

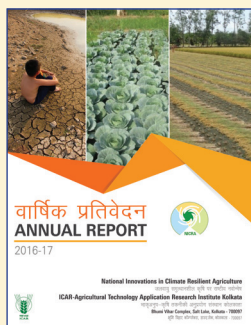
वार्षिक प्रतिवेदन
Annual Report
2016-17

**National Innovations in
Climate Resilient Agriculture**
Technology Demonstration Component



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

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Preface

National Innovations in Climate Resilient Agriculture (NICRA), was launched in 2011 to address the challenges of climate variability and climate change along with farmers need to adopt quickly increasing frequency of drought, flood and other extreme events by application of science and technology. Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technology under field conditions with the background of current climate hostility. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. This also facilitates quantification of various components of climate resiliency in different bio-physical and socio-economic context. In this way NICRA-KVKs play an important role in preparing village level contingency crop planning and different climate resilient measurements.

Climatic vulnerability of selected NICRA-KVKs were assessed during implementation of various modules of NICRA programme which help to bring forward the requirements of different technological supports, human resource developments and overall empowerment of farming community and enabling the farmers to cope up climate vulnerabilities like drought, erratic monsoon rain fall, heat wave, flood, cyclones *etc.* Plan of actions was prepared accordingly and for its implementation different technological interventions were executed which includes crop production, resource conservation, livestock and fish rearing, water harvesting *etc.* in NICRA- villages. Formation of VCRMCs and setting up of custom hiring centres in NICRA villages added grass-root level monitoring of the project followed by initiating farm mechanization as per suitability of small and marginal farmers.

Compilation of NICRA Annual Report of ICAR-ATARI Kolkata for 2016-17 depicts a close assessment of endeavour of selected NICRA-KVKs in climatically vulnerable zones under supervision and guidance of ICAR-ATARI Kolkata and simultaneous attainment in the area of technology demonstration, Village Climate Risk Management Committee, institutional interventions, seed production, capacity development of the farmers extension activities, review workshops *etc.* were also noted. The NICRA Annual Report 2016-17 includes all the relevant and required information of ICAR-ATARI Kolkata and achievements of NICRA-KVKs coping with the challenges of climate vulnerabilities in farming practices as well as livelihood pattern for the empowerment of farming community.

I wish to express my sincere gratitude to Dr. T. Mahapatra, Secretary, DARE and Director General, ICAR, Dr. A. K. Singh, Deputy Director General (Agricultural Extension); Dr. Ch. Srinivasan Rao, Director NAARM, Hyderabad and Dr. J. V. N. S. Prasad and Dr. Md. Osman, Coordinators (NICRA-TDC), CRIDA, Hyderabad and other officials of Division of Agricultural Extension, ICAR, New Delhi for providing guidance and help in compiling the Annual Report 2016-17. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the NICRA implementing KVKs in providing information in time. The support and help rendered by all the staff of ICAR-ATARI Kolkata are duly acknowledged.

(S. S. SINGH)
Director

Contents

Subjects	Page No.
Executive Summary	i
1. Introduction	1
2. Interventions with Modules	2
2.1 MODULE I- Natural Resource Management (NRM)	3
2.1.1 In-situ Moisture Conservation - Resource Conservation Technology	3
2.1.2 Water harvesting and recycling for supplemental irrigation	4
2.1.3 Conservation tillage	5
2.1.4 Artificial ground water recharge	6
2.1.5 Water saving irrigation methods	7
2.1.6 Other Demonstrations	8
2.1.7 Rainwater harvesting structures developed during 2016-17	8
2.2 MODULE II - Crop Production	10
2.2.1 Introducing drought resistant varieties	10
2.2.2 Introducing salt tolerant paddy varieties	12
2.2.3 Introducing flood tolerant varieties	12
2.2.4 Advancement of planting dates of rabi crops in areas with terminal heat	12
2.2.5 Water saving paddy cultivation methods	13
2.2.6 Community nurseries for delayed monsoon	14
2.2.7 Location specific intercropping systems with high sustainable yield index	15
2.2.8 Introduction of new crops/ crop diversification	16
2.2.9 Other Demonstrations	17
2.3 MODULE III- Livestock & Fisheries	19
2.3.1 Use of community lands for fodder production during droughts / floods	19
2.3.2 Improved fodder/feed storage methods	20
2.3.3 Preventive vaccination	20
2.3.4 Management of ponds / tanks for fish and duck rearing	21
2.3.5 Livestock demonstration	22
2.3.6 Improved shelters for reducing heat stress in livestock	22
2.4 MODULE IV- Institutional Interventions	23
2.4.1 Village Climatic Risk Management Committee (VCRMC)	27
2.4.2 Custom Hiring on Farm Implements and Machinery	28
3. Capacity Building	29
4. Extension Activities	31
5. Soil Health Card Distribution	32
6. Review Workshop	33
7. Annual Zonal Workshop	34
8. Convergence Programme	36
9. Dignitaries visited NICRA Villages during 2016-17	39
10. Success Story of NICRA Village Farmers	40
11. Newspaper coverage	48
12. Publications	49
13. Expenditure Statement 2016-17	51
Annexure -1: Contributors- NICRA KVKs of Zone II	52

EXECUTIVE SUMMARY

National Innovations in Climate Resilient Agriculture (NICRA) - A National Network Project of Indian Council of Agricultural Research (ICAR) with the objectives to enhance the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The rationale for Technology Demonstration Component (TDC) is based on the premise that an array of technologies is available to cope with different types of climate related vulnerabilities in National Agricultural Research System. The project is implemented by Krishi Vigyan Kendras at district level regionally coordinated by ICAR-ATARIs. ICAR- Agricultural Technology Application Research Institute (ATARI) Kolkata having seventeen NICRA implementing KVKs spreading across Bihar (7), Jharkhand (6), West Bengal (3) and Andaman & Nicobar Islands (1) which carried out different activities under Technology Demonstration Components of National Innovations in Climate Resilient Agriculture Programme in different modules like Natural Resource Management, Crop Production, Livestock & Fisheries and Institutional Intervention through which 49962 farmers were benefitted (Natural Resource Management - 8173, Crop Production - 5182, Livestock and Fisheries - 6903 Institutional Interventions - 1158, Capacity Building - 11425 and Extension Activities - 17121).

Natural Resource Management module covered improved drainage in flood prone areas, in-situ moisture conservation, construction/renovation of new water harvesting and recycling, structures/farm ponds/ checks dams/tank roof water harvesting tank, land shaping & rainwater harvesting structures, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, 5% model of irrigation, crop residue management, bunding of field, Broad Bed Furrow, soil test based nutrient application, micro irrigation techniques, compost pits etc. which benefitted 8173 practicing farmers in the zone covering an area of 66 ha.

Under **Crop Production module** different area specific intervention were taken by the NICRA-KVKs viz; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location

specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, were covered which benefitted 5182 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. were covered which benefitted 6903 livestock owner with 3895 units in vaccination programme.

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 546 units covering of 1158 number of farmers in the Zone.

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

The custom hiring centers and VCRMC helped the farmers to generate revenue worth Rs. 3,11,412.00 and the existing revenue with VCRMC is Rs. 14,34,531.00 for making newer implements available in the villages on



hiring basis and take up various productive initiatives in the event of climate vulnerability.

A total 584 courses were conducted under **Capacity Building** on various thematic areas benefitting 11425 farmers and farmwomen (8811 males and 2614 females) during 2016-17. 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 1741 **Extension Activities** on various thematic areas benefiting 17121 practicing farmers (11584 males and 5537 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 of field and farmers' days, diagnostic visits, group discussion, World Earth Day, technology week, kishan mela *etc.* All the 17 NICRA-KVKs have celebrated International Day of Soils through conducting workshop, seminar, symposia, awareness camp on December 5, 2016 in the respective KVK and distributed 3045 Soil Health Cards among the farmers of NICRA villages.

1. INTRODUCTION

National Innovations in Climate Resilient Agriculture (NICRA) - A Network Project of Indian Council of Agricultural Research (ICAR) since February, 2011 aims to enhance the 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

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

Technology Demonstration Component is one of the most important components of this project through which demonstrations are conducted with site specific technology packages on farmers' fields, encouraging the farmers to adopt new technologies to cope with the emerging threat of climate change as well as current climate vulnerability. Both short and long term output are expected from the project pertaining to new and improved varieties of crops, livestock breeds, management practices that help in the development of policy making to mainstream climate resilient agriculture in the path of developmental planning.

Enhancing resilience is one of the important keys to achieve sustainability in agriculture especially in the background of climate vulnerability and climate change.

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 (B1-1)	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



The NICRA-villages are selected based on vulnerability of agriculture to climatic variability. The climatic vulnerability of the village (droughts, floods, heat wave, cold wave *etc*) represents that of the district. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather

data, resource situation, farming systems and agricultural yields in the past few years. Thus the interventions executed in NICRA villages by the NICRA-KVKs has not only enabled the farmers to cope with climatic vulnerability as well as it plays a key role in farmers' empowerment along with sustainable livelihood.

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

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

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 and rainwater harvesting structure development.

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

Module IV: Institutional Interventions

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 parts of this module.

2.1 Module I: Natural Resource Management

The major emphases of the intervention were on augmenting rainwater availability through its efficient use by adopting site-specific rainwater harvesting strategies. Major interventions under this theme included in-situ moisture conservation, construction/renovation of new water harvesting and recycling structures/farm ponds/checks dams/tank roof water harvesting tank, land shaping and RWH structure, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, 5% model of irrigation, crop residue management, bunding of field, broad bed furrow, soil test based nutrient application, micro irrigation techniques, compost pits, participatory soil health management through identification and correction of major and micro nutrients. The impact of interventions aimed at 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 3.17 million cu m leading to increase cropping intensity by bringing around 2257 ha of area under protective

irrigation regime since the inception of the project.

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology:

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by *in situ* moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in 17 NICRA adopted villages covering 412 farmers in 66 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)	62	10.0	39.7	25480	23762	1.96
Green manuring (dhaincha) in Paddy (var. Lalat)	70	10.5	39.6	26900	26400	1.95
Brown manuring in Paddy (var. Anjali)	35	3.9	29.8	18900	16320	1.91
Azolla in Paddy (var. Lalat)	9	3.5	34.5	23200	20220	1.99
Zero Tillage in wheat	32	10.0	35.9	22800	21812	1.97
Zero Tillage in Maize	10	3.0	31.8	11600	9800	1.73
Repair of bund	14	4.0	27.5	18500	12750	1.74
Up gradation of monocropped land to multiple one with integration of fish	7	1.5	168.2	31600	26340	1.85
Optimization of horticultural production through land embankment development	10	1.5	187.0	23700	19825	1.85
Optimization of horticultural crops through land embankment	32	4.8	68.3	55100	62670	2.17
Organic mulching in vegetables (Tomato, brinjal)	18	2.0	258.5	61550	74500	2.23
Mulching	34	3.0	206.3	70450	62680	1.88
Plastic mulching Okra, cucumber	22	1.3	32.8	5680	7750	2.54
Use plant leaf mulching in ginger	33	5.5	534.0	401000	989500	3.48
Use paddy straw, forest leaves in elephant foot yam	24	1.5	303.0	287000	328500	2.19
Total	412	66.0				



Land shaping with Ail cultivation



Water harvesting through sand bag check dam



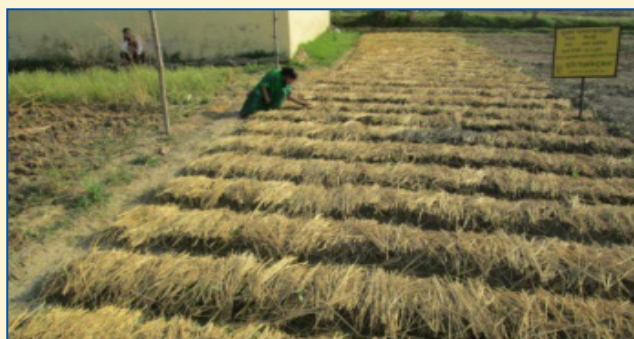
LEWA in Pulse



Zero tilled wheat



Plastic mulching



Straw mulching in Okra

2.1.2 Water harvesting and recycling for supplemental irrigation:

Water harvesting and recycling for supplemental irrigation were demonstrated in 17 NICRA adopted

villages by the different KVKs involving 915 numbers of farmers. The performances of different indicators in the demonstrations are presented in following table.

