Annual Report
वार्षिक प्रतिवेदन
2019-20

National Innovations on Climate Resilient Agriculture

जलवायु समुत्थानशील कृषि पर राष्ट्रीय नवोन्मेष

ICAR- Agricultural Technology Application Research Institute Kolkata

भाकृअनुप-कृषि तकनीकी अनुप्रयोग संस्थान कोलकाता

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National Innovations on Climate Resilient Agriculture

Technology Demonstration Component

NICRA

National Innovations on Climate Resilient Agriculture

ICAR-Agricultural Technology Application Research Institute Kolkata

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Preface

Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. The impacts of climate changes are global, but countries like India are more vulnerable in view of the high population depending on agriculture. National Innovations on Climate Resilient Agriculture(NICRA) - A National Network Project of Indian Council of Agricultural Research (ICAR) with the objectives to enhance the resilience of Indian agriculture to climate change and climatic vulnerability through the components viz. strategic research on adaptation and mitigation, technology demonstration on farmers' fields to cope up with current climate variability, sponsored and competitive research grants to fill critical research gaps and capacity building of different stakeholders. The rationale for Technology Demonstration Component (TDC) is based on the premise that an array of technologies is available to cope with different types of climate related vulnerabilities in National Agricultural Research System. The component TDC of the project has been implemented through Krishi Vigyan Kendras at district level regionally coordinated by ICAR- Agricultural Technology Application Research Institutes (ATARIs). ICAR-Agricultural Technology Application Research Institute Kolkata having nine KVKs where different activities under Technology Demonstration Components of National Innovations on Climate Resilient Agriculture (NICRA) programme in various modules are carried out. The overall focus of NICRA is on adaption to climate variability which entails appropriate response to contingency situations. The central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains.

Technology Demonstration Component (TDC) under NICRA (National Innovations in Climate Resilient Agriculture) project is in operational in nine climatic vulnerable districts in the state of West Bengal (3), Odisha (5) and A & N Islands (1) of the Zone V. Location specific best innovative practices to address major climatic vulnerabilities such as drought, flood, heat stress and other extreme weather events were demonstrated during 2019-20 in farmers' field in NICRA adopted villages. The overall focus of technology demonstration under NICRA is to enhance resilience of farms and the farming community to climate risks so as to ensure sustainability over a period of time. The emphasis has been on capturing and improving the understanding on performances of technologies in different agro-ecologies and farming systems.

Compilation of NICRA Annual Report of ICAR-ATARI Kolkata for 2019-20 depicts a close assessment of endeavour of selected NICRA-KVKs in climatically vulnerable zones under supervision and guidance of ICAR-ATARI Kolkata and simultaneous attainment in the area of technology demonstrations, VCRMC, institutional interventions, seed production, capacity building, extension activities, review workshops etc. were also noted.

I wish to express my sincere gratitude to Dr. T. Mahapatra, Secretary, DARE and Director General, ICAR, Dr. A. K. Singh, Deputy Director General (Agricultural Extension), Dr. M. Maheswari, Director, Dr. J.V.N.S. Prasad and Dr. Md. Osman, Coordinators (NICRA-TDC), ICAR-CRIDA Hyderabad and other officials of Division of Agricultural Extension, ICAR for providing guidance and help in compiling the Annual Report 2019-20. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the selected NICRA-KVKs in providing information in time. The support and help rendered by all the staff of ICAR-ATARI Kolkata are duly acknowledged.

Date: 15.12.2020

Director

Contents

कार्यकारी सारांश

जलवायु परिवर्तन 21वीं सदी की प्रमुख वैश्विक चुनौतियों में से एक प्रमुख चुनौती है और यह विगत कुछ वर्षों से अन्तर्राष्ट्रीय मंच पर चर्चा की एक प्रमुख प्राथमिकता बनी हुई है। जलवायु परिवर्तन का प्रतिकूल प्रभाव सभी देशों, विशेष रूप से विकासशील देशों को प्रभावित कर रहा है। यह निरंतर सूखे और मौसम के अत्यधिक बदलाव, समुद्र के जल स्तर के बढ़ने, तटीय क्षरण और समुद्र के अम्लीकरण को प्रभावित करने के साथ-साथ खाद्य सुरक्षा, जल ऊर्जा और स्वास्थ्य के लिए खतरा पैदा कर रहा है और व्यापक रूप से गरीबी उन्मूलन और सतत विकास के प्रयासों को प्रभावित कर रहा है। जलवायु परिवर्तन का सामना करने के लिए ग्रीनहाऊस गैस के उत्सर्जन 'जीएचजी' में पर्याप्त और निंरतर रूप से कमी लाना आवश्यक होगा, जो अनुकूलन के साथ मिलकर जलवायु परिवर्तन के जोखिम को सीमित कर सकता है। वास्तव में, अनुकूलन और न्यूनीकरण की क्रियाएं, जलवायु परिवर्तन के जोखिम को कम और प्रबंधित करने की पूरक क्रियाएं हैं। जलवायु परिवर्तन को एक सतत चुनौती मानते हुए, इस महत्वपूर्ण क्षेत्र पर निरंतर रूप से अत्यधिक बल देते हुए ध्यान केन्द्रित करने की आवश्यकता है। इस बात को ध्यान में रखते हुए, XIवीं पंचवर्षीय योजना के दौरान एक योजना को सुदृढ़ किया गया है, और की गई पहलों को मजबूत करने के प्रयास किए गए। जलवायु परिवर्तन की इस स्थिति में घरेलू खाद्य उत्पादन को बनाए रखने की चुनौतियों का सामना करने और यूएनएफसीसीसी जैसे वैश्विक मंच को योगदान देने हेतु कृषि क्षेत्र के अंगीकरण और न्यूनीकरण संबंधी जानकारी उत्पन्न करने हेतु, भारतीय कृषि अनुसंधान परिषद ने - XIवीं पंचवर्षीय योजना के दौरान फरवरी, 2011 में "जलवायु अनुकूल कृषि पर राष्ट्रीय पहल" (निक्रा) - एक फ्लेगशिप नेटवर्क परियोजना का शुभारंभ किया और XIIवीं योजना के दौरान इसे 'जलवायु अनुकूल कृषि में राष्ट्रीय नवप्रवर्तन' (एनआईसीआरए) के रूप में जाना गया। इस प्रकार से 'जलवायु अनुकूल कृषि में राष्ट्रीय नवप्रवर्तन' (निक्रा) अग्रलिखित उद्देश्यों के साथ निरंतर आगे बढ़ रहा है: 1. उन्नत उत्पादन और जोखिम प्रबंधन प्रौद्योगिकियों के विकास और अनुप्रयोग के माध्यम से जलवायु विविधता और जलवायु परिवर्तन के प्रति, फसलों पशुधन और मत्स्य-पालन को सम्मिलित करते हुए भारतीय कृषि की अनुकूलता को बढ़ाना, 2. वर्तमान जलवायु जोखिमों के प्रति अनुकूलन हेतु किसानों के खेतों पर स्थान-विशिष्ट के प्रौद्योगिकी पैकेजों का प्रदर्शन करना, 3. जलवायु अनुकूल कृषि अनुसंधान और इसके अनुप्रयोग के क्षेत्र में वैज्ञानिकों और अन्य हितधारकों की क्षमता निर्माण को बढ़ावा देना और 4. अनुकूलता-संवर्धन प्रौद्योगिकियों और विकल्पों को व्यापक स्तर पर अपनाने हेतु नीति-निर्देश तैयार करना।

इसका समग्र अपेक्षित परिणाम संवेदनशील क्षेत्रों में जलवायु परिवर्तनशीलता के प्रति कृषि उत्पादन की अनुकूलता का बढ़ना है। आरम्भ में इस परियोजना को लागू करने के लिए सम्पूर्ण भारत में 100 कृषि विज्ञान केन्द्रों (केवीके) का चयन किया गया था। इसके अतिरिक्त, अनुमोदित XIIवीं योजना के अनुसार इस योजना को लागू करने के लिए सम्पूर्ण देश में 21 और केवीके को शामिल किया गया। अनुकूलन और न्यूनीकरण संबंधी अनुसंधान में फसलों, पशुधन, मात्स्यिकी और प्राकृतिक संसाधन प्रबंधन को शामिल किया गया है।

निक्रा (एनआईसीआरए) का प्रौद्योगिकी प्रदर्शन घटक (टीडीसी), वर्तमान जलवायु परिवर्तनशीलता की समस्या का समाधान करने के लिए किसानों के साथ कार्य करने और प्रक्षेत्र परिस्थितियों के तहत ऐसी प्रौद्योगिकियों का अनुप्रयोग के लिए शानदान अवसर प्रदान करता है। इससे इन अनुकूल प्रौद्योगिकियों को अपनाने की गति को बढ़ावा मिलेगा। जलवायु अनुकूलता के ऑन-फार्म सहभागिता प्रदर्शनों को देश भर में जलवायु की दृष्टि से संवेदनशील 121 जिलों में केवीके के माध्यम से और भारतीय कृषि अनुसंधान परिषद के 7 कोर अनुसंधान संस्थानों द्वारा गांव-समूहों में क्रियान्वित किया जा रहा है। इनमें, विभिन्न कृषि-पारिस्थितिकियों और कृषि प्रणालियों में प्रौद्योगिकियों के प्रदर्शन की जानकारी हासिल करने और इसमें सुधार लाने पर बल दिया जा रहा है। इससे विभिन्न जैव-भौतिकीय और सामाजिक-आर्थिक संदर्भों में जलवायु अनुकूलता के कारकों की पहचान करने में सहायता मिलती है। निक्रा केवीके ने ग्राम स्तरीय आकस्मिक फसल योजनाएं और उपाय तैयार और क्रियान्वित किए हैं। निक्रा कार्यक्रम के क्रियान्यन के दौरान ओड़िशा के 5, पश्चिम बंगाल के 3 और संघाशासित प्रदेश अंडमान निकोबार द्वीप समूह के 1, कुल 9 चयनित केवीके जिलों की जलवायु संवेदनशीलता का मूल्यांकन किया गया, जिससे यह पता चला कि वहां प्रौद्योगिकीय सहायता, मानव संसाधन विकास और समग्रतः कृषि समुदाय के सशक्तिकरण की निश्चित आवश्यकता है ताकि वे सूखे, अनिश्चित वर्षा, लू, बाढ़, चक्रवाती तूफान, जैसी जलवायु संवेदनशीलताओं से निपटने में सक्षम हो सके। तद्नुसार, केवीके के जिलों के संवेदनशील गांवों में फसल उत्पादन, संसाधन संरक्षण, पशुधन और मत्स्य-पालन, जल संचयन आदि कार्य आरम्भ करने के लिए प्रौद्योगिकीय युक्तियों के निष्पादन के माध्यम से लागू करने हेतु कार्य योजना तैयार की गई।

भाकृअप-कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान, कोलकाता, जिसके पास निक्रा को लागू करने के लिए नौ केवीके हैं, ने वर्ष 2019-20 के दौरान विभिन्न मोड्यूल में जलवायु अनुकूल कृषि संबंधी राष्ट्रीय नवप्रवर्तन कार्यक्रम के प्रौद्योगिकी प्रदर्शन घटक के तहत विभिन्न कार्यकलापों का निष्पादन किया, जिनसे 25535 किसान (एनआरएम- 1276, फसल उत्पादन-2272, पशुधन और मत्स्य-पालन-1991, संस्थागत युक्तियां-2997, क्षमता निर्माण-3825 और विस्तार कार्यकलाप-13174) लाभान्वित हुए।

प्राकृतिक संसाधन प्रबंधन मोड्यूल में बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, स्व-स्थाने आर्द्रता संरक्षण, नए जल संचयन एवं पुनरूपयोग की संरचनाओं/फार्म तालाबों/बांधों/टैंक, छत पर जल संचयन टैंक, भूमि को आकार देने एवं वर्षा जल संचयन संरचनाओं का निर्माण/नवीकरण बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, संरक्षण जुताई को शामिल किया गया है, जहां समुचित, कृत्रिम भू-जल पुनर्भरण और जल बचत सिंचाई प्रविधियां, हरी खाद देने, फसल अवशेष प्रबंधन, फील्ड-बंडिंग, चौड़ी क्यारी खूड, मृदा परीक्षण आधारित पोषक-तत्व अनुप्रयोग, माइक्रो सिंचाई तकनीक, कम्पोस्ट खड्डे आदि द्वारा 648.6 हेक्टेयर क्षेत्र को कवर किया गया है जिनसे क्षेत्र के 1276 प्रतिभागी किसान लाभान्वित हुए।

फसल उत्पादन मोड्यूल के तहत निक्रा-केवीके द्वारा विभिन्न क्षेत्र विशिष्ट युक्तियों को अपनाया गया अर्थात् सूखा, लवण और बाढ़ सहिष्णु/प्रतिरोधक किस्मों की शुरूआत, चरम ताप दबावों वाले क्षेत्रों में रबी की फसलों की रोपण तारीखों को पहले कर देने, जल बचत धान खेती पद्धतियों (एसआरआई, एरोबिक, प्रत्यक्ष पौद) विलंबित मानसून हेतु सामुदायिक नर्सरी, उच्च टिकाऊ पैदावार सूचकांक के साथ स्थान विशिष्ट की अंतर फसल प्रणाली, नई फसलों/फसल विविधता की शुरूआत, समय पर रोपण के लिए कस्टम हायरिंग केंद्र, निम्न तापमान सहिष्णुता, मानसून-पश्चात की वर्षा का उपयोग करते हुए दलहन को बढ़ावा देने, समेकित फसल/नाशीजीव रोग प्रबंधन, आकस्मिक फसल के रूप में सब्जियां उगाना, समेकित फसल प्रबंधन, आकस्मिक फसल द्वारा 411.75 हेक्टेयर क्षेत्र कवर किया गया है, जिनसे 2272 किसान लाभान्वित हुए हैं।

इसी प्रकार पशुधन और मत्स्य पालन मॉड्यूल के तहत विभिन्न पशुधन केंद्रित उपाय किए गए जिनमें- सूखे/बाढ़ के दौरान चारे के उत्पादन के लिए सामुदायिक भूमि का उपयोग, बेहतर चारा/चारा भंडारण पद्धति, पशुधन में ताप दबाव को कम करने के लिए उन्नत आश्रय, जल की कमी और जल अधिकता के दौरान मछली तालाबों/टैंकों का प्रबंधन, नस्ल उन्नयन, खनिज मिश्रण के माध्यम से संतुलित आहार एवं चारा प्रबंधन, आहार ब्लॉक एवं सिलेज तैयार करना, एजोला फीडिंग, कीडे मारने एवं टीकाकरण के माध्यम से नस्ल पशु स्वास्थ्य प्रबंधन, मछली तालाब की सफाई और मत्स्य पालन, स्वच्छ दूध एवं चारा उत्पादन को शामिल किया गया, इनसे 1991 पशुधन स्वामी लाभान्वित हुए। संस्थागत उपायों के तहत निक्रा के लगभग सभी गांवों में बीज बैंक, चारा बैंक, जींस समूह, समय पर कृषि-कार्यों हेतु कस्टम हायरिंग, सामुदायिक नर्सरी स्थापना, सिंचाई, ग्राम स्तरीय मौसम केन्द्र के माध्यम से सामूहिक विपणन जलवायु साक्षरता और जागरूकता को बढ़ावा देने को शामिल किया गया। 2997 किसानों के 108 हे. क्षेत्र को सम्मिलित करते हुए कुल 143 ईकाइयां विकसित की गई। एक मिनी स्वचालित मौसम केन्द्र (एडब्ल्यूएस) की व्यवस्था की गई जिसके माध्यम से किसानों को मौसम पूर्वानुमान के आंकड़े उपलब्ध करवाए गए।

