Resilience in Agriculture Enhanced through Technology Demonstrations

Experience of NICRA - TDC

F.H. Rahman
S. S. Singh
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ICAR - Agricultural Technology Application Research Institute Kolkata
Indian Council of Agricultural Research
Salt Lake City, Kolkata - 700 097

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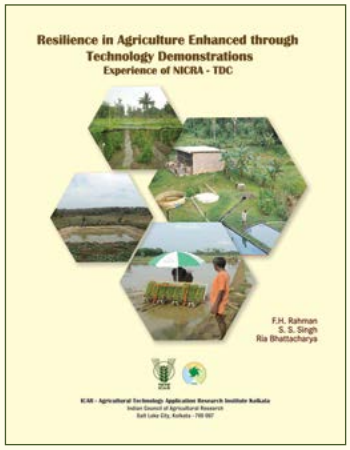

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Preface

A nation-wide project National Innovations in Climatic Resilient Agriculture (NICRA) of Indian Council of Agricultural Research in response to the challenge of climate change facing Indian agriculture in present days. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The overall focus of technology demonstrations 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. Thus the emphasis is on adaption to climate variability which entails appropriate response to contingency situations. Sustainability is the immediate goal in highly intensive production systems facing natural resource degradation. Therefore, 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.

Enhancing the adaptive capacity and building resilience of the farming communities is important in the context of climate variability and to cope with these extreme events effectively. As part of the Technology Demonstration Component (TDC) of NICRA, proven technologies are being demonstrated in climatically vulnerable districts of the country. The objective is to impart resilience under variable climates and consequently enhance the pace of adoption of these resilient technologies by stakeholders. On-farm participatory demonstrations were taken up in 121 climatically vulnerable districts across the country through KVKs.

The report aims to highlight the achievement of NICRA villages which have become hubs of learning on climate resilient agriculture in a short span, opening up opportunities for horizontal and vertical diffusion of the successful interventions in other parts of the districts. The author take this opportunity to gratefully acknowledge the co-operation and assistance of all the Heads and SMSs of NICRA KVKs under ICAR-ATARI Kolkata, all NICRA village farmers, VCRMC members, Scientists and Department officials for their valuable contribution in bringing out this publication. The authors also acknowledge the financial support of ICAR-CRIDA, Hyderabad for the study through NICRA.

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Foreward

Climate change is one of the global challenges to ensure food and livelihood security. The Indian Council of Agricultural Research (ICAR) is addressing this issue by enhancing the adaptive capacity and building resilience of the farming communities through Technology Demonstration Component (TDC) of National Innovations in Climate Resilient Agriculture (NICRA) project across the country. Climate vulnerability of selected NICRA-KVKs have been assessed during implementation of various modules like NRM, Crop Production, Livestock and Fisheries and Institutional Interventions to cope up with climate vulnerabilities like drought, erratic monsoon rainfall, heat wave, flood, cyclone etc. most of the districts. Technologies such as on-farm water harvesting in ponds, supplemental irrigation, introduction of early maturing drought tolerant varieties, rice varieties tolerant to sub-mergence in flood prone districts, improved drainage in water logged areas, recharging techniques for tube wells, site specific nutrient management and management of sodic soils, mulching, use of zero till drills were enthusiastically implemented by the farmers in NICRA villages across the country. The intervention of custom hiring centers generated enormous interest and enthusiasm amongst the farmers and other stakeholders.

I am happy to note that this compilation covering eight years activity of nine NICRA KVKs under ICAR-ATARI Kolkata may be useful to the concerned stake holders and others.

I also complement all the Krishi Vigyan Kendras and the farmers who are actively taking part in this very important initiative.

I congratulate Director and concerned Scientists of ICAR-ATARI Kolkata for bringing out the highlights of technology demonstrations.

Dated : 30.08.2019

Dr. A.K. Singh

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कार्यकारी सारांश

जलवायु परिवर्तनशीलता के संदर्भ में, किसानों को फसल की पैदावार और खेत की आय को स्थिर करने के लिए सूखा, बाढ़ और अन्य चरम घटनाओं की बढ़ती आवृत्ति के लिए जल्दी से अनुकूलित होने की आवश्यकता है। वर्षों से, राष्ट्रीय कृषि अनुसंधान प्रणाली ने मौसमी विविधताओं के हमले के खिलाफ कृषि उत्पादन में स्थिरता को बढ़ावा देने के लिए प्रथाओं और प्रौद्योगिकियों की एक सरणी विकसित की है। एक राष्ट्रव्यापी परियोजना, नेशनल इनोवेशन ऑन क्लाइमेट रेजिलिएंट एग्रीकल्चर (एनआईसीआरए), 2011 से विज्ञान और प्रौद्योगिकी के अनुप्रयोग द्वारा इस चुनौती को दूर करने के लिए काम कर रही है। भा.कृ.अ.प. की इस परियोजना का उद्देश्य रणनीतिक अनुसंधान और प्रौद्योगिकी प्रदर्शन के माध्यम से जलवायु परिवर्तन और जलवायु भेद्यता के लिए भारतीय कृषि का लचीलापन बढ़ाना है। एनआईसीआरए का प्रौद्योगिकी प्रदर्शन घटक (टीडीसी) किसानों के साथ काम करने और वर्तमान जलवायु परिवर्तनशीलता को दूर करने के लिए क्षेत्र की परिस्थितियों में ऐसी तकनीकों को लागू करने का शानदार अवसर प्रदान करता है। यह इन लचीली प्रौद्योगिकियों को अपनाने की गति को बढ़ाएगा। देश भर के 151 जलवायु संवेदनशील जिलों में केवीके के माध्यम से गाँव के समूहों में जलवायु लचीलेपन के लिए कृषि-आधारित भागीदारी प्रदर्शनों को कार्यान्वित किया जा रहा है। विभिन्न कृषि-पारिस्थितिकी और कृषि प्रणालियों में प्रौद्योगिकियों के प्रदर्शन पर समझ विकसित करने और सुधारने पर जोर दिया गया है। छोटे और सीमांत किसानों के हाथों तक मौजूदा प्रौद्योगिकी पहुँचाना और बदलती जलवायु की माँगों को पूरा करने के लिए सूखा या बाढ़ सहने वाली फसलों जैसी नई तकनीकों को विकसित करना भी एनआईसीआरए कार्यक्रम के दायरे में आता है।

भा.कृ.अ.प.-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान (अटारी) द्वारा क्षेत्रीय स्तर पर समन्वित रूप से पश्चिम बंगाल, ओडिशा और केंद्र शासित प्रदेश अंडमान एवं निकोबार द्वीप समूह के चयनित 9 केवीके जिलों की जलवायु भेद्यता तकनीकी सहायता, मानव संसाधन विकास और कृषि समुदाय को सूखा, अनिश्चित वर्षा, गर्मी/ लू, बाढ़, चक्रवाती तूफान जैसी जलवायु कमजोरियों से निपटने में सक्षम बनाने के लिए समग्र रूप से सशक्तिकरण करने के संदर्भ में नितांत आवश्यक है।

प्राकृतिक संसाधन प्रबंधन, फसल उत्पादन, पशुधन एवं मत्स्य पालन और संस्थागत हस्तक्षेप जैसे विभिन्न मॉड्यूलों में जलवायु आधारित कृषि कार्यक्रम पर राष्ट्रीय नवाचारों के घटकों के माध्यम से 110887 किसानों को लाभान्वित किया गया (प्राकृतिक संसाधन प्रबंधन- 8250, फसल उत्पादन - 6743, पशुधन और मत्स्य - 11326, संस्थागत हस्तक्षेप - 2783, क्षमता निर्माण -33717 और विस्तार गतिविधियाँ - 48068)।

प्राकृतिक संसाधन प्रबंधन मॉड्यूल में बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, स्व-स्थाने नमी संरक्षण, जल संचयन और पुनर्चक्रण के लिए नई संरचनाओं/ खेत में तालाबों / चैक डेम / टैंक की छत पर जल संचयन टैंक का निर्माण/ नवीनीकरण, भूमि को आकार देना और वर्षा जल संचयन संरचनाएं, बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, जहां उपयुक्त हो वहां जुताई संरक्षण, कृत्रिम भूजल पुनर्भरण और पानी की बचत वाले सिंचाई के तरीके, हरी खाद, सिंचाई का 5% मॉडल, फसल अवशेष प्रबंधन, खेतों की मेढ़बंदी, चौड़ी नालियां बनाना (ब्रॉड बेड फरो), मृदा परीक्षण आधारित पोषक तत्वों का अनुप्रयोग, सूक्ष्म सिंचाई तकनीक, खाद के गड्ढे इत्यादि शामिल हैं, जिससे 1617 हेक्टेयर के क्षेत्र में फैले इलाके के 8250 सक्रिय किसान लाभान्वित हुए हैं।

मेंड़ एवं कूंड़ विधि एवं चौड़े कूंड़ों के माध्यम से स्व-स्थाने वर्षा जल प्रबंधन खेत स्तर पर वर्षा जल का संरक्षण करता है और अतिरिक्त पानी को सामुदायिक जल निकासी चैनलों में बाहर निकालता है। इस पानी का उपयोग भूजल को रिचार्ज करने के लिए भी किया जा सकता है ताकि बरसात के बाद की फसलों को पूरक सिंचाई प्रदान की जा सके, जो कि सपाट रोपण से संभव नहीं है। इन विधियों के माध्यम से, मिट्टी की नमी के रिसाव एवं नमी प्रतिधारण के माध्यम से वर्षा जल के उपयोग को अधिकतम करके और अपवाह तथा मिट्टी के कटाव को कम करके प्रबंधित किया जाता है। बेहतर उपज देने वाली किस्मों के प्रदर्शन को स्व-स्थाने नमी प्रबंधन द्वारा अनुकूलित किया जाता है। सतह अपवाह और गहरे निकासी वाले पानी का उपयोग गेहूं एवं छोटी मटर जैसी वर्षा के बाद की फसलों की पूरक सिंचाई के रूप में किया जाता है। 491 हेक्टेयर क्षेत्र में 2136 किसानों को शामिल करते हुए गोद लिए गए गांवों में इन संरक्षण प्रौद्योगिकियों का प्रदर्शन किया गया है। **चौड़े कूंड़ों वाली पद्धति** से अंडमान एवं निकोबार द्वीप समूह में किसानों को सब्जियों और चावल में सिंचाई के साथ-साथ विभिन्न आईएफएस घटकों जैसे कि कूंड़ों में मछली पालन, ऊपरी सतह पर चारे वाली फसलों के साथ-साथ जल निकासी सुविधा में भी मदद मिली है। किसानों पर महत्वपूर्ण प्रभाव के साथ इस विधि को 500 से अधिक हैक्टेयर क्षेत्र लाया गया है।

तालाब, कुएं और नहर, बालू के चेकडेम, बांध बनाने, 5% मॉडल आदि के नवीकरण के माध्यम से 1195 किसानों को शामिल करते हुए विभिन्न केवीके द्वारा गोद लिए गए गांवों में पूरक सिंचाई के लिए जल संचयन और पुनर्चक्रण को प्रदर्शित किया गया।

संरक्षित जुताई के अंतर्गत रबी फसलों की बोवाई पूर्ववर्ती खरीफ फसल की कटाई के समय और बोवाई के लिए भूमि की तैयारी के लिए मिट्टी की नमी की स्थिति पर भी निर्भर करती है। गेहूं के मामले में, बोवाई के लिए मिट्टी की उपयुक्त स्थिति को प्राप्त करने के लिए इसमें 2 से 3 या इससे अधिक जुताई शामिल होती हैं। आवश्यक लागत और ऊर्जा के अलावा, इससे गेहूं के बोवाई में देरी होती है, जिसके परिणामस्वरूप फरवरी / मार्च के दौरान उच्च तापमान के साथ अक्सर कमजोर अवस्था का संयोग बन जाता है। इससे अक्सर अनाज की पैदावार में कमी और किसान को नुकसान होता है। शून्य जुताई तकनीक भूमि की तैयारी तथा बुवाई के लिए बार-बार जुताई से बचने, खेती की लागत को कम करने और 10-15 दिन पहले ही बोवाई करने में सहायक होती है। बुवाई की तारीख में वृद्धि अंतिम गर्मी से बचने के लिए एक अनुकूलन है। शून्य जुताई या हैप्पी सीडर का उपयोग कर चावल की कटाई के तुरंत बाद अनियंत्रित धान के खेतों में गेहूं की सीधी ड्रिलिंग को शून्य-जुताई कहते हैं। एनआईसीआरए द्वारा गोद लिए गए 9 गांवों में 824 किसानों की 186 हेक्टेयर भूमि पर गेहूं, धान, मसूर, मटर और चना में संरक्षण में जुताई का प्रदर्शन किया गया। शून्य जूताई कार्य में मुख्य रूप से तकनीकों की प्रयोग किया गया। जेडटीडी के माध्यम गेहूं की खेती में महत्वपूर्ण वृद्धि हुई। शून्य जुताई तकनीक ने पूरे क्षेत्र में दलहन और तिलहन की खेती में बहुत आशाजनक परिणाम दिखाए। केंग्रपाड़ा, झारसगूड़ा में खरीफ में कम वर्षा के दौरान ओएल (किस्म एचवाईवी गजेंद्र); फूलगोबी (किस्म एमएसएन -16); चावल (किस्म पूसा बोल्ड, पूसा 362); टमाटर (किस्म परम एफ1) आदि जैसी कम पानी की आवश्यकता वाली फसलों को विभिन्न फसलों को आकस्मिक फसल की योजना के रूप में शुरू किया गया है

एनआईसीआरए के गोद लिए गए गांवों में 319 किसानों के खेतों की 60 हेक्टेयर भूमि के धान में सब-सोइलर द्वारा खेतों की मेड़बंदी, जल प्रबंधन एवं एसआरआई के माध्यम से कृत्रिम भूजल पुनर्भरण किया गया। एसआरआई द्वारा सब-सोइलर द्वारा भूजल पुनर्भरण से एक आशाजनक आर्थिक प्रतिफल के साथ ही धान की उच्चतम उपज (59.5 क्विंटल प्रति हेक्टेयर) दर्ज की गई।

एनआईसीआरए के गोद लिए गए गांवों में 388 किसानों के खेतों की 150 हेक्टेयर भूमि में छिड़काव सिंचाई, चावल में कम ऊर्जा जल अनुप्रयोग (LEWA), बैंगन में ऊंची उठी क्यारियां(RBF), धान में सूक्ष्म सिंचाई जैसी पानी की बचत वाली कृषि विधियों को प्रदर्शित किया गया।

वर्षा जल संचयन (एक्स-सीटू) और खेतों का लचीलापन बढ़ाने के लिए कुशल उपयोग, खेत के तालाबों से खरीफ और रबी मौसम के दौरान फसल उत्पादन में एक परिवर्तनशील बदलाव देखा गया। हालांकि जून के महीनों के दौरान और जुलाई के शुरुआती दिनों में बारिश कम थी, बारिश के साथ तीव्र तूफान जिनसे अपवाह उत्पन्न हआ और किसानों के खेत में बनाए गए खेत तालाबों में जल संग्रहीत हो गया। संचित पानी का उपयोग चावल, गेहूं, सब्जियों, चारे आदि की महत्वपूर्ण सिंचाई के लिए किया गया। किसानों को फसलों से अतिरिक्त उपज और आय का प्राप्त हुई। पूरे क्षेत्र में वर्षा जल संचयन के लिए कुल 256 संरचनाएं विकसित की गई है, जिनमें 9.06 मिलियन घन मीटर पानी संग्रहित किया जा सकता है, जिसके माध्यम से 2100 हेक्टेयर भूमि की सिंचाई की जा सकती है। इस कार्य से फसल गहनता 125% के औसत के साथ 250% तक की सीमा तक बढ़ी है। मध्यम उच्च भूमि चावल क्षेत्र में, जहां जल धारण क्षमता कम थी, 5% मॉडल की तरह एक और हस्तक्षेप का सृजन किया गया। विशेष रूप से देरी के मानसून या अपर्याप्त वर्षा में समय पर रोपाई नहीं की जाती है। वर्षा जल संचयन और एकत्रित करने के लिए प्रत्येक भूखंड में 5% मॉडल की खाई बनाई गयी। संग्रहीत पानी नमी के स्तर को बढ़ाता है, प्रत्यारोपण में मदद करता है और बाद में नमी की कमी के दौरान सिंचाई की सुविधा भी प्रदान कर सकता है।

3132 किसानों की 5532.15 हेक्टेयर भूमि पर सीप मशरूम की खेती, दालों के बीज उत्पादन के माध्यम से प्रभावी नमी उपयोग, बागों में स्व-स्थाने वर्मीकम्पोस्टिंग, मृदा परीक्षण आधारित पोषक तत्व अनुप्रयोग, पुराने खेत तालाबों की सफाई और नवीकरण, अच्छी तरह से रोपण, वन वृक्ष लगाना, वनीकरण, मृदा परीक्षण आधारित पोषक तत्वों का अनुप्रयोग, विभिन्न फसलों में जैव कीटनाशक, फूलगोभी में बोरान का प्रयोग और खेत की मेड़ पर उच्च उपज देने वाली घास की खेती जैसे अन्य प्रदर्शन किए गए।

फसल उत्पादन मॉड्यूल के तहत विभिन्न क्षेत्र विशिष्ट अर्थात; सूखा, क्षार और बाढ़ सहिष्णु / प्रतिरोधी किस्मों की शुरूआत, टर्मिनल गर्मी के तनाव से बचने के लिए रबी फसलों की रोपण की तारीखों में वृद्धि, एसआरआई, एरोबिक जैसी पानी बचाने वाली धान की खेती कि विधियां, प्रत्यक्ष अंकुरण, विलंबित मानसून के लिए सामुदायिक नर्सरी, उच्च सततता उपज सूचकांक के साथ स्थान आधारित अंतर-फसल प्रणाली, नई फसलों / फसल विविधीकरण की शुरूआत, समय पर

रोपण के लिए कस्टम हायरिंग केंद्र, कम तापमान सहनशीलता, मानसून की वर्षा के बाद दालों का प्रचार, एकीकृत फसल / कीट / रोग प्रबंधन, आकस्मिक फसल के रूप में सब्जियां उगाना, एकीकृत फसल प्रबंधन, एकीकृत रोग प्रबंधन, आकस्मिक फसल को शामिल करते हुए हस्तक्षेप किया गया जिससे जिससे 6743 किसान लाभान्वित हुए।

सहभागी, अंजलि, नवीन, अभिषेक जैसी सूखा सहनशीलता वाली धान की किस्मों को 952 किसानों की 265.14 हेक्टेयर भूमि में प्रदर्शित किया गया। दलहन और तिलहन के लिए कालेचने, मूंगफली, हरेचने की PU-31, देवी TARM-1, OBGG-52 किस्मों का का प्रदर्शनव्यापक भूमि पर किया गया और इससे अधिकतम आर्थिक प्रतिफल (B: C: 2.60) प्राप्त हुआ।

क्षार सहने योग्य चावल की किस्मों जैसे; कारी (CARI) धान -5, ऊसर धान -5, जारवा, गीतांजलि, SR-26B, अमलमोना का प्रदर्शन 70 किसानों के खेतों में 19.78 हेक्टेयर भूमि पर किया गया। जावरवा, गीतांजलि और अमलमोना किस्मों ने 50.5 क्विंटल प्रति हेक्टेयर और अधिक आर्थिक प्रतिफल (2.41 का लाभ-लागत अनुपात) देकर अधिकतम क्षार सहनशीलता साबित की।

स्वर्णा उप 1, सबिता, दुधेश्वर जैसी धान की बाढ़ सहने योग्य किस्मों को 845 किसानों के खेतों में 294 हेक्टेयर भूमि पर प्रदर्शित किया गया, जिससे 45 क्विंटल प्रति हेक्टेयर की उपज के साथ 2.45 के आर्थिक प्रतिफल प्राप्त हुआ।

रबी के मौसम में चावल, गेहूं, मसूर, सरसों, आलू, आदि आदि फसलों में अंतिम ताप दबाव से बचने के लिए 12 दिन पहले बोवाई की गयी थी। ये प्रदर्शन गोद लिए गए गांवों में 651 किसानों के खेतों में 134.4 हेक्टेयर भूमि पर किए गए थे।

एसआरआई के माध्यम से पानी की बचत करने वाले धान की खेती, छोटी अवधि की किस्मों, सीधे बीज वाले चावल, भूरी खाद आदि का प्रदर्शन 452 किसानों के खेतों में 126 हेक्टेयर भूमि में किया गया है। तमाम हस्तक्षेपों के बीच सहभागी किस्म की धान की पैदावार में सबसे ज्यादा बढ़ोतरी हुई।

मानसून में देरी की स्थिति से निपटने के लिए, चावल के लिए सांतरित सामुदायिक पौधशाला का हस्तक्षेप अब पश्चिम बंगाल तथा ओडिशा के कुछ हिस्सों में बहुत लोकप्रिय हो गया है। 25-30 दिन की उम्र के बीज जुलाई में प्रत्यारोपित किए जाते हैं ताकि रबी फसलों की समय पर बुवाई करने की सुविधा के लिए अक्टूबर से पहले प्रकाशसंवेदी किस्मों को पूरा किया जा सके और नवंबर के मध्य तक कटाई की जा सके। इस तरह के अभ्यास से खरीफ और रबी दोनों फसलों का इष्टतम प्रदर्शन सुनिश्चित होता है। ओडिशा में पिछले 10 वर्षों में से 5 में विपुल वर्षा की स्थिति का सामना करना पड़ा, जिससे किसानों के चावल उत्पादन और आजीविका पर प्रतिकूल प्रभाव पड़ा है। यह देखा गया कि जुलाई में बारिश का न होना चावल की देरी से रोपाई के लिए जिम्मेदार है जिसका उत्पादकता पर प्रतिकूल प्रभाव पड़ता है और परिणामतः रबी फसलों पर भी नकारात्मक प्रभाव पड़ता है। धान की रोपाई में देरी, उत्पादकता को प्रभावित करती है क्योंकि ज्यादा दिनों के पौधों की रोपाई में कलम करने की क्षमता कम हो जाती है। चावल के अलावा फूलगोभी, बैगन, और टमाटर जैसी अन्य फसलों में भी सांतरित सामुदायिक पौधशाला विकास को अपनाया जाता है। 574 किसानों की 27 हेक्टेयर भूमि में इन हस्तक्षेपों का प्रदर्शन किया गया। सभी प्रदर्शनों के बीच फूलगोभी के लिए सामुदायिक नर्सरी सबसे आशाजनक थी जिसने पैदावार में सबसे अधिक वृद्धि के साथ-साथ आर्थिक लाभ भी दिखाया।

सूखे की आशंका वाले क्षेत्रों में विभिन्न अंतर-फसल प्रणालियों का प्रदर्शन किया गया। अंतर-फसल प्रणालियों को परिवर्तनशील वर्षा की स्थितियों के लिए महत्वपूर्ण अनुकूलन तंत्र में से एक माना जाता है। लगभग सभी गोद लिए गए गांवों में स्थान विशेष पर के अनुसार अंतर-फसल हस्तक्षेप का प्रदर्शन किया गया।

प्रचलित फसल प्रतिरूप में नई फसलों को शुरू करने के माध्यम से फसल विविधता का प्रदर्शन 817 किसानों की 230.91 हेक्टेयर भूमि में किया गया। ओडिशा में बैंगन (किस्म- FI-Hybrid long) और मक्का (किस्म P3377) की खेती में अधिकतम आर्थिक लाभ (लाभ:लागत :: 4.1) दर्ज किया गया।

पशुधन और मत्स्य पालन मॉड्यूल जिसमें विभिन्न पशुधन केंद्रित हस्तक्षेप किए गए थे, जिनमें सूखे / बाढ़ के दौरान चारा उत्पादन के लिए सामुदायिक भूमि का उपयोग, भूसा/ चारा भंडारण के तरीकों में सुधार, पशुधन में गर्मी के दबाव को कम करने के लिए बेहतर आश्रय स्थल, पानी के कमी और अधिकता के दौरान मछली तालाबों / टैंकों का प्रबंधन, नस्ल उन्नयन, खनिजों के मिश्रण के माध्यम से संतुलित चारा एवं भूसे का प्रबंधन, चारा ब्लॉक और सिलेज बनाना, एजोला चारा, प्रजनन और टीकाकरण के माध्यम से पशु नस्ल स्वास्थ्य प्रबंधन, मछली तालाब की सफाई और मछली पालन, सुअर पालन, स्वच्छ दूध और चारा उत्पादन आदि शामिल हैं। इन हस्तक्षेपों से टीकाकरण कार्यक्रम में 33247 पशुओं के साथ 11326 पशुधन मालिक को लाभान्वित हुए।

हरे या सूखे, चारे की पर्याप्त आपूर्ति, बारिश वाले क्षेत्रों में पशुओं की जीवन के लिए महत्वपूर्ण है। कई राज्यों में विलंबित शुरुआत और वर्षा की कमी की स्थिति का अनुभव किया गया। बाजरा और दालों के क्षेत्र में कमी आई, जो कि बारिश वाले क्षेत्रों में चारा आवश्यकताओं को पूरा करने के लिए महत्वपूर्ण हैं। खरीफ और रबी दोनों मौसमों में कई फसलों और चारे की प्रजातियों के कम एवं मध्यम अवधि के चारे की खेती का प्रदर्शन किसानों के खेतों में बारिश और सीमित सिंचाई की स्थिति में किया गया ताकि पशुपालन से आय और नकदी के प्रवाह बनाए रखा जा सके। किसानों के खेतों में चावल की फलियों और साइलेज बनाने के उन्नत चारे का प्रदर्शन किया गया। विभिन्न गोद लिए गए गाँवों में 30.02 हेक्टेयर क्षेत्र की सामुदायिक भूमि में 303 किसानों को शामिल करते हुए विभिन्न प्रकार के चारे के उत्पादन को प्रदर्शित किया गया था। कार्यक्रम में बरसीम, ओट, सूडान चरी, मक्का, संकर नैपियर प्रमुख चारा उत्पाद थे। इन सभी प्रदर्शनों में से सूडान घास ने अधिकतम लाभ प्रतिफल दिखाया (लाभ: लागत :: 5.59)।

मवेशियों में एफएमडी, बकरियों में पीपीआर, मुर्गी पालन में रानीखेत बीमारी, बीक्यू टीका, कृमिहरण आदि के लिए टीकाकरण शिविर आयोजित किए गए। टीकाकरण शिविर के आयोजन के बाद मृत्यु दर में 90% तक की कमी और मवेशियों के दूध उत्पादन में 40% तक की औसत वृद्धि दर्ज की गई है।

288 किसानों के खेतों में ग्रामीण घरेलू मुर्गीपालन (कुरोइलर, निकोबारी फाउल), खाकी कैम्पबेल बत्तख, टी एक्स डी नस्ल के सुअर, मवेशी के चारे के रूप में खनिज मिश्रण और एजोला का प्रदर्शन किया गया। इस हस्तक्षेप के माध्यम से उन्नत सजावटी पक्षी प्रस्तुत किए गए इससे भी काफी आशाजनक परिणाम प्राप्त हुए।

उन्नत पोल्ट्री शेड से मृत्यु दर में कमी दर्ज की गई और छायादार क्षेत्र में गर्मी का दबाव कम हुआ। बेहतर शेड में मानक खाली स्थान के कारण मुर्गीपालन और दूध वाले जानवरों में बेहतर प्रदर्शन हुआ। घरेलू मुर्गीपालन और दूध वाले जानवरों की उच्च उत्तरजीविता के लिए गर्मी के दबाव को कम करने के लिए बेहतर आश्रय के हस्तक्षेपों का प्रदर्शन किया गया था।

किसानों के खेतों में मौजूदा एवं पुनर्निर्मित तालाबों में कंपोजिट और कैटफिश पालन को प्रदर्शित किया गया। खाकी कैंपबेल बतख, कड़कनाथ मुर्गे भी इस हस्तक्षेप के माध्यम से पेश किए गए थे।

संस्थागत हस्तक्षेपों के तहत बीज बैंक, चारा बैंक, जिंस समूह, कस्टम हायरिंग केंद्र, सामूहिक विपणन समूह, मौसम सूचकांक आधारित बीमा एवं एक ग्राम मौसम स्टेशन के माध्यम से जलवायु साक्षरता एवं जागरूकता से संबंधित मौजूदा अथवा नए साधनों को सशक्त करते हुए अंचल के 2783 किसानों की 583.6 हेक्टेयर भूमि पर 147 इकाइयों और 64 बेडों को विकसित किया गया।

चावल, सोयाबीन, मूंग, अरहर, रागी, चना, गेहूँ, सफेद सरसों और सरसों में केवीके के तकनीकी सहयोग से कई एनआईसीआरए गांवों में सूखा एवं बाढ़ सहने योग्य लघु आवधिक किस्मों के ग्रम स्तरीय बीज उत्पादन के माध्यम से किसानों और बीज समितियों द्वारा बीज बैंक की स्थापना की गयी। आकस्मिक स्थितियों से निपटने के लिए, विशेष रूप से धान, सोयाबीन और कँगनी के मामले में सहनशील किस्मों की उपलब्धता बढ़ाने को प्राथमिकता दी गई। सूखा सहनशील बीज के स्रोत और कुछ एनआईसीआरए गांवों से कम अवधि की खेती के लिए यह एक नियमित प्रथा बन गयी है क्योंकि इच्छुक किसानों और बीज समितियों ने इसे आजीविका गतिविधि के रूप में लिया है।

हरे चारे और सूखे चारे, आमतौर पर पशुधन को खिलाने के लिए जिसकी बहुत कमी है, के उत्पादन के माध्यम से गांवों में चारा बैंक स्थापित किए गये। अन्य जिलों के कई एनआईसीआरए गाँवों में चारा, मक्का, बाजरा, बरसीम, रिजका और जई के उन्नत किस्मों के बीज का नियमित और आकस्मिक स्थितियों में उपयोग के लिए उत्पादन किया गया।

सामूहिक विपणन उस जगह पर होता है जहां कई उत्पादक अपनी संयुक्त फसलों को बेचने के लिए साथ काम करते हैं। हालांकि इन सदस्यों को सामूहिक रूप से साझा लागत के साथ, फसल के अतिरिक्त भंडारण, प्रसंस्करण या पैकेजिंग की आवश्यकता हो सकती है।

एक कृषि जिंस को अनाज, पशुधन, मुर्गी पालन, फल या कृषि गतिविधियों से उत्पन्न किसी भी अन्य वस्तुओं के रूप में परिभाषित किया जा सकता है। कृषि जिंस का सामान्य मूल्य स्तर, चाहे एक प्रमुख टर्मिनल, बंदरगाह, या कमोडिटी फ्यूचर्स एक्सचेंज पर, विभिन्न प्रकार की बाजार शक्तियों से प्रभावित होता है, जो आपूर्ति और मांग के बीच वर्तमान या अपेक्षित संतुलन को बदल सकती हैं।

गोद लिए गए गाँव में स्वचालित मौसम केंद्र की स्थापना के माध्यम से किसानों के बीच ग्राम स्तरीय मौसम स्टेशन के माध्यम से जलवायु साक्षरता सेवा प्रदान की गई। गांव में जलवायु संबंधी समस्याओं और बेसलाइन सर्वेक्षण का आकलन करने के लिए पीआरए के बाद ग्रामीण जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) बनायी गयी। तब उन्होंने ग्राम स्तर के मौसम स्टेशन के माध्यम से केवीके और अन्य संस्थान के वैज्ञानिकों द्वारा सिफारिशों का पालन किया।

ग्रामीण जलवायु जोखिम प्रबंधन समिति (वीसीआरएमएस) का गठन ग्रामीणों के साथ गाँवों की जलवायु कमजोरियों को दूर करने और इस कार्यक्रम के तहत अपनाई जाने वाली रणनीतियों के बारे में गहन चर्चा के बाद किया गया था। वीसीआरएमएस के नाम से बैंक खाता खोलने के साथ ही ये कार्यशील हो गयी और इस खाते का संचालन वीसीआरएमएस के अध्यक्ष और संबंधित केवीके के प्रमुख द्वारा संयुक्त रूप से किया जाएगा। वीसीआरएमसी कृषि उपकरणों एवं सूक्ष्म सिंचाई प्रणालियों, बीज और चारा बैंक, सामुदायिक नर्सरी, रोपण सामग्री और आदानों में किसानों की हिस्सेदारी, गांव में छोटे मौसम केंद्र की स्थापना, क्षमता विकास कार्यक्रमों में किसानों की भागीदारी तथा सीखने वाले स्थानों के दौरे के लिए कस्टम हायरिंग सेंटर का प्रबंधन करती है। संस्थागत हस्तक्षेपों में बीज बैंक, चारा बैंक, जिंस समूह, कस्टम हायरिंग केंद्र, सामूहिक विपणन, एक ग्राम मौसम स्टेशन के माध्यम से जलवायु साक्षरता और अंचल में किसानों के बीच जागरुकता विकसित करना शामिल हैं।

केवीके के परामर्श से गांव में लागू किए जाने वाले तकनीकी हस्तक्षेपों पर महत्वपूर्ण निर्णय लेने के अलावा विभिन्न कृषि यंत्रों एवं उपकरणों की कस्टम हायरिंग की निगरानी वीसीआरएमसी द्वारा की जा रही थी, जो अब किसानों के बीच काफी लोकप्रिय हो गई है और पर्याप्त मात्रा में राशि (राजस्व) का भी सृजन हुआ है। जलवायु परिवर्तन के साथ तालमेल करने के लिए कृषि कार्यों की समयबद्धता महत्वपूर्ण है, विशेष रूप से बुवाई और गुड़ाई संचालन के मामले में। मेंड़ एवं कूंड़, चौड़े कूँड़ और उठी हुई क्यारियों में रोपण के लिए व्यापक प्रथाओं को अपनाने हेतु स्व-स्थाने मृदा नमी संरक्षण एवं भारी मिट्टी में अतिरिक्त पानी की निकासी के लिए कृषि उपकरण आवश्यक हैं। वर्षा आधारित क्षेत्रों में, छोटे और सीमांत किसानों के लिए ऐसे कृषि उपकरणों की उपलब्धता महत्वपूर्ण है। इसी तरह सिंचित क्षेत्रों में, रबी फसलों की शून्य जुताई के माध्यम से खरीफ फसलों का अवशेष प्रबंधन अवशेषों को जलाने की समस्या को कम करता है और मिट्टी के स्वास्थ्य में सुधार लाता है तथा जल उपयोग दक्षता बढ़ाता है। मशीनों / उपकरणों को भाड़े पर लेने की दरें वीसीआरएमसी के सदस्यों द्वारा तय की जाती हैं। यह समिति भाड़े से अर्जित राजस्व का उपयोग करती है और वीसीआरएमसी के नाम से खोले गए बैंक खाते में जमा करती है। राजस्व का उपयोग उपकरणों की मरम्मत और रखरखाव के लिए किया जाता है तथा 25% हिस्सा स्थिरता निधि के रूप में रखा जाता है। विभिन्न प्रकार के कृषि उपकरणों और मशीनों को सीएचसी में स्टॉक किया जाता है, जिनमें जीरो टिल ड्रिल, हैप्पी सीडर, बीबीएफ प्लांटर, ड्रम सीडर, मल्टी क्रॉप प्लांटरर, पावर वीडर, चैफ कटर, कोनोवीडर, डस्टर, स्प्रेयर, लॉवेलर, एफआरबी प्लांटर, सब-सॉइलर, जीरो-टिल फर्टी-सीड, डिस्क हैरो, बकेट लॉवेलर, रीपर, थ्रेसर, कल्टीवेटर, रोटावेटर, पंपसेट आदि सबसे लोकप्रिय हैं।

पिछले 8 वर्षों के दौरान क्षमता विस्तार के तहत विभिन्न विषयगत क्षेत्रों में 33717 किसानों (26417 पुरुष और 7303 महिलाएं) को लाभान्वित करने वाले कुल 1326 पाठ्यक्रम आयोजित किए गए। विषयगत क्षेत्रों में फसल प्रबंधन, प्राकृतिक संसाधन प्रबंधन, पोषक तत्व प्रबंधन, एकीकृत फसल प्रबंधन, फसल विविधीकरण, संसाधन संरक्षण प्रौद्योगिकी, कीट और रोग प्रबंधन, पशुधन और मत्स्य प्रबंधन, नर्सरी स्थापना, रोजगार सृजन, पोषक तत्व उद्यान, कृषि मशीनों और उपकरणों की मरम्मत एवं रखरखाव, एकीकृत कृषि प्रणाली, भूसा और चारा प्रबंधन, महिला के लिए कृषि उपकरणों के साथ लाख की खेती में श्रम में कमी, मूल्य संवर्धन, मानव पोषण और बच्चों की देखभाल, कृंतक (कुतरने वाले जानवर) का नियंत्रण आदि शामिल हैं।

रिपोर्टिंग अवधि के दौरान विभिन्न विषयगत क्षेत्रों में विस्तार गतिविधियों से 48068 सक्रिय किसान (37129 पुरुष और 13871 महिलाएं) लाभान्वित हुए हैं। विस्तार गतिविधियां कृषि विधि प्रदर्शनों, कृषि सलाहकार सेवाओं, पशु स्वास्थ्य जागरूकता शिविर, किसान चौपाल, किसान गोष्ठी, संसाधन संरक्षण तकनीकों, खेत एवं किसान दिवस के आयोजन, नैदानिक यात्राओं, समूह चर्चा, विश्व पृथ्वी दिवस, प्रौद्योगिकी सप्ताह, किसान मेला आदि के बारे में आयोजित की गई। सभी 9 एनआईसीआरए-केवीके ने कार्यशाला, सम्मेलन, संगोष्ठी और जागरूकता शिविर के माध्यम से 2015 में अंतर्राष्ट्रीय मृदा वर्ष तथा 2016 में अंतर्राष्ट्रीय दलहन वर्ष मनाया है। प्रत्येक वर्ष 5 दिसंबर को विश्व मृदा दिवस के अवसर पर संबंधित केवीके में आयोजन किया गया और एनआईसीआरए गांवों के किसानों के बीच 2100 मृदा स्वास्थ्य कार्ड वितरित किए गए।

चल रही अन्य विकास योजनाओं के साथ अभिसरण के माध्यम से संसाधन सृजन, परियोजना की शुरुआत के बाद से सभी एनआईसीआरए केवीके द्वारा प्राप्त की गई सबसे महत्वपूर्ण गतिविधियों में से एक है। चल रही विकास योजनाओं के साथ एनआईसीआरए लागू करने वाले प्रत्येक केवीके द्वारा काफी बड़ी संख्या में अभिसरण कार्यक्रमों को अंजाम दिया गया। प्रमुख विकास योजनाएँ एनएआईपी, महात्मा गांधी नरेगा, राष्ट्रीय सूक्ष्म एवं लघु सिंचाई योजना, प्रधानमंत्री ग्राम सड़क योजना, पिछड़े ग्रामीण अनुदान निधि, सुंदरबन विकास बोर्ड, एनएफएसएम, आईडब्ल्यूएमपी, आईवीआरआई, वन विभाग, पीडब्ल्यूडी आदि हैं। विभिन्न अभिसरण कार्यक्रमों का भाग होने के नाते एनआईसीआरए लागू करने वाले केवीके द्वारा 2011 से 2019 की अवधि के दौरान 2.40 करोड़ की बड़ी राशि सृजित की गयी है।

Executive Summary

In the context of climate variability, farmers need to adapt quickly to increasing frequency of drought, flood and other extreme events to stabilize crop yields and farm income. Over the years, the National Agricultural Research System has developed an array of practices and technologies to foster stability in agriculture production against the onslaught of seasonal variations. A nation-wide project, National Innovations on Climate Resilient Agriculture (NICRA), has been working since 2011 to address this challenge by application of science and technology. This project of ICAR aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technologies under field conditions to address current climate variability. This will enhance the pace of adoption of these resilient technologies. On-farm participatory demonstrations for climate resilience are being implemented in village clusters through KVKs in 151 climatically vulnerable districts across the country. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. Getting existing technologies into the hands of small and marginal farmers and developing new technologies like drought or flood tolerant crops to meet the demands of a changing climate also come under the purview of NICRA programme.

Climatic vulnerability of selected 9 KVK districts of West Bengal, Odisha and Union Territory of A & N Islands at district level regionally coordinated by ICAR-Agricultural Technology Application Research Institutes (ATARIs) 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.

Components of National Innovations on Climate Resilient Agriculture Programme in different modules like Natural Resource Management, Crop Production, Livestock & Fisheries and Institutional Interventions through which 110887 farmers were benefitted (Natural Resource Management- 8250, Crop Production - 6743, Livestock and Fisheries – 11326, Institutional Interventions - 2783, Capacity Building -33717 and Extension Activities - 48068).

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, 5% model of irrigation, crop residue management, bunding of field, Broad Bed Furrow, soil test based nutrient application, micro irrigation techniques, compost pits etc. which benefitted 8250 practicing farmers in the zone covering an area of 1617 ha.

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 adopted villages covering 2136 farmers in 491 ha area. Broad Bed Furrow System helped the farmers to provide irrigation in vegetables and rice as well as to include various IFS components like fish rearing in the furrows, fodder crops on the beds along with drainage facility in A&N Islands. More than 500 ha have been brought under this intervention with significant impact among the farmers.

Water harvesting and recycling for supplemental irrigation through renovation of pond, well and canal, sand check dam, making bund, 5% model etc. were demonstrated in adopted villages by the different KVKs involving 1195 numbers of farmers.

Under *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 tillage 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 rice fields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, rice, lentil, pea and chickpea demonstrated in 9 NICRA adopted villages in an area of 186 ha of 824 numbers of farmers. The technologies followed mainly by zero tillage operation. Wheat with cultivation through ZTD showed significant increased yield. Zero tillage technology showed very promising results in pulse and oilseed cultivation through the entire zone. Introducing different crops like ol (var. HYV Gajendra); auliflower (var. MSN-16); rice (var. Pusa Bold, Pusa 362); tomato (var. Param F1) etc in Kendrapara, Jharsaguda as less water requiring crop as contingent crop planning during deficit rainfall in kharif.

Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in rice in NICRA adopted villages covering 60 ha area in 319 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest rice yield (59.5 q/ ha) with a promising economic return.

Water saving irrigation methods like sprinkler irrigation, low energy water application (LEWA) in rice, Raised Bed Furrow (RBF) in brinjal, micro-lift irrigation in rice demonstrated in NICRA adopted villages covering an area of 150 ha in 388 farmers' fields.

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 rice, wheat, vegetables, fodder etc. Farmers realized an additional yield and income from the crops. A total of 256 number of rainwater harvesting structures have been developed throughout the zone which could store 9.06 million cu m of water through which 2100 ha area could be brought under irrigation. This intervention increased the cropping intensity to the maximum extent up to 250% with an average cropping intensity of 125%. Another intervention like 5% models were created on medium upland rice field where water retention capacity was low. Especially in late monsoon or insufficient rainfall transplanting of seedling are not done in time. By creating 5% model ditches in each plot to harvest and collect the rain water. Stored water increases the moisture level, helps in transplanting and also can provide irrigation during moisture stress later on.

Other Demonstrations like oyster mushroom cultivation, effective utilization moisture through seed production of pulses, in-situ vermicomposting in orchards, soil test based nutrient application, cleaning and renovation of old farm pond, renovation of well, planting forest trees, afforestation, soil test based nutrient application, bio pesticides in various crops, boron application in cauliflower and cultivation of high yielding grass on farm bund were carried out in 3132 farmers' fields with an area of 554.15 ha of land.

Under **Crop Production** module different area specific intervention were taken by viz; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops to avoid terminal heat stress, water saving rice cultivation methods like SRI, aerobic, direct seedling, community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop

management, integrated disease management, contingency crop, were covered which benefitted 6743 farmers.

Drought tolerant rice varieties like *Sahbhagi, Anjali, Naveen, Abhishek* were demonstrated in 265.14 ha areas of 952 number of farmers' field. For pulse and oilseeds, *PU-31, Devi TARM-1, OBGG-52* varieties of blackgram, groundnut, greengram were demonstrated in large area and gave the maximum economic return (B: C: 2.60).

Salt tolerant varieties of rice like *CARI Dhan-5, Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona* were demonstrated in 19.78 ha area in 70 farmers' fields. *Jarava, Geetanjali and Amalmona* varieties proved maximum salt tolerant potential by giving highest yield of 50.5 q/ha and more economic return (BC ratio of 2.41).

Flood tolerent varieties of rice like *Swarna sub 1, sabita, dudheswar* were demonstrated in 294 ha area in 817 farmers' field by giving yield of 45 q/ha with an economic return 2.45.

To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, etc. were sown in 12 days advance during rabi season. These demonstrations were carried out in adopted villages involving 651 number of farmers' fields with an area of 134.4 ha land.

Water saving rice cultivation through SRI, short duration varieties, direct seeded rice, brown manuring etc. have been demonstrated in 126 ha area of 452 number of farmers' fields. Among all the interventions rice cultivation with Sahbhagi variety showed highest increase in yield .

To combat the situation of delayed monsoon, intervention of staggered *community nursery* for rice has now become very popular in some parts of West Bengal and Odisha. 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. Odisha experienced aberrant rainfall situations in 5 out of the previous 10 years impacting adversely rice production and livelihood of farmers. It appeared that failure of rain in July is responsible as transplanting of 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. Besides rice other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 27 ha area of 574 numbers of farmers. Among all the demonstration the community nursery for cauliflower was the most promising one which showed highest increase in yield as well as economic return.

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 almost all adopted villages.

Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in 230.91 ha area of 817 number of farmers' fields. The maximum economic return was recorded (B:C:: 4.1) in the cultivation of brinjal (var. FI-Hybrid long) and maize (var. P3377) in Odisha.

Livestock and Fisheries module comprising various livestock centric interventions were carried out which include 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 and fodder management through mineral mixture, feed blocks and silage making, azolla feeding, breed animal health management through deworming and vaccination, fish pond cleaning and fish farming, pig farming, clean milk and fodder production. These interventions benefitted 11326 livestock owner with 33247 units in vaccination programme.

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. 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. Community lands of an area of 30.02 ha involving 303 number of farmers utilized for different fodder production were demonstrated in different adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration legume Sudan grass showed maximum benefit return (B:C:: 5.59).

Vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming etc. in 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.

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 288 number of farmers fields. Improved ornamental bird was introduced through this intervention which also showed very promising results.

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.

Composite and cat fish rearing in the existing and renovated ponds were demonstrated in farmers' fields. Khaki Campbell duck, Kadaknath poultry were also introduced through this intervention.

Institutional Interventions including strengthening the existing or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centres, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station and awareness developed 584.6 ha area, 147 units and 64 no of beds covering of 2783 number of farmers in the Zone.

Seed Bank through 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, 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 rice, soybean and foxtail millet. 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 was established in the villages through the production of green fodder and dry fodder which are usually very shortage as feed to livestock. 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 is where a number of growers work together to sell their combined crops. However these members may require additional storage, processing or packaging of the crop, with the costs shared by the collective.

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 service through village level weather station was provided among the farmers through the establishment of automatic weather station in the adopted village. 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.

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. VCRMC manages the custom hiring centre for farm implements and micro-irrigation systems, seed and fodder bank, community nurseries, collection of farmers share in planting material and inputs, establishment of small weather

station in the village, participation of farmers in capacity development programs and exposure visits to learning sites. Institutional interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed among the farmers in the Zone.

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 has now become immensely popular among the farmers and substantial amount has also been generated. 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. The rates for hiring the machines / implements are decided by the members of 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, chaff cutter, conoweeder, duster, sprayer, laveler, FIRB planter, sub-soiler, zero-till frti-seed, disc harrow, bucket laveler, reaper, threser, cultivator, rotavator, pumpset etc.

A total 1326 courses were conducted under **Capacity Building** on various thematic areas benefitting 33717 farmers and farmwomen (26417 males and 7304 females) during last eight years. 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.

Extension Activities on various thematic areas benefiting 48068 practicing farmers (37129 males and 13871 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 9 NICRA-KVKs have celebrated International Year of Soils in 2015 and International Year of Pulses in 2016 through conducting workshop, seminar, symposia and awareness camp. December 5 each year was observed as World Soil Day in the respective KVK and distributed 2100 soil health cards among the farmers of NICRA villages.

Resource Generation through Convergence with ongoing other development schemes is one of the most significant activities achieved by all the NICRA KVKs since the inception of the project. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development schemes. The prominent development schemes are NAIP, MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, Backward Rural Grant Fund, Sunderban Development Board, NFSM, IWMP, IVRI, Forest Department, PWD etc. NICRA implementing KVKs being part of the different convergence programmes generated huge amount over Rs. 2.40 crores during the period of 2011 to 2019.

INTRODUCTION

National Innovations in Climate Resilient Agriculture (NICRA) - A Network Project of Indian Council of Agricultural Research (ICAR) since February, 2011 aims to enhance the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The objectives of this network project are:

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks
- To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application

On-farm participatory demonstrations for climate resilience are being implemented in village clusters through KVKs in 151 climatically vulnerable districts across the country. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. Getting existing technologies into the hands of small and marginal farmers and developing new technologies like drought or flood tolerant crops to meet the demands of a changing climate also come under the purview of NICRA programme. The project is comprised of four components.

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

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

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

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

Table. List of districts and KVKs with Climate vulnerability

S. N.	State	NARP Zone	Districts	Climate vulnerability
1	A&N Islands	Coastal Zone	Port Blair	Cyclone
2	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.

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

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

The interventions covered with the following 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 rice 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.

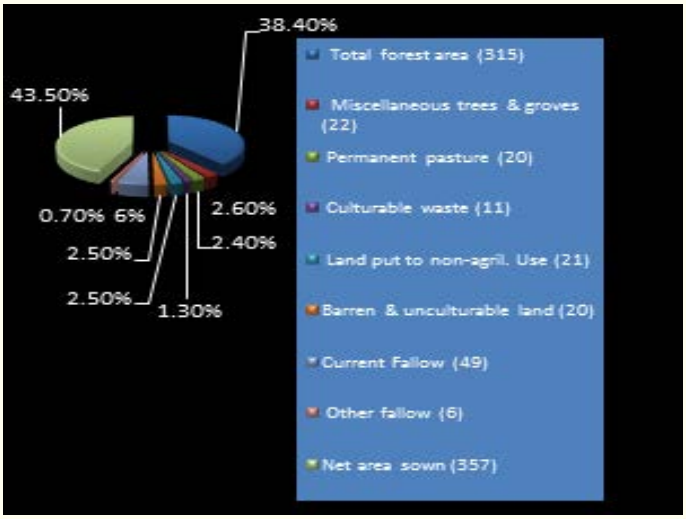
Basic Resources of NICRA Villages

Odisha

Ganjam I

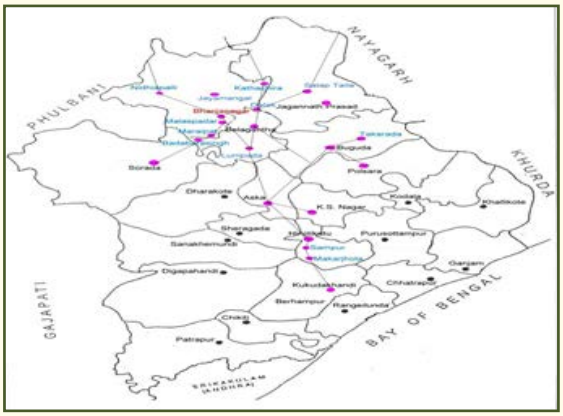
1. Village information:

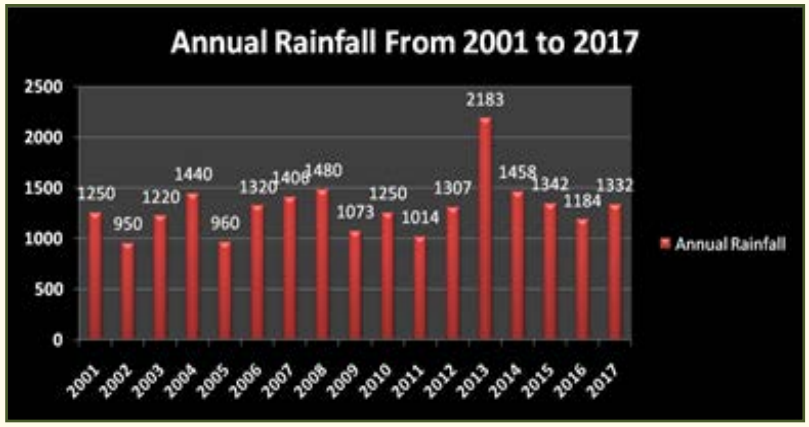
Name of the village and district	Chopara
No. of households	315
Total cultivated area (ha)	150
Area under rainfed cultivation (ha)	54
Major soil type	Acidic, sandy clay, sandy Clay Loam
Climatic vulnerability of the village	Drought, terminal moisture stress



2. Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events >60mm	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1040	951	46	-	-	03	-	865	63	86
2012-13	1040	1307	57	01	-	03	-	897	303	44
2013-14	1040	2181	80	-	-	06	-	1019	940	222
2014-15	1040	1724	62	01	-	03	-	1282	401	226
2015-16	1040	1342	60	01	-	03	-	1015	28	114
2016-17	1040	1205	70	-	-	03	-	828	260	117
2017-18	1040	1333	75	-	-	0	-	955	256	122
2018-19	1040	1325	72	-	-	02	-	960	245	120





3. Detail of climatic vulnerability

Three dry spell occurred during Sept. 21-30, 2012, Sept. 21-30, 2014 and July 01 -10, 2015.The Short duration rice variety. *Sahabhagidhan* performed better than local variety. The medium duration var. were also performed better than local var. as critical irrigation were supplied through checkdam and farm pond. In 2014 Monsoon delayed by 02 weeks, so farmers were advised to delay the sowing by 15 days, so that direct sown crops were not affected.

2013- Cyclone (Phailin) occurred in October month which caused water logging and heavy loss of rice, vegetable occurred, however short suration rice var. *Sahabhagidhan* was not effected much as it was sown in 20th June, through DSR and harvested before phailin. In October, 2014 Cyclone Hudhud caused a little (20 % low land) submergence problem in low land situation , however flood tolerant rice variety *Swarna sub-1* performed better than other variety. There was no other submergence problem during 2011-18 during rainfall event of more than 60 mm/days.

4. Predominant farm enterprises

i) Cropping pattern: Rice-Greengram, Rice- Black gram, Rice- Groundnut, Rice- Brinjal, Rice- Tomato, Brinjal-Okra, Groundnut-fallow, Maize-fallow, Rice- fallow

ii) Major cropping system: Rice- Greengram, Rice-Blackgram, Rice- Brinjal, Groundnut-fallow, Maize-Fallow

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Rice (Short duration)	170	139
Rice (Medium duration)	462	192
Greengram	269	47.2
Blackgram	116	41.9

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*Pooja,MTU-1001,Pratikshya,masoori, Naveen,Sahabhagidhan, Swarna sub-1*	895	409
Greengram	*PDM-139, TARM-1, IPM-02-03*	630	249
Blackgram	*Prasad, OBG-17, PU-31*	274	102
Maize	*Hybrid-super-36, JK hybrid, Pioneer 3OR 77*	138	49

v) Cropping intensity (%): Before NICRA-131. After NICRA-163

vi) Horticulture Crops:

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Brinjal	39	1362	*Utkal Tarini,Green star, VNR, Utkal hybrid, JK hybrid*	29.5
Tomato	23	1425	*BT-10, BT-02, Red Ruby*	18
Chilli	16	730	*Utkal ava, Pusa Jwala*	11
Cabbage	14	1369	*Hare Krishna, Konark, Rare ball, Krishna-1, Snow ball*	10.5
Cowpea	18	519	*Utkal manika, Gomoti, Gayatri*	13.5

vii) Area under fodder cultivation and number of farmers growing green fodder: 2 ha

viii) Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle- Indigenous breed	2742	173	0	FMD , HS , BQ	374	78
Cattle- Cross bred	328	35	600	FMD , HS , BQ	618	21
Goat	808	58	205	PPR	383	105
Poultry	2291	132	221	Rani khet	358	139

ix) Milk productivity (litres/milch animal/day): Indigenous breed-2.4 to 3.6 L/day, Cross bred-12 to 14 L/day.

x) Details data about inland fisheries practiced: Total Fish pond area- 03 ha., Fish yield- 2.6 t/ha.

5. a) Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status
2011-12	Community tank, farm pond	03	-
2012-13	Community tank, farm pond	03	-
2013-14	Community tank, farm pond	3.5	Desilted, Fish farming
2014-15	Community tank, farm pond	3.8	Desilted, Fish farming
2015-16	Community tank, farm pond	4.0	Desilted, Fish farming
2016-17	Community tank, farm pond	4.0	Desilted, Fish farming
2017-18	Community tank, farm pond	4.0	Desilted, Fish farming
2018-19	Community tank, farm pond	4.0	Desilted, Fish farming

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
1	No. of farm ponds/*Jalkund*	Constructed	-	-	-	-	1	-	-
		Repaired/ Renovated	-	-	-	-	-	1	-
2	Community pond /tank	Constructed	-	-	1	-	-	-	-
3	Percolation tanks/ Re-charge pits (No.)	Constructed	-	-	-	03	-	-	-
4	No. of Check dams	Constructed	-	-	1	-	-	-	-
		Repaired/ Renovated	-	-	-	1	1	1	1
5	Recharging of wells		-	-	-	-	-	03	03

c) Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

Name of imlement	Before NICRA	After NICRA
Tractor	-	3
Power tiller	-	4
Sprayer	2	13
Diesel pumpset	2	9
Winnower	4	14

6. Socio-economic status:

a) No. of households: General: 165 nos; OBC: 95 nos; SC: 55 nos; ST: nil

b) Literacy rate (%): Male: 72; Female: 58

Jharsuguda

1. Village information:

Name of the village and district	Bhoimunda
No. of households	117
Total cultivated area (ha)	98 ha
Area under rainfed cultivation (ha)	98 ha
Major soil type	Red lateritic
Climatic vulnerability of the village	Drought situation, irregular rainfall, low fertility status of soil, disease and pest occurrence in crops.

2. Rainfall Trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1362.8	1360.0	79	0	0	02	-	1345	0	15.1
2012-13	1362.8	1799.5	89	0	0	03	-	1613	142.8	43.7
2013-14	1362.8	1291.8	92	0	0	02	-	1034	202.5	55.3
2014-15	1362.8	1334.6	85	0	0	01	-	1269.74	56.46	8.4

Year	Normal rainfall (mm)	Total rainfall (mm)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2015-16	1362.8	1513.4	82	0	0	02	-	1393.4	68.92	51.08
2016-17	1362.8	1169.3	74	0	0	01	-	1004.04	42.82	122.5
2017-18	1362.8	1392.7	72	0	0	02	-	1217.42	104.56	70.72
2018-19	1362.8	1375.5	73	0	0	02	-			

- **Name of Agro climatic zone**
  - West Central Table Land Zone
  - North Western Plateau Zone

3. Detail of climatic vulnerability

2011-12- Duration of dry spell more than 10 days- 1 (Not affected the crops). 2012-13- High rainfall (Managed and not affected the crops). 2013-14- Duration of dry spell more than 10 days- 1(Not affected the crops). 2014-15- No such remarkable climate vulnerability (Not affected the crops). 2015-16- Higher rainfall as compared to normal rainfall (Not affected the crops). 2016-17-Scanty rainfall, drought situation (Not affected, Manageable). 2017-18 – Normal rainfall

4. Predominant farm enterprises

i) Cropping pattern: Rice-Cowpea/Rice-Radish/Maize-vegetable-pulses/Rice-vegetables-pulses

ii) Major cropping system: Mono cropping (before NICRA), Double to multiple cropping (After NICRA)

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Rice	579	281.5
Maize	148	262.5

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*Sahabhagidhan, Pratikshya*	742	411
Maize	*30-R-77*	368	126

v) Cropping intensity (%): 108% (Before NICRA), 135 % (After NICRA)

vi) Horticulture Crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Cauliflower	134.5	1765	*Megha*	113
Cowpea	80	742.5	*YB-7*	64
Cabbage	79	1991	*BC-76*	77
Brinjal	56.4	1552	*Bluestar*	49.9
Tomato	68.9	2227	*Laxmi*	67.4
Chilli	52.3	772.5	*Siamhot*	51.1
Radish	64.6	721.5	*Pusha chetaki*	63.1
Bhindi	70.7	685	*Sonal*	69.2

vii) Micro-irrigation:

Micro-irrigation	Area (ha)	No. of farmers
Sprinkler	26	81

viii) Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle: Cross breed	29	29	-	FMD & HS & BQ	50-55	64
Indigenous breed	544	218	-	FMD & HS & BQ		
Goat	432	167	34	PPR		100
Poultry	8027	30	171	Rani khet		183

ix) Milk productivity (litres/milch animal/day): Cow Cross breed 6-8 lit/day & Indigenous breed 1-3 lit/day

5. a) Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status	
			Before NICRA	After NICRA
2011-12	WHS	4 ha	Silted, less water content.	Desilting done by convergence with watershed department
2012-13	-	-	-	-
2013-14	WHS	4 ha	Silted, less water content.	Desilting done by convergence with watershed department
2014-15	-	-	-	-
2015-16	WHS	4 ha	Silted, less water content.	Desilting done by convergence with watershed department
2016-17	**-**	**-**	**-**	**-**
2017-18	WHS	4 ha	Silted, less water content.	Desilting done by convergence with watershed department
2018-19	WHS	3 ha	Silted, less water content.	Desilting done by convergence with watershed department

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
1	WHS	Desilting	4 ha	-	4 ha	-	4 ha	-	4 ha

c) Status of farm mechanization before start of NICRA: Poor

List of Farm implements available in the village:

i. Tractor
ii. Power tiller
ii. Motor pumpset
iii. MB plough

6. Socio-economic status:

a) No. of households : OBC: 92 nos.; SC: 02 nos.; ST: 25 nos

b) Literacy rate (%):

Male: 45% Female: 25%

Kalahandi

1. Village information:

Name of the village and district	Pipalpada
No. of households	60
Total cultivated area (ha)	150 ha
Area under rainfed cultivation (ha)	148 ha
Major soil type	Red and sandy loam
Climatic vulnerability of the village	Drought prone and scanty rainfall

2. Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1330.5	1264.6	72	0	0	4	-	1077.2	26.0	161.4
2012-13	1330.5	1392.0	77	0	0	4	-	1109.0	144.0	139.0
2013-14	1330.5	1429.0	72	0	0	5	-	1023.0	254.0	152.0
2014-15	1330.5	1720.0	67	2	2	6	-	1328.0	98.0	294.0
2015-16	1330.5	1294.7	66	1	0	3	-	1125.2	38.3	131.2
2016-17	1330.5	1141.79	72	0	0	5	-	876.7	220.6	21.4
2017-18	1330.5	1452.8	73	0	0	3	-	1164.2	172.2	116.4
2018-19	1330.5	1460.6	74	0	0	4	-	1160.3	176.7	123.6

3. Detail of climatic vulnerability

- Medium annual but uneven distribution round the year being very high during kharif months and minimal or no rainfall during winter months
- Frequent dry spell
- Low bright sunshine hours, foggy weather and low temperature during peak winter months
- Gradual shortening of winter months leading to terminal; heat stress in *rabi* crops

4. Predominant farm enterprises

i) Cropping pattern: Cotton-Black gram, Arhar-Black gram, Rice-Black gram

ii) Major cropping system: Cotton+Pigeon pea-Rice+Blackgram

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Cotton	248	123
Rice	138	139
Black gram	108	91.4
Pigeon Pea	103	105
Maize	91	123

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Cotton	*Bunny, Shalimaar, Chandramukhi, Tulasi*	258	173
Rice	*Lalaat, Harishankar, Swanra, Moti*	129	118
Black gram	*Pu-31,*	107	99
Pigeon Pea	*Asha, PRG-176*	97	91
Maize	*cv.4325*	93	88
Horse gram	*Local* variety	87	84

v) Cropping intensity (%):127

vi) Horticulture Crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Mango	25	364	*Amrapalli*	19
Tomato	9.5	261	*Utkal kumara, Utkal Anushree*	7
Cabbage	9.2	302	*Golden acre, Konark*	5.8
Cauliflower	9	279	*Early snowball,*	6.1
Brinjal	9	332	*Purple long, Utkal gaurav*	5.9
Chilli	8	55.6	*Agnirekha*	5.5

vii) Micro-irrigation:

Year	Micro-irrigation	Area (ha)	No. of farmers
2015-16	Drip irrigation	03	02
2016-17	Drip irrigation	04	03
2017-18	Drip irrigation	04	03

viii) Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle	757	351	280	FMD	100	Nil
Goat	798	325	298	PPR, Goat pox	100	Nil
Poultry bird	642	315	328	Ranikhet disease	100	Nil

ix) Milk productivity (litres/milch animal/day):1.25 L/day

x) Details data about inland fisheries practiced: Mixed fish farming

5. a) Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status
2015-16	Grazing land	30	Effective use
	Water bodies	10	Defunct
2016-17	Grazing land	28	Effective use
	Water bodies	15	Effective use
2017-18	Grazing land	27	Effective use
	Water bodies	20	Effective use
2018-19	Grazing land	22	Effective use
	Water bodies	25	Effective use

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/ Years of Construction	Category	2015-16	2016-17	2017-18
1	Community pond /tank	Repaired/ Renovated	-	1	1
2	Percolation tanks/ Recharge pits (No.)	Constructed	5	7	7

c) Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Tractor
ii. Power tiller
iii. Motor pumpset
iv. MB plough

6. Socio-economic status:

a) No. of households: General: 2 nos; OBC: 3 nos.; SC: 9 nos.; ST: 80 nos.

b) Literacy rate (%): Male: 45 Female: 23

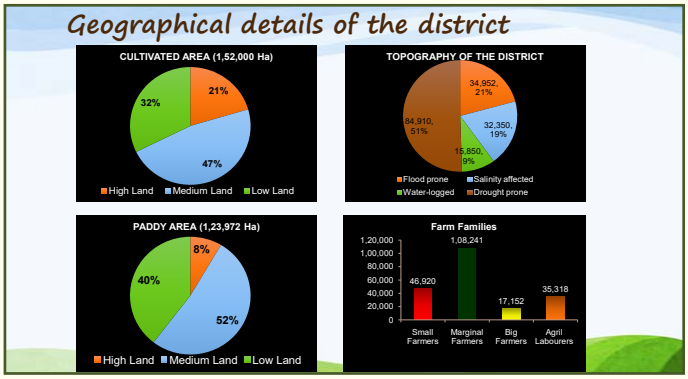
Kendrapara

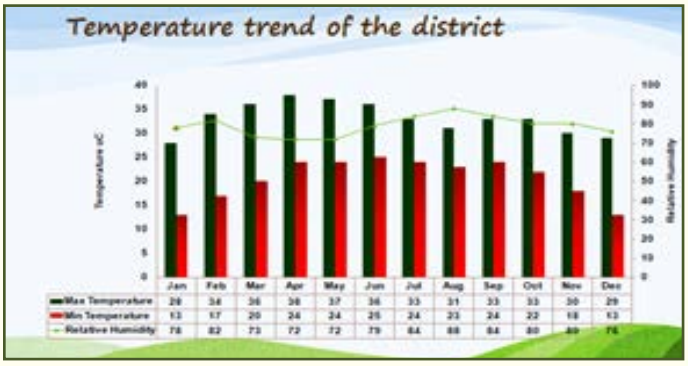
1. Village information:

Name of the village and district	Village : Krushnadaspur, Block : Marshaghai
No. of households	152
Total cultivated area (ha)	195
Area under rainfed cultivation (ha)	86
Major soil type	Alluvial (sandy loam)
Climatic vulnerability of the village and the extent area affected (explain) during the study period(2011-16)	Flood and Cyclone
Year of Implementation	2011-12 to 2012-13

Name of the village and district	Village :Kasotibali, Block : Pattamundei
No. of households	150
Total cultivated area (ha)	128
Area under rainfed cultivation (ha)	56
Major soil type	Sandy loam
Climatic vulnerability of the village and the extent area affected (explain) during the study period(2011-16)	Flood and Cyclone
Year of Implementation	2013-14 to 2015-16