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	45	31.0	53.0	75200	399500	6.4
Renovation of canal	75	2.50 (km)	-	-	-	-
5% Model	18	6.8	41.0	55800	71000	2.4
Bora bandh	79	6.5	44.0	37200	45600	2.3
Renovation of Well for irrigation	73	25.4	41.0	10900	4650	1.5
Bund making leveling in paddy field	55	17.8	37.5	30690	19180	1.68
Natural mulching	15	4.0	289.2	45970	138800	4.25

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Digging of small pits in Diara land for cucubits	16	4.5	81.5	45890	130908	3.95
New water harvesting structure in the paddy field	3	0.5	35.6	35444	16156	1.49
New water harvesting structure in the wheat field	1	0.3	36.5	33480	19859	1.58
Renovation of old water harvesting structure in paddy field	109	28.7	42.8	116599	69550	1.58
Raising of land embankment	31	4.0	204	45291	153909	3.94
Ground water recharge	47	9.5	-	-	-	-
Construction of new pond for wheat	65	7.5	34.9	35000	22000	1.65
Desiltation of defunct water harvesting structures	5	1.0	-	-	-	-
Renovation of pyne	139	4500 (ft)	-	56100	-	-
Renovation of irrigation channel	13	22.0				
Newly Check dam	13	0.8	39.1	32100	19500	1.58
Renovation of common pond	68	146'x146'		107385		
10 bamboo boring	45	40.3				
Total	915					



Borabandh



Renovation of canal



5% model



New Pond excavated

2.1.3 Conservation tillage:

Sowing of *rabi* crops depends on the harvesting time of the preceding crop in *kharif* and also soil moisture status for undertaking land preparation for sowing. In case of wheat, this involves 2 to 3 or even more tillage

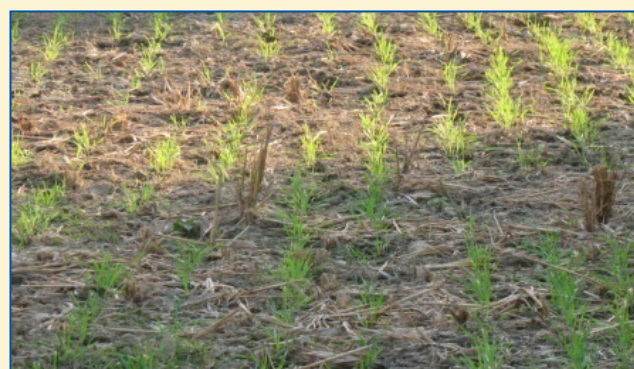
operations for obtaining appropriate tilth before planting of wheat. In addition to the costs incurred and energy required, this causes delay in planting of wheat which often results in coincidence of vulnerable stage with high temperature stress during February/ March. This often leads to reduction in grain yield and loss to farmer.

Zero till technology offers a viable and practical solution by avoiding repeated tillage for land preparation and sowing, reducing cost of cultivation and also permits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoid terminal heat stress. Zero-tillage refers to direct drilling of wheat in unploughed paddy fields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in 15

NICRA adopted villages in an area of 217.3 ha of 375 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 43.8 q/ha. Zero tillage technology showed very promising results in pulse and oilseed cultivation. Pea (Var. *Arkel*) gave highest economic return (B: C ratio 2.79) 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	65	35.4	43.0	73650	78600	2.56
Sowing of paddy with ZTD machine	48	22.6	44.5	68900	76100	2.31
Sowing of lentil with ZTD machine	64	43.8	22.5	60550	59300	2.07
Sowing of chick pea with ZTD machine	50	43.7	19.6	83650	145600	2.78
Sowing of paddy with power tiller	58	34.7	43.5	58580	54800	1.95
Sowing of wheat (K-9107) with ZTD	38	20.8	37.8	33900	29700	1.94
Sowing of pea(Arkel) with ZTD	33	11.8	26.4	43800	75100	2.79
Sowing of Maize with ZTD	19	4.5	34.5	15400	14600	1.95
Total	375	217.3				



Zero tillage

2.1.4 Artificial ground water recharge:

Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in

paddy in 9 NICRA adopted villages covering 50.3 ha area in 90 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (59.5 q/ha) and benefit: cost ratio (2.24).

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	25	12.6	39.4	25700	20222	1.78
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	40	28.4	45.5	24500	16700	1.71
Ground water recharge through SRI by sub-soiler	25	9.3	59.5	39465	44918	2.24
Total	90	50.3				



Bunding in paddy field

2.1.5 Water saving irrigation methods:

Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in

paddy demonstrated in NICRA adopted villages covering an area of 76.0 ha in 347 farmers' fields.

Table. Performance of different water saving irrigation methods

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Irrigation system (micro lift Irrigation system) for paddy	33	14.8	37.5	26800	20800	1.79
Application of biofertilizer in rice (var. MTU 7029)	77	25.1	71.5	36240	60340	2.71
Vermi-compost from biodegradable wastes	41	1.7	17.8	4900	4200	1.88
Production of pigeon pea (var. PRG-158) on farm bund	29	1.8	19.5	27238	39970	2.49
RBF in Brinjal	24	3.5	273.0	62950	64850	2.33
LEWA in rice (var. Rajendra sweta)	21	4.9	56.5	32340	39100	2.29
Sprinkler irrigation in rai (var. Bio-902)	17	5.0	16.5	18700	40100	3.49
Sprinkler irrigation in green gram (Var. HUM-16)	16	3.0	20.5	15100	36980	3.56
Sprinkler irrigation in lentil (Var. Arun)	25	6.9	21.5	18550	42775	3.44
Sprinkler irrigation in chickpea (Var. PG-186)	33	7.5	16.8	16250	23970	2.51
RBF in cucumber (Var. Malini)	31	1.8	317.0	93225	134155	2.51
Total	347	76.0				



Sprinkler and LEWA in field



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 and renovation of old farm pond, renovation of well, planting forest

trees, plants 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 1146 farmers' fields with an area of 323.5 ha of land. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return.

Table. Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Effective utilization moisture through seed production of blackgram after flood	135	20.1	17.8	16100	46100	3.94
In-situ vermicomposting in orchards	38	7.0	111.5	32970	267400	7.46
Soil test based nutrient application	521	230.8	47.5	37978	30800	1.95
Cleaning & renovation of old farm pond	117	5.8	43.5	63850	164000	3.18
Renovation of old water harvesting structure (Well)	35	5.5	38.5	24100	39500	2.95
Planting forest trees for biodiversity, forestation	49	8.8		-	-	-
Soil test based nutrient application (FYM/ inorganic fertilizer)	147	19.4	35.6	9750	14980	2.96
Bio pesticides in tomato	39	6.6	169.5	53875	135240	3.75
Dolomite in gora paddy	48	13.5	27.8	19910	15150	1.95
Cultivation of high yielding grass on farm bund	17	6.0	145.2	8570	16970	3.11
Total	1146	323.5				

2.1.7 Rainwater harvesting structures developed:

Rainwater harvesting (*ex-situ*) and efficient use to enhance resilience of farms, farm ponds brought about a perceptible change in crop production during *Kharif* and *rabi* season. Though the rainfall was less during the months of June and early part of July, the intense storms with rains which generated run-off and was stored in farm ponds created in farmers' field. The harvested water was used for critical irrigations to wheat, vegetables, fodder

etc. Farmers realized an additional yield and income from these crops. There were 121 number of rainwater harvesting structures have been developed which could store 524446.0 cu m of water. This intervention increased the cropping intensity to the maximum extent up to 250%. This intervention increased the cropping intensity to the maximum extent up to 250% with an average cropping intensity of 98%. KVK wise these structures along with storage capacity and increase in cropping intensity are given in the following table.

Table. KVK wise rainwater harvesting structures developed during 2016-17

KVK	RWH structures	No.	Storage capacity (cu. m)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Port Blair	Desilting Pond	4	14500	20	2.5	50
	Rain shelter	3	3617	20	2.0	50
Aurangabad	Pond	1	4500	25	7.0	80
	Canal	3	20000	140	3.5	120
Buxar	Farm pond	1	25000	12	7.5	80
Jehanabad	Pond	6	18000	385	5.5	80
	Checkdam	2	8000	25	6.5	90
	5% model	3	125	6	2.0	50

KVK	RWH structures	No.	Storage capacity (cu. m)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Nawada	Pyne	2	16500	125	12.0	95
	Well	3	126.5	222	19.0	75
	Pond	5	3558.6	50	6.5	75
Saran	Pond	1	18500	110	15.5	75
	Inlet Channel	3	13580	35	1.5	90
	Inlet Channel	3	13210	38	2.0	100
Supaul	Desilting drainage channel	2	300	65	1.0	100
Chatra	Well	2	1165	46	2.0	90
E. Singhbhum	5% Model	6	1200	42	5.5	90
	Pond Renovation	2	45500	45	7.5	250
Gumla	Renovation of Pond	1	20000	30	5.0	250
	Bora bandh (Temporary check dam)	7	10000	65	15.5	50
	5% Model	2	2000	80	22.0	200
Koderma	Defunct pond	8	18500	20	15.5	90
	Repaired well	1	1665	18	6.5	80
	Jalkund	9	27000	20	8.5	70
Palamu	Well	2	6500	330	15.5	90
	Pond	2	21000	1745	15.5	90
	5% model	6	4000	80	2.5	100
Cooch Behar	Farm Ponds	3	35000	74	10.5	120
Malda	Small ditches for jute retting	10	20000	175	7.0	80
S. 24 Pgs.	Landshaping and rain water harvesting structure	5	10000	30	5.0	100
	Renovated defunct water bodies	6	25000	30	15.5	80
	Renovated 4 Km long canal	4	178000	715	45.5	100
Godda	Ring Well	5	12565	10	7.5	120
	Pond Renovation	3	25000	35	7.0	90
Banka	Pond Renovation	3	26500	20	5.5	80
Total		129	650112.1	4888	319.0	98



Renovated well



Renovated Pond



5% Model



Pond based IFS



Canal

2.2 MODULE II: Crop Production

Monsoon contingency action plans were prepared and implemented in NICRA KVKs which experienced delayed onset/ deficit rainfall conditions during 2016-17. Contingency crop plans for late planting (after mid July) involving appropriate crop, soil moisture, nutrient management measures, crop diversification etc. were taken up in NICRA villages. The impact of resilient practices and technologies is highlighted below.

2.2.1 Introducing drought resistant varieties:

During the current year delayed onset of monsoon was experienced in several districts of Bihar and Jharkhand and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Introductions of drought resistant varieties of paddy, brinjal, niger, maize pigeon pea, and ragi were demonstrated in 17 NICRA adopted villages involving 1825 number of farmers in 497.5 ha area. Performance of the different drought resistant varieties of various crops is presented in the following table.

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)	310	65.2	255.5	198.5	77.7	56870	65150	2.21
Drought resistant paddy (var. Anjali)	180	49.5	122.0	108.0	88.5	38100	26850	1.69
Sowing of drought tolerant paddy (var. Sahbhagi) with ZTD machine	65	12.8	79.0	68.0	86.1	33550	46550	2.45
Sowing of drought tolerant paddy (var. Sahbhagi) with Drum seeder machine	68	10.6	53.5	37.2	69.5	30875	43250	2.51
Drought tolerant paddy varieties (var. Naveen)	21	6.8	42.5	28.2	66.4	36500	33870	1.85
DSR Transplanting (var. Sahbhagi)	49	24.5	43.5	27.8	63.9	35900	39550	2.12

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
DSR Transplanting (var. Abhishek)	62	32.6	50.6	39.2	77.5	39100	43200	2.21
Tolerant Varieties to submergence	38	46.1	48.0	39.4	82.1	33928	40890	2.25
Maize (var. Suwan-1)	350	103.0	43.5	31.6	72.6	95867	189667	2.96
Maize (HQPM - 1)	103	12.5	46.2	33.4	72.3	12700	15700	2.45
Drought tolerant ragi (GPU-28)	125	32.4	38.5	19.5	50.6	20900	23900	2.05
Drought tolerant pigeon pea (var. ICPL 88039)	110	27.3	25.5	17.5	68.6	23250	51250	3.36
Drought tolerant pigeon pea (var. ICPL- 858063)	35	3.9	19.0	11.6	61.1	20900	32750	2.75
Niger (var. Birsa Niger -1)	37	4.2	6.4	3.0	46.9	9990	5100	1.18
Red gram (var.-PGR-158)	25	3.4	18.5	11.5	62.2	18990	19885	2.26
Horse gram (var. Birsa kulthi-1)	32	5.9	19.5	12.4	63.6	15100	15975	2.05
Contingent Crops Horse gram	45	8.6	25.0	16.0	64.0	38975	36000	1.91
Drought resistant brinjal (var. CARI- Brinjal -1)	32	5.4	25.0	14.5	58.0	25880	35550	2.51
Draught tolerant variety DBU -14	57	20.8	39.0	35.4	90.8	35985	24890	1.57
Short duration variety (var. Pukkhraj)	56	16.1	258.0	155.2	60.2	51780	123750	3.51
Wheat (DPW-17)	25	5.9	41.5	34.7	83.6	12500	18470	2.61
Total	1825	497.5						

Drought tolerant paddy varieties like *Sahbhagi*, *Anjali*, *Naveen* and *Abhishek* were demonstrated in 242.0 ha areas of 855 number of farmers' field. 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:: 3.36).



Ragi (var. GPU-28)



Paddy (var. Sahbhagi)



Maize (var. HQPM-7)



Paddy (var. Anjali)

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 54.7 ha area in 130 farmers' fields. *Jarava*, *Geetanjali* and *Amalmona* varieties proved maximum salt tolerant potential by giving highest yield of 48.5 q/ha and more economic return (BC ratio of 2.41).