ग्राम जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) का गठन, ग्रामीणों के साथ गांवों की जलवायु- संवेदनशीलताओं के न्यूनीकरण और इस कार्यक्रम के तहत अपनाई जाने वाली कार्य-नीतियों के बारे में गहन चर्चा करने के बाद किया गया। वीसीआरएमसी के कार्य की शुरूआत इसके नाम से बैंक में खाता खेलने के साथ ही हुई, जिसका संचालन वीसीआरएमसी के अध्यक्ष और संबंधित केवीके के प्रमुख द्वारा संयुक्त रूप से किया जाना है। केवीके के परामर्श से गांव में कार्यान्वित किए जाने वाले प्रौद्योगिकीय उपायों के बारे में महत्वपूर्ण निर्णय लेने के अतिरिक्त वीसीआरएमसी द्वारा विभिन्न कृषि औजारों और उपकरणों की कस्टम हायरिंग की निगरानी की जा रही है। कस्टम हायरिंग केन्द्र में विभिन्न कृषि उपकरणों जैसे पावर टिलर, थ्रेसर, रीपर, वाटर पंप, जीरो-टिल ड्रिल, रेज्ड बेड प्लांटर, स्प्रैयर, वीडर आदि की व्यवस्था है।

वीसीआरएमसी की देखरेख में एनआईसीआरए (निक्रा) द्वारा गोद लिए गए गांव में शुरू किए गए कस्टम हायरिंग सेंटर किसानों के बीच काफी लोकप्रिय हो रहे हैं तथा इनसे पर्याप्त धन-राशि भी अर्जित हुई है। दक्षिण 24 परगना केवीके द्वारा बोंधेरी गांव में गठित वीसीआरएमसी ने वर्ष 2019-20 के दौरान अधिकतम रू. 223000/- की धन राशि अर्जित की है।

वर्ष 2019-20 के दौरान विभिन्न विषय-वस्तु क्षेत्रों के संबंध में **क्षमता निर्माण** के तहत कुल 127 पाठ्यक्रम आयोजित किए गए। जिनसे 3825 किसान और कृषिरत महिलाएं (2530 पुरूष और 1295 महिलाएं) लाभान्वित हुई। इन विषय-वस्तु क्षेत्रों में - फसल प्रबंधन, प्राकृतिक संसाधन प्रबंधन, पोषक तत्व प्रबंधन, समेकित फसल प्रबंधन, फसल विविधीकरण, संसाधन संरक्षण प्रौद्योगिकी, नाशीजीव एवं रोग प्रबंधन, पशुधन और मत्स्य प्रबंधन, नर्सरी स्थापना, रोजगार सृजन, पोषक तत्व उद्यान, कृषि मशीनरी और उपकरणों की

मरम्मत एवं रखरखाव, समेकित कृषि प्रणाली, चारा और आहार प्रबंधन, कृषि महिलाओं के लिए कृषि उपकरणों के साथ लाख की खेती के कठिन-परिश्रम को कम करना, मूल्य संवर्धन, मानव पोषण एवं शिशु देखभाल, कृन्तक नियंत्रण सम्मिलित है।

समीक्षाधीन अवधि के दौरान विभिन्न विषय-वस्तु क्षेत्रों पर कुल 319 विस्तार कार्यकलाप आयोजित किए गए, जिनसे 13174 प्रतिभागी किसान (7854 पुरूष एवं 5320 महिलाएं) लाभान्वित हुए। विस्तार कार्य-कलापों का आयोजन प्रविधि प्रदर्शन, कृषि परामर्श सेवाओं, पशु स्वास्थ्य जागरूकता कैंप, कृषि चौपाल, किसान गोष्ठी, संसाधन संरक्षण प्रौद्योगिकी, प्रक्षेत्र एवं किसान दिवस समारोह, नैदानिक दौरे, समूह चर्चा, विश्व पृथ्वी दिवस, प्रौद्योगिकी सप्ताह, किसान मेले आदि पर किया गया। सभी नौ निक्रा (एनआईसीआरए) – कृषि विज्ञान केन्द्रों ने दिनांक 5 दिसम्बर, 2019 को संबंधित केवीके में कार्यशाला, संगोष्ठी, सिंपोसिया, जागरूकता कैंप का आयोजन करते हुए विश्व मृदा दिवस मानाया और निक्रा गांवों के किसानों में 1082 मृदा स्वास्थ्य कार्डों का वितरण किया।

Executive Summary

Climate change is one of the major global challenges of the 21st Century, and is one of the key priorities of the discussion in the International for a since last few years. The adverse impacts of climate change are affecting all countries, especially developing countries, including persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieve sustainable development. Combating climate change would require substantial and sustained reductions in greenhouse gas emissions GHG, which, together with adaptation, can limit climate change risk. Indeed adaptation and mitigation actions are complementary for reducing and managing the risks of climate change. Considering that the climate change is a continued challenge, the focus on this critical area needs to be continued with greater emphasis. Keeping this view, one scheme has been strengthened and efforts were made to build on the initiative taken during XI five year plan. To meet the challenges of sustaining domestic food production in the face of changing climate and to generate information on adoption and mitigation in agriculture to contribute to global fora like UNFCCC, the Indian Council of Agricultural Research launched - A Flagship Network Project 'National Initiative on Climate Resilient Agriculture' (NICRA) during XI Plan in February 2011, and during XII Plan it is referred as 'National Innovations in Climate Resilient Agriculture' (NICRA). Considering that the climate change is a continued challenge, the focus on this critical area needs to be continued with greater emphasis. Keeping this view, one scheme has been strengthened and efforts were made to build on the initiative taken during XII five year plan. Thus National Innovations in Climate Resilient Agriculture' (NICRA) has been continuing with these objectives: 1. 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, 2. To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks, 3. To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application and 4.To draw policy guidelines for wider scale adoption of resilience-enhancing technologies and options

The overall expected outcome is enhanced resilience of agricultural production to climate variability in vulnerable regions. Initially, 100 KVKs all over India were selected for implementation of the project. In addition to that 21 more KVKs throughout the country have been included for carrying out the project as per approved XII Plan. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management.

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

ICAR- Agricultural Technology Application Research Institute Kolkata having nine NICRA implementing

KVKs which carried out different activities under Technology Demonstration Components of National Innovations on Climate Resilient Agriculture Programme in various module benefitting 25535 farmers (NRM-1276, Crop Production-2272, Livestock and Fisheries- 1991, Institutional Interventions- 2997, Capacity Building- 3825 and Extension Activities-13174) during 2019-20.

Natural Resource Management module covered improved drainage in flood prone areas, in-situ moisture conservation, construction/ renovation of new water harvesting and recycling, structures/farm ponds/ checks dams/tank roof water harvesting tank, land shaping & rainwater harvesting structures, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, crop residue management, bunding of field, Broad Bed Furrow, soil test based nutrient application, micro irrigation techniques, compost pits etc. covered 648.6 ha area which benefitted 1276 practicing farmers in the zone.

Under **Crop Production** module different area specific intervention were taken by the NICRA-KVKs *viz*; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, covering 411.75 ha area which benefitted 2272 farmers.

Similarly under **Livestock and Fisheries** module various livestock centric interventions were carried out including Use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water, breed up-gradation, balanced feed & fodder management through mineral mixture, feed blocks & silage making, azolla feeding, breed animal health management through deworming and vaccination, fish pond cleaning and fish farming, clean milk & fodder production *etc.* were covered which benefitted 1991 livestock owner.

Institutional Interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed in almost all NICRA villages. A total of 143 units have been developed covering of 108 ha area of 2997 number of farmers. There is a provision of Mini Automatic Weather Station (AWS) through which farmers are provided weather forecasting data.

Village Climate Risk Management Committee (VCRMC) was constituted after in-depth discussion with the villagers about the mitigation of the climatic vulnerabilities of the villages and the strategies to be adopted under this programme. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Head of the KVK concerned. The custom hiring of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK. Custom Hiring Centre has the provision of various farm implements like Power tiller, Thresher, Reaper, Water pump, Zero-till Drill, Raised bed planter, Sprayer, Weeder *etc.*

Custom Hiring Centers initiated in the NICRA adopted village under the supervision of VCRMC has become immensely popular among the farmers and substantial amount has also been generated. VCRMC constituted by South 24 Parganas KVK at Bongheri village generated maximum amount of Rs. 223000 during 2019-20

A total 127 courses were conducted under **Capacity Building** on various thematic areas benefitting 3825 farmers and farmwomen (2530 males and 1295 females) during 2019-20. Thematic areas cover on crop management, natural resource management, nutrient management, integrated crop management, crop diversification, resource conservation technology, pest and disease management, livestock and fishery management, nursery raising,

employment generation, nutrient garden, repair and maintenance of farm machineries and implements, integrated farming system, fodder and feed management, lac cultivation drudgery reduction with farm implements for woman, value addition, human nutrition and child care, rodent control *etc*.

A total of 319 **Extension Activities** on various thematic areas benefiting 13174 practicing farmers (7854 males and 5320 females) during the reporting period. The extension activities were conducted on method demonstrations, agro advisory services, awareness animal health camp, Kishan Chaupal, Kishan Gosthi, resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, World Earth Day, technology week, kishan mela *etc*. All the nine NICRA-KVKs have celebrated World Soil Day through conducting workshop, seminar, symposia, awareness camp on December 5, 2019 in the respective KVK and distributed 1082 Soil Health Cards distributed among the farmers of NICRA villages.

1. Introduction

India is more vulnerable in view of large population depending on agriculture and excessive pressure on natural resources. Indian farmers have evolved various coping mechanisms over time, but these mechanisms are not enough to cope with extreme weather aberrations witnessed in the recent years. 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. In order to deal with climate change and its impact, A Network Project entitled, 'National Innovations in Climate Resilient Agriculture (NICRA)' of Indian Council of Agricultural Research (ICAR) has been launched in February, 2011 aiming to enhance the 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. This also facilitates identification of what constitutes climate resilience in different bio-physical and socio-economic contexts. NICRA KVKs prepared and implemented village level contingency crop plans and measures. Technology Demonstration Component (TDC) of NICRA offers a great opportunity to work with farmers to address current climate variability with matching responses. Getting existing technologies into the hands of small and marginal farmers and developing new technologies like drought or flood tolerant crops to meet the demands of a changing climate also come under the purview of NICRA programme. Climatic vulnerability of selected nine 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. 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

The objectives of this network project are:

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

The overall expected outcome is enhanced resilience of agricultural production to climate variability in vulnerable regions. Initially, 100 KVKs all over India were selected for implementation of the project. In addition to that 21 more KVKs throughout the country have been included for carrying out the project as per approved XII Plan. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management. The project is comprised of four components.

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

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

The project was formulated and addressed based on the following steps:

- Analysis of climate constraints of the village based on long term data
- Assessment of natural resources status of the village
- Identification of major production systems
- Studying of existing institutional structures and identifying the gaps
- Focus group discussion with the community to finalize the interventions

The interventions being implemented are based on four modules, i.e. (1) Natural resources management, (2) Crop production, (3) Livestock and fisheries and (4) Institutional interventions.

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:

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

List of districts and KVKs with Climate vulnerability

S. N.	State	NARP Zone	Districts	Climate vulnerability
1	A&N Islands	Coastal Zone	Port Blair	Cyclone
2	Odisha	North-Eastern Ghat	Ganjam 1	Drought
3	Odisha	West Central Table Land	Jharsuguda	Drought / Flood
4	Odisha	Western Undulating	Kalahandi	Drought
5	Odisha	East & South Eastern Coastal Plain	Kendrapara	Flood / Cyclone
6	Odisha	West Central Table Land	Sonepur	Drought / Flood
7	West Bengal	Terai Zone (WB-2)	Coochbehar	Heavy rainfall
8	West Bengal	Old Alluvial Zone (WB-3)	Malda	Flood
9	West Bengal	Coastal Saline Zone (WB-6)	South 24 Parganas	Cyclonic storm/heavy rainfall within short period

The NICRA village was selected based on vulnerability of agriculture to climatic variability. 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 have not only enabled the farmers to cope up climatic vulnerability as well as it plays a key role in farmers' adaptive capacity along with sustainable agricultural production. Climatic vulnerability of selected nine KVK districts of Odisha, West Bengal and union Territory of A & N Islands assessed during implementation of NICRA programme brought forward definite requirement in terms of technological support, human resource development and overall empowerment of farming community to enable them to cope up with climate vulnerabilities like droughts, erratic rainfall, heat wave, flood, cyclonic storm. Plan of action, accordingly, was prepared for its implementation through executing technological interventions to initiate crop production, resource conservation, livestock and fish rearing, water harvesting etc. in the vulnerable villages of KVK districts. Demonstration of appropriate practices and technologies with a climate focus is taken up in farmer participatory mode in NICRA villages. The NICRA villages have become hubs of learning on climate resilient agriculture in the other parts of the districts.

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 & 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

2. Interventions With Modules:

Module I: Natural Resource Management

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

Module II: Crop Production

Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving 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.

2.1 Module L: Natural Resource Management

The major emphases of the intervention were on augmenting rainwater availability through its efficient use by adopting site-specific rainwater harvesting strategies. Major interventions under this theme included in-situ moisture conservation; construction/renovation of new water harvesting and recycling structures/farm ponds/checks dams/ tank roof water harvesting tank; land shaping and RWH structure; improved drainage in flood prone areas; conservation tillage where appropriate; artificial ground water recharge and water saving irrigation methods; green manuring; 5% model of irrigation; crop residue management; bunding of field; broad bed furrow; soil test based nutrient application; micro irrigation techniques; compost pits; participatory soil health management through identification and correction of major and micro nutrients. The impact of interventions aimed and enhancing rainwater harvesting and utilization capacity was very significant across the clusters. The efforts in this area resulted in the creation of an additional rainwater harvesting capacity of over 17.3 lakh cu m leading to increase cropping intensity by bringing around 1250 ha of area under protective irrigation regime since the inception of the project.

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology:

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil

moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by *in situ* moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in 9 NICRA adopted villages covering 392 farmers in 104.6 ha area. The performance of different technologies by the various KVKs is presented in the following table.

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

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Use of rice straw mulch in Cucumber (Local variety: Jampur) and Poi (Basella) var: Panchsira	22	1.8	189.0	68000	165500	3.43
Zero Tillage in wheat; Var. DBW39 / HD 2967	147	18.0	35.3	21375	34305	2.61
Organic mulching in vegetables (Tomato, brinjal); Var. Hybrid	38	0.4	340.0	131250	142875	2.08
Vegetables Poly-mulching in winter cucumber, Okra	15	1.0	306.0	64900	114000	2.76
Summer Ploughing in Rice	25	25.0	34.0	23400	27040	2.15
Green manuaring (dhaincha) in Rice	21	16.0	40.2	22800	25820	2.13
Ridge and furrow method of brinjal, cow pea (var. Kashikanchan) and radish cultivation	35	7.0	304.7	56000	45990	1.82
Green manuaring (dhaincha) in Rice	33	13.0	52.0	24000	36000	2.5
Moisture conservation in Rice – Summer ploughing by MB plough	27	11.0	45.3	30100	28259	1.94
Sowing of maize in Ridge & furrow method in upland	20	9.4	51.6	26200	25640	1.98
Green manuring by Sunhemp. (Sunhemp-Rice)	9	2.0	26.0	31100	25642	1.82
Total	**392**	**104.6**				

2.1.2 Water harvesting and recycling for supplemental irrigation:

Water harvesting and recycling for supplemental irrigation were demonstrated in nine NICRA adopted villages by the different KVKs involving 131 numbers of farmers. The performances of different indicators in the demonstrations are presented in following table.

Table: Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (cu.m)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Repairing of Check Dam	14	0.6	1301	29600	27377	1.92
Renovation of pond	30	0.2	17899	47500	125100	3.63
Enlargement of existing freshwater pond	5	1.9	1266	48000	51250	2.07
Brackish water pond	1	0.3	783	140280	145875	2.04
New water harvesting structure in the wheat field	2	0.5	908	34600	19500	1.56
Renovation of old water harvesting structure in rice field	4	3.7	3384	37500	23500	1.63
Raising of land embankment	11	3.3	1205	42350	145990	4.45
Dug out pond	3	2.5	1369	65500	62450	1.95
Renovation of canal	28	0.1	17900	40750	112500	3.76
Renovation of Defunct Well-03 nos.	15	2.5	1125	65500	82530	2.26
Construction of deep open well	18	4.2	1561	255000	345000	2.35
Total	**131**	**20.7**				

2.1.3 Conservation tillage:

Sowing of *rabi* crops depends on the harvesting time of the preceding crop in *kharif* and also soil moisture status for undertaking land preparation for sowing. In case of wheat,this involves 2 to 3 or even more tillage operations for obtaining appropriate tilth beforeplanting of wheat. In addition to the costs incurred and energy required, this causes delay in planting of wheat which often results in coincidence of vulnerable stage with high temperature stress during February/ March. This often leads to reduction in grain yield and loss to farmer. Zero till technology offers a viable and practical solution by avoiding repeated tillage for land preparation and sowing, reducing cost of cultivation and alsopermits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoidterminal 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 five NICRA adopted villages in an area of 37 ha in 154 numbers of farmers. The technologies followed mainly by zero tillage operation. The results of the ZTD in various crops are presented in below table.

