Annual Report
वार्षिक प्रतिवेदन
2018-19

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
Bhumi Vihar Complex, Salt Lake, Kolkata – 700097
भूमि विहार कॉम्प्लेक्स, साल्ट लेक, कोलकाता - 700097

वार्षिक प्रतिवेदन

Annual Report

2018-19

National Innovations on Climate
Resilient Agriculture
Technology Demonstration Component

NICRA
National Innovations on Climate Resilient Agriculture

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

Citation

Annual Report of National Innovations on Climate Resilient Agriculture 2018-19

ICAR-ATARI, Kolkata, Salt Lake,
Kolkata - 700097, India

Published by

Director, ICAR-ATARI, Kolkata, Kolkata – 700097

Compiled and Edited by

F. H. Rahman, S. S. Singh and R. Bhattacharya

Printed at:

Semaphore Technologies Pvt. Ltd.
3, Gokul Baral Street,
Kolkata- 700 012
+91 33 2221 7475, +91 9830249800

Preface

National Initiative on Climate Resilient Agriculture (NICRA) launched by Indian Council of Agricultural Research is a step towards climate-smart agriculture that includes application of proven practical techniques in major areas of water management, crop husbandry, livestock management, farm implements and others. 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 KVKs of Odisha, West Bengal and 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. Formation of VCRMC and setting up of custom hiring centres under NICRA in all the adopted villages added to the grass-root level monitoring of the project followed by initiating farm mechanization as per suitability of small and marginal holdings.

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 2018-19 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 2018-19 depicts a close assessment of endeavour of selected NICRA-KVKs in climatically vulnerable zones under supervision and guidance of ICAR-ATARI Kolkata and simultaneous attainment in the area of technology demonstrations, VCRMC, institutional interventions, seed production, capacity building, extension activities, review workshops etc. were also noted. The NICRA Annual Report 2018-19 includes all the relevant and required information of ICAR-ATARI Kolkata and achievements of selected NICRA-KVKs coping with the challenges of climate vulnerabilities in farming practices as well as livelihood pattern for the empowerment of farming community.

I wish to express my sincere gratitude to Dr. T. Mahapatra, Secretary, DARE and Director General, ICAR, Dr. A. K. Singh, Deputy Director General (Agricultural Extension), Dr. G Ravindra Chary, 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 2018-19. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the selected NICRA implementing KVKs in providing information in time. The support and help rendered by all the staff of ICAR-ATARI Kolkata are duly acknowledged.

Director

Contents

कार्यकारी सारांश

21 वीं सदी की प्रमुख वैश्विक चुनौतियों में से एक जलवायु परिवर्तन है, और विगत कुछ वर्षों से अंतर्राष्ट्रीय मंच पर चर्चा की प्रमुख प्राथमिकताओं में से एक है। जलवायु परिवर्तन का प्रतिकूल प्रभाव सभी देशों, विशेष रूप से विकासशील देशों पर पड़ रहा है। इसके साथ ही लगातार सूखा तथा मौसम में अत्यधिक बदलाव, समुद्र के जल स्तर का बढ़ना, तटीय क्षरण और समुद्र का अम्लीकरण आदि खाद्य सुरक्षा, जल, ऊर्जा और स्वास्थ्य को प्रभावित कर रहा है और अधिक व्यापक रूप से गरीबी उन्मूलन एवं सतत विकास के प्रयास को भी प्रभावित कर रहा है। जलवायु परिवर्तन के संयोजन के लिए ग्रीनहाउस गैस उत्सर्जन जीएचजी, में पर्याप्त और निरंतर कटौती की आवश्यकता होगी, जो अनुकूलन के साथ, जलवायु परिवर्तन के जोखिम को सीमित कर सकता है। वास्तव में जलवायु परिवर्तन के जोखिमों को कम करने और प्रबंधित करने के लिए अनुकूलन और शमन क्रियाएं पूरक हैं। जलवायु परिवर्तन को एक सतत चुनौती मानते हुए, इस महत्वपूर्ण क्षेत्र में अधिक बल देने व ध्यान केंद्रित करने की आवश्यकता है। इस बात को ध्यान में रखते हुए, ग्यारहवीं पंचवर्षीय योजना के दौरान की गई पहल पर एक योजना को मजबूती प्रदान करने एवं निर्माण करने का प्रयास किया गया। बदलती जलवायु की परिस्थिति में घरेलू खाद्य उत्पादन को बनाए रखने की चुनौतियों का सामना करने और कृषि में अपनाने और शमन की जानकारी उत्पन्न करने के लिए यूएनएफसीसीसी की तरह के वैश्विक मंचों पर योगदान देने हेतु, भारतीय कृषि अनुसंधान परिषद ने जलवायु पर एक फ्लैगशिप नेटवर्क परियोजना 'नेशनल इनिशिएटिव ऑन क्लाइमेट रेजिलिएंट एग्रीकल्चर' (एनआईसीआरए) को ग्यारहवीं योजना के दौरान फरवरी, 2011 में शुरू किया तथा बारहवीं योजना के दौरान इसे 'नेशनल इनोवेशन इन क्लाइमेट रेजिलिएंट एग्रीकल्चर' (एनआईसीआरए) के रूप में जाना गया। यह देखते हुए कि जलवायु परिवर्तन एक सतत चुनौती है, इस महत्वपूर्ण क्षेत्र पर अधिक बल देने के साथ ही साथ ध्यान केंद्रित करने की आवश्यकता है। इस दृष्टिकोण को ध्यान में रखते हुए, बारहवीं पंचवर्षीय योजना के दौरान की गई पहल पर एक योजना को मजबूती प्रदान करने व निर्माण करने का प्रयास किया गया। इस प्रकार जलवायु परिवर्तनशील कृषि में राष्ट्रीय नवाचार 'नेशनल इनोवेशन इन क्लाइमेट रेजिलिएंट एग्रीकल्चर' (एनआईसीआरए) निम्नलिखित उद्देश्यों के साथ आगे बढ़ रहा है। 1. भारतीय कृषि में रेजिलिएंट को बढ़ावा देना, जिसके अन्तर्गत फसल, पशुधन और मत्स्य पालन को जलवायु परिवर्तनशीलता और जलवायु परिवर्तन से बचाव हेतु उन्नत उत्पादन एवं जोखिम प्रबंधन तकनीकों के विकास तथा अनुप्रयोग, 2. वर्तमान जलवायु जोखिमों से बचने के लिए किसानों के खेतों में साइट विशिष्ट प्रौद्योगिकी पैकेजों का प्रदर्शन, 3. जलवायु की स्थिति के अनुरूप कृषि अनुसंधान और इसके अनुप्रयोग के माध्यम से वैज्ञानिकों एवं हितधारकों की क्षमता निर्माण को बढ़ावा देना और 4. रेजिलिएंट को प्रबलित करने वाली प्रौद्योगिकी को बड़े पैमाने पर अभिग्रहण करने हेतु पॉलिसी तैयार करना और विकल्प देना।

इसका समग्र अपेक्षित परिणाम यह है कि कमजोर क्षेत्रों में जलवायु परिवर्तनशीलता के लिए कृषि उत्पादन की लचीलता को बढ़ाया गया। प्रारंभ में, पूरे भारत में 100 केवीके को परियोजना के कार्यान्वयन के लिए चुना गया था। अनुमोदित बारहवीं योजना के अनुसार परियोजना को पूरा करने के लिए देश भर में और 21 केवीके को शामिल किया गया। अनुकूलन और शमन पर किए जा रहे अनुसंधान में फसल, पशुधन, मत्स्य पालन और प्राकृतिक संसाधन प्रबंधन शामिल है।

एनआईसीआरए की प्रौद्योगिकी प्रदर्शन घटक (टीडीसी) किसानों के साथ काम करने का शानदार अवसर प्रदान करता है तथा फील्ड कंडिशन में इस प्रकार की तकनीकी का उपयोग करता है जिससे वर्तमान जलवायु परिवर्तनशीलता की समस्या से निजात पाया जा सके। इस प्रकार का पहल इन लचीली प्रौद्योगिकियों को अपनाने की गति को बढ़ाएगा। केवीके एवं भारतीय कृषि अनुसंधान परिषद के 7 मुख्य अनुसंधान संस्थानों के माध्यम से देश भर के 121 जलवायु परिवर्तन वाले जिलों में ग्रामीण किसान समूहों में जलवायु लचीलापन पर खेतों में सहभागिता प्रदर्शन को कार्यान्वित किया गया। विभिन्न कृषि-पारिस्थितिकी और कृषि प्रणालियों में प्रौद्योगिकियों के अनुप्रयोग के परिणाम की जानकारी को बढ़ाने और समझाने पर जोर दिया गया है। इस प्रयास से विभिन्न जैव-भौतिक और सामाजिक-आर्थिक संदर्भ में जलवायु में लचीलापन होने के कारणों की पहचान की जा सकी। एनआईसीआरए केवीके ने गांव स्तर की आकस्मिक फसल योजनाएं और उपाय तैयार की तथा उन्हें कार्यान्वित किया। ओडिशा में 5 जिले, पश्चिम बंगाल में 3 जिले और केंद्र शासित प्रदेश अंडमान व निकोबार द्वीप समूह में 1 जिला चयनित किया गया तथा इन 9 केवीके जिलों की जलवायु भेद्यता को एनआईसीआरए कार्यक्रम के कार्यान्वयन के दौरान मूल्यांकन किया गया तथा यह पाया गया कि वहां तकनीकी सहायता, मानव संसाधन का विकास और समग्र रूप से कृषि समुदाय के सशक्तिकरण की निश्चित आवश्यकता है ताकि वे सूखा, अनिश्चित वर्षा, गर्मी की लहर, बाढ़, चक्रवाती तूफान जैसी जलवायु कमजोरियों से निपटने में सक्षम हो पाएं। तदनुसार, केवीके द्वारा जिलों के कमजोर गांवों में फसल उत्पादन, संसाधन संरक्षण, पशुधन और मत्स्य पालन, जल संचयन आदि शुरू करने के लिए प्रौद्योगिकियों को निष्पादित करने के माध्यम से इसके कार्यान्वयन के लिए योजना तैयार की गई।

भाकृअनुप-कृषि तकनीकी अनुप्रयोग संस्थान, कोलकाता में एनआईसीआरए को कार्यान्वित करने वाले नौ केवीके हैं, जिन्होंने विभिन्न मॉड्यूल में जलवायु लचीलापन कृषि कार्यक्रम पर राष्ट्रीय नवाचारों के प्रौद्योगिकी प्रदर्शन घटकों के तहत विभिन्न प्रकार की गतिविधियों शुरू की हैं तथा 16081 किसानों (एनआरएम-1220, फसल उत्पादन-2470, पशुधन और मत्स्य पालन-2288, संस्थागत हस्तक्षेप-1352, क्षमता निर्माण-1463 और विस्तार गतिविधियाँ-7288) को लाभ पहुंचाया है।

प्राकृतिक संसाधन प्रबंधन मॉड्यूल निम्नलिखित को कवर करता है- बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, इन-सीटू नमी संरक्षण, नवीन जल संचयन का निर्माण/नवीकरण और रीसाइक्लिंग, संरचना/फार्म तालाब/चैक डेम/ छत टैंक के जल संचयन टैंक, भूमि को आकार देना और वर्षा जल संचयन संरचनाओं में सुधार, बाढ़ प्रवण क्षेत्रों में जल निकासी सुधार, जहां उपयुक्त हो वहां संरक्षण जुताई, कृत्रिम भूजल पुनर्भरण तथा पानी की बचत सिंचाई विधि, हरी खाद का प्रयोग, फसल अवशेष प्रबंधन, खेत की बंडिंग, ब्रॉड बेड फुरो, मिट्टी परीक्षण आधारित पोषक तत्व का अनुप्रयोग, सूक्ष्म सिंचाई तकनीक, खाद गड्ढे आदि सहित 281 हेक्टेयर क्षेत्र को कवर किया गया, जिससे उस क्षेत्र के 1220 किसानों को लाभ मिला।