Table. Performance of different salt tolerant paddy varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	35	10.2	43.5	34.8	80.0	28950	23550	1.91
SR-26B	28	6.1	39.0	32.0	82.1	26000	28900	2.23
Usar Dhan-3	45	32.5	38.5	31.2	81.0	34698	16165	1.45
Jarava, Geetanjali, Amalmona	22	5.9	48.5	38.2	78.8	33800	45990	2.41
Total	130	54.7						



CARI Dhan-5



Geetanjali

2.2.3 Introducing flood tolerant varieties:

Flood tolerant varieties of paddy like *Swarna sub 1* and

Sabita were introduced through demonstration in 23.1 ha area in 105 farmers' fields.

Table. Performance of different flood tolerant varieties

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Temporary submergence rice variety (Var. Swarna Sub-1)	70	16.2	41.5	30.5	73.4	26255	34560	2.38
Flood tolerant paddy	35	6.9	45.0	39.0	86.6	31150	40995	2.33
Total	105	23.1						



Sabita



Seed bed of Swarna Sub -1

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

To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, etc. were sown in 12 days advance

(avg) during rabi season. These demonstrations were carried out in seven NICRA adopted villages involving 342 number of farmers' fields with an area of 63.3 ha land.

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)	53	9.2	45.0	33.0	73.3	27800	26550	1.97
Wheat (var. WR-544)	35	9.5	30.0	17.5	58.3	21800	17950	1.91
Wheat (HD2985)	45	10.6	49.0	35.0	71.4	30854	37540	2.04
Maize (var. DHM 117)	65	4.8	69.0	56.5	81.2	23000	53500	3.55
Lentil (var. Arun)	28	7.4	20.0	15.5	75.0	20450	39900	2.85
Mustard (var. Shiwani)	65	10.5	13.0	8.5	65.4	18200	16000	1.63
Mustard (var. Pusa Gold)	46	8.8	17.0	10.5	61.8	14600	26950	2.95
Potato (var. K. Ashoka)	32	7.4	220	170	77.3	75850	50950	1.87
Potato (var. Kufri giridhari)	19	3.9	314.5	292.2	92.9	121580	192600	2.79
Total	342	63.3						



Short duration rice (var. GB-1)



Lentil (var. Arun)

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 204 ha area of 608 number

of farmers' fields. These interventions were 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 3.01.

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	170	68.0	59.0	34.5	57.6	43287	45915	2.05
SRI (var. MTU -7029)	65	4.9	51.5	41.5	79.6	25550	44100	2.77
Paddy Seed (var. Sahbhagi)	100	42.3	50.5	29.5	58.4	18870	35400	2.96
Aerobic Rice (var. Anjali) cultivation	60	34.0	27.5	19.5	72.2	20800	22688	2.19
Direct seeded brown manured rice	41	10.6	45.0	34.0	75.6	32900	36100	2.12
DSR (var. Anjali)	43	19.9	38.0	29.5	77.6	22858	33800	2.38
SRI system in paddy (var. Rajendra subhasini)	42	9.5	55.0	42.5	76.4	38990	59434	2.59
Sowing of paddy(var. Rajendar sweta) with ZTD machine	52	8.4	59.0	45.5	76.3	33875	66200	3.01
Zero tilled rice	35	6.4	45.0	32.0	71.1	37665	45950	2.29
Total	608	204.0						



Paddy Seed (var. Sahbhagi)



Paddy Seed (var. Anjali)

2.2.6 Community nurseries for delayed monsoon:

To combat the situation of delayed monsoon intervention of staggered community nursery for paddy has become very popular in Bihar and Jharkhand. Seedlings of 25-30 days age are transplanted in July so as to complete flowering of photosensitive varieties before October and harvesting by mid November to facilitate taking up of timely sowing of rabi crops. Such a practice ensures optimum performance of both kharif and rabi crops. However, Bihar experienced aberrant rainfall situations in 5 out of the previous 10 years impacting adversely rice production and livelihood of farmers. It appeared that failure of rain in July is responsible as

transplanting of paddy is delayed with resultant adverse effect on productivity and a cascading negative impact on rabi crops. Delay in transplanting of paddy affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides paddy other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 38.6 ha area of 187 numbers of farmers. These interventions were carried out in 12 NICRA adopted villages. Among all the demonstration the community nursery for cauliflower was the most promising one which showed highest increase in yield as well as economic return.

Table. Performance of Community nurseries

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Raised Community nursery of paddy (var. Naveen)	29	3.5	53.0	42.0	79.2	39100	43600	2.19
Nursery Management of paddy (var. Rajendra sweta)	25	6.8	55.5	45.5	82.7	41100	58825	2.41
Paddy (var. Induri sambha)	22	3.8	48.5	41.5	85.4	33500	35895	2.18
Community nursery of paddy (var. Lalat)	18	6.8	43.5	29.5	67.8	33600	25950	1.77
Community nursery of paddy (var. Jaldi dhan 3)	25	7.1	43.0	33.0	76.7	44900	30833	1.71
Community nursery of cauliflower	28	4.2	415.5	355.5	85.7	45650	189500	5.23
Community nursery of brinjal	25	2.8	625.5	535.5	85.7	53800	200650	4.81
Community nursery of tomato	15	3.6	389.5	338.0	86.8	53000	63900	2.15
Total	187	38.6						



Community Nursery of paddy

2.2.7 Location specific intercropping systems with high sustainable yield index:

Various intercropping systems were demonstrated in regions which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. Intervention

on location specific intercropping was demonstrated in 12 NICRA adopted villages. The demonstrations were carried out in 88.3 ha area of 511 number of farmers' fields. Of all these intercropping of maize + ladies finger was found most popular although maximum return (B: C: 8.74) 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)	86	16.4	Maize: 87.0	Maize- 05	82.6	189500	160000	1.85
			Ladies Finger:1.5					
Chili (var. Bullet as main crop)+Ladies finger(HYV)	40	5.8	Chili:47.0 Ladies Finger:1.0	Chili	85.0	315600	2415000	8.74
Maize + Redgram	30	5.6	Maize: 86.0 Redgram:0.5	Maize	91.5	27950	53300	2.95
Maize + Groundnut	28	2.4	Maize:74.5 Groundnut: 13	Maize	62.0	32000	45990	2.46
Sorghum (var. CSV – 20)	98	14.8	29	11.4	65.0	9800	18100	1.64
Potato (var. Pukhraj) + Maize (var. Laxhmi)	70	7.8	Potato:85.0 Maize:134.0	Maize	55.5	75650	145600	2.84
Redgram (var. Bahar)+ Millet (var. GPU-28)	25	6.7	Redgram: 22.5 Millet: 12.5	Redgram	64.0	28850	86070	4.27
Potato (var. Pukhraj) + Radish (var. Pusa chetki)	23	6.1	Potato:190.5 Radish:41	Potato	79.5	27500	76250	3.88
Arhar+ Blackgram	18	6.8	Arhar:18.9 Blackgram: 17.23	Arhar	59.6	29950	49800	2.77
Cucumber + Beans	41	6.9	Cucumber: 12.5 +Beans: 11.7	Cucumber	40.5	45900	98900	3.35
Wheat+ Mustard	27	6.5	Equally	Wheat	35.0	32850	29900	1.81
Okra (Mahyco 959) + Chilli (Surya)	25	2.5	Equally	Okra	68.0	196500	229500	2.21
Total	511	88.3						



Ground nut + red gram



Red gram+millet



2.2.8 Introduction of new crops/ crop diversification:

Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in the

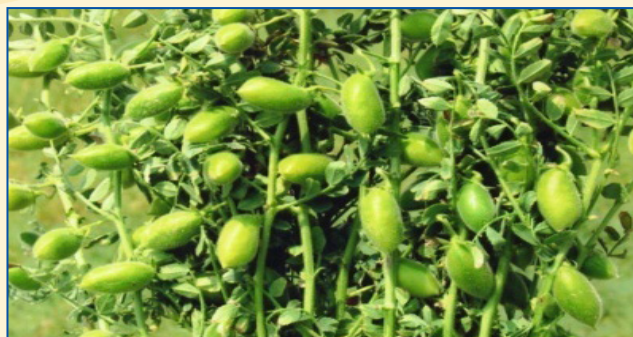
different NICRA adopted villages. These demonstration were carried out in 140.5 ha area of 855 number of farmers' fields. Introduction of *ol* (var. *Gajendra*) in the cropping pattern. District is the most promising one which gave maximum economic return (B:C:: 6.89).

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)	55	23.5	12.0	8.5	70.8	24800	40970	2.77
Gram (var. Pusa 362)	65	18.6	18.0	9.5	52.8	26650	46800	2.86
Onion(var. N-53)	40	6.1	298.5	190.5	63.7	70500	305650	5.45
Tomato (var. Param F1)	54	8.1	227.0	158.0	69.6	78700	157550	3.11
Chilli (var. Surajmukhi)	55	8.5	97.0	59.5	60.8	77000	189000	3.45
Cabbage (var. OM-3)	45	7.5	341.0	257.0	75.4	74800	235000	4.24
Radish (var. Suhra-32)	55	6.9	129.0	86.5	66.7	71100	83000	2.27
French Bean (var. FE-51 ANUPMA)	47	2.5	73.5	45.0	61.2	80900	107000	2.35
Cauliflower (var. MSN-16)	50	6.5	221.0	128.5	58.1	82800	196000	3.47
Brinjal (var. F1-Hybride Long)	45	9.0	245.0	173.0	70.6	78500	169500	3.26
Turmeric (var. Rajendra soniya)	35	6.6	239.0	160.0	66.9	81000	310000	4.77
Ginger (var. Nadiya)	42	3.7	226.0	173.5	76.8	110000	590000	6.83
Lentil (Short duration variety PL – 406)	48	9.6	16.5	7.5	45.5	18000	30000	2.74
Linseed (Short duration variety T397)	34	7.5	7.5	4.8	64.0	11000	19000	2.83
Ol (HYV. Gajendra)	35	3.7	800.0	253.0	31.6	94000	551840	6.9
Nutritional garden- Veg. seed Seem (dolichus lablab)	85	5.5	19.5	10.0	51.3	8000	17000	3.27
Tomato under mulching	65	6.7	85.0	42.0	49.4	10000	30000	3.33
Total	855	140.5						



Mustard (*Pusa Bold*)



Brinjal (*Var. F1-Hybride Long*)



Turmeric



Methi



Tomato under mulching



Elephant Foot Yam

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 619 numbers

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 demonstration

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Low temperature tolerance - cultural practice -Banana bunch cover (var. Malbhog & Dwarf Cavendish)	25	3.0	499.0	476.0	21	198500	4055550	3.17
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (WBU-108) in jute AZO-PSB fallows with INM	40	5.9	17.0	11.0	49	30000	46500	2.58
Promotion of stem rot resistant Jute (var. JBO-2003H)	40	6.5	38.0	29.0	66	35500	49900	2.45

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Integrated crop management of mustard (NC-1)	45	6.5	21.0	11.0	54	40560	47580	2.13
Integrated crop management of lentil (Maitri)	46	6.5	17.5	11.5	56	31500	42970	2.41
Integrated disease management in vegetables	26	5.9	251.5	225.5	38	96000	41500	1.51
Demonstration short duration vegetables as contingent crop Tomato (var. PUSA Gaurav)	22	3.5	365.0	300.0	24.5	59500	197500	4.63
Contingency crop Brinjal (var. PUSA Uttam)	21	2.5	389.5	315.5	36	59500	291950	6.64
Contingency crop Cauliflower (var PUSA Sharad)	30	2.5	265.0	220.0	36	61000	237500	4.85
Contingency crop Radish (var. PUSA Chetki)	47	2.7	165.0	125.0	64	57500	65900	2.19
Soil reclamation : Levelling /bundng and flooring for leaching of salt	42	9.6	41.0	35.0	66.5	40000	49000	2.29
Integrated fish farming	45	6.5	4.0	2.5	82.5	58000	141200	3.39
IFS	45	6.5	-	-	-	-	-	-
late blight disease of potato	22	2.9	315.0	280.0	8.5	122500	195000	2.54
Bio-control agent production	32	-	-	-	-	Rs. 55/Kg	Rs.600/Kg	
Mushroom	26	-	14.0	-	-	Rs. 25 / cylinder	Rs.55/ cylinder	3.22
Forest tree plantation	65	1600 Plant						
Total	619	70						



Mushroom Production



Bio-control agent production



Vegetables production in polyhouse



Green manuring

2.3 MODULE III: Livestock & Fisheries

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

of water quality in aquaculture and integrated farming system models in diverse agro ecosystems.

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

Community lands of an area of 178.6 ha involving 854 number of farmers utilized for different fodder production were demonstrated in eight different NICRA adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return (B:C:: 5.59).

