2017-18 Annual Report
वार्षिक प्रतिवेदन

National Innovations in Climate Resilient Agriculture
जलवायु समुत्थानशील कृषि पर राष्ट्रीय नवोन्मेष
ICAR- Agricultural Technology Application Research Institute Kolkata
भाकृअनुप-कृषि तकनीकी अनुप्रयोग संस्थान कोलकाता
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Annual Report
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National Innovations in Climate Resilient Agriculture

Technology Demonstration Component

ICAR-Agricultural Technology Application Research Institute Kolkata
Indian Council of Agricultural Research
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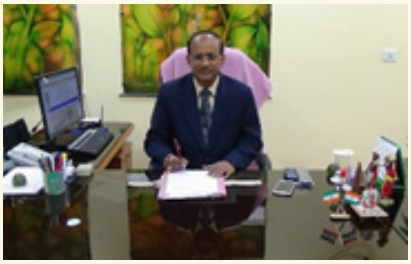
Preface



Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. The impacts of climate changes are global, but countries like India are more vulnerable in view of the high population depending on agriculture. 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 climatic vulnerability through the components *viz.* 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 and capacity building of different stakeholders. 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 component TDC of the project has been implemented through Krishi Vigyan Kendras at district level regionally coordinated by ICAR- Agricultural Technology Application Research Institutes (ATARIs). ICAR-Agricultural Technology Application Research Institute Kolkata having nine KVKs where different activities under Technology Demonstration Components of National Innovations in Climate Resilient Agriculture (NICRA) programme in various modules are carried out. The overall focus of NICRA is on adaption to climate variability which entails appropriate response to contingency situations. The central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains.

Technology Demonstration Component (TDC) under NICRA (National Innovations in Climate Resilient Agriculture) project is in operational in nine climatic vulnerable districts in the state of West Bengal (3), Odisha (5) and A & N Islands (1) of the Zone V. Location specific best innovative practices to address major climatic vulnerabilities such as drought, flood, heat stress and other extreme weather events were demonstrated during 2017-18 in farmers' field in NICRA adopted villages. The overall focus of technology demonstration under NICRA is to enhance resilience of farms and the farming community to climate risks so as to ensure sustainability over a period of time. The emphasis has been on capturing and improving the understanding on performances of technologies in different agro-ecologies and farming systems.

Compilation of NICRA Annual Report of ICAR-ATARI Kolkata for 2017-18 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 demonstrations, VCRMC, institutional interventions, seed production, capacity building, extension activities, review workshops *etc*. were also noted. The NICRA Annual Report 2017-18 includes all the relevant and required information of ICAR-ATARI Kolkata and achievements of selected 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. K. Sammi Reddy, Director, Dr. J.V.N.S. Prasad and Dr. Md. Osman, Coordinators (NICRA-TDC), ICAR-CRIDA Hyderabad and other officials of Division of Agricultural Extension, ICAR for providing guidance and help in compiling the Annual Progress Report 2017-18. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the selected 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

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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 climatic vulnerability through the various components *viz.* 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 and capacity building of different stakeholders. 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.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 technologies under field conditions to address current climate variability. This will enhance the space of adoption of these resilient technologies. On-farm participatory demonstrations for climate resilience are being implemented in village clusters through KVKs in 121 climatically vulnerable districts across the country and by 7 core research institutes of ICAR. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. This also facilitates identification of what constitutes climate resilience in different bio-physical and socio-economic contexts. NICRA KVKs prepared and implemented village level contingency crop plans and measures. Climatic vulnerability of selected 9 KVK districts of Odisha (5), West Bengal (3) and union Territory of A & N Islands (1) assessed during implementation of NICRA programme brought forward definite requirement in terms of technological support, human resource development and overall empowerment of farming community to enable them to cope up with climate vulnerabilities like droughts, erratic rainfall, heat wave, flood, cyclonic storm. Plan of action, accordingly, was prepared for its implementation through executing technological interventions to initiate crop production, resource conservation, livestock and fish rearing, water harvesting *etc.* in the vulnerable villages of KVK districts.

ICAR- Agricultural Technology Application Research Institute Kolkata having nine NICRA implementing KVKs which carried out different activities under Technology Demonstration

Components of National Innovations on Climate Resilient Agriculture Programme in various module benefitting 20809 farmers (NRM- 2505, Crop Production- 2905, Livestock and Fisheries- 2539, Institutional Interventions- 1455, Capacity Building- 3371 and Extension Activities- 8035).

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 and rainwater harvesting structures, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, crop residue management, bunding of field, Broad Bed Furrow, soil test based nutrient application, micro irrigation techniques, compost pits *etc*. covered 648.6 ha area which benefitted 2505 practicing farmers in the zone.

Under **Crop Production** module different area specific intervention were taken by the NICRA-KVKs *viz*; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of *rabi* crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, covering 452.8 ha area which benefitted 2904 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, clean milk & fodder production *etc.* were covered which benefitted 2539 livestock owner.

Institutional Interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed in almost all NICRA villages. A total of 48 units have been developed covering of 191 ha area of 1455 number of farmers. There is a provision of Mini Automatic Weather Station (AWS) through which farmers are provided weather forecasting data.

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 Head of the KVK concerned. The custom hiring of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK. Custom Hiring Centre has the provision of various farm implements like Power tiller, Thresher, Reaper, Water pump, Zero - till Drill, Raised bed planter, Sprayer, Weeder *etc*.

Custom Hiring Centers initiated in the NICRA adopted village under the supervision of VCRMC has become immensely popular among the farmers and substantial amount has also been generated. VCRMC constituted by South 24 Parganas KVK at Bongheri village generated maximum amount of Rs. 221915 during 2017-18

A total 175 courses were conducted under **Capacity Building** on various thematic areas benefitting 3371 farmers and farmwomen (2598 males and 773 females) during 2017-18. 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 874 **Extension Activities** on various thematic areas benefiting 8385 practicing farmers (5740 males and 2645 females) during the reporting period. The extension activities were conducted on method demonstrations, agro advisory services, awareness animal health camp, Kishan Chaupal, Kishan Gosthi, resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, World Earth Day, technology week, kishan mela *etc.* All the nine NICRA-KVKs have celebrated World Soil Day through conducting workshop, seminar, symposia, awareness camp on December 5,2017 in the respective KVK and1616 Soil Health Cards distributed among the farmers of NICRA villages.

1. INTRODUCTION

Climate change is one of the major global challenges of the 21st century, and is one of the key priorities of the discussion in the International for a since last few years. The adverse impacts of climate change are affecting all countries, especially developing countries, including persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieve sustainable development. Combating climate change would require substantial and sustained reductions in greenhouse gas emissions GHG, which, together with adaptation, can limit climate change risk. Indeed adaptation and mitigation actions are complementary for reducing and managing the risks of climate change. Considering that the climate change is a continued challenge, the focus on this critical area needs to be continued with greater emphasis. Keeping this view, one scheme has been strengthened and efforts were made to build on the initiative taken during XI five year plan. To meet the challenges of sustaining domestic food production in the face of changing climate and to generate information on adoption and mitigation in agriculture to contribute to global fora like UNFCCC, the Indian Council of Agricultural Research launched - A Flagship Network Project 'National Initiative on Climate Resilient Agriculture' (NICRA) during XI Plan in February 2011, and during XII Plan it is referred as 'National Innovations in Climate Resilient Agriculture' (NICRA).

Considering that the climate change is a continued challenge, the focus on this critical area needs to be continued with greater emphasis. Keeping this view, one scheme has been strengthened and efforts were made to build on the initiative taken during XII five year plan. Thus National Innovations in Climate Resilient Agriculture' (NICRA) has been continuing with these following objectives:

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies
- 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
- To draw policy guidelines for wider scale adoption of resilience-enhancing technologies and options

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 through network as well as Sponsored / Competitive Grants mode
- Technology demonstration on farmers' fields to cope up with current climate variability
- Knowledge Management
- 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:

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	Odisha	North-Eastern Ghat	Ganjam 1	Drought
3	Odisha	West Central Table Land	Jharsuguda	Drought / Flood
4	Odisha	Western Undulating	Kalahandi	Drought
5	Odisha	East & South Eastern Coastal Plain	Kendrapara	Flood / Cyclone
6	Odisha	West Central Table Land	Sonepur	Drought / Flood
7	West Bengal	Terai Zone (WB-2)	Coochbehar	Heavy rainfall
8	West Bengal	Old Alluvial Zone (WB-3)	Malda	Flood
9	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.

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

Name of KVK	Name of village
Ganjam 1	Chopara
Jharsuguda	Bhoimunda and Tharkaspur
Kalahandi	Pipalpada, Maskaguda and kamardha
Kendrapara	Dasmankul
Sonepur	Badmal, Dipapali and Ganjathapar
Cooch Behar	Khagribari
Malda	Brozolaltola, Meherchandtola, Jayramtola and Mahendrotola
South 24 Parganas	Bongheri
Port Blair	Badmaspahad and Port Mout

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 part of this module.