फसल उत्पादन मॉड्यूल के तहत एनआईसीआरए-केवीके द्वारा विभिन्न क्षेत्र विशिष्ट हस्तक्षेप किए गए थे, जैसे; सूखा, लवण और बाढ़ सहिष्णु/प्रतिरोधी किस्मों की शुरूआत, टर्मिनल गर्मी के प्रभाव वाले क्षेत्र में रबी फसलों की रोपण तारीखों में उन्नयन, जल बचत धान खेती पद्धति (एसआरआई, एरोबिक, प्रत्यक्ष अंकुर), विलंबित मानसून हेतु सामुदायिक नर्सरी, स्थान विशेष इंटरक्रोपिंग सिस्टम के साथ उच्च टिकाऊ उपज सूचकांक,

नई फसल/फसल विविधीकरण की शुरूआत, समय पर रोपण के लिए कस्टम हायरिंग केंद्र, कम तापमान सहिष्णुता, मानसून की वर्षा के बाद दालों का प्रमोशन, एकीकृत फसल/कीट/रोग प्रबंधन, आकस्मिक फसल के रूप में सब्जियों को बोना, एकीकृत फसल प्रबंधन, एकीकृत रोग प्रबंधन, आकस्मिक फसल, 470 हेक्टेयर क्षेत्र को कवर किया, जिससे 2470 किसानों को लाभ मिला।

इसी प्रकार पशुधन और मत्स्य पालन मॉड्यूल के तहत विभिन्न पशुधन केंद्रित हस्तक्षेप किए गए जो निम्नवत हैं- सूखे/बाढ़ के दौरान चारे के उत्पादन के लिए सामुदायिक भूमि का उपयोग, बेहतर चारा/चारा भंडारण पद्धति, पशुधन में गर्मी के प्रभाव को कम करने के लिए बेहतर आश्रय, पानी की कमी या अतिरिक्त पानी के दौरान मछली के तालाबों/टैंकों का प्रबंधन, नस्ल अपग्रेडेशन, खनिज मिश्रण के माध्यम से संतुलित चारा एवं चारा प्रबंधन, फ़ीड ब्लॉक और सिलेज तैयार करना, एजोला फीडिंग, डिवार्मिंग और टीकाकरण के माध्यम से नस्ल पशु स्वास्थ्य प्रबंधन, मछली तालाब की सफाई और मत्स्य पालन, स्वच्छ दूध और चारा उत्पादन आदि जिससे 2288 पशुधन मालिक लाभान्वित हुए।

संस्थागत हस्तक्षेप के तहत लगभग सभी एनआईसीआरए गांवों में बीज बैंक, चारा बैंक, कमोडिटी ग्रुप, समय पर संचालन हेतु कस्टम हायरिंग, सामुदायिक नर्सरी स्थापना, सिंचाई, ग्रामीण स्तर के मौसम स्टेशन के माध्यम से सामूहिक विपणन जलवायु साक्षरता एवं जागरूकता को बढ़ाया गया। 1352 किसानों के 217 हेक्टेयर भूमि को कवर करते हुए कुल 152 इकाइयों को विकसित किया गया। मिनी ऑटोमेटिक मौसम स्टेशन (एडब्ल्यूएस) का प्रावधान भी किया गया जिसके माध्यम से किसानों को मौसम संबंधी पूर्वानुमान प्रदान किए गए।

ग्रामीण जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) का गठन ग्रामीणों के साथ गाँवों की जलवायु कमजोरियों के शमन और इस कार्यक्रम के तहत अपनाई जाने वाली रणनीतियों के बारे में गहन चर्चा के बाद किया गया। वीसीआरएमसी के नाम से बैंक में खाता खोला गया तथा बैंक खाते का वीसीआरएमसी के अध्यक्ष और संबंधित केवीके के प्रमुख द्वारा संयुक्त रूप से संचालित होने के साथ ही वीसीआरएमसी चालू हो गया। केवीके के परामर्श से गाँव में कार्यान्वित किए जाने वाले तकनीकी हस्तक्षेपों पर महत्वपूर्ण निर्णय लेने के अलावा विभिन्न कृषि उपकरणों एवं औजारों के कस्टम हायरिंग की निगरानी वीसीआरएमसी द्वारा की जा रही है। कस्टम हायरिंग सेंटर में विभिन्न कृषि उपकरण जैसे पावर टिलर, थ्रेशर, रीपर, वाटर पंप, जीरो-टिल ड्रिल, रेज्ड बेड प्लानर, स्प्रेयर, वीडर आदि का प्रावधान है। वीसीआरएमसी की देखरेख में एनआईसीआरए द्वारा गोद लिए गए गाँव में शुरू किए गए कस्टम हायरिंग सेंटर किसानों के बीच काफी लोकप्रिय हो रहे हैं तथा पर्याप्त मात्रा में धनोपार्जन भी हुआ है। दक्षिण 24 परगना केवीके द्वारा बोंघेरी गांव में गठित वीसीआरएमसी ने 2018-19 के दौरान अधिकतम रु 221915/- का धनोपार्जन किया।

2018-19 के दौरान 1463 किसानों और किसान महिलाओं (890 पुरुषों और 573 महिलाओं) को लाभान्वित करने वाले विभिन्न विषयगत क्षेत्रों पर क्षमता निर्माण के तहत कुल 175 पाठ्यक्रम आयोजित किए गए। विषयगत क्षेत्र थे- फसल प्रबंधन, प्राकृतिक संसाधन प्रबंधन, पोषक तत्व प्रबंधन, एकीकृत फसल प्रबंधन, फसल विविधीकरण, संसाधन संरक्षण प्रौद्योगिकी, कीट और रोग प्रबंधन, पशुधन और मत्स्य प्रबंधन, नर्सरी स्थापना, रोजगार सृजन, पोषक उद्यान, खेत मशीनरी की मरम्मत और रखरखाव, एकीकृत कृषि प्रणाली, पशु भोजन व चारा प्रबंधन, महिलाओं के लिए खेत की जुताई के साथ लाख की खेती में कठिन परिश्रम में कमी, मूल्य संवर्धन,

मानव पोषण और बच्चे की देखभाल, रोडेन्ट नियंत्रण आदि।

समीक्षाधीन अवधि के दौरान 7288 किसानों (4898 पुरुषों और 2390 महिलाओं) को लाभान्वित करने वाले विभिन्न विषयगत क्षेत्रों पर कुल 741 विस्तार गतिविधियाँ आयोजित की गई। विस्तार गतिविधियाँ निम्नवत विषयों पर आयोजित की गई- प्रविधि प्रदर्शन, कृषि सलाहकार सेवा, पशु स्वास्थ्य शिविर के माध्यम से जागरूकता, किसान चौपाल, किसान गोष्ठी, संसाधन संरक्षण प्रौद्योगिकी, किसान दिवस व फील्ड दिवस मनाना, नैदानिक यात्रा, समूह चर्चा, विश्व पृथ्वी दिवस, प्रौद्योगिकी सप्ताह, किसान मेला आदि। सभी नौ एनआईसीआरए-केवीके ने संबंधित केवीके में 5 दिसंबर, 2108 को कार्यशाला, संगोष्ठी, सिंपोसिया, जागरूकता शिविर के माध्यम से विश्व मृदा दिवस मनाया और एनआईसीआरए गांवों के किसानों को 1335 मृदा स्वास्थ्य कार्ड वितरित 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 16081 farmers (NRM- 1220, Crop Production-2470, Livestock and Fisheries- 2288, Institutional Interventions- 1352, Capacity Building-1463 and Extension Activities- 7288).

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 281 ha area which benefitted 1220 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 470 ha area which benefitted 2470 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 2288 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 152 units have been developed covering of 337.5 ha area of 1352 number of farmers. There is a provision of Mini Automatic Weather Station (AWS) through which farmers are provided weather forecasting data.

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

Custom Hiring Centers initiated in the NICRA adopted village under the supervision of VCRMC has become immensely popular among the farmers and substantial amount has also been generated. VCRMC constituted by South 24 Parganas KVK at Bongheri village generated maximum amount of Rs. 221915 during 2018-19

A total 101 courses were conducted under *Capacity Building* on various thematic areas benefitting 1463 farmers and farmwomen (890 males and 573 females) during 2018-19. 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 741 *Extension Activities* on various thematic areas benefiting 7288 practicing farmers (4898 males and 2390 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, 2018 in the respective KVK and distributed 1876 Soil Health Cards distributed among the farmers of NICRA villages.

1. Introduction

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

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

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

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

The project is comprised of four components.

- Strategic research through network as well as Sponsored / Competitive Grants mode
- Technology demonstration on farmers' fields to cope up with current climate variability
- Knowledge Management
- Capacity building of different stakeholders

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

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

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

List of districts and KVKs with Climate vulnerability

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

The NICRA-villages are selected based on vulnerability of agriculture to climatic variability. The climatic vulnerability of the village (droughts, floods, heat wave, cold wave etc) represents that of the district. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather data, resource situation, farming systems and agricultural yields in the past few years. Thus the interventions executed in NICRA villages by the NICRA-KVKs has not only enabled the farmers to cope with climatic vulnerability as well as it plays a key role in farmers' empowerment along with sustainable livelihood.

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

Name of KVK	Name of village
Ganjam 1	Chopara
Jharsuguda	Bhoimunda & 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 I: Natural Resource Management

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

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology:

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by *in situ* moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in 9 NICRA adopted villages covering 379 farmers in 91.83 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	20	1.5	175	68000	165500	3.43
Zero Tillage in wheat; Var. DBW39 / HD 2967	150	20	38.4	21375	34305	2.61
Organic mulching in vegetables (Tomato, brinjal); Var. Hybrid	35	0.33	322.5	131250	142875	2.08
Vegetables Poly-mulching in winter cucumber, Okra	17	1.0	314	64900	114000	2.75
Summer Ploughing in Rice	25	25	38.8	23400	27040	2.15
Green manuaring (dhaincha) in Rice	20	10	37.4	22800	25820	2.13
Ridge and furrow method of brinjal, cow pea (var. Kashikanchan) and radish cultivation	38	9.5	315.2	56000	45990	1.82
Green manuaring (dhaincha) in Rice	30	12	50	24000	36000	2.5
Moisture conservation in Rice – Summer ploughing by MB plough	20	6	39.7	30100	28259	1.94
Sowing of maize in Ridge & furrow method in upland	14	5	43.2	26200	25640	1.98
Green manuring by Sunhemp. (Sunhemp-Rice)	10	3	38.6	31100	25642	1.82
Total	**379**	**91.83**				

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 122 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	12	0.50	1242	29600	27377	1.92
Renovation of pond	32	0.28	18059	47500	125100	3.63
Enlargement of existing freshwater pond	02	0.32	1023	48000	51250	2.06
Brackish water pond	01	0.20	752	140280	145875	2.04
New water harvesting structure in the wheat field	01	0.40	852	34600	19500	1.56
Renovation of old water harvesting structure in rice field	05	4.2 0	3852	37500	23500	1.62
Raising of land embankment	09	2.50	1172	42350	145990	4.44
Dug out pond	02	2.00	1232	65500	62450	1.95
Renovation of canal	36	0.05	19548	40750	112500	3.76
Renovation of Defunct Well-03 nos.	11	1.50	1050	65500	82530	2.26
Construction of deep open well	12	2.50	1324	255000	345000	2.35
Total	**122**	**14.45**				

2.1.3 Conservation tillage:

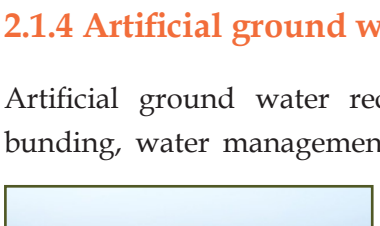
Sowing of *rabi* crops depends on the harvesting time of the preceding crop in *kharif* and also soil moisture status for undertaking land preparation for sowing. In case of wheat, this involves 2 to 3 or even more tillage operations for obtaining appropriate tilth before planting of wheat. In addition to the costs incurred and energy required, this causes delay in planting of wheat which often results in coincidence of vulnerable stage with high temperature stress during February/ March. This often leads to reduction in grain yield and loss to farmer. Zero till technology offers a viable and practical solution by avoiding repeated tillage for land preparation and sowing, reducing cost of cultivation and also permits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoid terminal heat stress. Zero-tillage refers to direct drilling of wheat in unploughed paddy fields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in five NICRA adopted villages in an area of 36 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.