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	55	7.5	825.0	685.5	42	36500	91500	3.59
JHB-146	46	6.5	840.0	649.0	22	30000	73000	3.45
Quality legume fodder Berseem (var. Muskavi)	29	3.9	979.0	855.0	32	34500	74000	3.19
Quality legume fodder Oat (var. JHO-822)	47	4.5	545.0	439.0	28	29850	45000	2.55
Quality legume fodder Sudan chari	25	1.6	46.5	35.0	49	13900	36200	3.79
Quality legume fodder Sudan Grass	52	8.9	557.5	205.0	45	58000	263000	5.59
Fodder production of Maize/ Sudan	425	49.9	538.5	455.0	31	41000	91000	3.29
Fodder cultivation with improved varieties Hybrid Napier,	28	4.9	88.0	48.5	65	15100	19000	2.34
Sorghum (Moti)	22	2.6	338.8	257.0	33	19950	56200	3.74
Molases	95	75.8	23.5	18.5	38	9900	7500	1.79
Oat (Kent)	30	12.5	477.5	374.0	29	20800	23900	2.25
Total	854	178.6						



Napiergrass



Berseem



Green fodder sorghum



Oat

2.3.2 Improved fodder/feed storage methods:

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. In 2015-16, delayed onset and deficit rainfall conditions were experienced in several states. There was reduction in area under millets and pulses, which are important to meet the fodder requirements in the rainfed areas. Short

and medium duration fodder cultivars of several crops and fodder species both in *kharif* and *rabi* seasons were demonstrated in farmers' fields under rainfed and limited irrigation conditions to support income and cash flow from animal husbandry. Improved fodder of rice bean and silage making were demonstrated in farmers fields. Silage making for 28 numbers and 2 ha of units showed very promising results.

Table. Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder grass on farm bund (Rice bean Var. Bidhan-1)	35	2	195.0	-	-	1600	16300	13.75
Silage Making	50	28	9.2	6.5	66	45	270	8.65
Total	85	30						

2.3.3 Preventive vaccination:

Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ

vaccine, deworming etc. in 17 different NICRA adopted villages. Mortality rate reduce up to the extent of 90% and average increase in cattle milk yield up to 40% have been recorded after the vaccination camps organized.

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No.	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	625	580	Mortality rate (75-80%) reduced	Mortality rate (40-50%) reduced	-	-	-	-
Vaccination HS, BQ	2010	610	100 % Mortality reduced, Increase Milk yield Av. from 1.6 -1.9 lit/day/cow	2.2% Mortality reduced, Av. Milk yield 1.4 lit/day/cow	31	8150	8950	2.35
Vaccination for PPR in goat and Ranikhet in Poultry.	630	785	Occurrence of disease not recorded in vaccinated group.	Sporadic outbreak	-	-	-	-

Technology demonstrated	No. of farmers	Unit/ No.	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Animal health camp (HS+BQ)	535	785	10% mortality	69 %mortality	83% survival	34980	91139	3.79
Deworming (Febendazole) & Mineral mixture	125	530	11% mortality	90% mortality	91% survival	624500	154570	1.35
Animal Treatment Camp Butox, Prajana,Sulpha Dimadin ,Oxytetra cycle	420	165	Reduced occurrence of diseases 94%	Occurrence of diseases 40%	63	-	-	-
Proper De-worming	860	230	8	6	42	27	159	7.91
Vaccination raksha triovac	232	210	40	28	-	-	-	-
Total	5437	3895						



Vaccination programme and animal health camp

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

Composite and cat fish rearing in the existing pond or in

renovated pond were demonstrated in 125 farmers' fields of NICRA adopted villages. Khaki Campbell duck was also introduced through this intervention.

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

Technology demonstrated	No. of farmers	Unit/ No.	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	55	15.6	790	295	310	21000	53600	3.69
Cat fish culture	35	2.9	1680	870	160	19950	77100	5.15
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus & lata species cultivation	35	3.6	-	-	140	18800	65910	4.69
Total	125	22.1						



Seed spawn distribution and fish cultivation

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 316 number of farmers fields. Improved ornamental bird was introduced through this intervention which showed very promising results (B:C :: 5.96).

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No.	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry Kuroiler Birds	40	190	2.5 kg at 10 weeks	1.5 kg at 10 weeks	42	95/bird	55/bird	1.48
Backyard poultry (Improved Nicobari fowl)	29	168	162 egg	88 egg	89	3300	4889	2.51
Replacement of local breed with Khaki Cambell	25	140	Prodn: 28/duck/ month	Prodn: 19/duck/ month	44	Rs. 85 duck/ month	Rs. 75duck/ month	1.91
Ornamental bird	22	42	Hatchability - 90%, fecundity-70%, chick	-	-	90pair/ bird/year	430/pair/ bird/year	5.96
Improved breed of Pig (T & D)	28	51	1.2 q/pig	0.8q/pig	82	32500	42720	2.42
Addition of mineral mixture	115	619	1.94	1.05	35	1850	2600	2.48
Low cost Azolla production as supplementary cattle feed	57	105	Prodn: 9 q/yr; Milk: 49.75 l/ cow/month	Milk: 40.6 l/ per cow/ month	34.5	760 /pit	700/pit	1.96
Total	316	1315						



Livestock Production in NICRA village

2.3.6 Improved shelters for reducing heat stress in livestock:

Improved Poultry shed recorded low mortality rate and in shady area reduced heat stress. Standard spacing in

improved shed resulted better performance in poultry and dairy animals. Interventions to reduce heat stress for higher survivability of backyard poultry and dairy animals were demonstrated of improved shelter.

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No.	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	49	Mortality 10%	Mortality 75%	Survival 74%	-	-	-	-
Hut making	14	19	45	13	88	40	290	295	8.25
Improved shelters for poultry and livestock	32	31	-	-	-	-	-	-	-
Total	86	89							



Livestock Production in NICRA village

2.4 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, and introduction of weather index based insurance and climate literacy through a village weather station and awareness developed of 1158 number of farmers in the zone.

Seed Bank: Village level seed production of short duration, drought and flood tolerant varieties was taken up by farmers and seed societies in several NICRA villages with the technical support of KVKs in rice, soybean, foxtail millet, greengram, pigeonpea, finger millet, chickpea, wheat, rapeseed and mustard. To tackle

contingency situations, increased availability of tolerant varieties was accorded priority especially in the case of paddy, soybean and foxtail millet during 2016-17. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

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



Community seed production



Seed bank

Table. Details of the various institutional interventions

Inter-ventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	12	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta,Naveen,Jaldi Dhan 13,Madhuri	3.50	Quality seed	38	7.0
		Paddy Var. Lalat	35.50	Participatory approach market linkage	12	2.2
		Wheat Var.-HUW-468	35.50	Participatory approach market linkage	8	1.7
		Paddy Var. Anjali	32.50	Multiplication of seeds	39	6.0
		Paddy Var. Sahbhagi	34.50	Multiplication of seeds	14	2.5
		Foundation seed Paddy	15.00	Seed production and storage	10	6.0
		Foundation seed Rapeseed and mustard	10.00	Seed production and storage	20	5.0
		Foundation seed Wheat	16.00	Seed production and storage	29	9.5
		Paddy Sahbhagi	55.00	Seed	8	3.0
		Paddy Rajendra Sweta	90.00	Seed	5	2.0
		Pigeon pea	9.00	The Seed given to the farmers for seed production will get refunded after production	14	6.5
		Paddy	9.00	-	40	6.5
		Gram	9.00	-	12	2.0
		Blackgram	22.00	-	27	3.0
Fodder bank	7	Oat JHO-851	5kg	-	5	1.0
		Berseem Wardan	10kg	-	7	1.0
		Mineral mixture	11 kg	-	109	1.5
		Urea and molasses	10 Kg	-	47	2.5
		Berseem JHB-146	10 kg	-	7	1.5
		Jowar	31.5	Fodder use in drought spill/heavy rain	15	1.5
		Wheat straw	3.50	Urea treatment	15	5Unit
		Maize	2.50	-	25	2.0
		Sudan Grass	3.00	-	15	2.0
		Paddy & Wheat Straw	3.00	VCRMC is maintaining this	25	3.0

Inter-ventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)	
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups			
Commodity groups	6	Kitchen Gardening	-	Improved Variety Seed	43	2.5	
		Veg Mustard Pusa sag 1			37	2.8	
		5 group Fingerlings fish	110.00	Fish farming	52	6.5	
		Fertilizer procurement/ storage/Sale counter	-	Farmers through PACS and cooperative society	250	20 unit	
		Vegetable production and marketing.	5 groups handle 2,000 green vegetable and potato, Onion	1. Production oriented training.2. Linkage with market.	150	1.0	
Custom hiring centre	16	Power tiller	5	-	305	3 unit	
		Mould bold plough,	02/ Rs.36/hr	-	15	2.5	
		Rotavator (4'),	02/ Rs. 55/hr	-	18	4.5	
		Zero till seed drill,	02/ Rs. 80/hr	-	28	4.5	
		Turbo seeder,	02/Rs. 157/ hr	-	26	3.5	
		Power Duster,	02/Rs 20/ hr	-	29	2.5	
		Power sprayer, Pumping Set,	02/Rs 20/hr	-	15	5.5	
		Farm implements	-	Technology demonstration	254	45 unit	
		Wheat Thresher, Zero Tillage Machine, Sprayer, Duster, Paddy Thresher etc	60.00	Implements is provided to the Group for hiring purpose	30	20 unit	
		Wheat, Paddy, Lentil, Chick pea ZTD, Drum Seeder	-	ZTD, Drum Seeder	70	15 unit	
		Water pump, thresher, power sprayer, weeder, SRI marker, Zero till drill	Water pump (2) @ Rs. 80/ hr, Thresher (1) @ Rs. 50/hr, Power sprayer (2) @ Rs. 25/hr, Weeder (5) @ Rs. 10/hr, SRI marker (5) @ Rs. 5/hr, Zero till drill (2) @ Rs. 55/hr		60	7 unit	
		Conoweeder, duster, sprayer, SRI marker, Zero tillage machine	Conoweeder:	Rs. 15/-	1. Weeding	40	4.0
			Duster:	Rs.15/-	2. Dusting	40	3.0
			Sprayer:	Rs.20 /-	3. Sprayer	39	3.5
SRI Marker:			4. Sri marker	25	4.8		
Zero tillage Machine:	47/-		5. Zero tillage	55	7.5		

Inter-ventions	No. of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
		Farm implemented Zero-till ferti-seed, Laveler/ bund maker/FIRB planter/ Drum seeder/Weedicide/ Sprayer/Sub-soiler/Disc harrow/Bucket laveler/ connoweeder/marker/ reaper/thresher/cultivator	5.00	Technology demonstration	540	325 unit
		VCRMC Equipments purchased under the project	6.00	Farm implements	261	7.5
Collective marketing	5	Onion/ Vegetable	5.00	-	45	11.0
		Milk production and marketing group.	2.50	1. Introduce new green fodder like Sudan grass, 2. Linkage with market.	35	5 unit
		Vegetables	2.00	Cooperative arrangement	75	32unit
Climate literacy through a village level weather station	16	Temperature, Relative humidity, Rain fall, Wind speed and direction	14.00		215	3 unit
		Weather station SMS/Voice SMS	10.00	Data interpretation of AWS and forecasting/ Advisory	67	1 unit
		AWS	15.00	-	142	1 unit
		Wheat	11.00	-	50	38 unit
Total					3577	155.7 ha & 520 unit



Power tiller



Reaper



Zero tillage



Urea treatment

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

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

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

scientist through village level weather station.

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



VCRMC Meetings in NICRA villages

2.4.2 Custom Hiring of Farm Implements and Machinery:

Timeliness of agricultural operations is crucial to cope with climate variability, especially in case of sowing and intercultural operations. Access to implements for planting in ridge-furrow, broad bed furrow and raised beds is essential for widespread adoption of resilient practices for *in situ* soil moisture conservation and drainage of excess water in heavy soils. In rainfed areas, availability of such farm implements to small and marginal farmers is important. Similarly in irrigated areas, residue management of *kharif* crops through zero till cultivation of *rabi* crops reduces the problem of burning of residues and adds to the improvement of soil health and increases water use efficiency. Custom hiring

centres (CHCs) for farm implements were established in NICRA villages. A committee of farmers' manages the custom hiring centre. The rates for hiring the machines / implements are decided by the VCRMC. This committee also uses the revenue generated from hiring charges and deposits in a bank account opened in the name of VCRMC. The revenue is used for repair and maintenance of the implements and 25% share is earmarked as a sustainability fund. Different types of farm machinery are stocked in the CHCs, the most popular being Zero till drill, Happy seeder, BBF planter, drum seeder, multi crop planter, power weeder and chaff cutter. Each CHC was provided an initial sum of Rs. 4.25 lakhs for its establishment under NICRA project. Revenue generated through custom hiring and under VCRMC in different KVKs were presented in the following table.



Farm implements and Machinery at NICRA Adopted villages

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

Name of KVKs	Revenue generated (Rs.)	
	From Custom Hiring Centres (2016-17)	Total under VCRMC
Aurangabad	17250.00	92150.00
Buxar	3240.00	30597.00
Chatra	37922.00	59482.00
Cooch Behar	19354.00	67340.00
East Singhbhum	25500.00	64600.00
Gumla	27156.00	127156.00
Jehanabad	18500.00	91663.00
Koderma	20470.00	40100.00
Malda	17050.00	37500.00
Nawada	25250.00	327641.00
Palamu	6600.00	24000.00
Port Blair	2380.00	30304.00
Saran	7000.00	67000.00
Supaul	20473.00	87485.00
South 24 Parganas	31913.00	226159.00
Godda	15000.00	45000.00
Banka	16354.00	16354.00
Total	311412.00	1434531.00

3. CAPACITY BUILDING

A total of 584 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 11425 farmers and farm women (8811 male and 2614 female) during 2016-17. 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.