Table: Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Promotion of improved variety of wheat + Zero tillage technology	40	8	34.02	26750	24758	1.93
Promotion of improved variety of maize + Zero tillage technology	55	7	52.14	40000	39870	2.00

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Surface seeding and mulching in lentil	20	7	19.45	19450	34500	2.77
Surface seeding and mulching in mustard	10	5	15.30	17950	18500	2.03
Sowing of rice with power tiller	29	10	23.87	23585	22550	1.96
Total	**154**	**37**				

2.1.4 Artificial ground water recharge:

Artificial ground water recharge done by field bunding, water management and through SRI by sub-soiler in rice in 9 NICRA adopted villages covering 66.5 ha area in 107 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest ice yield (53.2 q/ha) and benefit: cost ratio (2.14).

Table: Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Water management through bunding of rice fields	83	51.1	47.2	24700	20750	1.84
Ground water recharge through SRI by sub-soiler	24	15.4	53.2	39550	45250	2.14
Total	**107**	**66.5**				

2.1.5 Water saving irrigation methods:

Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in rice demonstrated in NICRA adopted villages covering an area of 49.64 ha in 237 farmers' fields.

Table: Performance of different water saving irrigation methods

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Irrigation system (micro lift Irrigation system) for rice	21	5.8	34.2	26800	21750	1.81
Application of biofertilizer in rice (var. *MTU 7029*)	38	5.5	59.3	34250	48540	2.42
Vermi-compost from biodegradable wastes	22	2.5	17.1	5150	4320	1.84
RBF in Brinjal and cucumber (var. *Malini*)	15	1.3	14.0	59550	64550	2.08
Sprinkler irrigation in green gram (Var. *HUM-16*)	11	2.7	13.5	15200	24670	2.62
Sprinkler irrigation in chickpea (var. *PG-186*)	20	4.8	13.0	15550	23950	2.54
Vermi-compost from biodegradable wastes	17	15 nos.	55.0	20750	64750	4.12
Sprinkler irrigation in green gram	19	15.0	16.0	19750	17440	1.88
Sprinkler irrigation in Brinjal (*MuktaKeshi*)	12	1.8	498.0	152000	635500	5.18
Sprinkler irrigation in Chilli(Tejaswini)	22	2.7	256.0	177500	800500	5.51
Sprinkler irrigation in Greengram (PDM-84-139)	11	5.0	13.2	7500	24900	4.32
Sprinkler irrigation in Poi (Basella)	5	0.7	241.0	49500	176500	4.57
Sprinkler irrigation in Okra	7	0.6	214.0	67000	131000	2.96
Sprinkler irrigation in Cucumber	7	0.5	134.0	53000	160000	4.02
Sprinkler irrigation in Pumpkin	10	0.8	190.0	57000	118200	3.07
Total	**237**	**49.7 ha & 15 nos.**				

2.1.6 Other Demonstrations:

Demonstrations like in-situ vermicomposting in orchards, soil test based nutrient application, planting forest trees, plant for biodiversity, forestation, bio pesticides in tomato, were carried out in 255 farmers' fields with an area of 45.3 ha of land. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return.

Table: Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Soil test based nutrient application	75	26.0	18.2	32978	25800	1.78
Solid waste management (Compost and Vermi-compost production unit)	55	55 unit	Production (7.5 q/chamber), pH 7.02, OC 17.73%, N 1.25%, P 0.63%, K 0.77%	2500	4500	2.80
In-situ vermicomposting in orchards	20	4.1	19.8	34970	167400	5.79
Bio pesticides in Vegetables	36	6.2	165.0	50875	125240	3.46
Soil test based nutrient application in Cucumber	25	4.0	125	60200	177800	3.95
Use of IPM in Chilli leaf curl management	14	2.6	116.67	187533	395817	3.11
Use of IDM in Bittergourd bacterial wilt management	18	2.4	132.2	202985	525415	3.59
Shed net house for mushroom cultivation	12	-	2.2 kg Per bed	40/- per bed	136/-per bed	4.40
Total	**255**	**45.3 ha + 55 unit**				

2.1.7 Rainwater harvesting structures developed:

Rainwater harvesting (*ex-situ*) and efficient use to enhance resilience of farms, farm ponds brought about a perceptible change in crop production during *Kharif and rabi* season. Though the rainfall was less during the months of June and early part of July, the intense storms with rains which generated run-off and was stored in farm ponds created in farmers' field. The harvested water was used for critical irrigations to wheat, vegetables, fodder *etc*. Farmers realized an additional yield and income from these crops. There were 78 number of rainwater harvesting structures have been developed which could store 1.04 million cu m of water which could provide irrigation to 352 ha of land. This intervention increased the cropping intensity to the maximum extent up to 250%. Storage capacity and increase in cropping intensity through the rain water harvesting structures are given in the following table.






Table: KVK wise rainwater harvesting structures developed during 2019-20

New (Nos.)	Renovated (Nos.)	Total	Storage capacity (cu m)	Protective irrigation potential (ha)	Cropping Intensity (%) increase
30	25	55	0.8 million	220 ha	100-250

2.2 MODULE II: CROP PRODUCTION

Monsoon contingency action plans were prepared and implemented in NICRA KVKs which experienced delayed onset/ deficit rainfall conditions during 2018-19. Contingency crop plans for late planting (after mid July) involving appropriate crop, soil moisture, nutrient management measures, crop diversification *etc.* were taken up in NICRA villages. The impact of resilient practices and technologies is highlighted through different intervention mentioned below.

2.2.1 Introducing drought resistant varieties:

During the current year delayed onset of monsoon was experienced in several districts of Odisha and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Iintroductions of drought resistant varieties of rice, brinjal, tomato, black gram, arhar *etc* were demonstrated in 9 NICRA adopted villages involving 252 number of farmers in 82.7 ha area. Performance of the different drought resistant varieties of various crops is presented in the following table.

Table: Performance of different drought tolerant varieties

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Drought tolerant Rice (Jogesh)	20	15.2	25.5	15.5	64.5	18200	15316	1.84
Drought tolerant Rice (var. *Sahabhagidhan*)	60		36	24	50.0	14600	21400	2.46
Red gram (bund planting)	15	1.2	15	11.8	27.1	29800	47200	2.58
Drought resistant brinjal (VNR- 218)	35	5.9	562	436	28.9	75000	205000	2.90
Tomato (*Utkal Kumari*)	32	4.0	250	175	42.8	65000	199000	4.0
Black gram (*PU 31*)	25	4.9	12	7	71.4	18000	37000	3.05
Cotton (*Shalimar*)	35	18.3	25	15	66.6	38000	82000	3.15
Arhar (*PRG 176*)	30	15.2	18	12	50.0	22000	58000	3.63
Total	**252**	**82.7**						

Drought tolerant rice varieties like *Sahbhagi, Jogesh and others vegetables, pulses* were demonstrated in 82.7 ha areas of 252 number of farmers' field. The demonstrations of Tomato (*Utkal kumari*) gave the maximum economic return (B:C:: 4.0).

2.2.2 Introducing salt tolerant rice varieties:

Salt tolerant varieties of rice like *CARI Dhan,Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona* were introduced in 13.4 ha area in 65 farmers' fields. Variety Jarava and CSR-36 proved maximum salt tolerant potential by giving highest yield of 43 q/ha and more economic return (BC ratio of 2.04).

Table: Performance of different salt tolerant rice varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% in-crease	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	15	3	50.2	36.7	36.78	29750	23500	1.79
SR-26B	18	2.9	43.0	34.0	26.47	27500	28700	2.04
Usar Dhan-3	16	2.6	35.0	30.2	15.89	33650	16500	1.49
Salt tolerant Rice *var. Jarava*	10	2.5	45.0	25.0	80.00	41250	25550	1.62
Rice *CSR-36*	6	2.4	44.0	33.6	30.95	29650	27830	1.94
Total	**65**	**13.4**						

2.2.3 Introducing flood tolerant varieties:

Flood tolerant varieties of rice like *Swarna sub 1* and *Nilanjana/ Pratiksha/ CR 500 / NC 492* were introduced through demonstration in 22 ha area in 93 farmers' fields.

Table: Performance of different flood tolerant varieties

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Temporary submergence tolerant rice variety Swarna Sub-1	25	6.5	40.1	29.1	37.93	40000	31200	1.78
Promotion of submergence tolerance rice var. Swarna sub-1/Nilanjana/ Pratiksha	52	10.1	43.0	30.0	43.33	21250	34440	2.62
Rice CR500	7	3.4	4.0	2.1	90.48	27500	19000	1.69
Rice NC 492	9	2.1	4.1	3.1	32.26	25750	14500	1.50
Total	**93**	**22**						

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

To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, *etc.* were sown in 12 days advance (avg.) during *rabi* season. These demonstrations were carried out in seven NICRA adopted villages involving 176 number of farmers' fields with an area of 32.8 ha land.

Table: Performance of advancement of planting dates in different crops

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Lentil var. *Moitree*	75	13.0	12.5	8.0	56.25	21250	27125	2.28
Green Gram, *var. PDM139*	42	5.5	13.4	6.9	94.20	20500	40700	2.98
Promotion of short duration rice (*GB-1/ Panth-18/ Sahabhagi*)	49	6.8	35.0	26.0	34.62	22060	34640	2.57
Short duration rice (*Jogesh*)	10	7.5	22.0	14.6	50.68	18200	15316	1.84
Total	**176**	**32.8**						

2.2.5 Water saving rice cultivation methods:

Water saving rice cultivation through SRI, short duration varieties, direct seeded rice*etc.*have been demonstrated in 49.3 ha area of 138 number of farmers' fields. These interventions were carried out in seven NICRA adopted villages.




Table: Performances of water saving technologies for rice cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Line sowing by rice drum seeder	36	15.5	38.0	29.1	31.0	14580	35720	3.44
Direct seeded brown manured rice	38	10.2	45.5	35.0	30.0	32900	36100	2.12
Water saving technology through SRI	6	1.0	53	39.0	35.9	14850	19300	2.34
DSR (var. *Anjali*)	44	20.0	40	30.0	33.3	22858	33800	2.38
SRI/Use of trans-planter	14	2.6						
Total	**138**	**49.3**						

2.2.6 Community nurseries for delayed monsoon:

Seedlings of 25-30 days age are transplanted in July so as to complete flowering of photosensitive varieties before October and harvesting by mid November to facilitate taking up of timely sowing of *rabi* crops. Such a practice ensures optimum performance of both *kharif* and *rabi* crops. It appeared that failure of rain in July is responsible as transplanting of rice is delayed with resultant adverse effect on productivity and a cascading negative impact on rabi crops. Delay in transplanting of rice affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides rice other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 3 ha area of 45 numbers of farmers. These interventions were carried out in five NICRA adopted villages.


Table: Performance of Community nurseries

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Community nursery of tomato	6	0.4	325	248	31.1	131250	142875	2.08
Community nursery of brinjal	11	1.0	560	420	33.3	75000	205000	3.7
Community nursery of onion	21	1.3	230	185	24.3	145000	12000	1.8
Community nursery of Chilli (Tejaswini)	7	0.3	112	75	49.3	177500	362500	3.04
Total	**45**	**3**						

2.2.7 Location specific intercropping systems with high sustainable yield index:

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

Intervention on location specific intercropping was demonstrated in six NICRA adopted villages. The demonstrations were carried out in 4.05 ha area of 50 number of farmers' fields. Of all these intercropping of maize + ladies finger was found most popular although maximum return (B: C: 8.74) was found in Chilli + ladies finger intercropping.

Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cauliflower + Ridge gourd	5	0.4	700	560	25.0	163800	224800	2.37
Brinjal + Coriander	6	0.4	600	502	19.5	145700	272600	2.87
Cucurbits / Gourd + solanaceous vegetables	22	1.5	Gourd : 63 Vegetables: 272			97500 + 120000 = 217500	64500	3.02
Maize+Ladies finger	8	0.8	Maize: 87	Maize: 75.0		63750	121500 +17250 = 138750	3.17
Others if any chilli + tomato	9	1.0	320	260	23.1	48000+ 193200= 241200	113700	1.89
Total	**50**	**4.1**						

2.2.8 Introduction of new crops/ crop diversification:

Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in the different NICRA adopted villages. These demonstration were carried out in 136.5 ha area of 851 number of farmers' fields. Introduction of *ol* (var. *Gajendra*) in the cropping pattern. District is the most promising one which gave maximum economic return (B:C:: 6.89).

Table: Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Crop Diversification by Hybrid Maize var. Kaveri	25	4.5	118q/ha (green cob)	65 q/ha (green cob)	81.5	45200	72800	2.60
Crop diversification by Sweet corn variety- Sugar-75	14	1.4	116q/ha (green cob)	97(q/ha) Green cob	19.5	72000	160000	3.20
Onion (var. *N-53*)	45	7.5	305.3	200.1	52.6	70500	305650	5.45
Mustard (var. *Pusa bold*)	49	21.9	10.1	7.1	40.8	24800	40970	2.77
Chilli (var. *Surajmukhi*)	45	7.5	90.0	48.0	87.5	77000	189000	3.45
Gram (var. *Pusa 362*)	63	15.2	17.1	9.0	88.8	26650	46800	2.86
Tomato (var. *Param F1*)	55	8.5	210.0	140.0	50.0	78700	157550	3.11
Cabbage (var. *OM-3*)	51	8.5	360.0	265.2	35.8	74800	235000	4.24
Radish (var. *Suhra -32*)	45	5.4	142.0	90.2	57.7	71100	83000	2.27
Brinjal (var. *F1-Hybride Long*)	46	9.0	250.1	170.1	47.0	78500	169500	3.26
Cauliflower (var. *MSN-16*)	51	6.5	229.0	130.0	76.1	82800	196000	3.47

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
French Bean (var. *FE-51 ANUPMA*)	38	2.5	68.8	42.0	63.8	80900	107000	2.35
Turmeric (var. *Rajendra soniya*)	40	7.0	230.1	160.0	43.7	81000	310000	4.77
Ginger (var. *Nadiya*)	40	3.9	227.2	170.1	33.5	110000	590000	6.83
Lentil (Short duration var. *PL 406*)	39	6.2	12.4	6.7	85.0	18000	30000	2.74
Linseed (Short duration var. *T 397*)	29	6.5	7.5	4.8	56.2	11000	19000	2.83
Ol (var. *HYV Gajendra*)	38	3.7	650.3	250.0	160.1	94000	551840	6.90
Nutritional garden- veg. seed Seem (*dolicus lablab)*	78	4.8	19.5	12.1	62.5	8000	17000	3.27
Tomato under mulching	60	6.0	78.1	42.2	85.7	10000	30000	3.33
Total	**851**	**136.5**						

2.2.9 Other Demonstrations:

There are some other demonstrations in various aspects mentioned in the following table which was carried out in different NICRA adopted villages involving 602 numbers of farmers. Among all the demonstration cultivating contingency crops like brinjal, cauliflower and short duration tomato and banana bunch cover, integrated fish farming were remunerative.