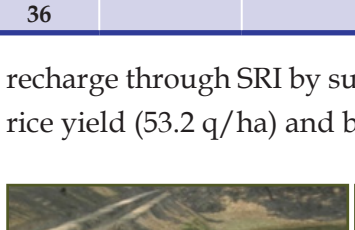
Table: Performance of ZTD in various crops

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	42	8	32.12	26750	24758	1.92
Promotion of improved variety of maize + Zero tillage technology	52	6	54.12	40000	39870	1.99
Surface seeding and mulching in lentil	17	5	21.23	19450	34500	2.77
Surface seeding and mulching in mustard	11	6	19.12	17950	18500	2.03
Sowing of rice with power tiller	32	11	25.52	23585	22550	1.95
Total	**154**	**36**				

2.1.4 Artificial ground water recharge:

Artificial ground water recharge done by field bunding, water management and through SRI by sub-soiler in paddy in 9 NICRA adopted villages covering 53.6 ha area in 92 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest rice yield (53.2 q/ha) and benefit: cost ratio (2.24).





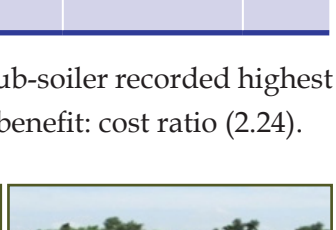


Table: Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Water management through bunding of rice fields	71	42.3	47.2	24700	20750	1.84
Ground water recharge through SRI by sub-soiler	21	11.3	53.2	39550	45250	2.14
Total	**92**	**53.6**				

2.1.5 Water saving irrigation methods:

Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in paddy demonstrated in NICRA adopted villages covering an area of 38.11 ha in 221 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	15	4.2	32.8	26800	21750	1.81
Application of biofertilizer in rice (var. *MTU 7029*)	42	6.5	67.3	34250	48540	2.41
Vermi-compost from biodegradable wastes	16	1.2	16.2	5150	4320	1.83
RBF in Brinjal and cucumber (var. *Malini*)	16	1.5	19.2	59550	64550	2.08
Sprinkler irrigation in green gram (Var. *HUM-16*)	9	2.4	12.6	15200	24670	2.83
Sprinkler irrigation in chickpea (var. *PG-186*)	24	5.5	12.8	15550	23950	2.62
Vermi-compost from biodegradable wastes	26	17.nos.	65	20750	64750	4.12
Sprinkler irrigation in green gram	14	11	18	19750	17440	1.88
Sprinkler irrigation in Brinjal (*MuktaKeshi*)	15	2.1	525.0	152000	635500	5.18
Sprinkler irrigation in Chilli(Tejaswini)	14	1.39	245	177500	800500	5.50
Sprinkler irrigation in Greengram (PDM-84-139)	8	1.06	8.1	7500	24900	4.32
Sprinkler irrigation in Poi (Basella)	3	0.2	226	49500	176500	4.57
Sprinkler irrigation in Okra	8	0.53	198	67000	131000	2.96
Sprinkler irrigation in Cucumber	6	0.2	142	53000	160000	4.02
Sprinkler irrigation in Pumpkin	5	0.33	146	57000	118200	3.07
Total	**221**	**38.11 ha & 17 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 252 farmers' fields with an area of 46.9 ha of land and 58 unit. 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	80	28.2	19.2	32978	25800	1.78
Solid waste management (Compost and Vermi-compost production unit)	58	58 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	22	4.5	21.2	34970	167400	5.79
Bio pesticides in Vegetables	35	6.2	159.0	50875	125240	3.46
Soil test based nutrient application in Cucumber	21	3.6	125	60200	177800	3.95
Use of IPM in Chilli leaf curl management	12	2.3	116.67	187533	395817	3.11
Use of IDM in Bittergourd bacterial wilt management	14	2.1	132.2	202985	525415	3.59
Shed net house for mushroom cultivation	10	-	2.2 kg Per bed	40/- per bed	136/-per bed	4.4
Total	**252**	**46.9 ha + 58 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 58 number of rainwater harvesting structures have been developed which could store 0.75 million cu m of water which could provide irrigation to 220 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 2018-19

New (Nos.)	Renovated (Nos.)	Total	Storage capacity (cu m)	Protective irrigation potential (ha)	Cropping Intensity (%) increase
26	32	58	0.75 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 paddy, brinjal, tomato, black gram, arhar etc were demonstrated in 9 NICRA adopted villages involving 245 number of farmers in 78.8 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)	17	12.5	23.5	15.5	51.61	18200	15316	1.84
Drought tolerant Rice (var. *Sahabhagi dhan*)	58	17.5	32.5	22	47.7	14600	21400	2.46
Red gram (bund planting)	16	1.3	16.2	12.4	30.64	29800	47200	2.58
Drought resistant brinjal (VNR-218)	32	5.1	532	440	20.90	75000	205000	2.9
Tomato (*Utkal Kumari*)	35	4.5	270	178	51.68	65000	199000	4.0
Black gram (*PU 31*)	28	5.8	11	7	57.14	18000	37000	3.05
Cotton (*Shalimar*)	36	19.5	24	16	50.0	38000	82000	3.15
Arhar (*PRG 176*)	23	12.6	16	11.5	39.13	22000	58000	3.63
Total	**245**	**78.8**						

Drought tolerant rice varieties like *Sahbhagi, Jogesh and others vegetables, pulses* were demonstrated in 78.8 ha areas of 245 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 12.2 ha area in 63 farmers' fields. Variety *Jarava* and *CSR-36* proved maximum salt tolerant potential by giving highest yield of 44.8 q/ha and 44.7 q/ha respectively and more economic return (BC ratio of 1.62 and 1.94 respectively).



Table: Performance of different salt tolerant rice varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	12	2.2	43.5	35.5	23.0	29750	23500	1.79
SR-26B	16	2.3	41.5	33.7	18.79	27500	28700	2.04
Usar Dhan-3	19	3.1	38.0	31.5	20.0	33650	16500	1.49
Salt tolerant Paddy *var. Jarava*	11	2.5	44.8	26.4	69.7	41250	25550	1.62
Rice *CSR-36*	5	2.1	44.7	34.3	30.3	29650	27830	1.94
Total	**63**	**12.2**						

2.2.3 Introducing flood tolerant varieties:

Flood tolerant varieties of paddy like *Swarna sub 1* and *Nilanjana/ Pratiksha / CR 500 / NC 492* were introduced through demonstration in 22.7 ha area in 95 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	31	8.0	44.5	-	100 Due to flood Swarna variety total damaged	40000	31200	1.78
Promotion of submergence tolerance rice var. Swarna sub-1/Nilanjana/ Pratiksha	56	11.1	42.25	29.5	44.73	21250	34440	2.62
Rice CR500	3	2.2	3.2	2.0	56.5	27500	19000	1.69
Rice NC 492	5	1.4	3.1	2.7	14.0	25750	14500	1.5
Total	**95**	**22.7**						

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 173 number of farmers' fields with an area of 33.5 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*	72	12.2	11.85	7.90	58	21250	27125	2.28
Green Gram, *var. PDM139*	31	4.3	11.10	5.14	63.5	20500	40700	2.98
Promotion of short duration rice (*GB-1/ Panth-18/ Sahabhagi*)	58	8.5	42.00	31.00	35.48	22060	34640	2.57
Short duration rice (*Jogesh*)	12	8.5	22.8	15.5	38.18	18200	15316	1.84
Total	**173**	**33.5**						

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 53.9 ha area of 143 number of farmers' fields. These interventions were carried out in seven NICRA adopted villages.

Table: Performances of water saving technologies for rice cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% in-crease	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Line sowing by paddy drum seeder	42	20.0	41	35	17.14	14580	35720	3.44
Direct seeded brown manured rice	41	10.6	45	34	75.6	32900	36100	2.12
Water saving technology through SRI	5	1.0	52.5	38.6	36.01	14850	19300	2.34
DSR (var. *Anjali*)	43	19.9	38	29.5	77.6	22858	33800	2.38
SRI/Use of trans-planter	12	2.4						
Total	**143**	**53.9**						

2.2.6 Community nurseries for delayed monsoon:

Seedlings of 25-30 days age are transplanted in July so as to complete flowering of photosensitive varieties before October and harvesting by mid November to facilitate taking up of timely sowing of *rabi* crops. Such a practice ensures optimum performance of both kharif and rabi crops. It appeared that failure of rain in July is responsible as transplanting of paddy is delayed with resultant adverse effect on productivity and a cascading negative impact on rabi crops. Delay in transplanting of paddy affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides paddy other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 38.6 ha area of 187 numbers of farmers. These interventions were carried out in 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	05	0.33	322.5	225.0		131250	142875	2.08
Community nursery of brinjal	10	1.00	560	425	32%	75000	205000	3.7
Community nursery of onion	25	1.50	265	210	26%	145000	12000	1.8
Community nursery of Chilli (Tejaswini)	5	0.20	108	79	36.71	177500	362500	3.04
Total	**187**	**38.60**						

2.2.7 Location specific intercropping systems with high sustainable yield index:

Various intercropping systems were demonstrated in regions which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. Intervention on location specific intercropping was demonstrated in six NICRA adopted villages. The demonstrations were carried out in 3.66 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.

Table: Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cauliflower + Ridge gourd	5	0.33	688	528	30.30	163800	224800	2.37
Brinjal + Coriander	5	0.33	591	521	13.44	145700	272600	2.87
Cucurbits / Gourd + solanaceous vege-tables	20	1.00	Gourd : 75.0 Vegetables: 251		72000	217500	64500	3.02
Maize+Ladies finger	10	1.00	Maize: 101.25.0	Maize: 75.0	-	63750	138750	3.17
Others if any chilli + tomato	10	1.00	30 + 322	275	127500	48000+ 193200= 241200	113700	1.89
Total	**50**	**3.66**						

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 145.7 ha area of 887 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).

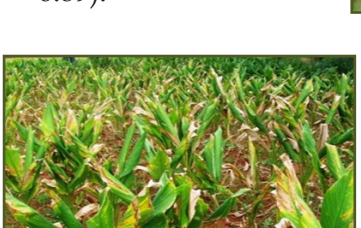


Table: Performance of different crop diversification in NICRA villages

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	22	4	118q/ha (green cob)	65 q/ha (greencob)	81.5	45200	72800	2.6
Crop diversification by Sweet corn variety-Sugar-75	10	0.8	116q/ha(green cob)	97(q/ha) Green cob	19.58	72000	160000	3.2
Onion (var. *N-53*)	40	6.1	298.5	190.0	63.7	70500	305650	5.45
Mustard (var. *Pusa bold*)	55	23.5	12.0	8.5	70.8	24800	40970	2.77
Chilli (var. *Surajmukhi*)	55	8.5	97.0	59.0	60.8	77000	189000	3.45
Gram (var. *Pusa 362*)	65	18.6	18.0	9.5	52.8	26650	46800	2.86
Tomato (var. *Param F1*)	54	8.1	227.0	158.0	69.6	78700	157550	3.11
Cabbage (var. *OM-3*)	45	7.5	341.0	257.0	75.4	74800	235000	4.24
Radish (var. *Suhra -32*)	55	6.9	129.0	86.0	66.7	71100	83000	2.27
Brinjal (var. *F1-Hybride Long*)	45	9.0	245.0	173.0	70.6	78500	169500	3.26
Cauliflower (var. *MSN-16*)	50	6.5	221.0	128.5	58.1	82800	196000	3.47
French Bean (var. *FE-51 ANUPMA*)	47	2.5	73.5	45.0	61.2	80900	107000	2.35
Turmeric (var. *Rajendra soniya*)	35	6.6	239.0	160.0	66.9	81000	310000	4.77
Ginger (var. *Nadiya*)	42	3.7	226.0	173.5	76.8	110000	590000	6.83
Lentil (Short duration var. *PL 406*)	48	9.6	16.5	7.5	45.5	18000	30000	2.74
Linseed (Short duration var. *T 397*)	34	7.5	7.5	4.8	64.0	11000	19000	2.83
Ol (var. *HYV Gajendra*)	35	3.7	800.0	253.0	31.6	94000	551840	6.9