Thematic area	No. of KVKs	Topic of the training	No. of Courses	No. of beneficiaries		
				Male	Female	Total
Natural Resource Management	17	Integrated weed management in rice through land management	13	98	42	140
		Management of salt affected soil	14	100	32	132
		Impact of bunding in water conservation	10	105	17	122
		Increase of water holding capacity of sandy soil of Diara land	10	35	2	37
		Mulching and its impact	22	150	65	215
		Use of drip and sprinkler irrigation system				0
		Paddy and other cultivation through SRI	23	272	74	346
		Salt tolerant and deep water paddy cultivation	13	255	42	297
Crop Management	17	Crop Management	10	172	32	204
		Water management	7	100	38	138
		Improved package of practices for pulse and oilseeds	12	150	27	177
		Quality seed production technology of cereals	9	145	25	170
Nutrient Management	12	Integrated Nutrient Management in pulses	10	140	30	170
		Application of sulphur in oil seed crop	8	160	26	186
		Green manuring	12	240	34	274
		Soil health management	8	1100	526	1626
Integrated Crop Management	16	Cultivation Practices of Kharif pulses	10	200	45	245
		Scientific cultivation of crop management.	9	170	45	215
		Scientific cultivation of oilseeds	11	126	35	161
		Kisan chaupal	9	47	18	65
		Cultivation of potato	11	123	25	148
Crop Diversification	12	Increase in cropping intensity through introduction of black gram in jute fallows	10	90	15	105
		Crop Diversification through lentil cultivation	7	126	39	165
		Training on intercropping	10	120	25	145
		Cultivation of Millets	8	92	18	110
		Fodder production.	14	120	75	195
Resource conservation Technology	17	Zero Tillage	8	105	35	140
		Operation & Maintenance of Zero Tillage Machine	6	125	15	140
		Summer ploughing	10	110	30	140
		Direct seeding method of Paddy	7	80	30	110
		Use & importance of multi crop planter in Maize & protected Nursery.	10	90	45	135
		Crop residue management by using happy seeder	7	75	10	85

Thematic area	No. of KVKs	Topic of the training	No. of Courses	No. of beneficiaries		
				Male	Female	Total
Pest and disease management	17	Integrated Pest Management	9	150	35	185
		Storage pest of pulses and their management	7	130	10	140
		Judicious pesticide application in crops	12	145	40	185
		Integrated Disease Management	8	105	35	140
		Crop Diversification of sustainable crop production	4	55	7	62
Nursery raising	10	Nursery raising and Management of major vegetable crops.	8	170	55	225
Employment Generation	9	Poultry farming for employment generation	6	140	24	164
Nutrition garden	6	Selection of Suitable crops for nutrition garden	6	110	52	162
Repair & Maintenance of farm machinery & Implements	16	Operation and maintenance of sprayer, duster and small agril. Implements and tools	8	150	42	192
Integrated Farming System	17	Integrated Farming System	7	143	33	176
Livestock and Fishery Management	17	Duckery as an additional source of income	10	100	26	126
		Management schedule for dual purpose poultry birds	12	140	55	195
		Feed and health management of livestock	8	132	121	253
		Feeding breeding and management of Goat and Pig under drought like situation.	18	360	80	440
		Prevention and control of live-stock Disease	24	390	160	550
		Scientific rearing of IMC	24	330	50	380
		Composite fish culture	16	280	50	330
		Production of quality compost using local resources	10	100	20	120
		Integrated farming methods in landshaping plots	10	120	30	150
		Vegetable cultivation on raised land embankment	12	95	37	132
Fodder and feed management	15	Skill/knowledge development on Fodder and feed management	9	75	19	94
Lac cultivation	3	Skill/knowledge development on Lac cultivation	9	55	27	82
Farm implements and machineries	15	Skill/knowledge development on Farm implements and machineries	6	100	21	121
Value addition	13	Skill/knowledge development on Value addition	6	110	16	126
Employment generation	13	Skill/knowledge development on Employment generation	7	105	52	157
Total			584	8811	2614	11425



Capacity Building programme conducted in NICRA adopted villages

4. EXTENSION ACTIVITIES

NICRA implementing KVKs conducted a total of 1741 extension activities on various thematic areas benefitting 17121 practicing farmers and farm women (11584 males and 5537 females) during 2016-17. 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 and Kisan mela etc.

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services	670	909	555	1464
Awareness	222	1080	595	1675
Diagnostic visit	215	980	660	1640
Exposure visits	113	790	380	1170
Field Day	105	1080	790	1870
Group Discussion	80	1575	665	2240
Method demonstrations	41	756	355	1111
KMAS Services	37	2028	395	2423
Farmers day	45	280	90	370
SHG	22	65	140	205
Campaign	19	370	130	500
Popular extension literature	4	-	-	0
Animal Health Camp	18	190	80	270
World earth day	7	160	45	205
Krishak Chaupal	5	65	35	100
Kishan Gosthi	9	290	210	500
Woman health and nutrition	5		80	80
Technology week	8	780	290	1070
NICRA Workshop at ATARI, Kolkata	1	26	7	33
Scientist visit to field	115	160	35	195
Total	1741	11584	5537	17121



Different extension activities of special day at NICRA adopted villages

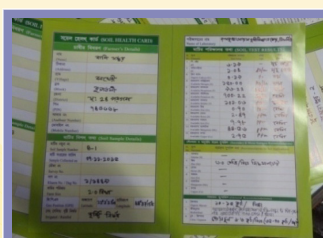
5. SOIL HEALTH CARD DISTRIBUTION

December 5 is declared as ‘World Soil Day’ by the International Union of Soil Sciences and to celebrate the importance of soil as a critical component of the natural system and as a vital contributor to human wellbeing, all the NICRA-KVKs have organized Seminar/symposia/workshop. The World Soil Day campaign aims to connect people with soil and raise awareness on their critical importance in our lives. One of the several ways of connecting people with soils

is to restore and preserve the soil health. All the seventeen NICRA-KVKs of Zone-II distributed the soil health cards among the farmers in NICRA adopted villages. A total of 3045 numbers of Soil Health Cards were distributed on that particular day and cards were distributed by the public representatives like MP/MLAs and others in the respective KVKs. KVK wise distribution of soil health cards are presented in the following table.

Table: SHC card distribution at NICRA adopted villages

KVK	Year	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
Port Blair	2016-17	270	270	270	620
Aurangabad	2016-17	70	62	70	80
Buxar	2016-17	115	68	75	125
Jehanabad	2016-17	117	86	100	116
Nawada	2016-17	175	145	160	165
Saran	2016-17	330	205	210	137
Supaul	2016-17	145	110	29	220
Chatra	2016-17	148	109	300	300
East Singhbhum	2016-17	11	11	88	95
Gumla	2016-17	125	103	110	110
Koderma	2016-17	139	108	108	148
Palamu	2016-17	265	245	240	610
Coochbehar	2016-17	119	100	110	115
Malda	2016-17	35	22	35	19
S. 24 Pgs	2016-17	189	179	189	185
Total		2253	1823	2094	3045



Distribution of SHC

6. REVIEW WORKSHOP OF NICRA-TDC HELD AT DARJEELING KVK KALIMPONG ON DEC 15-16, 2016

The Zonal Level Review Workshop of National Innovations on Climate Resilient Agriculture (Technology Demonstration Component) of ICAR-ATARI Kolkata was held at Darjeeling KVK Kalimpong on December 15-16, 2016. The workshop was chaired by Dr. Chirantan Chattopadhyay, Vice Chancellor, Uttar Banga Krishi Viswavidyalaya, Coochbehar, Co-Chaired by Dr. Ch. Srinivasa Rao, Director ICAR-CRIDA, Hyderabad and Dr. S. K. Roy, Director, ICAR-ATARI Kolkata. The workshop was attended by Dr. Md. Osman, NICRA-TDC Coordinator, CRIDA, Hyderabad, Dr. H. Bhattacharya, Director of Extension Education, UBKV, Coochbehar, Dr. S. Chakraborty, Professor Incharge, RRS-UBKV Kalimpong,, Dr. F. H. Rahman, Principal Scientist-cum- NICRA Nodal Officer, ICAR-ATARI Kolkata, Scientists Incharge of IARI-Regional Station at Kalimpong, CISH-Regional Station at Malda, and all the Programme Coordinators of NICRA implementing KVKs of Zone II.

One CD on ‘Success Story of *NICRA Project of KVK Chatra*’ published by Birsa Agricultural University was released during the workshop.

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

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

Dr. Ch. Srinivasa Rao, Director CRIDA, Hyderabad

showed his satisfaction on the performances of KVKs’ activities. He mentioned that the KVKs should focus on details of district on climate resilient information. He remarked that some of the presentations were excellent and few of them need improvement which should focus only on climate resilient activities. He emphasized that the successful technologies should be transferred from one KVK area to other areas of KVKs involving other stakeholders. He further mentioned that performance of NICRA activities would be evaluated and as per the report the project may be extended further.

Dr. Chirantan Chattopadhyay, Vice Chancellor, Uttar Banga Krishi Viswavidyalaya, Coochbehar, while addressing the inaugural speech he mentioned that the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority. He spoke about the climatic issues exists in Darjeeling district and problems of water crisis are being faced by the people there. Dr Chattopadhyay proposed to include Darjeeling KVK in the NICRA-TDC programme in the coming years.

Dr. Md. Osman, Coordinator, NICRA-TDC, CRIDA, Hyderabad informed the overall performance of NICRA KVKs of this Zone is quite good. He emphasized that intervention should be taken on farmers’ field based on the variability of environmental condition and extent of climatic variability should be available in each of the NICRA-KVK.

In the technical session all the Programme Coordinators/ PIs of the KVKs have presented one by one their salient achievements of out scaled technologies during the last five years.

The workshop ended with vote of thanks proposed by Dr F. H. Rahman, Pr. Scientist-cum- NICRA Nodal Officer, ICAR-ATARI Kolkata.





Few general recommendations of the workshop:

- Farmers wise and intervention wise data to be provided by every KVK
- There should be scientific data along with good action photograph will be more than previous year
- Intervention should be taken on farmers' field based on the variability of environmental condition
- Scientific data and good action photograph will be more than previous year
- Data on extent of climatic variability should be provided
- More focusing only NICRA intervention work for all KVKs
- Documentation of the successful intervention
- Need to improve of the performance of CHC and VCRMC
- Timely report on unseasonal rainfall and extreme events
- Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs
- Contingency planning may be prepared to respond in time
- Mention on flooded, drought, upland, midland and lowland area at the village
- Provide information of contingency plan on NICRA villages
- Vulnerability index should be measured and accordingly intervention to be executed
- Large scale dissemination of successful technologies to be undertaken
- NICRA activities should not clubbed with KVKs normal activities
- Topography situation of village data (Up, Mid & Low land) should be kept in each NICRA village
- All KVKs should have GPS facility (Approx cost Rs. 8000/-)
- Socio-economic impact of the successful technology demonstration should be analyzed
- For NRM activities Farmers share to be collected @ 10%
- There may be around 20% member from women section in VCRMC Committee 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

7. ANNUAL ZONAL WORKSHOP OF NICRA-TDC HELD AT UTTAR BANGA KRISHI VISWAVIDYALAYA COOCHBEHAR ON MAY 30-31, 2017

The Zonal Workshop of National Innovations on Climate Resilient Agriculture (Technology Demonstration Component) of ICAR-ATARI Kolkata was held at Uttar Banga Krishi Vishwavidyalay, Coochbehar, West Bengal. The workshop was chaired by Dr. Chirantan Chattopadhyay, Vice Chancellor, Uttar Banga Krishi Viswavidyalaya, Coochbehar, Co-Chaired by Dr. S. S. Singh, Director ICAR-ATARI Kolkata. The Chief Guest of the Workshop was Dr. Randhir Singh Poswal, Assistant Director General (AE), ICAR New Delhi. The workshop was attended by Dr. Anjani Kumar Singh, Director, ICAR-ATARI Patna, Dr. J V N S Prasad, Coordinator-NICRA TDC, ICAR-CRIDA, Hyderabad, Dr. S. C. Sarkar, Director of Extension Education, Dr. Ashok Chowdhury, Director of Research, Registrar, Heads of Departments, Senior Faculties of UBKV Coochbehar, NICRA Nodal Officer of ICAR-ATARI Kolkata and all the Heads of NICRA-KVKs of the Zone.

One CD on 'Success Story of Sand Bag Check Dam of KVK Gumla' and two publications on 'An Introduction of Edible Mushroom' and 'Green fodder cultivation' published by Coochbehar Krishi Vigyan Kendra were released during the workshop.

In the welcome address Dr. F. H. Rahman, NICRA Nodal Officer presented the highlights of the salient achievements carried out by the 17 NICRA- KVKs of the zone.

Dr. JVNS. Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderabad mentioned in his presentation that each intervention should be planned in relation to the climatic vulnerability like drought, cyclone, salinity, heat stress, flood etc. Overall he showed his satisfaction about the performance of NICRA-KVKs of this zone.