2.1 Module I: NATURAL RESOURCE MANAGEMENT

The major emphases of the intervention were on augmenting rainwater availability through its efficient use by adopting site-specific rainwater harvesting strategies. Major interventions under this theme included in-situ moisture conservation; construction/renovation of new water harvesting and recycling structures/farm ponds/checks dams/tank roof water harvesting tank; land shaping and RWH structure; improved drainage in flood prone areas; conservation tillage where appropriate; artificial ground water recharge and water saving irrigation methods; green manuring; 5% model of irrigation; crop residue management; bunding of field; broad bed furrow; soil test based nutrient application; micro irrigation techniques; compost pits; participatory soil health management through identification and correction of major and micro nutrients. The impact of interventions aimed and enhancing rainwater harvesting and utilization capacity was very significant across the clusters. The efforts in this area resulted in the creation of an additional rainwater harvesting capacity of over 17.3 lakh cu m leading to increase cropping intensity by bringing around 1250 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 9 NICRA adopted villages covering 454 farmers in 85.8 ha areas. 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
Use of paddy straw mulch in Cucumber (Local variety: *Jampur*)	22	0.3	117.0	67500	166500	3.47
Use of paddy straw mulch in Poi (Basella) (var: *Panchsira*)	20	0.4	221.0	52500	168500	4.21
Zero Tillage in wheat (var. *DBW39 / HD 2967*)	140	20	38.4	21375	34305	2.61
Organic mulching in vegetables Tomato, brinjal (var. Hybrid)	43	0.3	322.5	131250	142875	2.08
Vegetables Poly-mulching in winter cucumber	15	0.4	298.0	65977	112823	2.71
Summer Ploughing in Paddy	25	25.0	38.8	23400	27040	2.15
Green manuaring (dhaincha) in Paddy	20	10.0	37.4	22800	25820	2.13
Plastic mulching Okra, cucumber etc	15	0.4	48.0	14380	38826	3.70
Ridge and furrow method of cow pea cultivation	15	1.4	42.0	16577	16423	1.99
Ridge and furrow method of brinjal cultivation	15	2.6	234.0	55003	44997	1.81
Mulching in brinjal	15	1.0	242.0	60005	70000	1.99
Ridge and furrow method in cow pea (var. *Kashikanchan*)	10	2.0	77.0	45250	68479	2.50
Ridge and furrow method in Radish.	10	2.0	147.5	55000	93455	2.60
Green manuaring (dhaincha) in Paddy	15	6.0	50.0	24000	36000	2.50
Moisture conservation in Paddy – Summer ploughing by MB plough	40	6.0	39.7	30100	28259	1.94
Sowing of maize in Ridge and furrow method in upland	14	5.0	43.2	26200	25640	1.98
Green manuring by Sunhemp. (Sunhemp-paddy)	20	3.0	38.6	31100	25642	1.82
Total	**454**	**85.8**				

2.1.2 Water harvesting and recycling for supplemental irrigation:

Water harvesting and recycling for supplemental irrigation were demonstrated in nine NICRA adopted villages by the different KVKs involving 347 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
Dug out pond	10	10.0	Rain water harvesting structures to store 1428 cu.m of water to supplement life saving irrigation	65820	64500	1.98
Renovation of pond	60	0.3	33.41	48400	139100	3.87
Renovation of canal	60	100 m	30.45	42600	132100	3.32
Enlargement of existing freshwater pond	10	4.3	Rain water harvesting structures to store 935 cu.m of water to supplement life saving irrigation	48720	52500	2.08
Brackish water pond	10	1.2	Brackish water exchange capacity of 1121 cu.m for sustaining crab fattening	140280	145875	2.04
Repairing of Check Dam	42	0.5	39.1 (Paddy)	29100	28377	1.97
New water harvesting structure in the wheat field	14	0.4	37.5	33580	20859	1.62
Renovation of old water harvesting structure in paddy field	38	3.5	20.6	37577	22295	1.60
Raising of land embankment	29	2.5	201	42291	143909	4.40
Renovation of Defunct Well-03 nos.	28	1.5	184 (Brinjal)	65000	82200	2.26
Construction of deep open well	26	3.5	272 (brinjal) + 49 (chilli) +282 (tomato)	200000	320800	2.64
Natural mulching	20	2.0	420	48500	47500	1.97
Total	**347**	**29.7 ha & 100 m**				

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 five NICRA adopted villages in an area of 58.9 ha in 410 numbers of farmers. The technologies followed mainly by zero tillage operation. The results of the ZTD in various crops are presented in below table.

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; (var. DBW*39* / HD *2967*)	180	20.0	38.40	21375	34305	2.61
Promotion of improved variety of wheat + Zero tillage technology	65	6.0	31.88	26600	24408	1.92
Promotion of improved variety of maize + Zero tillage technology	55	4.9	56.60	39470	39770	2.01
Surface seeding and mulching in lentil	35	4.0	10.35	18430	33320	2.81
Surface seeding and mulching in mustard	30	10.0	12.00	18900	18450	1.98
Sowing of paddy with power tiller	45	14.0	23.21	23634	22109	1.94
Total	**410**	**58.9**				

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 52.5 ha area in 157 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	47	13.1	39.4	25700	20222	1.78
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	62	29.2	45.5	24500	16700	1.71
Ground water recharge through SRI by sub-soiler	48	10.2	59.5	39465	44918	2.24
Total	**157**	**52.5**				



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 27.8 ha in 405 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	29	4.8	36.5	27800	21800	1.78
Application of biofertilizer in rice (var. *MTU* 7029)	64	5.1	70.5	35240	50340	2.43
Vermi-compost from biodegradable wastes	28	0.7	14.8	4850	4150	1.86
RBF in Brinjal and cucumber (var. *Malini*)	24	1.5	270.0	61950	63550	2.03
Sprinkler irrigation in green gram (var. HUM-16)	19	1.5	10.5	16100	26970	2.68
Sprinkler irrigation in chickpea (var. PG-186)	32	4.5	10.8	15250	22970	2.51
Vermi-compost from biodegradable wastes	35	15 nos.	60.0	18750	63750	4.40
Sprinkler irrigation in green gram	30	5.0	7.0	19875	17500	1.90
Sprinkler irrigation in Brinjal (var. *MuktaKeshi*)	30	1.0	525.0	152000	635500	5.18
Sprinkler irrigation in Chilli (var. *Tejaswini*)	24	1.4	272.0	187500	900500	5.80
Sprinkler irrigation in Greengram (var. *PDM-84-139*)	18	1.1	8.1	7500	24900	4.32
Sprinkler irrigation in Poi (Basella)	23	0.2	226.0	49500	176500	4.57
Sprinkler irrigation in Okra	18	0.5	198.0	67000	131000	2.96
Sprinkler irrigation in Cucumber	16	0.2	142.0	53000	160000	4.02
Sprinkler irrigation in Pumpkin	15	0.3	146.0	57000	118200	3.07
Total	**405**	**27.8 ha & 15 nos**				


2.1.6 Other Demonstrations:

Demonstrations like oyster mushroom cultivation, effective utilization moisture through seed production of black gram, in-situ vermicomposting in orchards, soil test based nutrient application, cleaning and renovation of old farm pond, renovation of well, planting forest trees, plant for biodiversity, forestation, soil test based nutrient application, bio pesticides in tomato, dolomite in gora paddy and cultivation of high yielding grass on farm bund were carried out in 732 farmers' fields with an area of 75.5 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	85	8.1	17.8	16500	41100	3.49
In-situ vermicomposting in orchards	31	5.0	57.5	34970	167400	5.79
Soil test based nutrient application	125	30.8	17.5	32978	25800	1.78
Cleaning and renovation of old farm pond	107	3.1	146.9	59850	154000	3.57
Renovation of old water harvesting structure (Well)	30	2.5	37.5	22100	35500	2.61
Soil test based nutrient application (FYM/ inorganic fertilizer)	92	14.4	42.8	10750	15980	2.49
Bio pesticides in tomato	24	2.6	159.0	50875	125240	3.46
Soil test based nutrient application in Cucumber	35	0.4	119.0	60200	177800	3.95
Use of IPM in Chilli leaf curl management	40	0.3	116.7	187533	395817	3.11
Use of IDM in Bittergourd bacterial wilt management	35	0.3	364.2	202985	525415	3.59
Effective utilization moisture through seed production of blackgram after flood	38	8.0	11.6	16875	81980	5.86
Renovation of old water harvesting structure (Canal)	60	100 m	30.5	42600	132100	3.32
Solid waste management (Compost and Vermi-compost production unit)	30	30 unit	7.5 q/chamber, pH 7.02, OC 17.73%, N 1.25%, P 0.63%, K 0.77%	2500	4500	2.80
Total	**732**	**75.5 ha + 100 m; 30 unit**				




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 78 number of rainwater harvesting structures have been developed which could store 1.04 million cu m of water which could provide irrigation to 352 ha of land. This intervention increased the cropping intensity to the maximum extent up to 250%. Storage capacity and increase in cropping intensity through the rain water harvesting structures are given in the following table.

Table: Rainwater harvesting structures developed during 2017-18

New (Nos.)	Renovated (Nos.)	Total	Storage capacity (cu m)	Protective irrigation potential (ha)	Cropping Intensity (%) increase
40	38	78	1.04 million	352 ha	100-250






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 2017-18. 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 through different intervention mentioned below.

2.2.1 Introducing drought resistant varieties:

During the current year (2017) delayed onset of monsoon was experienced in several districts of Odisha and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Iintroductions of drought resistant varieties of paddy, brinjal, tomato, black gram, arhar etc were demonstrated in 9 NICRA adopted villages involving 627 number of farmers in 76.2 ha area. Performance of the different drought resistant varieties of various crops is presented in the following table.

Table: Performance of different drought resistant 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 rice (var. *Jogesh*)	55	10.0	23	16	43.7	18200	15316	1.84
Drought tolerant parice (var. *Sahabhagi dhan*)	95	15.0	33	22	47.7	14600	21400	2.46
Red gram (bund planting)	65	1.0	16	12	59.0	29800	47200	2.58

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Drought resistant brinjal (var. *VNR- 218*)	73	4.5	560	445	58.2	75000	205000	2.90
Tomato (var. *Utkal Kumari*)	84	4.2	264	178	48.3	65000	199000	4.00
Chili (var. *Agnirekha*)	68	3.6	48	36	33.3	73000	167000	3.30
Black gram (var. *PU 31*)	58	5.8	11	7	57.1	18000	37000	3.05
Cotton (var. *Shalimar*)	76	19.5	24	16	50.0	38000	82000	3.15
Arhar (var. *PRG 176*)	53	12.6	16	11	39.1	22000	58000	3.63
Total	**627**	**76.2**						




2.2.2 Introducing salt tolerant rice varieties:

Salt tolerant varieties of price like *CARI Dhan, Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona* were introduced in 12.3 ha area in 130 farmers' fields. Variety *Jarava* and *CSR-36* proved maximum salt tolerant potential by giving highest yield of 44.8 q/ha and 44.7 q/ha respectively and more economic return (BC ratio of 2.41), respectively.