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Nutritional garden- veg. seed Seem (*dolicus lablab)*	85	5.5	19.5	10.	51.3	8000	17000	3.27
Tomato under mulching	65	6.7	85.0	42.0	49.4	10000	30000	3.33
Total	**887**	**145.3**						

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 627 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	26	6	46.5	43.5	6.89	30000	35100	2.1

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cultivation of disease resistant Tomato var. Arka Rakshyak	10	0.4	284	242	76.85	82000	346000	5.2
Cultivation of short duration green gram var. IPM 02-3	10	4	7.8	5.7	36.84	15510	22490	2.4
Income generation activities (Marigold cultivation by women SHGs)	10	5	124 q/ha flower yield	86 q/ ha Flower yield	44.18	78000	294000	4.7
Vermicomposting	2	2 unit	5q/pit	4q/pit	25	1500	3500	3.3
Oyster mushroom cultivation by WSHGs	10	4 unit	2.2 kg Per bed	1.8 kg/ bed	22.22	40/- per bed	136/-per bed	4.4
Contingency crop Brinjal (var. *PUSA Uttam*)	24	3.5	399	325	36	59500	291950	6.64
Integrated crop management of mustard (*NC-1*)	47	6.8	31	18	72	40560	47580	2.13
Promotion of stem rot resistant Jute (var. *JBO-2003H*)	40	6.5	38	29	66	35500	49900	2.45
Integrated crop management of lentil (*Maitri*)	46	6.5	17	11.5	56	31500	42970	2.41
Integrated disease management in vegetables	26	5.9	251	225	38	96000	41500	1.51
Demonstration short duration vegetables as contingent crop Tomato (var. *PUSA Gaurav*)	22	3.5	365	300	24.5	59500	197500	4.63
Contingency crop Cauliflower (var *PUSA Sharad*)	30	2.5	265	220	36	61000	237500	4.85
Contingency crop Radish (var. *PUSA Chetki*)	47	2.7	165	125	64	57500	65900	2.19
Soil reclamation : Levelling / bunding and flooring for leaching of salt	42	9.6	41	35	66.5	40000	49000	2.29
Integrated fish farming	45	6.5	4	2.5	82.5	58000	141200	3.39
Integrated farming system	45	6.5						
late blight disease of potato	22	2.9	315	280	8.5	122500	195000	2.54
Bio-control agent production	32	-				Rs. 55/Kg	Rs.600/Kg	
Mushroom	26	-	14			Rs. 25/ cylinder	Rs.55/ cylinder	3.22
Forest tree plantation	65	2.5	1600 Plant					
Total	**627**	**81.3 ha & 6 unit**						

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 181.6 ha involving 867 number of farmers utilized for different fodder production were demonstrated in eight different NICRA adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return (B:C:: 5.59).

Table: Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Berseem	48	7.0	820	680	42	36500	91500	3.59
JHB-146	50	6.7	850	659	22.5	30000	73000	3.45
Quality legume fodder Berseem (var. *Muskavi*)	24	3.6	969	845	32	34500	74000	3.19
Quality legume fodder Oat (var. *JHO-822*)	48	4.5	550	444	28	29850	45000	2.55
Quality legume fodder Sudan chari	27	1.4	45	34	49	13900	36200	3.79
Quality legume fodder Sudan Grass	51	8.5	549	199	45	58000	263000	5.59
Fodder production of Maize/Sudan	427	50.1	540	456	31	41000	91000	3.29
Fodder cultivation with improved vars. Hybrid Napier (CO -3)	31	5.9	78	40	65	15100	19000	2.34
Sorghum (*Moti*)	28	3.2	354.5	270	33.5	19950	56200	3.74
Molases	101	78	24	17	38.5	9900	7500	1.79
Oat (*Kent*)	32	12.9	480	376	29.7	20800	23900	2.25
Total	**867**	**181.8**						

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. 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 82 numbers and 2.5 ha and 30 nos. of units showed very promising results.

Table: Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder grass on farm bund (Rice bean Var. Bidhan-1)	30	2.5	182	-	-	1600	16300	13.75
Silage Making	52	30 nos	9.8	7.1	66	45	270	8.65
Total	82	2.5 ha & 30 nos.						

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 for PPR in goat and Ranikhet in Poultry.	220	250	Occurrence of disease not recorded in vaccinated group.	Sporadic out break	-	-	-	-
Vaccination camp against FMD Cattle & PPR against goat	265	273	Mortality rate (80-85%) reduced	Mortality rate (40-50%) reduced	-	-	-	-
Deworming (Febendazole) & Mineral mixture	50	195	13% mortality	89% mortality	91% survival	624500	154570	1.35
Proper De-worming	270	78	11	7	42	27	159	7.91
Vaccination camp against HS+BQ+FMD in Cattle & PPR against goat, De-worming & providing Mineral mixture (Cattle: 212, Goat: 82, Sheep: 56, Poultry: 352)	108	745	-	-	-	-	-	-
Total	**913**	**1541**						

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 107 farmers' fields of NICRA adopted villages. *Khaki Campbell* duck was also introduced through this intervention.

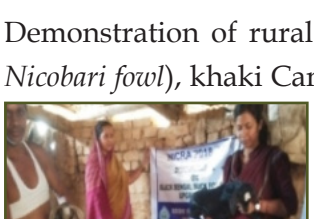
Table: Performance of composite and cat fish in the renovated ponds

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite fish culture with **Pacu** and **carp** Stocking density Local practice: 11000/ha Demo: Carp – 9000/ha Pacu – 3000/ha Introduction of Pacu helped the farmers to utilize vegetables like cabbage, bottle gourd, etc. as fish feed when there is low market price for the same vegetables.	4	0.55	**Carp: 30.50 q/ha** **Pacu: 15.1 q/ha** Avg wt. 550g **Total: 44 q/ha**	**Carp: 38.0 q/ha**	30.52%	191250	383550	3.01

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite fish culture with **Tilapia** (Salinity tolerant) and **carp** Introduction of tilapia (all male) increased the total cost of cultivation by 25%, but it gives extra protection to the farmer in case of any saline water ingress	5	0.67	**Tilapia** Length (mm)-183 Weight(g)-145 Survivability (%)- 83 Yield (q/ha)- **16.90** **Carp** Length (mm) -235 Weight(g)-490 Survivability (%)-81 Yield(q/ha)- **29.00** **Total: 47.60 q/ha**	**Carp** Length (mm) -238 Weight(g)-447.6 Survivability (%)-83 Yield(q/ha)- **34.5**	52%	238750	277800	2.16
Cat fish culture	35	3.5	1550	805	97.08	19900	76500	4.84
Composite Fish Farming	08	0.6	35.5	24	172	48400	139100	3.87
Composite Fish Farming	55	21.3	690	300	132	21500	53000	3.46
Total	**107**	**26.62**						

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 233number of farmers fields. Improved ornamental bird was introduced through this intervention which showed very promising results (B: C:: 5.96).



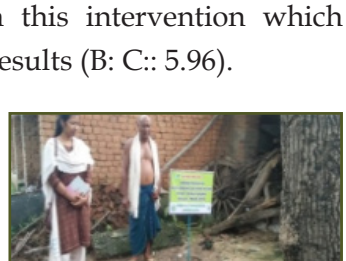


Table: Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Breed up gradation with buck breed Black Bengal.	2	2	Body weight (kg) in 10 month 25 kg	Body weight (kg) in 10 month 18 kg	38	2080	6670	4.2
Rearing of colour synthetic poultry bird	10	10	Body weight 2.5 kg in 6 month	Body weight 1.8 kg in 6 month	39	320	1180	4.6

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
Duck Rearing-Khaki Campbell	10	10	Body weight (kg) 2.4 kg in 6 month	Body weight (kg) 1.8 kg in 6 month	33	380	1350	4.5
Hydroponic fodder production	5	5	Milk yield per month/animal 150 lit	Milk yield per month/ animal 146lit	40	1350	4800	4.0
Low cost Azolla production as supplementary cattle feed	11	10	3.5 lit/ animal	2.75 lit/ animal	131	3800	7400	2.95
Replacement of local breed with Khaki Cambell	24	125 nos	Prodn: 26/duck/ month	Prodn: 21/ duck/month	46	Rs. 85 duck/ month	Rs. 75duck/ month	1.91
Backyard poultry (Improved Nicobari fowl)	26	150 nos	160 egg	85 egg	87	3300	4889	2.51
Ornamental bird	21	34 nos	Hatchability-90%, fecundity-70%, chick	-	-	90pair/ bird/year	430/pair/ bird/year	5.96
Addition of mineral mixture	85	490nos	1.85	1.25	35	1850	2600	2.48
Rural backyard poultry Kuroiler Birds	48	200 nos	2.5 kg at 10 weeks	1.5 kg at 10 weeks	45	95/bird	55/bird	1.48
Total	**233**	**37 ha & 999 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
Cementing floor of Cattle	2	2	Lactational Milk yield(lit) 1110	Lactational Milk yield(lit) 850	30.5	8770	33300	24530	3.8
Hut making	12	15	35	08	85	40	290	295	8.25
Improved shelters for poultry and livestock	29	27	-	-	-	-	-	-	-
Mud based Shelter Bamboo+Paddy straw+mud	43	45	Mortality 10%	Mortality 70%	Survival 75%	-	-	-	-
Total	**86**	**89**							

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 paddy, soybean and foxtail millet during 2016-17. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

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

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	7	Paddy seed	101.9 q	Metal seed bins, layers of dried neem leaves and dry chilli kept with seeds to prevent insect attack	118	21.5
		Lentil	5.0 q	Buy back by KVK Variety: var IPL- 406 following rules of seed production	10	1
		Black gram	102q	Proper care and storage of black gram. Seed treatment with babistine. Preservation of germination quality. Registration of seed bank	474	5
Fodder bank	6	Napier grass	245	Animal feed	31	1.57 ha
		Hybrid napier	28t/yr	Managed by the group	04	0.4
		Maize	39 q	Proper care and storage of maize seeds. Seed treatment with bavistin. Preservation of germination quality. Registration of fodder bank	26	39 q
Commodity groups	7	Paddy straw mushroom	-	Cultivation of paddy straw mushroom Volvariella volvaceae and Volvariella diplasia by WSGH for income generation	52	10 nos. (100 beds)
		Oyster Mushroom	-	Cultivation of oyster mushroom (var. P.Sajarcaju) by WSHG for income generation	46	10 nos. (100 beds)
Custom hiring centre	9	Power Tiller	3 no. (Rs. 160/hr)	Managed by VCRMC	56	22
		Power Tiller	1 no. (Rs. 150/hr)		15	5
		Pumpset	4 no. (Rs. 80/day)		32	16
		Knapsack	4 no. (Rs. 40/hr)		35	18
		Sprayer	4 no. (Rs. 2/hr)		24	14
		Water pump	156 hours	Total Rs. 36600 earn Custom hiring centre 15500, 2400, 600, , 18000		
		Sprayer	80 days			
		Thresher	-			
		Paddy weedier	30 day			
		Zero tillage machine	90 hrs			
		Power tiller	Rs.250/hr	Ploughing	10	16 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		
		Paddy reaper	Rs.250/hr	Reaping paddy	9	8 ha
		Tractor drawn labeller, Tractor drawn MB plough, Tractor drawn rotavator, Self-propelled riding type reaper, Diesel pumpset, Knapsack Sprayer	27000		146	82
		Power sprayer	Rs.20/hr	25 hr	62 nos	38
		Diesel Water pump Set	Rs.30/hr	30 hr		
		MB plough	Rs.20 /hr	25 hr		
		Mini weeder	Rs.20/hr	30 hr		
		Reaper	Rs.100/hr	30 hr		
		Thresher cum winnower	**Rs.30/hr**	**40 hr**		
		Power tiller	Rs.40/hr	44 hr		
Climate literacy through a village level weather station	9	Recording daily temperature, RH, Rainfall in the village	3 units	Daily data recorded by VCRMC	All villagers	-
		Off/On season vegtables	9 units	Awareness & skill development	170	**12.5**
Others (if any)		Elephent foot yam	4		32	7 ha
Total					**1352**	**337.5 ha & 20 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