Dr. Anjani Kumar Singh, Director, ICAR-ATARI Patna while addressing he asked all the NICRA-KVKs to prepare case studies/success stories based on the most successful and scalable technologies and those should be replicated in nearby areas.

Dr. S. S. Singh, Director ICAR-ATARI Kolkata in his speech he mentioned that the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority. He emphasized to take up new interventions model which have direct bearing with the climate changes. He informed that there must be

preparedness for handling climatic contingency.

Dr. Randhir Singh Poswal, Assistant Director General (Agricultural Extension), ICAR New Delhi showed his satisfaction on the performances of KVKs' activities. He mentioned that the KVKs should focus on details of district on climate resilient information and suggested that if any modify is necessary. He also suggested that some of the presentation were excellent and few of them need improvement which should focus only on climate resilient activities.

Dr. Chirantan Chattopadhyay, Vice Chancellor, Uttar Banga Krishi Viswavidyalaya, Coochbehar, while addressing the inaugural speech he mentioned that the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority. He spoke about the climatic issues exists in and problems of water crisis in the northern parts of West Bengal are being faced by the people there.

In the technical session all the Programme Coordinators/ PIs of the NICRA-KVKs have presented their salient achievements of out scaled technologies during the last six years and action plan for 2017-18.

The following recommendations were come up during the deliberation:

- So far NICRA programme is concern, intervention must be correlated and focus in the specific climatic vulnerability
- For enhancing resilience in NICRA adopted village low cost suitable technologies already demonstrated needs to be expanded horizontally.
- Quantification of impact of already demonstrated successful technologies should be given prior importance
- As far as possible holistic convergence with line dept. & other development agency in NICRA villages for better strengthening and impact of work
- Always latest variety should be taken for demonstration. In case of cereals not more than 05 years old and pulses not more than 10 years old variety. Varieties should have specific characteristic like hot or cold, flood resistant, short duration etc which will be quantify with specific climatic vulnerability
- For better impact & dissemination of technology programme like Farmers to farmer's interaction, seminar, Exposure visit for Extension functionaries along with public representative should be organized in NICRA village. Assessment of shelf life of technology for sustainability should be done
- Agricultural practices that reduce methane, nitrous oxide and carbon dioxide emission to be implemented.
- Special focus to be given on popularizing technologies that could minimize adverse effect on animal and fish components
- Focus should be given on urbanization of custom hiring centre efforts for inflow of fund from other organization to NICRA village and listing of good technologies
- Human resource development through women empowerment, women in agriculture, use of gender friendly tools in NICRA adopted villages
- For doubling the farmer income specific role of NICRA programme should be addressed. Action plan may be prepared in such a way that maximum utilization of NRM
- Govt. Flagship programme like PMKSY, PMFBY, PKVY, and National Agril. E Marketing (E-NAM) may be implemented & awareness programme should be conducted
- Need to develop 2-3 "Climate smart Village" per district & focus on science based intervention
- Crop planning should be done according to availability of water for maximum return with low cost climate resilient technology. Impact of technology to be assessed in terms of BC ratio
- Farmer's innovation and ITK practices need to be scaling up. Community nursery is a very important component to be considered
- Emphasis should be given on SHC for correction of nutrient deficient & make based used of soil health card
- The entire programme should be documented and data based. NICRA programme and submitted to



the concerned department for further replication and dissemination. Real time data should be collected

- ◉ Intervention about vulnerability of the district need to be publishes. Put the information of all the activities at KVK portal
- ◉ Swachh Bharat Mission, Sanitization may also concern in NICRA village
- ◉ As far as possible to reach large no. of household in the NICRA village. If adoption by 80% house hold

then it is climate smart village

- ◉ Identification of village on the basis of upland, midland & low land *i.e.* on the basis of agro-ecological situation
- ◉ Soil & water conservation work (NRM work) should be done in convergence mode
- ◉ Weather based advisory service should be provided. IMD, Pune should be linked up with NICRA project.

8. CONVERGENCE PROGRAMME

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

crop seed, planting material and material for silage making were taken up in convergence. Capacity building of the farmers in NICRA villages was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programs. Efforts were made to enhance the coverage of the interventions in the village with the support of the line departments through convergence. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2016-17. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, BASF, NABARD, Sunderban Development Board, IWMP, Forest Department, IAP Yojana, RKVY *etc.* NICRA implementing KVKs being part of the different convergence programmes generated a handsome amount of Rs. 47720936.00 - during 2016-17.



Convergence Programme through NICRA Project

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

KVK	Development Scheme/Programme	Nature of work	Amount (Rs.)
Port Blair	During the high tide period sea water are entered and affected 23 ha of paddy land at Port Mout village	Construction and repaired Sluice gate to check the sea water intrusion.	380000.00
Total			380000.00
Aurangabad	National micro irrigation system project	Sprinkler irrigation system	1005237.00
	Adarsh dairy gram yojna	Milk chilling plant	1482000.00
	Pradhan mantri gram sadak yojna	Construction of road (4 km)	17600000.00
	IAP Yojna	PACS godown	1769000.00
	National agriculture development yojna	PACS godown	1145000.00
	National agriculture development yojna	Threshing floor	78000.00
	Animal husbandry Department	Veterinary Hospital	4000000.00
	National agriculture development yojna	Rice mil	3440000.00
Total			30519237.00
Buxar	MGNREGA	CC Work of floor of Harijantola, Earth work at kabir ground	4105500.00
Total			4105500.00
Jehanabad	MANREGA, Modanganj, Jehanabad	Strengthening of field bunds	871895.00
	MANREGA, Modanganj, Jehanabad	Pyne Renovation	811014.00
	MANREGA, Modanganj, Jehanabad	Strengthening of pyne bund	567639.00
	MANREGA, Modanganj, Jehanabad	Soil filling for approach road	276651.00
	COMFED, Jehanabad	FMD vaccination and Deworming for cow & buffalos	14000.00
	ICAR-RCER, Patna	Vaccination camp & Deworming for cattle	2500.00
	Bihar Veterinary College, Patna	Animal health checkup	8000.00
Total			2551699.00
Nawada	MGNREGA	Land Leveling	500000.00
	MGNREGA	Renovation of Ratoiya Aahar	350000.00
	MGNREGA	Renovation of Irrigational channel	500000.00
	MGNREGA	Plantation	500000.00
Total			1850000.00
Supaul	State Govt, vaccination prog	Animal Vaccination for FMD and HSBQ	12000.00
Total			12000.00
Chatra	Soil conservation office	DHOBHA	600000.00
	BOI Chatra	Skill oriented training	120000.00
	MGNREGA	Construction of New Pond under MANREGA	670000.00



KVK	Development Scheme/Programme	Nature of work	Amount (Rs.)
Total			1390000.00
East Singhbhum	DHO	Net house	350000.00
	District Agriculture Officer	Vermincompost – 70 unit	350000.00
Total			700000.00
Godda	District Dairy Development, Godda	13 Cows to BPL family	767000.00
	MGNREGA	Goat Shed - 03	201000.00
	Block scheme	Sabha Bhavan	295000.00
	Crop Production	Chickpea (Var.: JAKI- 9218) in 10 ha	97500.00
Total			1360500.00
Gumla	MGNERGA	Well digging (no. 2)	400000.00
	MGNERGA	Goat shed (no. 8)	160000.00
	MGNERGA	DOVA (no. 8)	184000.00
Total			744000.00
Koderma	Dova-10	irrigation	800000.00
	Zero tillage machine	RCT	40000.00
	Rejuvenation of exiting pond-2	Irrigation	1700000.00
	Vermicompost unit-10	Increase moisture retention capacity and organic carbon of soil	200000.00
Total			2740000.00
Palamu	BAIF	Vaccination	50000.00
	Fishery Department, Palamu	Jeera, 70 Lakh	49000.00
	DAO, Palamu	Mize seed	14000.00
Total			113000.00
Cooch Behar	MGNERGA	Vermi-compost & Azolla production	350000.00
	TSP	Vermin-compost production	50000.00
	NABARD bank	Banana bunch cover	200000.00
			500000.00
Malda	MGNREGA	Renovation of Pond	36000.00
	MGNREGA	Reconstruction of drainage channel.	123000.00
	MGNREGA	Repairing of Roads and bunds	176000.00
Total			335000.00
S. 24 Pgs.	IWMP	NRM	420000.00
Total			420000.00
Grand Total			47720936.00

9. DIGNITARIES VISITED NICRA VILLAGES DURING 2016-17

Name of KVK	Name of VIPs/Experts	Date of visit
Aurangabad	District Agriculture Officer, Aurangabad	23.07.2016
	DHO, Aurangabad	18.11.2016
	PD, ATMA, Aurangabad	10.02.2017
Buxar	Dr. A. Kumar Associate professor, BAU	21.05.2016
	Dr. A. Kumar Associate professor, BAU	
Chatra	Sri. Ashok Kumar Singh, District Agriculture Officer Chatra	09.10.2016
	Smt. Shaweta Kumar, DDM, NABARD, Chatra	14.11.2016
	Sri. Ashok Ram, District Soil Conservation Officer, Chatra	16.02.2017
East Singhbhum	Sri Laxman Tudu, MLA, Ghatsila	12.02.2017
	Sri Kalipada Mahato, DAO, East Singhbhum	30.07.2016
Godda	Sri Sunil Kumar, DHO, Godda	18.10.2016
	Sri Suresh Tirkey, DAO, Godda	11.01.2017
	Sri Rakesh Kumar, Dy. P. D., ATMA, Godda	11.01.2017
	Sri Nirmal Kumar, DDM, NABARD	16.02.2017
Gumla	D.A.O. Gumla, Block Uppramukh Ghaghra	28.09.2016
	Dr. F.H. Rahman, Nodal Officer NICRA, ATARI Kolkata	07.10.2016
	Smt. Rajbala Verma (CS Government of Jharkhand)	14.11.2016
	Technical Officer MNREGA Government of Jharkhand	
	Chief Engineer PWD Government of Jharkahnd	
Nawada	Sri Ashwani Kumar PD ATMA ,NAWADA	04.04.2016
	Dy. Director Soil conservation Department ,NAWADA	03.03.2017
	Dy. Director Horticulture NAWADA	17.03.2017
	SDO Agriculture ,NAWADA	17.03.2017
Koderma	Smt. Neera yadav, Minister of Human resource , govt.of Jharkhand	18.02.2017
	Smt. Neera yadav, Minister of Human resource , govt.of Jharkhand -	22.04.2017
Saran	DDM NABARD with team of World Bank and Farmers' Producers Group	23.02.2017
	Dr. Indu Bhushan Nagar with team of World Bank	17.05.2017
	State Coordinator of Jeevika, Bihar	17.05.2017
	Shri Jai Ram Pal, DAO Saran	15.03.2017
South 24 Paraganas (Nimpith)	Dr. Md. Osman, Coordinator, NICRA-TDC CRIDA, Hyderabad	06.06.2016
	Dr. JVNS. Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderabad	02.08.2016



Dignitaries visited at NICRA- KVKs

10. SUCCESS STORY OF NICRA VILLAGE FARMERS

1. Water harvesting and recycling for supplemental irrigation through Ahar

Village: Harigaon, Dist: Aurangabad, Bihar

Harigaon village belonging to Goh block of Aurangabad district, Bihar is adopted under NICRA project in 2011. It is located between N 25° 02.666', E 0.84° 42.540' and elevation 333 ft. Total population of village is 1041 in which 563 are male while other 478 female. Total cultivated area of Harigaon is 100 ha. Most of the farmers belong to small and marginal group. The farmers are fully depended on onset of monsoon, rice-wheat cropping system rice-wheat mono cropping system of this village. Before NICRA there was no facility of irrigation. Irrigation through water reservoir (Ahar) is also present from long time, but it is fully damage condition. Farmers were not irrigating rabi crop in time. In month of April to June many hand pumps, wells and bore well were dried due depletion of water table. Animals and few people migrated due to insufficient drinking water. After

the starting of this project, 9 ponds, 4 wells and 2.2 km irrigated reservoir (Ahar) were renovated. At present time reservoir (Ahar) is useful in following aspect:-

- Ground water is fully recharged and water level increase up to 2.0-3.0 feet during month of May & June. So, water level is also maintained and there is no problem of drinking water and irrigation of crops.
- Farmers are also happy because they apply 3 to 4 irrigation in wheat and 1 sprinkler irrigation apply in pulses which increase the cultivated area and yield.
- Before renovation of ahar farmers could not able to cultivate moong but in this summer season they also cultivated moong in the month of April.
- Ahar water is used by animal, cultivation of fishes and other activities.
- In Kharif-2015, farmers raised his paddy nursery in time. Before renovation of reservoir they raised paddy nursery in neighbouring village.