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	37	2.5	42.5	34.5	23.0	29750	23500	1.79
SR-26B	25	2.1	39.5	32.5	21.0	27500	28700	2.04
Usar Dhan-3	38	3.5	38.0	31.5	20.0	33650	16500	1.49
Salt tolerant Rice var. *Jarava*	20	2.7	44.8	26.4	69.7	41250	25550	1.62
Paddy CSR-36	10	1.5	44.7	34.3	30.3	29650	27830	1.94
Total	**130**	**12.3**						


2.2.3 Introducing flood tolerant varieties:

Flood tolerant varieties of rice like *Swarna sub* 1 and *Nilanjana/ Pratiksha / CR 500 / NC 492* were introduced through demonstration in 23.0 ha area in 114 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
Flood tolerant paddy	35	6.9	45.0	39.0	86.6	31150	40995	2.33
Temporary submergence tolerant rice variety Swarna Sub-1	15	4.0	41.8	25.2	65.9	41250	22650	1.55
Promotion of submergence tolerance rice var. Swarna sub-1/ Nilanjana/ Pratiksha	60	9.7	41.3	28.5	44.7	21250	34440	2.62
Rice *CR 500*	2	2.0	3.2	2.0	56.5	27500	19000	1.69
Rice *NC 492*	2	0.4	3.1	2.7	14.0	25750	14500	1.5
Total	**114**	**23.0**						


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 180 number of farmers' fields with an area of 33.7 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
Lentil var. *Moitree*	75	10.0	10.7	6.8	58.0	21250	27125	2.28
Green Gram, *var. PDM139*	30	4.0	10.2	6.2	63.5	20500	40700	2.98
Promotion of short duration rice (*GB-1/ Panth-18/Sahabhagi*)	60	9.7	42.0	31.0	35.5	22060	34640	2.57
Short duration rice (*Jogesh*)	15	10.0	22.8	15.5	38.2	18200	15316	1.84
Total	**180**	**33.7**						

2.2.5 Water saving rice cultivation methods:

Water saving paddy cultivation through SRI, short duration varieties, direct seeded rice *etc*. have been demonstrated in 53.9 ha area of 143 number of farmers' fields. These interventions were carried out in seven NICRA adopted villages.

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
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/Use of trans-planter	12	2.4	-					
Water saving technology through SRI	5	1.0	52.5	38.6	36.01	14850	19300	2.34
Line sowing by paddy drum seeder	42	20.0	41.0	35.0	17.14	14580	35720	3.44
Total	**143**	**53.9**						

2.2.6 Community nurseries for delayed monsoon:

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. It appeared that failure of rain in July is responsible as transplanting of rice is delayed with resultant adverse effect on productivity and a cascading negative impact on *rabi* crops. Delay in transplanting of rice affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides rice 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 five NICRA adopted villages.

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
Community nursery of Chilli (var. *Tejaswini*)	45	13.2	108	79	36	177500	362500	3.04
Community nursery of tomato	45	9.0	322	225	43	131250	142875	2.08
Community nursery of brinjal	50	12.0	560	425	32	75000	205000	3.70
Community nursery of onion	47	4.4	265	210	26	145000	12000	1.80
Total	**187**	**38.6**						



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 six NICRA adopted villages. The demonstrations were carried out in 3.6 ha area of 50number of farmers' fields. Of all these intercropping of maize + ladies finger was found most popular although maximum return (B: C: 3.17) 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
Brinjal + Coriander	5	0.3	591	521	13.4	145700	272600	2.87
Cauliflower + Ridge gourd	5	0.3	688	528	30.3	163800	224800	2.37
Maize+Ladies finger	10	1.0	102	75	36.0	63750	138750	3.17
Others if any chilli + tomato	10	1.0	30 + 322	275	28.0	241200	113700	1.89
Cucurbits / Gourd + solanaceous vegetables	20	1.0	Gourd: 75.0 Vegetables: 251	-	-	217500	64500	3.02
Total	**50**	**3.6**						



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. HYV *Gajendra*) in the cropping pattern. District is the most promising one which gave maximum economic return (B:C:: 6.9).

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	190.0	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	59.0	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	86.0	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 var. *PL 406*)	48	9.6	16.5	7.5	45.5	18000	30000	2.74
Linseed (Short duration var. *T 397*)	34	7.5	7.5	4.8	64.0	11000	19000	2.83
Ol (var. *HYV Gajendra*)	35	3.7	800.0	253.0	31.6	94000	551840	6.90
Nutritional garden- veg. seed Seem (*dolicus 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**						





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 and Dwarf Cavendish*)	25	3.0	499	476	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	11	49	30000	46500	2.58
Promotion of stem rot resistant Jute (var. *JBO-2003H*)	40	6.5	38	29	66	35500	49900	2.45
Integrated crop management of mustard (var. *NC-1*)	45	6.5	21	11	54	40560	47580	2.13
Integrated crop management of lentil (var. Maitri)	46	6.5	17	11	56	31500	42970	2.41
Integrated disease management in vegetables	26	5.9	251	225	38	96000	41500	1.51
Demonstration short duration vegetables as contingent crop Tomato (var. *PUSA Gaurav*)	22	3.5	365	300	24	59500	197500	4.63
Contingency crop Brinjal (var. *PUSA Uttam*)	21	2.5	389	315	36	59500	291950	6.64
Contingency crop Cauliflower (var. *PUSA Sharad*)	30	2.5	265	220	36	61000	237500	4.85
Contingency crop Radish (var. *PUSA Chetki*)	47	2.7	165	125	64	57500	65900	2.19
Soil reclamation : Levelling /bunding and flooring for leaching of salt	42	9.6	41	35	66	40000	49000	2.29
Integrated fish farming	45	6.5	4	2	82	58000	141200	3.39
Integrated farming system	45	6.5	-					
late blight disease of potato	22	2.9	315	280	8	122500	195000	2.54
Bio-control agent production	32	-	-	-	-	Rs. 55/ Kg	Rs.600/Kg	-
Mushroom	26	-	14	-	-	Rs. 25/ cylinder	Rs.55/ cylinder	3.22
Forest tree plantation	65	-	-	-	1600 Plant			
Total	**619**	**71**						

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 908 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	685	42	36500	91500	3.59
JHB-146	46	6.5	840	649	22	30000	73000	3.45
Quality legume fodder Berseem (var. *Muskavi*)	29	3.9	979	855	32	34500	74000	3.19
Quality legume fodder Oat (var. *JHO-822*)	47	4.5	545	439	28	29850	45000	2.55
Quality legume fodder Sudan chari	35	1.6	46	35	49	13900	36200	3.79
Quality legume fodder Sudan Grass	52	8.9	557	205	45	58000	263000	5.59
Fodder production of Maize/Sudan	425	49.9	538	455	31	41000	91000	3.29
Fodder cultivation with improved vars. Hybrid Napier (CO -3)	48	4.9	88	48.5	65	15100	19000	2.34
Sorghum (Moti)	42	2.6	339	257	33	19950	56200	3.74
Molases	95	75.8	23	18	38	9900	7500	1.79
Oat (*Kent*)	34	12.5	477	374	29	20800	23900	2.25
Total	**908**	**178.6**						

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 since last three years 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 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)	135	2	195.0	-	-	1600	16300	13.75
Silage Making	150	28 nos	9.2	6.5	66	45	270	8.65
Total	**285**	**2 ha 28 nos**						

Animal Health Case Advisory based on Temperature-Humidity Index (THI)

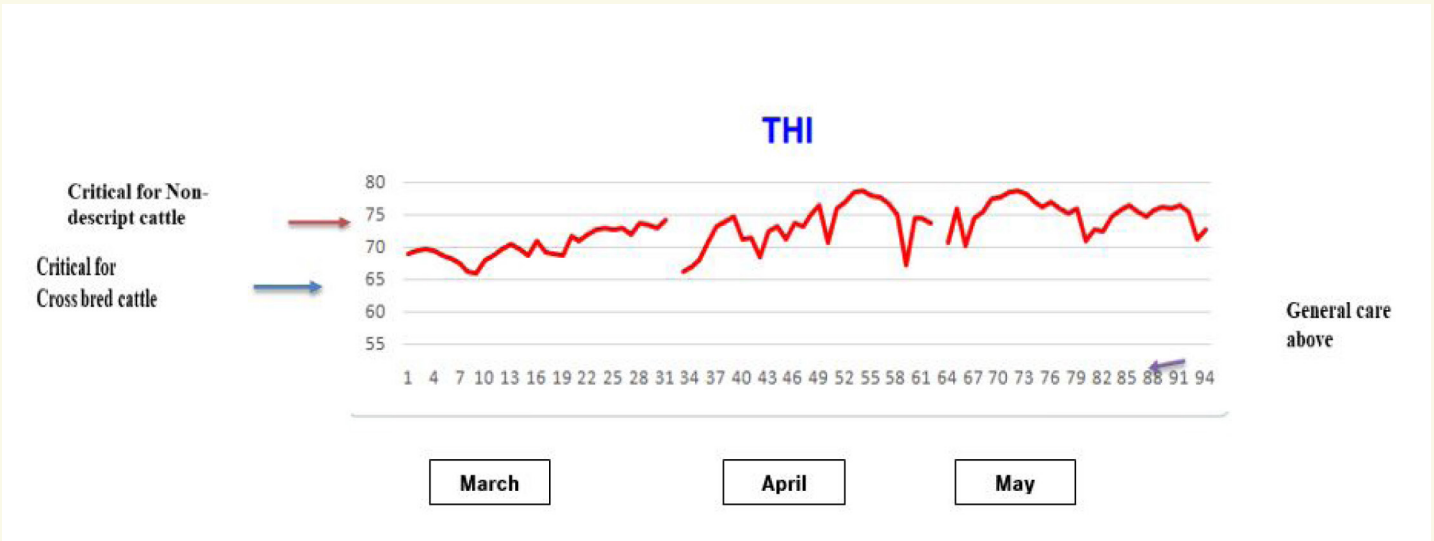
In the NICRA village taking the help of weather station, especially during the hot humid season the THI was calculated and the enlisted farmers were provided with SMS alert and accordingly steps to be taken for managing stress.

The THI formula used for these studies is: THI = Tdb – [0.55 – (0.55 x RH/100)] x (Tdb – 58)

This formula uses dry bulb temperature (Tdb, ºF) and the relative humidity (RH). The RH is divided by 100 to express the percentage in decimals.

Advice

1. High yielding cattle should be provided with more green fodder and fresh cool water when THI is above 65
2. The same was advised for ND cattle when THI was more than 75
3. In general, three times bathing was advised when THI is over 60
4. Most of the ration (80%) was provided during the cooler periods of the day (early morning from 5:00-6:00am, and late evening from 8:00-10:00 pm & The feeding was split into 4 numbers instead of two



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 nine 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./ Area (ha)	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	250	265	Mortality rate (75-80%) reduced	Mortality rate (40-50%) reduced	-	-	-	-
Vaccination for PPR in goat and Ranikhet in Poultry.	215	245	Occurrence of disease not recorded in vaccinated group.	Sporadic out break	-	-	-	-
Deworming (Febendazole) & Mineral mixture	55	210	11% mortality	90% mortality	91% survival	624500	154570	1.35
Proper De-worming	280	85	8	6	42	27	159	7.91
Vaccination camp against HS+BQ+FMD in Cattle & PPR against goat, De-worming & providing Mineral mixture (Cattle: 238, Goat: 97, Sheep: 66, Poultry: 380)	114	781	-	-	-	-	-	-
Total	**914**	**1586**						

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 113 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. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	58	20.6	685	295	132.0	21500	53000	3.46
Cat fish culture	39	3.9	1690	850	98.8	19900	76500	4.84
Composite fish culture with **Tilapia** (Salinity tolerant) and **carp** Introduction of tilapia (all male) increased the total cost of cultivation by 25%, but it gives extra protection to the farmer in case of any saline water ingress	5	0.67	**Tilapia** Length (mm)-183 Weight(g)- 145 Survivability (%)- 83 Yield(q/ha)- **17.80** **Carp** Length (mm) -235 Weight(g)- 490 Survivability (%)-81 Yield(q/ha)- **30.50** **Total: 48.30 q/ha**	**Carp** Length (mm) -238 Weight(g)- 447.6 Survivability (%)-83 Yield(q/ha)- **32.85**	47.0	238750	277800	2.16

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite fish culture with **Pacu** and **carp** Stocking density Local practice: 11000/ha Demo: Carp – 9000/ha Pacu – 3000/ha Introduction of Pacu helped the farmers to utilize vegetables like cabbage, bottle gourd, etc. as fish feed when there is low market price for the same vegetables.	5	0.67	**Carp: 32.40 q/ ha** **Pacu: 14.6 q/ha Avg wt. 540g** **Total: 47 q/ha**	**Carp: 36.5 q/ha**	28.8	191250	383550	3.01
Composite Fish Farming	06	0.4	37.5	22.5	167.0	48400	139100	3.87
Total	**113**	**26.24**						

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 233 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. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry Kuroiler Birds	45	205 nos	2.5 kg at 10 weeks	1.5 kg at 10 weeks	42	95/bird	55/bird	1.48
Backyard poultry (Improved Nicobari fowl)	22	140 nos	160 egg	88 egg	87	3300	4889	2.51
Replacement of local breed with Khaki Cambell	31	130 nos	Prodn: 28/ duck/month	Prodn: 19/duck/ month	44	Rs. 85 duck/ month	Rs. 75duck/ month	1.91
Ornamental bird	18	35 nos	Hatchability-90%, fecundity-70%, chick	-	-	90pair/ bird/ year	430/ pair/ bird/year	5.96
Addition of mineral mixture	95	550 nos	1.94	1.05	35	1850	2600	2.48
Low cost Azolla production as supplementary cattle feed	22	12 ha	3.6 lit/ animal	2.75 lit/ animal	131	3800	7400	2.95
Total	**233**	**1060 nos & 12 ha**						

2.3.6 Improved shelters for reducing heat stress in livestock:

Improved Poultry shed recorded low mortality rate and in shady area reduced heat stress. Standard spacing in improved shed resulted better performance in poultry and dairy animals.

Interventions to reduce heat stress for higher survivability of backyard poultry and dairy animals were demonstrated of improved shelter.

Table: Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based Shelter Bamboo+Paddy straw+mud	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**	**99**							



2.4 Module IV: INSTITUTIONAL INTERVENTION

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 all together developed of 1455 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 2017-18. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

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

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

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

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

Table: Details of the various interventions

Interventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	7	Pulse (Black Gram)	10.0	Seed production of Pulses	40	5.0
		Paddy var- *Jogesh, Sahabhagidhan*)	30 qt/18/300 per month	Paddy var- *Jogesh, Sahabhagidhan*	68	10.0
		Black gram	47q	Proper care and storage of black gram. Seed treatment with bavistin Preservation of germination quality. Registration of seed bank	85	15.5
		Lentil	5.0 q	Buy back by KVK Variety: var IPL- 406 following rules of seed production	30	1.0
		Green gram	15.0 q	Water management/ bio product application/weed control	103	18.5

Interventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Fodder bank	6	Maize	39 q	Proper care and storage of maize seeds. Seed treatment with bavistine. Preservation of germination quality. Registration of fodder bank	66	6.0
Commodity groups	7	Oyster Mushroom	-	Cultivation of oyster mushroom (var. *P.Sajarcaju*) by WSHG for income generation	50	10 nos. (100 bed)
		Paddy straw Mushroom	-	Cultivation of paddy straw mushroom *Volvariella volvaceae and Volvariella diplasia* by WSHG for income generation	45	10 nos (100 bed)
Custom hiring centre	9	Power tiller	6 no. (Rs. 160/hr)& (Rs.250/hr)	Farm Implements used for various farm operations (Managed by VCRMC)	236	35.5
		Paddy Reaper	1 no. (Rs. 150/hr)		187	8.2
		Paddy thresher	5 no. (Rs. 80/day)		102	16.0
		Pumpset	4 no. (Rs. 40/hr)		95	18.0
		Knapsack sprayer	4 no. (Rs. 2/hr)		74	14.0
		Conoweeder	4 no. (Rs. 2/hr)		18	4.8
		Fodder chaff cutter	1 no.			
		Coconut dehusker	3 no.			
		Power sprayer	1 no.			
		Rocker sprayer	2 no.			
		Sprinkler	Rs. 5/Pipe		71	28
		MB plough	Rs.20 /hr			

Interventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No. / Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
		Mini weeder	Rs.20/hr			
		Power thresher cum winnower	Rs.40/hr			
Climate literacy through a village level weather station	9	Recording daily temperature, RH, Rainfall in the village	1 unit	Manual reading of the weather parameters are taken and maintained by the VCRMC members	-	-
		Off/On season Vegetables	9 unit	Awareness & skill development	185	10.5
Total					**1455**	**191 ha & 48 unit**



2.4.1 Village Climate Risk Management Committee (VCRMC)

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



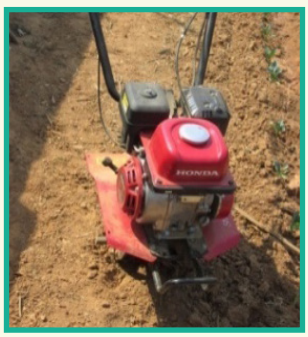
2.4.2 Custom Hiring of Farm Implements and Machinery

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.

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

Name of KVK	Revenue generated (Rs.)	
	From Custom Hiring Centres	Total under VCRMC
Cooch Behar	42000	103000
Malda	13685	45685
Port Blair	39186	21400
South 24 Parganas	32176	221915
Kendrapara	38009	42209
Sonepur	33000	5000
Kalahandi*	-	-
Jharsuguda	3270	29156
Ganjam	6820	6820
Total	**208146**	**475185**

*No CHC has been established yet



3. CAPACITY BUILDING

A total of 175 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 3371 farmers and farm women (2598 male and 773 female) during 2017-18. 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	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Natural Resource Management	Improved package of practices of wheat	2	68	22	90
	Increase of water holding capacity of sandy soil of Diara land	1	71	33	104
	Selection of crops grown in multi tier	3	78	22	100
	Mulching and its impact	5	72	18	90
	Use of drip and sprinkler irrigation system	4	80	15	40
	Paddy and other cultivation through SRI	6	90	10	35
	Training on cultivation of vegetables using ridge and furrow method	3	85	22	47
Climate Change	Climate change and its impact on rural livelihoods	2	65	29	63
	Climate change adaptation strategies for sustaining coastal agriculture	3	0	30	30
	Inter-village dissemination of sustainable climate smart technologies evolved through NICRA	3	89	39	128
Crop Management	Seed treatment with chemical & bio-agents, nursery management and nutrient management in *Kharif* paddy	5	66	-	66
	Drought escape through cultivation of low water demanding early winter vegetables	4	68	7	75
	Aerial farming as an intensive vegetable cultivation option	3	81	13	94
	Cultivation of vegetables as intercrop with maize	2	62	06	68
	Training on Oyester mushroom cultivation	4	-	25	25
	Organic production of vegetables	3	68	06	74
	Training on Cultivation of Oyster and Paddy straw Mushroom	6	82	38	120
	Training on Off- season Vegetable Cultivation	5	62	13	75
	Training on Vermi-composting	7	90	15	105
	Training on Soil sample collection technique	5	81	8	89
	Crop Management	6	85	-	85
	Water management	8	25	-	25
	Improved package of practices for pulse and oilseeds	6	25	-	25
Nutrient Management	Nutrient management for *rabi* seasonal crops	5	28	02	30
	Green mannuring	4	66	9	75
	Use of sun hemp/ brown manuring for better fertility status and yield	3	37	13	50
	Training on INM in Brinjal	5	38	17	55
Integrated crop management	Training on cultivation of cucurbits in trellie system	3	25	-	25
	Training on improved package and practices of potato	2	25	-	25
	Off season Tomato cultivation	3	18	7	25
Plant propagation	Plant propagation on fruit crops	4	13	7	20

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
IF System	Pond based IFS	3	15	9	24
Soil health	Awareness on Soil health	2	61	8	69
IPM and IDM	IPM on vegetables	3	41	6	47
	IPM in Paddy	2	21	4	25
	IPM in Pulse crops	4	90	6	96
Poultry farming	Scientific poultry farming	1	17	20	37
	Training on scientific rearing of poultry birds	5	16	9	25
	Training on management of Honey bee boxes	1	-	25	25
	Training on scientific rearing of goats	1	41	14	55
Resource conservation Technology	Cultivation of vegetables as intercrop with maize through ZTD	1	27	3	30
	Resouce conservation	1	21	4	25
Crop Diversification	Method of Cultivation of remunerative crops	2	45	10	55
	Training on intercropping	1	15	10	25
Pest and Disease management	Eco-friendly chemical and organic plant protection measures against pest resurgence	1	13	3	16
	Preparation and use of eco-safe neem based bio-pesticides	1	13	7	20
	Viral diseases in crops and their management - a growing challenge due to climate change	1	12	6	18
	Pest and disease management of winter vegetables	1	27	3	30
	Method of preparation of botanical pesticides	1	25	5	30
	Integrated Disease Management	1	21	4	25
	Crop Diversification of sustainable crop production	1	18	7	25
	Practice of Bio-pesticides instead of large scale use of synthetic	1	22	8	30
	Mechanical weeder as substitute of new as weed side	1	21	9	30
Fodder and feed management	Green fodder cultivation – to boon livestock production	1	36	-	36
Employment generation	Mushroom production	1	-	25	25
	Skill/knowledge development on Employment generation	1	35	20	55
Nutrition garden	Selection of Suitable crops for nutrition garden	2	13	42	55
	Training on planning layout and maintainance of Nutritional Garden	1	-	25	25
Integrated Farming System	Integrated Farming System	3	61	20	81
	Scientific cultivation of crop management.	1	20	5	25
	Integrated Farming System	1	19	6	25
Livestock and Fishery Management	Composite fish culture	1	23	07	30
	Different vaccination schedule implies for prevention of viral diseases in livestock	1	48	12	60
ICT	Role of farmer club in climate smart agriculture	1	18	7	25
Total		**175**	**2598**	**773**	**3371**






4. EXTENSION ACTIVITIES

NICRA implementing KVKs conducted a total of 874 extension activities on various thematic areas benefitting 8385 practicing farmers and farm women (5740 males and 2645 females) during 2017-18. The extension activities were conducted on Method demonstrations, Agro advisory services, Awareness camp, Animal Health Camp, Krishak Chaupal, Kishan gosthi Resource conservation technologies, celebration field and farmers' days, diagnostic visits,group discussion, Technology week, Kisan mela *etc*.

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services	191	356	175	531
Awareness	30	640	267	907
Diagnostic visit	211	274	167	441
Group Discussion	22	476	217	693
KMAS Services	41	224	111	335
NICRA Review Workshop	3	245	108	353
Popular extension literature	9	339	149	488
Animal Health Camp	5	418	245	663
Exposure visits	11	219	74	293
Field Day	37	757	316	1073
Method demonstrations	25	274	173	447
Farmers day	3	143	112	255
SHG	6	305	107	412
Campaign	02	114	22	136
Woman health and nutrition	3	00	75	75
Technology week	3	104	92	196
Scientist visit to field	254	270	80	350
Integrated Farming System	2	118	87	205
Others if any	15	316	41	357
World earth day	1	148	27	175
Total	**874**	**5740**	**2645**	**8385**

5. SOIL HEALTH CARDS DISTRIBUTION AND OBSERVANCE OF WORLD SOIL DAY

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 nine NICRA-KVKs of Zone-V distributed the soil health cards among the farmers in NICRA adopted villages. A total of 1616 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: KVK wise SHC distribution during 2017-18

KVK	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers benefitted
Port Blair	200	200	200	200
Ganjam I	125	110	150	150
Sonepur	48	48	92	92
Kalahandi	122	91	105	105
Jharsuguda	180	150	165	165
Kendrapara	128	120	120	120
Coochbehar	250	250	250	250
Malda	143	128	128	128
S. 24 Pgs	300	300	406	406
Total	**1496**	**1397**	**1616**	**1616**

6. ANNUAL ZONAL WORKSHOP OF NICRA-TDC OF ICAR-ATARI KOLKATA AND PATNA HELD AT UTTAR BANGA KRISHI VISHWAVIDYALAY, 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), and I.C.A.R 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 Educatio; 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.

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. 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 workshop ended with vote of thanks proposed by Dr Bikas Roy, Head of Coochbehar KVK.

General remarks and suggestion were wrap-up –

- 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. and 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 and 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 uberisation 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 and awareness programme should be conducted
- Need to develop 2-3 "Climate smart Village" per district and 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 and 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 and low land *i.e.* on the basis of agro-ecological situation
- Soil and 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.

7. REVIEW WORKSHOP OF NICRA-TDC OF ICAR-ATARI KOLKATA AND PATNA HELD AT RAMA KRISHNA ASHRAM NIMPITH ON JANUARY 13-15, 2018

The Review Workshop of National Innovations in Climate Resilient Agriculture (Technology Demonstration Component) of ICAR-ATARI Kolkata and ICAR-ATARI Patna was held at Ramkrishna Ashram Nimpith during January 13-15, 2018. Dr. A. K. Singh, Deputy Director General (Agricultural Extension), ICAR New Delhi was the Chief Guest of the programme. The workshop was attended by Swami Sadanand Maharaj, Secretary, Ramkrishna Ashram Nimpith; Dr. S. S. Singh, Director, ICAR-ATARI Kolkata; Dr. Anjani Kumar, Director, ICAR-ATARI Patna; Dr. J V N S Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderabad; Dr. Prabhat Pal, DEE, UBKV; Dr. P. K. Roul, DEE, OUAT; Dr. B. Sahi, Dr RPCAU, Pusa; Dr. F. H. Rahman, Principal Scientist-cum- NICRA Nodal Officer, ICAR-ATARI Kolkata; Dr A. Haldar, Pr. Scientist, ICAR-ATARI Kolkata and all the Programme Coordinators of NICRA implementing KVKs of Zone IV and V.

Few publications like - CD on '*Climate Resilient Agriculture and Endeavour of KVK Nimpith*', Bulletins – *ATARI Kolkata News*, *Purbi Kiran, Kheti bari, Flood tolerant rice varieties, Insect Pest of Vegetable Crop etc*. were released during the workshop.

The workshop started with the Vedic Chanting and welcome address by Swami Sadanand Maharaj, Secretary, Ramkrishna Ashram Nimpith.

Dr. F. H. Rahman, Principal Scientist-cum- NICRA Nodal Officer, ICAR-ATARI Kolkata presented the highlights of the salient achievements carried out by the 22 NICRA- KVKs of the zone IV and Zone V.

Dr. A. K. Singh, Deputy Director General (Agricultural Extension), ICAR New Delhi, Chief Guest of the programme, while addressing the inaugural speech he mentioned that the KVKs should give emphasize on documentation on the various climate resilient activities and transfer to the block and district administration for further dissemination. KVKs need to organize for validation of research on local technology to address the climate vulnerability issues. Integrated Farming

System models must be emphasized in the KVKs and farmers field.

Dr. S. S. Singh, Director, ICAR-ATARI Kolkata 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. Agriculture Scientists have to frame resilience technologies by considering climatic condition like (temperature,CO_2 concentration, sea level, dry spell *etc*.)

Dr. Anjani Kumar, Director, ICAR-ATARI Patna 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. J V N S Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderabad KVKs 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-KVKs and NICRA village should be model for R.W.H, I.F.S and doubling farmers income, zonal monitoring committees has been formed.

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 six years and also placed the next plan of work.

The workshop ended with vote of thanks offered by Dr. A. Haldar, Pr. Scientist, ICAR-ATARI Kolkata.





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

1. Vulnerability index should be measured and accordingly intervention to be executed
2. Large scale dissemination of successful technologies to be undertaken
3. After saturation of farmers in present NICRA village with technology then those should be replicated in neighbouring villages
4. Farmers wise and intervention wise data to be provided by every KVK
5. Performance of CHC and VCRMC need to be improved particularly in Odisha KVKs
6. Contingency planning may be prepared to respond in time
7. Detail of proven technology needs to be documented
8. NICRA activities should not clubbed with KVKs normal activities
9. Topography situation of village data (Up, Mid and Low land) should be kept in each NICRA village
10. Socio-economic impact of the successful technology demonstration should be analysed
11. Intervention on livestock/fishery should be taken on proper climate resilient basis
12. Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs
13. Documentation of the successful intervention to be prepared
14. Creation of water resources should be more in Odisha KVKs
15. Crop diversification intervention need to be undertaken in more numbers in Odisha KVKs particularly
16. Extension activities or training programme to be conducted on climate related issues
17. All the KVKs should prioritize their required equipments based on the budgetary provision.
18. The titles of the training under NICRA should be innovative with thrust on climate resilience.

19. Conducting Impact evaluation of KVK by ATARI and other external agency.
20. Effective utilization of fund must be followed
21. Emphasis must be given for convergence with different ongoing programmes in the district particularly for KVKs of Odisha
22. Demonstration of different units in KVK to showcase different technology
23. Identification of technology according to land pattern must be followed
24. Identify different climate resilient varieties and inclusion of those in the district plan in collaboration with district authority for horizontal spread.

8. ZONAL MONITORING COMMITTEE VISIT TO NICRA KVKS

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

The Monitoring Committee comprised the following members:

Chairman: Prof. H. K. Senapati, Former Dean PG-cum-DRI, OUAT, Bhubaneshwar

Vice- Chairman: Dr. S. S. Singh, Director, ATARI Kolkata

Member: Dr. Md. Osman, NICRA-TDC Coordinator as CRIDA Nominee

Member: Dr. B. Maji, Former Head, ICAR-CSSRI Canning Town as DDG (NRM) Nominee

Member: Dr. P. K. Roul, Dean Extension Education, OUAT Bhubaneshwar

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

Proceedings of the Visit of NICRA-ZMC of ICAR-ATARI Kolkata two KVKs (Kendrapara and Jharsuguda) of Odisha during Oct 31- Nov 1, 2017

The Zonal Monitoring Committee of NICRA –TDC of Zone V comprising Prof. H. K. Senapati, Former Dean PG-cum-DRI, OUAT, Bhubaneshwar as Chairman, Dr. S. S. Singh, Director, ATARI Kolkata as Vice Chairman, Dr. Md. Osman, NICRA-TDC Coordinator as CRIDA Nominee, Dr. B. Maji, Principal Scientist and Former Head, ICAR-CSSRI Canning Town as DDG (NRM) Nominee, Dr. P. K. Roul, Dean Extension Education, OUAT Bhubaneshwar and Dr. F. H. Rahman, Principal Scientist, ICAR-ATAR Kolkata as Member Secretary, visited Kendrapara and Jharsuguda KVKs and NICRA Project sites to get an overall view of the agro-climatic conditions of the ecosystem in the region during the period of 31st October to 1st November , 2017. The committee interacted with the Kendrapara KVK personnel and reviewed the salient achievements of NICRA-TDC programmeduring last six years. Thereafter the committee moved to the NICRA village Dasmankul of Kendrapara KVK and interacted with VCRMC members and visited different interventions implemented at the village. In the next day the committee moved to Jharsaguda KVK, visited KVK farms and interacted on major activities of NICRA-TDC programme implemented during last six years. The committee also visited NICRA village, Bhoimunda and reviewed all the demonstration and interacted with the VCRMC members on the activities and impact of the programme.

The ZMC Team during their visits to the sites was accompanied by the project personnel. Following the presentation made initially at the KVKs for an overview of the problems and the activities undertaken in-depth discussions took place with the farmers and VCRMC members at respective sites of both the KVKs.The salient intervention-wise recommendations emanating from the discussion directly related to the project sites are as follows:

Water resource	Provision of irrigation facility and optimal utilization of available water are important interventions for mitigation of climate induced adverse impacts on agro economy in a ecosystem. • The rain water harvesting may be encouraged for efficient use of water as the major vulnerability factors with respect to climate of the village as well as the district are drought proneness with scanty rainfall, high temperature and moisture stress. It is recommended to prepare master plan on increasing water resource use for different areas, and following steps are suggested: (1) Minimum 25 year database of rainfall and ET are required to work out probable availability of excess rainfall water for irrigation. (2) For storing excess rainwater structures may be developed, and for appropriate crop planning commensurate with the factors like climate, crop water requirement, soil properties, land configuration, water table status, and other relevant factors there are methods/ expertise available in the country. Water may be stored for its utilization in various water harvesting structures like fresh ponds, re-excavated existing ponds, canals, etc.

Minimizing irrigation requirement	Adoption of water conservation measures to get more crops per drop may be undertaken and some of the steps may be: • Low discharge- high frequency irrigation methods like drip, sprinkler and pitcher are ideal to increase water use efficiency and cover larger areas under irrigation. • Drips are particularly useful as well for poor quality water use otherwise not permissible for conventional irrigation.
Climate change &crop planning	The committee suggested that each and every demonstration should address the changing climates and their effects. • The interventions onrainfed rice based cropping systems may be taken up as priority as rice is the major crop of the area. • Paira/Utera cropping (relay cropping) are to be taken in paddy field for proper utilisation of residual moisture. • The Cropping system such as rice-cowpea, maize-cowpea, rice- arhar, rice-green gram may be followed for utilization of fallowland and residual moisture. • No further intervention on boron application in cauliflower may be practiced • Crop diversification with suitable varietal substitution having drought tolerant capacity and short growing period should be taken up to combat the ill effects of climate. • Introduction of inter cropping such as potato + maize, maize + groundnut, maize + moong during rabi in post flood areas. • In case of INM in brinjal, inoculation of Azotobacter and Azosporillum may be considered. It is suggested that project may be taken up on the subject to motivate and train farmers on establishing nursery for flower or other commercially important horticultural plants.
Soil resource	Few interventions to be undertaken to address the effect of climate change on the soil resources as: • Finding out the amount of nitrogen fixation by green manuring in rice and other crops and then in accordance to that recommending the fertilizer to the farmers. • Suitable low cost industrial waste materials may be used to neutralize the acidity of soil. • Use of bio- fertilizers may be encouraged in crop production.
Conservation tillage	This is regarded as an important practice to build up soil carbon and combat adverse impact of climate change, on which there are no studies made so far. Raising of bund height in rice field may be encouraged along with residue incorporation for better restoration ofsoil moisture and organic carbon status. In addition, salinity problems will be reduced to a great extent in the project sites of Kendrapara.
Custom hiring of agricultural machineries	There were considerable interests shown by the farmers for custom hiring of agricultural machineries. The existing facility is of good use and may be augmented to provide such facilities like wheat thresher, maize sheller (bigger size), spray machines, zero tillage equipment, meeting hall, weather station etc. There were large demands for bigger tractors for custom hiring. Small implements required for both the sites may be procured from the contingency head of the budget.
Alternate farming practice & roles of women folks	Alternate farming practice was also suggested by the committee which are mentioned as: • To upgrade the local goat breed by the introduction of Black Bengal isa better option, which should spread to other villages andthe stage method of housing for goat should be improved by enhancing the height of machha than the existing practices with good ventilation. • Introduction of poultry breed Kadaknath • Poultry breeds like Devjan, Banaraja, Grampriyaetc, which are heat tolerant &having highersurvival capacity in this dry climate may be taken up. • Balanced animal feed with mineral mixture supplementation maybe done for better growthof animals in hot climate. Following could be the areas for entrepreneurship where women also may take significant role. These are: (1) Preparation of feed concentrate as fodder supplement since grass/fodder alone may not suffice to feed cattle and animals, their health condition being in general very poor.(2) Establishing polyhouses

	and nurseries for flower and other commercially important horticultural plants. (3) Construction of cross-ventilated poultry sheds and scientific cultivation of poultry, duckery, piggery and goatery with emphasis on introduction of local breeds resistant to survive under adverse conditions with high yielding ability.(4) Scientific/composite fish cultivation (including selling of fish fingerlings) in ponds. (8) Frequent health camp for cattle's and other domesticated animals including emphasis on AI of cattle's, (5) Allied practices like apiary, mushroom, vermicomposting & composts out oflocal falls and other wastes etc.
Village Climate Risk Management Committee (VCRMC)	VCRMC is advised to organize more awareness meetings among the famers for taking up the various interventions. There must be at least 20% members from women folk in each VCRMC. Being a remote and difficultly accessible area in both the sites the members of the committee should strive to develop self-reliant technologies, for which a major approach could be to set up small scale industries on value addition of several local products of fruits and vegetables.
Marketing strategy	It is advisable for VCRMC to form small cooperatives and fetch higher return for the farmers themselves from their farm produces by avoiding middlemen. The SHGs may also be useful for this purpose. The project may advice and encourage them.
Introduction of new plant species	The project may take special initiative through their own efforts and also encourage & train the farmers to identify new plant species as for example YMV resistant green gram variety Virat.
Convergence programme	The committee emphasized on the Convergence programme where both the KVKs need to take initiative for making convergence with ongoing projects in the respective district. Through this convergence KVK might generate good funding flow from other department.
Change of the Site of the Project	The Committee feels that the project site i.e. village Bhoimunda, Jharsaguda where the activities being carried out is not representing the typical climate changing issues. Therefore, the committee recommended to change the site to other village considering accessible to the village and other suitable parameters.





9. CONVERGENCE PROGRAME

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the NICRA adopted villages. Support from these developmental programmes 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, land shaping and ail cultivation, 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, demonstration programme etc. 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 mineral mixture demonstration 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 2017-18. The prominent development schemes are MGNREGA, NTPC, NABARD, Sunderban Development Board, Forest Department, Irrigation Department, different Departments of the concerned states. RKVY etc.

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

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Port Blair	Zilla Parishad, Andaman	Groyne on sea wall at Badmash Pahad	45,00,000
	MNREGA, Chouldari Panchayat	Sluice gate at Loha barack (Port Mout)	15,00,000
	ATMA	Demonstration and exposure visit	40,000
	Zilla parishad, Andaman	Groyne on sea wall at Badmash Pahad	6,40,000
Total			**66,80,000**
Ganjam I	NABARD	Training on Coir and Sabai preparation	3,60,000
Total			**3,60,000**
Sonepur	ATMA	Demonstration of paddy var. NRK-51 & 52	4,25,000
Total			**4,25,000**
Kendrapara	Rural Infrastructure Development and Employment (RIDE)	Village road repairing	1,00,000
	Rural Water Supply and Sanitation (RWSS)	Water lifting devices (Tube well etc.)	3,20,000
	Panchyati Raj Department	Training and demonstration	1,74,000
	District Veterinary Department	Vaccination programme	32,000
Total			**6,26,000**
Jharsuguda	Watershed development mission, Jharsugda	Desilting of WHS.	6,00,000
Total			**6,00,000**
Kalahandi	Odisha lift irrigation corporation	Construction of deep bore well	5,00,000
	Department of Agriculture, Govt. of Odisha	Construction of dug well	1,25,000
	Minor irrigation, Govt. of Odisha	Renovation of check dam	19,00,000
	Department of Animal Husbandry, Govt. of Odisha	Construction of cattle shed	8,80,000
	Department of Animal Husbandry, Govt. of Odisha	Distribution of cattle feed and mineral mixture	1,10,000
Total			**35,15,000**
Cooch Behar	MNREGA	Compost Chamber	44,00,000
	MNREGA	Cat fish culture chamber	52,80,000
	MNREGA	Planting materials (Arecanut, Black pepper, banana)	25,44,000
	MNREGA	Azolla mother culture	11,00,000
	MNREGA	Chicks	18,000

	IWMP	Bund making in riverside	3,50,000
	Irrigation department, Govt. of West Bengal	Renovation of Gully formation	6,00,000
	NREGS	Renovation of pond	6,80,000
	Department of Forestry, Govt. of West Bengal	Tree saplings	1,20,000
	ATMA	Improved vegetable cultivation & Nursery management	-
	Department of Horticulture,Govt. of West Bengal	Poly House	3,00,000
	Department of Agriculture, Govt. of West Bengal	Agricultural inputs (Seed, Fertilizer, Pesticides, *etc.*)	-
	Department of Veterinary & Animal Science, Govt. of West Bengal	Animal Health Camp	-
Total			**1,53,92,000**
Malda	MGNREGA	Reconstruction of road	36,000
	Irrigation Department, Govt of WB & NTPC, Govt of India	Repairing of crocodile bund	1,23,000
Total			**1,59,000**
S. 24 Parganas	Rashtriya Krishi Vikash Yojana	Land shaping and Ail cultivation	19,00,000
Total			**19,00,000**
Grand Total			**2,96,57,000**









10. DIGNITARIES VISITED NICRA VILLAGES DURING 2017-18

Name of KVK	Name of VIPs/Experts	Date of visit
Port Blair	Dr. C.S.Rao, Director NAARM, Hyderabad	25.11.2017
Ganjam I	D. Indra Kumar, Member of NITI Ayoga	21.12.2017
Sonepur	Dr. S. Mandal, Principal scientist, ATARI, Kolkota,	21.12.2017
Kendrapara	Dr. Hrushikesh Senapati, Chairman Zonal Monitoring Team, NICRA Project	30.10.2017
	Dr. S.S. Singh, Director, ICAR- ATARI Kolkata Member, Zonal Monitoring Team, NICRA Project	30.10.2017
	Dr. Pravat Kumar Roul, Dean Extension Education, OUAT, Bhubaneswar Member, ZMC	30.10.2017
	Dr. F.H.Rahman, Principal Scientist, ICAR-ATARI, Kolkata, Member, Zonal Monitoring Team, NICRA project	30.10.2017
Jharsuguda	Dr. F.H Rahman, Principal Scientist, ICAR-ATARI, Kolkata	04.08.2017
	Dr. Hrushikesh Senapati, Chairman Zonal Monitoring Team, NICRA Project	01.11.2017
	Dr. S.S. Singh, Director, ICAR- ATARI Kolkata Member, Zonal Monitoring Team, NICRA Project	01.11.2017
	Dr. Pravat Kumar Roul, Dean Extension Education, OUAT, Bhubaneswar Member, ZMC	01.11.2017
	Dr. F.H.Rahman, Principal Scientist, ICAR-ATARI, Kolkata, Member, Zonal Monitoring Team, NICRA project	01.11.2017
Coochbehar	Dr. S.S.Singh, Director, ICAR-ATARI, Kolkata	29.05.2017
	Dr. F.H.Rahman, Principal Scientist, ICAR-ATARI, Kolkata	29.05.2017
	Dr. B.Shahi, Nodal officer (KVKS), Dr. R.P.C.A.U, Pusa, Bihar	29.05.2017
Malda	Dr. Chiranton Chattopadhaya, Vice Chancellor, UBKV	04.08.2017
	Prof. P. Pal, DEE, UBKV	04.08.2017
	Mr. Ajay Kr. Baidya, DDM, NABARD	05.12.2017
South 24 Paraganas (Nimpith)	Dr. C.S Rao, Director, NAARM Hyderabad	08.06.2017
	Dr. A. K. Singh, DDG, Agriculture Extension, ICAR, New Delhi	13.01.2018






SUCCESS STORY OF NICRA VILLAGE FARMERS

1. Improvement of livelihood through Land shaping and Ail cultivation

Name of farmer : Sri Sanat Naskar
Address : Bongheri, Kultali, South 24 Parganas, West Bengal

Sri Sanat Naskar is a educated (graduate), young and energetic rural youth who used to help his father in farming operation after his college hours. However the inherent land characteristics and changing climatic vagaries forced him to move out of the village for seeking some petty jobs. After the devastating cyclone in 2009, when the farming of the entire village (Bongheri) stood still for next three years, he thought of leaving the village permanently in search of job. However, the introduction of the NICRA project in Bongheri village in 2011, motivated many farmers and rural youths like Sanat to stick to the farming with a new zeal. He was moved by seeing the land Shaping demonstration unit at the KVK Farm and immediately convinced his father to implement it in their land. After successfully implementing and harvesting the benefits of land shaping, he adopted sprinkler irrigation for judicious use of irrigation water. Now he has 2 acres of cultivated land and 0.5 acre of pond.

(a) Land shaping 7 Ail cultivation

(b) Use of sprinkler irrigation for water saving irrigation

(c) Use of farm machineries from village Custom Hiring Centre for timely land preparation

(d) Use of improved varieties (Rice - Swarna Sub 1 and hybrid vegetables)

(e) On-farm mass production of microbial bio-pesticides for minimizing chemical pesticide usage

(f) Periodic soil testing and soil test based fertilizer application

Land shaping and Ail cultivation: 20% of his land was dug out to create a farm pond. The dug out soil was used for raising the height of the remaining land by 1.5 ft. The land and pond embankments were strengthened to give a top width of 3 ft and height of 3 ft. He introduced submergence tolerant rice variety (*Swarna sub-1*) to combat prolonged submergence. Along with rice, he could now also grow bitter gourd, brinjal and chilli on the *Ail* (broad embankments). The pond water ensured irrigation during dry spell. After the rainy season, the pond water was used for taking up second and third crop of vegetables like Hybrid Tomato, chilli and brinjal. The fish in pond assured added income to the family. The use of sprinkler irrigation helped in judicious use of the rainwater harvested in the pond. Before installation of the sprinkler system, he could use the pond water upto the month of January to sustain the fish in the pond. After using sprinkler irrigation, he is now able to irrigate his vegetable plot upto May, without hampering fish production. The frequent watering of the soil during winter and summer and continuous crop cover throughout the year, helped to reduce the soil salinity of his land.

Increase in cropping intensity to **220%**

Annual family income (Net) from farming: Rs. **1.60 lakh**

Crops grown:	Area (acres)	Productivity (kg/acre)	Net income (Rs.)
Rice (*Swarna sub-1*)	1.67	1680	16,250.00
Green gram (*PDM-84-139*)	0.30	390	3,000.00
Bitter gourd (*US-6207*)	0.17	16000	50,000.00
Brinjal	0.20	8000	24,400.00

Crops grown:	Area (acres)	Productivity (kg/acre)	Net income (Rs.)
Chilli (*Bullet*)	0.08	3750	36,600.00
Chilli (*Tejaswini*)	0.10	4480	
Tomato (*SG-1458*)	0.08	39375	20,200.00
Fishery	-	-	10,000.00
Livestock	-	-	5,500.00
Total			**1,65,950.00**

Many farmers from within and outside of the state comes to visit Bongheri village to see the impact of the NICRA project. Sanat leads them to show the transformation of his farming and his life due to adoption of the climate resilient agricultural practices. He is also very much interested in biological control of pest and diseases.

(a) Increase in soil organic carbon from 0.29% in 2011 to 0.41% in 2017.
(b) Reduction in soil salinity from 5.5 ds/m in 2011 to 1.17 ds/m in 2017 in winter season
(c) Alternate irrigation and drying in rainy season is possible due to assured irrigation and improved drying
(d) Improve in soil microbial activity due to use of home produced microbial bio-pesticides and organic manure

By seeing the climate resilient agricultural practices and thereby increasing farm income, all the friends of Sanat adopted the same in their plot and are now reaping the benefits. They have now stopped migrating out of their village. More than 15 crores of rupees has been invested to replicate the climate resilient agriculture model of NICRA project in South 24 Parganas district in the past 5 years by the KrishiVigyan Kendra, through convergence of various Government sponsored schemes, like RKVY, IWMP, BGREI, NWDPRA, ATMA, *etc*.

2. Vegetables Cultivation in Broad Ridges and Furrows

Farmers' Name : Radhakanta Mali
Address : Village : Bongheri, Dist.: South 24 Parganas, West Bengal

Sri Radhakanta Mali is an enthusiastic and progressive farmer of Bongheri village. He had 0.83 ha of low land, only fit for cultivation of long duration traditional paddy varieties like Morishal, in *Kharif*. In absence of fresh water, he could not cultivate during winter or summer. He could hardly meet the annual requirement of food grains for his family through farming. After the "*Aila*" (Cyclone) in 2009, he was even ripped of this hope, as the entire land turned unfit for cultivation due to salinity. He turned into a regular labourer, moving in and out of the village in search of work. His family was unsecured at home. After the launch of NICRA project in 2011 in Bongheri, Shri Mali was one of the leading farmers who wanted to adapt to the various climatic vulnerabilities, witnessed by the village. He wanted to explore the village resources, so that he doesn't need to go out of the village by risking the social security of his family. In 2013, he excavated a small pond of 0.06 ha, by his own cost and started fishery. He is now using vermicompost, biofertilizers, bio-pesticides, straw mulching and many other eco-friendly technologies in his farm. He converted 0.13 ha of his lowland into broad Ridges and Furrows, under the NICRA project. The small piece of land is developed as a series of furrows (4 ft wide x 3 ft deep) alternating with ridges (4 ft wide x 3 ft deep). He started growing vegetables like Tomato, Okra and Bottle gourd on the ridges. This modification helped him to save the vegetables from prolonged submergence in Monsoon season. The stored water in the furrow could be used as life saving irrigation during dry spell. Simultaneously, he used the stagnant water in the furrows to grow prawns and carps. The moisture retained in the land during winter season, helped him to take a second crop like beans and bitter gourd. In rest of the 0.7 ha land, he continued to grow paddy. In 2013, he excavated a small pond of 0.06 ha, by his own cost and started fishery. He is now using vermicompost, biofertilizers, bio-pesticides, straw mulching and many other eco-friendly technologies in his farm. In 2013, he excavated a small pond of 0.06 ha, by his own cost and started fishery. He is now using vermicompost, biofertilizers, bio-pesticides, straw mulching and many other eco-friendly technologies in his farm. Last year he harvested 18 q bitter gourd worth Rs. 27000/- and 15 q okra worth Rs. 18000/- in *Kharif* and 34 q tomato worth Rs. 34000/- in *Rabi* season. He got 2 q fish worth Rs. 30000/- from the pond and the furrows during monsoon. His gross earning was Rs. 1.09 lakh. He got Rs. 71000/- as net profit

with BC ratio of 2.87. Sri Mali could spend Rs. 90000/- for the marriage of his elder son, last year. He saved few more over the years and now has purchased a carriage van (Mahindra Alpha Plus) after 50% down payment, to the tune of Rs. 1 lakh (in 2017-18). By seeing the benefits of Custom Hiring Centre, he has purchased his own pumpset and paddy threshing machine. His son is now engaged in vending of vegetables from the village to the nearby market at a nominal cost. This ensures an additional income of Rs. 60000/- per year, to the family. His daughter is now studying in College. Sri Radhakanta Mali is now a happy farmer as his land is well protected against prolonged water stagnation resulting from intensive precipitation in short time span as well as against dry spell in Monsoon season. The increased soil moisture retention capacity of the land is allowing him to take a second crop in winter. He also knows that his village, "Bongheri" is also protected against future climatic vulnerabilities.

3. Cauliflower Cultivation through application of micro-nutrients

Name of the Farmer: Subash Meher
Village- Bhoimunda, Block- Jharsuguda, Dist- Jharsuguda

An advanced farmer having a joint family, maintaining their livelihood and other family expenses from 4 acres of cultivated land, out of which upland is 0.5 acres, medium land 2 acres and low land 0.5 acres. He is cultivating rice, cabbage, cauliflower, brinjal, tomato, chili, cowpea, bottle gourd in total areas having an average annual income is Rs.85,000 from 2 acre of land. From cauliflower and cabbage cultivation, he got a profit of Rs.32,000 from 0.5 acre of area. KVK scientists advised him to cultivate cauliflower and cabbage with application of micronutrients for better yield and to get more income, as there is very good marketing area is in the nearby area *i.e.* Jharsuguda, Belpahar, Brajarajnagar. Then he was interested to cultivate cauliflower and cabbage with application of micronutrients. Through village meeting, personal contact, the technology was introduced to get more yield of 16% than the normal practice. KVK scientist visited his field and helped him in giving the technical know-how through training and front line demonstration by giving required critical inputs. He got a good income of Rs.60,000/- from 90 quintal of cauliflower from one acre of land. Extent of diffusion of newly adopted technology- near about 42 farmers in the adopted villages are adopting this technology and 120 farmers are adopting in the district. Farmers demand good quality seeds to be supplied for future dissemination of the technology. KVK has included demonstration on off-season vegetable cultivation, training on technical knowhow, post-harvest technology and marketing strategy and making arrangement to supply good quality seeds to farmers.

4. Mushroom cultivation – A business oportunity

Name of farmer: Chhalal Uddin Miya

Address : Khagribari, Patlakhawa, Cooch Behar- II

Cooch Behar District experiences high rainfall (average 3000 mm). so, most of the time weather here remains humid which is congenial for growing mushroom. In order to tap potentiality of this Climatic Vulnerability Cooch Behar KVK encouraged frmers for cultivation of Mushroom under NICRA Project. Shri Chhalal Uddin Miya is one of the trainees of Rural Youth training conducted by Cooch Behar KVK under NICRA Project in the in year 2011-12.After getting training, he started one small unit at Khagribari with 500 cylinders in his own plot of land. He was very much interested in this cultivation and with little support from KVK he started mushroom cultivation. Presently, he is cultivating mushroom in a large scale with more than 30,000 cylinders per year on a land holding of 0.40 ha collecting spawns from Cooch Behar KVK, Uttar Banga Krishi Viswavidyalaya and parts of Jalpaiguri District. The harvested

mushroom is being supplied to various parts of Bhutan and Assam. He is also providing employment to the rural youths of the village who are working in his unit thus creating around 950 man days per year. He is working on his own farm earning. But, now he is a successful agri-entrepreneur and through his skill and knowledge he has attained a better position which is really appreciable. Presently, he is earning Rs. 50,000 to 45,000 per month of which anet profit of Rs. 15,000 to 20,000.

He is a young successful mushroom grower in his area and popularized various types of mushroom (Black and White) in his village as well as various parts of Cooch Behar, Assam and Bhutan as a source of nutrients and fiber in daily diets of the people. Mushroom cultivation does not have any adverse impact on environment. As per suggestions of KVK, He is using chemicals of standard grade and using them judiciously. He is also converting mushroom spent into compost for its further use.

He is selling fresh product in local market as well as in Assam and Bhutan. It is getting popular day by day which motivated him for large scale cultivation. Apart from fresh mushroom, ChhalalUddinMiya also sundries the mushroom and packet them for longer time storage. Ithas been adopted by many more youths of the village who are comg forward for training in our KVK.

5. Three - Tier Farming System through Land manipulation

Name : Shri Asok Chandra Roy
Village: Badmash Pahad, Block: Ferrargunj, South Andaman District ,

The ISS system converts in waterlog areas to Pond based farming system . The dyke of the pond utilized for cultivation of vegetables round the year. The tank 33 m X 25 m X 2.5 m are utilized for rearing of fishes like Singhi, Magur, Annabus and cultivation of aerial vegetables . Inputs supplied during the year include seedlings of vegetable for the dyke and fish fingerlings (Grass carps) for the tank. A gross return of Rs 2,23,600/- was observed against the Gross cost of cultivation of Rs 85,300/- with a net profit of Rs 1,38,300 with the BC 2.6.

6. Pond Based Integrated Farming System

Name: Shri Sahrwran Singh
Village ; Port Mout, Block : Ferrargunj, South Andaman

One Unit of farm pond size 30 m x 22 m x 2.5 m was constructed to harvest 1194 cu m of rainwater. This pond was used as a water source for harvesting the rain water for efficient utilization during the post monsoon deficit period to meet the crop water requirement for development of one pond based integrated farming System model. Inputs are supplied in the form of Fish fingerlings *i.e.* Grass carp, *Rohu* , *mrigal* and vegetable seeds like Cowpea , French bean , Okra , Radish, Brinjal, Amaranthus . A gross return of Rs 75,000/- was observed against the Gross cost of Rs 32,000/- with a net profit of Rs 43,000/- with the BC - 2.34.

12. NEWSPAPER COVERAGE OF NICRA ADOPTED VILLAGES

13. PUBLICAIONS

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14. Expenditure Statement 2017-18

Table. Expenditure details during 2017-18

KVK	Revised Estimate			Expenditure	Closing Balance as on 01.04.18
	Contingencies	TA	Total		
ATARI- Kolkata	875000	75000	950000	711465	169104
South 24 Parganas	1100000	50000	1150000	1149939	61
Coochbehar	1100000	80000	1180000	1178141	1859
Malda	480000	40000	520000	498593	21407
Sonepur	700000	50000	750000	750000	0
Kalahandi	780000	52000	832000	832000	0
Jharsuguda	650000	80000	730000	730000	0
Kendrapara	700000	35000	735000	735000	0
Ganjam-I	675000	50000	725000	725000	0
Port Blair	650000	60000	710000	307573	402427
Total	**7710000**	**572000**	**8282000**	**7617711**	**594858**

Annexure - 1

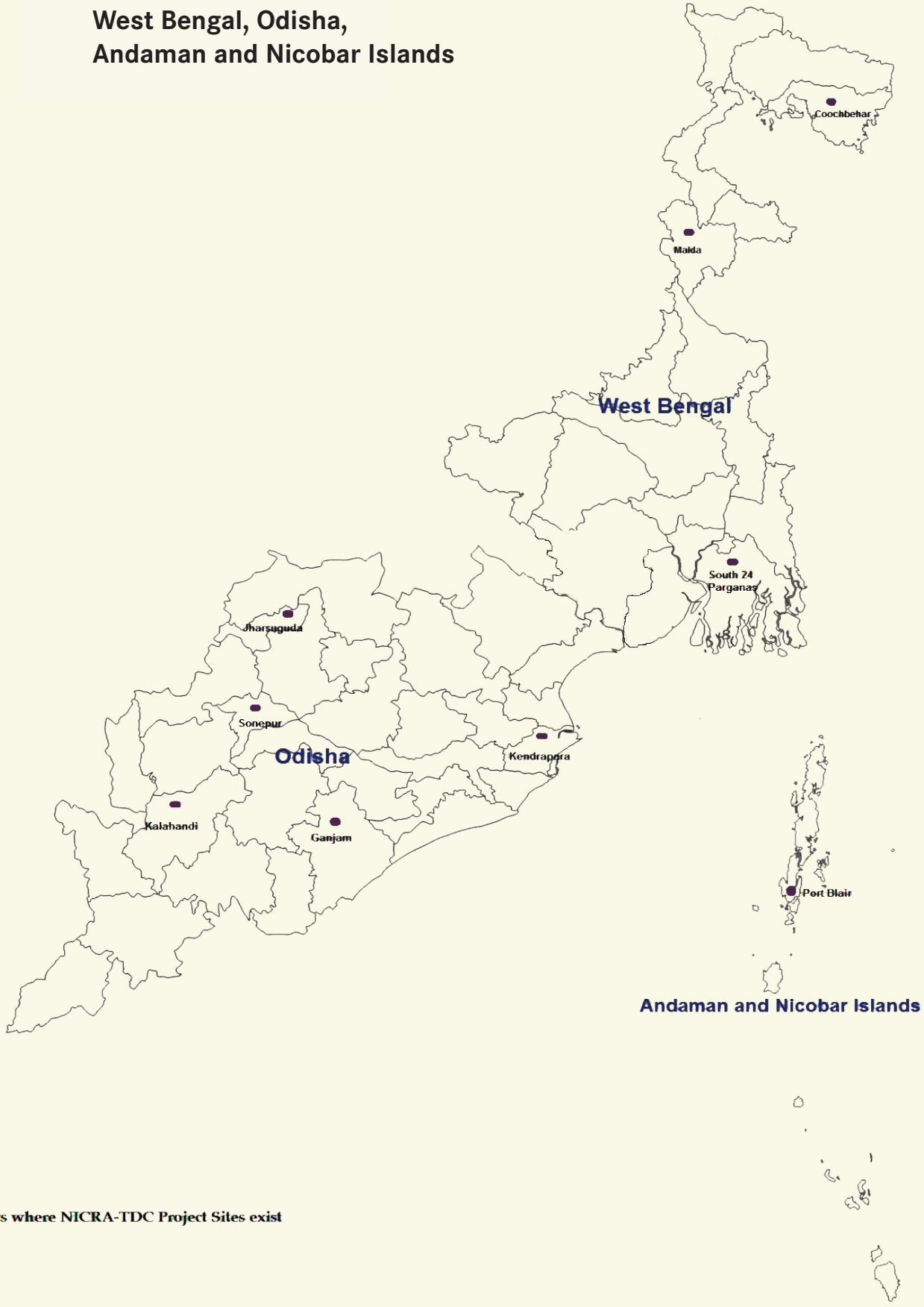
Contributors - NICRA KVKs of Zone V

Sl. No.	KVK	State/UT	Contributors
1.	Ganjam I	Odisha	Dr. Lalit Kr Mohanty Dr. Prasant Kr. Panda
2.	Kalahandi	Odisha	Dr. Tapan Kr Das Dr. H. N. Mallick
3.	Jharsuguda	Odisha	Dr. Biswa Ranjan Pattanaik Dr. Manoj Barik
4.	Kendrapara	Odisha	Dr. Surjo Narayan Mishra Dr. Namita
5.	Sonepur	Odisha	Dr. Jibanjit Sen Dr. Geetanjali Pradhan
6.	Coochbehar	West Bengal	Dr. Bikash Roy Dr. Sujan Biswas
7.	Malda	West Bengal	Dr. Bhabani Das Dr. Adwaita Mandal
8.	S. 24 Pgs	West Bengal	Dr. N. J. Maitra Dr. P. Garain
9.	Port Blair	A & N Islands	Dr. Nagesh Ram Dr. L. B. Singh

Annexure-2

NICRA-TDC PROJECT SITES

West Bengal, Odisha, Andaman and Nicobar Islands



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भारतीय कृषि अनुसंधान परिषद

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