Name of KVK	Revenue generated (Rs.)	
	From Custom Hiring Centres	Total under VCRMC
Cooch Behar	36600	55416
Malda	23570	55215
Port Blair	39186	21400
South 24 Parganas	32176	221915
Kendrapara	24,800	42,209
Sonepur	33000	5000
Kalahandi*	-	-
Jharsuguda	34555	5200
Ganjam	6820	6820
Total	**230707**	**413175**

* No CHC has been established yet

3. Capacity Building

A total of 101 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 1463 farmers and farm women (890 male and 573 female) during 2018-19. 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	Breeding and seed production of Asian Catfish (Desi Magur – *Clarias batrachus*) as a climate resilient species	2	56	18	74
	Different vaccination schedule implies for prevention of viral diseases in livestock	6	40	34	74
	Care and management of livestock	6	39	23	62
Integrated Pest and disease Management	Eco-friendly chemical pesticides and organic plant protection measures against pest resurgence	3	57	20	77
	Practice of Bio-pesticides instead of large scale use of synthetic	4	62	29	91
	Mechanical weeder as substitute of new as weedicide	2	21	9	30
Natural Resource Management	Use of indigenous technological knowledge to combat biotic and abiotic stresses in agriculture	2	36	14	50
	Zero Tillage in maize	3	19	0	19
Biological Control	Bio-intensive pest and disease management for Rabi season	4	89	25	114
Food processing	Food processing training for empowerment of farm women	2	0	40	40
Integrated Farming System	Training Programme on "Integrated Farming System"	3	65	35	100
	Small scale entrepreneurship on mushroom cultivation	1	24	6	30
Skill development training	Skill development training on Quality Seed Grower	3	9	1	10
	Skill development training on "Nursery grower	5	20	5	25
Spice cultivation	Turmeric cultivation	2	32	18	50
Plantation crop	Arecanut Cultivation	3	0	24	24
Organic farming	Training on Organic Farming.	7	82	43	125
Vermi composting	Training on Vermi-composting	5	34	31	65
Soil sample collection Technique	Training on Soil sample collection technique	7	49	26	75
Income generation activity	Training on Marigold cultivation	2	11	14	25
Mushroom cultivation	Skill development training on mushroom production	2	22	23	45
Bio- fertilizer application	Bio fertilizer application in cauliflower	3	19	14	33
Off- season Vegetable Cultivation	Training on Off- season Vegetable Cultivation	1	18	7	25

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Value addition	Skill development training on fruit and vegetable preservation and value addition	6	0	32	32
Nutrient Management	Use of sun hemp/ brown manuring for better fertility status and yield	4	17	9	26
	Micronutrient application and soil test based fertilizer application	8	43	38	81
Nursery raising	Community nursery	5	26	35	61
Total		**101**	**890**	**573**	**1463**

4. Extension Activities

NICRA implementing KVKs conducted a total of 741 extension activities on various thematic areas benefitting 7288 practicing farmers and farm women (4898 males and 2390 females) during 2018-19. 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	22	241	164	405
Group meetings	18	263	149	412
Field day	33	627	208	835
Exposure visits	17	275	73	348
Awareness Campaigns	24	570	198	768
ICT based extension services	35	216	37	253
Diagnostic visit	215	248	170	418
Field Visit	32	554	358	912

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
World Environment Day Celebration	1	125	14	139
Live Webcasting	3	43	16	59
Strengthening SHGs	12	0	24	24
Strengthening kisan clubs	4	50	15	65
Other Training Courses	15	316	41	357
KMAS Services	48	222	117	339
Popular extension literature	8	244	160	404
Animal Health Camp	6	558	454	1012
NICRA Workshop at ATARI, Kolkata	1	44	26	68
Scientist visit to field	246	230	88	318
Kisan Mela	1	72	78	150
Total	**741**	**4898**	**2390**	**7288**

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 1876 numbers of Soil Health Cards were distributed on that particular day and cards were distributed by the public representatives like MP/MLAs and others in the respective KVKs. KVK wise distribution of soil health cards are presented in the following table.

Table: KVK wise distribution of soil health cards

KVK	Year	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers benefitted
Port Blair	2018-19	38	38	48	48
Ganjam I	2018-19	54	54	62	62
Sonepur	2018-19	48	48	92	92
Kalahandi	2018-19	55	55	45	45
Jharsuguda	2018-19	8	8	35	35
Kendrapara	2018-19	24	24	24	24
Coochbehar	2018-19	1200	1200	1200	1200
Malda	2018-19	380	380	312	312
S. 24 Pgs	2018-19	42	42	58	58
Total		**1849**	**1849**	**1876**	**1876**

6. Annual Zonal Workshop of NICRA-TDC of ICAR-ATARI Kolkata and Patna Held at WBUA&FS, Kolkata on June 27-28, 2018

Annual Zonal Workshop of KVKs of Zone IV and V was jointly organized by ICAR-Agricultural Technology Application Research Institute Kolkata and Patna during June 27-28, 2018 at West Bengal University of Animal and Fishery Sciences, Kolkata. In this program, all 22 KVKs from Andaman & Nicobar Islands (1), Bihar (07), Jharkhand (06), Odisha (05) and West Bengal (03) participated and presented their progress report and action plan.

Dr. J. S. Samra, Former Deputy Director General (NRM), ICAR and former CEO, National Rainfed Area Authority, Government of India, New Delhi, Chief Guest of the programme, while addressing the inaugural speech he emphasized upon 'waste to wealth' to produce bio-CNG from crop residues which is cheaper than the fossil fuels etc. He has also made a presentation on Management of paddy straw for Bio- CNG manure, Employment and Swachh Bharat. Pollution due to ultra fine particles (PM 2.5) is more severe causing premature death and disability. He concerned about crop residue burning is a serious threat in northern India and gradually increasing in eastern India.

Dr. S. S. Singh, Director, ICAR-ATARI Kolkata mentioned that the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority.

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

Dr. Md. Osman, Coordinator, NICRA-TDC, CRIDA, Hyderabad stressed upon up-scaling of low cost promising technologies to neighbouring villages and documentation of success stories. He also emphasized that development of different models of entrepreneurship with focus on custom hiring centres, seed bank and primary level of value addition.

Few publications like *Effect of heat stress on livestock and their remedies*, *Crop cultivation during flood through land managemen*t and *Mung ki Kheti etc*. were released during the workshop.

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

In the technical session all the Heads of the KVKs have presented one by one their salient achievements of out scaled technologies during the last six years and also placed the Action Plan of 2018-19.

Directors of Extension Education of SAUs of Zone IV and V, State Government representative and scientists from other ICAR Institute have also attended the workshop.

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

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

- In flood prone area land embankment should be done in community basis and *Paedasekhram* system develop in Kerala (Kutanal area) should be adopted.
- Custom Hiring Centre (CHC) should be made self sustainable.
- NRM should be done in convergence mode with line department like MGNREGA, Soil conservation and other agencies
- An interactive meeting with Institutes involved in strategic research of NICRA with TDC NICRA for dissemination of technology generated through the strategic research
- Annual progress report of strategic basic research of NICRA should be circulating among the NICRA KVKs of Zone IV and V.
- Low cost/portable hatchery should be promoted for employment generation.
- Ridge and sunken system should be promoted for maize cultivation.
- State wise meeting with TDC, State government department, ATARI Scientists and SAUs Scientists for up-scaling the successful technologies
- Area specific mineral mixture should be demonstrated for health improvement of livestock
- At least one Signatory authority should be from KVK for VCRMC bank account.
- AWS established in the KVKs must be functional
- KVKs where no SRF recruited, there Project Assistant/Young Professional may be engaged for running the activities under the project
- Rainfall intensity month wise must be calculated and presented in the report
- Emphasis must be given for convergence with different ongoing programmes in the district particularly for KVKs of Odisha
- Vulnerability index should be measured and accordingly intervention to be executed
- Large scale dissemination of successful technologies to be undertaken in the nearby villages also
- After saturation of farmers in present NICRA village with technologies then those need to be replicated in neighbouring villages
- Performance of CHC and VCRMC need to be improved particularly in Odisha KVKs
- Contingent planning season wise need to be prepared to respond in time
- NICRA activities should not be clubbed with KVKs normal activities
- Topographic situation of village data (Up, Mid & Low land) should be kept in each NICRA village
- Socio-economic impact of the successful technology demonstration should be analysed
- Intervention on livestock/fishery should be taken on proper climate resilient basis
- Well performing NICRA KVKs must exchange their knowledges with other NICRA KVKs
- Documentation of the successful intervention to be prepared
- Crop diversification intervention need to be undertaken in more numbers particularly in Odisha KVKs

- Extension activities or training programme to be conducted on climate related issues
- All the KVKs should prioritize their required equipments based on the budgetary provision. Small implements may be procured from the contingency budget of NICRA
- Effective utilization of fund must be followed and AUC/SOE must be submitted in time
- Demonstration of different units in KVK to showcase different technology
- Identification of technology according to land pattern must be followed
- Identify different climate resilient varieties and inclusion of those in the district plan in collaboration with district authority for horizontal spread.

7. Review Meeting of NICRA-TDC of ICAR-ATARI Kolkata Held at CISH-KVK Malda During Dec 21-22, 2018

The Review Meeting of NICRA, Seed Hub and CSISA of Zone V was held at CISH-KVK Malda during Dec 21-22, 2018. The programme was co-chaired by Dr. S. S. Singh, Director, ICAR-ATARI Kolkata and Dr. S. Rajan, Director, ICAR-CISH, Lucknow. The Programme was attended by Dr. S. K. Roy and Dr. F. H. Rahman Principal Scientists, ICAR-ATARI Kolkata; Prof P. Pal, DEE, UBKV and Dr. S. Mukherjee, Deputy DEE, UBKV and 19 KVKs from Odisha and West Bengal involved in the said projects.

Dr. S. S. Singh, Director, ICAR-ATARI Kolkata mentioned the purpose of Seed hub, CSISA and NICRA and briefed the different components and interventions. He also asked the successful and scalable technologies of NICRA project should be replicated in nearby areas.

Dr. S. Rajan, Director, ICAR-CISH Lucknow threw light on the progress of Seed Hub and gave committment for completion on seed storage go down and installation of seed processing unit by end of this financial year.

Dr. S. K. Roy, Nodal Officer of Seed Hub and CSISA briefly presented the progress of the projects as a whole.

Dr. F. H. Rahman, NICRA Nodal Officer presented the highlights of the salient achievements carried out by the NICRA- KVKs of the zone V with fund utilisation status.

In the technical session all the PIs of the KVKs have presented one by one their salient achievements of out scaled technologies during this year and also placed the next plan of work.

There was a field visit to NICRA village Narayanpur of district Malda and participants interacted with the VCRMC members regarding outscaling of various climate resilient technologies.

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

1. Vulnerability index should be measured and accordingly intervention to be executed
2. Large scale dissemination of successful technologies to be undertaken
3. After saturation of farmers in present NICRA village with technology then those should be replicated in neighbouring villages
4. Farmers wise and intervention wise data to be provided by every KVK
5. Performance of CHC and VCRMC need to be improved particularly in Odisha KVKs
6. Contingency planning may be prepared to respond in time

7. Detail of proven technology needs to be documented
8. NICRA activities should not clubbed with KVKs normal activities
9. Topography situation of village data (Up, Mid & Low land) should be kept in each NICRA village
10. Socio-economic impact of the successful technology demonstration should be analysed
11. Intervention on livestock/fishery should be taken on proper climate resilient basis
12. Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs
13. Documentation of the successful intervention to be prepared
14. Creation of water resources should be more in Odisha KVKs
15. Crop diversification intervention need to be undertaken in more numbers in Odisha KVKs particularly
16. Extension activities or training programme to be conducted on climate related issues
17. All the KVKs should prioritize their required equipments based on the budgetary provision.
18. The titles of the training under NICRA should be innovative with thrust on climate resilience.
19. Conducting Impact evaluation of KVK by ATARI and other external agency.
20. Effective utilization of fund must be followed
21. Emphasis must be given for convergence with different ongoing programmes in the district particularly for KVKs of Odisha
22. Demonstration of different units in KVK to showcase different technology
23. Identification of technology according to land pattern must be followed
24. Identify different climate resilient varieties and inclusion of those in the district plan in collaboration with district authority for horizontal spread.