Water harvesting and recycling for supplemental irrigation in Wheat

Technology Demonstrated	Storage of rain water in Ahar (m ³)	Water used from Ahar (m ³)	Irrigated area (ha.)	Irrigated area increase due to sprinkler system (%)
Ahar	270000	99000	33 (1 st & 2 nd irrigation)	-
Sprinkler irrigation	-	-	45 (1 st & 2 nd irrigation)	36.7

Water harvesting and recycling for supplemental irrigation in Lentil

Technology Demonstrated	Storage of remaining rain water in Ahar (m ³)	Water used from Ahar (m ³)	Irrigated area (ha.)
Sprinkler irrigation from ponds	171000	34593	21.0
Farmers practices (no irrigation)	-	-	-

Water harvesting and recycling for supplemental irrigation in Gram

Technology Demonstrated	Storage of remaining rain water in Ahar (m ³)	Water used from Ahar (m ³)	Irrigated area (ha.)
Sprinkler irrigation from ponds	136407	20000	14
Farmers practices (no irrigation)	-	-	-



Remaining water 116407 m³ is being used for moong irrigation and use of animals. Due to Ahar water table slightly increased.

2. Boosting Farm income through diversified farming

Farmer's Name: Sri Sunil Mardi

Village: Pathergora, Dist: East Singhbhum, Jharkhand

Sri Sunil Mardi of village Pathergora, block Musabani of East Singhbhum (Jharkhand) is a graduate. After trying different source of income in which he failed, finally came in contact with NICRA activities during 2011-12 and went to Chatra and Nimpith KVK for exposure visit. He got inspired from farmers of other district he started paddy cultivation in his own land of 3.2 ha. But

due to lack of technical knowledge and prevailed climatic vulnerability (Drought & frequent long dry spell) again he disappointed with his earning which was not profitable. However, traditional monoculture cultivation of paddy leads to low productivity. Then to make his farming profitable & cost effective he attended ten no. of training in NICRA office and also in KVK of East Singhbhum. He was advised for diversified and intensive cultivation of vegetables in some areas where he used to cultivate paddy and was also linked with district horticulture office for construction of net house. His pond was de-silted (spacing 100× 100 ×8 ft) through NICRA project during 2016-17 as it benefited 8 more nearby farmers. In convergence mode a net house with spacing of 180 × 100 ft costing-Rs. 3, 50,000.00 (Rs. Three lakh fifty thousand only) was constructed near his pond during September 2016.

His income details before & after NICRA intervention are given below:

Sl no	Crop	Area (ha)	Before NICRA	After NICRA
1.	Paddy	3.5	30000.00	50000.00
2.	Leafy Vegetables (namely: Chulai, spinach, fenugreek, poi etc.)	0.6	-	50000.00
3.	Vegetables (namely: Brinjal, Bhindi, Tomato, cucumber)	1.0	-	40000.00
4.	Composite fish farming	100×100 ft pond	-	30000.00
	Total		30000.00	170000.00

At present he is earned Rs. 1,70,000.00 (Rs. One lakh seventy thousand only) as net income in 8th month, which is much more than his expectation, as earlier he was getting only Rs. 30000.00 (Rs. Thirty thousand only) annually. He uses his money in children education and

family welfare. Looking at his success the farmers of nearby villages are also inspired & thinking to follow his cultivation practices & in touch with KVK, for technical support and convergence with other departments.



3. Elephant foot yam based Multilayer Vegetable Cropping System (MLVCS)

Farmer Name: Sri Amrit Lal Singh

Village: Bhelwa, Dist: Godda, Jharkhand

Sri Amrit Lal Singh has been cultivating cucurbits like Sponge gourd, Ridge gourd, and Bottle gourd since long back. They were also cultivating Elephant foot yam but of Desi variety having high calcium oxalate content causing more acidity and less acceptability. Generally they sow elephant foot yams in the back yard of their houses. Both the crops were cultivated in separate land. No sincere and scientific efforts were carried out before the innovation

made by KVK under NICRA project.

The improved variety of Elephant foot yam (Gajendra) and hybrid variety of Bottle gourd (Mahima), Ridge gourd (local) and Bitter gourd (US – 6214) was grown simultaneously in the same piece of land with leafy vegetables. So, it has been named Elephant foot yam based multilayer vegetable cropping system.

A *machan* like structure was erected with the help of bamboo, wire and threads over 6.5 feet height from the ground level over the main crop i.e. EFY to spread the vines of Bottle gourd, Ridge gourd and Bitter gourd. Elephant foot yam (EFY) variety *Gajendra* was planted

during the second fortnight of June at 75cm x 75cm spacing in the plot size of 1000m². A pit size of 30 cm x 30 cm x 30 cm was dug out and 2 kg well decomposed cow manure was filled 3/4th of pit. 500 g cut tubers of elephant foot yam were treated with cow dung slurry (one kg of fresh cow dug in one litre of water) one day before planting on the pit and then filled the pit with the remaining soil and small mound was formed on the pit. The seeds (hybrid) of cucurbits bitter gourd, ridge gourd, and bottle gourd were sown in between two rows of main crop i.e. Elephant foot yam at the recommended spacing for each crop.

All the plots were fertilized with 150 kg N, 100 kg P₂O₅ and 150 kg K₂O/ hectare. Half dose of nitrogen and potash and full dose of phosphorus were applied at the time of



planting of main crop in pits and rest half of nitrogen and potash were applied after harvesting the companion crops i.e. at 95 days after planting (DAP). Recommended dose of fertilizer was also given to the companion crops

i.e. Bottle gourd, Ridge gourd and Bitter gourd as per schedule. All other cultural practices as per schedule for the cultivation of main crop as well as companion crops were followed to raise healthy crop.

Practical Utility of Innovation:

- ⦿ Better utilization of inputs like land, fertilizer & irrigation etc.
- ⦿ Upliftment of livelihood and social status.
- ⦿ More return/unit area.
- ⦿ Crop intensification.

Utility of the innovation from the climate change perspective

- ⦿ Judicious use of irrigation water, fertilizers and pesticides.
- ⦿ Due to accumulation of organic matter micro climate improves.



Farmers practice		Innovation	
Crop	B:C ratio	Crop	B:C ratio
Elephant foot yam (EFY)	3.32 : 1	EFY+ Ridge gourd	3.43 : 1
Ridge gourd	1.58 : 1	EFY+ Bitter gourd	3.99 : 1
Bitter gourd	2.38 : 1	EFY+ Bottle gourd	3.48 : 1
Bottle gourd	2.34 : 1		

4. Use of Zero Tillage Technology

Farmer Name: Sri Devendra Kumar

Village: Sakrorha, Dist: Jehanabad, Bihar

Sri Devendra Kumar is a progressive farmer. Rice-wheat is major cropping system in his village. During rabi season, wheat is prominent crop. He sowed wheat after 3-4 ploughing followed by planking and broadcast seed and fertilizer, which causes delay in wheat sowing and involved high cost of cultivation also. He came in

contact with Krishi Vigyan Kendra, Jehanabad where he got technical training by Scientist (Agril. Engg.) on use of improved agricultural implements and machineries and he used 11 rows zero till seed cum fertilizer drill for wheat sowing. Zero tillage technology saved Rs. 3000/- per ha in cost of ploughing, labour as well as irrigation water. This technology advanced wheat sowing by 8-10 days and caused a yield increase of 15-18 % as well less weed infestation.

1. Income level before adopting such farming:

Enterprise	Area (Acre)/ No.	Cost of Production* (per unit)	Return (Rs. Per unit)	Net Income* (per unit)
Wheat (Broadcasting method)	10	27000	54400	27400

*includes cost of input, labour and others including marketing and transport of the products

2. Economics of the farm:

Crop/Livestock/ Fish/ Enterprise	Area (Acre)/No.	Cost of Production *(per unit)	Return (Rs. Per unit)	Net Income (Rs. per unit)
Paddy	14	23500	54900	31490
Wheat (ZTSFD)	10	24000	64600	40600
Chickpea	2	22500	154000	131500
Lentil	2	16500	96000	79500
Mustard/rapeseed	2	16000	48000	32000



5. Improved life style through vegetable cultivation

Farmer's Name: Sri Baneshwar Oraon

Village: Lal Pandariya, Dist: Gumla, Jharkhand

Sri Baneshwar Oraon has an experience of farming since 2006. He has a total holding of 4 acres. Out of this he uses to grow vegetables in 0.50 acre during summer and in 1.50 acre during winter season apart from Cereals, Pulses and Oilseeds. On the basis of the experience in



vegetable cultivation he realized that small farmers can enhance their income and livelihood through vegetable cultivation. He finds quite profitable provided the sale of the produce is managed by the farmers themselves in the markets and also adopt best management practices (BMPs) to get maximum economic yield. Keeping all

the things he came in contact with the scientist involved in NICRA Project of KVK and narrated his idea for big way cultivation of commercial vegetable cultivation. Mr. Baneshwar said he planned to grow vegetables in more than 40 acre of land for which he has formed a group of ten tribal youth farmer and accordingly he wanted to train them for Best Management Practices by the KVK and also somewhat support in selection of suitable crop varieties and plant propagation measures with his felt need. KVK Gumla provided training, bio fertilizer and need based pesticides.

As per his plan and technology interventions viz., fertilizer management including quality compost, Bio enzyme and NPK (12:32:16), Zinc sulphate use he cultivated Tomato var.-Laxmi and 145-55 in 30 acre area and Chilli var.-Surayamukhi in (10 acre) in different area. Need based irrigation and plant protection measures were undertaken. Sound market strategies were established with VEGFED for better post harvest management. By this way Mr. Oraon and his group has succeeded to harvest 240 t of Tomato and 60 t of Chilli and earned a gross income of Rs. 21,60000 in Tomato and Rs. 90, 0000 in Chilli with a gross investment of Rs. 10, 50000 in Tomato and Rs 42,0000 in Chilli. The B: C ratio was found in 2.05 and 2.14 respectively.

Sri Oraon's initiative of collective Group farming is an example for small and marginal farmers especially of



tribal farmers. However, he has succeeded in managing the production as well as market linkage by forming an enterprise group.

6. Zero Tillage Technique- Viable Technology for Accelerating Wheat Productivity

Farmer's Name: Sri Sahdev Yadav

Village: Chopnadih, Dist: Koderma, Jharkhand

Sri Sahdev Yadav a progressive farmer of village and post Chopnadih, Block Markachho, District Koderma, Jharkhand having about 10 acre agricultural land, his main occupation is agriculture. The major crop he grown in *Kharif* rice and in *Rabi* wheat in 2 ha & 0.5 ha each gram & linseed. He participated in an on campus training conducted by Krishi Vigyan Kendra, Koderma (NICRA) held on "Zero tillage (ZT) technique". In the training course, scientists of the Kendra demonstrated the zero tillage technique and told in details about the technique, in this system the sowing the crop where the seed is directly placed into the slit made by the seed drill without prior land preparation, which reduce the cost of cultivation and increase the crop yield. But all 30 participants including Sri Yadav from village chopanadih were psychologically in favour of conventional tillage. Sri Sahdev Yadav finally adapted the technology to sow rice with zero tillage technique (DSR) during *Kharif* 2015. Germination and growth of crop (ZT rice) was good but due to severe infestation of weeds he could not

get desired yield of rice.

The scientists of KVK, Koderma took this as challenge and it made them more careful in the Rabi season not only for present but also for the future consequences and possible good impacts of ZT on profitability. They organized two training programmes on ZT technique in training programme they got success to motivate few farmers including Shri Sahdev Yadav to ready for demonstration on their field.

After motivation by scientists from KVK, Koderma (NICRA) he again convinced to Shri Sahdev Yadav to sow wheat by zero tillage on that land which were always remain kept fallow after rice harvest due to late harvest of rice Sahbhagi Dhan, Abhishek and excessive soil moisture. He had sown wheat cv. K 307 in that 0.5 ha land with zero tillage machine under supervision of KVK scientists. The farmers were surprised to see satisfactory germination which was 2 days earlier than conventional method and dark green colour wheat seedlings but none of them agreed that this technology was successful till the final yield data were available. The yield of wheat increased with the tune of 21.4% over conventional method (28 q/ha) and it saves about Rs. 2940 in cost of cultivation compare to the conventional cultivation with reduction in irrigation. By advanced 8 days of sowing as compared to conventional method, the additional yield obtained under zero tillage in late condition which is predominantly due to late harvesting of Swarna Mahsoori (MTU 7029). It reduces the use of diesel fuel which prevents air pollution due to reduction in CO₂ emission. He observed that changing one hectare of land to zero tillage system saved about 18 L diesel. Considering all the facts, an additional advantage of about Rs.9540/ha came due to adoption of zero tillage technology. During rabi 2014-2015 Sri Sahdev Yadav increased the area of wheat from 1.5 ha and sown their total area of wheat, mustard, gram and Linseed by zero tillage machine to about 22 ha wheat in 2015-2016. Comparative study of cost of cultivation of Zero tillage (ZT) and conventional method

Activities	Items used (ZT)	Cost of items in Rs. (ZT)	Items used (CM)	Cost of items in Rs. (CM)	Saving over CM
Land preparation	Nil	0.00	3	2400.00	2400.00
Sowing	1	1000.00	1	1000.00	Nil
Seed sowing labour	1	60	5	300.00	240.00
Seed	120kg @Rs.20/kg	1200.00	150kg	1500.00	300.00
Germination	6 th DAS	-	8 th DAS	-	-
No. of tillers /Plant	14			12	
Weeds infestation	Less		More		
Production	34Q/ha@Rs.11/kg	37400.00	28Q/ha	30800.00	
Total benefit by ZT technique over conventional method		9540.00			

7. Vegetables based Multi-tier Horticulture System

Village: Manikchak, Dist: Malda, West Bengal

Farmers generally cultivate seasonal crops. Hence, after a certain time they have no scope to earn more. Vagaries of weather many times spoil that scope of earning which aggravates their poverty. When farmers are planted single climber crop in bower system made by bamboo structure there most of the land remain unutilized. The nutrient of different soil layer remains unused. Farmers lack of technical knowledge of different cropping systems. In this situation Multi-tier cropping system opens a new door to earn from round the year as well as there is less risk of complete crop failure. Multitier cropping systems are dynamic interactive practices that better use of the production components such as soil, water, air space, solar radiation and all other inputs on sustainable basis to take full advantage of limited land resources. This cropping system minimizes risks of crop yield loss.