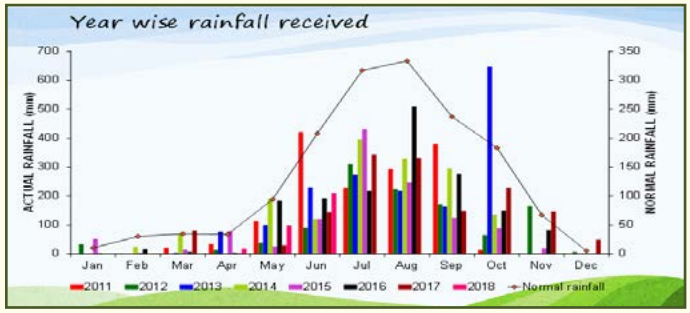
Name of the village and district	Village : Dasmankul, Block : Marshaghai
No. of households	80
Total cultivated area (ha)	54
Area under rainfed cultivation (ha).	54
Major soil type	Sandy loam
Climatic vulnerability of the village and the extent area affected (explain) during the study period(2011-16)	Flood and Cyclone
Year of Implementation	2016-17





2. a) Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1556	1509.51	75	1	0	4	01	1324.51	13.67	171.33
2012-13	1556	1118.90	73	1	2	4	01	795.5	270.73	52.67
2013-14	1556	1713.61	87	0	1	2	-	884.83	647.00	181.78
2014-15	1556	1561.32	76	1	1	3	01	1141.10	137.55	282.67
2015-16	1556	1204.89	85	1	1	1	01	923.55	158.78	122.56
2016-17	1556	1642.68	80	1	1	4	-	1195.72	235.3	211.66
2017-18	1556	1504.33	88	1	0	1	01	965.01	424.65	114.67
2018-19	1556	1580.50	84	1	0	1	0	1040.50	414.50	125.50



3. Detail of climatic vulnerability

- Climatic vulnerability areuntimely heavy rain, flood, dry spell and cyclone
- Frequent heavy rains with cyclones
- Untimely heavy rains causes seedlings damaged
- Frequent dry spell
- Low bright sunshine hours, foggy weather and low temperature during peak winter months
- Gradual shortening of winter months leading to terminal; heat stress in rabi crops

4. Predominant farm enterprises

i) Cropping pattern: Rice, green gram, horse gram, vegetables *etc.*

ii) Major cropping system: Rice–fallow, Rice-Green gram, Rice - vegetables

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Rice	1532	379
Green gram	348	164.9
Black gram	238.8	163.3
Horse gram	171.2	172.3
Ground nut	173.8	239.2
Sugar cane	257	686
Jute	163.8	241

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*Swrna, Pooja, Sarala, Lalata, CR 1014, Sadhana*	72	94
Green gram	*Local, PDM 139, SML 66, IPM 2-14*	527	187
Black gram	*Local, Prasad, T9,PU 31*	186	43.2
Ground nut	*AK 12-24, Devi, Smruti*	119	259.6
Sugarcane	*Raghunath*	188	37.8
Horse gram	*Urmi*	33	7.4

v) Cropping intensity (%):180

vi) Horticulture Crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Brinjal	80.4	1040.4	*Local, Utkalkeshari, UtkalJyoti, JK 33, Madhuri, PusaKranti*	67.4
Chilli	22.4	566.4	*Utkalava, Utkalrashmi, Tejaswini,Kranti,Jawalamukshi, Surjyamukshi*	19
Tomato	48.6	1496.4	*UtkalKumari, UtkalRaja,Rajani,Rupali, Laxmi, UtkalDipti, Swarnasampad*	41.2
Potato	93.2	514.4	*Kufrichandramukshi, KufriSinduri, Kufribasdsaha, Kufrilalaima*	80.2
Cabbage	45	1351.4	*Priya, Ramada,Gold star, Pusasambha, Pusa drum head, Field rocket*	37.6
Cauliflower	38.2	1210.4	*Kartika, Shewta,Amajing, Snow ball -16,Rima, Late man,Mahima*	32.2
Pointed gourd	60	743.4	*Local, Swarnareksha, Swarnaalukik*	52
Cowpea	10.4	326	*Pusabarshati, Utkalmanika, Kashikanchan*	9
Bitter gourd	9.6	281	*Arkaharit, Nakhara, Prachi, Priya, Kiran, chaman,*	9.6
Pumpkin	14	813	*Guamal, Badyabhati,Vairav, Arkachandan*	14
Cucumber	9.8	294	*Azad, Trupti, Rani, Himangi, PusaSangog*	9.8

vii) Area under fodder cultivation and number of farmers growing green fodder: 598 ha

Source of irrigation	Area (ha) under irrigation
Lift irrigation/Canal/Water bodies	1024

viii) Micro-irrigation:

Micro-irrigation	Area (ha)	No. of farmers
Drip irrigation	8	32

ix) Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cow	218	82	-	FMD cattle	12	14
Goat	232	83	-	PPR in goat	56	8
Poultry	442	148	22	Ranikhet in poultry	62	6
Fish	468	152	27	HS, BQ	66	5

xi) Milk productivity (litres/milch animal/day):8 L/day (average production)

xii) Details data about inland fisheries practiced: IMC, 35 q/ha

5. a. Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha)	Current status	
			Before NICRA	After NICRA
2011-12	*Pasture, Village forest, River bank, Water bodies*	2.5	-	9
2012-13	*Pasture, Village forest, River bank, Water bodies*	2.1	-	9
2013-14	*Pasture, Village forest, River bank, Water bodies*	6.2	-	24
2014-15	*Pasture, Village forest, River bank, Water bodies*	6.5	-	24
2015-16	*Pasture, Village forest, River bank, Water bodies*	6.5	-	24
2016-17	*Pasture, Village forest, River bank, Water bodies*	7.5	-	35
2017-18	*Pasture, Village forest, River bank, Water bodies*	7.8	-	35
2018-19	*Pasture, Village forest, River bank, Water bodies*	7.5	-	35

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	No. of farm ponds/ *Jalkund*	Repaired/ Renovated	1	1	1	-	-	-	-	-
2	Community pond / tank	Constructed				1				-
		Repaired/ Renovated	-	1	1	-	-	-	-	-
3	No. of Check dams	Constructed	-	-	1	1	-	-	-	-
4	Permanent check dam/Sand Bag Check dam	Constructed	-	-	1	1	-	-	-	-

c. Status of farm mechanization:

Before start of NICRA	After CHC establishment
MB plough	MB plough, Diseal motor
Diseal motor	Power operator thresher
Manual operated thresher	Axial flow thresher, Rotavator
	Powertiller, Mould blow plough
	Rice winnower

6. Socio-economic status:

a) **No. of households:** General: 35 nos.; OBC: 272 nos.; SC: 55 nos.; ST: 20 nos.

b) Literacy rate (%): 58 :: Male: 64; Female: 52

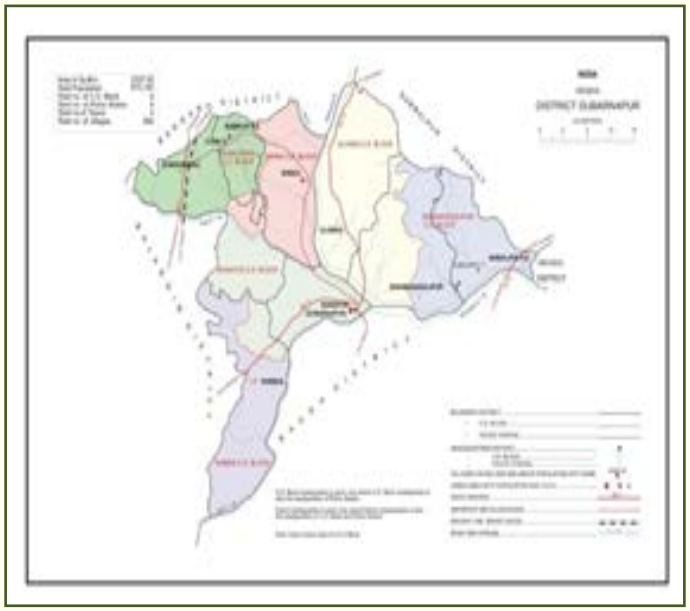
Sonepur

1. Village information:

Name of the village and district	Badmal, Ullunda
No. of households	115
Total cultivated area (ha)	597 ha
Area under rainfed cultivation (ha)	495 ha
Major soil type	Black, Brown forest, Lateritic
Climatic vulnerability of the village	Drought prone

2. Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1418.5	812.0	39.6	-	-	-	-	736.0	8.0	68
2012-13	1418.5	1064.5	40.7	-	-	-	-	954.0	74.5	36
2013-14	1418.5	1376.0	41.5	-	-	-	-	1039.0	292.0	45
2014-15	1418.5	1955.0	42.3	1	-	-	-	1788.0	43.0	124
2015-16	1418.5	996.0	46.5	1	-	2	-	904.0	32.0	60
2016-17	1418.5	1275.4	48.2	-	-	2	-	1113.8	103.6	58
2017-18	1418.5	1069.3	41.2	-	-	2	-	890.6	170.6	8
2018-19	1418.5	1210.4	40.5	-	-	2	-	1025.9	169.5	15



3. Detail of the climatic vulnerability

- Duration of dry spell more than 10 days
- High rainfall and uneven
- Duration of dry spell more than 10 days-
- No such remarkable climate vulnerability
- Higher rainfall as compared to normal rainfall
- Scanty rainfall, drought situation
- Normal rainfall

4. Predominant farm enterprises

i) Cropping pattern: Rice-Green gram, Rice-Black gram, Rice-Groundnut, Rice- Vegetable, Rice- Fallow, Rice-Green gram-Fallow,

ii) Major cropping system: Rice-Green gram , Rice-Black gram, Rice-Vegetable

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Rice	1825	351.0
Green gram	788	27.6
Arhar	46	9.0
Ground Nut	160	8.0
Black Gram	175	5.2
Chilli	59	210.0

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*Sahabhagi Dhan, Jogesh*	73	92
Green gram	*TRAM-1*	545	185
Cabbage	*Golden pcre*	170	44.2
Cowpea	*Utkal Manik*	130	269.6
Ground nut	*Smruti*	187	37.4
Blackgram	*T9*	35	17.4

v) Cropping intensity (%): 183

vi) Horticulture Crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids in the village (acre)
Cauliflower	3.8	877	*Early Snowball*	110
Cabbage	5.4	1071	*Golden pcre, BC-90*	120
Tomato	7.3	1064	*Utkalraja, Laxmi*	2
Okra	2.8	245	*Ajay*	3.5
Brinjal	1.0	182	*Kutmendha local*	5.0
Water melon	0.8	350	*Augusta*	10.5
Pumpkin	0.8	762	*Guamal*	4.5
Onion	6.0	210	*N 53*	12.0
Yam	0.8	210	*Orissa elite*	2.0
Chilli	3.0	338	*Utkal ava, Pusa jwala*	14.5

vii) Area under fodder cultivation and number of farmers growing green fodder: 13 ha

viii) Micro-irrigation:

Micro-irrigation	Area (ha)	No. of farmers
Sprinkler and Drip	9.0	40

ix) Livestock:

Live-stock type	Total number	No. of live-stock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vac-cination (%)	Mor-tality rate (%) due to diseases
Cow	1058	760	46	FMD, HS, BQ	75	22
Goat	214	52	100	PPR	85	25
Poultry	700	70	90	Rani khet	75	25
Duck	214	105	95	FMD, HS	82	20
Fish	5000	220	95			

xi) Milk productivity (litres/milch animal/day): 5.6

xii) Details data about inland fisheries practiced:

5. a) Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha)	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011-12	Community tank farm pond	1.5	-	3
2012-13	Community tank farm pond	1.0	-	6
2013-14	Community tank farm pond	1.5	-	9
2014-15	Community tank farm pond	1.0	-	10
2015-16	Community tank farm pond	1.0	-	12
2016-17	Community tank farm pond	2.0	-	15
2017-18	Community tank farm pond	2.5	-	18
2018-19	Community tank farm pond	1.0	-	12

b. Summary of Water harvesting interventions taken up in the NICRA village

Sl. No.	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	No. of farm ponds/*Jalkund*	Constructed	2	-	-	-	-	1	-	-
2	Community pond /tank	Repaired/ Renovated	-	-	3	3	-	1	-	-
3	Recharging of open/tube wells with silt trap	Constructed	20	-	-	-	-	-	-	-
		Repaired/ Renovated	3			6	2	2		-
4	No. of Check dams	Repaired/ Renovated					1			-
5	Drainage Channel (length in meter)	Cleaning/ desilting	-	-	-	-	1	-	-	-
6	Arhars/pynes etc	Renovated	-	-	-	-	-	-	-	-
7	Others	3	-	-	-	-	-	1	-	-

c) Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Tractor drawn land leveler
ii. Tractor drawn M.B.Plough
iii. Tractor drawn Rotavator
iv. Seed cum fertilizer drill
v. Self propelled riding type reaper
vi. High capacity multi crop thresher
vii. Power weeder
viii. Diesel pumpsert
ix. Sprinkler
x. Power tiller
xi. Diesel pump Greaves with accessories
xii. Aspee spare MB bolo motorized knapsack mist blower cum duster
xiii. Aspeevidut deluxe battery operated sprayer
xiv. Happy seeder , 9 tyne , tyne to tyne distance 225 mm, PTD 540 , RPM tractor power 45 HP

6. Socio-economic status:

a) No. of households: General: 168 nos.; OBC: 78 nos.; SC: 50 nos.; ST: 75 nos.

b) Literacy rate (%):

Male: 86.49 **Female:** 70.80

A & N Island

Port Blair

1. Village information:

Name of the village and district	South Andaman	
	Port Mout	Badmashpahad
No. of households	70	104
Total cultivated area (ha)	35 ha + 15 ha	45 ha + 08 ha
Area under rainfed cultivation (ha)	Rainfed	
Major soil type	Clay loam	
Climatic vulnerability of the village	Drought prone area	Cyclonic area

2. Rainfall received (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events) *	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	3074.3	3827.6	166	2	2	16	1	2387.2	520.7	919.7
2012-13	3074.3	4006.9	157	1	3	18	2	2207.5	549.7	1249.7
2013-14	3074.3	3406.6	158	4	2	15	4	2207.1	513.4	686.1
2014-15	3074.3	2915.9	120	1	1	11	0	2447.8	191.0	277.1
2015-16	3074.3	2808.4	136	2	2	8	1	1821.7	465.5	521.2
2016-17	3074.3	3541.4	119	3	3	14	1	2538.0	733.0	270.4
2017-18	3074.3	3315.5	122	0	1	15	1	2341.5	713.5	260.5
2018-19	3074.3	3285.5	124	0	1	15	1	2211.5	680.5	393.5

* indicates no. of continuous rainy days. Flooding rarely occurs due to high land slope (2-10%).

3. Detail of climatic vulnerability

The period 2011-16 experiences an average rainfall of 3418 mm which is 11% more than the average annual normal rainfall of the islands with maximum in 2012 (4006.9 mm) and lowest in 2015 (2808.4 mm). Maximum no. of rainy days occurred in the year 2011 (166). The duration of dry spells in days (10 days and above) are as below:

A& B. Tropical Cyclone *PHAILIN* (8-10.10.2013) and *LEHER* (25.11.2013)

The very Severe Cyclonic Storm (VSCS) *PHAILIN* which hit the Odisha coast originated from a remnant cyclonic circulation from the South China Sea. It lay over north Andaman Sea as a well marked low pressure area on 7th October 2013 as reported by IMD. It concentrated into a depression over the same region on 8th October 2013 near latitude 12.0^{0}N and longitude 96.0^{0}E. Moving west-northwestwards, it intensified into a deep depression on 9th morning and further into cyclonic storm (CS), '*PHAILIN*' in the same day evening. Accordingly the depression moved northwestwards and intensified into a deep depression at 0530 hrs IST of 9th Oct. near 13.0^{0}N and 93.5^{0}E. Moving west-northwestwards, it crossed Andaman Islands near MayaBandar at 1430 hrs IST of 9th Oct. 2013. Later it intensified into a Cyclonic Storm (CS), *PHAILIN* and moved over east central Bay of Bengal.

Another deep depression originated over South Andaman Sea and its neighbourhood about 300 km south-southeast of Port Blair on 25.11.2013 which moved northwestward and intensified into a cyclonic storm called *Lehar*. The cyclone crossed Andaman & Nicobar Islands (ANI) between Hut Bay and Long Island, close to Port Blair around early morning of 25th November 2013. Then it emerged into southeast Bay of Bengal, gradually slowed down and moved towards northwest of Andhra Pradesh coast. During the cyclone there was heavy to very heavy rainfall of around 20 cm at most places of the South Andaman. Whereas in the sea condition severe storm surge of about 1–1.5 m height and inundated the low-lying areas of ANI. The speed of gale winds was 90–100 km/h, which damaged the huts, thatched roofs, *etc*.

A. Rainfall recorded:

The station-wise daily 24 hr cumulative rainfall (7 cm or more) during 8-10 October and 25 November recorded in districts of **Andaman & Nicobar Islands** at 0830 hrs IST of date are given below.

S. No.	Date	Area	Rainfall (cm)
1	**08-10-2013**	**North & Middle Andaman-** Maya Bandar	24
		South Andaman- Port Blair	9
2	**09-10-2013**	**Middle Andaman** – Long Island	34
		North & middle Andaman – Maya Bandar	34
		South Andaman- Port Blair	07
3	**10-10-2013**	**North & Middle Andaman** – Maya Bandar	16
		Nicobar- Car Nicobar	07
4	**25-11-2013**	**South Andaman**	22

B. Damage Assessment:

As per the information collected from Directorate of Agriculture, Animal Husbandry and Fisheries and the District Administration by personal contact there was no causality and major damage to agriculture due to *phailin* and *leher* in Andaman Islands. Heavy to very heavy rainfall of around 20 to 34 cm was recorded and wind speed of 40-60 km /hr was forecasted. There was no major damage to standing rice crops except flooding of low lying areas as it coincided with the vegetative phase of rice. There were no reports of loss of livestock except few cases of fowl typhoid (salmonellosis) as proper forecast of the possible disease out break has been issued. However, there were very few cases of falling of arecanut trees in the cyclone tract which might account for less than 1% of arecanut plantation areas. In the lowlying areas of Middle Andaman district flooding was observed ranging from one to few hours and erosion of streams (Louki and Rangat

Nallahs) and adjoining areas. In addition in the coastal areas of Middle Andaman flooding was reported (300 – 500 ha) for few hours which coincided with the high tide. The major cause was drainage congestion.

C. Tropical cyclone *VARDAH* (08.12.2016)

The rainfall occurred during the 08.12.2016 of 212.4 mm resulted due to the tropical cyclone (*VARDAH*) over the Andaman Sea. The cyclone later upgraded as L2 type disaster declared by the Andaman and Nicobar Administration. The depression remained situated 340 km Northeast of Car Nicobar and 240 km West South-west of Port Blair with a wind speed of 65 kmph. There was no major crop damage reported from the villages. The villages Badmaspahad being situated in close proximity of the sea is experienced the tropical cyclone whereas the village Port Mout being situated on the top and western direction of the sea experiences more water scarcity during the summer months. The drought like situation in the village Port mout requires more intervention in creating water resource structures whereas the village Badmaspahad requires to be protected from the sea water intrusion during the cyclone occurrence periods. the average annual rainfall is 3008 mm. The majority of the rainfall is received during the SW monsoon spreading from May to September. The percent SW rain of the annual rainfall vary from 57.2% to 79.4%, showing a marginal decrease in the trend with time. The variation of the rainfall indicates the occurrence of more extreme events (11 days of 100 mm and more in 2012) and more dry spell (83 days of 5 times during 2012). The occurrence of extreme events of high rainfall was well taken by the project so that less extent of crop damage occurred. The dry spells mostly occurred during December to April experience the water scarcity to meet the crop water damage sometimes coinciding the crop growth stage. The water resources created in the adopted villages meet the demand of crop water requirement during the dry spells.

4. Predominant farm enterprises

i) Cropping pattern: Rice +Pulses and Vegetables; rice + Vegetables +vegetables: vegetables +leafy vegetables + pulses

ii) Major cropping system: Plantation based cropping system. Pond based IFS: Integrated farming system (BBF, ridge and furrow methods)

iii) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*CSR-36,MTU 1010 Swarna dhan Sahbhagi dhan, Naveen*	35	20.5
Maize	*Vivek QPM-5*	9	4.2
Arhar	*APK-1*	2	1.0

iv) Cropping intensity (%): 165

v) Horticulture: crops

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Vegetables	159.3	796.5	Brinjal (*CIARI-Brinjal -1*)	159.3
Fruits	41.2	668.5	Guava, Sapota, Mango	41.2
Coconut	51	223125	Tall- Andaman Ordinary	51
Arecanut	55	242	Mangla, samrudhi	55
Flowers	5.18		Loose flower (Marigold)	5.18

vi) Area under fodder cultivation and number of farmers growing green fodder: 5.5 ha

vii) Livestock:

The total livestock and poultry as per 2012 Census in Andaman & Nicobar accounts to 154,741 and 11, 65,363 poultry birds.

The distribution of category wise and number of animals for South Andaman district is shown below

Category	No. of Animals
1. Cattle	17927
2. Buffalo	985
3. Goats	27564
4. Pigs	3075

The total number of Poultry according to the census 2012 is 11, 65,363. Out of these, 4, 48,713 belong to improved variety.

Category	No. of Animals
Total Poultry	665422
Fowls	642251
Ducks	20105

viii) Milk/ Egg & Meat Production:

Milk (in "000" tones)	Egg ("in Lack nos.)	Meat "in ('000' kgs)"
12.259	434.255	145.372
11.709	358.548	2553.000
9.219	509.989	2573.000

ix) Details data about inland fisheries practiced:

The Andaman & Nicobar Islands have a vast potential for fisheries in view of coastal length of about 1,912 Km and the continental shelf area of about 35,000 Sq. Km. The Exclusive Economic Zone(EEZ) around these islands is about 6,00,000 Sq Km forming 28% of the total EEZ area of the country.

As per the report of the working group on revalidation of potential Marine Fisheries Resources of EEZ of India during the year 2010 the estimated annual exploitable stock of marine fish in A & N waters is 1.48 lakhs MT

Inland Water Bodies

Minor Irrigation Ponds in A & N Islands used for Pisciculture

S. No	Place/Tehsil	Fresh water Ponds (No.)	Water Area (ha.)
1.	South Andaman	533	34.64
2.	Neil Island	70	4.55
3.	Havelock	105	6.82
4.	Little Andaman	80	5.20
5.	Baratang & Kadam-tala	229	14.80
7.	Rangat	250	17.02
8.	Billiground	365	26.06
9.	Mayabunder	107	6.06
10.	Diglipur	820	67.06
11.	Car Nicobar	07	0.45
12.	Nancowry	06	0.39
13	Campbell Bay	33	2.14
Total		**2605**	**185.19**

Reservoirs

S. No	Name	Area in ha.
1.	Dhanikari Reservoir	65
2.	V.K. Puram Reservoir	48
3.	R.K. Puram Reservoir	65
4.	Dilthaman Tank	03
5.	Chakkargaon Tank	03
6.	Nayagaon Tank	03
7.	Kalpong Reservoir	180
Total		**367**

Marine And Inland Fish Production (tones)

Fish Production	2012-13	2013-14	2014-15	2015-16	2016-17
Marine	36426	36753	36980	37125	38581
Inland	194	195	197	200	226
Total	**36620**	**36948**	**37177**	**37325**	**38807**

Potential Fishery Resources & Infrastructures (based on FSI report) (in MT)

Fish Production	2012-13	2013-14	2014-15	2015-16	2016-17
Marine	36426	36753	36980	37125	38581
Inland	194	195	197	200	226
Total	**36620**	**36948**	**37177**	**37325**	**38807**

Exploitation For The Last Five Years (tones)

Sl No.	Resource	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Pelagic	17295	18454	18231	18704	18978
2.	Demersal	15863	17005	16329	15405	16543
3.	Oceanic	3268	1294	2420	3016	3060
Total		**36426**	**36753**	**36980**	**37125**	**38581**

Fishing Boats In Operation For The Last Five Years

Sl. No	Fishing Boats in operation	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Mechanized Boats	59	43	68	69	83
2.	Motorized Boat	1484	1401	1352	1385	1255
3.	Non Motorized (Country crafts)	1704	1571	1510	1528	1550
Total		**3247**	**3015**	**2930**	**2982**	**2888**

Fishing Gears In Operation For The Last Five Years

Sl. No.	Name of the Gears	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Gill Net	2357	2344	2327	2326	4270
2.	Shore Seine Net	31	37	37	37	31
3.	Anchor Net	04	04	04	04	-
4.	Cast Net	975	971	953	950	4411
5.	Hook & Line	3212	3217	3200	3214	15050
6.	Long Line	231	229	227	227	2607
7.	Disco Net	59	58	50	50	-

5. a) Resource availability:
Status of common pool resources (CPRs)

CPR	Area (ha) or Numbers	Current status	
		Before	After
Pond	05	05 defunct	20 renovated

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	Total No
1	Community pond /tank	Constructed	06
		Promoted as Tank well system	11
		Repaired/ Renovated/ Desilted	14
2	BBF		51
3	Bund Raising		03

5. c) Status of farm mechanization before start of NICRA: Poor

List of Farm implements available in the village:

v. Deshi (country) plough
vi. Spade, Garden rake
i. Knapsack Sprayer
ii. Power tiller
iii. Coconut climbing machine

6. Socio-economic status:

a) No. of households : General- 125; OBC-45

b) Literacy rate (%): Male: 90.27 :: Female: 82.43

c) Workers engaged in agricultural activity (%): 63.6 %

West Bengal

Coochbehar

1. Village information:

Name of the village and district	Village : Khagribari
No. of households	1686
Total cultivated area (ha)	2010- 534, 2016 - 548
Area under rain-fed cultivation (ha)	Initial (2010) : 362 (68 % of total cultivated area) Present (2017) : 301 (55 % of total cultivated area)
Major soil type (2016)	Sandy Loam : 395 , Loam : 66 , Sandy : 87
Climatic vulnerability of the village	• High annual but uneven distribution of rainfall round the year being very high during kharif months and minimal or no rainfall during winter months • Uneven, intensive and erratic pattern of rainfall during kharif season leading to temporary flood condition or occasional short dry spell • High relative humidity throughout the year • Low bright sunshine hours, foggy weather and low temperature during peak winter months • Gradual shortening of winter months leading to terminal; heat stress in rabi crops

2. Rainfall (mm) trend :

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	3000	3692.1	106	2	0	20	2	2883.9	49.6	758.6
2012-13	3000	3957.7	107	0	0	16	2	3139.5	206	612.2
2013-14	3000	2512.0	81	2	0	8	0	1755.8	158.8	597.4
2014-15	3000	2513.8	84	0	0	9	1	1924.6	3.8	585.4
2015-16	3000	3107.5	104	1	0	10	2	2380.9	54.6	672.0
2016-17	3000	3299.7	92	1	0	12	1	2643.4	153.1	503.2
2017-18	3000	3350.5	98	2	0	14	2	2669.5	160.5	520.5
2018-19	3000	3168.5	92	2	0	13	2	2459.0	171.0	538.5

3. Details of climatic vulnerability

- High annual but uneven distribution of rainfall round the year being very high during kharif months and minimal or no rainfall during winter months
- Uneven, intensive and eratic pattern of rainfall during kharif season leading to temporary flood condition or occasional short dry spell
- High relative humidity throughout the year
- Low bright sunshine hours, foggy weather and low temperature during peak winter months
- Gradual shortening of winter months leading to terminal; heat stress in rabi crops

4. Predominant farm enterprises

i) Cropping pattern: Rice-potato/mustard/wheat/vegetables-jute/fallow

ii) **Major cropping system:** Rice based cropping system

iii) Area and productivity of major crops:

Crop	Area (ha)	Yield (q/ha)
Rice	494	36.1
Jute	284	25.3
Potato	126	214
Wheat	32	23.2
Mustard	20	7.7
Boro rice	16	49.3
Vegetables (Brinjal, tomato, chilli *etc.*)	24	205

iv) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Aman Rice	*MTU-7029, SS-1, GB-1*	662	87.40
Maize	*DKC-9081, DKC-900MM Gold*	122	26.8
Wheat	*PBW-343, HD-2967*	71	8.8

v) Cropping intensity (%): 198

vi) Area under fodder cultivation and number of farmers growing green fodder: 1.06 ha (37 no. of farmer)

vii) Horticulture:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha)
Cucumber	7.0	315	*Local, Malini*	5.8
Tomato	3.6	205	*Pusarubi, Abinash, local*	2.1
Chilli	6.4	96	*Bullet, Akash, Tejaswini, Mahico, local*	4.8
Brinjal	7.0	289	*Local, Muktakeshi, BE-706, NS-797*	4.3

viii) Milk productivity (L/milch animal/day):

Type of livestock	Before NICRA	After NICRA
Indigenous cattle	1 L milk/day	1.8 L milk/day
Crossbred	10 L milk/day	13 L milk/day
Buffalo	8 L milk/day	9 L milk/day

ix) Details data about inland fisheries practiced:

Inland Fisheries	Before NICRA	After NICRA
Area (ha)	2	9.6
Yield (t/ha)	1.3	1.6

x)Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle, buffalo, goat, sheep, poultry, duck	15345	1020	23	FMD, BQ, PPR, Ranikhet, cholera, pleague, septicemia	78	22

5. a) Resource availability:

Status of common pool resources (CPRs)

CPR	Area (ha) or Numbers	Current status
Canal for drainage and irrigation	2000 m	Needs renovation and desilting
Community water bodies	2000 m	Good

b) Status of farm mechanisation before start of NICRA:

Name of machineries	Before CHC	After CHC establishment (as on date)
No. of tractor	3	3
No. of power tiller	2	2
Rotavators	0	1
Levelling blades	2	2
Planter	0	1
Zero-till drill	0	2
Any other (SRI Marker)	0	3
Manual wheel hoe	4	7
Manual operated (Knapsack sprayer)	9	15
No. of reapers	0	2
Crop specific thresher	1	2
Multicrop thresher	0	1

c) Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	No. of farm ponds/*Jalkund*	Repaired/ Renovated	16	-	4	4	3	6	3	2
2	Drainage Channel (length in meter)	Cleaning/ desilting	-	2000 m	-	-	-	-	-	-
3	Compost tank (Pacca)	Construction	25	7	15	15	9	23	16	12
4	Vermi-compost chamber (poly)	Construction	15	20	3	7	28	10	27	25

6. Socio-economic status:

a) No. of households : General-596; OBC-84 ; SC-932; ST-74

b) Literacy rate (%): Male: 78.12, Female: 69.33

S 24 Pgs (Nimpith)

Village information:

Name of the village and district	Village: Bongheri
No. of households	406
Total cultivated area (ha)	216.53 ha
Area under rainfed cultivation (ha)	216.53 ha
Major soil type	Clay and Silty-clay
Climatic vulnerability of the village	1. Cyclone 2. Intensive rainfall in short time span 3. Prolonged submergence during Kharif season 4. Late onset of monsoon and prolonged dry spells 5. Soil and water salinity in winter and summer

2. Rainfall trend of the district (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	Summer
2011-12	1876	1520	74	1	1	1	1	1286	17	217
2012-13	1876	1719	73	1	-	2	2	1447	228	44
2013-14	1876	1873	72	1	-	3	2	1435	142	296
2014-15	1876	1531	78	1	1	2	1	1298	160	73
2015-16	1876	1927	65	1	-	3	2	1771	25	131
2016-17	1876	1306	81	2	1	-	-	999	80	227
2017-18	1876	1685	82	2	1	2	2	1323	122	240
2018-19	1876	1725	79	2	1	2	2	1402	118	205

3. Detail of climatic vulnerability

During 2011 to 2016, the village witnessed at least one dry spell during the mid-crop growth stage and 1-2 prolonged water stagnation during early and late crop growth stage. Due to deep water stagnation, the rice nursery bed and transplanting was hampered. The late season precipitation hampered the land preparation for winter crops. The year 2016-17 received the least precipitation (1306 mm) among the last 5 year. Whereas highest precipitation (1926 mm) was observed in 2015-16.

- Heavy rainfall within the short span of time hampered the Kharif crop, during rainy season in the year 2011, 2013 and 2015
- In 2013, Rice field of 18 ha was severely affected due to high rainfall during August that resulted in continuous submergence for 14 days. Vegetables like, Okra, Bottlegourd, Bittergourd also suffered crop loss in about 12 ha area.
- In 2014, NICRA village witnessed a late onset of monsoon with deficit rainfall in the early season (40 mm actual rainfall in May, in comparison to normal rainfall of 122 mm)
- In 2015, 196 mm precipitation on 28th June washed away Rice nursery (2.5 ha) and submerged the newly transplanted fields for continuous 14 days in 6 ha. Other Kharif vegetables like, Okra, Bittergourd, Ridge gourd were also affected in 7 ha area.
- In 2016-17 there was 30.39% deficit rainfall.

4. Predominant farm enterprises

i) Cropping pattern:

Rainfed	Pre-Kharif	Kharif	Rabi
Low lying	Fallow	Rice	Lathyrus/ Greengram
	Fallow	Rice	Fallow
Medium land	Fallow	Rice/ vegetable	Fallow
Irrigated	**Pre-Kharif**	**Kharif**	**Rabi**
Low lying	Fallow	Rice	Vegetable
Medium land	Fallow	Rice/ vegetable	Vegetable

ii) Major cropping system: Rice based mono-cropping system

Only rice is grown in *Kharif* season due to water logged condition. The village is mostly low lying and protected by river embankment from flooding with brackish river water. Hence, rice is the only possible option for the farmers in *Kharif* season. Again there is dearth of fresh water for irrigation during winter and summer, coupled with soil salinity, restricting any option of growing vegetables.

iii) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Rice	*Morishal, Dudheswar, Bidhan-1, Bidhan-2, Swarna,Lolat, IET-5656, IET-11904, Dinesh, IET-15848, Sabita, Swarna sub-1*	101	55
Sunflower	*KBSH-53, LSFH-171*	62	8.5
Greengram	*Chaiti mung, PDM-84-139*	72	12
Lathyrus	*Local, Nirmal and Biol-212*	47	8

iv) Cropping intensity (%): Before NICRA : 122.13% ; After NICRA: 162% (Total cultivable area: 212 ha and Gross cropped area: 343.5 ha)

v) Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Chilli	32	51.87	*Tejaswini, Bullet*	26
Bittergourd	19	177	*VNR-Megha, JK- Junior, US-6207*	16
Okra	13	136.4	*Satsira, Jhanti, J.K-1060, Shakti*	12
Brinjal	15	327	*Boral, Muktokesi*	14
Tomato	23	495	*Pusarubi, S.G-1458, JK-811*	23

vi) Area under fodder cultivation and number of farmers growing green fodder: 4 ha

vii) Livestock:

Livestock type	Total number	No. of live-stock owner	Share of im-proved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle	268	139	11.2	F.M.D., Parasitic infestation	74.6	-
Sheep	643	143	-	Parasitic infestation	19.9	-
Goat	705	159	-	Goat pox, Parasitic infestation	47.9	-
Poultry	8000	146	20.5	Ranikhet, Pox	87.5	2.5

viii) Milk productivity (L/milch animal/day):

Indigenous Breed : 2.54L/animal/day

Improved Breed: 4.5 L/animal/day

ix) Inland fisheries practiced:

a) Inland fresh water fishery (IMC) practiced in the existing ponds which have reduced storage capacity, broken bunds and defunct inlet and outlet.These ponds do not hold water for more than 7-8 months.

b) Improper pond preparation, un-realistic stocking density and lack of care in balanced feeding also lowered the productivity

c) Average productivity of fish was merely 0.5q on an average 0.13 ha water area.

d) Another problem of the area is occasional ingress of brackish water into the fresh water ponds, leading to loss of entire fish stocks.

e) The traditional practice of rice cum fish cultivation has not been improved over the period, rather became a lost art in the village. Indigenous rice cultivation in low lands in kharif season gives very low productivity. In such plots, wild fish such as murrels, loaches,etc., automatically gains entry into the field during monsoon but the productivity is not upto the mark. No investment is made for raising fish which are used for domestic consumption.

Average production	Gross Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	BCR
0.5 q	2100.00	5000.00	2900.00	2.38

5. a. Resource availability:

Status of common pool resources (CPRs)

CPR	Area (ha) or Numbers	Current status (before start of NICRA)
Drainage canal	2 no.(4km and 2.5 km long)	The renovated canal stores approximately 3.66 lakh cu. m water at the end of rainy season and benefits more than 50 ha of agricultural land within and across the project village
Mangrove	Along 4 km long river bund	The river bed has now a thick and dense coverage of mangrove plantation, protecting the embankment from any possible breaching during cyclones.

b. Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	No. of farm ponds	Constructed								
		Repaired/ Renovated	20	12	-	3	-	-	-	-
2	Drainage Channel (length in meter)	Cleaning/desilting	4000	-	-	-	-	-	-	-
3	Land shaping	Constructed	13	7	-	3	-	4	6	4
4	Construction of land embankment around deep water rice fields	Constructed	14	8	24	6	-	-	-	-
5	Ridge and furrow cultivation	Constructed	4	1	-	-	-	-	-	-

C.Status of farm mechanization before start of NICRA: Poor

List of Farm implements available in the village: Power tiller: 1 no; Thresher: 5 no; Pump set: 10 no.; Country plough: 181 No. ; Spade, Sickle, Harrow

6. Socio-economic status:

a) No. of households: General- 71nos; OBC-12 nos; SC-323 nos; ST - nil

b) Literacy rate (%): Male: 58% Female: 32%

Malda

Village information:

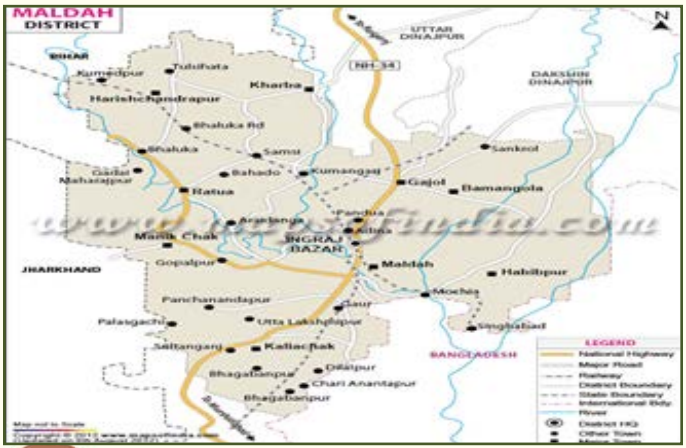
Name of the village and district	Brozolaltola, Meherchandtola, Jairamtola and Mahendratola
No. of households	484
Total cultivated area (ha)	255 ha
Area under rainfed cultivation (ha)	167
Major soil type	Sandy-claye, Sandy-loam
Climatic vulnerability of the village	Recurrent occurrence of flood, long dry season

2. a. Rainfall trend of the district (mm):

Year	Normal rainfall (mm)	Total rainfall (Jan-Dec)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)
2011-12	1349	1395.1	76			
2012-13	1349	1413.5	88	0	0	10
2013-14	1349	1184.5	78	2	0	4
2014-15	1349	1364.6	83	0	1	7
2015-16	1349	1479.1	87	2	1	8
2016-17	1349	1321.2	82	4	2	2
2017-18	1349	1460.5	80	3	1	2
2018-19	1349	1375.6	83	3	2	2

3. Details of climatic vulnerability

- High annual but uneven distribution of rainfall round the year being very high during kharif months and minimal or no rainfall during winter months
- Uneven, intensive and eratic pattern of rainfall during kharif season leading to temporary flood condition or occasional short dry spell



- High relative humidity throughout the year
- Low bright sunshine hours, foggy weather and low temperature during peak winter months
- Gradual shortening of winter months leading to terminal; heat stress in rabi crops

4. Predominant farm enterprises: Wheat, Jute, Maize, Blackgram, Mustard, Vegetables.

i) Major cropping system:

Pre-kharif/Summer	Kharif	Rabi/Winter
Pointed gourd		Brinjal/Tomato/Chilli
Maize	Fallow	Mustard/Wheat
Jute	fallow	Wheat
Maize	Black gram	Chilli/Brinjal/other veg
Green gram	Maize	Lentil/Mustard
Maize/Jute		Wheat/Tomato/Brinjal
Bitter gourd/pointed gourd	Fallow	Lentil/mustard/ vegetables

ii) Predominant varieties of major food crops in the village:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Blackgram	*WBU 109*	280	48
Wheat	*DBW 39*	150	45.23
Mustard	*B-54*	24	11.41
Maize	*Hybrid*	21	16.15

iii) Cropping intensity (%): 196.70

iv) Horticulture crops :

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Brinjal	15	231	*Muktakeshi. Vnr Hybrid*	11
Pointed gourd	9	150	*Kajoli*	5
Turmeric	6	10	*Suranjana*	7
Mango	29	39	*Fazli Himsagar, Langra*	17

v) Area under fodder cultivation and number of farmers growing green fodder: 10 ha

vi) Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cow/goat/buffalo	3570	450	5%	FMD/PPR	35	09

vii) Milk productivity (litres/milch animal/day): 3.50L/ animal/day

5.a. Resource availability:

Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)
2011-'12	03		Canal/River
2012-'13	03	03	Canal/River
2013-'14	05	05	Canal/ River/Community Pond
2014-'15	05	05	Canal/ River/Community Pond
2015-'16	15	15	Canal/ River/Community Pond/community jute retting Tank
2016-'17	15	15	Canal/ River/Community Pond/community jute retting Tank

b. Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	Total
1	No. of farm ponds/ *Jalkund*	Repaired/ Renovated	04
2	Community pond / tank	Repaired/ Renovated	06
3	Drainage Channel (length in meter)	Cleaning/desilting	300
4	Others	Jute retting tank/ pond (constructed & renovated)	63

c. Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village: i. Bullock plough: 116

ii.Bullock cart: 12 iii.Thresher: 05

6. Socio-economic status:

a) No. of households: General-182 **;** OBC-56 ; SC-162 ; **ST-*32***

b. Literacy rate (%): Male: 68% Female: 55%

Module I: Natural Resource Management

In-situ Moisture Conservation – Resource Conservation Technology

Ganjam I

In-situ moisture conservation practices play a major role in moisture conservation in drought prone area. The different practices like Summer ploughing, Green manuring, poly mulching, ridge and furrow method improves soil moisture conservation, soil health, water use efficiency. By summer ploughing the hard crust broke, better penetration of root, more infiltration of rain water, storage of rain water increases, decrease in pest and disease incidence and more over yield of rice increased by 5-7 %. By raising farm bund height to 10 inch . The soil & moisture conservation increased and yield of Rice was also increased by 6 %. Poly mulching in vegetable suppressed weed growth, increases moisture & nutrient availability to crop and Yield also increased by 9%. Two no. of less irrigation required in poly mulching. Ridge and furrow method in maize, cowpea decreases water requirement by 20 %, requires 02 nos less irrigation as compared to conventional method and yield was also increased by 10-12 %.

Jharsuguda

To ensure and enhance the moisture availabilities in the field several frontline demonstrations was conducted in NICRA village with an objective to reduce the cost of cultivation, time saving, energy saving, soil health management, enhancement of water holding capacity, use of residual moisture through para and sequential cropping. Keeping the in-situ moisture conservation in the center different resource conservation technology *viz*, green manuring by *Dhaincha* application in ricefield, Ridge and furrow method in Cowpea and Radish were demonstrated in 59.8 ha among 342 farmers during 2011-17.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Summer Ploughing in Rice (var. *Pratikshya*)	77	20.4	39.7	34000	33490	1.98
Green manuaring (Sun hemp) in Rice (var. *MTU-1001*)	47	11.0	36.6	32000	30220	1.94
Repair of bund (raising of farm bund ht.)	32	9.0	38.1	34000	30770	1.90
Mulching (Poly mulching in Tomato by UV polythene of 50 micron size)	8	0.4	296	116000	120000	2.04
Sowing of Maize in Ridge & furrow method for more water harvesting	35	13.0	42.6	29000	30640	2.01
Sowing of Cowpea in Ridge & furrow method for more water harvesting	08	2.0	44.4	45000	43800	1.96
Total	**207**	**55.80**				

Intervention like green manuring by *Dhaincha* application in rice field, Ridge and furrow method in Cowpea and Radish were being widely accepted by the farmers of NICRA and adjoining villages, and their extent was more than 128 ha. Through these interventions, moisture availabilities extent has been increased and standing crop may face water stress without any damage as per farmer feedback. Intervention like Green manuring especially of *Dhaincha* is also being widely accepted in low land rice field and their extent was 15-20% of the total rice field. In situ conservation of *Dhaincha* not only improved the soil fertility but also enhanced the moisture extent duration in successing crops as per farmer feedback. The water use efficiency has been increased in the intervention on Ridge and furrow method in cowpea and radish.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Green manuring (*Dhaincha*) in Rice (var. *Pratikshya*)	96	31	47	22300	34100	2.52
Ridge & furrow method (cowpea)	138	18.7	76.0	32500	79800	3.4
Ridge & furrow method (Radish)	108	10.1	78.5	17000	64500	3.8
Total	**342**	**59.8**				

Kendrapara

The demonstrations/interventions taken under NICRA programme in the NICRA adopted villages are shown the path to the farmers to adopt different technologies resilient to the climate change more particularly heavy rain, flood and cyclone in Kendrapara district.The farmers are lost their vegetable seeding due to untimely heavy rain, now they are used low cost walk in tunnel poly house for vegetable seedling raising , more than 32 farmers of NICRA village locality are raised their vegetable seedling under poly house. The farmers are adopting ridge and furrow, broad based furrow method of vegetable cultivation (Cow pea, Cucumber, Radish, Brinajl *etc.*) by reducing the no of irrigation upto 30 %.

About 42 farmers of NICRA and its adjacent village are adopted the ridge and furrow as well as broad based furrow method of vegetable cultivation in *rabi* season.The green manuring is a very good practice of in-situ moisture conservation as well as soil health management. We have demonstrated the green manuringin three NICRA adopted villages. Now more than 42 hectares of land under green manuring in NICRA adopted villages and nearby villages. Poly mulching with drip irrigation in brinjalresulted good yield with increase the water use efficiency of the crop.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Green Manuring	62	72.0	48.4	67760	27960	1.70
Ridge & furrow method of cow pea cultivation	14	1.6	68	36500	47500	2.30
Broad based furrow method of cucumber cultivation	27	6.4	82.0	36500	45500	2.24
Vermi	34	34.0	1MT/63ft2	--	--	--
Ridge & Furrow Brinjal	46	48.0	234	55003 288200	44997 138200	1.81 1.92
Plantation of cashew nut and casuarinas in river bed for soil erosionact as wind breaker & live hood support.(2013-14)	25	1.0		10666		
Total	**208**	**88.0**				

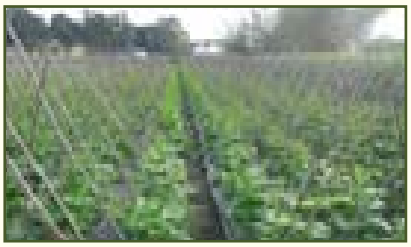
Sonepur

Due to proper moisture conservation the crop yield has been increased and wastage of water is minimized. Due to green manuring soil fertility has been enhanced resulting in overall yield enhancement. Due to mulching weed growth has been reduced amd yield of vegetable is also increased.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Summer Ploughing in Rice (var. *Lalat*)	82	49	38.8	23400	27040	2.15
Green manuaring (*dhaincha*) in Rice (var. *Lalat*)	88	51	35.8	22800	25820	2.13
Repair of bund	6	1	-	-	-	
Organic mulching in vegetables (Tomato, brinjal)	36	18	245.5	85000	125000	2.47
Plastic mulching Okra, cucumber	5	1	350.5	110000	1400000	2.27
Total	**217**	**120**				

Coochbehar

Dhaincha reduced fertilizer application by 145 kg/ha. During the year 2016-17, 39 farmers cultivated dhaincha before aman rice as green manure. Demonstrations were carried out during 2011-12 and 2012-13 only. 22 farmers adopted brown manuring technology in aman rice. *Azolla* has multipurpose use. *Azolla* reduced fertilizer application by 39 kg/ha.42 farmers have used *azolla* in rice covering 2.6 ha area. 19.19 % increase in grain yield. Saving of 20 lit. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of wheat. Saving of Rs. 7500 per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation. 14.28 % increase in grain yield. Saving of 20 lit. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of rice. Saving of Rs. 7500 per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation. Utilize the harvested rain water to increase the water holding capacity of the field as well as recharge the ground water. Saving of 11.76 ha-cm irrigation water (29.55 %).Reduction in cost of irrigation by Rs. 3,420.00. 30.21% increase in WUE. Less weed population. Fuel savings 57 lit. diesel/ha. Saving of 11.76 ha-cm irrigation water (29.55 %).Reduction in cost of irrigation by Rs. 3,420.00. 30.21% increase in WUE. Less weed population. Fuel savings 57 lit. diesel/ha. Saving of 8.90 ha-cm irrigation water (26.40 %). Reduction in cost of irrigation by Rs. 4,438. Increase in WUE by 341 kg/ha-cm (40.35 % increase).Fuel savings 34. diesel/ha. Saving of 8.90 ha-cm irrigation water (26.40 %). Reduction in cost of irrigation by Rs. 4,438. Increase in WUE by 341 kg/ha-cm (40.35 % increase). Fuel savings 34 L diesel/ha.



Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Green manuring (*dhaincha*) in Rice	48	7.6	43.1	26450	29580	2.11
Brown manuring in *Rice*	28	3.6	42.1	26450	28280	2.06
Azolla in *Rice*	42	6.8	41.2	26450	27110	2.02
Zero Tillage in wheat	313	53.55	29.5	26250	23900	1.91
Zero Tillage in Maize	45	7.79	66.5	32380	39120	2.05
Repair of bund	40	10.8	41.2	26450	27110	2.02
Organic mulching in vegetables (Tomato, brinjal)	64	2.25	260	120000	260000	2.17
Plastic mulching Okra, cucumber	29	5.22	310	114000	134000	2.17
Total	**609**	**97.61**				

Malda

Zero Tillage Wheat 36.20% yield increase with BC ratio of 1.98 over traditional practice with BC ratio of 1.13 *i.e.* the varietal demonstration in RCT condition is much better than the traditional practice. Due to Mulching of tomato and pointed gourd around 47% yield increase due to better moisture intension capacity through rice straw mulching and less weed immergence.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Zero Tillage in wheat	305	41.16	43	52200	25700	1.98
Organic mulching in vegetables (Tomato, brinjel)	60	1.06	242	82000	128000	2.5
Mulching	80	0.93	225	85000	165000	2.94
Total	**445**	**43.15**				

S 24 Pgs (Nimpith)

Due to poor drainage system, the low lying land of the area gets easily inundated after heavy rainfall. Cultivation of long duration rice again delays the release of lands to be ready for timely vegetable cultivation in *Rabi* season. Raising and strengthening of the land embankment enables the farmers to grow vegetables during rainy season. A peripheral canal is dug out and the earth is added to the existing land embankment to raise it upto 3 feet height and broaden to 5 feet bottom width. On an average 5-10% of the total land thus could be brought under additional cultivation. Vegetables like okra, cowpea and bitter gourd are then cultivated over this strengthened bund (*ail*) during *kharif* season with almost no chance of submergence. During *rabi* season, tomato, french bean, etc., are cultivated on the same land embankment. The problem of salinity is also avoided in *ail* cultivation during *rabi-summer* season. Under traditional practice of deep-water rice cultivation in 1 ha (=10000 m^2) lowland, 20q of rice could be harvested during *kharif* season. And the same piece of land remains fallow in the next *rabi* season. The actual cultivable land is 9880 m^2. Whereas, the rest 120 m^2 area is consumed for construction of traditional bund (*ail*), that remains fallow during both the seasons. In this system of deep-water rice cultivation, from 1 ha of land, an average net profit of only Rs 12,000.00 is generally obtained throughout the year.Under the innovative ail cultivation system in 1 ha land, the total cultivable lowland area utilized for deep-water *Kharif* rice is reduced from 9880 m^2 to 8680 m^2. This results to almost 2.5 q reduction in rice production equivalent to Rs. 2250.00. The remaining 1200 m^2 area (9880 m^2 – 8680 m^2) is utilized for broadening of the traditional *ail* upto 600 m^2 and rest 600 m^2 for peripheral canal. The modified low land now becomes suitable for rice cum fish cultivation during *kharif* season as the fish cannot escape due to raising of the embankment, hence, providing an additional crop. Vegetables are cultivated over the broadened ail, round the year. An average net profit of Rs. 62,547.00 is obtained from vegetable cultivation and rice cum fish culture per year. The *ail* cultivation technology played a great role in reducing the migration rate among the rural people. Even women, who used to work as maid-servants in the city, now are engaged in their own village in these vegetable fields.

In small patches of lands, where excavation of pond is not possible, ridge and furrow system is a suitable alternative to harvest freshwater for irrigation during the dry spell. Ridge and furrow cultivation provides a good scope for sustenance of the marginal farmers by growing vegetables on the ridges throughout the year and fish in the furrows in kharif. Farmers with small land holdings could increase the profit from multipurpose utilization of the land with this system. In monsoon season the furrow is used for fish

cultivation while the ridge is used for vegetable cultivation. In small patches of lands, where excavation of pond is not possible, ridge and furrow system is a suitable alternative to harvest freshwater for irrigation during the dry spell. Ridge and furrow cultivation provides a good scope for sustenance of the marginal farmers by growing vegetables on the ridges throughout the year and fish in the furrows in *kharif*. Previously this land was used only for traditional rice cultivation. Previously these lowlands were only used for traditional rice cultivation in *kharif*. From 1 ha of such land a farmer could earn only Rs.18000.00 from *kharif* rice cultivation. After implementing this technology in small holdings, the low lands were converted into multi-cropping land having half of its entire land as ridge, where round the year vegetable cultivation could be possible. The rest of the land, *i.e.* the furrows, stores enough water during rainy season to make pisciculture a successful intervention apart from irrigating the vegetables. By this intervention income increased manifold in case of small holdings. Small & marginal farmers now have an option to remain engaged in their own field throughout the year, fetching good revenue.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Optimization of horticultural production through land embankment development	52	14.34	223	53000	62547	2.18
Ridge and furrow cultivation	5	1.08	257	105854	120674	2.14
Total	**57**	**15.42**				

Port Blair

Mulching with coconut husk and rice straw on vegetables and plantation crops (Coconut) was introduced for soil moisture conservation, which reduces the total crop water requirement during the dry spells. It reveals that a higher BCR of 3.7 is obtained for vegetable and plantation crops by practicing the mulching technologies.

Mulching with coconut husk and rice straw on vegetables and plantation crops (Coconut) was introduced for soil moisture conservation, which reduces the total crop water requirement during the dry spells. It reveals that a higher BCR of 1.8 is obtained for vegetable and plantation crops by practicing the mulching technologies. Some of the benefits gained through mulching are as follows:

- It can be incorporated as manures later.
- Influences thermal regime of soil by reducing soil temperature.
- Improves soil moisture storage from rainfall.
- Controls evaporation loss.

- Controls evaporation loss during seed germination.
- Effective utilization of initial soil moisture for crop establishment.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Fodder grass on farm bunds	02	0.04		2500	5000	2.6
Mulching (Coconut husk, Rice straw, Banana leaf)	29	5.5		48700	131875	3.7
Aerial Vegetable cultivation in sloppy land (Bitter gourd)	20	5.6		48700	131875	3.7
Total	**51**	**11.14**				

Water harvesting and recycling for supplemental irrigation

Ganjam I

In drought prone area most crops yield decreased due to unavailability of critical irrigation. Also due to delay in monsoon the sowing and transplanting is delayed which increases pest , disease incidence and decreases yield. To cope up with the problem KVK has conducted a group meeting in the village and constructed a check dam with the help of villagers in the old seasonal canal having area- 100m X 20m X 3m which increased irrigation area by 14 ha. Sowing, transplanting could be done in right time. By utilizing check dam water the yield of rice increased by 5-6%., cropping intensity also increased by 12-14 % by sowing onion, sunflower, greengran in check dam area. By farm pond renovation the cropping intensity increased by 3-4 % and also supplied life saving irrigation to crops. By renovation of well farmers could provide irrigation to vegetable crops.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	52	02 ha	Rice yield-37.6	33000	30920	1.94
	15	03 ha	Fish yield-23.4	122600	111400	1.91
Check dam construction & repairing	165	0.2 ha.	Rice yield-36.8	32000	30560	1.95
Renovation of Well for irrigation	06	06 unit	Brinjal yield-216	104000	112000	2.08
Total	**264**	**2.3 ha/6 unit**				

Kalahandi

2 community ponds were renovated around which papaya plants and Moringa plants were planted for fencing. The farmers started fish cultivation in the ponds and that added more money to their income. Some farmers also used that water for irrigation purpose in their vegetable fields as there is water scarcity in the village.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ ha)	Economics of demonstration (Rs/ha)	Net Return	BCR
				Gross Cost		
Renovation of pond for fish production and irrigation	45	2.2	11 fish	250000	600000	2.4
Total	**45**	**2.2**				

Kendrapara

The construction of new check dam, renovation/ desiltationof water harvesting structure and farm pond provide live saving irrigation to the rice crop at critical crop growth stage. Generally in rain-fed conditionthe rice crop affected due to dry spell above 10-15 days, at that time the water bodies created through the NICRA programme play an important role to save the crop. Now the farmers are himself constructed 4nos of water bodies from the government support, in which they also taken up pisciculture as wellas used to provide live saving irrigation to the crops. The water bodies created / renovated under NICRA programme is now provide live saving irrigation to 18 ha. of rice crop.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of old water harvesting structure in rice field	12	2.4	48.0	67200	25200	1.6
Desiltation of defunct water harvesting structures	16	5.00	45.8	64120	22320	1.53
Newly Check dam	12	3.4	45.0	63000	24000	1.61
Renovation of common pond	6	1.4	46.2	64680	23180	1.55
Total	**56**	**122**				

Sonepur

The Renovation of pond for fish production and irrigation, renovation of Well for irrigation, bund making leveling in rice field and natural mulching provide live saving irrigation to rice and others crop at critical crop growth stage. The crops affected due to dry spell above 10-15 days in rain-fed, at that time the water bodies renovated through the project played vital role to save the crops. The farmers themselves renovated 5 nos of water bodies with the government support, in which they also taken up pisciculture as well as used to provide life saving irrigation to the crops in 6.5 ha. Through these intervention 17 ha area were covered and 129 farmers have been benefitted.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	97	6.5	22.5	12400	18600	2.5
Renovation of Well for irrigation	4	4	-	-	-	-
Bund making leveling in rice field	6	1.5	-	-	-	-
Natural mulching	15	4.0	-	-	-	-
Renovation of common pond	7	1	-	-	-	-
Total	**129**	**17**				

Coochbehar

Total area under cultivation during *boro* season has been increased by 25.9 ha and thereby increasing the cropping intensity from 183% to 190%.The yield increase recorded in case of potato may be due to timely irrigation; where as in case of wheat yield increase was due to higher number of irrigation. During short dry spell in *kharif* season, critical irrigation was given in an area of 34.10 ha. Making bunds in the rice field helps in ground water recharge as well as reduces the nutrient out flow from the field. The technology has been widely accepted by farmers. More than 332 farmers of the village are now making bunds of about 2 ft height. Making bunds in the rice field helps in ground water recharge as well as reduces the nutrient out flow from the field. The technology has been widely accepted by farmers. More than 332 farmers of the village are now making bunds of about 2 ft height. Loss of irrigation water has been reduced and more area was covered due to renovation of irrigation channel.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	33	7.05	10	51000	115000	3.96
Renovation of canal	1	2.00	-	-	-	-
Bund making leveling in rice field	40	10.80	41.20	26450	27110	2.02
Renovation of irrigation channel	42	9.60	42.1	26450	28280	2.06
Total	**88**	**20.65**				

Malda

Renovation of pond for fish production and irrigation: before introduction of NICRA Project, these ponds are mainly used for irrigation and jute retting purposes. After introduction of NICRA Project, these areas are also used for fish production and the fish production is increased to 189% in terms of economic return. After renovation of existing canal in NICRA adopted village, crop production is increased due to availability of water during dry season. By natural Mulching: the production is increased due to adding of organic mulch *i.e* Rice straw, leaves. This technology also improves soil health nutrient availability. It is also improve water holding capacity of soil.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	32	0.4/unit	38.9	205000	389000	1.89
Renovation of canal	450	500 mtr	102.5	152500	112850	1.74
Natural mulching	80	0.93	225	85000	165000	2.94
Total	**562**					

Port Blair

Tank cum well system of irrigation is best suitable for the farmers as the tanks are situated in higher slopes and well is located in downhill within the recharge zone of the tank on the valley areas. The harvested seepage water from the tank is stored in the well and subsequently pumped out and irrigated the vegetable crops like brinjal, okra and bitter gourds during the dry spells. Small irrigation tanks are constructed in the recharge zones of the area and seepage water is harvested and used for providing supplemental irrigation to the summer crops. Irrigation is allowed from the tank till March and then the well water is used for irrigation. Total of about 8.0 ha area brought under vegetable cultivation in summer which was only about 1.0 ha before adoption. An average B: C of 3.5 was obtained by adopting the practice of Tank cum well system of irrigation in the project area.

BBFs (Broad bed and furrow system) of size 33 m X 30 m are constructed to bring the unutilized lands to cultivation. The brackish water and fresh water submerged land has brought to cultivation by modifying the land to BBFs. The broad beds of width 5m are utilised for cultivation of vegetables and the furrows of depth 1m are utilised for rearing of fishes like singhi, magur, annabus species and cultivation of deep water rice. Most of the BBFs are constructed in collaboration with the NAIP project of CIARI. Inputs are being supplied through the project include seedlings

(tomato, brinjal, chilli) for the beds and fish fingerlings (grass carp) for the furrows and seeds (maize, black gram, ladies finger, fodder cowpea, agathi) for the bed.

Desilting of 5 nos. of tanks (2 nos. of tanks in Port Mout and 3 nos. of tanks in Badmas pahad) has been carried out during April-May 2014 and another 2 nos. of tanks situated in Badmas pahar during March 2015. Desilting activity increases the volumetric capacities of desilted tanks by 15-20% over the original silted tanks.

Technology demonstrated	No. of farmers	Area (ha)/Unit	Economics of demonstration (Rs/ha)		
			Gross Cost	Net Return	BCR
Tank cum well irrigation system	9	8.933	890300	813080	3.4
Construction of new dug out ponds	6	0.0297	420200	43000	2.34
Renovation of pond for fish production and irrigation	1	0.08	-	-	-
New water harvesting structure in the rice field (Rice cum fish , Three tier system)	6	1.24	-	-	-
Renovation of old water harvesting structure	1	0.08	-	-	-
Creation of new water harvesting structures through convergence from NAIP Project	6	1.24	-	-	-
Desilting of dug out ponds	14	0.966	85440	-	-
Broad Bed Furrow	7	1.254	176060	16300	3.23
Total	**51**	**14.12**			

Conservation Tillage

Sonepur

Due to zero tillage practice there is less disturbance of soil microbes , so it results in higher yield and good quality produce. Fuel consumption is also minimized as there is zero tillage so cost of cultivation is reduced. Due to use of power tiller soil pulverization is more resulting in more yield.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of rice with ZTD machine	15	5	32.4	22800	19320	1.84
Sowing of rice with power tiller	45	65	2280	19200	15316	1.84
Total	**60**	**70**				

Coochbehar

19.19 % increase in grain yield. Saving of 20 lit. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of wheat. Saving of Rs. 7500 per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation. Yield increment 17.50%. Saving in irrigation water 24.91%. Saving of 20 L. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of rice. Saving of Rs. 7500 per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation. Yield increment 17.50%. Saving in irrigation water 24.91%.

Saving of 20 L. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of rice. Saving of Rs. 7500 per ha towards mandays requirement & Rs. 1200 per ha towards fuel consumption during land preparation. The technology has resulted in about 28% increase in grain yield, saving of cost in the tune of Rs. 6500.00 towards lands preparation and irrigation. 14.28 % increase in grain yield. Saving of 20 L. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of rice. Saving of Rs. 7500 per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation.

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	313	53.55	29.5	26250	23900	1.91
Sowing of Rice with ZTD machine	15	2.4	39.2	25330	25630	2.01
Sowing of lentil with ZTD machine	46	7.4	10.10	15250	30200	2.98
Sowing of Maize with ZTD	45	7.79	66.5	32380	39120	2.05
Total	**439**	**71.14**				

Malda

Sowing of wheat with ZTD machine 36.20% yield increase with BC ratio of 1.98 over traditional practice (BC ratio of 1.13) *i.e* the sowing of wheat with ZTD machine is much better than the traditional practice. Sowing of lentil with ZTD machine 40 % yield increase with BC ratio of 4.74% over traditional practice (BC ratio 1.34) which indicate that the ZTD sowing better result.

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	305	41.16	43	52200	25700	1.98
Sowing of lentil with ZTD machine	20	3	13.25	17250	81900	4.74
Total	**325**	**44.16**				

Artificial Ground Water Recharge

Ganjam I

By raising farm bund height to 10 inches the soil and moisture conservation increased. Soil erosion was also decreased during heavy rainfall and nutrient loss of soil was also reduced. Yield of Rice was also increased by 10 %.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for rice(raising of farm bund height to 10 inch)	32	09	38.1	34000	30770	1.90
Total	**32**	**09**				

Kalahandi

Raising farm bund of rice fields height upto 2.5 ft and width of 9 inch the soil and moisture conservation increased significantly. Soil erosion was also decreased during heavy rainfall and nutrient loss of soil was also reduced. Yield of Rice was also increased by 12 %.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Water management through bunding of rice fields (2.5 ft height and width 9 inch width)	22	3.6	28	24500	38250	1.56
Total	**22**	**3.6**				

Kendrapara

Ground water recharge through SRI by sub-soiler demonstrated in 32 farmers field covering an area of 8.4 ha. Conservation of soil and moisture have been significantly increased. And also increase in yield of rice was observed by 10 %.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Ground water recharge through SRI by sub-soiler	32	8.4	78	109200	54800	2.0
Total	**32**	**8.4**				

Sonepur

Farm bund of rice fields was rasied by 2.5 ft in height and width of 9 inch the conservation of soil and moisture increased significantly. Soil erosion was also decreased during heavy rainfall and nutrient loss of soil was also reduced. Yield of Rice was also increased by 12 %.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Water management through bunding of rice fields (2.5 fit height and width 9 inch width)	06	2.5	34.7	15300	26340	2.72
Total	**06**	**2.5**				

Coochbehar

Making bunds in the rice field helps in ground water recharge as well as reduces the nutrient out flow from the field. The technology has been widely accepted by farmers. More than 332 farmers of the village are now making bunds of about 2 ft height.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Water management through bunding of rice fields (2.5 fit height and width 9 inch width)	40	10.8	41.20	26450	27110	2.02
Total	**40**	**10.8**				

Malda

Water saving technology through SRI 41.25% yield increase with BC ratio of 2.29 over traditional practice *i.e* the cultivation of rice through SRI technique is better than the traditional method of transplanting. DSR (var.*MTU-7029*): cultivation of rice through DSR method using drum seeder recorded 39.57 % yield increase with BC ratio of 1.12 over traditional practice *i.e* the cultivation of rice through traditional method of transplanting.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for rice	72	9	42.5	49500	8250	1.2
Ground water recharge through SRI by sub-soiler	115	15.5	61.02	73224	41250	2.29
Total	**187**	**24.5**				

Water saving irrigation method

Kendrapara

Now lift irrigation is very essential to take the second crop in *Rabi* season and also provide live saving irrigation to the crop during the long dry spell. In NICRA and NICRA nearby villages the framers are now adopting this process an also they have formed panipanchyat for smooth management of water among the farmers at the time of need. Now in NICRA villages panipanchyat formed and more than 60 farmers 88 ha. area are under irrigation.

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 rice	28	54.0	46.8	65520	22720	1.53
Mulching in brinjal (Polymulching)	12	2.5	320	88000	104000	2.18
Total	**40**	**56.5**				

Sonepur

Saving of water through bund planting of Arhar and use of sprinkler in green gram . Water holding capacity and quality of produce is increased through use of vermicompost .

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Vermi-compost from biodegradable wastes	25	25 nos.	4.0	1250/ tank	4250/ tank	4.4
Production of pigeon pea (var. *PRG-158*) on farm bund	30	2.0	15.4	29800	47200	2.58
Sprinkler irrigation in green gram (Var. *HUM-16 TARM-1*)	20	10	7.1	14400	21100	2.46
Total	**55**	**37**				

Coochbehar

Out of 96 farmers in whose field demonstrations 39 farmers are applying bio-fertilizer by their own. Use of organic manure was increased in the tune of 141 ton. Improvement in quality of organic manure. Increase in motivation for production and use of vermin-compost among other farmers. Now patlakhawa GP is promoting the technology under MGNREGS scheme. Saving of 10.10 ha-cm irrigation water (30.5 %). Reduction in cost of irrigation by Rs. 2,610 . 30.72 % increase in WUE. Fuel savings 43.50 L diesel/ha. Saving of 10.10 ha-cm irrigation water (30.5 %). Reduction in cost of irrigation by Rs. 2,610 . 30.72 % increase in WUE. Fuel savings 43.50 lit. diesel/ha.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Application of biofertilizer in rice (var. MTU 7029)	96	16.2	44.1	26450	30880	2.17
Vermi-compost from biodegradable wastes	83	24	7.5	2100	4500	2.14
BBF in Brinjal	38	4.2	301	120000	150900	2.25
BBF in cucumber (Var. Malini)	32	3.30	310	114000	134000	2.17
Total	**249**	**47.7**				

Malda

Farmers adopted vermin composting from the bio-degradable wastes and used it in their crop fields, particularly in vegetables. Using vermin compost, it was recorded net return of Rs. 32375 with BC ratio of 2.87, which is more beneficial than the existing method of nutrient application through chemical fertilizer and cow dung.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Vermi-compost from biodegradable wastes	44	8.7	8.62	17250	32375	2.87
Total	**44**	**8.7**				

Other Demonstration

Ganjam I

Soil test based fertilizer application decreased cost of purchase, improved soil health, increased Rice yield by 07 %. The acidity of soil decreased and pH increased due to less application of Nitrogenous fertilizer.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Soil test based nutrient application	126	42	38.8	34000	31960	1.94
Cleaning and-renovation of old farm pond	52	02	Rice-yield-37.6	33000	30920	1.94
Renovation of old water harvesting structure (Well)	06	06 unit	Brinjal yield-216	104000	112000	2.08
Total	**186**	**44/06 unit**				

Kalahandi

2 old community ponds were cleaned and renovated. Farmers were benefitted from it by releasing fingerlings into the pond. The water was also used for irrigating the vegetable fields. Papaya and Moringa trees planted on the periphery of the ponds for fencing also produced a good harvest.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Cleaning and renovation of old farm pond	45	2.2	11 fish	250000	600000	2.4
Total	**45**	**2.2**				

Kendrapara

Green gram cultivation in residual moisture demonstration conducted successfully in the NICRA villages particularly in the catchment area of water bodies renovated/ created under NICRA programme. Similarly cultivation of bitter gourd in poly grow bag also adopted by more than 42 farmers in NICRA and nearby NICRA villages. Straw mulching in tomato, and high yielding varieties of ground nut and cow pea also cultivating by the farmers.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Demonstration of heat tolerant tomato variety *Chranjivi*	20	22.0	310	-	-	-
Green gram cultivation in residual moisture *IPM 2-14*	73	43.4	6.9	-	-	-
Cultivation of bitter gourd in Grow bag	24	4.5	78	Damaged	-	-
Demonstration on Improved Groundnut var. smruti	25	8.4	24.10	-	-	-
Demonstration on HYV cow pea *KashiKanchan*	22	4.2	140	-	-	-
Tomato under straw mulching	9	1.4	328	-	-	-
Total	**173**	**83.9**				

Sonepur

In-situ vermicomposting in orchards, soil test based nutrient application, cleaning and renovation of old farm pond and renovation of old water harvesting structure (Well) were demonstrated in 93 ha area covering 365 numbers of farmers. In-situ vermicomposting in orchards was the promising demonstration through which net return of Rs. 63750/- was obtained with B:C ratio of 4.4.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
In-situ vermicomposting in orchards	45	45 nos.	60	18750	63750	4.4
Soil test based nutrient application	150	30	-	-	-	-
Cleaning & renovation of old farm pond	160	8	-	-	-	-
Renovation of old water harvesting structure (Well)	10	10	-	-	-	-
Total	**365**	**93**				

Coochbehar

Soil testing of a particular field before application of fertilizers has reduced the application as well as cost of procurement of fertilizers and also reduced the harmful effects of heavy use chemical fertilizers than the required amount. Renovating the old farm pods has increased the water holding capacity of the ponds thus increasing area under irrigation. Total area under cultivation during boro season has been increased by 25.9 ha and thereby increasing the cropping intensity from 183% to 190%.The yield increase recorded in case of potato may be due to timely irrigation; where as in case of wheat yield increase was due to higher number of irrigation. During short dry spell in *kharif* season, critical irrigation was given in an area of 34.10 ha. Encouraged Alley cropping and introducing different N fixing trees and those trees from which bio pesticides can be prepared. Soil testing of a particular field before application of fertilizers has reduced the application as well as cost of procurement of fertilizers and also reduced the harmful effects of heavy use chemical fertilizers than the required amount. Bio pesticides use has led the farmers of the village to be interested and is training themselves for preparing Bio pesticides in their own villages.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Soil test based nutrient application	364	59	-	-	-	-
Cleaning & renovation of old farm pond	33	7.05	-	-	-	-
Planting forest trees for biodiversity, forestation	37	3.6	-	-	-	-
Soil test based nutrient application (FYM/ inorganic fertilizer)	364	59	-	-	--	-
Bio pesticides in tomato	14	2	-	-	-	-
Total	**812**	**130.65**				

S 24 Pgs (Nimpith)

Soil health management: Indiscriminate use of chemical fertilizers is posing added threat to agriculture by affecting the soil fertility adversely and increasing the cost of production. Injudicious use of nitrogenous fertilizers also contributes to the greenhouse gas production. To minimize the use of chemical fertilizers, soil test based fertilizer recommendation approach was taken up. Pusa Soil Test and Fertilizer Recommendation Kit (Model: *WST-001*) and MridaParikshak has been procured. 312 soil samples have been tested and the recommendations were intimated to the respective farmers through soil health.

Community afforestation with mangroves : One of the major interventions taken up was creation of awareness among the community about the benefits of having

mangrove vegetation along the river embankment which could absorb the brunt of cyclonic storms and high tides thereby sparing the village from mass destruction. To replenish the diminishing mangroves in their locality

along the river bank, initially, a group of young people took interest and started a mangrove nursery with seeds of "sundari", *Heritierafoames* distributed from the project fund. Thereafter, more and more villagers came forward andstarted collecting seeds of various mangrove plants like *Rhizophora spp., Bruguiera spp., Ceriops spp., Avicennia spp., Sonneratia spp., Nypafruticans., Xylocarpusspp, Aegiceras sp. Excoecaria sp.*, etc., from the adjacent river and started a community nursery. When the plants grew to a height of 1.5 to 2.0 feet within a period of 3-4 months, they were transplanted, on a community basis, along the river bed. Within a span of almost 2½ years of the project, approximately 20,000 mangrove plants were transplanted which is slowly expanding the green belt along the coastal border of the village. Bongheri village has a coastline of 4.5 km and has two other villages, Kaikhali and Garankati on either side. The mangrove cover has already extended upto a length of nearly 1.5 km within 2½ years and at this rate it should be able to provide the much needed natural barrier to the village within another 5 year.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Soil test based nutrient application	181	73.50	-	-	-	-
Total	**187**	**73.50**				

Malda

43.08% yield increased with BC ratio of 3.99% with effective utilization of soil moisture through seed production of blackgram after flood in NICRA adopted villages.

Cleaning and renovation of old farm pond : After renovation of existing canal in NICRA adopted village, crop production is increased due to availability of water during dry season.

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	1320	200	13.65	16825	50153	3.99
Cleaning & renovation of old farm pond	32	0.4/ unit	38.9	205000	389000	1.89
Total	**1352**	**200 ha/ 0.4 unit**				

Port Blair

Rice transplanter has been successfully demonstrated and operated in 0.03 ha of land where 15 days old seedlings rice (*Swarna*) is transplanted by the machine. Farm women are more involved in the operation and maintenance training was subsequently

imparted. The results showed that the total time taken for transplanting by transplanter was reduced by 95 percent but the nos. of missing plants by mechanical transplanting is increased from 0 to 6 when compared with manual transplanting methods. The yield with the BCR 1.3 was at par with the yield data of the line sowing plots.

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Small irrigation tanks in the recharge zone	02	0.2	-	10000	29500	3.9
Farm mechananization in rice transplanting	1	0.03	-	29170	8850	1.3
Renovation of old water harvesting structure (farm pond)	1	0.08	-	-	-	-
Cost effective poly house 2014-2015 2015-2016	04 04	0.02 0.02	-	98060 98060	-	-
Total	**12**	**0.35**	**-**	**-**	**-**	**-**

Rain Water Harvesting Structures Developed

Ganjam I

In drought prone area most crops yield decreased due to unavailability of critical irrigation. Also due to delay in monsoon the sowing and transplanting is delayed

which increases pest, disease incidence and decreases yield. To cope up with the problem KVK has conducted a group meeting in the village and constructed a check dam with the help of villagers in the old seasonal canal having area-100m X 20m X 3m which increased irrigation area by 14 ha. and sowing,transplanting could be done in right time. By utilizing check dam water the yield of rice increased by 5-6%., cropping intensity also increased by 12-14 % by sowing onion, sunflower, greengram in check dam area. By farm pond renovation the cropping intensity increased by 3-4 % and also sup[plied life saving irrigation to crops. By renovation of well farmers could provide irrigation to vegetable crops.

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Farm pond	03	40000m^3	52	24	7
Checkdam	01	6000m^3	165	54	18
Well	06	06 units	06	02	1
Total	**10**	**46000m^3/06 units**			

Jharsuguda

Desilting of water harvesting structure was done by Pani Panchayat of the village sponsored by watershed department on request of KVK, Jharsuguda. Around 55 farmers are benefited who are taking more crop in *rabi* and summer season . Due to this the storage capacity of WHS has increased from which the cropping season can also be increased.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Desilting pond	4	28800	55	36 ha	135
Total	**4**	**28800**			

Kalahandi

The adopted village has scarcity of water as a result the farmers cannot grow cereals and other vegetables commercially. Therefore, 19 deep open wells were dug and 2 community farm ponds were renovated for harvesting the rain water and using ground water. It helped the villagers in a very positive way as they are able to grow vegetables commercially round the year utilising water from the wells.

RWH structures	No.	Storage capacity (gallon)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Well	19	180	37	2.5	25
Pond	2	2000	45	5.5	35
Pond Renovation	2	2000	45	5.5	35
Total	**23**	**4180**			

Kendrapara

The construction and renovation of water bodies provide live saving irrigation to the crops and increase the cropping intensity as well as yield of crop. The jute retting ditches developed under the NICRA programme, now adopted by more than 18 farmer of nearby villages of NICRA adopted villages. Borabandhan under NICRA programme is a new concept to farmers for repair of embankment of water harvesting structure, pond and check dams during heavy rain. This technology is low cost technology and does not require more skill and prepared in very short period of time. This method is now adopted by most of the farmers to repair their waterbodies embankment and increase the water holding capacity of water bodies. Some farmers are also increase their water bodies pondage area by utilized the borabandhan technology and doing pisciculture activities in the seasonal ponds. Now more than 24 farmers of NICRA and nearby village farmers are adopting this process at the time of need.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Desiltation of defunct water harvesting structures	1	14400	16	4.0	170
Newly Check dam for water harvesting	2	16575	12	4.8	175
Renovation of Pond	1	850	6	2.0	170
Bora bandh (Temporary check dam)	2	1020	12	3.0	168
Defunct pond	1	750	6	1.2	166
Jalkund	1	550	5	0.8	160
Small ditches for jute retting	5	380	4	0.6	180
Renovated defunct water bodies	2	1880	28	5.8	185
Total	**15**	**36405**			

Sonepur

Repair and renovation of water harvesting structure scope has been increased for farming and pisciculture. People are being engaged in year round farming activities.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Farm pond	3	6000	105	2.5	12
Checkdam	2	-	34	3.0	8.5
Well	3	60	18	4.5	10.5
Pond	2	45000	99	25	11
Desiliting drainage channel	1	-	4	15	5.0
Repaired well	10	199	16	3.5	11
Landshaping and rain water harvesting structure	73	225	22	2.0	9.0
Renovated defunct water bodies	4	9000	10	5.0	12.5
Pond Renovation	3	30000	42	3.0	10.5
Total	**101**	**90484**			

Coochbehar

Renovating the old farm pods has increased the water holding capacity of the ponds thus increasing area under irrigation. Total area under cultivation during boro season has been increased by 25.9 ha and thereby increasing the cropping intensity from 183% to 190%. The yield increase recorded in case of potato may be due to timely irrigation; where as in case of wheat yield increase was due to higher number of irrigation. During short dry spell in *kharif* season, critical irrigation was given in an area of 34.10 ha.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Pond	33	139190	33	400	50
Total	**33**	**139190**			

Malda

Before introduction of NICRA Project, these ponds are mainly used for irrigation and jute retting purposes. After introduction of NICRA Project, these areas are also used for fish production and the fish production is increased to 189% in terms of economic return.Early sowing of *rabi* crops particularly pulses. Increased income by growing 2nd crop from RS. 73250/- to Rs. 112850/- . Increased cropping intensity from 145% to 200% created 260 additional mandays.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Pond	05	2800	450	15 ha	189
Canal	01	50000	850	150 ha	200
Pond Renovation	0.4	1.3 ha	450	15 ha	189
Total	**6.4**	**52800 cum/ 1.3 ha**			

S 24 Pgs (Nimpith)

Land shaping and rainwater harvesting

Most of the cultivable area of the project village is low lying and flood prone. During *Kharif* season,these low lands are only suitable for indigenous flood tolerant rice

varieties that are also long duration and low yielding. The occasional and uncontrolled flooding also reduces the scope of fishery. During post-*kharif*, scarcity of irrigation water, forces the farmers to leave the lands remain fallow. Due to declining trend in total precipitation and its erratic

nature, there is always a scarcity of quality irrigation water during and after the *kharif* season.

This intervention was taken up for provision of freshwater for multiple cropping including vegetable cultivation in *rabi* season and pisciculture round the year.

Land shaping is an effective agro-technology which helps to harvest rainwater and utilization of that water for cultivation of vegetable crops in the same field after *kharif* rice.

In this technology, 1/5th portion of the flat low land is dug up to make a pond upto 8-9 feet depth. The excavated earth is utilized for raising the rest of the low land upto a 1.5 feet height. The land embankment around the entire land is strengthened to 3 feet height and 5 feet wide. With the rest of the soil, a 5-feet wide and 4-feet high pond embankment is created.

Here the low yielding traditional deep water rice varieties in the kharif season are replaced by short duration HYV rice and vegetables are introduced in the same land in *rabi* season. Both the widened pond embankment and the land embankment are used for vegetable cultivation throughout the year. At the same time, pisciculture with duck rearing is taken up in the pond.

Traditionally, only local, long duration variety of rice used to be grown in the low-lying land during kharif season. Second crop was not possible during rabi-summer season due to the late release of land as well as for scarcity of irrigation water.

A farmer could earn a meager sum of Rs. 6500.00 from a 0.266 ha of land. After intervention with land shaping, traditional variety of rice is now replaced by HYV rice during *kharif* season. The crop is harvested earlier.

In *rabi-summer* season, with the help of rain water so harvested in the dugout pond, the raised land is used for vegetable and oil seed cultivation. Pond and land embankment, are also used for year round vegetable cultivation.

At the same time, pisciculture with duck rearing in the pond is also practiced. Average net income from a 0.266 ha land is now about Rs. 37035.00.

It was observed that previously at least 1 female member per family use to migrate to nearby towns. These womenfolk could now get engaged in their own farm in various agricultural activities, besides leisure hour.

Renovation of defunct water bodies

Most of the ponds in the project area were found to be in derelict and defunct condition. With their reduced storage capacity, broken bunds and defunct inlet and outlet, they offered little assurance for irrigation to grow vegetables and pursue fish culture profitably. Such ponds could hardly support fishery as they could not hold enough water for more than 7-8 months.

These derelict ponds were re-excavated and renovated upto a depth of 3ft. more over the existing average depth of 5ft. Proper embankment, inlets and outlets were also made. A portion of the silt was used to spread over the adjoining low lying agricultural field.

As a result of desiltation, water storage capacity of the ponds increased and the fresh rainwater harvested in these ponds ensured irrigation to the vegetables during *rabi* season. Option of fishery became more profitable as water storage increased to almost 11 months.

The defunct water bodies which could not promise much to the farmers, ensured sufficient rainwater harvesting following their renovation, giving the farmers multiple options of fish culture as well as vegetable cultivation.

Previous data reveals that before renovation, the average production of fish from a 0.13 ha. pond was a paltry 0.5qt whereas after renovation fish production increased to an average 2.8 qt. The pond embankment could also be used for growing vegetables like brinjal, okra, tomato, chilli, bitter gourd, bottle gourd *etc*. providing an average production of 5.5 qt.

Rejuvenation of canal

A canal passing through the project village was severely inundated with brackish water during the super cyclone "*Aila*" in 2009 and silted up. The 4 km long canal was de-silted and renovated by the villagers.

During rainy season, approximately 3600 acre-inch of rain water was harvested and effectively used for irrigation. 500 farm families were benefited through additional coverage of 100 acre under sunflower, 50 acre under chilli and 50 acre under other vegetables.

Around 9000 person-days worth earthwork and 6000 person-days worth farm-labour work was generated through this intervention. This in turn helped to check migration of 15000 person-days of labour, outside the project area.

Thus, localized employment generation in off season helped to save consumption of non-renewable energy through transportation. Considering a 40 min walking (104 Kcal), 40 min cycling (240 Kcal) and 4 hr train/bus traveling per day (1392 Kcal), a total of 1736 Kcal of energy is lost per person, in case of daily migration. (Source: "Dietary Guidance for Indians", a manual by NIN, ICMR, 2011). Through this activity of canal renovation, a total of 2.6 crore Kcal of physical energy could be saved directly and indirectly. The same non-productive energy was effectively utilized locally for employment generation and crop production.

RWH structures	No.	Storage capacity (cum)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Landshaping and rain water harvesting structure	27	34894	27	6.33	220
Renovation of defunct water bodies	35	107778	35	4.66	167
Rejuvenation of 4 Km long canal	1	365760	100	50	135
Total	**63**	**508432**			

Module II: Crop Production

Climate resilient crop cultivars

Drought tolerant varieties

Ganjam I

The Village Chopara is drought prone and experiences moisture stress at maturity stage of Rice which decreases yield. By growing Drought tolerant rice var. *Sahbhagi dhan* (105 days) in upland the yield increased by 20 %. It also could withstand moisture stress for 15 days. Due to short duration it is harvested before dry spell which occurred in Last week of September.

Pigeonpea are grown in upland and var. are mostly > 180 days, so there is moisture stress in flowering period which decreases yield. By growing medium duration Pigeon pea var. *PRG-176* (150 days) it was earlier, could moisture stress for 20 days and yield also increased by 30 %.

By growing short duration high yielding var. of Blackgram *PU-31* (65 days) the yield increased by 27 % and there is no YMV incidence.

Groundnut var. *Devi* is a high yielding var. and it can tolerate moisture stress for 10 days. It requires less 02 nos. of irrigation as compared to local var. By growing *Devi* in *rabi* season the yield increased by 21 %.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice (*Sahbhagi dhan*)	145	58	22.3	18.6	20	22000	15910	1.72
Pigeon pea (*PRG-176*)	43	17	10.8	8.3	30	35000	40600	2.16
Short duration Rice (*Naveen*)	40	15	36.2	32.6	9.8	29000	32540	2.12
Short duration Blackgram (*PU-31*)	130	45	5.6	4.4	27.2	15600	12400	1.79
Drought tolerant Groundnut (*Devi*)	24	06	21.40	17.60	21.5	42700	42900	2.0
Total	**382**	**141**						

Jharsuguda

Keeping the rain water availabilities in the center, short duration drought tolerant crop varieties like Rice greengram were demonstrated in 48 ha area involving 185 farmers in NICRA village. The extent of area under respective crop varieties ranges from 20-55%. Previously the upland was not utilized by the farmers due to non-availability of suitable variety for moisture stress area. After introduction of such moisture stress tolerant rice variety *Sahabhagi Dhan*, maximum farmers are now utilized their upland followed by maize cultivation in some area. Also the short duration crop greengram var. *TARM-1*, *OBGG-52* was cultivated in Rabi after rice was harvested in upland medium land which require less water for production.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice (*Sahbhagi Dhan*)	143	34	32.0	25.0	28.00	18300	20100	2.09
Greengram var. *TARM-1*	32	10	7.5	6.7	11.94	25520	15455	1.60
Greengram var. *OBGG-52*	10	4	7.6	5.5	38.10	14510	23490	2.60
Total	**185**	**48**						

Kalahandi

As the adopted village has water stress condition, so the farmers need to grow drought tolerant rice varieties to overcome this condition. *Sahbhagi* is one of those varieties and the farmers adopted this variety which gave good yield as compared to other rice varieties.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice (*Sahbhagi*)	29	4.3	28	21	33.3	22400	36000	1.6
Total	**29**	**4.3**						

Kendrapara

The rice variety *sahabhagidhan* is a short duration drought tolerant variety and stands even in long dry spell 15-20 days successfully , now more than 32 farmers are growing *sahabhagidhan* successfully in 38 ha. of land. Similarly in drought condition Yam and EFY is grow with high profit. Under NICRA programme we have demonstrated Yam (*Orissa elite*, *Shreenidhi*) and EFY (*Gajendra*) as crop diversification and also high returns even in drought condition. Now farmers are taking interest and more than 32 farmers are cultivating these tuber crops in 4 ha area.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Yam cultivation	10	4.6	184	146	26	214000	154000	1.71
EFY cultivation	10	2.8	410	368	11.41	402000	213000	1.53
Rice (*Sahabhagidhan*)	20	5.0	26	34	30	30400	17200	1.56
Total	**40**	**12.4**						

Coochbehar

32% increase in yield over traditional variety *MTU-7029*. Average net return increase in the tune of Rs. 12490 per ha. Out total cultivated area of the village nearly 30-35% falls under low to low-medium category of which nearly 50% area under aman rice cultivated area is covered by the variety. The var. *DKC 9081* has a yield increment of 10.09 % over other varieties used by farmers. Interestingly area under maize cultivation is progressively increasing since inception of NICRA activities. At present more than 60 % of maize cultivated area has been under the var. in the village. Inspite of promising result the variety could not be popularized due to unavailability of seed.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Tolerant Varieties to submergence (*SS-1*)	168	26.25	42.40	32.10	32.08	26450	28670	2.08
Maize (var. *DKC 9081)*	45	7.79	66.5	60.40	10.09	32380	39120	2.05
Wheat (*DBW-39*)	29	4.8	30.6					
Total	**242**	**38.84**						

Port Blair

Short duration rice varieties of *MLT 10* were introduced in late onset of monsoon season to take advantage of the existing water resources available during the season and early cultivation of vegetable crops during *Rabi* season. *MLT 10* gave grain yield of 3.6 t/ ha as compared to local check.

Drought tolerant *Sahbhagi dhan* is more suitable for upland condition as well as second crop in Andaman & Nicobar Islands which provides new hope to the farmers in drought prone areas. The higher productive tillers of 278/ m^2 obtained with *sahbhagi dhan* were significantly superior to that of control (232 productive tillers/m^2). Panicle length (22.5 cm), numbers of grains/ panicle (192) were registered higher in drought tolerant rice. Higher grain (4570 kg/ha) was recorded with *sahbhagi dhan* followed by farmers variety which led to 18.7 % higher yield than other cultivar. Higher gross return (Rs. 45700/ ha) and net return (Rs. 20950/ha) with B: C ratio of 1.85. Performance of *sahbhagi dhan* is more acceptability by the farmers.

Sahbhagi dhan was recorded the maximum number of 363 productive tillers/ m^2 obtained with *sahbhagi dhan* was significantly superior to that of control (254 productive tillers/m^2). Panicle length (24.9 cm), numbers of grains/ panicle (225) were registered higher in drought tolerant rice. Higher grain (5428 kg/ha) was recorded with *sahbhagi dhan* followed by farmers variety which led to 30.8 % higher yield than other cultivar. Higher gross return (Rs. 54280/ ha) and net return (Rs. 27430/ ha) with B: C ratio of 2.02.

Drought tolerant *Naveen* dhan was demonstrated in drought prone area in one farmer field in an area of 0.1 ha during the rainy season, 2014. The results revealed that significantly higher number of 284 productive tillers/ m^2 produced by *Naveen* compared to local check. *Naveen* recorded more grain yield of 3280 kg/ha which was 27.6 % higher yield as compared to local check. Even though, *Naveen* dhan faced moisture stress (48.6% deficit rainfall) during early stage of crop growth. 46.7 % higher rainfall was received as compared to Normal rainfall during October, 2014. *Naveen dhan* gave highest net return and B:C ratio (Rs. 11300/- and 1.55) while *Swarna* was least profitable (Rs.4200/- and 1.20).

KVK demonstrated yellow mosaic virus resistant blackgram variety (*VNB (Bg) - 6*) in five farmers field in an area of 0.4 ha per farmer. Blackgram seed hardening with 100 ppm $ZnSO_4$ increased germination percentage of 29.5 % as compared to untreated seeds in per sqm which also induces better root development which enables absorption of more moisture. Seed hardening develop a more extensive system, thus enabling them to survive better under drought conditions.

Technology demonstrated		No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
				Demo	Local	Gross Cost	Net Return	BCR	
Bacterial wilt and drought resistant brinjal.		21	4.3	46.2	22.3	103.9	232500	512500	3.3
Drought resistant Dhania		04	0.2	0.5	0.2	150	12500	22500	2.8
Drought resistant Pineapple (*Kew*)		05	1.5	20	16	25	-	-	-
Short duration rice varieties (*MLT-10*)		02	0.8	3.64	2.98	22	15500	20900	2.3
Short duration pulses (T-9)		03	1.0	0.7	0.4	75	16000	12000	1.8
Drought tolerant rice (var. *Sahbhagi*)		15	6.1	203.88	158	127	104040	85690	1.95
Rice cum daincha(*CSR-36, Daincha, 2,4- DEE*)		2	0.8	4950	4380	13.0	20125	29375	2.46
Leafy vegetables Amaranthus	CARI AMA-Green	02	0.10	7.2	5.6	22	18000	39312	2.80
	CARI-AMA-Red	02	0.10	7	5.5	21	18000	38220	2.72
	CARI Poi Selection	04	0.16	5.4	4.7	32	19000	29600	2.56
Drought tolerant rice varieties (var. *Naveen*)		04	1.70	98.4	78.2	77.90	70450	34170	1.50
Total		**74**	**20.6**						

Flood tolerant varieties

S 24 Pgs (Nimpith)

This intervention was taken to help in maintaining production in case of water logging following heavy rain. In spite of 12-14 days water logging condition, following heavy rainfall during the month of July-August, the crop still remained in field. The average productivity of this variety was found to be 65% more than traditional ones under similar stressful condition.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Temporary submergence tolerant rice variety **Swarna Sub-1** Medium land (1'-1.5' water stagnation) Check var. Dudheswar	37	9.9	41.8	25.2	65.87	41250	22650	1.55
Total	**37**	**9.9**						

Malda

Introduction of Flood tolerant Variety of Rice *Swanra Sub-1* at flood prone areas of NICRA village Malda covers around 4.7% of the total area of the state and is home to 4.1% of the total state population. Agriculture is the main source of income of the people of the district which is the distributing center for rice and other cereals. Rice is grown in all the three physiographic regions *viz.* Tal, Diara and Barind. As on 2012-13, the total rice production consisted of 6, 32, 807.6 MT which is far more that other staple food grains and vegetables. One of the major challenges is ensuring food security of the population. The production and productivity of major crops (mainly rice) has to be increased so as to meet the increased demand. But due to flood situation during *kharif* season, most of the farmers of NICRA village did not cultivate rice during this period due to damage of rice crop because of water stagnation for more than a week. Keeping this problem in mind, this Flood tolerant Variety of Rice *Swanra Sub-1* was introduced in these flood prone areas of NICRA village so as to meet up the demand of these areas as well as the district regarding this particular staple food.This Variety was introduced in Diara region of Old Alluvial zone (Malda), West Bengal. This is a Variety of 140-145 days and cultivated in 10 ha area of these particular areas. It was sown on 1st week of July, 2017 and it can withstand up to 10-15 days of water stagnation during 2nd week of August-mid of August, 2017 in these flood affected areas. It was harvested during mid of November, 2017. The production of this Variety during this flood situation was 5-5.6 ton/ha. This technology was initially adopted by 20 farmers in Deherutola and Brojolaltola villages of NICRA village and now it has good impact among the farming community of other villages viz. Jayramtola, Mahanandatola etc.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Swarna Sub - 1	121	27	41.60	30.50	136	41250	14670	1.32

Coochbehar

Thirty two increase in yield over traditional Variety *MTU-7029*. Average net return increase in the tune of Rs. 12490 per ha. Out total cultivated area of the village nearly 30-35% falls under low to low-medium category of which nearly 50% area under aman rice cultivated area is covered by the Variety. The var. *DKC 9081* has a yield increment of 10.09 % over other varieties used by farmers. Interestingly area under maize cultivation is progressively increasing since inception of NICRA activities. At present more than 60 % of maize cultivated area has been under the var. in the village. Inspite of promising result the Variety could not be popularized due to unavailability of seed.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Tolerant Varieties to submergence (*SS-1*)	168	26.25	42.40	32.10	32.08	26450	28670	2.08
Maize (*DKC 9081)*	45	7.79	66.50	60.40	10.09	32380	39120	2.05
Wheat (*DBW-39*)	29	4.80	30.60					
Total	**242**	**38.84**						

Ganjam I

During heavy rainfall of greater than 60 mm/days, cyclone there was problem of water logging in medium & low land which decresed rice yield and mortality of plants. During Cyclone Phailin and Hudhud the rice crop was affected due to water logging. Moreover heavy rainfall during October month is a regular phenomenon. To cope up with the situation Flood tolerant rice var. *Swarna sub-1* was demonstrated in medium and low land situation which could with stand waterlogging for 8-10 days. The yield of *Swarna sub-1* was 7 % more as compared to *Pratikshya*.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice variety (*Swarna Sub-1*)	70	25	42.6	39.8	7	33500	43080	2.16
Total	**70**	**25**						

Kendrapara

The climate vulnerability of NICRA village is flood and cyclone. It was observed that in every alternative year there is flood and the flood water retain in the crop field upto 10-12 days , sometimes more than that which is sufficient to damage the ruling Variety rice crop *Pooja*, *Swarna*, *Sarala etc.* In this situation under NICRA programme we have demonstrated *Swarna –sub-1* rice Variety which is tolerant to submerge condition upto 15 to 17 days with yield potential 50-55 qt./ha. In the year 2016-17, the farmers transplanted *Swarna sub-1* and it is survive in the submerge condition upto 13 days with good yield. After that we are also demonstrated the *Swarna Sub -1* Variety in NICRA village Dsamankul in 2017-18. Now the *Swarna sub 1* Variety is cultivated in more than 155 hectares of land of NICRA and other villages. Now Government also started the demonstration of *Swarna sub 1* Variety. The farmers are generally not taken any crop after flood, under the NICRA programme demonstrations on post flood potato,mustard, Green gram and horse gram cultivation were taken up in the flood year successfully with BC ratio 2.39,2.1, 2.15 and 2.4 respectively. 44 farmers of NICRA and nearby villages are cultivating pulses, oil seed and potato in post flood situation in 15 ha. area.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice variety (*Swarna Sub-1*)	112	68	44.5	-	100	40000	31200	1.78
Potato cultivation *Kufrisinduri*	62	25.4	182	152	70	76000	106000	2.39
Mustard cultivation (*Anuradha*)	42	22.2	9.2	7.5	22.60	22000	24000	2.1
Green gram cultivation (*IPM 2-14*)	73	43.4	6.9	5.7	21	16000	18500	2.15
Horse gram cultivation (*Urmi*)	58	34.6	9.6	7.8	23	12000	16800	2.4
Total	**347**	**193.6**						

Salt tolerant varieties

S 24 Pgs (Nimpith)

Salt tolerant varieties, *SR 26 B*, *Jarava* and*Amalmona*were supplied to rice farmers of the project area. The average productivity in low land situation increased by 17 % to 27% whereas in medium land situation it increased by 69%. The net return under medium land situation could be doubled by introduction of Jarava Variety. The impact of the salt tolerant varieties were prominent during the mid-season dry spells. In such situation the traditional varieties started drying up from the tip and resulted in poor yield.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rice var.***SR 26 B*** Low land (2'-2.5' water stagnation) Check var. Morishal	10	1.55	36.25	28.5	27.19	37500	17700	1.47
Rice var.***Amalmona*** Low land (2'-2.5' water stagnation) Check var. Morishal	15	4	32.5	27.6	17.75	36000	13400	1.37
Rice var.***Jarava*** Medium land (1'-1.5' water stagnation) Check var. Dudheswar	15	5.33	44.8	26.4	69.70	41250	25550	1.62
Total	**40**	**10.88**						

Kendrapara

Out of nine block of Kendrapara district seven blocks are under saline condition. The cultivation of ruling Variety rice is not possible and the saline tolerant rice varieties are preferred by the framers. The varieties like *Lunishree* and *Lunibahirial* are resulted resistance to saline condition with average yield 43 q and net income Rs.20,000/- per ha. Now most the farmers are cultivating these two varieties rice in saline condition.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Lunishree	8	2.4	43.0	32.0	34	60200	19700	1.48
Lunibarhiral	12	3.2	42.4	34.0	24.70	59360	20860	1.54
Total	**20**	**5.6**						

Port Blair

Salt tolerant Variety was demonstrated in sea water inundation of tsunami affected land in adopted villages. CARI Dhan-5 recorded yield of 3770 kg/ ha which was 25.6 % higher yield as compared to local check (Jaya).

Salt tolerant Variety of *CSR-36* rice was demonstrated in sea water inundated tsunami affected land during 2013. The results revealed that significantly higher number of 324 productive tillers/m^2 produced by *CSR-36* compared to local check besides it recorded significantly higher panicle length (22.7 cm) and more no of filled grains/ panicle (129). CSR-36 recorded more grain yield of 4620 kg/ha which was 11.3 % higher yield as compared to local check (Bhavani). CSR-36 gave highest net return and B:C ratio (Rs. 24015/- and 1.94) while bhavani was least profitable (Rs.15850/- and 1.62).

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	08	2.5	37.7	30	25.6	20250	14850	1.80
CSR-36	02	0.8	46.20	41.50	11.3	25650	24015	1.94
Total	**10**	**3.3**						




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

Ganjam I

Due to growing of local Greengram Variety and high incidence of YMV the yield decreased. By growing YMV tolerant var. *IPM 02-03* (65-70 days) the yield increased by 29 % & there was no incidence of YMV incidence. Due to high temp im march month the YMV incidence increased in local var. , however the var. *IPM 02-03* could perform well in late sowing also.

By transplanting Naveen 10 days advance in medium land the moisture availability for Greengram increased. The yield of rice and HYV greengram var. *IPM 02-03* also increased by 10 and 6.6 % respectively.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
YMV tolerant Greengram (*TARM-1*)	140	45	6.2	4.8	29.2	14200	10600	1.75
Rice (*Naveen*) followed by Greengram	25	10	Rice-35.2 Greengram-6.4	Rice-32 Greengram-6.0	10 & 6.6	43000	42440	1.99
Total	**165**	**55**						

Coochbehar

18.20% increase in yield over traditional Variety *MTU-7029*. Average net income increased in the tune of Rs. 8710/- per ha. 20-25 days advancement in sowing of *rabi* crops. The Variety has been well accepted by the farmers and 30% replacement has been noted. Inspite of promising result the Variety could not be popularized due to unavailability of seed.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Short duration rice (*GB-1*)	198	31.5	43.5	36.8	18.21	26450	30100	2.13
Wheat (*DBW-39*)	29	4.8	29.5	24.8	18.95	26250	23900	1.91
Total	**227**	**36.3**						

Malda

Wheat: 36.20% yield increase with BC ratio of 1.98 over traditional practice with BC ratio of 1.13 i.e the varietal demonstration with advancement of sowing date is much better than normal sowing dates. Advancement of sowing date of lentil (Maitri): 40 % yield increase with BC ratio of 4.74% over traditional practice (BC ratio 1.34) by flowing integrated crop management practice.

Mustard (*NC-1*) : 39.45% yield increased with BC ratio 1.96 over traditional practice by replacing old Variety. Mustard (B 54) : 47.8% yield increased with BC ratio 2.07 over traditional practice by replacing old Variety.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Wheat (*DBW39*)	150	20.00	38.4	28.5	34.73	21375	34305	2.61
Lentil (var. W*BL77*)	30	4.00	15.75	11.25	40.0	17250	81900	4.74
Mustard (var. *NC-1*)	24	11.23	10.32	7.40	39.45	16875	16174	1.96
Mustard (var. *B54*)	30	04.00	10.05	10.10	47.8	16875	15750	2.07
Total	**234**	**39.23**						

Port Blair

CoH (M)-5 registered the highest grain yield of 41.5 q/ha which was 29.6 per cent higher grain yield over local check.

Hybrid maize recorded higher net return of Rs.50375 with the B: C ratio of 3.86.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Traditional (Bhendi, Bitter gourd)and Non-traditionl vegetable (French bean)	16	1.9	22.9	7.9	90.96	206800	536700	3.36
Bacterial wilt resistant tomato (Var. *Ayush*)	3	0.5	17.5	10.5	76.0	95000	1657510	2.76
Bacterial wilt resistant Brinjal (*CIARI- Brinjal 1*) 2015-2016	3	0.5	17.5	10.5	76.0	95000	167510	2.76
Maize (var. *CoH (M)-6*)	3	1.0	41.5	32.8	29.6	62250	21800	2.86
Total	**25**	**3.9**						

factors. However upon introduction of rice transplanter machine and following the principal of water management as followed in case of SRI same potentiality has been observed and now it is gradually becoming popular.

Water saving rice cultivation

Coochbehar

Though the technology has shown high potentially in *rabi rice* still it has not been accepted by farmers due to some

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	47	8.2	74.25	58.30	27.36	30140	66385	3.20
Total	**47**	**8.2**						

Ganjam I

Direct Seeded Rice was demonstrated with *Sahabhagidhan* in 30 ha area covering 80 farmers field showed higher yield (21.2 q/ha) as compared to local (18.4 q/ha) with an increase of 15.2 % and net return of Rs. 16380/- and B:C ratio 1.82.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
DSR- *Sahabhagidhan*	80	30	21.2	18.4	15.2	20000	16380	1.82
Total	**80**	**30**						

Jharsuguda

Due to late onset of monsoon the duration of rice should be less, basing on this the SRI method in rice was done for less water requirement and more spacing given for better growth of plant which ultimately helps for better weeding operation. The technique of SRI was well accepted by farmers as because it gives higher yield than the normal transplanting with minimum requirement of water.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
SRI (Rice var. *Pratikshya*)	5	02	53	44	20.45	22000	41600	2.8
Total	**5**	**02**						

Kalahandi

As there was always water scarcity for growing cereals in the village so SRI method of sowing rice was practiced which saved about 50% of water required for sowing rice in normal method. A number of farmers adopted the technology and were benefitted.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	35	5.8	32	21	52.38	25500	42300	1.65
Total	**35**	**5.8**						

Kendrapara

The SRI method of rice cultivation is mostly suitable for medium land with well drainage and irrigation facilities. The high yielding medium duration rice varieties (120-140 days) is suitable for SRI method of rice cultivation in medium land. The farmers are developed roller markers/manual rope liner for transplanting the rice seedling in appropriate distance in the main field. Due to the higher yield, more than 62 % yield increase over the conventional practice with BC ratio around 2.0. Now the farmers of NICRA adopted village and its adjacent village cultivating the rice in SRI method with better yield.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	32	8.4	78	48	62	54400	54800	2.0
Total	**32**	**8.4**						

Sonepur

Water saving technology through SRI and low water requiring rice (*Sahabhagi*) were demonstrated in 45 ha area covering 60 numbers of farmers. Rice cultivation taking Variety *Sahabhagi* was found better option which showed 42.1 % more yield than local and net return of Rs. 21400/- per ha with B:C ratio of 2.46.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	25	25	52.5	38.6	36.01	13580	13600	2.01
Rice Seed (var. *Sahbhagi*)	35	20	32.40	22.80	42,10	14600	21400	2.46
Total	**60**	**45**						

Malda

Water saving technology through SRI: 41.25% yield increase with BC ratio of 2.29 over traditional practice *i.e* the cultivation of rice through SRI technique is better than the traditional method of transplanting. DSR (var. *MTU-7029*): Cultivaqtion of rice through DSR method using drum seeder recorded 39.57 % yield increase with BC ratio of 1.12 over traditional practice *i.e* the cultivation of rice through traditional method of transplanting.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI (var. *MTU -7029*)	115	15.5	61.02	41.25	47.92	73224	41250	2.29
DSR (var. *MTU-7029*)	72	9.0	42.5	30.45	39.57	49500	8250	1.2
Total	**187**	**24.5**						

Port Blair

SRI method recorded 38.1% higher root mass which enhances uptake of nutrient and moisture from the rhizosphere. SRI method has obtained higher yield attributes and yield as compared to traditional method of rice cultivation. More number of productive tillers/m^2 (341) was registered in SRI method which was 33.5% higher tiller production than farmer practices. SRI recorded maximum grain yield of 42.95 q/ha and straw yield of 68 q/ha which was 36.4 % higher grain yield over farmers practice. The highest B: C ratio of 2.30 was recorded in SRI method but farmer's practices registered B: C ratio of 1.87.

Rice cum *daincha* seeder resulted that the beneficial effect of concurrent growing of *daincha* with rice. Growing *daincha* along with rice and its subsequent incorporation thus can reduce the use of nitrogenous fertilizers approximately by 25%, without affecting grain yield which is due to biomass addition and subsequent increase in the availability of nutrients in the soil. The yield increase was to the tune of 13.0 % higher than control. Higher gross return (Rs. 49500 ha^{-1}) and net return (Rs. 29375 ha^{-1}) with B: C ratio of 2.46 was recorded in rice cum *daincha* seeder.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
SRI (var. BPT-5024 Swarna)	4	1.6	42.95	31.5	36.3	19750	25710	2.3
Direct seeded brown manuring in rice	2	0.8	49.50	43.80	13.0	20125	29375	2.46
Total	**6**	**2.4**						

Community nurseries for delayed monsoon

Ganjam I

Due to late onset of monsoon and dry spell the seedling in rice nursery are affected to a great extent , heavy mortality occurs, delay in transplanting and decrease in yield. To cope with the situation community nursery was done near farm pond and check dam area., so that life saving irrigation can be provided. By adopting community nursery method the transplanting was done in right time, mortality of seedling reduced by 20 %. The Yield of rice also increased by 5.2 %.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Raised Community nursery of rice (var. *Pooja*)	190	06	42.4	40.3	5.21	34000	38080	2.12
Total	**190**	**06**						

Kalahandi

In case of delayed monsoon there is chance of less production of vegetables. So, the farmers were given low cost poly house to grow community nursery of different vegetables like tomato, brinjal, chilli *etc*. so that the healthy seedlings can be transferred to main field after the onset of monsoon.

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 brinjal	34	2.5	212	134	58.2	55000	105800	2.92
Community nursery of tomato	42	2.8	264	178	48.31	59000	119000	3.00
Community nursery of chilli	18	3.6	48	36	33.33	64000	116000	2.80
Total	**94**	**8.9**						

Kendrapara

Community nursery of rice and vegetables may be considered as suitable contingent majors for the delayed monsoon or adverse climatic condition like dry spell/ drought/flood. If the crop damaged particularly the rice crop due to long dry spell then after the rain we could again transplant the seedlings available in the community nursery. Similarly, the vegetable seedlings are also produced under the low cost poly house in community nursery. The farmersare generally raised their vegetable nursery in open field condition leading to damage in untimely rainfall upto 100 %. In this situation only alternative source of seedling is community nursery. The NICRA village and other nearby village framers are formed committees and adopted community nursery technology as a contingent major to adverse climatic condition. Now the farmers are raising rice and vegetable seedling in community nursery as contingent majors during adverse climatic condition.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Raised Community nursery of rice (var. Swarna sub -1)	58	2.0	51.5	39.5	30	36500	33500	1.91
Raised vegetable nursery (Tomato)	28	0.2	260	294	13	235200	155200	2.94
Total	**86**	**2.2**						

Sonepur

Community nursery of various crops like brinjal, tomato and onion were demonstrated in 50 farmers fields of which community nursery of brinjal was the promising one where 69.7 % more yield was obtained with net return of Rs. 205000/ ha and B:C ratio of 3.7.

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 brinjal	20	2	560	330	69.7	75000	205000	3.7
Community nursery of tomato, onion	30	5	265	210	26.2	145000	120000	1.8
Total	**50**	**7**						

Coochbehar

With introduction of transplanter machine the technology is now being gradually accepted by farmers.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Raised Community nursery of rice	54	2	50.5	37.5	34	33500	31500	1.94
Total	**54**	**2**						

Malda

Rising of different vegetables seedling has been done in the nursery bed of area of 0.133 ha as community nursery. The seedlings are supplied to the farmers of the NICRA adopted villages with minimum cost.

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 cauliflower	20	0.03	190	125	52	12000	6000	1.5
Community nursery of brinjal	25	0.03	540	340	58	8000	6890	1.86
Community nursery of tomato	20	0.03	285	205	39	10000	8760	1.87
others	35	0.03	-	-	-	13546	7600	1.56
Total	**100**	**0.12**						

Location specific intercropping systems with high sustainable yield index

Coochbehar

This was promoted in the current year only. Programme needs to be continued for another 2 years.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Potato+maize	38	7	Potato-202 Maize-48	-	-	122250 32000	51350 16000	1.45
Total	**38**	**7**						

Malda

Inter cropping of maize (var. *X92*) as main crop along with ladies finger (var. HYV) recorded 30.13 % more yield than the sole crop of maize with BC ratio of 2.52%. Inter cropping of chilli (var. *Bullet*) and tomato recorded more yield over the single crop from same land. Growing of different cucurbitatious crops along with leafy vegetables and solanaceous vegetables for effective utilization of land and space. It gives more yield and profit from same piece of land.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize (var.*X 92* as main crop)+Ladies finger (*HYV*)	130	17.33	90+5	73	30.13	45000	68400	2.52
Chili (var. *Bullet* as main crop)+tomato (*HYV*)	20	1.00	75+240	275	14.54	72000	64500	3.02
Cucurbits/Gourd + solanaceous vegetables (Multitier horticulture)	10	1.00	30+322	217	62.2	127500	113700	1.89
Total	**160**	**19.33**						

Port Blair

Intercropping in maize is practiced in the adopted villages to increase the total productivity per unit land area by judicious utilization of resources such as land, labour and inputs. Various intercropping system like Maize + Radish, Maize + water melon, Maize + Okra are followed in the area. Among the intercropping system maize + bhendi and maize + radish has exploiting more nutrient and water as compared to Maize + water melon. But maize+ Okra recorded higher gross returns (Rs. 84793/ha) and net return (Rs. 60463/ha) than other intercropping treatment combinations and sole crops.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Okra (*Mahyco 959*) – chilly (*Surya*)-beans (*Arka Komal*)	04	0.10	7.5	3.2	134	130000	170000	2.3
Maize (var.*X 92* as main crop)+Ladies finger (*HYV*)	5	2.0	48.0	37.2	29	84793	60463	2.5
Tissue culture banana under coconut and pond dyke	07	1.90	500	320	56	65000	105000	2.61
Leafy vegetables spice tree perennial species (False Coriander (CARI Broad Dhania),Suckers Clove, Nutmeg, Cinnamon and Black pepper) 2011-2012	06	1.22	-	-	-	-	-	-
Total	**22**	**5.22**						

Crop diversification

Ganjam I

Short duration rice varieties in upland are not much remunerative. The net profit for upland rice was only Rs. 12000-15000/ha. So by adopting crop diversification from rice to Maize the profit also increased by Rs. 10000 -12000 /ha. Maize could also perform well in upland situation. Due to ridge and furrow method of sowing it could harvest more rain water as compared to rice crop.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize *hybrid-super 36* (Rice to Maize)	30	12	42.6	38.4	10.9	29000	30640	2.01
Total	**30**	**12**						

Jharsuguda

Due to non-availability suitable high yielding upland rice Variety the farmers got less profit from local rice. So the maize was introduced as a remunerative crop instead of rice in upland which gives 37-39 q/ha of grains with net return of Rs 128700. The maize is cultivated in upland as well as medium land with less water requirement and more profit than rice. Therefore farmers of this village and adjoining village are cultivating maize in 40-45 ha.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Crop diversification by Maize var. *P3377*	95	17	38	23.0	65.21	42300	128700	4.0
Crop diversification by Maize var. *30-R-77/Kaveri*	10	4	37	31.8	16.35	45300	121200	3.6
Total	**105**	**21**						

Kalahandi

New varieties of vegetables were also introduced in the village. Onion (var. *N 53*), chilli (var. *Surajmukhi*) and brinjal (var. *F1-hybride long*) had been distributed in the village and the farmers used those seeds for cultivation. The yield was really good in quality and surplus in quantity. The farmers were pleased to grow these varieties.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Onion(var. *N-53*)	25	3.2	220	155	41.93	65000	155,000	2.38
Brinjal (var. *F1-Hybride Long*)	23	3.5	212	134	58.2	73000	192400	4.1
Chilli (var. *Surajmukhi*)	18	3.6	48	36	33.33	73000	167000	3.3
Total	**66**	**10.3**						

Kendrapara

The framers are habituated to growing rice crops with marginal profit in medium land in irrigated condition and as well as in rainfed condition. It is observed that the crop failure due to scarcity of water and long dry spells. In this situation the crops like Yam and Elephant foot yam are survive and give good yield. If not harvested in the same year then the crop will harvest in the next year with higher yield. The farmers are interested to cultivate yam and EFY instead of other crop. More than 32 farmers are cultivating these tuber crops in 4.0 ha. area.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cultivation of Yam	12	1.6	184	146	26	21400	154000	1.71
Cultivation EFY	14	0.8	410	368	11.41	402000	213000	1.53
Cultivation of Cowpea	08	1.6	84	72.5	15.86	36500	47500	2.30
Onion(var. *N-53*)	45	15	124	98	26.53	46300	129640	3.8
Tomato (var. *Param F1*)	60	20	208	155	34.2	44500	97900	3.2
Chilli (var. *Surajmukhi*)	50	45	220	150	46.6	40000	10200	3.55
Cabbage (var. *OM-3*)	55	25	230	165	39.3	49500	131260	3.65
Cauliflower (var. *MSN-16*)	40	30	178	142	25.35	54600	141200	3.58
Total	**284**	**139**						

Port Blair

Quality protein maize (*QPM-5*) recorded higher maize yield of 52q/ha which was 49 per cent higher over control. The highest gross return and net returns of Rs. 92000 and Rs. 64000 respectively was recorded in *QPM-5* with B:C ratio of 1.43.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Hybrid maize (Var. *QPM-5*)	07	2.2	5.2	35	49	92000	64000	1.43
Total	**07**	**2.2**						

S 24 Pgs (Nimpith)

The village suffers from acute water scarcity and soil salinity during *Rabi* season thus resulting in extensive fallow lands in this season. The only crop that was grown in this season was Greengram. But the productivity of the local Variety (*Choiti mung*) was very low (6 q/ha). This Variety was highly susceptible to YVMV disease. Moreover, the growing soil salinity, year after year, resulted in reduction of area under Greengram in the village. Hence a new high yielding Variety (*PDM-84-139*), tolerant to YVMV disease, was introduced that gave 62.5% more yield. In areas with more soil salinity, sweet potato and sunflower were introduced as new crop. These two crops helped to increase the cropping intensity of the village apart from ensuring a healthy economic return. Besides ensuring edible oil for domestic use, the small rural families can also use the thalamus of the Sunflower as a feed for the livestock.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Sunflower var. *KBSH-44*	25	6.0	17.2	11.5	49	22500	29100	2.29
Sunflower var. *DRSH-1*	38	9.0	18.1	12.8	41	21715	32585	2.38
Sweet potato var. *Sree Vardhini*	35	2.8	118.	89.5	32	32500	27935	1.86
Greengram var. *PDM-84-139* (Check var. *Choiti mung*)	12	1.6	9.7	6	62.5	18750	20250	2.08
Total	**142**	**26.9**						

Coochbehar

Toria Variety *B-54* was very much popularized in the village. More farmers are interested to cultivate mustard in the village.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (*toria*)	51	7.45	8.9	7.2	23.6	15000	16150	2.08
Total	**51**	**7.45**						

Malda

Mustard (NC-1) : 39.45% yield increased with BC ratio 1.96 over traditional practice by replacing old Variety. **Tomato under mulching**: The production is increased due to adding of organic mulch *i.e* rice straw, This technology also improves soil health, soil moisture, controls soil temperature and increase nutrient availability to the crops. It is also improve water holding capacity of soil. Cultivation of vegetables in nutritional garden increases availability of nutritious vegetables to the family members and also gave extra monetary benefits to the family.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (*NC-1*)	24	11.23	10.32	7.40	39.45	16875	16174	1.96
Nutritional garden	75	0.50	185.0	97.00	90.70	90000	47000	1.91
Tomato under mulching	33	0.33	322.0	225.00	43.11	131250	142875	2.08
Total	**132**	**12.06**						

Other Demonstration

Ganjam I

Tomato farmers are facing problems due to the climate change which leads to outbreak of pest and diseases, depletion of ground water, decrease in water table of water bodies due to high transevaporation, *etc*. Besides, raised input cost, low market price in rabi also threats for farmers. To cope up with the situation a demonstration programme in summer has been conducted for better market price of tomato. Heat tolerant var. *Chiranjibi* was demonstrated with IPM practices. It was transplanted in last week of January to 15 th Feb. The yield was also 14 % more as compared to local Variety and the profit was also increased by Rs. 30000/ha. Due to higher price in summer. It could tolerate temp. up to 40˚ . By growing hybrid Brinjal var. *green star* the yield increased by 14 %. Brown plant hopper was a major problem to harvest stage in rice . Due to increase in night winter temp., the BPH population was multiplying at a faster rate. Due to BPH infestation Chaffy grain, mortality of plant occurred. To cope up the problem a demonstration programme has been conducted. Farmers were awared about alley making, spraying of proper insecticides, pest monitoring at regular interval. By adopting IPM practice for BPH management the yield increased by 24 % and pest population decreased by 40 %.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Demonstration on Heat tolerant tomato hybrid *Chiranjibi*	10	02	264	232	13.8	86000	72400	1.84
Demonstration hybrid Brinjal var. *green star*	20	04	240	210	14.2	106000	134000	2.26
Demonstration on Management of Brown Plant Hopper in Rice	40	15	38.4	29.2	23.9	34000	31280	1.92
Total	**70**	**21**						

Jharsuguda

The local rice Variety *Swarna* was highly susceptable to disease and pest. So it was replaced by rice var. *Pratikshya* for medimum land which was then spreaded to 88 ha area in the village along with adjoining village. The *Pratikshya* resistant to blast and stemborer which gives 48- 50 q/ ha with a net return of 36100 and the Variety is highly acceptable for medium land by the farmers in the area.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Improved variety of Rice variety - *Pratikshya*	100	35.2	48	44	9.09	21500	36100	2.6
Boron application in Cauliflower	59	6.8	192	163	17.79	62500	167900	3.6
INM in Brinjal	23	2.4	183	172	6.39	60000	210000	3.5
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (*WBU-108*) in jute AZO-PSB fallows with INM	55	70	4.9	3.8	28.9	7640	10180	2.33
Integrated disease management in vegetables	40	16	43.2	36.4	18.7	48800	80800	2.65
Total	**182**	**44.4**						

Kalahandi

Integrated disease management in vegetables made the farmers aware about the diseases and pests affecting the vegetables, as a result of which the yield loss was reduced to a greater extent. Integrated fish farming also doubled the income of the farmers. Mushroom cultivation was one of the best sources to double the income of the farmers. They adopted this technology very quickly and happily.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Integrated disease management in vegetables	28	3.6	264	178	48.3	65000	199000	4.0
Integrated fish farming	45	2.2	11	6	83.3	250000	600000	2.4
Mushroom	35	1.2	800gm/ bed	550gm/ bed	45.0	50/bed	120/bed	2.4
Integrated fish farming	120	5	30	20	50.0	45500	45200	1.98
Mushroom	60	600	1.8	1.2	50.1	50/Bed	91/Bed	3.6
Total	**108**	**7.0**						

Kendrapara

Green gram cultivation in residual moisture demonstration conducted successfully in the NICRA villages particularly in the catchment area of water bodies renovated/created under NICRA programme. Similarly cultivation of bitter gourd in poly grow bag also adopted by more than 42 farmers in NICRA and nearby NICRA villages. Straw mulching in tomato, and high yielding varieties of ground nut and cow pea also cultivating by the farmers.

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Demonstration of heat tolerant tomato variety *Chranjivi*	20	22.0	254	220	15.4	85000	72400	1.89
Green gram cultivation in residual moisture *IPM 2-14*	73	43.4	61.2	51.7	18.3	15800	12600	1.79
Cultivation of bitter gourd in Grow bag	24	4.5	15.3	11.2	36.6	16780	13700	1.81
Demonstration on Improved Groundnut var. *smruti*	25	8.4	21.4	18.3	15.0	42700	42850	2.00
Demonstration on HYV cow pea *KashiKanchan*	22	4.2	18.3	10.3	77.7	31000	28500	1.91
Tomato under straw mulching	9	1.4	320	225	29.6	131270	142855	2.08
Total	**173**	**83.9**						

Port Blair

Utilization of residual soil moisture and soil enrichment through short duration Blackgram seed hardening with 100 ppm $ZnSO_4$ increased germination percentage of 35.7 % per sqm as compared to untreated seeds and more root dry weight of 0.146 g/plant and root length of 14.2 cm. The higher grain yield of 7 q/ha was recorded with seed hardening with ZnSo4 with the B:C ratio of 2.41.

Integrated Fish Farming:-

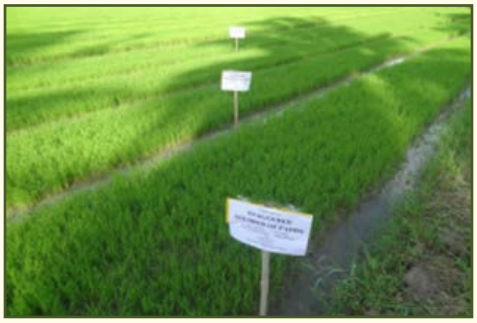
Six ponds were taken for demonstration of Integrated fish farming wherein Fish+ seasonal vegetables + duck (*Khaki Campbell*) were reared. The total area of 6 Nos. farm ponds was 0.48 ha. In each pond 265 fish fingerlings (40-50gm.), 25 Nos. *Khaki Campbell* and on the bunds seasonal vegetables were raised. For the demonstration Rs. 23,700/- was incurred towards the culture operation and net return obtained was Rs. 48,670/- with B:C 3.05 over the control with net return of Rs.9,450/- and B:C 1.90.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Utilization of residual soil moisture and soil enrichment through short duration black gram	22	2.62	7.0	3.5	100	35000	20500	2.41
Varietal evaluation (Pumpkin var. *BSS-749 RANA*)	10	04	13.0	8.5	53	75000	55000	1.7
Integrated Fish culture	40	4.0	1.5	0.7	71	53300	111000	3.0
Total	**72**	**10.62**						

S 24 Pgs (Nimpith)

The village falls under the coastal agro-ecological zone and suffers from occasional torrential rain during Monsoon. Rice is the major crop during Monsoon season. More than 75% of the agricultural lands are low lying and hence the *Kharif* rice suffers prolonged submergence after any intensive precipitation (>60 mm per day). Due to climate change there is an increase in intensity of precipitation during the initial monsoon days (June-July) resulting into prolonged submergence (10-12 days). This causes havoc damage to the seedbed preparation as well as to the standing seedbeds of rice.

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



A 10ft x 4ft size bamboo frame was prepared. A polythene sheet was covered over the bamboo frame and a thin layer of top soil was spread over it.

The frame was either fixed with bamboo poles at four corners and manually lifted with the rise of water level or was fixed with empty plastic vessels to keep it floating.

Rice seeds were sown on the floating seedbed

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

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

Demonstration on staggered seedbed of Rice

Torrential rainfall in short period coupled with lack of drainage results in prolonged flooding of both seed beds and newly transplanted fields. Keep in mind these view as well as to prevent complete loss of transplanted seedlings at a time the staggered seed bed were promoted in NICRA village.

Seeds are sown in different seedbeds in different dates

So there are batches of seedlings of different ages

If one batch of seedlings are lost after transplantation due to prolonged water stagnation in main field, other batches of younger seedlings are still saved in the nursery

So, farmers will have some seedlings for subsistence

Vermicomposting

As an effort to rejuvenate soil health, this year 2 improvised vermicomposting chambers have been demonstrated in the NICRA village. Each of the 2 beneficiaries was provided with 2000 worms comprising of Eiseniafoetida, Perionyx excavates andEudriluseugeniae. Apart from this, another 16 farmers were provided with 2000 worms each for vermicomposting. The pits are 10 ft in length, 4 ft in width and 2.5 ft in height. Each pit has a separating wall along the length thus making the pits a two-chambered structure. The separating wall has honey-comb openings to facilitate early decomposition of the organic waste and movement of earthworm in-between the two chambers. A water channel is provided at the top of the peripheral wall to prevent ants and millipedes. The two-chambered structure helps in continuous production of vermicompost without separating the earthworms manually. The partial decomposition of the organic waste and vermicomposting are carried out simultaneously in one of the two chambers on alternate basis. Hence there is no production gap if raw material is available.

On-farm mass production of Trichoderma viride at farmers' field:

To reduce indiscriminate and injudicious application of chemical pesticides it was decided to start production of bio-control agents at farmers own house. 10 farmers (rural youths) were trained in production of *Trichoderma viride* with a low cost technology. They were supplied with the necessary inputs like pressure cooker, culture transfer chamber, mother culture, etc. All the farmers are producing *Trichoderma* at their own and using in their field.

Chilli Leaf Curl Disease management:

Chilli used to be an important cash crop for the farmers of South 24 Parganas. However, its production and area has declined sharply over the last 10 years mainly due to leaf curl disease. Erratic rainfall, frequent drought spell, abnormal temperature fluctuation and indiscriminate use of chemicals have resulted in growing incidence of sucking pests (thrips, whitefly, mites) and certain viral diseases. Chilli leaf curl disease is the result of such a complex interaction of thrips, yellow mite and whitefly mediated chilli leaf curl virus.

A bio-intensive integrated pest management approach was demonstrated against this disease complex in the field of five farmers.

Seed treatment with Thiamethoxam followed by Trichoderma viride

Nursery bed covered with mosquito net

Soil test based fertilizer application

Seedling dip in Imidacloprid before transplanting

Spraying schedule for main crop:

Neem oil – Fipronil – Neem oil – Spiromesifen – Neem oil - Difenthiuron

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Floating seedbed of rice (var. Dudheswar)	5	0.26	33.0	27.0	22.2	39000	27000	1.69
Staggered seedbed of rice (var. Dudheswar)	5	0.67	32.8	30	9.3	40100	25600	1.63
Double chambered Vermicomposting	6	2	40	25	60.0	12000	16000	2.33
On-farm mass production of Trichoderma viride	10	1.6	-	-	-	-	-	-
Bio-intensive management of Chilli Leaf Curl disease	10	1.6	112	84	33.0	122250	325750	3.66
Total	**36**	**6.13**						

Coochbehar

Excess moisture at upland fallows are utilized better. More farmers are now adopting the technology in the village. Lentil was not so famous in the village but with the introduction of *maitri*, farmers are eager to cultivate lentil in their field and more than 25 farmers are now cultivating lentil in thevillage. IDM in brinjal was very much popularized among the farmers in the village as the yield was comparatively higher and better disease management.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (*WBU-108*) in jute fallows with INM	88	11.6	8.5	6.6	28.7	14250	28250	2.99
Integrated crop management of lentil (*Maitri*)	67	11.3	9.2	7.4	24.3	14500	26900	2.86
Integrated disease management in vegetables (brinjal)	26	4.2	330	270	22.2	123000	141000	2.15
Total	**181**	**27.1**						

Malda

Promotion of Pulses utilizing post-monsoon rainfall: Black gram (*WBU-108*) in jute AZO-PSB fallows with INM 43.08% yield increased with BC ratio of 3.99% with effective utilization of soil moisture after monsoon growing of black gram (*WBU-108*) in NICRA adopted villages . Mustard (*NC-1*): 39.45% yield increased with BC ratio 1.96 over traditional practice by replacing old Variety and proper nutrient management. Integrated crop management of lentil (*Maitri*): 40 % yield increase with BC ratio of 4.74% over traditional practice (BC ratio 1.34) by flowing integrated crop management practice. Integrated fish farming with vegetable crops in the pond dykes has been adopted. From the demonstration it was found that the net return increased of Rs. 15000 with BC ratio of 1.75. Integrated Farming System (Pond Based) with introduction of duckery and goat raring in the pond dykes increases the income by 140% with BC ratio of 3.39.

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (*WBU-108*) in jute AZO-PSB fallows with INM	1320	200.00	13.6	7.5	81.3	16825	50153	3.99
Integrated crop management of mustard (*NC-1*)	24	11.23	10.3	7.4	39.5	16875	16174	1.96
Integrated crop management of lentil (*Maitri*)	20	3.00	13.2	8.1	60.9	17250	81900	4.74
Integrated fish farming	02	0.50	-	-	-	20000	15000	1.75
IFS	02	2.00	-	-	-	95000	67000	3.39
Total	**1368**	**216.73**						

Module III: LIVESTOCK & FISHERIES

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

Kalahandi

Fodder cultivation with Hybrid Napier in community lands of 24 farmers have been demonstrated through which average milk production was increased by 21.15 %. Farmers got net return of Rs. 10940 /cattle for 6 months with good economic return *i.e.*, B:C ratio of 2.77.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder cultivation with improved varieties Hybrid Napier	24	4.3	Milk production of cattle 3.78 L/day	Milk production of cattle 3.12 L/day	21.15	6160/- for 6 month/ Animal	10940/- for 6 month/ Animal	2.77
Total	**24**	**4.3**						

Kendrapara

Fodder cultivation with Napier-Co4 in community lands of 12 farmers have been demonstrated through which farmers got a net return of Rs. 24400 /ha with good economic return *i.e.*, B:C ratio of 2.31.

Technology demonstrated	No. of farmer	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Napier-Co4	12	0.4	1200	790	51.8	18500	24400	2.31
Total	**12**	**0.4**						

Sonepur

Fodder cultivation with Hybrid Napier in community lands of 15 farmers have been demonstrated through which average milk production was increased by 17.9 %.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder cultivation with improved varieties Hybrid Napier	15	5	Fodder yield 1150 Milk yield (liters/day) 4.6	Fodder yield 810 Milk yield (liters/day 3.9	41.9 17.9	19500	22300	2.14
Total	**15**	**5**						

Port Blair

To meet the requirement during acute shortage of green fodder; fodder cowpea, maize and Hybrid Napier grass were promoted in the area. The fodder enhances milk production of livestock through satisfying its nutritional requirement. Agathi as a fodder for goatry has also been demonstrated in the Port Mout village for fodder availability and harnessing the maximum production potential of the animal.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder Napier (Var. *Co-3*)	10	3.086	800	400	100	6000	5200	1.86
Total	**10**	**3.086**						

Coochbehar

29 farmers only practicing the above technology. Fodder maize was being cultivated by few farmers for feeding their cattle.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Quality legume fodder Sudan Grass	29	1.94	825	625	32.0	8900	7200	1.92
Fodder production of Maize	30	2.9	420	310	35.4	10600	7200	1.78
Total	**59**	**4.84**						

Malda

By introducing hybrid Napier and other fodder in NICRA adopted villages, the milk production has been increased 3.5 liter/lactation than earlier *i.e* 2.40 L/lactation. Therefore, the income of rural poor farmers is increasing in nature.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder cultivation with improved varieties Hybrid Napier,	105	7.85	1170 Milk 3.5 L/ day	805 Milk 2.4 L/ day	45.3 45.0			
Total	**105**	**7.85**						

S 24 Pgs (Nimpith)

During the initial survey it was observed that although the village is rich in livestock population, the animals seemed to suffer from acute malnutrition. Productivity of milk was also a meagre 1-2L./animal/day. This was obvious, as the poor villagers could afford to feed their animals with only straw and allowed them for grazing in the open.

In an effort to revive the health status of the animals, it was decided in consultation with the beneficiaries that those who were allotted with different NRM interventions should also grow fodder crops on at least one side of their pond or land embankment. With this view, cuttings of napier and guinea grass were procured from AICRP on forage crops, BCKV and distributed to 78 beneficiaries.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Hybrid Napier	78	4.53	855	210	307	15200	70300	5.6
Total	**78**	**4.53**						

Improved fodder/feed storage methods:

Kendrapara

In community land, farmers who are rearing improved cows are in commercial basis formed a group and cultivating the hybrid grass for their own cattle consumptions and also sometimes sale to the needy framers. The farmers are dividing their responsibility and purchase the grass from the group.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Hybrid napier CO 4	18	1.0	1200	910	31.8	185000	415000	3.24
Total	**18**	**1.0**						

Coochbehar

Mineral mixturewas used by the farmers for feeding their cattle which resulted in increase in milk yield compared to others.

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Feed enrichment with urea and molasses	62	68	2.16 lit/ day/ livestock	1.69` lit/ day/ livestock	27.81	6850	3690	1.52
Feed enrichment with mineral mixture	320	406	2.28 lit/ day/ livestock	1.69` lit/ day/ livestock	34.90	7100	4850	1.68
Total	**382**	**474**						

Port Blair

During the summer season there is acute shortage of fodder in villages, therefore a training programme was organized and during the training programme fodder cuttings and fodder seeds (cow pea and maize) was supplied to the farmers for demonstration in their field to get fodder during summer seasons with the BCR 4.8.

This intervention is done inside the coconut plantation to check the soil erosion and to provide green fodder to the milch animal during dry period and also intervention of Napier fodder in plantation crop to check the soil erosion due to its perennial nature.

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 cultivation with improved varieties (Hybrid Napier)	12	1.7	200 t/ ha	80 t/ ha	150	8000	16000	4.8
Fodder cowpea (CoFC8) 2013-2014 2014-2015 2015-2016	12	3.06	933	57	161.1	16800	20250	2.0
Total	**24**	**4.76**						

Preventive Vaccination:

Ganjam I

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
Animal health camp (HS+BQ)	324	1320	Disease incidence-5%	Disease incidence-14%	64			
Mineral mixture	76	245	1080 lt/yr	900 lt./yr	20	16000	16400	2.03
Proper De-worming	132	570	Mortality%-3	Mortality%-9				
Total	**532**	**2135**						

Jharsuguda

Animals like Cattle, Goat, & Poultry are vaccinated & treatment as per the disease was done during Animal health camp in every year by which the mortality rate was decreased and the health

status of animal was good. This type of camp was appreciated by the farmers by which they were benefited of it in their own village without going to any veterinary office.

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
Animal health camp (HS+BQ)	325	No of animal covered 710	Mortality 75% reduced	-	-	-	-	-
Vaccination for PPR in goat and Ranikhet in Poultry.	65	950	No disease occured	-	-	-	-	-
Animal health camp (HS+BQ)	220	450	Milk production of cow 3.2 L/day	Milk production of cow 2.6 L/day	23.0	-	-	-
Vaccination camp against FMD Cattle and PPR against goat	315	556	Milk production of cow 3.1 L/day	Milk production of cow 2.6 L/day	19.2	-	-	-
Vaccination for PPR in goat and Ranikhet in Poultry.	65	950	5.25 g/day	4.15 g/day	26.5	-	-	-
Total	**325**	**710**						

Kalahandi

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	47	280 nos	Milk production of cow 3.2 L/Day	Milk production of cow 2.7 L/Day	18.51	6320/- for 6 month/Animal	7680/- for 6 month/ Animal	2.27
Vaccination HS,BQ	43	269 nos	Milk production of cow 3.4 L/Day	Milk production of cow 2.8 L/Day	21.4	6500/- for 6 month/Animal	7700/- for 6 month/ Animal	2.34
Vaccination for PPR in goat and Ranikhet in Poultry.	43	260 no.of poultry	5.45 g/day	4.23 g/day	28.8	70,000/-	61,000/-	2.3
Animal health camp (HS+BQ)	43	250 nos. of cattle	Milk production of cow 4.3 L/Day	Milk production of cow 3.8 L/Day	13.15	8120/- for 6 month/Animal	11180/- for 6 month/ Animal	2.37
Deworming (Febendazole) and Mineral mixture	32	218 no.of goat	840 gm/week	378 gm/week	122	3500/-/6month	7020/-/6month	3.0
Total	**208**							

Kendrapara

Under the NICRA programme Animal health camps are conducted for the big and small ruminants regularly which resulted decrease in disease infestation as well as

mortality. The farmers are now aware about the benefit of animal health camp and doing regularly by contacting line department and minimize their losses due to lack of vaccination and deworming.

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	172	-	Disease incidence 6 %	Disease incidence 22 %	72 % decrease	-	-	-
Vaccination for PPR in goat and Ranikhet in Poultry.	48	-	Disease incidence 7 %	Disease incidence 18 %	61 % decrease	-	-	-
Proper De-worming	172	-	Disease incidence 8 %	Disease incidence 21 %	62 % decrease	-	-	-
Total	**404**	**-**						

Coochbehar

Vaccination protects livestock from seasonal diseases. Reduction in mortality rate by more than 20%.

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	2010	8120	Mortality Rate -14%	Mortality rate-34	Reduction in mortality rate by 20%	-	-	-
Vaccination HS,BQ	680	2390	Mortality rate-19%	Mortality rate-41%	Reduction in mortality by 22%	-	-	-
Deworming (Feben-dazole) & Mineral mixture	990	2480	2.36 lit / day/ livestock	1.69 lit/ livestock/day	39.60	7800	5900	1.76
Animal Treatment Camp Butox,Prajana,SulphaDimadin, Oxytetra cycle	540	1280	-	-	-	-	-	-
Total	**4229**	**14270**						

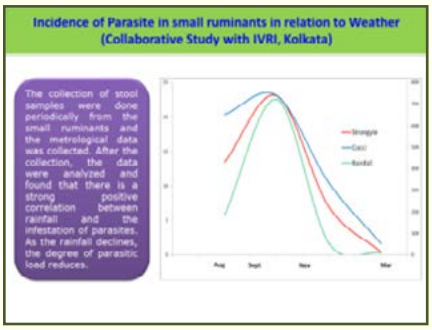
S 24 Pgs (Nimpith)

The NICRA village of Bongheri is rich in livestock resources. The livestock population comprises of both large and small ruminants as well as a good assortment of poultry birds.However, before the launching of the project in the village, the status of livestock, with respect to health and vitality, was abysmal.

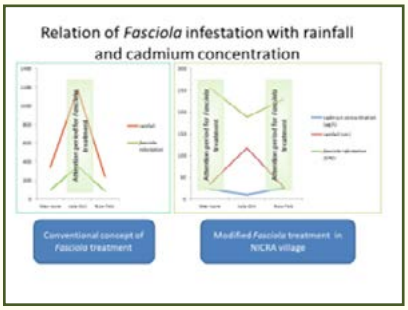
Animal health and vaccination camps were organized twice a year to provide the animals with deworming drugs,

vitamins and minerals and immunization of animals against H.S., B.Q. and F.M.D.

Supplementation of specific mineral mixture in the diet of the animals was also given due importance after soil analysis, plant analysis, analysis of animal serum followed by supplementation with iron, zinc, cobalt, copper, calcium.



Epidemiological studies of parasitological infestations in animals in relation to climate change are being conducted in collaboration with PDADMS, Hebbal. This is done to find out a correlation between the amount of cadmium concentration in the pond water used by the livestock and the incidence of Fasciolaworm infestation in the snail population of the aquatic bodies in the village.



Another study is being conducted in collaboration with Indian Veterinary Research Institute, Kolkata to find out incidence of parasite in small ruminants in relation to weather. For this purpose stool samples were collected periodically from the small ruminants and the meteorological data was also recorded. Thereafter, it was found that a strong positive correlation exists between rainfall and the infestation of parasites. As the rainfall declines, the degree of parasitic load reduces. This study helped to schedule the deworming of animals more effectively. These steps enabled the enhancement of health and population of livestock in the village.

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	680	3995	-	-	-	-	-	-
Deworming & Mineral mixture	850	4430	-	-	-	-	-	-
Total	1530	8425						

Malda

Mortality rate of cattle reduces from 38% to 7%. Mortality rate of goat reduces 56% to 12%

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	1650	12 nos	-	-	40% milk and 23% wt gain in goat	-	-	-
Total	**1650**	**12 nos**						

Port Blair

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 for Ranikhet and Foot and Mouth Disease	14	480	Two animal health camps were conducted in both the villages in collaboration with Directorate of Animal Husbandry and Veterinary Services, Port Blair.					
Mineral supplementation	8	8	4.05 l	5.20 l	28.4	1875	5925	4.16
Animal health and awareness camp on FMD	6	180	-	-	-	-	-	-
Total	**28**	**608**						

Manangement of ponds / tanks for fish and duck rearing:

Ganjam I

The village Chopara of Jagannath Prasad block, Ganjam has 7 farm ponds which are rainfed and water depth suitable for Pisciculture is maintained from July to December . It gradually decreases from January to March and becomes dry in April which hampers Pisciculture. Earlier farmers were stocking fry and fingerlings of *catla* and *Rohu* whose avg. growth was 0.5 kg upto end of December and they were bound to harvest the small sized fish due to water scarcity after December. The yield and net profit was very less due to low growth rate of fish. To cope up with the problem KVK has conducted demonstration programme. Farmers were supplied with 5000 yearlings / ha. of *Catla*, *Rohu* & *Mrigal* at a ratio of 3:4:3 which was stocked in the pond in 1st week of August after proper manuring with raw cow dung. The floating fish feed was applied @ 1 % of body wt. of fish every day. Farmers could harvest yearling in February and yield increased by 22 %.

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	22	10 ha.	23.4	28.6	22.2	135800	150200	2.11
Total	**22**	**10**						

Kalahandi

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	45	2.2	11 fish	250000	600000	2.4	45	2.2
Total	**45**	**2.2**						

Kendrapara

The farmers are motivated to take pisciculture activities in their unutilized seasonal ponds with onsite training on improved pisciculture technologies. Some ponds also renovated under NICRA programme and now the farmers are taking IMC in these 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	14	1.4	32.4	24.2	33.8	232000	156800	1.67
Total	**14**	**1.4**						

Sonepur

The farmers are motivated to take pisciculture activities in their unutilized seasonal ponds with onsite training on improved pisciculture technologies. Some ponds also renovated under NICRA programme and now the farmers are taking IMC in these 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	75	4	31.0	22.5	37.8	124000	186000	2.5
Total	**75**	**4**						

Coochbehar

Renovation of defunct fish ponds helped in better utilization of land and space which in turn fetching additional returns.

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	20	20 no.	16	13	23.08	56000	137000	3.45
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus&lata species cultivation	33	33 no.	10	7	42.85	51000	115000	3.96
Total	**53**	**53**						

Malda

Before NICRA project, water logged areas or ponds of that area are mainly used for jute retting purpose and capture fishery only taken place due flood which is a natural phenomena of that area. After introduction of NICRA, people are motivated towards scientific fish culture and after continuous guidance and demonstration by KVK they adopt the fish culture practices and production increased upto double *i.e.* 187% than earlier production.

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	27	14	58	31	187	234000	346000	2.47
Total	**27**	**14**						

S 24 Pgs (Nimpith)

The NICRA village of Bongheri is susceptible to frequent storms and cyclones, rendering it vulnerable to ingress of brackish water from the adjacent river through breaching of embankment. This may lead to mass mortality of the existing freshwater fish like, carps, catfish, snakehead fish and other indigenous fish species. However, the fish tilapia, with a wide range of salinity tolerance, has been found to be unaffected due to this sudden change in their environment. The fish is also hardy, omnivorous in nature and can tolerate fluctuation in water temperature.

Tilapia has good consumer preference and is also popular with the local farming community. However, due to its prolific breeding habit, the fish over populates the pond quite easily leading to reduced growth of all the fish present and also lowers fish production.

Hence, monosex *tilapia* (only male) of *Tilapia nilotica*, procured from the farm of a KVK trained entrepreneur, is converged with NRM interventions like landshaping and renovation of defunct ponds during the past two years.

The main aim of introducing monosex *tilapia* in the NICRA village is to provide the farming community with a stress tolerant fish which can withstand drastic changes in the climate and at the same time maintain a sustainable production from a water body.

It was observed that from a 0.13 ha pond, by stocking tilapia @ 5000 nos. a production of 200 – 400kg could be achieved within 8-11 months. At an average selling price of Rs. 100/kg, an income of Rs. 20000-Rs. 40000 could be obtained which gives the farmers just enough profit to sustain their daily protein requirement.

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
Salinity tolerant fish - *Tilapia*	12	0.78	Tilapia Length (mm)- 188 Weight(g)- 150 Survivability (%)- 86 Yield(q/ha)-16.64 Carp Length (mm) -238 Weight(g)- 410 Survivability (%)-80 Yield(q/ha)-31.98	Carp Length (mm) -245 Weight(g)- 425 Survivability (%)-80 Yield(q/ha)-34.00	43	228859	273981	2.19
Total	**12**	**0.78**						

Livestock Demonstration

Ganjam I

The poultry breed *Vanaraja* is a dual purpose bird is adopted by the farmers due to its faster body wt. gain, less mortality , well adapted to hot climate& less affected by diseases. The body wt. gain was 85 % more as compared to local birds.

By supplementing mineral mixture to milch cows the milk yield increased by 20 % as compared to non feeding of mineral mixture.

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
Backyard poultry -*Vanaraja*	40	400 no.	2.6kg/bird	1.4kg/bird	85.7	120	140	2.17
Addition of mineral mixture in cattle	76	245 nos	1080 L/yr	900 L/yr	20	16000	16400	2.03
Total	**116**	**645 nos.**						

Jharsuguda

The breed of Black Bengal of Goat is highly accepted by farmers due to its better growth and higher body weight then the local breed and getting a net return of Rs. 6500 .There are more number of breeds of BlackBengal are now in the village, the farmers are happy to adopt this breed for high income. Likewise the poultry breed *vanaraja* is adopted by the farmers due to its high body weight more income than the local poultry breed. The breed *vanaraja* is well adapted to hot climate and less affected by diseases.

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
Improved breeds introduced Goat (Buck-Black Bengal)	10	6 unit	25.0 kg (Body weight / 9 month)	16.1 kg (Body weight / 9 month)	55.27	2050	6500	4.2
Backyard poultry birds introducing Backyard poultry var. *vanaraja*	260	2947 no	2.5 kg (Body weight per in 6 month) No of eggs per year= 135 no	1.4 kg (Body weight in 6 month) No of eggs per year=84	78.57	280	750	3.9
Total	**270**	**2947 no and 6 unit**						

Kalahandi

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
Replacement of local breed with Khaki Cambell	22	150 nos.	250 eggs/ year	90 eggs/ year	177	455/- per year	980/- per year	3.15
Addition of mineral mixture	32	218 nos.	840 gm/ week	378 gm/ week	122	3500/-/6 month	7020/-/6 month	3.0
Low cost Azolla production as supplementary cattle feed	60	-	Milk production of cow 4.1L/Day	Milk production of cow 3.4 L/Day	20.5	8000/- for 6 month/ Animal	12000/- for 6 month/ Animal	2.5
Total	**114**	**368 nos.**						

Kendrapara

Under the NICRA programme , the demonstration on improved poultry breed like *vanaraja, Polyshree, kadaknath* and *khaki Campbell* were demonstrated from 2012-13 to 2017-18 successfully. Similarly for breed up gradation of local goat beetal buck were demonstrated and now farmers are getting 38 % body weight increase than the local breed. More than 60 farmers are rearing *vanaraja*, *polyshree*, *kadaknath* and *khakicampbell* poultry birds and more than 25 farmers have beetal breed goat (160 goats) in NICRA and nearby NICRA 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
Breed up gradation in local goat with beetal buck	8	8 nos.	29 kg	21 kg	38 %	2400/-	4850/-	3.02
Mineral Mixture	140	212	700 lit	576 lit	16 %	11,400/-	6,100/-	1.53
Rural backyard poultry *Kadaknath* Birds	20	200 nos.	800 gm(in 8 months)	400 gm(in 8 months)	50%	1150	2450	2.25
Low cost *Azolla* production as supplementary cattle feed	20	20 units	6.3 lit	6 lit	51.2	20	81	5.05
Replacement of local breed with *Khaki Cambell*	28	280 nos.	2.2kg, Egg:275	1.2kg, Egg:160	45.45	100	41.81	2.2
Total	**216**	**700 nos. & 20 units**						

Sonepur

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
Replacement of local breed with *Khaki Cambell*	80	400	Body weight (Kg) 2.4	Body weight (Kg) 2.0	20	410/- per bird	1218/- per bird	3.97
Addition of mineral mixture	60	300	5.0 Milk Yield(Lt/ day)	4.5 Milk Yield(Lt/day)	11.11	-	-	
Low cost Azolla production as supplementary cattle feed	40	40	5.6	4.5	16.6	-	-	-
others	180	740						
Total	**360**	**1480**						

Port Blair

Backyard poultry: There is an acute shortage of animal protein in farming community and due to mal nutrition child health is not very sound. Desi birds are prone to diseases and incurring loss to the farming community due to heavy mortality in rainy and summer months. To popularize the backyard poultry farming among the villagers, training programme on backyard poultry was organized and Improved Nicobari fowl were distributed to the farm women to get egg and meat for their children and also to get more income for their family. These birds are natural scavengers, disease resistant and daily feed requirement is minimum.

Backyard pig farming: To utilize the waste and excess

of the farm produce and to enhance the family income a training programme on piggery was organized in the village to develop the skill in pig farming and the farmers were supplied white York Shire piglets. Piggery will give support to the farm family during lean period and any unforeseen calamities besides a source of animal protein to the family.

Backyard poultry production with improved Nicobari and Vanraja birds:

A total no. of 160 numbers of *Vanraja* bird were distributed among the four numbers of farmers along with 30 Nicobari birds were distributed to three numbers of farmers. The Nicobari birds regarded as one who possess some resistant to common diseases of the bird is suitable under backyard. The production characteristics revealed that the bird can well thrives in this condition and performed better in terms of egg production as compared to other indigenous bird.

The rearing of *Vanraja* was also initiated to improve the condition of the farmer. The bird is of dual purpose and can also attain higher bodyweight if provided the supplemental feed apart from scavenging during daytime.

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
Backyard poultry (Improved Nicobari fowl)	06	06 unit	180 eggs	75 eggs	140	13050	31950	3.4
Improved poultry birds (*Nicorock*)	05	47	140 eggs	80 eggs	75	2450	3450	2.41
Improved poultry birds (*Vanraja*)	12	120	1.4 kg meat/ bird	2.3 kg/bird	64.2	4960	6080	2.26
Improved breed of Pig (T & D)	03	03	120 kg/ animal	75 kg/ animal	60	7500	17500	3.3
Total	**26**	**176**						

Coochbehar

Increase in the number of eggs/year has helped the farmers increased their economic status.

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
Replacement of local breed with *Khaki Cambell*	47	47	285egg/ year/ bird	160 egg/year/ bird	78	290/bird/ year	1420	5.90
Total	**47**	**47**						

S 24 Pgs (Nimpith)

Farming of stress tolerant poultry bird for marginal and landless farmers

Most of the farm families of the NICRA village were used to raising of indigenous poultry birds. However, the production both in terms of meat and eggs was very low. There were also incidence of disease and mortality in this birds due to climatic variations at different times of the year. Diseases like ranikhet, gumboro, diarrhoea, pneumonia *etc*. were common.

Under the NICRA project, it was decided to promote dual purpose poultry bird among the beneficiaries, particularly marginal and land less farmers. For this purpose "*Nirbheek*" breed of poultry was selected because they are more tolerant in any adverse condition and highly resistance to disease attack. Within ten months they grew to around 2kg and started to lay eggs. Egg production was found to be about 180 per year. Hence, this intervention provided the poor farmers with their daily protein requirement in addition to revenue generation by selling surplus production.

Ornamental bird rearing

Ornamental bird rearing involves growing of love birds, budgerigar, cockatiel, java, finch, etc. in cages in homestead condition. The rearing of such birds does not tread upon the government ban imposed on the caging of indigenous birds. As a result, it provides a lucrative source of income for the landless community of Sundarbans. Among the different types of ornamental birds, rearing of Budgerigar is best suited for the beginners as the practice is easier, less costly, comparatively more disease resistant with minimal risk. It has been observed that these ornamental birds have about 85% hatchability for which an amount of Rs. 405.00 per pair of bird/year could be obtained.

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 with Nirbheek breed	35	35 (10 per unit)	Age at first lay-4.5 months' Egg wt. -60 g, Total egg prodn. 180, Body weight at 1 year-2.6 Kg	Age at first lay-6.5 months, Egg wt. -45 g, Total egg prodn. 160, Body weight at 1 year-2.1 Kg	23.81%	3280	3500	2.06
Ornamental bird	7	7 (8 pairs per unit)	50 pairs in one year	-	-	3750	20250	6.40
Total	**42**							

Malda

By introducing *khaki Campbell* duck the egg laying capacity is increased upto 165% than local bread and they are also habituated in local condition very easily and farmers are appreciated and accepted the *khaki Campbell* breed. By adding Mineral Mixture in Cattle feed, the milk production is increased 140% more than local feeding practice. After introduction of *Azolla* as supplementary cattle feed, the milk production is increased upto 159% than normal cattle feeding practice.

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
Replacement of local breed with *Khaki Cambell*	25	25 unit	-	-	165% egg laying	-	-	-
Addition of mineral mixture	80	03 nos/unit	-	-	140% milk productio	-	-	-
Low cost *Azolla* production as supplementary cattle feed	50	50	-	-	159% milk productio	-	-	-
Total	**155**							

Improved shelters for reducing heat stress in livestock

Ganjam I

Farmers mainly depend on cattle for Milk, compost and field ploughing. However, the cattle housing condition is improper and unhygienic which impacts cattle health, milk production and working efficiency. KVK, Ganjam-1 has conducted a demonstration programme on improved housing in Chopara village of Jagannath Prasad block. The floor of cattle house of farmers was undulated without concrete flooring. So in improved cattle housing the floor was made elevated with sloppy condition for better drainage, roof was thatched with bamboo straw and mud to cope up for high temperature .Mosquito net was also fitted in the cattle house. By adopting this technology the milk yield increased from 1180 L. to 1320 L. /annum and also the working efficiency of bullock increased by 25%. The disease incidence is also decreased by 20 %. He got a profit of Rs. 20600 as compared to Rs. 16400 from previous year.

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (lt./yr)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based Shelter Bamboo+Rice straw+mud	06	06 units	1320	1180	11.8	19000	39600	20600	2.08
Total	**06**	**06**							

Jharsuguda

Due to cementing floor in cow shed the sanitation and cleanliness has been maintained by the farmers which help decrease of disease incidence in cow and the milk yield capacity is increased and the additional income is more than before.

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
Cementing floor of cattle shed	2	2	Lactational Milk yield (L) 110	850 lit	30.5	8770	33300	24530	3.8
Total	**2**	**2**							

Kalahandi

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
Improved shelters for poultry and livestock	8	15 nos. of goat	Bw. gain- 57 g/day	Bw. gain- 46 g/day	23.91	3200/- per goat per 1 year	9000/- per goat per 1 year	5800/- per goat per 1 year	2.81

Kendrapara

Shelter is very important for the small ruminants and poultry birds to minimize the infectious diseases and mortality particularly in the adverse climatic conditions. So, under NICRA programme demonstrations were taken up on low cost goat housing system and low cost poultry housing system. Now, more than 23 farmers are rearing their poultry birds and goats in the improved housing system in NICRA and nearby villages of NICRA.

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
Improved shelters for Goat	11	11 nos.	Disease Incidence 4 %	18 %	77 % decrease	-	-	-	-
Improved shelters for poultry	18	18 nos	Disease Incidence 12%	21 %	43 % decrease	-	-	-	-
Total	**29**	**29 nos**							

Port Blair

Before adoption of village, there was mass mortality of desi poultry birds, which may be due to improper care, scavenging type and shelters completely closed with tins without proper aeration system. Similarly cow shelters were uncleaned with tin roof in open areas making the animals unrest during sunny days resulting in reduction of milk production.

After adoption farmers were advised for improvement of shelters for live stocks and poultry with improved poultry shed with well ventilated system enabling low mortality rate. Instead of close tinned shelter, they were advised to convert it into open shed by using wire mesh for proper aeration and raise the bed above the ground level so that the floor will be dry in rainy season and mortality of birds will be minimize even at the time of any outbreak in the area. Five farmers have made the shelters as per our advice.

For dairy and farm animals, one open shelter is made under the coconut garden by the farmer as per our advice where he keeps his animals during day and night time. Farmers himself noticed that animals are not stressed in the hot days and there is increase in milk production. He cleans the shed regularly. To check the mass mortality, disease resistant Nicobari fowl were introduced. A total no. of 140 Nicobari fowl were given to 7 farmers for enhancement of egg production and breed up gradation of desi birds to develop disease resistant stocks.

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
Improved shelters for poultry and livestock	23	23							
Others , Open shed under plantation	05	0.02	15 L	10 L	50	10000	16750	6750	1.7
Total	**28**	**23.02**							

Malda

By introducing improve Variety of Goat i.e. Black Bengal Goat in NICRA adopted villages, the BCR is increased as 1.23 and farmers are appreciated to adopt this varieties in future.

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
Improved shelters for poultry and livestock	25	02/ unit	-	-	23%	3500.00/ unit	4305.00/ unit	805.00	1.23
Total	**25**								

S 24 Pgs (Nimpith)

Poultry is a popular livelihood option for the villagers. However, due to frequent storms and cyclones, the traditional housing is damaged on and often leading to increased mortality of birds and financial loss to the farmers. So, a double floor, durable housing with iron and net structure was developed and demonstrated to one

farmer. The housing accommodates 20 poultry bird at the bottom floor and 20 pairs of ornamental bird at the top floor. The culling % of poultry birds have reduced and the egg production per cycle has increased. The ornamental birds provide an additional income to the family.

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
Storm resistant 2-tier integrated shelter model for poultry cum ornamental bird	1	1	Poultry: Egg:220/ month Meat: 7 kg/yr Orna-mental Bird: 150 chicks/yr	Poultry: Egg:150/ month Meat: 15.5 kg/yr	-	12100	28000	15900	2.31

Module IV: Institutional Intervention

Seed Bank

Productivity of any crop mainly depends on the quality of seed by farmers. It is imperative to make available quality seed at right tie and affordable prices to sustain the productivity of crops and in turn livelihood security of small and marginal farmers. The baseline studies in the project areas of NICRA identified key problems related to seed supply system. Lack of timely availability of good quality seed of high-yielding varieties is one of the major constraints contributing to stagnant yields of crops in the project area.

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 rice, soybean and foxtail millet. 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.

West Bengal

Seed Production of rice Var. *GB–1* and *SS-1* (60 q) and black gram (8 q) was taken up for seed bank in NICRA village of Cooch Behar district covering 810 farmers in 203 ha area. Seed production in rice var. *Jarava* (6.7 q); *Dudheswar* (5 q) and Lathyrus var. *NP-24* (0.6 q) was taken up for seed bank in the NICRA village of South 24 Parganas district covering 194 farmers in 37 ha area. Seed production of Blackgram (20 q) was taken up for seed bank in NICRA village of Malda district covering 10 farmers in 2 ha area.

Odisha

Seed Production of rice (*sahabhagidhan, naveen, MTU-1010*) was taken up for seed bank in NICRA village of Ganjam I district covering 60 farmers in 320 ha area. Seed production in rice var swarna sub 1 (26 q); var. sahabhagidhan (8 q) was taken up for seed bank in NICRA village of Kendrapara district covering 42 farmers in 16.2 ha area.

State	KVK	Name of crops	Quantity (q)	No. of farmers	Area (ha)
West Bengal	Coochbehar	Rice Var. GB–1	60.0	490	160.0
		Rice Var. SS –1			
		Black gram	8.0	320	43.0
	S 24 Pgs (Nim-pith)	Rice Var. Jarava	6.7	74	13.0
		Rice Var. Dudheswar	5.0	70	15.0
		Lathyrus var. NP-24	0.6	50	9.0
	Malda	Blackgram	20.0	10	2.0
Odisha	Ganjamm I	Rice (*sahabhagidhan, naveen, MTU-1010*)	30.0	60	320.0
	Kendrapara	Rice var swarna sub 1	26.0	32	11.0
		Rice var sahabhagidhan	8.0	10	5.2
Total			**164.3**	**1116**	**578.2**

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.

Odisha

Fodder cultivars Viz., Fodder maize were cultivated in 6 ha covering 35 farmers in NICRA village of Kalahandi district. 28 ton of fodders Hybrid-napier Co-4 were produced in 0.4 ha covering9 12 numbers of farmers in NICRA village of Kendrapara.

State	KVK	Name of crops	Quantity (q)	No. of farmers	Area (ha)
Odisha	Kalahandi	Maize	480	35	6
	Kendrapara	Hybrid Napier Co-4	280	12	0.4
Total			**760**	**47**	**6.4**

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.

State	KVK	Commodity groups	Quantity (q)	No. of farmers	Unit (no.)
Odisha	Jharsuguda	Mushroom production	6.5	22	520 bed
	Sonepur	Kitchen Gardening	10.5	25	42
		Veg Mustard Pusa sag 1	5.0	11	-
		5 group Fingerlings fish	26.5	33	-
West Bengal	Coochbehar	Kitchen Gardening	10	10	10
		Veg Mustard Pusa sag 1	4.0	8	-
		5 group Fingerlings fish	35.5	40	-
	Malda	Kitchen Gardening	12	12	12
Total			110	161	520 bed & 64 no.

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.

State	KVK	Crops/Enterprise	Quantity (q)	No. of farmers	Unit (no.)
Odisha	Sonepur	Onion/ Vegetable	5.0	40	10
		Milk production and marketing group.	2.0	23	5
		Vegetables	2.0	15	5
	Kalahandi	Onion/ Vegetable	3.0	15	10
		Milk production and marketing group.	1.5	20	5
		Vegetables	2.0	12	5
West Bengal	Coochbehar	Onion/ Vegetable	2.5	15	15
		Milk production and marketing group.	3.0	25	10
		Vegetables	2.5	15	10
A & N Islands	Port Blair	Vegetables	-	-	-
Total			**23.5**	**180**	**75**

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.

State	KVK	Activity	Technology Used	No. of farmers	Unit (no.)
Odisha	Ganjam I	Kisan Mobile Sandesh (KMS)	Mannual reading of the weather parameters like, temperature, relative humidity, rainfall, wind speed direction on different crops and weather related agroadvisory	278	1
	Kalahandi	Advisory on- Temperature, Relative humidity, Rain fall, Wind speed and direction Weather station SMS/Voice SMS are being provided		310	1
	Jharsuguda			291	1
	Sonepur			312	1
West Bengal	Coochbehar			335	1
	S 24 Pgs (Nimpith)			1365	1
	Malda			1280	1
A & N Islands	Port Blair			1155	1
Total				**2326**	**8**

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.

Custom Hiring Centres 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.

Revenue generated through Custom hiring Centres and VCRMC in KVKs

Name of KVK	Revenue generated (Rs.) Total under VCRMC
Cooch Behar	93700
Malda	42054
Port Blair	128465
South 24 Parganas	31913
Kendrapara	2480000
Sonepur	35000
Kalahandi*	-
Jharsuguda	31976
Ganjam	34320
Total	2877428

* Not yet established




Capacity Building of Farmers and Youth on Climate Resilient Practices/Technologies

Capacity building of farmers in NICRA villages was taken up by KVKs through a series of knowledge and skill development training programmes conducted on varied thematic areas related to resilient technologies. This kind of training will enable the farmers to extend their support in recording need based data on technologies in respect of raising crops and livestock, NRM activities and crop production in different districts of West Bengal, Odisha and A&N Islands.

State-wise summary of capacity building activities:

State	No. of courses	No. of participants		
		Male	Female	Total
West Bengal	835	18521	2608	21129
Odisha	429	7189	4136	11323
A & N Islands	62	707	560	1265
Total	**1326**	**26417**	**7304**	**33717**

Capacity building activities :

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
S24 Pgs (Nimpith)	Climate change	Countering climate change mediated increased incidence of pest infestation in vegetables by bio intensive methods	1	24	10	34
		Mitigation of climate change through participatory approach	1	26	8	34
	Natural Resource Management	Scope of integrated farming through rainwater harvesting	2	40	19	59
		Integrated farming methods in Land shaping plots	2	34	8	42
		Utilization of harvested rainwater for agri-horticultural practices	2	36	9	45
		Judicial utilization of harvested rainwater in desilted ponds for fish and vegetable cultivation	1	17	4	21
		Method of collection of soil sample and processing for soil testing	1	16	3	19
	Crop Management	Vegetable cultivation on land embankment in inundated situation	5	107	42	149
		Drought escape through cultivation of low water demanding early winter vegetables	2	58	21	79
		Management of weeds in Kharif Rice	2	61	23	84
		Salt tolerant and deep water rice cultivation	5	99	46	145
		Cultural practices on vegetables cultivation	1	14	4	18
		Summer okra cultivation technique	1	9	5	14
		Field preparation for rabi crop	1	71		71

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
		Improved methods of vegetable cultivation in coastal areas of Sundarbans	1	39	5	44
	Nutrient Management	Using of vermicompost as substitute of chemical fertilizers to keep soil fertility	2	39	23	62
		Integrated Nutrient Management for field and horticultural crops	1	72	4	76
	Integrated Crop Management	Integrated farming of agronomical and horticultural crops along with fish culture	1	29	3	32
	Crop Diversification	Suitability of sweet potato as a salt tolerant crop	3	64	29	93
		Agronomical practices on Sunflower cultivation in the rice fallows of NICRA village	5	87	38	125
	Pest and disease management	Eco-friendly chemical pesticides and organic plant protection measures against pest resurgence	3	74	29	103
		Plant protection measures to protect from different diseases and pest due to continuous rainfall	2	44	27	71
		Preparation and use of eco-safe neem based bio-pesticides	2	45	22	67
		Bio-intensive pest and disease management of winter crop	2	51	21	72
		Viral diseases in crops and vegetables and their management - a growing challenge due to climate change	3	63	37	100
		Judicious pesticide application in relation to climatic aberration for effective crop pest and disease management	6	119	54	173
		Role of alternate hosts in overwintering of disease pathogens	2	43	25	68
		Countering climate change mediated increased incidence of pest infestation in vegetables by bio intensive methods	2	44	19	63
		Use of indigenous technological knowledge to combat biotic and abiotic stresses in agriculture	2	46	18	64
		Mealy bug – a growing threat in the era of climate change	2	44	22	66
		Bio-intensive pest and disease management of sunflower, summer greengram and okra	2	45	21	66
		Use of WhatsApp messenger in timely diagnosis and management of plant protection related problems	2	44	22	66
		Pests and diseases in *kharif* crops and their management	2	25	14	39
		Plant protection measures for winter vegetables	1	23	3	26
		Plant protection measures in sunflower cultivation	3	121	12	133
		Preparation of neem based pesticides	1	20	2	22
		Pests and diseases in rabi crops and their management	1	12	6	18
		Integrated plant protection measures for kharif crops	1	15	3	18
		Biological control for plant disease management	1	74	3	77
		Forthcoming diseases and pests of crop and their management	1	80	5	85

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
		Plant protection measures for kharif crops through implementation of IPM	1	19	3	22
	Nursery raising	Nursery raising for rabi crop cultivation	3	60	20	80
		Seed bed preparation for winter vegetables crop	1	23	14	37
		Nursery management on *kharif* vegetables	1	18	6	24
	Integrated Farming System	Climate change related risk management through integrated farming	1	26	11	37
	Livestock and Fishery Management	Scientific management of small ruminents	2	35	21	56
		Management and rearing of poultry birds	1	12	9	21
		Management schedule for small and large ruminant animals	1	19	11	30
		Management of poultry bird	1	19	6	25
		Care and management of productive animals	1	20	6	26
		Management schedule for dual purpose poultry birds	2	21	8	29
		Management of livestock	3	31	14	45
		Integration of Asian catfish as a stress tolerant fish species in carp ponds	1	23	12	35
		Promotion of stress tolerant fish species in brackish water inundated ponds	5	117	35	152
		Fish culture in landshaping pond	2	39	11	50
		Fish farming hazards - methods of diagnosis & prevention	1	25	17	42
		Fish farming and hazards management	1	33	7	40
		Pond preparation for IMC	1	26	8	34
		Post stocking management of carps in freshwater ponds	1	83	5	88
		Steps of ornamentals fish culture in net enclosures	1	76	5	81
		Management of dual purpose poultry birds	1	61	17	78
		Scientific practiced of Mixed fish and prawn farming in fresh water ponds	1	14	4	18
		Feed preparation and disease control method for ornamental fish farming	1	32	6	38
		Scientific method for rearing and disease management of dual purpose poultry birds	1	41	5	46
		Scientific Animal Husbandry practices and fodder cultivation	1	21	11	32
	Fodder and feed management	Green fodder cultivation – to boon livestock production	3	64	32	96
	Employment generation	Skill development on mushroom cultivation, ornamental fish and integrated farming	1	10	4	14
Coochbehar	Natural Resource Management	Integrated weed management in rice through land management	26	595	30	625
		Management of salt affected soil				
		Impact of bunding in water conservation	9	222	16	238

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
		Increase of water holding capacity of sandy soil of Diara land				
		Mulching and its impact	22	508	34	542
		Use of drip and sprinkler irrigation system				
		Rice and other cultivation through SRI	25	606	23	629
		Salt tolerant and deep water rice cultivation				
	Crop Management	Crop Management	27	580	12	592
		Water management	26	595	30	625
		Improved package of practices for pulse and oilseeds	25	580	17	597
		Quality seed production technology of cereals	21	500	14	514
	Nutrient Management	Integrated Nutrient Management in pulses	15	342	16	358
		Application of sulphur in oil seed crop	8	172	14	186
		Green mannuring	19	426	15	441
		Soil health management	21	512	18	530
	Integrated Crop Management	Cultivation Practices of Kharif pulses	5	112	6	118
		Scientific cultivation of crop management.	5	112	6	118
		Scientific cultivation of oilseeds	5	92	8	100
		Cultivation of potato	14	309	11	320
	Crop Diversification	Increase in cropping intensity through introduction of black gram in jute fallows	6	112	11	123
		Crop Diversification through lentil cultivation	6	110	12	122
		Training on intercropping	11	254	16	270
		Cultivation of Millets				
		Fodder production.	6	92	36	128
	Resource conservation Technology	Zero Tillage	16	365	21	386
		Operation & Maintenance of Zero Tillage Machine	5	42		42
		Summer ploughing	6	132	22	154
		Direct seeding method of Rice	9	211	10	221
		Use & importance of multi crop planter in Maize & protected Nursery.	4	88	10	98
		Crop residue management by using happy seeder	5	92	12	104
	Pest and disease management	Integrate Pest Management	26	628	35	663
		Storage pest of pulses and their management	6	123	15	138
		Judicious pesticide application in crops	25	590	12	602
		Integrated Disease Management	25	595	20	615
		Crop Diversification of sustainable crop production	8	170	8	178
	Nursery raising	Nursery raising and Management of major vegetable crops.	25	602	26	628
	Employment Generation	Poultry farming for employment generation	12	188	19	207
	Nutrition garden	Selection of Suitable crops for nutrition garden	11	181	86	267
	Repair & Maintenance of farm machinery & Implements	Operation and maintenance of sprayer, duster and small agril. Implements and tools	5	42		42

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
	Integrated Farming System	Integrated Farming System	6	119	23	142
	Livestock and Fishery Management	Duckery as an additional source of income	12	212	84	296
		Management schedule for dual purpose poultry birds	12	218	70	288
		Feed and health management of livestock	12	232	46	278
		Feeding breeding and management of Goat and Pig under drought like situation.	10	212	40	252
		Prevention and control of live-stock Disease	22	466	87	553
		Scientific rearing of IMC	20	480	70	550
		Composite fish culture	6	132	14	146
		Production of quality compost using local resources	26	632	29	661
		Integrated farming methods in landshaping plots	18	488	30	518
		Vegetable cultivation on raised land embankment	15	360	40	400
	Fodder and feed management	Skill/knowledge development on Fodder and feed management	8	169	32	201
	Lac cultivation	Skill/knowledge development on Lac cultivation	4	75	12	87
	Farm implements and machineries	Skill/knowledge development on Farm implements and machineries	5	42		42
	Value addition	Skill/knowledge development on Value addition	9	194	26	220
	Employment generation	Skill/knowledge development on Employment generation	11	239	17	256
Malda	Natural Resource Management	Integrated weed management in rice through land management	03	60	36	96
		Increase of water holding capacity of sandy soil of Diara land	01	25	00	25
		Mulching and its impact	02	30	20	50
		Use of drip and sprinkler irrigation system	01	20	00	20
		Rice and other cultivation through SRI	04	70	30	100
		Salt tolerant and deep water rice cultivation	06	135	24	159
	Crop Management	Crop Management	05	95	15	110
		Water management	02	30	20	50
		Improved package of practices for pulse and oilseeds	04	94	16	110
		Quality seed production technology of cereals	02	48	12	60
	Nutrient Management	Integrated Nutrient Management in pulses	04	80	20	100
		Application of sulphur in oil seed crop	00	0	0	0
		Green mannuring	03	54	06	60
		Soil health management	02	40	25	65
	Integrated Crop Management	Cultivation Practices of Kharif pulses	02	40	10	50
		Scientific cultivation of crop management.	03	54	21	75
		Scientific cultivation of oilseeds	02	60	15	75
	Crop Diversification	Increase in cropping intensity through introduction of black gram in jute fallows	04	110	10	120
		Crop Diversification through lentil cultivation	01	25	5	30
		Training on intercropping	05	110	37	147

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
		Fodder production.	02	28	22	50
	Resource conservation Technology	Zero Tillage	06	160	10	170
		Operation & Maintenance of Zero Tillage Machine	01	25	00	25
		Summer ploughing	0			
		Direct seeding method of Rice	01	30	00	30
	Pest and disease management	Integrate Pest Management	04	115	05	120
		Storage pest of pulses and their management	01	28	2	30
		Judicious pesticide application in crops	06	170	10	180
		Integrated Disease Management	02	54	06	60
		Crop Diversification of sustainable crop production	03	58	17	75
	Nursery raising	Nursery raising and Management of major vegetable crops.	02	41	19	60
	Employment Generation	Poultry farming for employment generation	01	20	05	25
	Nutrition garden	Selection of Suitable crops for nutrition garden	01	0	30	30
	Integrated Farming System	Integrated Farming System	02	50	10	60
		Feed and health management of livestock	02	60	00	60
		Feeding breeding and management of Goat and Pig under drought like situation.	02	00	50	50
		Prevention and control of live-stock Disease	01	05	25	30
		Scientific rearing of IMC	01	25	00	25
		Composite fish culture	02	45	05	50
	Fodder and feed management	Skill/knowledge development on Fodder and feed management	02	35	15	50
	Farm implements and machineries	Skill/knowledge development on Farm implements and machineries	01	20	00	20
	Employment generation	Skill/knowledge development on Employment generation	05	55	30	85
	Others	Multitier horticulture/mulching/mushroom etc.	06	155	25	180
Ganjam I	Natural Resource Management	Integrated weed management in rice through land management	02	41	09	50
		Rice and other cultivation through SRI	01	18	07	25
		Salt tolerant and deep water rice cultivation				
	Crop Management	Crop Management	04	83	17	100
		Water management	02	37	13	50
		Improved package of practices for pulse and oilseeds	04	84	16	100
	Nutrient Management	Integrated Nutrient Management in pulses	02	42	8	50
		Green mannuring	01	21	4	25
		Soil health management	03	61	14	75
	Integrated Crop Management	Scientific cultivation of crop management.	04	62	13	75
	Crop Diversification	Crop Diversification	03	58	17	75
		Fodder production.	01	22	3	25
	Resource conservation Technology	Direct seeding method of Rice	03	66	09	75

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
	Pest and disease management	Integrate Pest Management	07	154	21	175
		Integrated Disease Management	03	66	09	75
	Nursery raising	Nursery raising and Management of major vegetable crops.	02	43	7	50
	Employment Generation	Poultry farming for employment generation	02	31	19	50
	Livestock and Fishery Management	Feed and health management of livestock	02	36	14	50
		Scientific rearing of IMC	03	62	13	75
		Composite fish culture	02	39	11	50
	Employment generation	Skill/knowledge development on Employment generation	02	-	50	50
Kalahandi	Natural Resource Management	Rice and other cultivation through SRI	2	40	20	60
	Crop Management	Crop Management	1	18	12	30
	Nutrient Management	Integrated Nutrient Management in pulses	2	35	25	60
		Soil health management	2	38	22	60
	Resource conservation Technology	Integrated Disease Management	3	54	36	90
		Crop Diversification of sustainable crop production	1	17	13	30
	Nursery raising	Nursery raising and Management of major vegetable crops.	3	62	28	90
	Employment Generation	Poultry farming for employment generation	1	17	13	30
	Livestock and Fishery Management	Feed and health management of livestock	3	58	32	90
	Value addition	Skill/knowledge development on Value addition	1	16	14	30
Jharsuguda	Varietal substitution	Cultivation of disease & pest resistant rice varieties	1	19	6	25
	Cultivation techniques	Green manuring by incorporation of dhanicha in rice	1	25	0	25
	Cultivation techniques	Ridge & furrow practices in radish & cowpea	1	25	0	25
	IGA	Vermicomposting as income generating activities	1	20	5	25
	INM	INM in cabbage & cauliflower	1	28	22	50
	IGA	Techniques off vermicomposting	1	26	24	50
	Farm machineries	Management of custom hiring center	1	15	0	15
	Cultivation techniques	Improved cultivation techniques of rose	1	31	19	50
	Poultry rearing	Backyard poultry cultivation	2	62	38	98
	IGA	Oyster Mushroom cultivation	1	14	61	75
	Entrepreneurship development	Entrepreneurship development & its management	1	34	16	50
	Cultivation techniques	Improved method of greengram cultivation	1	30	20	50
	Micro-irrigation	Use of micro-irrigation system for horticultural crops	1	32	18	50
	Group dynamics	Group management techniques & group formation	1	17	33	50
	IGA	Income generating activities for poor farmers	1	36	14	50

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
	IGA	Oyster Mushroom Cultivation	1	18	22	40
	Protected Hoeticulture	Protected cultivation of vegetables	1	34	16	50
	Farm Machineries	Vocational Training on Maintenance of farm machineries of custom hiring centre	1	5	0	5
	Fish farming	Culture of Desi magur in cement tank system	1	32	18	50
	Floriculture	Commercial floriculture	1	36	14	50
	Cultivation Techniques	Cultivation Technique of commercial fruit	1	38	12	50
	IGA	Rice straw mushroom cultivation	1	12	38	50
	Integrated Farming system	Farmers Scientist interaction on Integrated Farming System in Rainfed Areas	1	31	19	50
	Soil testing and sample collection	Soil testing and sample collection technique	1	25	0	25
	Organic Farming	Organic farming	2	35	20	55
	Backyard Poultry rearing (Banaraja)	Backyard Poultry rearing (Banaraja) technique.	1	7	8	15
	Hi-tech Horticulture	Canopy Management	1	11	14	25
	Protected Cultivation	Protected cultivation of Capsicum	1	11	14	25
	Value addition	Value addition of vegetables	1	25	0	25
	Off season Flower cultivation	Off season gerbera cultivation	1	37	13	50
	Integrated Nutrient Management	Integrated Nutrient Management in Brinjal	1	22	28	50
	Integrated Nutrient Management	Boron application in Cauli flower	1	18	07	25
	Organic Farming	Vermicomposting	1	35	15	50
	Mushroom Production	Mushroom Production technique	1	35	15	50
	Soil sample collection	Soil sample collection technique	1	49	26	75
	Protected cultivation of Capsicum and Tomato	Protected cultivation of Capsicum and Tomato	1	13	12	25
	Boron application in Cauliflower	Boron application in Cauliflower	1	12	13	25
Kendrapara	Crop production	Cultivation of flood/drought/salt tolerant rice varieties	01	14	11	25
	In-situ Moisture conservation	Ridge and furrow, broad based furrow method of vegetable cultivation	01	23	2	25
	Women in Agriculture	Planning, Lay out & maintenance of nutrition garden	01	-	25	25
	Nutrient Management	Organic farming	01	19	6	25
	Integrated Pest and disease management	Use of traps for vegetable cultivation	01	22	3	25

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
Sonepur	Natural Resource Management	Integrated weed management in rice through land management	6	98	52	150
		Impact of bunding in water conservation	4	57	43	100
		Mulching and its impact	7	114	61	175
		Use of drip and sprinkler irrigation system	6	102	48	150
		Rice and other cultivation through SRI	5	99	26	125
	Crop Management	Crop Management	10	132	118	250
		Water management	9	130	95	225
		Improved package of practices for pulse and oilseeds	12	195	105	300
	Nutrient Management	Integrated Nutrient Management in pulses	10	175	75	250
		Application of sulphur in oil seed crop	6	85	65	150
		Green mannuring	8	115	85	200
		Soil health management	5	85	40	125
	Integrated Crop Management	Cultivation Practices of Kharif pulses	7	114	61	175
		Scientific cultivation of crop management.	10	135	115	250
		Scientific cultivation of oilseeds	6	90	60	150
		Cultivation of potato	3	40	35	75
	Crop Diversification	Increase in cropping intensity through introduction of black gram in jute fallows	-	-	-	-
		Training on intercropping	5	105	20	125
		Fodder production.	7	138	37	175
	Resource conservation Technology	Zero Tillage	10	135	115	250
		Operation & Maintenance of Zero Tillage Machine	8	140	60	200
		Summer ploughing	7	100	75	175
		Crop residue management by using happy seeder	4	75	25	100
	Pest and disease management	Integrate Pest Management	8	125	75	200
		Judicious pesticide application in crops	6	96	54	150
		Integrated Disease Management	11	207	68	275
		Crop Diversification of sustainable crop production	12	224	76	300
	Nursery raising	Nursery raising and Management of major vegetable crops.	9	180	45	225
	Employment Generation	Poultry farming for employment generation	7	50	125	175
	Nutrition garden	Selection of Suitable crops for nutrition garden	10	52	198	250
	Repair & Maintenance of farm machinery & Implements	Operation and maintenance of sprayer, duster and small agril. Implements and tools	8	144	56	200

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
	Integrated Farming System	Integrated Farming System	10	185	65	250
	Livestock and Fishery Management	Duckery as an additional source of income	8	75	125	200
		Management schedule for dual purpose poultry birds	10	58	192	250
		Feed and health management of livestock	3	50	25	75
		Scientific rearing of IMC	9	182	43	225
		Composite fish culture	6	106	44	150
		Production of quality compost using local resources	4	55	45	100
		Integrated farming methods in landshaping plots	2	35	15	50
		Vegetable cultivation on raised land embankment	5	107	18	125
	Fodder and feed management	Skill/knowledge development on Fodder and feed management	3	55	20	75
	Farm implements and machineries	Skill/knowledge development on Farm implements and machineries	5	50	25	75
	Value addition	Skill/knowledge development on Value addition	8	55	145	200
	Employment generation	Skill/knowledge development on Employment generation	14	225	125	350
Port Blair	Crop Management	Fish pond management	1	15	08	23
		Management of salt affected soil/Problem soil	1	14	6	20
		Field layout and planting technique	1	18	14	32
		Azolla	2	2	0	2
	Integrated Crop Management	Scientific cultivation of crop management.	5	83	48	131
		Quality seed pulses production technologies	1	11	11	22
	Crop Diversification	BBF	1	19	05	24
		Oyster and rice straw mushroom cultivation technology	1	22	04	26
		Round the year vegetable production technology	1	13	05	18
		Multi-tier cropping system	2	30	16	46
	Resource conservation Technology	Zero Tillage				
		Use of plastic in agriculture	1	16	12	28
	Pest and disease management	Integrate Pest Management in rice	02	38	22	60
		Integrated pest and disease management in solaneceous crops	1	15	07	22
		Animal Health Camp	1	9	13	22
	Nursery raising	Establishment of commercial horticultural nursery	1	29	06	35
	Repair & Maintenance of farm machinery & Implements	Operation and maintenance of Rice transplanter	1	11	10	21
		Operation of rice thresher	1	15	10	25
	Integrated Farming System	Integrated Farming System	1	07	18	23

KVK	Thematic area	Title of the Training Programme	No. of courses	No. of participants		
				Male	Female	Total
	Livestock and Fishery Management	Duckery as an additional source of income	1	12	13	25
		Goat management	2	30	29	59
		Dairy management	1	18	12	30
		Fish farming (IMC and Catfish)	2	15	23	38
		Disease management in poultry	02	36	24	60
		Livestock management (Rabbit and pig)	4	38	64	102
		Fish feed preparation from locally available ingredients	1	11	03	14
		Carp breeding and nursery rearing	2	29	0	29
		Care and management of piglets	1	8	19	27
	Fodder and feed management	Skill/knowledge development on Fodder and feed management	12	80	56	136
	Value addition	Surplus agricultural produce	01	10	15	25
		Small scale Virgin coconut oil production technology	2	12	36	48
	NICRA awareness	Swach Bharat Abhiyan	2	28	44	72
	Exposure visit	Crab fattening	1	05	00	05
		Nursery production	1	03	02	05
		Bio-control agents	1	05	00	05
		Broiler farming	1	00	05	05

Extension Activities for Popularization of Climate Smart Agricultural Practices

Various extension activities were taken up by KVKs in NICRA KVKs in NICRA villages in order to bring awareness among farmers on climate resilient agricultural technologies and to motivate them for wider adoption of the same.

State-wise summary of extension activities:

State	No. of courses	No. of participants		
		Male	Female	Total
West Bengal	4532	20046	4908	20512
Odisha	1636	15328	7586	24424
A & N Islands	385	1755	1377	3132
Total	**6553**	**37129**	**13871**	**48068**

Extension activities conducted at different NICRA centers

KVK	Name of the activity	No. of courses	No. of participants		
			Male	Female	Total
Coochbehar	Agro advisory Services	356	1365	44	1409
	Awareness	26	631	18	649
	Diagnostic visit	278	516	46	562
	Exposure visits	12	175		
	Field Day	36	1370	190	1560
	Group Discussion	30	558	36	594
	Method demonstrations	28	485	78	563
	KMAS Services	356	1365	44	1409
	Farmers day	5	195	65	260
	SHG	15	-	155	155
	Popular extension literature	18	-	-	-
	Animal Health Camp	12	1140	310	1450
	World earth day	5	206	47	253
	Woman health and nutrition	6	-	128	-
	Technology week	4	-		-
	Scientist visit to field	346	1684	290	1974
S 24 Pgs (Nimpith)	Agro advisory Services	71	578	236	71
	Awareness	17	392	151	17
	Diagnostic visit	90	525	307	90
	Exposure visits	2	45	24	2
	Field Day	60	877	287	60
	Group Discussion	19	259	108	19
	Method demonstrations	16	0	0	0
	KMAS Services	1500	-	-	-
	Farmers day	1	29	14	1
	Campaign	2	0	0	0
	Popular extension literature	4	0	0	0
	Animal Health Camp	6	384	189	6

KVK	Name of the activity	No. of courses	No. of participants		
			Male	Female	Total
	ICAR Foundation day	1	-	-	-
	World Soil Day	2	-	-	-
	NICRA Workshop at ATARI, Kolkata	5	0	0	0
	Scientist visit to field	75	0	0	0
Malda	Agro advisory Services	348	462	124	586
	Awareness	16	362	88	450
	Diagnostic visit	148	295	64	359
	Exposure visits	06	32	00	32
	Field Day	42	370	60	430
	Group Discussion	19	310	180	490
	Method demonstrations	18	2456	422	2878
	KMAS Services	220	340	75	415
	Farmers day	20	310	140	450
	Campaign	15	256	122	378
	Popular extension literature	03	256	105	361
	Animal Health Camp	12	1185	465	1650
	Woman health and nutrition	01	00	75	75
	Technology week	06	215	75	290
	NICRA Workshop at ATARI, Kolkata	06	06	00	06
	Scientist visit to field	248	412	146	658
Ganjam I	Agro advisory Services	46	185	52	237
	Awareness	18	408	158	566
	Diagnostic visit	64	245	89	334
	Exposure visits	9	160	00	160
	Field Day	14	382	160	542
	Group Discussion	53	352	143	495
	Method demonstrations	29	397	206	603
	KMAS Services	170	212	66	278
	Campaign	08	416	64	480
	Popular extension literature	01	30	-	30
	Animal Health Camp	14	320	42	362
	NICRA Workshop at ATARI, Kolkata	04	-	-	-
	Scientist visit to field	130	520	145	665
Jharsuguda	Exposure visits	11	68	58	126
	Field Day	27	620	520	1140
	Workshop	1	72	63	135
	Farmers scientist interaction	5	362	213	575
	Ex-Trainees meet	2	52	23	75
	Farmers Convention	2	56	19	75
	Kissan Mela	1	102	48	150
	Animal Health Camp	6	127	61	188
	Animal Nutrition Camp	3	52	33	85
Kalahandi	Agro advisory Services	15	65	55	120
	Awareness	15	157	53	210
	Diagnostic visit	22	74	46	120
	Exposure visits	2	34	16	60

KVK	Name of the activity	No. of courses	No. of participants		
			Male	Female	Total
	Field Day	8	220	180	400
	Group Discussion	15	180	120	300
	Method demonstrations	15	210	140	350
	SHG	7	-	70	70
	Animal Health Camp	3	82	68	150
	NICRA Workshop at ATARI, Kolkata	3	-	-	-
	Scientist visit to field	30	380	120	500
Kendrapara	Agro advisory Services	120	520	210	730
	Soil Health Camp	08	138	62	200
	Focus Group Discussion	32	320	180	500
	Diagnostic visit	94	362	212	574
	Exposure visits	06	118	62	180
	Field Day	16	520	280	800
	Group meeting (SHG)	22	0	448	448
	Method demonstrations	91	742	224	966
	Animal Health Camp	9	450	0	450
Sonepur	Agro advisory Services	8	133	67	200
	Awareness	15	189	186	375
	Diagnostic visit	22	115	93	208
	Exposure visits	5	52	23	75
	Field Day	10	102	48	150
	Group Discussion	10	145	75	220
	KMAS Services	60	230	220	450
	Farmers day	-	-	-	-
	SHG	20	-	230	230
	Campaign	10	145	105	250
	Popular extension literature	10	315	185	500
	Animal Health Camp	6			1500
	World earth day	-	-	-	-
	Krishak Chaupal	-	-	-	-
	Kishan Gosthi	5	75	-	75
	Woman health and nutrition	5	-	210	210
	Technology week	18	220	130	350
	NICRA Workshop at ATARI, Kolkata	3	-	-	-
	Scientist visit to field	55	330	180	510
Port Blair	Agro advisory Services	109	171	96	267
	Awareness	17	227	143	370
	Exposure visits	12	129	130	259
	Field Day	10	121	150	271
	Group Discussion	19	143	111	254
	Method demonstrations	52	201	170	371
	Kishan Gosthi/Kisan Mela	03	560	190	750
	Woman health and nutrition	08		270	270
	Scientist visit to field	155	203	117	320




Soil health Cards

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 2100 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.

State-wise SHC distribution

State	No of soil samples collected	No. of sample analysed	SHC issued	No of Farmers benefitted
Odisha	810	760	1041	849
West Bengal	1187	728	984	1005
A & N Islands	350	75	75	350
Total	**2347**	**1563**	**2100**	**2204**

KVK wise SHC distribution

State	Name of KVK	No of soil samples collected	No. of sample analysed	SHC issued	No of Farmers benefitted
Odisha	Ganjam I	56	56	265	265
	Jharsuguda	92	92	52	112
	Kalahandi	430	380	380	164
	Kendrapara	184	184	184	148
	Sonepur	48	48	160	160
West Bengal	Coochbehar	450	396	272	394
	S. 24 Pgs	312	312	312	211
	Malda	425	20	400	400
A & N Islands	Port Blair	350	75	75	350
Total		**2347**	**1563**	**2100**	**2204**




Convergence Programme

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the 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*.

Convergence of Ongoing Development Programmes/Schemes in NICRA implementing KVKs

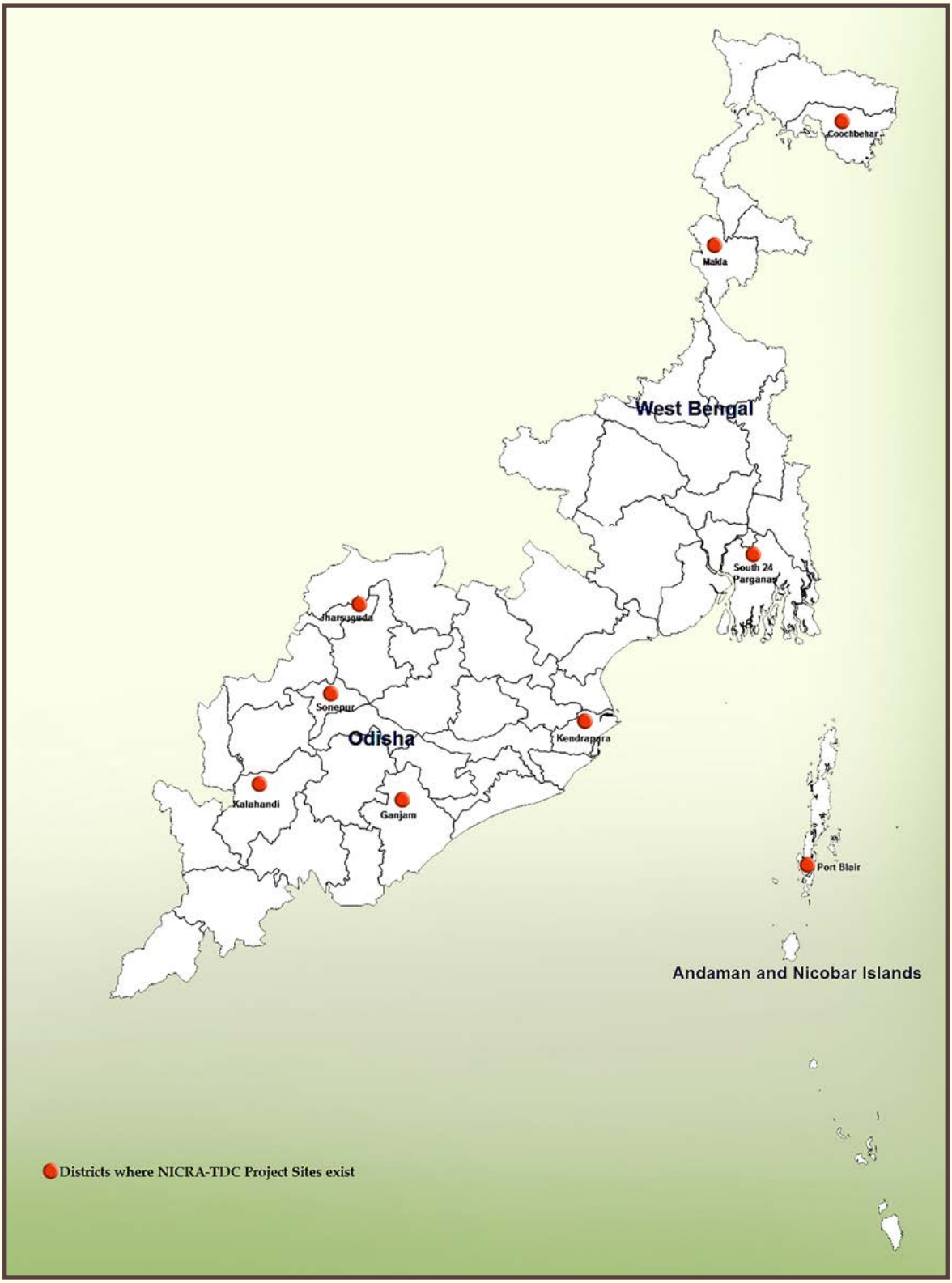
Name of KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Ganjam I	MGNREGS	Construction of check dam	800000/-
	Nutrition management of Goat & Woman empowerment	Training	80000/-
	Coir & sabai preparation (MEDP-NABARD)	Training	400000/-
	Total		**1280000/-**
Jharsuguda	Water shed development mission	Desilting of WHS.	200000/-
	Total		**200000/-**
Kalahandi	Odisha lift irrigation corporation	Construction of deep bore well	1000000/-
	Department of Agriculture, Govt. of Odisha	Construction of dug well	325000/-
	Minor irrigation, Govt. of Odisha	Renovation of check dam	3900000/-
	Department of Animal Husbandry, Govt. of Odisha	Construction of cattle shed	1280000/-
	Department of Animal Husbandry, Govt. of Odish	Distribution of cattle feed and mineral mixture	210000/-
	Total		**6715000/-**

Name of KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Kendrapara	Demonstration on green manuring by District Agriculture Department	Supplied dhanicha at subsidy rate for promotion of green manuring	320000/-
	Village concrete road	Road constructed by PWD department from village entrance to end of the village	240000/-
	Cloth for work	Repair of village	120000/-
	Tube well for drinking water	Establishment new tube well for clean drinking water	368000/-
	Animal health camp	Deworming and vaccination of large and small rumants	30000/-
	Pulse and oil seed minikit programme	Oil seed (Ground nut, mustard) and pulse minikit Green gram)	55000/-
	Cluster demonstration	NFSM cluster demonstration (green gram)	40000/-
	Total		**1173000/-**
Sonepur	District agriculture Dept.	Demonstration of rice var. NRK-51 & 52 tthrough ATMA	150000/-
	District agriculture Dept.	Demonstration of Arhar in field bunds	85000/-
	District agriculture Dept.	Demonstration of green gram in var. IPM-02-04	120000/-
	Total		**355000/-**
Port Blair	Sluice Gate	Construction of sluice gate, Zilla Parishad	750000/-
	Gryones	By APWD, Hard rock's tied with ropes are placed along sea road.	2570000/-
	Drainage improvement	In convergence with MNREGA for drainage of excess water	330000/-
	Rain water harvesting through BBF/rice cum Fish culture	Under NAIP project of CIARI	350000/-
	Total		**4000000/-**
Coochbehar	Department of Soil and water conservation	Renovation of drainage channel	700000/-
	Department of Forestry	Renovation of existing pond	300000/-
	Department of Animal husbandry	Azolla	180000/-
	Banana bunch cover	NABARD	210000/-
	MGNREGS, Khagribari gram panchayat	Vermicompost production	250000/-
	MGNREGS, Khagribari gram panchayat	Azolla production	100000/-
	Total		**1740000/-**

Name of KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
S 24 Pgs (Nimpith)	RKVY – State Agri Dept.	Land shaping and Ail cultivation	1500000/-
	IWMP	Land shaping and Ail cultivation	500000/-
	ATMA	Crop demonstration, SHG	200000/-
	Irrigation Department	NRM	1500000/-
	SDB	NRM	200000/-
	Total		**3900000/-**
Malda	MGNREGS	Reconstruction of Road	650000/-
	MGNREGS	Reconstruction of drainage channel	450000/-
	Total		**5000000/-**
	Grand Total		**24008000/-**

NICRA-TDC PROJECT SITES

West Bengal, Odisha
Andaman Nicobar Islands



NOTES

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