8. Zonal Monitoring Committee visit to NICRA KVKS

Zonal Monitoring Committee of NICRA-TDC for Zone V visited two KVKs of West Bengal State (Malda and Coochbehar) during August 28-29, 2018.

During the visit to KVKs, the Committee Members suggested to scale-up the climate resilient technologies for the benefit of farming community.

In Narayanpur, NICRA village of Malda the ZMC monitored various interventions implemented under NRM, Crop Production, Livestock and Institutional modules and interacted with farmers, farm women and VCRMC members.

At Khagribari, NICRA village of Coochbehar KVK the team gave valuable suggestions for further improvement and refinement of technologies as per the local needs in relation to climatic vulnerabilities.

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

One Publication NICRA-TDC Newsletter, July 2018 of ICAR-ATARI Kolkata was released during the visit.

The ZMC consisted of Dr. H. K. Senapati, Former Dean, OUAT, Bhubaneswar as Chairman; Dr. S. S. Singh, Director, ICAR-ATARI Kolkata as Vice-Chairman, Dr. JVNS Prasad, Coordinator, NICRA-TDC as Nominee of Director, CRIDA, Hyderabad; Dr. Prabhat Pal, Director Extension UBKV as Member; Dr. F. H. Rahman, Pr Scientist/Nodal Officer, NICRA-TDC, ICAR-ATARI, Kolkata as Member Secretary.

Following are the salient recommendations intervention-wise emanating from the discussion directly related to the project sites.

Water resource	Twenty percent of total cultivated area is irrigated using bore well by lifting ground water. Due to erratic distribution of rainfall observed it was recommended to renovate existing pond for water harvesting, store and recycle the same for use in crop production during winter experiencing minimal rains. Though there exist a number of small and large size water bodies most of them are seasonal and cannot be used as source of irrigation during critical stages of rabi crops because of the fact that (a) water holding capacity of the soil is very poor due to its coarse texture, and (b) average depth of ponds ranges from 5.5 - 7.0 ft from the ground level. Total 27 numbers of ponds having average depth of 5-7 ft. were selected for renovation at different corners of the village which however remain dry from December onwards but ponds having depth of 9 ft. or more can retain water throughout the year. Considering this, depth of selected ponds was increased from 5.5 - 7.0 ft. up to 10.5 - 11 ft (from ground level), so that water to be stored in the water bodies can be used for life saving irrigation to rabi crops with special emphasis on vegetables during mid-December to mid-March. Raised bed and furrow method of irrigation in vegetables is also recommended for saving irrigation water and fuel. Besides, attempts should be made to check the seepage loss of water using appropriate technologies for which necessary collaboration may be sought from relevant agencies. However, It is recommended to collaborate with the experts in relevant fields for hydrological survey of the ground water before planning for its exploration through re-excavation or fresh excavation of existing ponds and canals, shallow and semi-deep TW particularly in areas having acute shortage of water for irrigation. It would be preferable to combine such practices with creation of drainage facilities, wherever possible, so that the excess water may be re-utilized for irrigation.
Minimizing irrigation requirement	Adoption of water conservation measures to get more crops per drop may be undertaken and some of the steps may be: • It is suggested to find out the beneficiaries along with irrigated area coverage and find out their impact on the farming community. • Low discharge- high frequency irrigation methods like drip, sprinkler and pitcher are ideal to increase water use efficiency and cover larger areas under irrigation. • Drips are particularly useful as well for poor quality water use otherwise not permissible for conventional irrigation.
Climate change &crop planning	The committee suggested that each and every demonstration should address the changing climates and their effects. • It is suggested to conduct probability analyses of rainfall and temperature, and based on this the future trend of the climatic scenario with the help of climate change models available to work out scientifically future cropping and water use strategies to mitigate climate change. • The interventions onrainfed rice based cropping systems may be taken up as priority as rice is the major crop of the area. • Paira/Utera cropping (relay cropping) are to be taken in paddy field for proper utilisation of residual moisture. • The Cropping system such as rice-cowpea, maize-cowpea, rice- arhar, rice-green gram may be followed for utilization of fallowland and residual moisture. • No further intervention on boron application in cauliflower may be practiced • Crop diversification with suitable varietal substitution havingdrought tolerant capacity and short growing period should betaken up to combat the ill effects of climate. • Introduction of inter cropping such as potato + maize, maize + groundnut, maize + moong during rabi in post flood areas. • In case of INM in brinjal, inoculation of *Azotobacter* and *Azosporillum* may be considered. It is suggested that project may be taken up on the subject to motivate and train farmers on establishing nursery for flower or other commercially important horticultural plants.

Soil resource	Few interventions to be undertaken to address the effect of climate change on the soil resources as: • Finding out the amount of nitrogen fixation by green manuring in rice and other crops and then in accordance to that recommending the fertilizer to the farmers. • Suitable low cost industrial wastematerials may be used to neutralize the acidity of soil. • Use of bio- fertilizers may be encouraged in crop production.
Conservation tillage	This is regarded as an important practice to build up soil carbon and combat adverse impact of climate change, on which there are no studies made so far. Raising of bund height in rice field may be encouraged along with residue incorporation for better restoration ofsoil moisture and organic carbon status.
Custom hiring of agricultural machineries	There were considerable interests shown by the farmers for custom hiring of agricultural machineries. The existing facility is of good use and may be augmented to provide such facilities like wheat thresher, maize sheller (bigger size), spray machines, zero tillage equipment, meeting hall, weather station *etc*. There were large demands for bigger tractors for custom hiring. Small implements required for both the sites may be procured from the contingency head of the budget.
Alternate farming practice & roles of women folks	Alternate farming practice was also suggested by the committee which are mentioned as: • To upgrade the local goat breed by the introduction of *Black Bengal* is a better option, which should spread to other villages andthe stage method of housing for goat should be improved by enhancing the height of *machha* than the existing practices with good ventilation. • Introduction of poultry breed Kadaknath • Poultry breeds like *Devjan, Banaraja, Grampriya* etc, which are heat tolerant &having highersurvival capacity in this dry climate of Malda may be taken up. • Balanced animal feed with mineral mixture supplementation maybe done for better growthof animals in hot climate. Following could be the areas for entrepreneurship where women also may take significant role. These are: (1) Preparation of feed concentrate as fodder supplement since grass/fodder alone may not suffice to feed cattle and animals, their health condition being in general very poor.(2) Establishing polyhouses and nurseries for flower and other commercially important horticultural plants. (3) Construction of cross-ventilated poultry sheds and scientific cultivation of poultry, duckery, piggery and goatery with emphasis on introduction of local breeds resistant to survive under adverse conditions with high yielding ability.(4) Scientific/composite fish cultivation (including selling of fish fingerlings) in ponds. (8) Frequent health camp for cattle's and other domesticated animals including emphasis on AI of cattle's, (5) Allied practices like apiary, mushroom, vermicomposting & composts out oflocal falls and other wastes etc.

Village Climate Risk Management Committee (VCRMC)	VCRMC is advised to organize more awareness meetings among the famers for taking up the various interventions. There must be at least 20% members from women folk in each VCRMC. Being a remote and difficultly accessible area in both the sites the members of the committee should strive to develop self-reliant technologies, for which a major approach could be to set up small scale industries on value addition of several local products of fruits and vegetables.
Marketing strategy	It is advisable for VCRMC to form small cooperatives and fetch higher return for the farmers themselves from their farm produces by avoiding middlemen. The SHGs may also be useful for this purpose. The project may advice and encourages them.
Convergence programme	The committee emphasized on the Convergence programme where both the KVKs need to take initiative for making convergence with ongoing projects in the respective district. Through this convergence KVK might generate good funding flow from other department.

9. Field Visit For Monitoring NICRA Activities

Ms. Ria Bhattacharya, SRF, NICRA-TDC and Mrs. Jhumur Basak, SRF, CFLD-Pulses ICAR-ATAR Kolkata visited NICRA Project sites *viz*. Chopara village of Ganjam I and Dasmankul village of Kendrapara KVKs during Nov 14-18, 2018 to collect data of ongoing activities carried out by the KVKs and also to interact with the farmers and VCRMC members. Various demonstrations like Ridge and Furrow cultivation of cowpeas (var. *Utkalmanika*); rain water harvesting structures; azolla cultivation pits; check dams; flood tolerant rice varieties (*Swarna sub 1* and *Bina 11*), drought tolerant rice variety (*Sahabhagidhan*) , Brown mannuring, mushroom cultivation, hydroponic fodder cultivation, low cost poultry and gotary house, bee keeping, vermicompost pits, custom hiring centres etc were visited. There was in-depth discussions with the farmers and VCRMC members at respective sites of both the KVKs.



10. Convergence Programe

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

material and mineral mixture demonstration were taken up in convergence. Capacity building of the farmers in NICRA villages was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programs. Efforts were made to enhance the coverage of the interventions in the village with the support of the line departments through convergence. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2018-19. The prominent development schemes are MGNREGA, NTPC, NABARD, Sunderban Development Board, Forest Department, Irrigation Department, different Departments of the concerned states. RKVY *etc*.

KVK	Development Scheme / Programme	Nature of work	Amount (Rs.)
Ganjam I	Breed upgradation programme (AICRP, OUAT)	Training & Buck supply	1,20,000
	Women empowerment (CIWA)	Training & nutrient management of Goat	80,000
	Check Dam	MGNREGS	8,00,000
Total			**10,00,000**
Sonepur	ATMA	Demonstration of rice var. NRK-51 & 52	4,25,000
Total			**4,25,000**
Kendrapara	PWD	Supplied dhanicha at subsidy rate for promotion of green manuring	3,20,000
		Road constructed by PWD department from village entrance to end of the village	2,40,000
		Repair of village	1,20,000
		Establishment new tube well for clean drinking water	3,68,000
		Deworming and vaccination of large and small rumants	30,000
		Oil seed (Ground nut, mustard) and pulse minikit Green gram)	55,000
	NFSM	NFSM cluster demonstration (green gram)	40,000
Total			**11,73,000**
Jharsuguda	Water shed development mission, Jharsugda	Desilting of WHS	5,00,000
Total			**5,00,000**
Kalahandi	Odisha lift irrigation corporation	Construction of deep bore well	5,00,000
	Department of Agriculture, Govt. of Odisha	Construction of dug well	1,25,000
	Minor irrigation, Govt. of Odisha	Renovation of check dam	19,00,000
	Department of Animal Husbandry, Govt. of Odisha	Construction of cattle shed	8,80,000
	Department of Animal Husbandry, Govt. of Odisha	Distribution of cattle feed and mineral mixture	1,10,000
Total			**35,15,000**
Cooch Behar	MNREGA	Compost Chamber	44,00,000
	MNREGA	Cat fish culture chamber	52,80,000
	MNREGA	Planting materials (Arecanut, Black pepper, banana)	25,44,000
	MNREGA	Azolla mother culture	11,00,000
	MNREGA	Chicks	18,000
	IWMP	Bund making in riverside	3,50,000
	Irrigation department, Govt. of West Bengal	Renovation of Gully formation	6,00,000
	NREGS	Renovation of pond	6,80,000
	Department of Forestry, Govt. of West Bengal	Tree saplings	1,20,000

KVK	Development Scheme / Programme	Nature of work	Amount (Rs.)
	ATMA	Improved vegetable cultivation & Nursery management	-
	50 % subsidy provided by Department of Horticulture, Govt. of West Bengal	Poly House	3,00,000
	Department of Agriculture, Govt. of West Bengal	Agricultural inputs (Seed, Fertilizer, Pesticides, etc.)	-
	Department of Veterinary & Animal Science, Govt. of West Bengal	Animal Health Camp	-
Total			**1,53,92,000**
Malda	State deptt. of irrigation/NTPC	Crocodile Bund repairing of river Ganga	35,00,000
	State Deptt. Of Agriculture	Micro Irrigation	32,000
	MGNREGS	Pond renovation	1,80,000
	MGNREGS	Canal renovation	2,25,000
	MGNREGS	Road repairing	9,00,000
Total			**48,37,000**
S. 24 Parganas	IWMP	Land shaping and Ail cultivation in NICRA Village	2,50,000
	RKVY & IWMP	Land shaping and Ail cultivation in the District	2,10,00,000
Total			**2,12,50,000**
Grand Total			**4,80,92,000**