Table: Performance of other demonstration

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Demonstration on disease & pest resistant rice variety Pratikshya	25	6.0	45	41	9.7	30000	35100	2.10
Cultivation of disease resistant Tomato var. ArkaRakshyak	10	0.5	245	220	11.3	82000	346000	5.20
Cultivation of short duration green gram var. IPM 02-3	10	3.7	7	5	40.0	15510	22490	2.40
Income generation activities (Marigold cultivation by women SHGs)	12	-	125 q/ ha flower yield	85 q/ha	-	78000	294000	4.70
Vermicomposting	4	4 unit	5q/pit	4q/pit	25.0	1500	3500	3.30
Oyster mushroom cultivation by WSHGs	8	-	2.2 kg	1.8 kg/ bed	-	40/- per bed	136/-per bed	4.40
Contingency crop Brinjal (var. *PUSA Uttam*)	20	3.0	350	290	20.6	59500	291950	6.64
Integrated crop management of mustard (*NC-1*)	50	7.4	35	20	75.0	40560	47580	2.13
Promotion of stem rot resistant Jute (var. *JBO-2003H*)	43	6.5	40	32	25.1	35500	49900	2.45
Integrated crop management of lentil (*Maitri*)	40	5.5	15	9.5	57.8	31500	42970	2.41
Integrated disease management in vegetables	25	5.5	245	218	12.4	96000	41500	1.51
Demonstration short duration vegetables as contingent crop Tomato (var. *PUSA Gaurav*)	23	3.5	351	284	23.6	59500	197500	4.63
Contingency crop Cauliflower (var *PUSA Sharad*)	30	2.2	260	200	30.0	61000	237500	4.85
Contingency crop Radish (var. *PUSA Chetki*)	43	2.5	150	110	36.3	57500	65900	2.19
Soil reclamation : Levelling / bunding and flooring for leaching of salt	37	8.0	35	28	25.0	40000	49000	2.29
Integrated fish farming	40	5.7	4	2.5	60.0	58000	141200	3.39
Integrated farming system	45	5.5						
late blight disease of potato	20	2.5	300	265	13.2	122500	195000	2.54

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Bio-control agent production	30	-	-	-	-	Rs. 55/Kg	Rs.600/Kg	-
Mushroom	32	-	15		-	Rs. 25/ cylinder	Rs.55/ cylinder	3.22
Forest tree plantation	55	1500 Plant						
Total	**602**	**68.0**						

2.3 MODULE III-LIVESTOCK & FISHERIES

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

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

Community lands of an area of 6 ha and 5 unit involving 169 number of farmers utilized for different fodder production were demonstrated in eight different NICRA adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return.

Table: Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Sudan Grass	15	5 units	2920 lt. milk/yr	2628 lt. milk/yr	11.1	45000	42600	1.95
Hybrid Napier	154	6 ha	180	175	12	12470	7607	1.61
Total	**169**	**5 units & 6 ha**						

2.3.2 Improved fodder/feed storage methods:

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. In 2018-19, delayed onset and deficit rainfall conditions were experienced in several states. There was reduction in area under millets and pulses, which are important to meet the fodder requirements in the rainfed areas. Short and medium duration fodder cultivars of several crops and fodder species both in *kharif* and *rabi* seasons were demonstrated in farmers' fields under rainfed and limited irrigation conditions to support income and cash flow from animal husbandry Improved fodder of rice bean and silage making were demonstrated in farmers fields. Silage making for 28 numbers and 2 ha of units showed very promising results.

Table: Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Production of Napier grass for feed supplement of domestic animal	10	10 units &1.2 ha						
Azolla cultivation for feed supplement of domestic animal	42	42 units	3 kg/unit/ month			220/unit	900/unit	4.09
Hydroponic fodder production	7	7 units	1800	1100	63	18000	54000	4.00
Azolla in poultry	7	7 units	2	1.7	17	115	385	4.30
Rice bean	20	0.5 ha	250	240	20	8450	15464	2.83
Maize	30	0.5 ha	280	270	15	10500	15330	2.46
Hybrid napier co4	5	0.4 ha	200	-	-	70000	30000	1.42
Total	**121**	**66 units & 2.6 ha**						

2.3.3 Preventive vaccination:

Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming *etc.* in nine different NICRA adopted villages. Mortality rate reduce up to the extent of 90% and average increase in cattle milk yield up to 40% have been recorded after the vaccination camps organized.

Table: Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	386	492	949lt. milk/ yr	840lt. milk/ yr	13.0	15000	13470	1.90
Vaccination for PPR in goat and Ranikhet in Poultry.	235	486	Body wt(90days) 6.6kg	5.4kg	23.0	700	1280	2.80
Deworming	334	312	912lt. milk/ yr	840lt.milk/ yr	8.5	15000	12300	1.82
Mineral mixture	145	292	1131	985	14.8	16000	17930	2.12
Vaccination camp against other diseases	92	33						
Total	**1192**	**1615**						

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

Composite and cat fish rearing in the existing pond or in renovated pond were demonstrated in 113 farmers' fields of NICRA adopted villages. *Khaki Campbell* duck was also introduced through this intervention.





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

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cultivation of cat fish in cemented tank	8	8 units						
Composite fish culture by stocking of yearlings of Catla, Rohu and Mrigal	48	4.7	38.4	24.9	19.7	190000	232000	2.20
Stress tolerant fish (Asian Catfish) integrated with IMC for effective utilization of available water IMC (Catla:Rohu:Mriguel@ 3:4:3) = 1300 no./bigha for 4 months + Asian catfish : 1000 no./bigha for 8 months	3	0.13	34.1	30.1	21.7	220000	523000	3.34
Installation of Periphyton net by covering 40% of water surface area to facilitate natural feed production in pond and to reduce cost of artificial feed in *Tilapia* culture	2	2 units (0.13 ha)	225.2	210.0	7.14	757500	1495500	2.97
Eco Hatchery for Carp Breeding (Reservoir – 1 Breeding pool – 1 Hatching pool – 1 Spawn collection chamber – 1)	1	1 unit	Production of 5.2 million spawn of IMC (Catla, Rohu, Mriguel, Bata and *Puntius javonicus*) & Work opportunity for 3 rural youths			17000	42000	3.47
Total	**62**	**11 units & 4.96 ha**						

2.3.5 Livestock demonstration:

Demonstration of rural backyard poultry (*Kuroiler, Nicobari fowl*), *Khaki Campbell* duck, T X D breed of pig, mineral mixture and azolla as cattle feed were carried out in 343 number of farmers fields. Rearing of poultry birds howed very promising results (B: C:: 4.5).




Table: Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Promotion of Ghungroo Piglets	5	5 units&15 nos.	-	-	-	10000	7000	**1.70**
Promotion of poultry breed Rhode Island Red (RIR)	21	21 units &300 nos.	-	-	-	-	-	-
Empowerment of SHG through Egg Incubator	45	1 unit &1 no.	-	-	-	-	-	-
Promotion of goatery breeds for strengthening of marginal farm women	8	8 units &16 nos.	-	-	-	-	-	-
Duck Rearing-Khaki Campbell	111	320 nos.	2.4	1.8	33	550	1650	4.40
Rearing of poultry breed Vanaraj	88	110 nos.	2.5	1.8	39	200	700	4.50
Demonstration of stress tolerant breed Kadaknath	45	310 nos.	2.2	1.7	29	220	880	5.00
Colourbird poultry	20	400 nos.	2.3 kg	2.0 kg	15	180	280	2.55
Total	**343**	**35 units & 1472 nos.**						

2.3.6 Improved shelters for reducing heat stress in livestock:

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


Table: Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Cement flooring, Straw thatched roof, with mosquito repellent net for better hygienic for cattle	13	41	1022.0	912	12	18000	30660	12660	1.70
Low cost shed with raised bamboo platform	2	2	18.0	15	20	2100	8000	5900	3.80
Improved cowshed	3	3	4.6	4.4	4.5	25550	49680	24130	1.94
Low cost goat shed	8	15	Bw. gain- 57 g/day	Bw. gain- 46 g/day	23.9	3200/- per goat per 1 year	9000/- per goat per 1 year	5800/- per goat per 1 year	2.81
Total	**26**	**61**							

2.4 MODULE IV: INSTITUTIONAL INTERVENTION

Strengthening the existing institutional interventions or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, and introduction of weather index based insurance and climate literacy through a village weather station and awareness developed of 1158 number of farmers in the zone.

Seed Bank: Village level seed production of short duration, drought and flood tolerant varieties was taken up by farmers and seed societies in several NICRA villages with the technical support of KVKs in rice, soybean, foxtail millet, greengram, pigeonpea, finger millet, chickpea, wheat, rapeseed and mustard. To tackle contingency situations, increased availability of tolerant varieties was accorded priority especially in the case of rice, soybean and foxtail millet during 2018-19. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

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

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

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

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

Interventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No./ Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	6	Rice - Sahabhagidhan, Swarna Shreya	23q	Rouging,drying	72	46 ha
		Blackgram	55	Seed Production	440	0.8
		Rice var - Swarna Sub – 1	3.5 q	Metal seed bins, layers of dried neem leaves and dry chilli kept with seeds to prevent insect infestation	31	4.2
		Rice var – Sahabhagidhan	30 qt/15/300 per month	Rice var- Sahabhagidhan	15	10
		Black gram	47q	Proper care and storage of black gram. Seed treatment with bavistine. Preservation of germination quality. Registration of seed bank	34	47q
		Swarna Sub 1 Rice	10 q	-	25	1
Fodder bank	3	Hybrid Napier	35		120	0.2
		Maize	39 q	Proper care and storage of maize seeds. Seed treatment with bavistine. Preservation of germination quality. Registration of fodder bank	26	39 q
		Hybrid Napier	200 q	-	30	1
Custom hiring centre	6	Rice, Maize, Vegetables, Jute	Rs. 43900		55	1
		Power tiller, sprayer, reaper, diesel pump set, weeder, Thresher cum winnower, MB Plough, seed cum fertilizer drill			88	34 ha
		Power tiller	Rs.250/hr	Ploughing	14	12 ha
		Rice reaper	Rs.250/hr	Reaping rice	8	7 ha
		Power sprayer	Rs. 20/-hr	Spraying pesticides	25	2 ha

Interventions	No.of KVKs	Details of activity			No. of farmers	Unit/ No./ Area (ha)
		Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
		Power Tiller	2 no.* (Rs. 250/hr)	Managed by VCRMC	27	7.2
		Pump set	4 no. (Rs. 80/day)		25	6.7
		Battery operated Sprayer	6 no. (Rs. 50/hr)		40	10.7
		Rice thresher	6 no. (Rs. 100/ day)		42	11.2
		Tractor drawn labeller, Tractor drawn MB plough, Tractor drawn rotavator, Self-propelled riding type reaper, Diesel pump set, Knapsack Sprayer	17000		126	74
		Power sprayer, power tiller, Thresher, motor Pump			72	1
Climate literacy through a village level weather station	2	Weather station- Rain gauge, Stevenson screen, wind vein		Daily data recorded by VCRMC	1650	14
Others (if any)	1	Elephant foot yam	4		32	7 ha
Total					**2997**	**108 ha, 86 q & 143 nos.**

2.4.1 Village Climate Risk Management Committee (VCRMC)

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

2.4.2 Custom Hiring of Farm Implements and Machinery:

Timeliness of agricultural operations is crucial to cope with climate variability, especially in case of sowing and intercultural operations. Access to implements for planting in ridge-furrow, broad bed furrow and raised beds is essential for widespread adoption of resilient practices for *in situ* soil moisture conservation and drainage of excess water in heavy soils. In rainfed areas, availability of such farm implements to small and marginal farmers is important. Similarly in irrigated areas, residue management of *kharif* crops through zero till cultivation of *rabi*crops reduces the problem of burning of residues and adds to the improvement of soil health and increases water use efficiency. Custom hiring centres (CHCs) for farm implements were established in NICRA villages. A committee of farmers' manages the custom hiring centre. The rates for hiring the machines /implements are decided by the VCRMC. This committee also uses the revenue generated from hiring charges and deposits in a bank account opened in the name of VCRMC. The revenue is used for repair and maintenance of the implements and 25% share is earmarked as a sustainability fund. Different types of farm machinery are stocked in the CHCs, the most popular being Zero till drill, Happy seeder, BBF planter, drum seeder, multi crop planter, power weeder and chaff cutter. Each CHC was provided an initial sum of Rs. 4.25 lakhs for its establishment under NICRA project. Revenue generated through custom hiring and under VCRMC in different KVKs were presented in the following table.

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

	Revenue generated (Rs.)	
Name of KVK	**From Custom Hiring Centres**	**Total under VCRMC**
Cooch Behar	43900	62000
Malda	5235	57215
Port Blair	17500	54500
South 24 Parganas	23100	223000
Kendrapara	6800	6800
Sonepur	5000	33000
Jharsuguda	11000	47952
Ganjam	3400	14620
Kalahandi*	-	-
Total	**115935**	**499087**

* No CHC has been established yet

3. Capacity Building

A total of 127 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 3825 farmers and farm women (2530 male and 1295 female) during 2019-20. Thematic areas covered on SRI, scientific crop management, crop diversification, land shaping, green manuring, natural resource management, resource conservation technology, animal feed management, nursery raising, pest and disease management, weed control, vermicompost, value addition, livestock management, oilseed and pulse demonstration, farm implements, drudgery reduction *etc*. The HRD programme conducted on the basis of priority area of farmers or farm women.











Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Livestock and Fishery Management	Empowerment of farm women through Poultry and duckery farming	3	0	102	102
	Sustainable income generation of rural youth through pig farming	1	0	30	30
	Application of Floating feed in Pisciculture	1	27	8	35
	Training on importance of hydroponic & azolla cultivation & animal feed	1	18	17	35
	Training on Scarcity feed management	1	25	20	45
	Training on deworming & vaccination schedule of livestock	1	35	0	35
	Nursery pond management	2	20	15	35
	Composite fish culture	2	37	13	50
	Integrated Fish Farming with livestock & horticultural Crops	1	28	7	35
	Back yard poultry rearing of Kadaknath	1	29	6	35
	Care and management of dairy animal during heat stress	1	24	26	50
	Rearing of feed management of backyard poultry	1	0	25	25
Integrated Pest and disease Management	Management of Pest & diseases in Rice	2	40	20	60
	Management of Pest & diseases in Pulses	1	28	7	35
	IPM practices of kharif vegetables	2	35	15	50
	IPM practices of rabi vegetables	2	30	10	40
	IPM practices of summer vegetables	1	28	12	40
	IPM &INM System of Assured Rice Production (SARP)	1	32	3	35
	Disease and pest management in Rice	1	26	9	35
	Disease management in stress tolerant crops	1	23	27	50
	Practice of bio-pesticides for management of sucking pest in cotton	1	22	28	50
Natural Resource Management	Zero tillage technology of maize	2	50	25	75
	Transplanting rice through transplanter machine	2	45	25	70
	Waste Management for Sustainable Environment	2	55	20	75
	Water Harvesting and Management	2	60	15	75
	Contingency planning for kharif 2019	1	25	5	30
	Conservation of water & its judicious use for sustainable development	1	52	18	70
	Post Cyclone (Bulbul) Contingency Planning for Rabi season	1	25	5	30
	In-situ moisture conservation in vegetable	1	33	17	50
	Trenching and bunding method in mango plantation	1	16	24	40
	Use of farm machinery for conservation of soil moisture	1	23	17	40
	Onfarm water conservation in rice	1	28	7	35
Crop Management	Cultivation of rabi crops (Rice, Potato, Vegetables, Lentil, Mustard)	8	210	70	280
	Bio-intensive pest management practices for Rabi crops	1	34	10	44
	Importance and conservation of pollinators for better crop production in climate change perspective	1	43	2	45
	Hybrid vegetable cultivation	1	28	7	35
	Crop diversification from rice to non rice crop- groundnut	1	32	3	35

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
	Training on Use of green manuring for better fertility status and crop yield	1	14	26	40
	Training on high density planting system in cotton	1	26	24	50
	Management in black gram in rice fallow cropping system	1	13	27	40
	Scientific cultivation of swarna sub 1	1	27	8	35
	Management of maie based intercropping system	1	21	14	35
Fodder and feed management	Azolla cultivation for feed supplement of domestic animal	2	30	25	55
Resource conservation Technology	Vermicomposting, use of Bio-Fertilizer in diff. crop	1	24	11	35
	Resource conservation technology and implementation	1	40	10	50
	Cultivation of pulse crop as paira cropping	1	31	4	35
Integrated Farming System	Importance, scope and implementation of IFS	2	22	8	30
Farm implements and machineries	Effective use of farm machinery though Petroleum conservation	2	60	0	60
Organic farming	Training on Organic Farming.	1	24	11	35
Vermi composting	Training on Vermi-composting	1	31	14	45
Soil sample collection Technique	Training on Soil sample collection technique	1	27	8	35
Income generation activity	Scientific method of Mushroom cultivation	1	32	8	40
	Employment generation of SHGs through Egg Incubator	2	20	55	75
	Training on Marigold cultivation	1	30	5	35
Mushroom cultivation	Training on mushroom production	3	24	51	75
	Low-cost technology for mushroom cultivation for rural youth	4	33	7	40
	Low-cost technology for mushroom cultivation for women	2	25	15	40
Off- season Vegetable Cultivation	Training on Off- season Vegetable Cultivation	4	32	28	60
Multi tier horticulture	Selection of vegetables to be grown in multitier	2	25	10	35
Value addition	Value addition for fruits and vegetable crops	3	38	7	45
Nutrient Management	Nutritional garden	3	46	34	80
	System of assured Rice production -IPM & INM	1	22	2	24
	Application of chemical fertilizer based on STBF	1	18	22	40
	INM in Groundnut	1	26	9	35
Nursery raising	Nursery raising , Grafting techniques of veg. & fruits	1	35	10	45
	Seedling production of different horticultural crops throughout the year.	1	29	6	35
	Nursery raising under low cost polytunnel	1	22	13	35
Soil health management	Importance of soil health management and soil sampling	2	35	10	45
Seed production	Seed production technology of pulses	3	43	7	50
	Seed production of turmeric ginger elephant foot yam	2	22	13	35
Improved package of practices	Improved package of practices of pulse cultivation	2	49	11	60
	Package of practices for wheat and maize	1	45	15	60
	Improved Package of practices for winter vegetables crops	3	28	7	35
	Improved Package of practices for summer vegetables crops	1	21	9	30

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Post harvest technologies	Post harvest technologies for vegetables	2	27	8	35
Traps	Use of different attractants/ traps for vegetables	2	31	9	40
	Use of traps for mango and litchi	2	27	13	40
Care & management	Care & management of lactating mother	1	31	14	45
Water borne diseases	Care & management against water borne diseases particularly after flood	2	22	13	35
Awareness programme	Awareness programme on Swachh Bharat Abhiyan	1	36	24	60
Total		**127**	**2530**	**1295**	**3825**

4. Extension Activities

NICRA implementing KVKs conducted a total of 319 extension activities on various thematic areas benefitting 13174 practicing farmers and farm women (7854 males and 5320 females) during 2019-20. The extension activities were conductedon Method demonstrations, Agro advisory services, Awareness camp, Animal Health Camp, Krishak Chaupal, Kishan gosthi Resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, Technology week, Kisan mela *etc.*














Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Method demonstrations	20	395	314	709
Group meetings	17	413	299	712
Field day	26	777	358	1135
Exposure visits	16	425	223	648
Awareness Campaigns	22	720	348	1068
ICT based extension services	12	366	187	553
Diagnostic visit	21	398	420	818
Field Visit	30	704	508	1212
World Environment Day Celebration	11	275	164	439
Live Webcasting	12	293	166	459
Strengthening SHGs	5	0	174	174
Strengthening kisan clubs	9	252	165	417
Other Training Courses	15	466	191	657
KMAS Services	14	372	267	639
Popular extension literature	18	394	310	704
Animal Health Camp	28	708	584	1292
NICRA Workshop at ATARI, Kolkata	12	294	176	470
Scientist visit to field	18	380	238	618
Kisan Mela	13	222	228	450
Total	**319**	**7854**	**5320**	**13174**

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

December 5 is declared as 'World Soil Day' by the International Union of Soil Sciences and to celebrate the importance of soil as a critical component of the natural system and as a vital contributor to human wellbeing, all the NICRA-KVKs have organized Seminar/symposia/workshop. The World Soil Day campaign aims to connect people with soil and raise awareness on their critical; importance in our lives. One of the several ways of connecting people with soils is to restore and preserve the soil health. All the nine NICRA-KVKs of Zone-v distributed the soil health cards among the farmers in NICRA adopted villages. A total of 1082 numbers of Soil Health Cards were distributed on that particular day and cards were distributed by the public representatives like MP/MLAs and others in the respective KVKs. KVK wise distribution of soil health cards are presented in the following table.




Table : Soil Health Card prepared and distributed during 2019-20

KVK	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers benefitted
Port Blair	42	42	52	52
Ganjam I	24	24	108	108
Sonepur	35	35	70	70

KVK	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers benefitted
Kalahandi	12	12	12	45
Jharsuguda	12	12	45	45
Kendrapara	36	36	36	120
Coochbehar	360	360	425	425
Malda	325	325	281	281
S. 24 Pgs	53	53	53	39
Total	**899**	**899**	**1082**	**1185**

ICAR-CRIDA Team visited RAKVK, Nimpith and NICRA Village

Dr. G. Ravindra Chary, Director, CRIDA and Dr. K. V. Rao, Principal Scientist, CRIDA, Hyderabad, paid their august visit to Ramkrishna Ashram KVK at Nimpith, South 24 Parganas on 6th of July, 2019 . At first, a thorough discussion was held with our Revered Chairman Swami Sadanandaji Maharaj regarding the NICRA activities and then a field visit was organized at the NICRA village at Bongheri.

During their visit to Bongheri, they observed various climate resilient Technology Demonstration Components (TDC), implemented by our KVK and appreciated the effectiveness & suitability of such technologies to mitigate the climate change related vulnerabilities in the village. An interaction meeting was then organized with the villagers where various issues regarding the implementation and fruitfulness of the NICRA programme were discussed. All villagers equivocally agreed upon the fact that the NICRA programme has changed the fate of the Bongheri village, since the "*Aila*" (Super Cyclone) setback in 2009. Now, both the farmers and landless labourers have on-farm engagement in the village itself, throughout the year.

6. Zonal Monitoring Committee of NICRA-TDC visited South 24 Parganas KVK of West Bengal

On 10, July, 2019, a high level Zonal Monitoring Committee, under the Chairmanship of Hon'ble Dr. H. K. Senapati, Former VC & Dean, PGF cum DRI, OUAT, Bhubaneswar and Members - Dr. B. Kandpal, Joint Director, ICAR Research Complex, Tripura as DDG (NRM) nominee and Dr. J. V. N. S. Prasad, NICRA Coordinator, CRIDA, Hyderabad as Director, CRIDA nominee and Member Secretary, Dr. F. H. Rahman, Principal Scientist & NICRA Nodal Officer, ICAR-ATARI, Kolkata, visited Ramkrishna Ashram KVK, Nimpith, South 24 Parganas for monitoring the activities and outcome of the project on National Innovations on Climate Resilient Agriculture (NICRA).

Indian Council of Agriculture Research (ICAR), New Delhi, started this Network Project in 2011with an aim to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. During 2011-12 financial year, a project was sanctioned to Ramkrishna Ashram KVK, Nimpith, by the Central Research Institute of Dryland Agriculture (CRIDA), Hyderabad, through ICAR-ATARI, Kolkata, under Technology Demonstration Component (TDC) of NICRA. The objective of the project was to demonstrate climate resilient agricultural technologies to mitigate the climate change related vulnerabilities faced in the Sundarban region of South 24 Parganas district in West Bengal. Accordingly, Bongheri was selected as a representative village of Sundarbans, vulnerable to cyclones and prolonged submergence due to intensive rainfall in a short time span. The demonstrations conducted here were grouped under (a) Natural Resource Management, (b) Crop Production, (c) Livestock & Fisheries Development and (d) Institutional Interventions.

At the very beginning, the Hon'ble Members of the Committee were welcomed by Revered Swami Sadanandaji Maharaj, Chairman of RAKVK, Nimpith, who with his vast experience of working in Sunderbans, explained the practical problems faced by the resource poor farmers of this region. Then the members visited the Resource Centre of the KVK where different technologies, promoted by the KVK, were displayed to them.

Afterwards, a meeting was conducted by the ZMC where all the KVK staff participated. The meeting began with the welcome address from the In-Charge, Senior Scientist & Head of the KVK. Then Dr. H. K. Senapati, Chairman of the committee, discussed about the objectives of their visit. All the project reports and video documentation were submitted to the committee. Then the project activities were presented to the committee as a power point presentation by the SMS (Plant Protection) of the KVK.

An elaborate discussion was held over the relevance of each technologies towards climate resilience, their specifications, implementation, performance, acceptance and horizontal spread. The NICRA interventions are undertaken over 213 ha of cultivable land owned by more than 400 farm families. The best performing climate resilient technology was found to be Land Shaping that supported integrated farming system. The other important technologies were Ail cultivation, Bund-cum-Trench system, rejuvenation of water bodies and drainage channel, plantation of Mangrove, green manuring, vermicomposting, introduction of submergence and salinity tolerant rice varieties, organic mulching, animal health care, stress tolerant poultry birds and fishes, fish hatchery, seed bank, custom hiring centre, weather observatory, etc. All the developmental work were organized through Village Climate Risk Management Committee (VCRMC), which is represented by 30% women members. Dr. Kandpal praised for all the interventions and also suggested to take up these activities in a Farming System approach. He also advised on some latest and suitable varieties of oilseed crops that can be incorporated in the project. Dr. Senapati praised the integrated approach of rice-cum-vegetable-cum-fish farming and also advised to take up more demonstration on Rice cum fish cultivation for judicious utilization of land and water resources during kharif season. Dr. Rahman pointed out to the fact that all the NICRA interventions in the village were aimed at doubling of farmers' income and also suggested to take up more such income generating activities like mushroom cultivation, food processing, etc.

After deliberation of the presentation and a very constructive discussion, a visit was organised to the project site, Bongheri. The village is located on the periphery of a Sundarban island (Gopalgunj Gram Panchayat), at the bank of brackish water river *Matla* and is protected from its tidal surge through 4 km long river embankment. The members along with the KVK staffs and villagers first visited the river embankment, which is also the highest altitude point now, and from where, they could visualize the entire village's flat topography. They were very much convinced about the vulnerability of the entire village to saline water ingression, during intensive cyclone and breaching of the embankment. They praised the effort of all the villagers, lead by the VCRMC, in strengthening this embankment through Mangrove plantation along it.

Next, the members visited the plots of land shaping (Birupaksha Naskar), bund and trench system (Radhakanta Mali), Ail cultivation (Ananta Naskar), catfish hatchery through roof top rainwater harvesting (Gouranga Naskar) and other interventions and expressed their pleasure to witness the smile in the faces of all the family members.

After the field visit a small meeting was organized by the VCRMC at the custom hiring centre where more than 100 farmers gathered. The villagers were asked about the relevance & fruitfulness of the NICRA project in their village. To this, all the villagers equivocally acknowledged the untiring efforts and supports of the KVK, ICAR-ATARI Kolkata and CRIDA, Hyderabad officials for uplifting their livelihood in the climate change scenario.

Smt. Bamni Mondal told that she could earn Rs. 2.5 lakh per year by adopting land shaping, sprinkler irrigation and fishery under the NICRA project. Earlier she used to get Rs. 6000/- only per year from Kharif rice cultivation. In the remaining part of the year, her husband had to migrate to the city for job and she used to do labour work in other village. Now their Family income has substantially increased so that they can do farming in their land throughout the year and lead a peaceful life. Others like, Alok Naskar, Nemai Naskar, Rabi Makhal, Madan Mondal, Sanat Naskar, had the same story to narrate.

Dr. Rahman and Dr. Prasad asked the villagers about any other requirement that need to be addressed. The villagers told that the custom hiring centre has helped them in timely farm mechanization at a cheaper rate. However, they demanded to increase the number of power tiller and sprayers in the CHC so as to cater more farmers at a time. Several of them requested for desiltation and renovation of derelict ponds, repairing the existing sluice gate for better control of brackish water ingress and rejuvenation of a drainage channel. The committee members gave a patient hearing to all the demands of the villagers and assured for a justified sanction in the near future.

After returning from the village, the committee members once again sat for a discussion with the Chairman and other staffs of the KVK and suggested some future course of action. Dr. Prasad suggested the KVK to bring out good quality publications for widespread circulation of the climate resilient models developed by the KVK.




7. QRT of ICAR-ATARI Kolkata and Patna visited NICRA adopted village at Jharsuguda, Odisha

On September 5, 2019 the Quinquennial Review Team of ICAR-ATARI Kolkata and Patna, under the Chairmanship of Dr. R. K. Samanta, Former VC, BCKV, Mohanpur & Former Director, ICAR- NAARM, Hyderabad and the Members-

Dr. C. Satapathy, Former DEAN, OUAT, Bhubaneswar; Dr. Y. V. Singh, Former Director, ICAR-ATARI Jodhpur; Dr. R. B. Sharma, Former DEE, IGKV, Raipur, Chattishghar and Member Secretary Dr. F.H. Rahman, Principal Scientist, ICAR-ATARI Kolkata visited the NICRA adopting village *Bhoimunda* of Jharsuguda Krishi Vigyan Kendra, Odisha for monitoring the different activities under various module like NRM, crop production, livestocks & fisheries and outcome of the project. The members visited the Resource Centre of the KVK where different technologies, promoted by the KVK, were displayed to them. All the developmental work were organized through Village Climate Risk Management Committee (VCRMC), which is represented by farm men and women.

The salient recommendations emanating from the discussion directly related to the project sites as follows :

- Focus should be given on urbanization of Custom Hiring Centre for inflow of fund from other organization to NICRA village
- Human resource development through women empowerment should be increased
- Special focus to be given on selective breeding, upgradation of local breed, popularizing technologies that could minimize adverse effect on animal and fish components
- VCRMC is advised to organize more awareness meeting among the farmers for taking up the various interventions.

The Team appreciated the efforts of KVKs and active involvement of the farmers and suggested to scale-up the useable interventions in adjoining villages.


8. Convergence Programme

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
Ganjam I	AICRP on Goat, OUAT	Goat improvement	90000
	Woman empowerment by CIWA, Bhubaneswar	Training, exposure visit, Demonstration	90000
	Total		**180000**
Jharsuguda	Water shed Development Mission, Jharsugda	Desilting of WHS	500000
	Total		**500000**
Kalahandi	Department of Forestry	Roadside avenue plantation in the village	750000
	Total		**750000**
Cooch Behar	Department of Soil and Water Conservation	Renovation of drainage channel	500000
	Department of Forestry	Renovation of existing pond	200000
	Total		**700000**
Malda	State Deptt. of Irrigation/NTPC	Crocodile Bund Repairing of river Ganga	5500000
	State Deptt. of Agriculture	Micro Irrigation	32000
	MGNREGS	Pond renovation	180000
	MGNREGS	Canal renovation	225000
	MGNREGS	Road repairing	1800000
	Total		**7737000**
S. 24 Parganas	ICAR-DWR, Junagadh (under SCSP programme)	Rooftop Rainwater harvesting	400000
	Total		**400000**
	Grand Total		**10267000**

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 2019-20. The prominent development schemes are MGNREGA, NTPC, NABARD, Sunderban Development Board, Forest Department, Irrigation Department, different Departments of the concerned states. RKVY *etc*.



9. Dignitaries Visited NICRA Villages during 2019-20

Name of KVK	Name of VIPs/Experts	Date of visit
Cooch Behar	Kumar Kushal, Deputy Director and Mr. Ashoke Das, Assistant Director, Monitoring and Appraisal Directorate, Central Water Commission	07.02.2020
Ganjam-1	Dr. B. N. Sadangi, Scientist CIWA, Bhubaneswar Prof. P.K Roul, DEE, OUAT, BBSR	09.08.2019 18.12.2019
Jharsuguda	Dr. R.K Samanta, Former Vice-Chancellor, BCKV, Mohanpur Dr. S.S Singh, Director, ICAR-ATARI, Kolkata Dr. P.K Roul, Dean Extension Education, OUAT, Bhubaneswar Dr. C. Satapathy, Former Dean Extension Education, OUAT, Bhubaneswar Dr. R.B Sharma, Former Director, Extension Education, IGKV, Raipur Dr. Y.V Singh, Former Director, ICAR-ATARI, Jodhpur Dr. F. H Rahman, Principal Scientist, ICAR-ATARI, Kolkata	06.09.2019
Malda	Sri Gour Cahndra Mandal, Sabhadhipati, Malda Zilla Parishad Dr. Saikat Mukherjee, Deputy DEE, UBKV Mr. SK Singh, DDM, NABARD, Malda Dr. Saikat Mukherjee, Deputy DEE, UBKV	22.10.2019 23.10.2019
S. 24 Parganas	Prof. (Mrs.) Om Gupta, DEE, Jwaharlal Nehru Krishi Viswavidyalaya, Jabbalpur, MP R. Govinda Chary, Director, CRIDA, Hyderabad K. V. Rao, Principal Scientist, CRIDA, Hyderabad Dr. H. K. Senapati, Former VC, OUAT, Odissa Dr. B. Kandpal, Joint Director, ICAR Res. Complex, Tripura Dr. JVNS Prasad, National Coordinator, NICRA, CRIDA, Hyderabad F. H. Rahman, Principal Scientist, ICAR-ATARI Kolkata	18.04.2019 06.07.2019 10.07.2019
Kalahandi	Veterinary Surgeon Sub Divisional Veterinary Officer	18.07.2019 12.09.2019
Kendrapara	Dr. Tadyoshi Masuda, Ph.D, Kindai University, Japan	31.01.2019













10. Success story

Coochbehar

i. Use of Organic mulches in vegetable production

Name of farmer	**Arjun Oraon**
Address	Singimari Paschimpar
Contact details (Phone, mobile, email Id)	07797856014
Landholding	2.5 acre
Background of the technology	Use of organic mulches (Straw, vermi-compost) play an important role in the production of pointed gourd because they help in conservation of soil moisture, maintain the soil temperature, weed suppression, improving the soil fertility protect from disease pest which are ultimately helpful in boosting up the production. Beside this it also improves the quality and marketability of the produce.
Use of Climatic Vulnerability	Farmers of Teesta flood plains of Terai Region prefer to grow pointed gourd during winter months due to higher market demand and price. The region experiences extreme cold during January and February, when maximum and minimum temperature falls below 22°C and 8°C respectively, average being around 13°C. Cucumber is susceptible to low temperatures throughout its growth cycle. Cucumber cultivators of the district Cooch Behar also have similar experiences *i.e.* poor plant growth, development, fruit setting and poor yield of cucumber during rabi season with their conventional practice of cucumber cultivation without mulch.
Success point of the programme	1. It is seen that the soil temperature under both mulch and without mulch was recorded during the growth period. The average soil temperature during growth period was significantly higher(5^0c) in straw mulching than without mulch. 2. It is also revealed that the fruit setting percentage and fruiting period also increased in straw mulch area. 3. The average yield in straw mulching 16 tonne per hectare and 10 tonne per hectare in without mulch. 4. Number of the irrigation in straw mulch 8 number where in without mulch 11 number. So higher water use efficiency is an important part for straw mulch and better retention of soil moisture throughout the cropping season than without mulch.

Economic impact	1. Cost benefit ratio of straw mulch and without mulch 2.78
Social impact	From farmers view point the use of organic mulch(Straw) is found to be economically viable, profitable and give higher cost benefit ratio. It is very highly adoptable technology for the marginal farmer where low winter temperature and low moisture holding capacity of soil are detrimental for pointed gourd cultivation.
Environmental impact	Temperature is the main environmental component influencing vegetative growth, flower initiation, fruit growth and quality. Growth rate of the crop depends on the average 24 hour temperature, higher the average temperature faster the growth. Maximum fruit production is achieved with temperature of 20-22°C.
Horizontal/ Vertical spread	Considering the success of technologies in NICRA village initiatives were taken by Cooch Behar KVK to replicate the technology with straw mulching in vegetable specially pointed gourd grower and encouraging response has been received from farmers end.

South 24 Parganas (Nimpith)

i. Eco hatchery for carp breeding in Bongheri vllage of Sundarbans of South 24 Parganas

A small backward eco hatchery comprising of one reservoir, one breeding pool, one hatching pool and one spawn collection chamber was set up in the NICRA village "Bongheri" for facilitating carp breeding with the aim to supply quantity carp seeds to the fish farmers. The hatchery unit has been established by Mr. Sunil Banik, a marginal farmer having 0.13 ha of farm land and a pond of 0.13 ha.

Previously, most of the seeds used to come from far-away places like Naihati (200 km) and Gobardanga (215 km) and the quality of the seeds could not be ascertained. The price was also found to be expecetionally high. But the farmers had no other alternatives.

This year, as soon as the hatchery operation started, farmers from all corners of the village and also from neighbouring village, started placing orders for procuring carp seeds.

So far, Shree Banik could Produce 5.2 million spawn from four breeding operations, of which he sold 2.4 million spawn to fellow farmers worth of Rs. 9000/- and rest of the spawn was stocked in a nursery pond for growing successively to fry and fingerling stages. He has already sold 200 kg fry worth Rs. 50000/-. Now he is expected to produce 76q fingerlings within next 3 months, from the left over stock of fry. He has also plans to sale 30q of fingerlings to the fellow farmers and has decided to stock 20q of fingerling to grow upto table fish stage by culturing for another 8-10 months.

Thus, the establishment of the carp hatchery not only assured the supply of quantity fish seeds to the local farmers but has also opened up avenues for earning from different stages of the fish like spawn, fry, fingerling and table fish. The enterprise has also been successfully to attract the migrant rural youth and farmers to stay in the village during the Covid-19 lockdown period. His son and nephew has already returned to the village from Kolkata to assist him in the breeding operations and promised to stay back with him.

ii. Roof Top Rain Water Harvesting – a solution to drinking water problems in Sundarbans

Sundarbans is a vast tract of flat, densely forested, marshy islands enclosed by a network of saline tidal estuaries and creeks. Over the time, several of these islands have been inhabited by human beings through destruction of the mangrove forests, erecting dykes along the tidal streams and modifying the lands into cultivable ones. But one constraint, in the form of source of potable water, has remained the same or even worsened in many of these inhabited

islands. Groundwater is presently seen as the only source of safe drinking water on Sundarban islands, which is dwindling day by day. The NICRA village "Bongheri" is no exception to this reality where the depth of fresh ground water aquifer has reached to 1200 ft depth. Only two such drinking water bore wells are available in the village for more than 400 families.

To address the scarcity of drinking water in the village an innovative approach was taken up where the rainwater, collected through the roof top catchment area, is used for drinking and cooking purpose. This system is composed of the following five components.

a. Catchment: Roof top of the mud houses and pucca houses.

b. Conveyance: The rainwater pipes (PVC) are fitted to the outlet of roof surface. In case of corrugated asbestos roof of huts, a half slit PVC pipe is inserted horizontally along the surface and connected to another vertical collection pipe.

c. First flush: The first shower falling on the roof surface carries all the dust and dirt with it and hence is flushed out through a "first flush" device. This device remains in an open position. After few minutes of the start of a shower, when the dirty water flows out and clean water starts to come out, the device is closed. This device thus ensures passage of clean water in the storage tank devoid of silts and other materials deposited on the roof surface.

d. Filter: After first flush, the clean rain water is then channelized through a sand-gravel-charcoal filter to further remove the suspended particles in water and harvest potable water.

e. Storage tank: 1000 L capacity PVC tank is used for storing the filtered rain water.

In NICRA village 10 roof top rain water harvesting structures have been constructed during this year. The family members enjoyed the potable water for drinking and cooking from these structures throughout the rainy months. After the last shower, during "Bulbul cyclone" on 9th November 2019, all the tanks got filled up to the full capacity. Now the family members are using the water only for drinking water purpose. It is expected to support "**100 days of drinking water**" to a family of 5 members with 10 litre water per day. During rainy season also the women members need not to go out, fetching potable water from outside of their houses.

iii. Demonstration on System of Assured Rice Production (SARP) in *Kharif*

The system of assured rice production (SARP) is an innovative technology of producing healthy seedlings in specially prepared seedbeds where seedlings can be retained up to 60 days in case of climatic hazards at the time of transplantation. Thus it reduces the anxiety of farmers during the delay in transplantation in the main field due to prolonged submergence of main field followed by short intensive precipitation or due to long dry spells.

In Bongheri, the rice farmers frequently face the problem of either short intensive precipitation or long dry spell during rice transplantation. This results in delay in transplantation. At that time the seedlings in the nursery bed become aged, lean, weak and show multiple nutrient deficiencies. Such seedlings also become difficult to be uprooted. When transplanted, these seedlings result in poor growth and give 20-30% less yield than their potentiality.

The SARP technology can provide cushion to the farmers by providing a healthy growth of the seedlings in the modified, nutrient enriched seedbed for a prolonged period. SARP can be viewed as an ideal alternative for contingent cropping, combating changing climatic situation and restoring soil health.

The basic principles include production of healthy seedlings using very low seeding density (10-15 g per sq. m) and adequate addition of organic manure (2.5-5.0 kg per sq. m) and fertilizers in nursery. The seeds are treated with zinc sulphate and biocontrol agents.

During this Kharif season, a demonstration on SARP has been taken up in Bongheri village under the NICRA project. At first, training was organized at the KVK with the progressive rice farmers. Then training was organized at the village with the interested farmers. Necessary inputs like seeds, micronutrients and biocontrol agents were distributed among 11 beneficiaries on 21-06-2019.

The comparative yield and the economics of the technology are given below.

Economics of the technology

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
System of Assured Rice Production (SARP)	11	1.47	42.0	38.4	9.3	39000	29325	1.89

Malda

i. Azolla Cultivation – A rapidly spreading Climate Resilient Technology in flood situation

The farmers faced huge problems to arrange feed for the live-stock during the flood period. Considering the farmers' problem, the farm families belonging to relatively upland situation is recommended to cultivate azolla as livestock feed. Successful frontline demonstration by Malda KVK has increase the production of Azolla cultivation in the NICRA adopted villages and adjoining villages. Use of azolla as green fodder for cattle and poultry birds as protein supplement increase income by Rs. 3600 per animal /lactation and higher egg laying capacity upto 20%. In case of milching animals productivity is obtained 3.6 lt/ lactation/ animal/day whereas it is 2.75 lt/ lactation/ animal/day feeding only dry fodder (i.e. 31% increase in milk productivity per lactation per animal). Azolla as livestock feed is highly beneficial to the livestock farmers and is also liked by the livestock.

ii. In-situ moisture conservation practices through Zero Tillage technology in Wheat

Background: Due to continuous operation of conventional tillage on crop field, the residual soil moisture and nutrient status of soil are continuously

depleted. Apart from this due reduction of micro-organism in soil, the ecosystem of land is changing day by day and weed infestation is in increasing trend resulting in increased cost of cultivation and delayed sowing of wheat after harvesting of rice due to non-availability of soil moisture.

Scope of Technology: In West Bengal basically for area under Rice based cropping system after harvesting of rice huge area remained vacant for wheat cultivation. Conventional tillage, if practiced, may result in delayed crop sowing due to huge time taken in land preparation. Accordingly, Zero tillage cultivation system comes in practice utilizing the available soil moisture and weed infestation may be reduced without hampering soil structure by continuous tillage operation. It improves soil health due to decomposition of crop residue without disturbing of soil micro organisms.

Economics of Technology:

Interventions	Technology demonstrated	No. of farmers	Yield (Q/ha)	Economics of demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
In-situ moisture conservation practices	Zero Tillage Technology in wheat	150 nos. (20ha)	38.4	21375	55680	34305	2.61

Benefit of the Technology:

1. Time saving
2. Labour saving
3. Cost saving
4. Balanced fertilizer application
5. Less number of irrigation required
6. Reduction of weed infestation
7. Improves soil health
8. Increases yield
9. Increase organic matter in the soil
10. Save irrigation water up to 32% during growing period

iii. Mushroom Production: An Excellent Opportunity for Self Employment

Malda Krishi Vigyan Kendra organized several awareness programme cum demonstration to popularize the Mushroom production at adopted villages of Malda as most of the villagers do not know the benefit of Mushroom cultivation (as it is a low cost protein source which is eaten by vegetarians also) and most of the villagers are also suffering from malnutrition particularly farm women. After the awareness programmes and demonstration by Malda KVK, Mushroom production is in increasing trend in adopted villages of Malda District as whole.

Scope of the Technology:

The technology is highly potential because requirement of Mushroom is increasing day by day. District as well as block administrations like English Bazar Block, Ratua-I block, etc. issued order to all schools of their jurisdiction to incorporate Mushroom in their Mid-day meal. Apart from this several private company are also trying to increase Mushroom production in Malda district.

Economics of the Farm:

Crop/ Livestock/ Fish/Enterprise	Cost of Production (Rs. per unit)	Return (Rs. per unit)	Net Income (Rs. per unit)
Mushroom Unit	Rs. 672 (Rs. 32 per cylinder)	Rs. 4410 (Rs.210 per cylinder)	Rs.3738 per month (Rs.178 per cylinder)

1 unit = 21 cylinders; Size of cylinder = 14" x 22"; Rate-Rs.140/kg. of fresh mushroom

Benefit of the Technology:

The technology is highly potential because it uses the low cost materials. Farmers are highly interested to adopt this technology because any one can produce mushroom without hampering day to day activities of the respective family and increase the availability of low-cost protein food and reduce the malnutrition of the family.



Jharsuguda

i. Empowerment of farm women though backyard poultry rearing at Jharsuguda

Apart from being engaged in vegetable cultivation Smt Maithili Meher was in rearing of poultry in backyard as a subsidiary source of income . She owned 5 desi birds. Large number of the birds died during the monsoon suffering from *Ranikhet* disease. Higher rate of mortality was also observed during summer. Previously, she was engaged in rearing of desi birds in backyard system, the profit was negligible due to slow growth rate, higher mortality of birds. The lack of scientific knowledge and proper managemental practices were also the contributing factors towards the non receipt of profit from the practice. Under the NICRA programme of KVK Jharsuguda, she was provided with 15 nos of 21 day old *Kadaknath* poultry. She was imparted with training on scientific poultry production, supplementary feeding, health management and marketing. The interventions of NICRA gave her confidence to maintain the birds and to succeed in the practice. The poultry birds are allowed to free range during the day, and confined in a small shed during the night. A handful of grain (broken rice) was given as feed supplement daily. Lately, cultivation and feeding of Azolla was practiced. The birds started laying eggs upon attaining sexual maturity by 140 days. At initial laying period the egg size was small (40-45 g) but within a months period the eggs attained marketable size (55-60 g). The eggs with brownish colour of *Kadaknath* resembled that of local poultry egg and the birds attained body weight of an average of 1.8 kg and 2.2 kg for female and male birds, respectively. The annual egg production was an average of 80 eggs per bird. The birds were sold @ Rs. 500/kg live body weight and eggs were sold @ Rs. 10/egg. From 15 birds he was been able to get an amount of Rs. 12,000/-. Looking at the demand and performance of birds along with profit of Smt. Meher, other farmers and farm women of the village got interested, & started poultry rearing. After introduction of *Kadaknath* mortality rate reduced along with higher body weight and more remunerative value due to higher demand of meat. Introduction of more number of the stress tolerant poultry breed along with community brooding of birds in the village.

Treatment	Body wt (kg/ 6 months)	% change in body wt	Net Return (Rs/bird/ 6month)	B:C Ratio
Local bird	1.7	-	300	3.4
Kadaknath	2.2	29	800	5.0


Sonepur

i. Boosting crop yield and income through Cultivation of short duration rice-*Sahabhagi dhan*-*A initiative of Drought mitigation measure*

Shri Udhab Mahar, 58 years old farmer is the native Badmal village which is 22 km away from KVK, Subarnapur. He is a small farmer belongs to BPL category having 3 acres of upland. He is the only bread earner of the family. He is an innovative and

dynamic farmer of the village. He takes every opportunity to learn from KVK scientists to gain knowledge mainly agriculture and allied activities. He always interested to know about the improved package of practices of cultivation of field crops to enhance the productivity per unit area in his small land holding. In Kharif, he mostly used local long duration rice variety that frequently affected by adverse climatic condition like drought, erratic rainfall and water scarcity during critical stage of crop growth. He was supported to construct a farm pond of size (10x10) under NICRA NRM intervention.

The frequent occurrence of abiotic stresses such as drought has been identified in the project village as the key to the low productivity of rice in rain fed ecosystems, particularly in Western Odisha. That's why the yield of rice was not satisfactory to Udhab despite of his hard labour and more field expenses.

During NICRA village meeting he raised the issue in front of KVK scientists and requested to support him to enhance the productivity. In the NICRA action meeting, KVK scientists suggested him to cultivate a short duration rice variety (*Sahabhagidhan*) and briefed the features of the variety and technical aspect of *Sahabhagidhan*.

Under crop intervention programme, he had taken rice seed of *SahabhagiDhan* from NICRA project. He was followed the improved package of practices and applied all the instructions given by KVK scientists during crop production. Over telephone, he was contacted with scientists to get the technical know-how and time bound information's which are relevant to rice production. To mobilize the farming community in the village, a field was conducted at Badmal village.

In the time of harvesting rice yield was significantly increases 22qtl per ha (Local variety) up to 44 qtl/ ha (*SahabhagiDhan*) where the total expenditure per hector was Rs. 30,000/- and net profit was Rs. 29,400/-. He was quite happy with this variety. He observed the variety is having high drought resistant power. He narrated his personal opinion during interaction with other farmers in the village and neighbor villages. He also told his fellow farmers in the vicinity to cultivate *ShabhagiDhan*.

ii. Backyard poultry farming – an ideal to augment the income

Backyard poultry production is an age old practice in rural India. Most of the backyard poultry production comprises rearing of indigenous birds with poor production performances. The potentiality of indigenous birds in terms of egg production is very less i.e. 70 to 80 eggs/ bird/ year and meat production is also very less. However backyard poultry production can be boost up with improved breeds and can easily boost up with improved varieties of chicken and can promise a better production of meat and egg.

To improve the socio economic status of the traditional farmers, backyard poultry is a handy enterprise with low-cost initial investment, but high economic return along with guarantee for improving protein deficiency among the poor. Intervention was taken up for backyard poultry at Badmal, Dipapali and Ganjathapar village of Ullinda block. Kadaknath and Vanaraja chicks were distributed for dual purpose i.e. both for meat and egg production for higher income. It has the capacity to lay more eggs and gain higher body weight. Hatching of chicks is being done at KVK, Subarnapur and 21 days old

chicks are being provided in the villages. 25 nos of farmers were selected and each farmer was provided with 10 nos. Kadaknath and 10 nos. of Vanaraja chicks . The selected farmers constructed the poultry house with locally available materials like bamboo, thatch etc. as per the guidance provided. A total of 250 nos. of Vanaraja and 200 nos. of kadaknath chicks were distributed among the selected farmers for rearing under backyard farming system. Before starting the unit the farmers were also provided with information through training on site selection, construction of low cost poultry house, housing and feeding management, disease management etc. Monitoring was done at regular intervals.

Performance of different poultry breeds -

Results	Body weight (Kg) in 4 month	No. of egg production/ year	Cost of rearing/ bird (Rs/bird)	Gross Income (Rs/bird)	Net Income (Rs./bird)	BC Ratio
Vanaraja	Male- 2.0 kg Female- 1.7 kg	160	525	2100	1575	4.0
Kadaknath	Male- 1.5 kg Female- 1.2 kg	80	535	2350	1815	4.4

Impact of intervention

Farmers have shown high acceptability for poultry birds after the demonstration. On seeing the performance of the birds the farmers could observe the advantages of rearing these birds due to high egg laying capacity and higher weight gain over the local birds. Even if in a high temperature the birds sustained very well, so the farmers were highly motivated with the performance of the birds.

Kalahandi

i. A sustainable alternative employment opportunity

Background:

Pipalpada Village of Lanjigarh block of Kalahandi district is just 45 km away from Bhawanipatna town. Agriculture is the primary source of income for the farming community of Pipalpada village. The existing farming system in the village was agriculture with animal husbandry, where primary source of income was agriculture and allied enterprise particularly from commodities like rice, goatery and poultry. Though rearing poultry bird is an age old practice of the tribal community but due to lack of proper selection of breed, management practices, vaccination and feeding management they were not able to harness the expected income out of the poultry birds. Taking all these problems into consideration the KVK scientist introduced rearing of Vanaraja Poultry bird in their backyard.

The Chittaranjan Patra belongs to Schedule Caste community, 50 years old farmer having 4 acres of land where he cultivate rice, cotton and some seasonal vegetables and poultry rearing

KVK Intervention: Looking at the potential of growth of animal husbandry sector, KVK Scientist advised him to go for extensive backyard poultry rearing. KVK has distributed twenty Vanaraja chicks (21 days old) to each household of Pipalpada villagers.

The animal scientist demonstrated about housing, layout of litter bed, feeding management, vaccination and disease management practices during rainy season of poultry birds. The farmers were briefly taught about proper care and vaccination schedule employed to Vanaraja poultry. They were also given with feed supplements, medicines, technical inputs and other accessory inputs for better growth and to enhance egg laying capacity of Vanaraja bird. At the same time he was motivated for dairy and back yard goat farming. He was also encouraged for employing value addition and tag a brand name for milk and milk by products. Goat popularly known as poor man's ATM was incorporated as a back bone to his farming system.

Economics of the intervention

Sl. No	Enterprises	Area (acre)	Season	Yield(Q)	Cost of cultivation (Rs)	Gross return (Rs)	Profit (Rs)	B:C ratio
1.	Rice	2	Kharif	28	16000	33600	17600	2.10
2.	Cotton	3	Kharif	18	32000	81000	49000	2.50
3	Vanaraja bird	40 nos.	--	600 nos. egg/Bird/Year	--	3000	3000 6950	4.98
				Sold 35 no of poultry bird@180/kg (approx imately each bird will be 1.5 kg after 6months)	2500	9450		
	Total				**50500**	**127050**	**76550**	

Impact :

The positive attitude of the farmer along with his family member towards poultry farming as a alternative employment opportunity could able to raise his income upto 10% of his total income. Backyard poultry farming (Vanaraja poultry) now has become one of the important substitute source of income. By seeing his success farmers are shifting towards poultry rearing. Farmers focus emphasis to new enterprise like dairy, goatery and poultry farming system. Income substantially increased with technological intervention in sustainable manner. Many farmers have been motivated by his success and some farmers with marginal land holdings have adopted poultry farming as a significant farming system along with agriculture..

Kendrapara

i. *Swarna Sub 1* – A remunerative rice ariety under flood situation at Kendrapara

Swarna Sub -1 acts as a boon for the flood affected area where the total crop is damaged due to continuous water stagnation. The adopted village under NICRA Programme of KVK, Kendrapara is Ratanpur, Block: Marshaghai, which is most vulnerable to flood condition during kharif season (Aug., Sept. & Oct.) as the village is located beside the river Paika (a subsidiary of the giant Mahanadi River). The main crop of the locality is rice which is mostly damaged by usual flood. Flood is the regular phenomenon of this area, so entire crop get damaged, leading to total or major yield loss. As the rice crop damaged in the main crop season, farmer have no option to grow rice again, under rainfed situation. Keeping these problems in view, KVK, Kendrapara has started a trial on cultivation of Swarna Sub-1 rice variety. This variety has the ability to tolerate water submergence. Swarna Sub 1 is developed by introducing Sub-1 gene into the rulling variety Swarna which imparted flood tolerance potential to the crop. The duration of this variety is 142-145 days. It can tolerate upto 15-17 days of complete submergence. Under this flooded condition average yield is upto 3.5 t/ha. The package of growingswarna sub-1 is similar to any normal rice variety, except we have to apply 20 kg N/ha, just 7-10 days of receding of water for better yield. All the farmers had grown the community nursery of this variety and transplanted the rice variety before flood.

Before introduction of swarna sub-1 variety there was average 50-70 % yield loss due to the flood in particular area of the experimentation. Some year has witnessed complete damage of the crop due to prolonged water stagnation because of the flood. Introduction of the swarna sub-1 has become boon for the farmers of the flood affected area as it has tolerated 12-15 days of water submergence during the flash flood of the river Paika. The yield obtained from this variety was in range of 3.2 -3.8 t/ha where as there is complete loss of yield in other variety. Whatever the resources and energy utilized was going in vein due to the complete failure of the

crop due to occurrence of flood and where as this technology given output, after adopting. Farmers are getting return of at least a sum of Rs.30,000 / ha income by adopting swarna sub-1. The variety is gaining popular day by day in the flood affected area and is likely to expand in all over the district in coming 2-3 years.

ii. Enhancing economic and social security through crop diversification of Rice fallow to Rice-Blackgram system

Rice is the major crop of the district Kendrapara. Most of the farmers able to grow only single rice crop due to lack of enough moisture in the soil under rainfed situation. NICRA Project adopted village Ratanpur, G.P.: Mangarajpur, Block: Marshaghai, Dist. Kendrapara which is mainly a rainfed situation and only long duration low yielding rice is grown. In the next season the land is remaining vacant due to lack of enough moisture. Looking into the above problem KVK, Kendrapara introduced rice fallow to rice- blackgram cropping system in this flood prone area. In the medium land situation , the long to medium duration rice e.g. Swarna, Pooja is being replaced by the short duration rice DRR-44, Swarnashreya . As a result the rice crop is harvested 20-25 days earlier than the stipulated time period of harvest. In the field rice –blackgrampaira cropping is practiced. Before 10 days harvest of the rice crop ,blackgram seeds of the variety PU-31 is being broadcasted. As a result we are getting almost 30 days extra with enough soil moisture status due to change in variety and sowing window of blackgram. Rice- Blackgram cropping is a profitable system from economic as well as soil health management point of view. In addition to this it improves soil fertility by following crop rotation principle. This cropping system efficiently utilizes the residual moisture.

Steps in implementing this technology:

- ✓ The existing rice var. Swarna (145 days) which is replaced by an early variety DRR-44 (125 days). As a result soil moisture can be saved for the second crop that is Blackgram.
- ✓ The blackgram is broadcasted in rice crop 10 days before harvest of the rice.
- ✓ Total recommended fertilizer of blackgram (20-40-40) is applied to rice after panicle emergence as DAP & MOP.
- ✓ Two foliar spray of NPK (19-19-19) @ 1.5% at preflowering and pod development stage of blackgram for nutrient and moisture supplementation.

Impact of the technology:

Before the implementation of this cropping system under post flood situation farmers were growing only rice as *kharif* crop followed by fallow land due to lack of the soil moisture for rabi crop. By adopting this technology the following impacts were recorded:

i. Additional revenue generation by taking blackgram as second crop under post flood situation.
ii. The residual moisture in the rice fallow is utilized by the blackgram resulting in higher resource use efficiency.
iii. The existing cropping intensity is doubled due to introduction of double crop instead of sole cropping of rice and fallow.
iv. As a legume crop is introduced into the system it restores soil fertility through biological nitrogen fixation.
v. An extra net income of Rs. 10,200/- out of 3.5 q/ha yield of black gram PU-31

The rice-blackgrampaira cropping system is now gaining popular and farmers are adopting this technology as they getting more benefits from this cropping system than the existing one.

iii. Potato a remunerative crop under post flood situation

In the September-2018, severe flood occurred in NICRA adopted village- Dusmankul (Ratanpur), MarshaghaiBlock ,Kendrapara. Due to Heavy flood standing Rice crop got entirely damaged. After receding of flood water, land was laying fallow. Although under this post flood situation the land was fertile due to deposition of alluvial soil . KVK Kendrapara under NICRA Project introduced potato cultivation. In this intervention, all the 71 household affected by flood were provided with QPM of Potato variety Kufri-Sundari. A Late variety of potato maturing in 4 months time. All the recommended cultural practices were followed, starting from tuber treatment with carboxin 37.5%+Thiram 37.5%wp @500gm/ha seed. Dipped for 20min in the solution drying under for 5 min, before planting. As this variety moderately resistant early blight potato gave an yield of 304 quintal /ha. As procurement price of potato by the private retailers was very low during harvesting time. The growers stored, the properly

graded and sorted potato at Nischintakoili cold storage, for meeting their future seed demand.

The rest potato for home consumption stored in thatched house, with false bamboo ceiling (Attughara) with windows remaining to avoid entry of direct sunlight. Those farmers having no Attughara, kept these harvested potato on floor by putting 3-4''inch thickness dry sand for soaking moisture by that increasing the shelf life of potato . Value addition of potato was done by preparation of potato chips.

Impact of cyclones in NICRA Village of South 24 Parganas

Name of Cyclone	Type of damage	Damage in non-NICRA village	Damage in NICRA village	Resilience in NICRA village
Fani (3rd to 4th May 2019) Rainfall: 04.05.19 - 28 mm	Submergence	Sporadic	No	1. Well protected river embankment 2. Increased water harvesting potential in farm ponds helped in vegetable cultivation
	Crop loss	Rice: 20% loss (ripening stage)	Rice: Entire crop harvested early	
		Vegetable: 25% loss	Vegetables: no. crop loss	
Bulbul (9th to 10th November 2019) Rainfall: 08.11.19 - 11.9mm 09.11.19 - 84.4 mm 10.11.19 - 84.7 mm	Submergence	15 – 25 days water logging (2.5-3 ft in lowland and 1-2 ft in medium land situation)	4-5 days water logging (2-2.5 ft in lowland and 1 ft in medium to upland situation)	1. Quick drainage facility due to rejuvenation of drainage channels and implementation of land shaping, ail cultivation, trench cum broad bed systems 2. Short duration HYV rice grown on land shaping plots were more tolerant to lodging compared to traditional varieties 3. Quick recovery of standing crops and pond water quality due to the timely advisories given by KVK and dissemination to the farmers by the VCRMC
	Crop loss	Rice: Lowland: 60 to 100% yield loss Medium to upland: 40% yield loss	Rice: Lowland: 25 - 30% yield loss (50 ha) Medium to upland: 15-20% yield loss (20 ha)	
		Vegetables: 80-100% yield loss	Vegetables: 50-60% yield loss (8 ha)	
	Fisheries	Deterioration of water quality, Surfacing and death of fishes 75-100 % loss	Deterioration of water quality, Surfacing and death of fishes 15-20% loss	
	Submergence	Yes (in certain Blocks with high rainfall)	No (scanty rainfall)	
	Crop loss	Boro Rice: 25% area (in 75% area the crop was harvested)	Boro Rice: No loss (The entire crop was harvested before the cyclone)	
		Vegetables: 80-100 % crop loss	Vegetables: 10 % crop loss (12 ha)	
		Orchard: 50% fruit trees damaged	Orchard: 20% fruit trees damaged	
	Fishery	Deterioration of water quality, Surfacing and death of fishes 75-100 % loss	Deterioration of water quality, Surfacing and death of fishes 10-15% loss	
	Forestry plantation	Felling of trees (~10%), scorching of leaves	Felling of trees (~2%), scorching of leaves	

12. News Paper Coverage

সেরা কোচবিহার

বিশ্ব ওজোন দিবস

রবঙ্গ। ৩

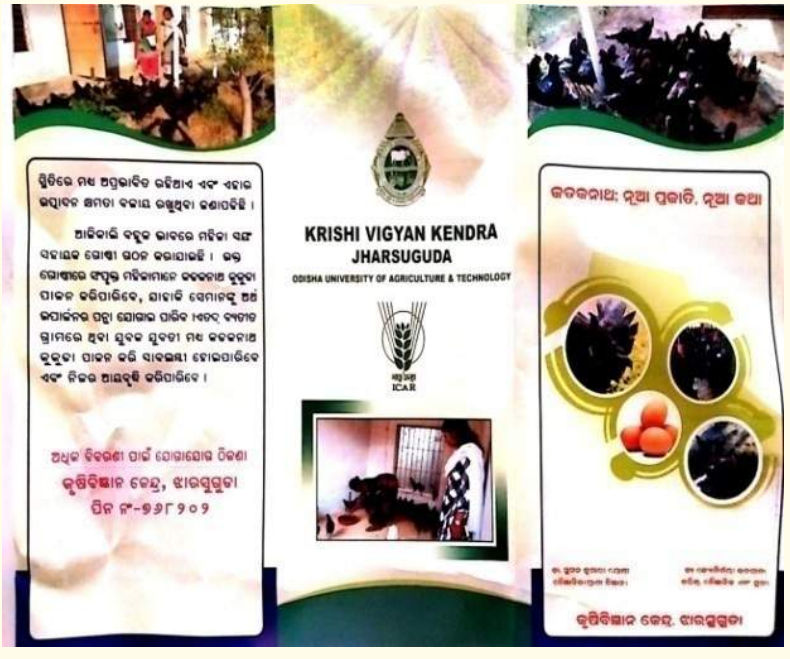
বৃক্ষরোপণ

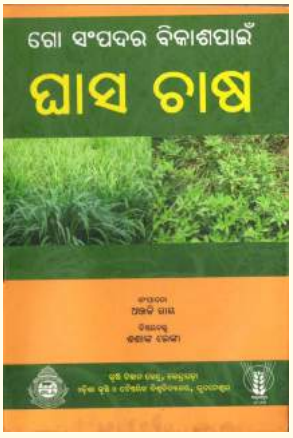
পুণ্ডিবাড়িতে কেন্দ্রীয় প্রতিনিধিদল

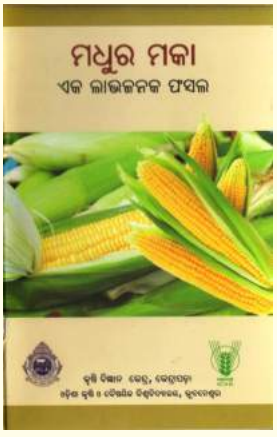
পুণ্ডিবাড়ি, ৮ ফেব্রুয়ারি : জলশক্তি মন্ত্রকের নির্দেশে কেন্দ্রীয় জল কমিশনের আধিকারিকরা কোচবিহার কৃষিবিজ্ঞান কেন্দ্র পরিদর্শনে এলেন। কোচবিহার কৃষিবিজ্ঞান কেন্দ্র সূত্রে জানা গিয়েছে, কেন্দ্রীয় জল কমিশনের উপ নির্দেশক কুমার কৌশল এবং সহ আধিকারিক অশোক দাস পরিদর্শনে আসেন। তাঁরা কোচবিহার–২ ব্লকের খাগড়িবাড়ি, সিঙ্গিমারি, যাত্রাপুর এবং কোচবিহার কৃষিবিজ্ঞান কেন্দ্র পরিদর্শন করেন। কোচবিহার কৃষিবিজ্ঞান কেন্দ্রের বিজ্ঞানী ডঃ বিকাশ রায় জানান, এই পরিদর্শনের মূল উদ্দেশ্য ছিল কোচবিহার জেলায় জল সংরক্ষণের ওপর কোচবিহার কৃষিবিজ্ঞান কেন্দ্রের ভূমিকা পালন। এই পর্যবেক্ষণের মাধ্যমে বিভিন্ন ধরনের পুকুর সংস্কার, নানারকম সম্পদের সংরক্ষণ প্রযুক্তি, এজোলা চাষ, মাশরুম চাষ, বাঁধ নির্মাণ, বহুমুখী চাষবাস, কেঁচো সার তৈরির প্রদর্শনী ক্ষেত্র তাঁরা দেখেন বলে জানা গিয়েছে।

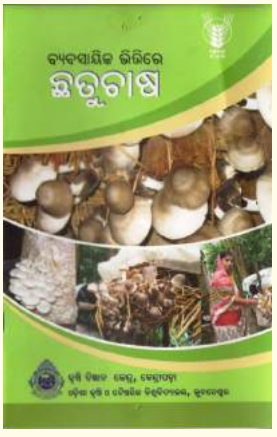
ଝାରସୁଗୁଡ଼ା କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ରରେ ନୂତନ ପ୍ରଜାତିର କୁକୁଡ଼ାର ଅନୁଧ୍ୟାନ

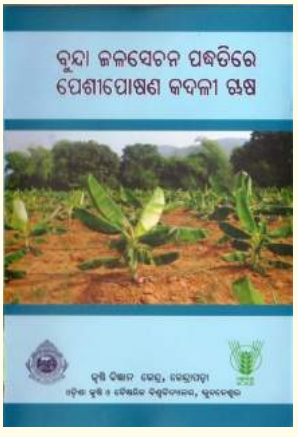
ବେଲପାହାଡ଼,୩।୨୧(ନି.ପ୍ର): ଝାରସୁଗୁଡ଼ା କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ରରେ ସମ୍ପୂର୍ଣ୍ଣ କଳା ରଙ୍ଗର ବୈଚିତ୍ରମୟ କଡ଼କନାଥ କୁକୁଡ଼ାର ଅନୁଧ୍ୟାନ ଓ ପର୍ଯ୍ୟବେକ୍ଷଣ କରାଯାଉଛି। ଏହି ପ୍ରଜାତିଟି ମଧ୍ୟପ୍ରଦେଶର ଝାବୁଆ ଜିଲ୍ଲାରେ ମିଳୁଥିବା ଭୌଗଳିକ ସଙ୍କେତ ଟ୍ୟାଗ ପ୍ରାପ୍ତ କୁକୁଡ଼ା। ଏହି କୁକୁଡ଼ାର ବିଶେଷତ୍ୱ ହେଉଛି ଏହି କୁକୁଡ଼ାର ମାଂସ କଳା। ସମସ୍ତ ବିଶ୍ୱରେ ମିଳୁଥିବା ଜଳାମାଂସ କୁକୁଡ଼ା ମଧ୍ୟରୁ ଏହି କଡ଼କନାଥ କୁକୁଡ଼ା ଅନ୍ୟତମ। ଏହି ପ୍ରଜାତିର କୁକୁଡ଼ାର ଖାଦ୍ୟତତ୍ୱ ଗୁଣ ଓ ଔଷଧୀୟ ଉପାଦେୟକୁ ଆଖି ଆଗରେ ରଖି ଝାରସୁଗୁଡ଼ା ଜିଲ୍ଲାରେ ବ୍ୟବସାୟିକ ସଫଳତା କରିବାକୁ ଝାରସୁଗୁଡ଼ା କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ର ଏହି କୁକୁଡ଼ା ଉପରେ ଅନୁଧ୍ୟାନ କରୁଥିବା କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ର ତରଫରୁ ସୂଚନା ଦିଆଯାଇଛି। ଏହି କୁକୁଡ଼ାର ରୋଗ ପ୍ରତିଶୋଧକ ଶକ୍ତିଅଧିକ ଥିବାରୁ ଏହାର ମୃତ୍ୟୁ ହାର ମଧ୍ୟ ସବୁଠାରୁ କମ। ଏହି କୁକୁଡ଼ା ୪ ମାସ ବୟସରୁ ଅଣ୍ଡାଦେବା ଆରମ୍ଭ କରିଦିଏ। ମାତ୍ର ଅଢ଼େଇ ମାସରେ ଏହି କୁକୁଡ଼ା ବିକ୍ରି ପାଇଁ ପ୍ରସ୍ତୁତ ହୋଇଯାଆନ୍ତି। ଦେଶର ବିଭିନ୍ନ ସ୍ଥାନରେ ଏହି କୁକୁଡ଼ାର ମାଂସ ୭୫୦ ରୁ ୮୫୦ ଟଙ୍କା କିଲୋ ପ୍ରତି ରହିଛି। ଏହି କୁକୁଡ଼ାର ଉତ୍ପାଦନ ପାଇଁ ଝାରସୁଗୁଡ଼ା କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ର ଚାଷୀ ମାନଙ୍କୁ ଉତ୍ସାହୀତ କରିବା ଦୋଇ କୃଷି ବିଜ୍ଞାନ କେନ୍ଦ୍ର ପକ୍ଷରୁ ସୂଚନା ଦିଆଯାଇଛି।











13. Publications

Rseach Paper/ Review paper

Debjyoti Majumder, Rakesh Roy, Paramita Bhowmik, Bankim Chandra Rudra, Adwaita Mondal, Bhabani Das and Samima Sultana. 2020. Impact and perceived constraints in adoption of climate resilient technologies in flood prone areas of West Bengal, India. *Int.J.Curr. Microbiol.App.Sci.* **9**(04): 797-806. doi: https://doi.org/10.20546/ijcmas.2020.904.095.

Rakesh Roy, Bankim Chandra Rudra, Debjyoti Majumder and Adwaita Mondal. 2020. Perceived Constraints in Mushroom Production Enterprise in West Bengal. *Int.J.Curr.Microbiol.App.Sci.* **9**(04): 1579-1583. doi: https://doi.org/10.20546/ijcmas.2020.904.185 .

Samima Sultana, Rakesh Roy, Bhabani Das, Adwaita Mondal and F.H. Rahaman.2020. Vegetable Based Multitier Cropping System: A Model for Higher Income for the Farmers in Old Alluvial Soils of West Bengal,Advances in Research, **21**(6): 30-34.doi: 10.9734/air/2020/v21i630212

H.N. Malik., A. Panda., S. Behera. And F.H. Rahaman (2020). A comparative study of different moisture stress tolerant rice varieties in Kalahandi district of Odisha. International journal of plant and soil science. 2020; 32(7): 1-6

Book

Rahman, F. H., Singh, S.S. and Bhattacharya, Ria. (2019) Resilience in Agriculture Enhanced through Technology Demonstration -Experience of NICRA-TDC. Published by ICAR-ATARI Kolkata, pp: 1-115

Book Chapter

S. S. Singh and **F. H. Rahman** (2019).Resource Conservation Technologies in the Eastern Region for Doubling Farmers Income. Lead paper published in the *Compendium of National Conference on Resource Conservation in Eastern Region of India*, Pub by Indian Association of Soil and Water Conservationists, Dehradun pp 119-130.

F. H. Rahman and Ria Bhattacharya (2019). Climate Resilient Agriculture through natural resource management in Eastern India, in Book ' *Perspective of climate change and Inland fisheries in India'*, pub. by CIFRI Barrackpore, pp 151-169

Ganesh Das and Sarthak Chowdhury (2019). Identifying the Engagement Status of Women in Agricultural Information Dissemination Process of Farm Science Centers. Published by Puspa Publishing House, Kolkata and Dept. of Agronomy, Visva-Bharati, Sriniketan, W.B.

Technical bulletins

Rahman F H, Bhattacharya R and Singh S S. 2019. NICRA Newsletter: Towards Climate Smart Agriculture, Pub. by ICAR-ATARI Kolkata, Vol. V, No. 2, pp: 1- 8.

Rahman F H, Bhattacharya R and Roy S.K. 2020. NICRA Newsletter: Towards Climate Smart Agriculture, Pub. by ICAR-ATARI Kolkata, Vol. VI, No. 1, pp: 1- 8.

Rahman F H, Bhattacharya R and Singh S S. 2019. NICRA Annual Report 2018-19. Pub.by Director ICAR-ATARI Kolkata, pp: 1- 48.

Ganesh Das and P Roy 2019. *Situation of Farm Machinaries in Birbhum District, West Bengal-Gaps to be Filled Up* in Advance Technologies in Agriculture for Doubling Farmer's Income, ISBN NO: 9789386453617

Popular Articles

S. Sarkar (2019). Special awareness for fall army work, Published in Uttar Banga Sambad

Ganesh Das (2019). Use of Information technology in agriculture, published in Ujjan, Uttar Banga Krishi Viswavidyalaya

Abstracts presented in national/ international seminars etc.

Rahman F H, Das Biplab and Singh S S. 2019. Fertilization and Vine Plantation for augmenting the Productivity Yield and Economics of Pointed Gourd in Terai Zone. Abstract in the proceedings of 84th Annual Convention and National Seminar of Indian Society of Soil Science at Banaras Hindu University, Varanasi during Nov. 15-17, 2019.

Rahman F H, Mukherjee S and Mukherjee K. 2019.

Evaluation of a New Organic Farming Technology towards Crop Sustainability and Soil Quality Development. Abstract in the proceedings of 84th Annual Convention and National Seminar of Indian Society of Soil Science at Banaras Hindu University, Varanasi during Nov. 15-17, 2019.

Sarkar Victor, Das Ganesh, Pradhan K., Maity B. and Das T. K. (2019). Role Women group on technology dissemination and its adoption among the farming community of Northern Sub Himalayan Terai Region of India. Abstract in the proceedings of 4th National Conference on Diversified farming System: Sustainable livelihood and Doubling farmers Income, COBACAS, Cooch Behar, West Bengal

Das Ganesh and Chowdhury Sarthak (2019). Identifying the Engagement Status of Women in Agricultural Information Dissemination Process of Farm Science Centers. Abstract in the proceedings of National Seminar on Sustainable Resource Management for Enhancing Farm Income, Nutritional Security and Livelihood Improvement, Dept. of Agronomy, Institute of Agriculture (PSB), VisvaBharati, Sriniketan, Birbhum, West Bengal.

Das Ganesh and Chowdhury Sarthak (2019). Networking of the farmwomen by farm centre for cultivation of medicinal plants. Abstract in the proceedings of Cultivation, Conservation and Sustainable Utilization of Medicinal Plants for Livelihood Improvement, COBACAS , UBKV , Cooch Behar

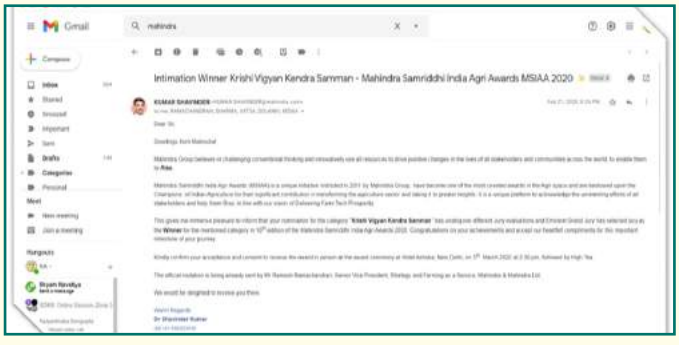
Das Ganesh, Saha Sankar, Roy Bikash and Rahman F.H (2019). Impact of NRM technology in Cooch Behar District of West Bengal. Abstract in the proceedings of 2nd International Conference on Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development, Solan, Himachal Pradesh (RAAEASGD-2019)

14. Awards / Recognition during 2019-20

1. **Best NICRA-KVK Award:** Cooch Behar KVK from West Bengal and Sonepur KVK from Odisha were awarded the Best Zonal NICRA KVK Award during Annual NICRA Workshop held at CRIDA during June 4-6, 2019.




2. **Mahindra Samriddhi Krishi Vigyan Kendra Samman** bagged by S 24 Parganas for innovation technology demonstrated in NICRA Village.



3. **1st Prize in *Khet Khamare Bazimat*** received by NICRA Farmers of S 24 Parganas KVK awarded by DD Bangla

4. **National water Award-Best Village Panchayat** of S 24 Parganas district awarded by Ministry of Jal Shakti, Dept. of Water Resources, River Development and Ganga Rejuvenation, Govt. of India

15. Expenditure Statement 2019-20

Table. Expenditure details during 2019-20

Name of KVK	Sanction for the year 2019-20					Total	Expenditure	Closing Balance as on 01.04.20
	Grants-in-Aid-General (REVENUE)			Grants for creation of capital assets (CAPITAL)				
	Operational	TA	SC Sub-Plan	Equipment	SC Sub-Plan			
ATARI-Kolkata	600000	65000	0	0	0	665000	567761	97239
South 24 Parganas	0	0	1740000	0	260000	2000000	1999915.50	15679 (Including bank interest)
Coochbehar	0	0	2000000	0	250000	2250000	189310	350690
Malda	0	0	1150000	0	94000	1244000	978822	279929
Sonepur	730000	60000	0	41000	0	831000	831000	0
Kalahandi	600000	40000	0	41000	0	681000	612029	68971
Jharsuguda	800000	70000	0	41000	0	911000	908500	2500
Kendrapara	1070000	40000	0	41000	0	1151000	1151000	0
Ganjam-I	750000	40000	0	41000	0	911000	831000	0
Port Blair	550000	100000	0	94000	0	691000	502164	188836
Total	**5100000**	**415000**	**4890000**	**246000**	**604000**	**11255000**	**10281501.50**	**1003844**

Annexure -1

NICRA-TDC PROJECT SITES

West Bengal, Odisha, A&N Islands

● **Districts where NICRA-TDC Project Sites exist**

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