At first a structure (about 6ft height) is made by bamboo on which climber crop like Cucumber, Bottle gourd, Bitter gourd, Snake gourd, Dolichos bean are grown. In this system the tallest components have foliage of strong light and high evaporative demand and shorter components with foliage requiring shade and or relatively

Economics/ Cost involved:

Area	Cost of cultivation (Rs/bigha)	Gross return (Rs/bigha)	Net return (Rs/bigha)	BC ratio
Farmers who followed the technology	14300	45700	31400	2.19
Farmers practice single crop	5400	13800	8400	1.55

The economic assessment for the technology was done on the basis of cost of cultivation, gross and net return, considering the cost of inputs and market price of the produce during the period of experimentation.

Impact and up scaling: The technology is highly potential because it uses natural resources properly. Farmers are highly interested to adopt this technology because production per unit area of land, time and inputs can be increased with multitier cropping system and reduce the insecurity of mono cropping.

8. Floating seedbed of paddy to escape early season flooding

Farmer's Name: Sri Madan Mandal

Village: Bongheri, Dist: South 24 Pgs, West Bengal

The village falls under the coastal agro-ecological zone and suffers from occasional torrential rain during

high humidity. Under the structure different vegetable crops according to their height can be grown. Under the structure land should properly ploughed and prepared plots and irrigation channels. The soil of plots mixed with fertilizer and manures according to crop requirement. Vegetables which are selected for multi tier cropping system like leafy vegetables (Coriander, Spinach, Radish, Amaranthus), Tomato, Brinjal, Chilli and even Elephant foot yam may also be grown. All growing space is used as crop fit together vertically or horizontally (tall, medium & short) and underground (deep-rooted and shallow-rooted plants). Crops can be grown according to market preference and seasons.

The technology was conducted by Malda Krishi Vigyan Kendra at farmers' field of NICRA adopted villages, Manikchak block in Malda district, West Bengal, India. The site was located in sub-tropical humid climate with gangetic old alluvial soil, sandy clay loam texture, good water holding capacity, well drained, and with acidic to neutral reaction and moderate fertility status. From this technology increases the income per unit area. It ensures a more evenly distribution of income and employment throughout the year due to harvesting of different crops in different seasons. Women's are highly interested to adopt this technology as entrepreneur in their home stead situation. This technology can be replicated for other district or other area also.

Monsoon. Paddy is the major crop during Monsoon season. More than 75% of the agricultural lands are low lying and hence the Kharif paddy suffers prolonged submergence after any intensive precipitation (>60 mm per day). Due to climate change there is an increase in intensity of precipitation during the initial monsoon days (June-July) resulting into prolonged submergence (10-12 days). This causes havoc damage to the seedbed preparation as well as to the standing seedbeds of paddy.

The intervention helped to save the paddy seedbeds from prolonged submergence and subsequent crop loss. The seedbed floats over the standing water and thus escapes any immediate damage. Moreover, seedbed preparation is neither delayed nor hampered due to heavy precipitation during initial phases of monsoon. The seedlings of floating seedbed were ready for transplantation at 24 days after sowing compared to 30-35 days in case of traditional method.

- Timely preparation of seedbed
- Escape from submergence
- Early transplanting

The entire seedbed is prepared on a bamboo frame that can float over water so that the paddy seedlings are protected from submergence during excess rainfall.

Process:

- ⦿ A 10ft x 4ft size bamboo frame is prepared.
- ⦿ A polythene sheet is covered over the bamboo frame.
- ⦿ A thin layer of top soil is spread over it.
- ⦿ The frame is either fixed with bamboo poles at four corners and manually lifted with the rise of water level or fixed with empty plastic vessels to keep it floating.
- ⦿ Paddy seeds are sown on the floating seedbed.

Specifications of the practice

Seed rate of paddy: 50kg/ha

Floating seedbed size: 10ft x 4ft

No. of floating seedbeds: 25no./ha

Age of seedling at transplantation: 24 days

Economics of the intervention:

Crop yields (kg/ha) or productivity of the systems as applicable	Variety: Dudheswar 33 q/ha
Expenses incur (Rs/ha/year)	Rs. 39000/ha/year
Net returns (Rs/ha/year)	Rs. 27000/ha/year
B:C ratio	1.69



9. IFS Model in Manjhila

Farmer's Name: Sri Rupesh Kumar

Village: Manjhila, Dist: Nawada, Bihar

Sri Rupesh Kumar of village Manjhila, block- Kawakol, district – Nawada with his strong determination has started the IFS Model which has changed his income 3 to 4 fold from the earlier income.

A pond was excavated on his land under NICRA programme by KVK Nawada in the year 2013-14. The rain water harvested and stored in this pond and approx 0.25 ha of paddy crop irrigated during dry spell in kharif. On the bund of the pond he started cultivation of Redgram, forest and fruit plants. Beside this some vegetable were also grown from the last year he has started cultivation vegetable in on two sides of the pond .He also started dairy unit in the year 2014-15.The dairy unit also increased his income up to 3.0 lakh which was earlier 1.25 lakhs only.



Other benefits:

- Timely preparation of seedbed
- Escape from submergence
- Early transplanting

The details of his income is given below

Crop	Are (Acr)	Cost of production	Return (Rs)	Net Income
Redgram	0.2	1425	9000	7775
Vegetable	02	1050	7000	5950
Brinjal		1050	3500	2450
Okra		650	1690	1040
Bottle gourd		1350	3250	1900
Bitter gourd		1550	10750	9200
Sponge gourd		1300	8000	6700
Tomato				
Cauliflower				
Cabbage				
Milk	06 cattle	475200	777600	302400
Total	-	482150	811790	329640



IFS Model Developed under NICRA Village

Now his income is three lakh twenty nine thousand six hundred forty /annum. He can invest more in children education and family welfare.

10. Jute cultivation- A case study in Supaul

Farmer's Name: Sri Ramanand Sah

Village: Sadanandpur, Dist: Supaul, Bihar

Sri Ramanand Sah, village Sadanandpur is a 30 years old and progressive farmer of the NICRA project Village Sadanandpur. He is also an active member and secretary of the VCRMC. He has own 16 acres of land. He has grown improved variety of Jute crop, JRO-66 in 2.5 acres of land. He got bumper yield of 20 quintals per hectare whereas traditional variety has given the yield of 14

quintals/hectare. A 42% yield increase has been achieved. He has applied scientific method of Jute cultivation like use of new and improved variety, balance fertilizers dose and application of bio fertilizers like PSB and Aztobactor at the rate of 5 kg each per hectare. Low yield 14 q/ha of Jute crop had started demotivating the farmers to take Jute crop. But few steps taken by him as mentioned above has helped him as well as other fellow farmers to take Jute crop. With the help from NICRA project of KVK Supaul the gross return of Rs. 60,000 per hectare with increase of 43% over traditional variety has been achieved. The lands were left barren after the harvests of jute are now getting cultivated with short duration Paddy variety Prabhat. The income of the farmers has been increased significantly.





11. NEWSPAPER COVERAGE

सीएस ने लिया योजनाओं का जायजा, लोगों को किया प्रोत्साहित

प्रधानमंत्री की शीर्ष गणना में शामिल योजनाओं का जायजा लेने के लिए सीएस ने जिला स्तर पर जायजा लेने के लिए लोगों को प्रोत्साहित किया।

ईमानदारी से कार्य करें जलदा: अशोक भगत

जलदा के कार्य में ईमानदारी से कार्य करने का आह्वान किया।

30 तक किसान कर सकते हैं रोपनी

किसानों को 30 तक रोपनी बनाने का अवसर प्रदान किया गया।

कम पानी में धान की खेती का जाना मुर

कम पानी में धान की खेती का जाना मुर के लिए किसानों को प्रोत्साहित किया।

सूचनाओं में कृषक अधिकतर जगजगत्ता पर प्रशिक्षण पारंपरिक खेती के संरक्षण की दी जानकारी

कृषकों को सूचनाओं में अधिकतर जगजगत्ता पर प्रशिक्षण पारंपरिक खेती के संरक्षण की दी जानकारी।

30 तक किसान कर सकते हैं रोपनी

किसानों को 30 तक रोपनी बनाने का अवसर प्रदान किया गया।

प्रत्येक गांव से दो युवक कृषि मित्र के रूप में जोड़े जाएंगे

प्रत्येक गांव से दो युवक कृषि मित्र के रूप में जोड़े जाएंगे।

350 गांवों में चलना जलसंरक्षण अभियान

350 गांवों में चलना जलसंरक्षण अभियान।

नवबिहार टाइम्स

नवबिहार टाइम्स का प्रकाशन शुरू किया गया।

निकरा प्रोजेक्ट से आ सकती है हरित क्रांति

निकरा प्रोजेक्ट से आ सकती है हरित क्रांति।

वर्षाजल को बहने न दें, खेतों में शेकने का उपाय करें किसान

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निकरा प्रोजेक्ट से आ सकती है हरित क्रांति

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समेकित कृषि प्रणाली अपना सुधलान वने किसान - कल्पना

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निकरा प्रोजेक्ट से आ सकती है हरित क्रांति

निकरा प्रोजेक्ट से आ सकती है हरित क्रांति।

मरदानपुर के किसानों ने जल संरक्षण की दिखाई राह

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सूचनाओं में कृषक अधिकतर जगजगत्ता पर प्रशिक्षण पारंपरिक खेती के संरक्षण की दी जानकारी

सूचनाओं में कृषक अधिकतर जगजगत्ता पर प्रशिक्षण पारंपरिक खेती के संरक्षण की दी जानकारी।

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13. EXPENDITURE STATEMENT 2016-17

Table. Expenditure details during 2016-17

KVK	Revised Estimate				Expenditure	Closing Balance 01.04.17
	Contingencies	TA	NRC	Total		
ATARI Kolkota	1021877	150000	80000	1251877	1323210	-71333
Aurangabad	850000	500000	50000	940000	940000	0
Buxar	1298729	400000	50000	1338729	1123832	214897
Chatra	1095630	500000	50000	1145630	1145630	0
Coochbehar	1100000	700000	60000	1210000	1208180	1820
East Singhbhum	1000000	500000	60000	1040000	1039860	140
Gumla	1219123	600000	60000	1354123	1313976	40147
Jehanabad	900000	400000	60000	960000	960000	0
Koderma	1296201	500000	60000	1346201	1172378	173823
Nawadah	1000000	500000	60000	1090000	1041339	48661
Malda	500000	300000	50000	570000	427980	144176
Palamau	1100000	500000	70000	1140000	1140000	0
Port Blair	950000	700000	70000	1025000	1021048	3952
Saran	857760	400000	70000	877760	871801	5959
South 24 Parganas	1245680	500000	70000	1398680	1452925	- 54245
Supaul	700000	500000	60000	740000	708374	31626
Banka	950000	500000	60000	990000	985000	5000
Godda	950000	500000	60000	1010000	997787	12213
Total	18035000	10000000	1100000	19428000	18873320	556836

CONTRIBUTORS - NICRA KVKs OF ZONE II

Sl. No.	KVK / District	State	Contributors
1.	Aurangabad	Bihar	Dr. Nitya Nand
2.	Banka	Bihar	Dr. Kumari Sarda
3.	Buxar	Bihar	Dr. Deokaran
4.	Jehanabad	Bihar	Dr. Shobha Rani
5.	Nawada	Bihar	Smt Kalpana
6.	Saran	Bihar	Dr. R. K. Jha
7.	Supaul	Bihar	Dr. S. K. Choudhary
8.	Chatra	Jharkhand	Dr. R. K. Singh
9.	East Singhbhum	Jharkhand	Dr. Arti Bin Ekka
10.	Godda	Jharkhand	Dr. Ravi Shanker
11.	Gumla	Jharkhand	Dr. Sanjay Kumar
12.	Koderma	Jharkhand	Dr. Sudhanshu
13.	Palamu	Jharkhand	Dr. L. K. Das
14.	Coochbehar	West Bengal	Dr. Bikash Roy
15.	Malda	West Bengal	Dr. Bhabani Das
16.	S. 24 Pgs	West Bengal	Dr. N. J. Maitra
17.	Port Blair	A & N Islands	Dr. Nagesh Ram