11. Dignitaries Visited NICRA Villages During 2018-19

Name of KVK	Name of VIPs/ Experts	Date of visit
Jharsuguda	Sj. Jual Oram, Hon'ble Minister of Tribal affairs, Govt. of India	31.08.2018
Coochbehar	Dr. H. K. Senapati, Chairman, NICRA-ZMC, ICAR-ATARI Kolkata	29.08.2018
	Dr. S.S. Singh, Director, ICAR-ATARI, Kolkata	
	Dr. F.H. Rahman, Nodal Officer, ICAR-ATARI, Kolkata	
	Dr. JVNS Prasad, Co-PI, CRIDA, Hyderabad	
Malda	Dr. Md. Osman, Principal Scientist & Head, PME, ICAR-CRIDA, Hyderabad	30.06.2018
	Dr. H. K. Senapati, Chairman, NICRA-ZMC, ICAR-ATARI KolkataDr. S. S. Sing (Vice-chairman)	28.08.2018
	Dr. S.S. Singh, Director, ICAR-ATARI, Kolkata	
	Dr. F.H. Rahman, Nodal Officer, ICAR-ATARI, Kolkata	
	Dr. JVNS Prasad, Co-PI, CRIDA, Hyderabad	
	Dr. Prabhat Kumar Pal, DEE, UBKV	
	Dr. S. S. Singh, Director, ATARI-Kolkata	22.11.2018
	Dr. S. Rajan, ICAR-CISH, Lucknow	
	Dr. S. K. Roy, ICAR-ATARI-Kolkata	
	Dr. F. H. Rahman, Nodal Officer, ICAR-ATARI-Kolkata	
	Dr. Prabhat Kumar Pal, DEE, UBKV	
	All Senior Scientist & Heads of KVKs of ATARI Kolkata	
South 24 Paraganas	Dr. B.M.K. Raju,Principal Scientist, ICAR CRIDA	14.11.2018
(Nimpith)	Dr. Keshav Kumar,Principal Scientist, Division of Agril. Extension, ICAR, New Delhi	06.12.2018



12. Success story

1. Cultivation of Cucumber on Raised Bed in High Rainfall Zone of Cooch Behar District

The district Cooch Behar experiences high humidity and rainfall during kharif season with erratic distribution and occasional short dry spell which affected the panicle initiation/flowering stage of paddy fetching poor or lower yield. Keeping these consequences in mind, Cooch Behar Krishi Vigyan Kendra has initiated a technology of replacing paddy in areas with comparatively lower yield with cucumber in vegetable trellis with a raised bed of 20-25 cm with spacing of 1.5 m plant to plant along with proper drainage was promoted which has been well accepted by the farmers. For these purpose 12 demonstration units covering 6.5 ha was conducted. It was found that cultivation of cucumber fetched a higher market price than paddy. Economics of technology is shown in the table (1 & 2).

Table 1: Economics of paddy cultivation in low lying areas

	Production (t)	Cost of cultivation (Rs.)	Net Return(Rs.)	B: C
Rice	3.3	22,500	18750	1.83

Table 2: Economics of cucumber cultivation in low lying areas

	Fruiting Start (day)	Fruiting period (days)	Prodn (q/ha)	Gross return (Rs./ ha)	Net return (Rs./ ha)	B: C
Cucumber	48	35	112.5	202500	90000	2.25

2. Additional Income through Fish Cultivation in Renovated Ponds

Since inception of NICRA Project, total 27 ponds were renovated from 2011-17 with an objective to convert seasonal ponds to annual ponds. It was found that an additional area of 37.30 ha was brought under irrigation utilizing renovated ponds as source of water benefitting 160 farmers. The scope of irrigation lifted production of potato, wheat, boro paddy etc. by 6987 quintal. Interestingly, it was found that farmers of the village are using the water as critical lifesaving irrigation as well as 15 farmers is doing fish cultivation throughout the year on the renovated ponds in a systematically scientific way. Information collected from 15 farmers has revealed that, their net income has increased by Rs. 10,000-15,000 per unit through fish production. These farmers are facing problem of quality fingerling

at right time. So, the farmers of the village have placed a demand for fish fingerling production to Cooch Behar Krishi Vigyan Kendra. Considering the above, Cooch Behar Krishi Vigyan Kendra initiated demonstration programme on fingerling production at one of the renovated ponds involving Adarsha Krishak Kalyan Samity Farmers' Club. This intervention will not only make fingerling easily available but will also generate additional income to the members of VCRMC who are directly involved in fish cultivation.

3. Empowerment of farm women through food processing technique

Background of the technology :Different types of fruits and vegetable were cultivated by the farmers of Khagribari Village. There was a problem on preservation of these vegetable and fruits. A training programme was conducted on food processing techniques for self-empowerment of rural women (Aparna Self Help Group) at NICRA village, Khagribari during April, 2018. Twenty numbers of farm women were trained (Two Self Help Group). A case study was conducted before organizing the training programme to know the socio-economic condition of the trainees. It was found that majority of the trainees were from below poverty level. Educational status was primary and middle class level, scheduled caste, women headed family (due to occupational migration of the male members). The decision of the family was mostly taken by the

female member. It was also observed that financial support was lacking in case of children education.

Success point: After completion of training programme several inputs were provided to the farm women for further monitoring and evaluation. It was found that 60% (12 no. Aparna SHG) of the trainee was successfully produce pickle, squash, jam and jelly. On the basis of the post training evaluation 12 numbers of trainees were selected for market oriented training programme. It was observed that all the trainees were successfully trained and are marketing their produce to the local

market, Anganwadi School, hostels of Uttar Banga Krishi Viswavidyalaya etc. after Six months; a post training evaluation was done to know the present socio-economic situation of the farm women.

Economic impact: It was found that monthly income of the trainees increased up to 66.66 % from the BM. Monthly income of the trainee increased to Rs. 10000 from Rs. 6000

Social impact: Major social impact of the programme:

1. Financial support towards children educational system has increased.

2. Self-empowerment of the farm women
3. Building relationships with farmers club and KVK

As per data collected, Knowledge and skill level was also found to be increased up to 38.59 % and 87.50 % respectively, from the BM.

Environmental impact: Pickle, jam and jelly making does not have any adverse impact on environment as its produce in a small scale.

Horizontal/ Vertical spread: Aparna SHG were financially support by Department of Agriculture, Govt. Of West Bengal after showing their successful activity. Another Self Help Group (Radha Gobinda SHG) are now trying to produce pickle, jam and jelly with the technical help of Cooch Behar KVK.

4. Success story of small scale goat farming

Farmers' Name	Smt. **Susama Meher** W/O Khageswar Meher
Land holding	Upland- 0.5 acre, Medium land-2 acre Low land-0.5 acre

Intervention: -

Apart from being engaged in vegetable cultivation Smt. Susama Meher was interested in keeping of goat as a subsidiary source of income from 2015, she was involved in goat rearing. But initially she kept 2 bucks and 20 no's of does, all of which were nondescript animals of the area. Those goats showed slower gain in body weight, late sexual maturity, lower kidding per year. Under the NICRA programme of KVK, Jharsuguda 2 no's of Black Bengal bucks were introduced in the herd for breed upgradation. After the replacement of bucks the offspring produced from the upgradation have shown higher growth rate , which is reported to the 13 kg at 6 month of age. However the upgraded goats attained sexual maturity at 8 months of age. Looking at the development programme of Smt. Susama Meher other goat keepers of the village were got interested, & started goat rearing by taking buck on rent.

Impact: After introduction of Black Bengal buck the growth rate, age of sexual maturity, kidding interval, twinning percentage has improved. Three other herds of the village took the Black Bengal buck on rental for upgradation purpose.

Treatment	Body wt (kg/6 months)	% change in body wt	Net Return (Rs/animal/ 6month)	B:C Ratio
T_1 (Non descript goat)	16.0	-	6400	3.4
T_2 (Black Bengal)	25.0	56.25	10,000	4.2

Even she was appreciated during the visit of Sj. Jual Oram, Hon'ble minister of tribal affair for her initiation in the concerned field

Future strategy:-

Breed up gradation of other heads with black Bengal buck and buck exchange programme after 3 years to avoid inbreeding and production depression.

5. Roof Top Rain Water Harvesting in Bongheri to support Asian Catfish Hatchery

Name of farmer	**Gouranga Naskar**, S/o: MahimNaskar
Landholding (in ha.)	1.2 ha
Pond (in ha)	0.2 ha (3 ponds)

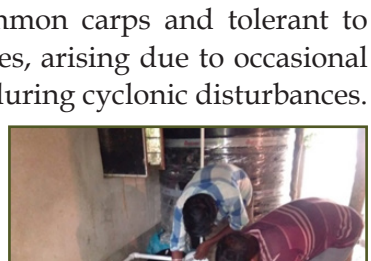
Sri Gouranga Naskar is a well-educated, young and energetic rural youth from Bongheri village of Sunderbans. He has witnessed the wrath of the nature in 2009 when his village succumbed to the fury of super cyclone "*Aila*". The heroics of Gouranga could ensure safe evacuation of his entire family but not the means of living and livelihood. All the villagers were strangled on an elevated strip of road for 14 days. As in other cases, the immediate impact of the cyclone was neutralized in a couple of months. But they were shocked to find that nothing would germinate on their field. The agricultural fields of the entire village turned into saline and unfit for cultivation. It took another two years to leach the excess salt from the top soil through natural precipitation, but the productivity never returnedto their normal. By that time around 80% of the villagers resorted to seasonal migration for a daily earning, leaving agriculture standstill in the village!

However, Gouranga was one among the very few, determined not to leave his village without giving

a last try. And he just found the apt support in the form of arrays of climate resilient agro-technologies to revive his farm and fishery. The project, National Innovations in Climate Resilient Agriculture, implemented by the Ramkrishna Ashram KVK in his village, helped him to harvest rainwater in his field, grow flood tolerant paddy varieties and produce vegetables throughout the year.

With the passing years, Shri. Gouranga grew more in confidence and started taking greater responsibilities as a VCRMC member in collection and maintaining daily weather data and the custom hiring centre. He took extra interest in climate resilient fishery and found the importance of Asian Catfish in combating the climatic vagaries unlike the common carps. He motivated many others to cultivate Asian Catfish in the shallow waters and paddy fields. This fish fetches better market price (Rs. 600/ kg) than common carps and tolerant to biotic and abiotic stresses, arising due to occasional brackish water ingress during cyclonic disturbances.

However, as the supply of Asian Catfish fry was very uncertain to this remotely located village, this endeavour soon started losing its familiarity. Gouranga was ready to establish a Catfish hatchery to solve the short supply of catfish



fry. But it was not possible to establish such hatchery with the available pond water in the village. It required clean, fresh groundwater for breeding and larval rearing of Asian catfish. But the village doesn't have a single bore well to serve the purpose. The only bore well of the village is a 1200 ft one, meant for drinking water for the entire village.

To ensure supply of clean and fresh water, roof top rainwater harvesting technology was utilized. The run off rainwater falling over the roof was diverted and collected in a 1500 L capacity storage tank. The same water was used for larval rearing of Asian Catfish and Koi (Climbing Perch). Before that, Gouranga went through necessary training in breeding of catfish, at the KVK. He was given necessary financial assistance through NICRA. The harvested rainwater was potable and measured 6.85 of pH and 0.05 of EC. It was perfectly suitable for breeding and larval rearing. The storage tank was filled for three times during the rainy season that supported 3 breeding cycles of Asian catfish and Koi. Mr. Gouranga produced 12000 Asian catfish and 12000 Koi fry and earned a net profit of Rs. 32050/- in four months in the 1st year. Next year, the net profit will go up to Rs. 60550/- considering the recurring cost and depreciation value of the assets created.

However, the most astounding impact was witnessed by the women members of Gouranga's family who reaped the benefit of the potable rain water for the cooking. The catfish breeding season was over in September. But the last harvest of rainwater was sufficient to support the kitchen up to the end of December, by 20 litres per day. So from the start of the rainy season and upto December, i.e., for six months period, the women members had to travel less to outside for collecting water for cooking.

6. Low cost portable poultry housing system

Generally the farmers are rearing local poultry birds which are low body growth (0.750 kg to 1.00 kg / year) and low egg laying capacity (55 to 65 nos / year) birds and also they are susceptible to different diseases like Coccidiosis, Sodium deficiency, Coilbacillosis, Ascariasis, IBD, RD and MD etc. leading to higher mortality , sometimes 100 % mortality i.e. Kukudamadak in local language. In this situation Sri. Subash Chandra Mohanty started rearing of banaraja and kadaknath poultry with proper vaccination schedule. As banaraja birds are higher body growth and egg laying capacity than the local bird with 750 kg to 1.250 kg body wt. in three months and 170-180 nos eggs /year. The birds sold at Rs.200 per kg and egg @ Rs.8. In the other hand the Kadaknath birds are highly nutritive rich and sold @ Rs.500 per kg and the eggs are sold @ Rs. 8 to Rs.-10 per egg. The poultry birds are rearing as backyard poultry without proper shelter neither in night nor in adverse climatic condition, but it is a highly profitable enterprise with low investment, not required specific skilled and one can start any time with regular profit and the BC ratio is not less than 3.0 if properly taken care of the enterprise.

Sri. Mohanty observed that the mortality of the birds are high during the heavy rain, flood situation and high temperature due to the lack of proper shelter as easily the birds are suffered from diseases like nasal infection, ILT,IBT,Coccidiosis, Infuenza. To overcome this problem Sri Mohanty designed that low cost poultry housing system with affordable price for the farmers i.e. Rs.3,200 (Rupees two thousand two hundred only) with (12X6) feet size. The unit also transport easily one place to another place as per the climatic condition. Now other farmers of NICRA village and adjacent villages are adopted such type of shelter for poultry birds.

13. Newspaper Coverage of NICRA Activities

14. Publications

Book

Rahman, F. H., Bhattacharya, R. and Singh, S.S. (2018) Enhancing Resilience in Agriculture and Adaptive Capacity to Climate Vulnerability-Experience of NICRA-TDC. Published by ICAR-ATARI Kolkata, pp: 1-215

Rseach Paper/ Review paper

Das. Ganesh, Rahman. F. H.,Roy. Bikash, Biswas. Sujan, Sarkar. Surajit,Saha. Sankar and Saha. Augustina (2018) Impact of NICRA project through analysis of different success point. International Journal of Agriculture Sciences, 10 (8) : 5863-5866

Biswas. Sujan, Sarkar. Surajit,Saha. Sankar, Saha. Augustina and Rahman, F. H. (2018) Study on interaction of earthworm with bioagents during vermicomposting. International Journal of current microbiology and applied science, 7(9): 300-308

Das. Ganesh and Rahman. F. H. (2018) Adoption and Discontinuation of Innovative Agricultural Technology by the Farmers of NICRA Village in Cooch Behar District. Indian Res. J. Ext. Edu. 18 (3), July, 2018

Technical bulletins

Rahman F H, Bhattacharya R and Singh S S. 2018. NICRA Newsletter: Towards Climate Smart Agriculture, Pub. by ICAR-ATARI Kolkata, Vol. IV, No. 2, pp: 1- 8.

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

Rahman F H, Bhattacharya R and Singh S S. 2018. NICRA Annual Report 2017-18. Pub. by Director ICAR-ATARI Kolkata, pp: 1- 48.

Abstracts presented in national/ international seminars etc.

Rahman F H, Bhattacharya R and Singh S S. 2018. Enhancing Climate Resilience in Agriculture through Demonstration of Stress Tolerant Crop Varieties in Eastern Indian. Abstract in the proceedings of 83rd Annual Convention and National Seminar of Indian Society of Soil Science at Gujarat Agricultural University, Anand during Nov. 27-30, 2018.

Garain P K, Maitra N J and Rahman F H. 2018. Bongheri – A Climate Resilient Village and its Adaptation Strategies. Abstract in the proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Ghosh Swagat, Sahu N C, Rahman F H and Das K S 2018. Periphyton Based Climate Smart Aquaculture for the Farmers of Indian Rural Sunderban Areas. Abstract in the

proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Rahman F H, Bhattacharya R and Singh S S 2018. Introducing Stress Tolerant Crop Varieties Enhanced Climate Resilience in Agriculture and Adaptive Capacity of the Farmers in Eastern Indian. Abstract in the proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Mukherjee S, Mukhopadhyay K, Bera R, Seal A and Rahman F H. 2018. Introduction of a New Climate Smart Agricultural Technology towards Development of Sustainable Organic and Green Farming Models based on Resource Availability and Socio-economic Framework – A Case Study from Howrah KrishiVigyan Kendra, ICAR. Abstract in the proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Ali Sajeed, Sherpa Furtengi and Rahman F H. 2018. Indigenous Methods of Agricultural Pests Management in Darjeeling Himalayas. Abstract in the proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Sarkar. Surajit, Das. Ganesh, Biswas. Sujan, Saha. Sankar, Roy. Bikash, Rahman. F. H. 2018. Studies on effect of black polythene mulch to combat with low temperature effect on winter cucumber in teesta flood plains of terai region. Abstract in the proceedings of 9th National Extension Education Congress of Society of Extension Education at CAPHET, Gangtok during Nov. 15-18, 2018.

Sarkar. Victor, Pradhan. K, Das. Ganesh, Maity. Biman and Das. Tarun Kumar 2018. Role of 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 Diversified farming system: Sustainable livelihood and Doubling Farmers Income

Awards/Recognition

Few activities under NICRA-TDC Project as a part of significant achievements for which the following scientists have been recognized with various awards:

- **Dr. F. H. Rahman**, Nodal Officer, NICRA-TDC, ICAR-ATARI Kolkata has been awarded with SEE FELLOW 2018 AWARD during 9th NEEC at Central Agricultural University-CAPHE, Gangtok on Nov 15, 2018
- **Dr. Surajit Sarkar** and **Mr. Ganesh Das**, Coochbehar KVK have been awarded with Best KVK Professional Award by Society of Extension Education
- **Mr. Ganesh Das** and **Mr. Suraj Sarkar**, Coochbehar KVK have been awarded with Young Scientist Award and Best Researcher Award, respectively, by EET-CRS, Bengaluru

15. Expenditure Statement 2018-19

Table. Expenditure details during 2018-19

Name of KVK	Sanction for the year 2018-19						Total	Expenditure	Closing Balance as on 01.04.19
	Grants-in-Aid-General (REVENUE)			Grants for creation of capital assets (CAPITAL)					
	Operational	TA	SC Sub-Plan	Equipment	IT	SC Sub-Plan			
ATARI-Kolkata	770000	150000	0	30000	5000	0	955000	91576	39024
South 24 Parganas	0	50000	1300000	0	0	300000	1650000	1649687	7061
Coochbehar	0	45000	1500000	0	45000	150000	1740000	1739939	61
Malda	0	50000	800000	0	0	100000	950000	948522	1478
Sonepur	695000	25000	0	30000	0	0	750000	750000	0
Kalahandi	500000	30000	0	30000	0	0	560000	542075	17925
Jharsuguda	830000	30000	0	30000	0	0	890000	890000	0
Kendrapara	795000	40000	0	30000	0	0	865000	865000	0
Ganjam-I	670000	30000	0	30000	0	0	730000	730000	0
Port Blair	400000	20000	0	30000	0	0	450000	438717	11283
Total	**4660000**	**470000**	**3600000**	**210000**	**50000**	**550000**	**9540000**	**9469916**	**76832**

Annexure -1

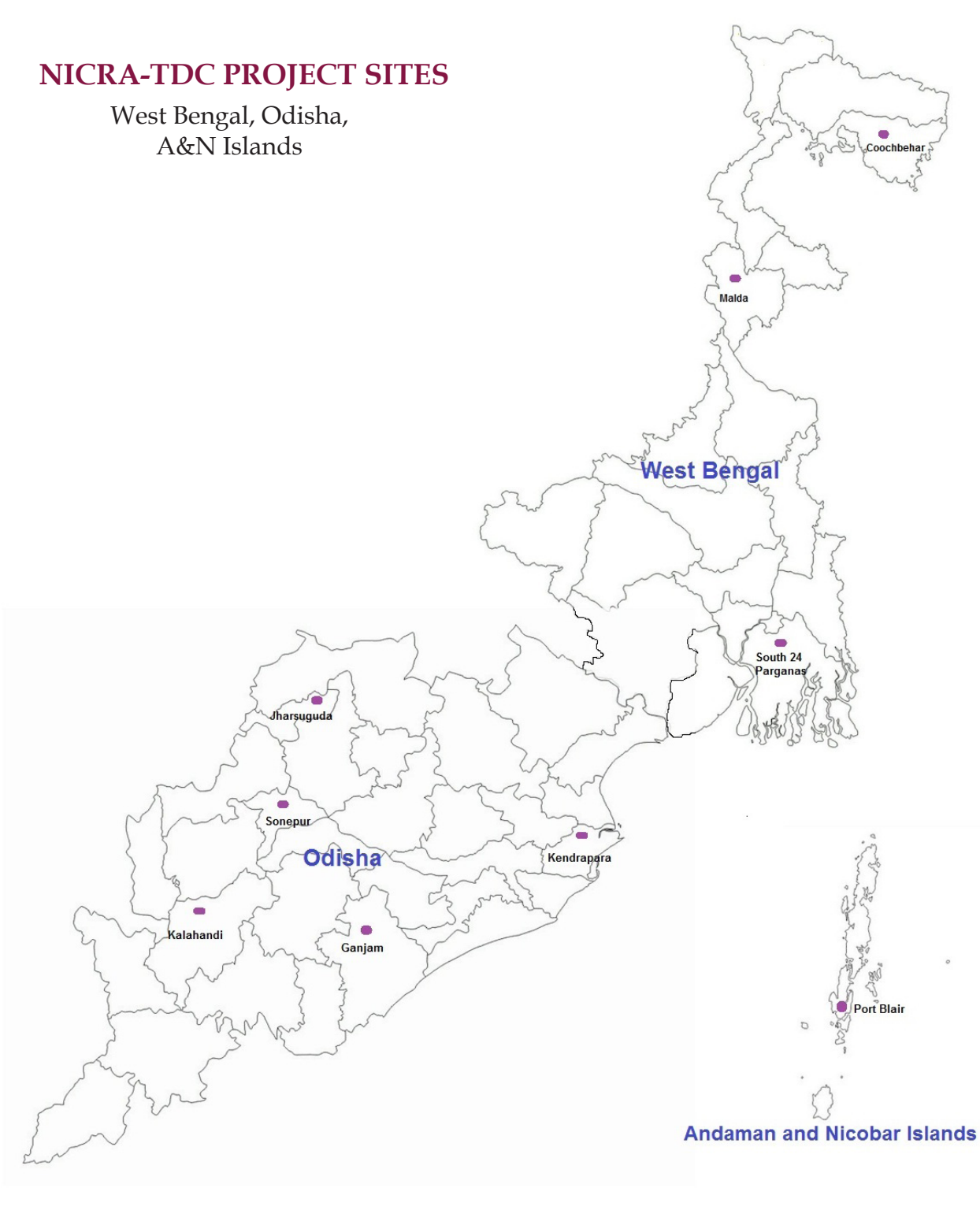
Contributors - NICRA KVKs of Zone V

Sl. No.	KVK	State/UT	Contributors
1.	Ganjam I	Odisha	Dr. Swagatika Sahoo Dr. Prasant Kr. Panda
2.	Kalahandi	Odisha	Dr. Amitava Panda Dr. H. N. Mallick
3.	Jharsuguda	Odisha	Dr. Jyotirmoyee Udgata Dr. Manoj Barik
4.	Kendrapara	Odisha	Dr. Surjo Narayan Mishra Dr. Namita Mahapatra
5.	Sonepur	Odisha	Dr. Jibanjit Sen Dr. Geetanjali Pradhan
6.	Coochbehar	West Bengal	Dr. Bikash Roy Dr. Surajit Sarkar
7.	Malda	West Bengal	Dr. Rakesh Roy Dr. Adwaita Mandal
8.	S. 24 Pgs	West Bengal	Dr. P. Chatterjee Dr. P. Garain
9.	Port Blair	A & N Islands	Dr. L. B. Singh Er. B. K. Nanda

Annexure -2

NICRA-TDC PROJECT SITES

West Bengal, Odisha,
A&N Islands



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

NOTES

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch