2020-21

वार्षिक प्रतिवेदन
Annual Report

National Innovations on Climate Resilient Agriculture
जलवायु समुत्थानशील कृषि पर राष्ट्रीय नवोन्मेष
ICAR- Agricultural Technology Application
Research Institute Kolkata
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ANNUAL REPORT

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National Innovations on Climate Resilient Agriculture
Technology Demonstration Component

NICRA
National Innovations on Climate Resilient Agriculture

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

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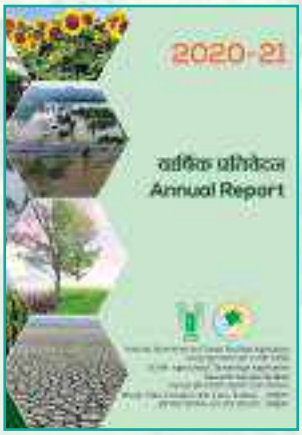

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Compiled and Edited by:

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

Contributors:

P. Chatterjee, Prabir Garain and Saon Jana, KVK S 24 Parganas Nimpith

B. Roy, Ganesh Das and Bablu Ganguly, KVK Coochbehar

R. Roy, Adawita Mandal and Sachin Sarkar, KVK Malda

S. Satapathy, Prasanta Panda and D. K. Patri, KVK Ganjam-1

J. Udgata, Manoj Barik and D. Parida, Jharsaguda KVK

J. Sen, Gitanjali Pradhan and N. P. Malik, Sonepur KVK

S. N. Mishra, N. Mahapatra and U. Suar, Kendrapara KVK

A. Panda, H. N. Malik and S. Pattanayak, Kalahandi KVK

L. B. Singh, B. K. Nanda and J. Chakravarthy, Port Blair KVK

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Preface

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

Technology Demonstration Component (TDC) under NICRA 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 2020-21 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 2020-21 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 2020-21 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. V. K. Singh, Director, Dr. J.V.N.S. Prasad, Coordinator (NICRA-TDC), ICAR-CRIDA Hyderabad and other officials of Division of Agricultural Extension, ICAR for providing guidance and help in compiling the Annual Progress Report 2020-21. I acknowledge the assistance received from the Directors of Extension Education of State Agricultural Universities of this zone and cooperation of all the NICRA implementing KVKs in providing information in time. The support and help rendered by all the staff of ICAR-ATARI Kolkata are duly acknowledged.

(S. K. Roy)
Director

Contents

कार्यकारी सारांश

जलवायु लचीला कृषि में राष्ट्रीय पहल (एनआईसीआरए) - भारतीय कृषि अनुसंधान परिषद (आईसीएआर) की एक राष्ट्रीय नेटवर्क परियोजना जिसका उद्देश्य विभिन्न घटकों जैसे अनुकूलन और शमन पर रणनीतिक अनुसंधान, वर्तमान जलवायु परिवर्तनशीलता से निपटने के लिए किसानों के खेतों पर प्रौद्योगिकी प्रदर्शन, महत्वपूर्ण अनुसंधान अंतराल को भरने के लिए प्रायोजित और प्रतिस्पर्धी अनुसंधान अनुदान और विभिन्न हितधारकों की क्षमता निर्माण के माध्यम से जलवायु परिवर्तन और जलवायु भेद्यता के लिए भारतीय कृषि के लचीलेपन को बढ़ाना है। प्रौद्योगिकी प्रदर्शन घटक (टीडीसी) के लिए तर्क इस आधार पर आधारित है कि राष्ट्रीय कृषि अनुसंधान प्रणाली में विभिन्न प्रकार की जलवायु संबंधी समस्याओं से निपटने के लिए प्रौद्योगिकियों की एक सरणी उपलब्ध है। जलवायु लचीला कृषि में राष्ट्रीय पहल (एनआईसीआरए), 2011 में शुरू किया गया था। किसानों के साथ-साथ जलवायु परिवर्तनशीलता और जलवायु परिवर्तन की चुनौतियों का समाधान करने के लिए विज्ञान और प्रौद्योगिकी के अनुप्रयोग द्वारा सूखे, बाढ़ और अन्य चरम घटनाओं की बढ़ती आवृत्ति को अपनाने की आवश्यकता है।

एनआईसीआरए का प्रौद्योगिकी प्रदर्शन घटक (टीडीसी) किसानों के साथ कार्य करने और वर्तमान जलवायु परिवर्तनशीलता से निपटने के लिए क्षेत्र की परिस्थितियों में ऐसी तकनीकों को लागू करने का शानदार अवसर प्रदान करता है। इससे इन लचीली प्रौद्योगिकियों को अपनाने की गति में वृद्धि होगी। देश भर में जलवायु की दृष्टि से संवेदनशील 151 जिलों और भाकृअनुप के 7 प्रमुख अनुसंधान संस्थानों द्वारा केवीके के माध्यम से ग्रामीण समूहों में जलवायु लचीलापन के लिए ऑन-फार्म सहभागी प्रदर्शनों को लागू किया जा रहा है। विभिन्न कृषि-पारिस्थितिकी और कृषि प्रणालियों में प्रौद्योगिकियों के प्रदर्शन पर समझ पर पकड़ बनाने और इसे सुधारने पर जोर दिया गया है। यह विभिन्न जैव-भौतिक और सामाजिक-आर्थिक संदर्भों में जलवायु लचीलापन के गठन की पहचान की सुविधा भी प्रदान करता है। एनआईसीआरए केवीके ने ग्राम स्तरीय आकस्मिक फसल योजनाएँ और उपाय तैयार किए हैं और कार्यान्वित किए हैं। ओडिशा (5), पश्चिम बंगाल (3) और केंद्र शासित प्रदेश अंडमान और निकोबार द्वीप समूह (1) के चयनित नौ केवीके जिलों की जलवायु भेद्यता का आकलन एनआईसीआरए कार्यक्रम के कार्यान्वयन के दौरान तकनीकी सहायता, मानव संसाधन विकास और समग्र रूप से निश्चित आवश्यकता को सामने लाया। किसान समुदाय का सशक्तिकरण ताकि वे सूखे, अनियमित वर्षा, ऊष्मा लहर, बाढ़, चक्रवाती तूफान जैसी जलवायु की कमजोरियों से निपटने में सक्षम हो सकें। तदनुसार, केवीके जिलों के कमजोर गांवों में फसल उत्पादन, संसाधन संरक्षण, पशुधन और मछली पालन, जल संचयन आदि शुरू करने के लिए तकनीकी हस्तक्षेप निष्पादित करके इसके कार्यान्वयन के लिए कार्य योजना तैयार की गई थी।

आईसीएआर- कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान कोलकाता में नौ एनआईसीआरए हैं जो केवीके को लागू करते हैं जो प्रौद्योगिकी प्रदर्शन के तहत विभिन्न गतिविधियों को पूरा करते हैं।

25270 किसानों (एनआरएम- 1242, फसल उत्पादन-2280, पशुधन और मत्स्य पालन- 2057, संस्थागत हस्तक्षेप- 2787, क्षमता निर्माण- 3609 और विस्तार गतिविधियों- 13295) को लाभान्वित करने वाले विभिन्न मॉड्यूल में जलवायु लचीला कृषि कार्यक्रम पर राष्ट्रीय नवाचार के घटक।

प्राकृतिक संसाधन प्रबंधन मॉड्यूल में बाढ़ प्रवण क्षेत्रों में बेहतर जल निकासी, स्वस्थानी नमी संरक्षण, नए जल संचयन और पुनर्चक्रण का निर्माण/नवीनीकरण, संरचनाएं/खेत तालाब/चेक बांध/टैंक छत जल संचयन टैंक, भूमि को आकार देने और वर्षा जल संचयन संरचनाओं को शामिल किया गया है। बाढ़ प्रवण क्षेत्रों में जल निकासी, संरक्षण जुताई जहां उपयुक्त हो, कृत्रिम भूजल पुनर्भरण और पानी की बचत सिंचाई के तरीके, हरी खाद, फसल अवशेष प्रबंधन, खेत की बंधी, चौड़ी क्यारी, मृदा परीक्षण आधारित पोषक तत्व अनुप्रयोग, सूक्ष्म सिंचाई तकनीक, खाद गड्ढे आदि ने 335.4 हेक्टेयर क्षेत्र को कवर किया जिससे क्षेत्र में 1242 किसान लाभान्वित हुए।

फसल उत्पादन मॉड्यूल के तहत एनआईसीआरए-केवीके द्वारा विभिन्न क्षेत्र विशिष्ट हस्तक्षेप किए गए थे; सूखा, नमक और बाढ़ सहिष्णु / प्रतिरोधी किस्मों का परिचय, टर्मिनल ऊष्मा तनाव वाले क्षेत्रों में रबी फसलों की बुवाई की तिथियों को आगे बढ़ाना, पानी बचाने वाली धान की खेती के तरीके (एसआरआई, एरोबिक, डायरेक्ट सीडलिंग), विलंबित मानसून के लिए सामुदायिक नर्सरी, स्थान विशिष्ट इंटरक्रॉपिंग सिस्टम के साथ उच्च टिकाऊ उपज सूचकांक, नई फसलों/फसल विविधीकरण की शुरूआत, समय पर रोपण के लिए कस्टम हायरिंग सेंटर, निम्न तापमान सहनशीलता, मानसून के बाद की वर्षा का उपयोग करने वाली दालों को बढ़ावा देना, एकीकृत फसल/कीट/रोग प्रबंधन, आकस्मिक फसल के रूप में सब्जियां उगाना, एकीकृत फसल प्रबंधन, एकीकृत रोग प्रबंधन, आकस्मिक फसल, इन्होंने 424.6 हेक्टेयर क्षेत्र को कवर जिससे जिससे 2280 किसान लाभान्वित हुए।

इसी प्रकार **पशुधन और मत्स्य पालन** मॉड्यूल के तहत विभिन्न पशुधन केंद्रित हस्तक्षेप किए गए जिनमें सूखे/बाढ़ के दौरान चारा उत्पादन के लिए सामुदायिक भूमि का उपयोग, चारा/चारा भंडारण विधियों में सुधार, पशुधन में ऊष्मा तनाव को कम करने के लिए

बेहतर आश्रय, कम और अतिरिक्त के दौरान मछली तालाबों/टैंकों का प्रबंधन, नस्ल उन्नयन, खनिज मिश्रण के माध्यम से संतुलित चारा और चारा प्रबंधन, चारा ब्लॉक और सिलेज बनाना, एजोला फीडिंग, डीवर्मिंग और टीकाकरण के माध्यम से नस्ल पशु स्वास्थ्य प्रबंधन, मछली तालाब की सफाई और मछली पालन, स्वच्छ दूध और चारा उत्पादन आदि को कवर किया गया जिससे 2057 पशुपालकों को लाभ प्राप्त हुआ।

संस्थागत हस्तक्षेप जिसमें बीज बैंक, चारा बैंक, कमोडिटी समूह, समय पर संचालन के लिए कस्टम हायरिंग, सामुदायिक नर्सरी की स्थापना, सिंचाई, सामूहिक विपणन जलवायु साक्षरता एक गांव स्तर के मौसम स्टेशन के माध्यम से और लगभग सभी एनआईसीआरए गांवों में जागरूकता विकसित की गई। 2787 किसानों के 110 हेक्टेयर क्षेत्र को कवर करते हुए कुल 135 इकाइयां विकसित की गई हैं। मिनी ऑटोमेटिक वेदर स्टेशन (एडब्ल्यूएस) का प्रावधान है जिसके माध्यम से किसानों को मौसम पूर्वानुमान डेटा प्रदान किया जाता है।

ग्राम जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) का गठन गांवों की जलवायु संबंधी समस्याओं को कम करने और इस कार्यक्रम के तहत अपनाई जाने वाली रणनीतियों के बारे में ग्रामीणों के साथ गहन चर्चा के बाद किया गया था। वीसीआरएमसी के अध्यक्ष और संबंधित केवीके के प्रमुख द्वारा संयुक्त रूप से उनके नाम पर एक बैंक खाता खोलने के साथ वीसीआरएमसी चालू हो गया। केवीके के परामर्श से गाँव में लागू किए जाने वाले तकनीकी हस्तक्षेपों पर महत्वपूर्ण निर्णय लेने के अलावा, वीसीआरएमसी द्वारा विभिन्न कृषि उपकरणों और उपकरणों की कस्टम हायरिंग की निगरानी की जा रही थी।

कस्टम हायरिंग सेंटर में विभिन्न कृषि उपकरण जैसे पावर टिलर, थ्रेशर, रीपर, वाटर पंप, जीरो-टिल ड्रिल, रेज़्ड बेड प्लांटर, स्प्रेयर, वीडर आदि का प्रावधान शामिल है।

वीसीआरएमसी की देखरेख में निक्रा गोद लिए गए गांव में शुरू किए गए कस्टम हायरिंग सेंटर किसानों के बीच बेहद लोकप्रिय हो गए हैं और रु. 115265 भी उत्पन्न किए गए हैं। दक्षिण 24 परगना केवीके द्वारा बोंगेरी गांव में गठित वीसीआरएमसी ने अधिकतम रु. 291094 उत्पन्न किए।

2020-21 के दौरान विभिन्न विषयगत क्षेत्रों में क्षमता निर्माण के तहत कुल 129 पाठ्यक्रम संचालित किए गए, जिससे 3609 किसानों और कृषि महिलाओं (2078 पुरुष और 1531 महिलाओं) को लाभ प्राप्त हुआ। विषयगत क्षेत्रों में फसल प्रबंधन, प्राकृतिक संसाधन प्रबंधन, पोषक तत्व प्रबंधन, एकीकृत फसल प्रबंधन, फसल विविधीकरण, संसाधन संरक्षण प्रौद्योगिकी, कीट और रोग प्रबंधन, पशुधन और मत्स्य प्रबंधन, नर्सरी पालन, रोजगार सृजन, पोषक उद्यान, कृषि मशीनरी और उपकरण की मरम्मत और रखरखाव, एकीकृत कृषि प्रणाली, चारा और चारा प्रबंधन, लाख की खेती महिलाओं के लिए कृषि उपकरणों के साथ कठिन परिश्रम में कमी, मूल्यवर्धन, मानव पोषण और बच्चे की देखभाल, कृंतक नियंत्रण आदि शामिल हैं।

समीक्षाधीन अवधि के दौरान 13295 किसानों (7742 पुरुषों और 5553 महिलाओं) को लाभान्वित करने वाले विभिन्न विषयगत क्षेत्रों पर कुल 371 विस्तार गतिविधियां। विस्तार गतिविधियाँ विधि प्रदर्शनों, कृषि सलाहकार सेवाओं, जागरूकता पशु स्वास्थ्य शिविर, किशन चौपाल, किशन गोष्ठी, संसाधन संरक्षण प्रौद्योगिकियों, उत्सव क्षेत्र और किसान दिवस, नैदानिक यात्राओं, समूह चर्चा, विश्व पृथ्वी दिवस, प्रौद्योगिकी सप्ताह, किशन मेला आदि पर आयोजित की गईं हैं। सभी नौ एनआईसीआरए-केवीके ने संबंधित केवीके में 5 दिसंबर, 2020 को कार्यशाला, संगोष्ठी, संगोष्ठी, जागरूकता शिविर आयोजित करके विश्व मृदा दिवस मनाया और एनआईसीआरए गांवों के किसानों के बीच वितरित 1185 मृदा स्वास्थ्य कार्ड वितरित किए।

वर्ष के दौरान एनआईसीआरए केवीके द्वारा अभिसरण कार्यक्रमों में विकास एजेंसियों के साथ कई अंतःक्षेप किए गए जो एनआईसीआरए द्वारा गोद लिए गए गांवों में कार्य कर रहे हैं। इन विकास कार्यक्रमों के समर्थन का उपयोग गाँव में सिद्ध अंतःक्षेपों को बढ़ाने के लिए किया गया था। 2020-21 के दौरान चल रहे विकास कार्यक्रमों या योजनाओं के साथ केवीके को लागू करने वाले बड़ी संख्या में एनआईसीआरए द्वारा अभिसरण कार्यक्रम शुरू किए गए। प्रमुख विकास योजनाएं मनरेगा, वाटरशेड विकास मिशन, सुंदरबन विकास बोर्ड, आत्मा, वन विभाग, सिंचाई विभाग, एआईसीआरपी, आईसीएआर संस्थान, संबंधित राज्यों के विभिन्न विभाग आदि हैं। वर्ष के दौरान इस कार्यक्रम के माध्यम से 63,41,000/- रुपये की राशि उत्पन्न की गई है।

Executive Summary

National Innovations on Climate Resilient Agriculture (NICRA) - A National Network Project of Indian Council of Agricultural Research (ICAR) with the objectives to enhance the resilience of Indian agriculture to climate change and climatic vulnerability through the various components *viz*. strategic research on adaptation and mitigation, technology demonstration on farmers' fields to cope up with current climate variability, sponsored and competitive research grants to fill critical research gaps and capacity building of different stakeholders. The rationale for Technology Demonstration Component (TDC) is based on the premise that an array of technologies is available to cope with different types of climate related vulnerabilities in National Agricultural Research System. National Innovations in Climate Resilient Agriculture (NICRA) was launched in 2011 to address the challenges of climate variability and climate change along with farmers need to adopt quickly increasing frequency of drought, flood and other extreme events by application of science and technology.

Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technologies under field conditions to address current climate variability. This will enhance the 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 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 nine 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 25270 farmers (NRM- 1242, Crop Production-2280, Livestock and Fisheries-2057, Institutional Interventions- 2787, Capacity Building- 3609 and Extension Activities- 13295).

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 335.4 ha area which benefitted 1242 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 424.6 ha area which benefitted 2280 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 2057 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 135 units have been developed covering of 110 ha area of 2787 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.*

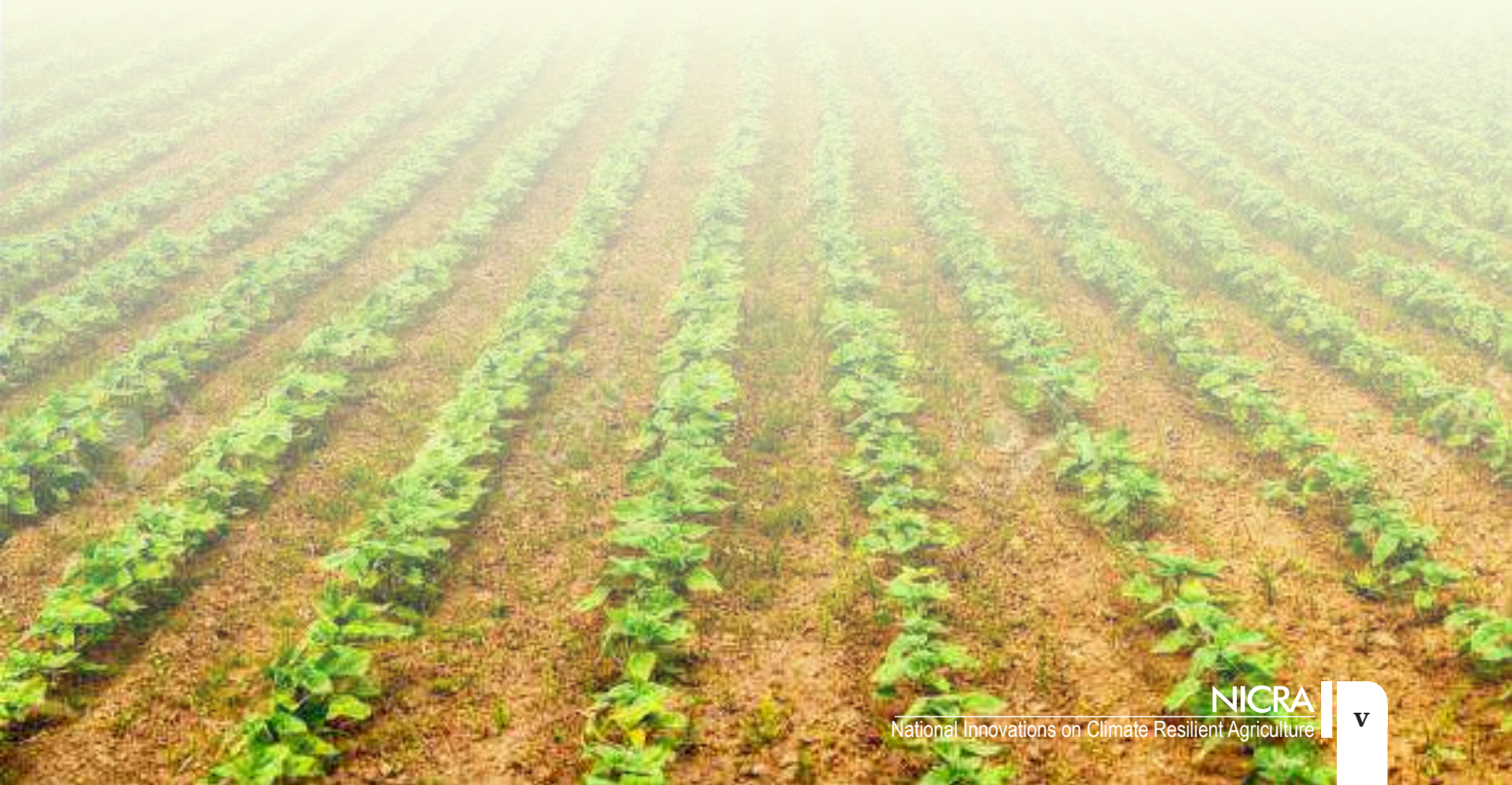
Custom Hiring Centers initiated in the NICRA adopted village under the supervision of VCRMC has become immensely popular among the farmers and Rs. 115265 has also been generated. VCRMC constituted by South 24 Parganas KVK at Bongheri village generated maximum amount of Rs. 291094.

A total 129 courses were conducted under **Capacity Building** on various thematic areas benefitting 3609 farmers and farmwomen (2078 males and 1531 females) during 2020-21. 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 371 **Extension Activities** on various thematic areas benefiting 13295 practicing farmers (7742 males and 5553 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, 2020 in the respective KVK and distributed 1185 Soil Health Cards distributed among the farmers of NICRA villages.

A number of interventions were taken up by NICRA KVKs during the year in **Convergence Programmes** with developmental agencies which are operational in the NICRA adopted villages. Support from these developmental programmes was used for scaling up of proven interventions in the village. Huge number of convergence programmes was carried out by the NICRA implementing KVK with ongoing development programmes or schemes during 2020-21. The prominent development schemes are MGNREGA, Watershed Development Mission, Sunderban Development Board, ATMA, Forest Department, Irrigation Department, AICRP, ICAR Institutes, different Departments of the concerned states etc. An amount of Rs.63,41,000/- has been generated through this programme during the year.



1. INTRODUCTION

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

In this way NICRA-KVKs play an important role in preparing village level contingency crop planning and different climate resilient measurements. ICAR-Agricultural Technology Application Research Institute Kolkata having nine KVKs where different activities under Technology Demonstration Components of National Innovations in Climate Resilient Agriculture (NICRA) programme in various modules are carried out. Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. The impacts of climate change are global, but countries like India are more vulnerable in view of the high population depending on agriculture. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The overall focus of technology demonstrations under NICRA is to enhance resilience of farms and the farming community to climate risks so as to ensure sustainability over a period of time. Thus the emphasis is on adaption to climate variability which entails appropriate response to contingency situations. Sustainability is the immediate goal in highly intensive production systems facing natural resource degradation. Therefore, the central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains. Enhancing the adaptive capacity and building resilience of the farming communities is important in the context of climate variability and to cope with these extreme events effectively. As part of the Technology Demonstration Component (TDC) of NICRA, proven technologies are being demonstrated in climatically vulnerable districts of the country. The objective is to impart resilience under variable climates and consequently enhance the pace of adoption of these resilient technologies by stakeholders. On-farm participatory demonstrations were taken up in climatically vulnerable districts across the country through KVKs. Enhancing resilience is the key to achieve sustainability in agriculture especially in the context of climate vulnerability. 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

The objectives of this network project are:

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

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

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

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

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

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

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

Enhancing resilience is one of the important keys to achieve sustainability in agriculture especially in the background of climate vulnerability and climate change. The vulnerabilities of the respective KVK districts are mentioned here under:

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

List of districts and KVKs with Climate vulnerability

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

The NICRA village was selected based on vulnerability of agriculture to climatic variability. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather data, resource situation, farming systems and agricultural yields in the past few years. Thus the interventions executed in NICRA villages by the NICRA-KVKs have not only enabled the farmers to cope up climatic vulnerability as well as it plays a key role in farmers' adaptive capacity along with sustainable agricultural production. Climatic vulnerability of selected nine KVK districts of Odisha, West Bengal and union Territory of A & N Islands assessed during implementation of NICRA programme brought forward definite requirement in terms of technological support, human resource development and overall empowerment of farming community to enable

them to cope up with climate vulnerabilities like droughts, erratic rainfall, heat wave, flood, cyclonic storm. Plan of action, accordingly, was prepared for its implementation through executing technological interventions to initiate crop production, resource conservation, livestock and fish rearing, water harvesting etc. in the vulnerable villages of KVK districts. Demonstration of appropriate practices and technologies with a climate focus is taken up in farmer participatory mode in NICRA villages. The NICRA villages have become hubs of learning on climate resilient agriculture in the other parts of the districts.

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

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

2. INTERVENTIONS WITH MODULES:

Module I: Natural Resource Management

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

Module II: Crop Production

Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting.

Module III: Livestock and Fisheries

Use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, preventive vaccination, improved livestock demonstration, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water.

Module IV: Institutional Interventions

Strengthening the existing institutional interventions or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station are part of this module.

2.1 Module l: NATURAL RESOURCE MANAGEMENT

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

and enhancing rainwater harvesting and utilization capacity was very significant across the clusters. The efforts in this area resulted in the creation of an additional rainwater harvesting capacity of over 17.3 lakh cu m leading to increase cropping intensity by bringing around 1250 ha of area under protective irrigation regime since the inception of the project.

2.1.1 In-situ Moisture Conservation - Resource Conservation Technology:

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by in situ moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in 18 NICRA adopted villages covering 395 farmers in 108.8 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	24	2	200	70000	164000	3.34
	139	16	35.3	22575	34000	2.51
	40	0.6	340	134350	140000	2.04
	17	2	306	65000	114000	2.75
Zero Tillage in wheat; Var. DBW39 / HD 2967	24	25	34	23000	27200	2.18
	22	18	40.2	24100	26000	2.08
	30	5	304.7	54000	46200	1.86
Organic mulching in vegetables (Tomato, brinjal); Var. Hybrid	40	15	52	24000	36000	2.50
	30	14	45.3	30000	28350	1.95
Vegetables Poly-mulching in winter cucumber, Okra	22	9.2	51.6	27500	25550	1.93
Summer Ploughing in Rice	7	2	26	29900	24980	1.84
Green manuaring (dhaincha) in Rice	24	2	200	70000	164000	3.34
Ridge and furrow method of brinjal, cow pea (var. Kashikanchan) and radish cultivation	139	16	35.3	22575	34000	2.51
Green manuaring (dhaincha) in Rice	40	0.6	340	134350	140000	2.04
Moisture conservation in Rice – Summer ploughing by MB plough	17	2	306	65000	114000	2.75
Sowing of maize in Ridge & furrow method in upland	24	25	34	23000	27200	2.18
Green manuring by Sunhemp. (Sunhemp-Rice)	22	18	40.2	24100	26000	2.08
Total	**395**	**108.8**				







NATIONAL INNOVATIONS IN
CLIMATE RESILIENT AGRICULTURE

2.1.2 Water harvesting and recycling for supplemental irrigation:

Water harvesting and recycling for supplemental irrigation were demonstrated in 18 NICRA adopted villages by the different KVKs involving 135 numbers of farmers in 21.0 ha. 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	0.75	1300	30100	27377	1.91
Renovation of pond	30	0.25	17945	42500	125100	3.94
Enlargement of existing freshwater pond	6	2	1235	46000	51250	2.11
Brackish water pond	2	0.3	801	130280	145875	2.12
New water harvesting structure in the wheat field	4	1.1	911	33700	19500	1.58
Renovation of old water harvesting structure in rice field	2	3.9	3404	35600	23500	1.66
Raising of land embankment	8	4.2	1245	43120	145990	4.39
Dug out pond	5	2.5	1259	64800	62450	1.96
Renovation of canal	34	0.1	16880	41030	112500	3.74
Renovation of Defunct Well-03 nos.	17	2.5	1154	66500	82530	2.24
Construction of deep open well	15	3.4	1498	250000	345000	2.38
Total	**135**	**21**				

2.1.3 Conservation tillage:

Sowing of rabicrops depends on the harvesting time of the preceding crop in kharif and also soil moisture status for undertaking land preparation for sowing. In case of wheat, this involves 2 to 3 or even more tillage operations for obtaining appropriate tilth beforeplanting of wheat. In addition to the costs incurred and energy required, this causes delayin planting of wheat which often results in coincidence of vulnerable stage with hightemperature stress during February/ March. This often leads to reduction in grain yieldand loss to farmer. Zero till technology offers a viable and practical solution by avoidingrepeated tillage for land preparation and sowing, reducing cost of cultivation and alsopermits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoidterminal heat stress. Zero-tillage refers to direct drilling of wheat in unploughed paddyfields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, rice, lentil, pea and chickpea demonstrated in five NICRA adopted villages in an area of 36 ha in 156 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	50	9	36.89	25550	23350	1.91
Promotion of improved variety of maize + Zero tillage technology	45	5	53.1	35000	39870	2.14
Surface seeding and mulching in lentil	25	6.5	17.65	21150	36000	2.70
Surface seeding and mulching in mustard	15	7.5	14.9	16450	17500	2.06
Sowing of rice with power tiller	21	8	18.1	21500	22040	2.03
Total	**156**	**36**				

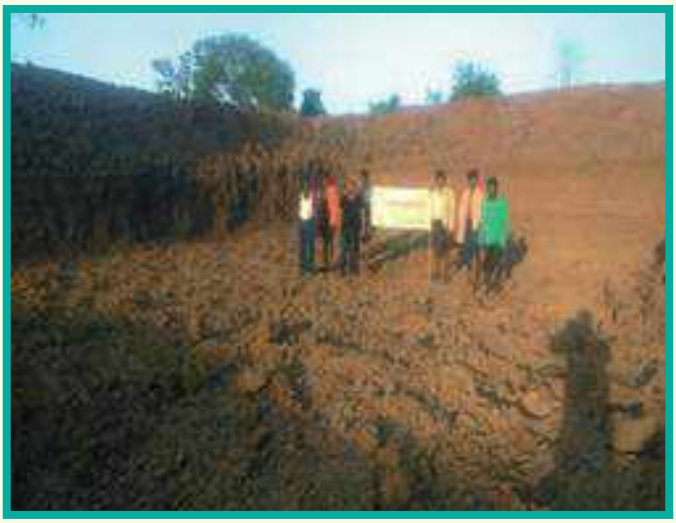



2.1.4 Artificial ground water recharge:

Artificial ground water recharge done by field bunding, water management and through SRI by sub-soiler in paddy in 18 NICRA adopted villages covering 74.3 ha area in 112 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest rice yield (53.0 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	86	57.1	47.0	24700	20800	1.92
Ground water recharge through SRI by sub-soiler	26	17.2	53.0	39550	45500	2.24
Total	**112**	**74.3**				



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 57.26 ha in234 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	25	6.1	32	27500	22000	1.80
Application of biofertilizer in rice (var. *MTU 7029*)	40	5.9	54	38000	50000	2.32
Vermi-compost from biodegradable wastes	18	1.9	14.2	4500	3990	1.89
RBF in Brinjal and cucumber (var. *Malini*)	13	1.2	11	51150	31550	1.62
Sprinkler irrigation in green gram (Var. *HUM-16*)	15	3.8	15.4	16200	25450	2.57
Sprinkler irrigation in chickpea (var. *PG-186*)	22	5	16	13000	18550	2.43
Vermi-compost from biodegradable wastes	15	11	49	21550	60050	3.79
Sprinkler irrigation in green gram	16	12	13	20150	15850	1.79
Sprinkler irrigation in Brinjal (*MuktaKeshi*)	12	2	464	148500	565500	4.81
Sprinkler irrigation in Chilli(Tejaswini)	20	2.4	239	175000	800500	5.57

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sprinkler irrigation in Greengram (PDM-84-139)	9	3.5	10.2	7500	23600	4.15
Sprinkler irrigation in Poi (Basella)	6	0.71	263	45900	159000	4.46
Sprinkler irrigation in Okra	5	0.3	186	54000	105500	2.95
Sprinkler irrigation in Cucumber	8	0.7	139	53000	160000	4.02
Sprinkler irrigation in Pumpkin	10	0.75	179	55000	104600	2.90
Total	**234**	**57.26**				

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 210 farmers' fields with an area of 38 ha of land. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return.

Table: Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Soil test based nutrient application	54	17	12.5	30000	26120	1.87
Solid waste management (Compost and Vermi-compost production unit)	43	43 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	14	3.2	14.8	35010	170500	5.87
Bio pesticides in Vegetables	34	6	149	48000	120000	3.50
Soil test based nutrient application in Cucumber	31	7.9	156	56000	166600	3.98
Use of IPM in Chilli leaf curl management	15	2.4	113	175820	396180	3.25
Use of IDM in Bittergourd bacterial wilt management	12	1.5	130	225585	509615	3.26
Shed net house for mushroom cultivation	7	-	2.4 kg per bed	40/- per bed	160/- per bed	5.00
Total	**210**	**38 ha + 43 unit**				

2.1.7. 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 255farmers' fields with an area of 45.3 ha of land. Out of these demonstrations on in-situ vermicomposting in orchards showed highest economic return.

Table: Performance of other demonstrations

2.1.8. 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 56 number of rainwater harvesting structures have been developed which could store 1.0 million cu m of water which could provide irrigation to 232 ha of land. This intervention increased the cropping intensity to the maximum extent up to 265%. 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 2020-21

New (Nos.)	Renovated (Nos.)	Total	Storage capacity (cu m)	Protective irrigation potential (ha)	Cropping Intensity (%) increase
29	27	56	1.0 million	232 ha	125-265

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 2020-21. Contingency crop plans for late planting (after midJuly) 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 (2020) delayed onset of monsoon was experienced in several districts of Odisha and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Iintroductions of drought resistant varieties of rice, brinjal, tomato, black gram, arhar etcwere demonstrated in 18 NICRA adopted villages involving 232 number of farmers in 79 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)	30	18.8	30	18	66.67	19100	16000	1.84
Drought tolerant Rice (var. *Sahabhagidhan*)	54	18	33	21	57.14	14000	21500	2.54
Red gram (bund planting)	17	1.4	15	12	25.00	27750	45500	2.64
Drought resistant brinjal (VNR- 218)	30	6	594	422	40.76	75000	190000	3.53
Tomato (*Utkal Kumari*)	21	2.2	160	110	45.45	53000	165000	4.11
Black gram (*PU 31*)	28	5.3	14	10	40.00	21500	39660	2.84
Cotton (*Shalimar*)	35	18.3	25	15	66.67	38000	82000	3.16
Arhar (*PRG 176*)	17	9	13	9	44.44	15500	39850	3.57
Total	**232**	**79**						

2.2.2 Introducing salt tolerant rice varieties:

Salt tolerant varieties of rice like CARI Dhan,Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona were introduced in 13.9 ha area in 74 farmers' fields. Variety CARI Dhan-5 and Jarava proved maximum salt tolerant potential by giving highest yield of 50.0 and 45.5 q/ha respectively and more economic return in SR-26B and CSR-36 (BC ratios 2.14 and 2.04 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	16	3.5	50.0	36.7	36.8	29750	23700	1.81
SR-26B	20	2.9	43.0	34.0	26.5	27500	29000	2.14
Usar Dhan-3	16	2.6	35.5	30.2	15.9	33650	16800	1.52
Salt tolerant Paddy *var. Jarava*	12	2.5	45.5	25.0	80.0	41250	26000	1.72
Rice *CSR-36*	10	2.4	44.0	33.6	31.0	29650	28200	2.04
Total	**74**	**13.9**						

2.2.3. Introducing flood tolerant varieties:

Flood tolerant varieties of paddy like Swarna sub 1, Pratikshaand CR 500 were introduced through demonstration in 20.9 ha area in 87 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	27	7.0	40.5	29.0	38.3	40000	31500	1.88
Promotion of submergence tolerance rice Pratiksha	53	10.5	43.5	30.0	44.3	21250	34600	2.72
Rice CR500	7	3.4	42.5	30.1	40.8	27500	19000	1.69
Total	**87**	**20.9**						

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 182number of farmers' fields with an area of 32.8 ha land.

Table: Performance of advancement of planting dates in different crops

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Lentil var. *Moitree*	78	13.0	12.5	8.0	56.5	21250	27125	2.28
Green Gram, *var. PDM139*	45	5.5	13.4	6.9	94.0	20500	40700	2.98
Promotion of short duration rice (*GB-1/ Panth-18/ Sahabhagi*)	49	6.8	35	26	34.6	22060	34640	2.57
Short duration rice (*Jogesh*)	10	7.5	22	14.6	50.6	18200	15316	1.84
Total	**182**	**32.8**						

2.2.5 Water saving rice cultivation methods:

Water saving paddy cultivation through SRI, short duration varieties, direct seeded riceetc.have been demonstrated in 58.2 ha area of 146number of farmers' fields. These interventions were carried out in seven NICRA adopted villages.

Table: Performances of water saving technologies for rice cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Line sowing by paddy drum seeder	38	15.5	38.0	29	31.3	14580	35720	3.44
Direct seeded brown manured rice	40	10.2	45.5	35	30.5	32900	36100	2.12

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	10	10.0	53.5	39	35.9	14850	19300	2.34
DSR (var. *Anjali*)	44	20.5	40.5	30	33.3	22858	33800	2.38
SRI/Use of trans-planter	14	2.0	45.2	32.2	32.5	22500	33300	2.45
Total	**146**	**58.2**						

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 13.5 ha area of 67 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	17	1.5	325	248	31.05	131250	142875	2.08
Community nursery of brinjal	11	5.0	560	420	33.33	75000	205000	3.7
Community nursery of onion	20	4.5	230	185	24.32	145000	12000	1.8
Community nursery of Chilli (Tejaswini)	19	2.5	112	75	49.33	177500	362500	3.04
Total	**67**	**13.5**						

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 5.5 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: 3.02) was found in Cucurbits / Gourd + solanaceous vegetablesintercropping.

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	8	1.5	750	560	27.5	163800	224800	2.37
Brinjal + Coriander	7	1.0	650	502	21.5	145700	272600	2.87

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cucurbits / Gourd + solanaceous vegetables	22	1.5	Gourd : 63 Vegetables: 272			97500 + 120000 = 217500	64500	3.02
Maize+Ladies finger	18	0.5	Maize: 87.0	Maize: 75.0		63750	121500 + 17250 = 138750	2.21
Others if any chilli + tomato	10	1.0	320	260	24.8	48000+ 193200 = 241200	113700	1.89
Total	**50**	**5.5**						

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 138.1 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:: 7.38).

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
Hybrid Maize var. Kaveri	35	6.7	129q/ha (green cob)	71 q/ha (greencob)	81.69	46000	72000	2.57
Sweet corn variety-Sugar-75	25	2.6	120q/ha(green cob)	93(q/ha) Green cob	29.03	68000	162000	3.38

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Onion (var. *N-53*)	40	7	299	190	57.37	68300	300050	5.39
Mustard (var. *Pusa bold*)	42	19	10.5	6.7	56.72	24800	41660	2.68
Chilli (var. *Surajmukhi*)	53	8.3	92	58	58.62	66000	173000	3.62
Gram (var. *Pusa 362*)	63	15.2	17	10	70.00	26650	48400	2.82
Tomato (var. *Param F1*)	54	8.5	200	153	30.72	75600	150200	2.99
Cabbage (var. *OM-3*)	60	9.4	360	260	38.46	75000	215500	3.87
Radish (var. *Suhra -32*)	45	5.4	159	97	63.92	71100	86000	2.21
Brinjal (var. *F1-Hybride Long*)	46	7	218	165	32.12	78500	156100	2.99
Cauliflower (var. *MSN-16*)	55	6.5	229	129	77.52	78800	184000	3.34
French Bean (var. *FE-51 ANUPMA*)	45	3.5	68.8	42.4	62.26	80900	112000	2.38
Turmeric (var. *Rajendrasoniya*)	40	7	260	170	52.94	90000	300000	4.33
Ginger (var. *Nadiya*)	35	3.6	206	158	30.38	110000	550000	6.00
Lentil (Short duration var. *PL 406*)	39	6.2	13.1	7	87.14	18000	30000	2.67
Linseed (Short duration var. *T 397*)	25	6.5	7.5	5	50.00	11000	18750	2.70
Ol (var. *HYV Gajendra*)	42	3.9	550	290	89.66	87000	555000	7.38
Nutritional garden- veg. seed Seem (*dolicus lablab)*	78	4.8	20	13	53.85	9000	17000	2.89
Tomato under mulching	65	7	81	40	102.50	10000	29400	3.94
Total	**887**	**138.1**						

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 555 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	23	5	40	35	14.29	30000	35000	2.17
Cultivation of disease resistant Tomato var. ArkaRakshyak	15	1	267	209	27.75	85000	353500	5.16
Cultivation of short duration green gram var. IPM 02-3	10	3.7	7.1	4.9	44.90	15510	22490	2.45
Income generation activities (Marigold cultivation by women SHGs)	10	-	125 q/ha flower yield	85 q/ ha		78000	301000	4.86
Vermicomposting	7	7 unit	5q/pit	4q/pit		1500	3500	3.33
Oyster mushroom cultivation by WSHGs	15	-	2.2 kg	1.8 kg/ bed		40/- per bed	140/-per bed	4.50
Contingency crop Brinjal (var. *PUSA Uttam*)	22	3.6	350	300	16.67	58000	290000	6.00
Integrated crop management of mustard (*NC-1*)	38	5.9	25	15	66.67	40000	47630	2.19
Promotion of stem rot resistant Jute (var. *JBO-2003H*)	36	4	27	18	50.00	35500	46670	2.31
Integrated crop management of lentil (*Maitri*)	40	5.5	16	12	33.33	31500	44500	2.41
Integrated disease management in vegetables	25	5.5	245	203	20.69	96000	43250	1.45
Demonstration short duration vegetables as contingent crop Tomato (var. *PUSA Gaurav*)	26	4	360	270	33.33	59500	205000	4.45
Contingency crop Cauliflower (var *PUSA Sharad*)	30	2.7	260	210	23.81	61000	262500	5.30
Contingency crop Radish (var. *PUSA Chetki*)	37	2	136	90	51.11	52500	65900	2.26

Technology demonstrated	No. of farmers	Area (ha)	Yield(q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Soil reclamation : Levelling /bunding and flooring for leaching of salt	37	10	36	30	20.00	37500	49000	2.31
Integrated fish farming	26	3.4	2	1.5	33.33	49000	132000	3.69
Integrated farming system	31	3.9						
late blight disease of potato	20	2.5	300	255	17.65	135000	190000	2.41
Bio-control agent production	22					Rs. 55/ Kg	Rs.600/Kg	
Mushroom	45		22			Rs. 25/ cylinder	Rs.55/ cylinder	3.20
Forest tree plantation	40	900 Plant						
Total	**555**	**62.7 ha / 7 unit / 900 Plant**						

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 7 ha involving 181 number of farmers utilized for different fodder production were demonstrated in eight different NICRA adopted villages. Sudan chari, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality hybrid napier demonstrated showed maximum benefit return (B:C:: 2.64).

Table: Performance of different fodder demonstration in community lands

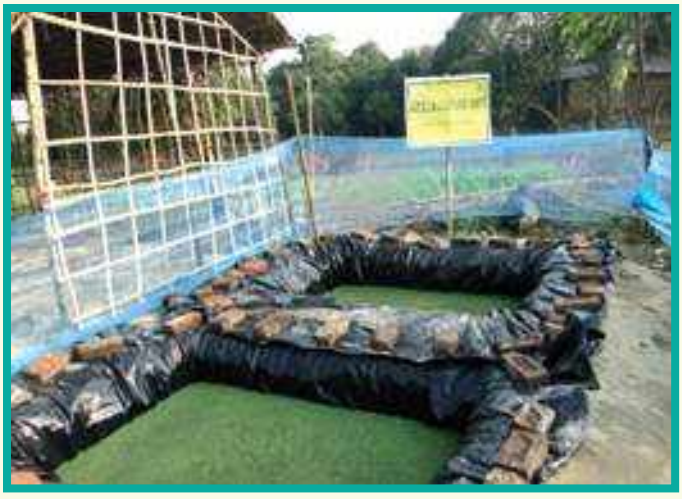
Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Sudan Grass	17	6 units	2920 lt. milk/yr	2620 lt. milk/yr	11.5	45500	42000	2.08
Hybrid Napier	164	7 ha	185	170	8.8	12500	7600	2.64
Total	**181**	**6 units &7 ha**						

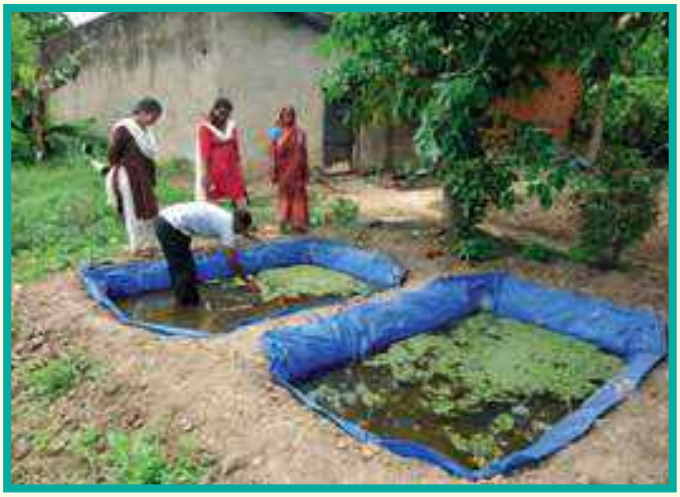
2.3.2 Improved fodder/feed storage methods:

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. In 2020-21 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. Azolla cultivation for feed supplement of domestic animalfor 45 numbers of farmers showed very promising results.

Table: Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Production of Napier grass for feed supplement of domestic animal	12	11 units &1.5 ha						
Azolla cultivation for feed supplement of domestic animal	45	45 units	3 kg/unit/ month			225/unit	950/unit	5.22
Hydroponic fodder production	9	9 units	1900	1200	59	18500	54500	3.94
Azolla in poultry	7	7 units	2.5	1.7	47	115	385	4.3
Rice bean	20	0.5 ha	255	220	20.3	8450	15464	2.83
Maize	30	0.5 ha	280	240	16.6	10500	15330	2.46
Hybrid napier Co4	5	0.4 ha	200	140	42.8	70000	30000	1.42
Total	**128**	**72 units & 2.9 ha**						





2.3.2 Preventive vaccination:

Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming etc. in 18 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)		% in-crease	Economics of demon-stration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	400	517	940lt. milk/ yr	840lt. milk/yr	11.9	15000	13500	1.90
Vaccination for PPR in goat and Ranikhet in Poultry.	252	471	Body wt(90days) 6.6kg	5.4kg	23	720	1200	2.67
Deworming	290	265	912lt. milk/ yr	840lt.milk/yr	8.5	13500	11500	1.85
Mineral mixture	127	270	1000	890	12.4	14500	16000	2.10
Vaccination camp against other diseases	157	47						
Total	**1226**	**1570**						




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

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

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

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Cultivation of cat fish in cemented tank	10	11 units	45.6	30.5	49.5	175000	245000	2.40
Composite fish culture by stocking of yearlings of Catla, Rohu and Mrigal	43	4.1	35.8	24.9	43.8	180000	240000	2.33

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
Stress tolerant fish (Asian Catfish) integrated with IMC for effective utilization of available water IMC (Catla:Rohu:Mriguel@ 3:4:3) = 1300 no./bigha for 4 months + Asian catfish : 1000 no./bigha for 8 months	4	0.2	35.2	30	17.3	220000	516000	3.35
Installation of Periphyton net by covering 40% of water surface area to facilitate natural feed production in pond and to reduce cost of artificial feed in *Tilapia* culture	2	2 units (0.1 ha)	230	210	9.5	730000	1450000	2.99
Eco Hatchery for Carp Breeding (Reservoir – 1 Breeding pool – 1 Hatching pool – 1 Spawn collection chamber – 1)	1	1 unit	Production of 5.2 million spawn of IMC (Catla, Rohu, Mriguel, Bata and *Puntius-javonicus*) & Work opportunity for 3 rural youths			17000	43000	3.53
Total	**60**	**14units & 4.4 ha**						




2.3.4 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 366 number of farmers fields. Kadaknath bird was introduced through this intervention which showed very promising results (B: C:: 5.00).

Table: Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Promotion of Ghungroo Piglets	7	7 units & 15 nos.				10000	7500	1.75
Promotion of poultry breed Rhode Island Red (RIR)	18	18 units & 280 nos.				-	-	-
Empowerment of SHG through Egg Incubator	35	1 unit & 1 no.				-	-	-

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Promotion of goatery breeds for strengthening of marginal farm women	13	13 units & 15 nos.	-	-	-	-	-	-
Duck Rearing-Khaki Campbell	100	295 nos.	2.3	1.9	21.05	550	1650	4.00
Rearing of poultry breed Vanaraj	115	150 nos.	3.5	2.5	40.00	200	600	4.00
Demonstration of stress tolerant breed Kadaknath	60	330 nos.	3	2	50.00	220	880	5.00
Colourbird poultry	18	360 nos.	2.0 kg	2.0 kg		180	275	2.53
Total	**366**	**39 units & 1446 nos.**						

2.3.5 Improved shelters for reducing heat stress in livestock:

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

Table: Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output* (q/ha)		% increase	Economics of demonstration (Rs./ ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Cement flooring, Straw thatched roof, with mosquito repellent net for better hygienic for cattle	15	40	945	830	13.9	17500	32250	14750	1.84
Low cost shed with raised bamboo platform	5	3.4	20	13	53.8	1975	6880	4905	3.48
Shelter 1 Low-Cost Goatery Shed	62	62	-	-		2500	4125	1625	1.65
Improved cowshed	4	4	4	3	33.3	26000	50000	24000	1.92
Low cost goat shed	10	11	Bw. gain- 57 g/ day	Bw. gain- 46 g/ day	-	3500/- per goat per 1 year	9500/- per goat per 1 year	6000	2.71
Total	**96**	**120.4**							

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 2020-21. 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.

Inter-ventions	No. of KVKs	Details of activity			No. of farm-ers	Unit/ No. /Area (ha)
		Name of crops / Commodity groups / Imple-ments	Quantity(q) / Number / Rent / Charges	Technology used in seed / fod-der bank & function of groups		
Seed bank	7	Rice - Sa-habhagidhan, Swarna Shreya	28q	Rouging,drying	80	56 ha
		Blackgram	50	Seed Production	440	1
		Rice var - Swarna Sub – 1	5.2 q	Metal seed bins, layers of dried neem leaves and dry chili kept with seeds to prevent insect infestation	30	4
		Rice var – Sahabhagidhan	35 qt/17/300 per month	Paddy var- Sahabhagidhan	15	12
		Black gram	45q	Proper care and storage of black gram. Seed treatment with bavistine. Preservation of ger-mination quality. Registration of seed bank	30	45q

Inter-ventions	No. of KVKs	Details of activity			No. of farm-ers	Unit/ No. /Area (ha)
		Name of crops / Commodity groups / Imple-ments	Quantity(q) / Number / Rent / Charges	Technology used in seed / fod-der bank & function of groups		
		Swarna Sub 1 Rice	11 q	-	29	1.5
Fodder bank	4	Hybrid Napier	40		115	0.5
		Maize	36 q	Proper care and storage of maize seeds. Seed treatment with bavistine. Preservation of ger-mination quality. Registration of fodder bank	22	30 q
		Hybrid Napier	200 q	-	30	1
Custom hiring centre	7	Rice, Maize, Vege-tables, Jute	Rs. 44000		48	1.5
		Power tiller, spray-er, reaper, diesel pump set, weeder, Thresher cum win-nower, MB Plough, seed cum fertilizer drill			67	29 ha
		Power tiller	Rs.250/hr	Ploughing	12	10 ha
		Paddy reaper	Rs.250/hr	Reaping paddy	8	7.5 ha
		Power sprayer	Rs. 20/-hr	Spraying pesticides	25	2 ha
		Power Tiller	2 no.* (Rs. 250/hr)	Managed by VCRMC	31	7.9
		Pump set	5 no. (Rs. 80/day)		25	7.3
		Battery operated Sprayer	6 no. (Rs. 50/hr)		40	9.8
		Paddy thresher	5 no. (Rs. 100/ day)		38	10.5
		Tractor drawn labeller, Tractor drawn MB plough, Tractor drawn rotavator, Self-pro-pelled riding type reaper, Diesel pump set, Knap-sack Sprayer	17000		110	60

Inter-ventions	No. of KVKs	Details of activity			No. of farm-ers	Unit/ No. /Area (ha)
		Name of crops / Commodity groups / Imple-ments	Quantity(q) / Number / Rent / Charges	Technology used in seed / fod-der bank & function of groups		
		Power spray-er, power tiller, Thresher, motor Pump			65	1
Climate literacy through a village level weather station	4	Weather station-Rain gauge, Steven-son screen, wind vein		Daily data recorded by VCRMC	1500	17
Others (if any)	1	Elephant foot yam	2		27	5 ha
Total					**2787**	**109.5 ha, 75 q & 135 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 rabicrops 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. 6.25 lakhs for its establishment under NICRA project. Revenue generated through custom hiring and under VCRMC in different KVKs were presented in the following table.

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

	Revenue generated (Rs.)	
Name of KVK	From Custom Hiring Centres	Total under VCRMC
Cooch Behar	42000	110200
Malda	5235	62450
Port Blair	12500	54500
South 24 Parganas	20000	291094
Kendrapara	6900	21900
Sonepur	8130	41030
Jharsuguda	10500	47952
Ganjam	10000	14620
Kalahandi	No CHC has been established yet	
Total	**115265**	**643746**

3. CAPACITY BUILDING

A total of 129 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 3609 farmers and farm women (2078 male and 1531 female) during 2020-21. Thematic areas covered on SRI, scientific crop management, crop diversification, land shaping, green manuring, natural resource management, resource conservation technology, animal feed management, nursery raising, pest and disease management, weed control, vermicompost, value addition, livestock management, oilseed and pulse demonstration, farm implements, drudgery reduction etc. The HRD programme conducted on the basis of priority area of farmers or farm women.

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Livestock and Fishery Management	Empowerment of farm women through Poultry and duckery farming	5	0	120	120
	Sustainable income generation of rural youth through pig farming	1	0	25	25
	Application of Floating feed in Pisciculture	2	34	10	44
	Training on importance of hydroponic & azolla cultivation & animal feed	2	30	22	52
	Training on Scarcity feed management	1	25	14	39
	Training on deworming & vaccination schedule of livestock	1	30	5	35
	Nursery pond management	1	11	16	27
	Composite fish culture	2	29	11	40
	Integrated Fish Farming with livestock & horticultural Crops	1	24	13	37
	Back yard poultry rearing of Kadaknath	2	46	18	64
	Care and management of dairy animal during heat stress	1	22	18	40
	Rearing of feed management of backyard poultry	1	0	31	31
Integrated Pest and disease Management	Management of Pest & diseases in Rice	1	20	20	40
	Management of Pest & diseases in Pulses	2	36	17	53
	IPM practices of kharif vegetables	1	18	9	27
	IPM practices of rabi vegetables	2	30	20	50
	IPM practices of summer vegetables	1	25	14	39
	IPM &INM System of Assured Rice Production (SARP)	2	45	17	62
	Disease and pest management in Paddy	1	18	15	33
	Disease management in stress tolerant crops	1	15	32	47
	Practice of bio-pesticides for management of sucking pest in cotton	2	18	40	58
Natural Resource Management	Zero tillage technology of maize	2	46	21	67
	Transplanting paddy through transplanter machine	1	20	15	35
	Waste Management for Sustainable Environment	2	60	35	95
	Water Harvesting and Management	2	54	28	82
	Contingency planning for kharif 2019	2	38	14	52
	Conservation of water & its judicious use for sustainable development	1	28	18	46
	Post Cyclone (Bulbul) Contingency Planning for Rabi season	1	21	9	30
	In-situ moisture conservation in vegetable	1	34	15	49

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
	Trenching and bunding method in mango plantation	2	32	37	69
	Use of farm machinery for conservation of soil moisture	1	16	8	24
	Onfarm water conservation in rice	1	15	8	23
Crop Management	Cultivation of rabi crops (Paddy, Potato, Vegetables, Lentil, Mustard)	6	155	64	219
	Bio-intensive pest management practices for Rabi crops	2	30	23	53
	Importance and conservation of pollinators for better crop production in climate change perspective	2	43	0	43
	Hybrid vegetable cultivation	1	18	13	31
	Crop diversification from paddy to non paddy crop- groundnut	1	34	5	39
	Training on Use of green manuring for better fertility status and crop yield	1	13	29	42
	Training on high density planting system in cotton	2	25	24	49
	Management in black gram in rice fallow cropping system	1	13	16	29
	Scientific cultivation of swarna sub 1	1	27	12	39
	Management of maie based intercropping system	1	10	22	32
Fodder and feed management	Azolla cultivation for feed supplement of domestic animal	2	30	21	51
Resource conservation Technology	Vermicomposting, use of Bio-Fertilizer in diff. crop	1	13	11	24
	Resource conservation technology and implementation	1	21	10	31
	Cultivation of pulse crop as paira cropping	1	15	9	24
Integrated Farming System	Importance, scope and implementation of IFS	2	27	17	44
Farm implements and machineries	Effective use of farm machinery though Petroleum conservation	2	44	2	46
Organic farming	Training on Organic Farming.	2	19	22	41
Vermi composting	Training on Vermi-composting	2	35	25	60
Soil sample collection Technique	Training on Soil sample collection technique	1	16	10	26

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Income generation activity	Scientific method of Mushroom cultivation	1	8	36	44
	Employment generation of SHGs through Egg Incubator	1	10	15	25
	Training on Marigold cultivation	1	25	13	38
Mushroom cultivation	Training on mushroom production	3	33	49	82
	Low-cost technology for mushroom cultivation for rural youth	2	28	14	42
	Low-cost technology for mushroom cultivation for women	1	25	15	40
Off- season Vegetable Cultivation	Training on Off- season Vegetable Cultivation	3	28	28	56
Multi tier horticulture	Selection of vegetables to be grown in multitier	1	15	20	35
Value addition	Value addition for fruits and vegetable crops	2	21	3	24
Nutrient Management	Nutritional garden	1	22	14	36
	System of assured Rice production -IPM & INM	4	46	24	70
	Application of chemical fertilizer based on STBF	1	18	22	40
	INM in Groundnut	2	26	20	46
Nursery raising	Nursery raising , Grafting techniques of veg. & fruits	2	30	19	49
	Seedling production of different horticultural crops throughout the year.	1	19	16	35
	Nursery raising under low cost polytunnel	1	12	5	17
Soil health management	Importance of soil health management and soil sampling	1	25	0	25
Seed production	Seed production technology of pulses	2	33	11	44
	Seed production of turmeric ginger elephant foot yam	2	11	34	45
Improved package of practices	Improved package of practices of pulse cultivation	1	19	10	29
	Package of practices for wheat and maize	3	45	24	69
	Improved Package of practices for winter vegetables crops	2	28	15	43
	Improved Package of practices for summer vegetables crops	1	10	4	14
Post harvest technologies	Post harvest technologies for vegetables	1	17	10	27
Traps	Use of different attractants/ traps for vegetables	1	16	2	18
	Use of traps for mango and litchi	3	15	35	50
Care & management	Care & management of lactating mother	2	22	13	35

Thematic area	Topic of the training	No. of Courses	No. of beneficiaries		
			Male	Female	Total
Water borne diseases	Care & management against water borne diseases particularly after flood	1	13	6	19
Awareness programme	Awareness programme on Swachh Bharat Abhiyan	1	30	24	54
Total		**129**	**2078**	**1531**	**3609**

4. EXTENSION ACTIVITIES

NICRA implementing KVKs conducted a total of 371 extension activities on various thematic areas benefitting 13295 practicing farmers and farm women (7742 males and 5553 females) during 2020-21. 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	25	410	320	730
Group meetings	7	250	153	403
Field day	21	606	312	918
Exposure visits	15	425	250	675
Awareness Campaigns	30	900	470	1370
ICT based extension services	10	351	173	524
Diagnostic visit	29	336	363	699
Field Visit	38	540	426	966
World Environment Day Celebration	22	377	193	570
Live Webcasting	39	545	320	865
Strengthening SHGs	6	0	230	230
Strengthening kisan clubs	6	135	92	227
Other Training Courses	24	628	318	946
KMAS Services	12	355	242	597
Popular extension literature	20	312	284	596
Animal Health Camp	31	855	700	1555
NICRA Workshop at ATARI, Kolkata	4	185	99	284
Scientist visit to field	25	270	310	580
Kisan Mela	7	262	298	560
Total	**371**	**7742**	**5553**	**13295**

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

December 5 is declared as 'World Soil Day' by the International Union of Soil Sciences and to celebrate the importance of soil as a critical component of the natural system and as a vital contributor to human wellbeing, all the NICRA-KVKs have organized Seminar/symposia/workshop. The World Soil Day campaign aims to connect people with soil and raise awareness on their critical; importance in our lives. One of the several ways of connecting people with soils is to restore and preserve the soil health. All the nine NICRA-KVKs of Zone-v distributed the soil health cards among the farmers in NICRA adopted villages. A total of 1082 numbers of Soil Health Cards were distributed among 1186 farmers on that particular day and cards were distributed by the public representatives like MP/MLAs and others in the respective KVKs. KVK wise distribution of soil health cards are presented in the following table.

Table: Soil Health Card prepared and distributed during 2020-21

KVK	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers benefitted
Port Blair	35	35	44	50
Ganjam I	30	30	120	120
Sonepur	35	35	61	63
Kalahandi	16	16	21	38
Jharsuguda	10	10	30	30
Kendrapara	39	39	52	94
Coochbehar	330	330	405	430
Malda	300	300	260	260
S. 24 Pgs	113	113	109	100
Total	**908**	**908**	**1102**	**1185**

6. CONVERGENCE PROGRAMME

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the NICRA adopted villages. Support from these developmental programmes was used for scaling up of proven interventions in the village. In case of NRM, support was mobilized for various water harvesting structures, recharge structures, micro irrigation systems, polythene lining of farm ponds, land shaping and ail cultivation, distribution of green manuring seed to large number of farmers, tree planting including horticulture, etc. In crop production, convergence with line departments was used for increasing the spread of HYV of food crops, promotion of cultivation practices such as SRI, Direct seeded Rice, demonstration programme etc. In case of animal husbandry, interventions such as animal vaccination camps, and health camps, timely availability of medicines, large scale production and availability of improved fodder crop seed, planting material and mineral mixture demonstration were taken up in convergence. Capacity building of the farmers in NICRA villages was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programs. Efforts were made to enhance the coverage of the interventions in the village with the support of the line departments through convergence. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2020-21. The prominent development schemes are MGNREGA, NTPC, NABARD, Sunderban Development Board, Forest Department, Irrigation Department, different Departments of the concerned states. RKVY etc.

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

KVK	Development Scheme /Programme	Nature of work	Amount (Rs.)
South 24 Parganas	SCSP programme sponsored by DGR, Junagarh	Distribution of backyard poultry (RIR)	33000/-
Jharsuguda	Water shed development mission, Jharsugda	Desilting of WHS.	25000/-
Ganjam I	AICRP on Goat, OUAT	Goat improvement	60000/-
	Woman empowerment by CIWA, Bhubaneswar	Demonstration	70000/-
Total			130000/-
Coochbehar	Gram Panchayat	Vermicomposting seed	5200000/-
	Gram Panchayat	Renovation of Pond	833000/-
Total			6033000/-
Kendrapara	ATMA	Demonstration	120000/-
Grand Total			**6341000/-**

7. Success Stories

Biotic and abiotic stress tolerance in the bio-fortified high protein rice variety "CR Dhan 310" in South 24 Parganas

A bio-fortified rice variety "CR Dhan 310", having higher protein content (10.3%), was demonstrated in the NICRA village during Kharif 2020, for the second consecutive year. It is a short duration rice variety (110-115 days), suitable for growing in the highland situation. The medium-bold grains remain firm and dry after cooking unlike other traditional varietiesand were found to have a typical flavour and taste that was well accepted by the community for consumption. The productivity of rice, in the area, was much lower during this year due to less rainfall and high incidence of bacterial leaf blight (10-25% PDI). The yield, economics and disease incidence Parameters observed during 2020 are compared below.

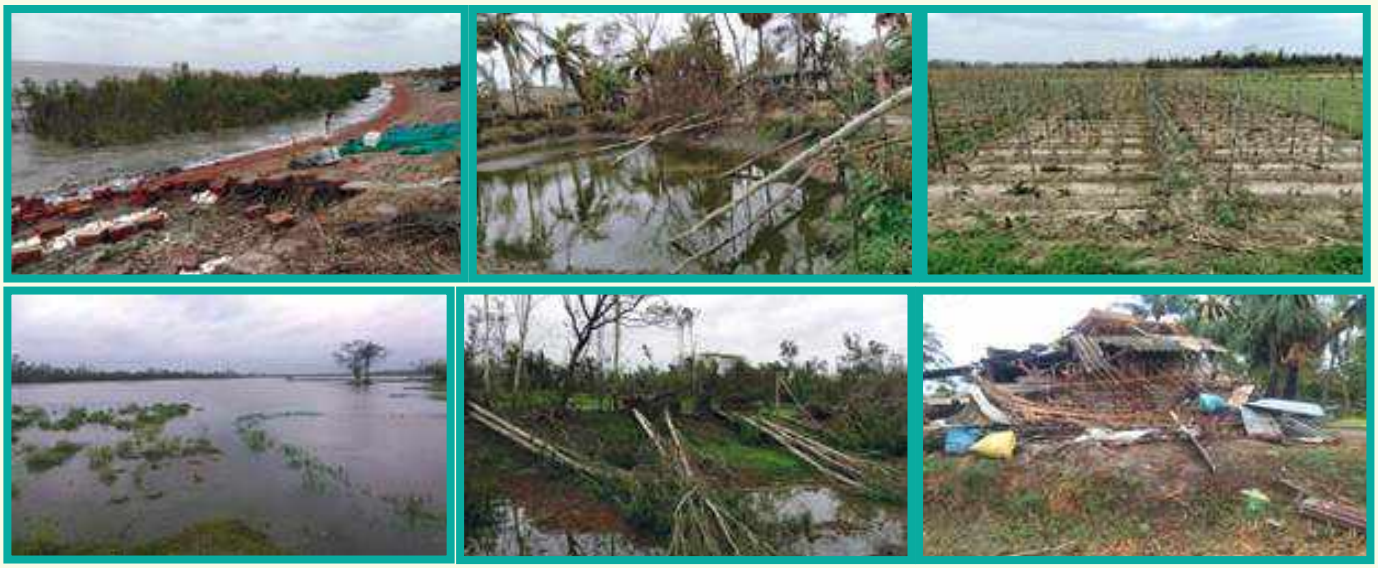
Intervention	Yield (q ha^{-1})	Gross returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C Ratio (%)	Bacterial leaf blight (PDI%)
Rice variety **CR Dhan 310**	39.64	69370/-	39600/-	29770/-	1.75	2.4%
Rice variety **Santoshi**	35.6	62300/-	42900/-	19400/-	1.45	16.8%

The yield and net profit during 2019 (normal rainfall) and 2020 (54% deficient rainfall + BLB infestation) are compared below. The CR Dhan 310 variety recorded 6.73% less yield compared to 15.24% yield reduction in the farmers practice, in 2020, due to the abiotic and biotic stresses. Similarly there was only 4.35% less profit in CR Dhan 310, compared to 21.40% reduction in net profit, during 2020, in the farmers practice.

Rice Variety	Yield (q/ha)		% change	Net profit (Rs./ha)		% change
	2019	2020		2019	2020	
CR Dhan 310	42.5	39.64	-6.73	31125	29770	-4.35
Santoshi	42	35.6	-15.24	28500	22400	-21.40

Impact of contingency measures taken up in the village (Relate the dry spells/floods/heat wave/ cold wave/etc., with crops and their growth stages)

Sl. No	Stress	Duration	Crop name	Crop stage affected	Intervention taken up	Number of farmers involved	Impact on crop yields (q/ha)		
							Farmers' practice	Demo	Increase over farmers' practice
1	Dry spell	18 days (01.09.20 to 18.09.20)	Rice	Tillering stage	**Irrigation facility :** • The farm ponds in the land shaping plots had sufficient water which helped in irrigation. **Seed treatment:** • Seed treatment in Zinc Sulphate solution **Nutrient management in seedbed (1 cottah):** • 200 kg organic manure, N: 165g, P: 660g, Borax: 33g, Zinc sulphate: 165g in nursery bed	25	30.4	35.41	(+) 16.48%
2	**Super cyclone** *Amphun*	(20.05.2020) Rainfall: 20.05.2020 : 8 mm Breaching of embankment & saline water ingression	Rice	Boro Paddy: 25% area (in 75% area the crop was harvested)	The VCRMC played instrumental role in creating awareness among the people to take care of the safety measures. The following contingency measures were taken up post cyclone. • Distribution of short duration and MYMV resistant Greengram seeds (var. IPM 02-03). • Distribution of foliar spray fertilizer (20-20-20) and growth promoter (Phytonol) for the cyclone hit fields of brinjal, chilli and dolichos beans. • Advisory for treatment of affected fish ponds with lime and potassium permanganate.	200	Resilience in NICRA village 1. Thick Mangrove plantation along river embankment 2. Timely cyclone alert and advisory 3. Post cyclone management of crop, livestock and fishery through the VCRMC		
			Vegetables	80-100 % crop loss					
			Orchard	50% fruit trees damaged					
			Fishery	Deterioration of water quality, Surfacing and death of fishes 75-100 % loss					



Havoc damage created by Amphun super cyclone on 20-05-2020

Eco hatchery for carp breeding in the village "Bongheri" of Sundarbans, South 24 Parganas

A small backward eco hatchery comprising of one reservoir, one breeding pool, one hatching pool and one spawn collection chamber was set up in the NICRA village "Bongheri" for facilitating carp breeding with the aim to supply quantity carp seeds to the fish farmers. The hatchery unit has been established by Shri Sunil Banik, a marginal farmer having 0.13 ha of farm land and a pond of 0.13 ha. Previously, most of the seeds used to come from far-away places like Naihati (200 km) and Gobardanga (215 km) and the quality of the seeds could not be ascertained. The price was also found to be expecetionally high. But the farmers had no other alternatives. This year, as soon as the hatchery operation started, farmers from all corners of the village and also from neighbouring village, started placing orders for procuring carp seeds.

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

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

Empowerment of farm women though backyard poultry rearing at Jharsuguda

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

Treatment	Body wt (kg/6 months)	% change in body wt	Net Return (Rs/bird/6month)	B:C Ratio
T_1 (Local bird)	1.7	-	300/-	3.4
T_2 (*Kadaknath*)	2.2	29	800/-	5

Integrated farming system with Live stock in Ganjam I

Case - I

Rice Var. – Swarna Shreya tolerate dry spell for 10 days. Integration of dairy, Poultry, Sweetcorn increased income. Fodder crop provides feeds round the year. Greengram var. IPM 02-03 has no YMV incidence Earlier he was getting profit of Rs.1,06,000/- per year & after IFS integration he got a profit of Rs.1,65,000/- per year. Dry spell decrease the yield & low income due to single enterprises. Integration of Dairy, Poultry, Fodder along with Crops(Rice, Greengram, Brinjal,Sweet corn, Cauliflower). Dairy -02 Crossbred cows, Poultry- Kadaknath 20 nos. Rice- 0.6ha, Brinjal -0.4 ha., Fodder- 0.2 ha.-Sweet corn-0.2ha., (Kharif)

Greengram-0.6 ha., Cauliflower-0.4 ha., Tomato-0.2 ha.(.(Rabi),

Rice var. Swarna Shreya has 16% higher yield as compared to local var., Sweet corn gave higher profit than Maize.. Brinjal var.- Swarna Shyamali decreased the mortality rate of seedlings by 76%.

Case – II

Dry spell decrease the yield & low income due to single enterprises

Integration of Honey bee, Dairy, Poultry, Fodder along with Crops(Rice, Ragi,Greengram, Brinjal,Mango orchard). Honey -10 box, Dairy -02 Crossbred cows, Poultry- Kadaknath 30 nos..

Rice- 0.6ha, Ragi-0.2 ha., Fodder- 0.2 ha.-Mango-0.2 ha., (Kharif)

Greengram-0.4 ha., Brinjal-0.4 ha.(.(Rabi). Rice var. Swarna Shreya has 14% higher yield as compared to local var., Ragi var. has higher yield than upland Rice var., Fruit fly management in Mango increased the yiel by 12 %. Brinjal var.- Swarna Shyamali decreased the mortality rate of seedlings by 72%.

Rice Var. – Swarna Shreya tolerate dry spell for 10 days, Ragi is a Climate Resilient crop, Integration of dairy, Poultry, Honey bee increased income. Fodder crop provides feeds round the year. Greengram var. IPM 02-03 has no YMV incidence. Earlier he was getting profit of Rs.1,03,000/- per year & after IFS integration he got a profit of Rs.1,34,000/- per year

Deep trench bund structure- a source of supplemental irrigation in mango orchard at Kalahandi

A continuous deep trench bund was dogged with a dimension of 50 ft length, 2 ft width and 3 ft depth in a mango orchard of NICRA adopted village Kinipadar, under M. Rampur block in Kalahandi district of Odisha. The bund was aimed to be 90 degrees to the peat slope to ensure best water retention. The excavated soil was piled up in the down side of slope and the final height of the peat bund was an average height of 250-300mm above the peat surface. The deep trench restricts the water loss by creating an underground 'wall' of wet 'putty' peat which slows water movement. This improves hydrological connectivity and re-hydrates the entire peat resource with improved general water table conditions. The long-term improvement in peat surface wetness promotes improved vegetation. The rain water was harvested and stored in the bund during rainy season. The mango trees utilized the stored water afterwards for its growth and fruiting.

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ ha)	Economics of demon-stration (Rs/ha)		
				Gross Cost	Net Return	BCR
Trench bund method in mango orchard	15	2.5	105	40000	1,17,500	3.93

Ridge and furrow technology enhancing economic security as well as the cultivation of different vegetables throughout the year in Port Blair

Vegetable production in Badmas Pahad, Port Mout under NICRA adopted villages were hampered because of limited cultivable land and excess rainfall during rainy season (May – December) and also unpredicted rains in summer. The other major problem for vegetable production is extensive damage (by Giant African Snail, Bacterial wilt, water storage in post monsoon period and less sun shine). A total of 16.23 ha area covered under rice and permanently in water logged condition, where no other crop is grown during rainy period. Rice cultivation is becoming highly uneconomical and it was thought that vegetables can fetch high price due to short supply in rainy months. Ridge and furrow is a technology identified to grow vegetable right in the midst of low lying rice field. It involves making of ridges (width 50cm, height 30-40cm) and furrow (width 100 cm) to provide drainage of excess and standing water from the fields.

A field experiment was conducted in farmers' field during the month of October-November, 2012 at low lying area of Badmas pahar and Lal Pahad covering with an area of 2.5 ha under National Initiative on Climate Resilient Agriculture (NICRA). The adopted villages are geographically situated between 11o38.452' N latitude and 92o 39.844' E longitude at an altitude of 5.7 m. The soil was sandy clay with medium organic carbon (0.58%), low in available nitrogen (263.3 kg ha-1), low in available phosphorus (7.4 kg ha-1) and medium in available potassium (224. kg ha-1). Vegetable growing farmers were very less due to loss in cultivation of vegetables during rains and unpredicted rains during summer months because of low lying fields. A total of six farmers with an area of 2.5 ha (2011-13) are covered from both the villages of Lal Pahad and Bad mash Pahad. With the meager investment of Rs 4500 per season, the families get the seasonal vegetables throughout the season also sold the surplus vegetables to the local market and get handsome income. The result showed that earlier the beneficiaries were growing only one crop (paddy) now they are able to grow more than five crops (vegetables) in the their land. The most impressive and effective impact is that, through the intervention of the technology, cultivation of vegetables, reduction in seed rate, integrated pest management approaches are more popular in the NICRA villages .In the project area, cropping seasons are clearly demarcated as per occurrence of rainfall viz. rainy season and dry season. Rainy season categorized with plentiful rains (400-600mm/month) and comparatively higher monthly minimum and maximum average temperature 23-250C and 28-300C respectively. These parameters also influence relative humidity that remains much higher (80% or above) during rainy season. Dry season i.e. December to April, is categorized as rain free period and comparatively lower temperature (minimum monthly average temperature 21-220C up to February but rises in March to April 22-24 0C); monthly maximum average temperature also follows same trend and rises from 29-320C. These parameters also influence relative humidity which remains nearly 65-75%. Most of the vegetables are very sensitive to water logging and heavy rains. As rains during flowering and fruiting stages affects pollination and fertilization of solanaceous vegetables. Besides, it also creates congenial climate for pathogens and different insects and

pests. But other vegetable crops like Okra, cow pea, amaranthus, Indian spinach and other local vegetables are performing well in ridge and furrow system under heavy rainy period.

Adoption rate is reaching 62 percent in the adjoining villages of NICRA and Production rate of vegetable are also increased. The system has been popularized and promoted in many parts of the islands for production of vegetable during rains as the system provides good drainage for excess water. From an area of 0.4 ha, higher gross return with the BC ratio of 3:1 was recorded in ridge and furrow vegetable production as compared to paddy cultivation. The system also resulted in higher yields, weeds free, increased soil health and reduced labor costs compared to the traditional cultivation. In respect of enterprise development for alternate livelihood generation, gender aspect to be highlighted i.e. benefits gained by women folk. The study confirmed that the ridge and furrow system with mulches is an efficient, simple and economical method enhanced better vegetable production during unpredicted rains in summer and also in rainy months. As a livelihood diversification option vegetable cultivation on ridge and furrow has enormous scope to improve food security and income generation, which in turn can help boost rural and urban economic growth. More females than male obtain information on weather from the Radio. Further, study suggests increasing women's participation in decision making at all level in climate change mitigation and adaptation.

Enhancing economic and social security through community nursery of swarna sub – 1 in Kendrapara

The concept of community nursery is to supply quality planting material on the larger basis to the entire community. Under NICRA programme, KVK, Kendrapara has done a demonstration on community nursery at Ratanpur village of Marshaghai Block, Kendrapara.

Generally farmers prepare small nurseries of rice solely for personal usage. At early stages the seedlings are damaged due to incidence of pest & disease and natural calamities like heavy rainfall or flood or may be due to long dry spell during few years. Under these situations farmers are prone to lose a complete season. To avoid such situations community nurseries are developed by a group of farmers near the readily available water source and in a well drained suitable topography land.

The community nursery of 2000 m2 area where rice var. Swarna Sub-1 (flood tolerant rice variety) is grown with due care under the technical guidance of experts from KVK, Kendrapara. Quality seed material (rice var Swarna Sub-1) has been provided by KVK, Kendrapara. The seeds are sown on a well prepared seed bed of 5m X 1m X 0.15m dimension after duly treated with seed treating chemical. Enough moisture is ensured before sowing of the rice seed. The seedlings are very healthy having good growth. There was only incidence of some leech and snails which were controlled by application of granular Thimate surrounding the nursery bed. The seedlings are ready after 21 days of sowing.

By adopting community nursery, the farmers could able to overcome the loss due to unpredicted dry spell during July month of 2020 in which there is significant reduction in rainfall amount compared to the normal

Varietal improvement of sugarcane cultivation in Malda

Sugarcane is a most important cash crop in India. In West Bengal sugarcane is the second most important commercial crop after jute. Farmers in this state have been cultivating sugarcane for many centuries for making gur and many sweets. Before introduction of NICRA project at Village(s) of Brozolaltola, Meherchandtola, Jairamtola and Mahendratola under Panchayat of Dakshin Chandipur, Manikchak Block of Malda District, The peoples used to cultivate indigenous varieties of sugarcane which are native to this place. The farmers also not aware about scientific cultivation and improve varieties of crop. The adopted villages under NICRA project are situated in flood prone area and nearest to the river The Ganges. Recurring incidence of severe flood and incoming of huge water in crop land damaged the standing crop of sugarcane.

The major problem of NICRA villages is the severe flood in this situation to cultivate indigenous varieties of sugarcane which are not tolerant to waterlogged condition and insect pests as well as crop yield also damaged. As a result the family incomes of farmers were very low.

For overcome this major problem of adopted villages under NICRA project the Malda KVK to introduce two improve sugarcane varieties (Swapan and Birendra) which are moderately resistant to red rot, wilt and smut and also tolerant to common borer insect pests and tolerant to both water submergence and drought. As the results the family incomes of farmers were high. The villagers were also happy

and they thanks to Malda KVK for introduced to improve varieties and also do aware about scientific cultivation. This two varieties covered 5.0 hectare land and benefited 50 farmers. The average yield of these two varieties of sugarcane is (80-88 tons) per hectare and average sugar content in juice is about (16.8-17.5) percent. Average cost of cultivation of sugarcane in farmers field is Rs.10,000 to Rs.12,000 per bigha (0.33 acre) and average profit per bigha is Rs. 20,000/- for a good sugarcane crop.

Zero tillage in Maize - DKC 9081 and Paira Cropping of Lentil - PL-8 demonstrated in Coochbehar

Demonstration conducted on Khagribari and Singimari village. Total numbers of farmers are 20. Innovative intercessions like demonstration of maize cultivation noted drastic improvement in the cropping pattern by zero tillage maize production in paddy fallows in Rabi season. The consistent cultivation of maize indicated better creation, profitability and farm income also increased. Farmer attitude was changed. The trend may be followed in future.

Demonstration conducted on Khagribari village. Total numbers of farmers are 20. Crop cultivated in lowland areas where moisture remains in soil for a long period. The same piece of land is used for the cultivation of two crops. Generally, farmers cultivated single crop in low land areas. In this system crops are grown in the same piece of land just after the harvesting of first crop.Selected pulse crop can be grown along with rice in lowland areas. As a result farmers benefitted in terms of cost of cultivation, time saving and water use.

Cultivation of short duration drought tolerant rice Swarna shreya in Sonepur

Rice is the main food crop, especially in Saharanpur district of Odisha. Badmal, Dipapali and Ganjathapar villages of Subarnapur was experiencing less scope for rice cultivation due to low and uneven distribution of rainfall in kharif. About 60 % of area under rice in the district is drought prone rain fed, but it has not been exploited to full potential due to lack of suitable drought tolerant varieties. There is hardly any scope to replace the rice crop considering the precipitation of less than 1500 mm rainfall during the monsoon season. Therefore, introducing drought tolerant rice cultivars is considered to be one of the most effective and economic approaches for ensuring food security particularly in drought prone areas of the district. To mitigate these problems KVK, Sonepur had conducted a demonstration programme on short duration drought tolerant rice variety Swarna Shreya in "National Innovations on Climate Resilient Agriculture cluster villages (NICRA) during the year 2020-21. The cultivation of paddy variety Swarna Shreya was found to be more productive and can replace the local check

since it fits to the existing farming situation for higher productivity and income and also it had been appreciated by the farmers due to its drought tolerance and higher tillering capacity. Swarna shreya recorded higher grain yield (44.58 q ha-1) in comparison to Sahabhagi dhan (41.23 q ha-1) and farmers practice Khandagiri (29.56 q ha-1).Water productivity was also higher (2.78 kg grain per mm of rain water received) in as comparison to farmers practice Khandagiri (1.80) and Sahabhagi dhan(2.16) owing to its higher grain yield probably due to more drought tolerance capacity. An economic analysis of the data revealed that Swarna shreya produced an extra grain yield of 15.02 q ha-1 which is 50.8 % higher yield than Khandagiri. The productivity gain under demonstration over farmer's practices created awareness and motivated the other farmers to adopt improved production technology of paddy in the district. Favourable benefit cost ratio (2.92) Is self explanatory of economic viability of the demonstration and convinced the farmers for adoption of intervention imparted. Both from the view point of crop intensification drive as well as climate change, it has satisfied the need of the farmer. Growing short duration varieties of rice has other advantages like fitting other crops in between like green gram, black gram, tuber crops. By the end of the intervention the farmers was able to harvest their kharif rice 25-30 days earlier than usual harvesting time, they could be able to sow their next crop in time during rabi. The new improved technologies have eventually led the farmers to discontinue the old varieties and to adopt new variety.



8. Publications

Research Paper

1. Surajit Sarkar, Ganesh Das, F. H. Rahman, Sujan Biswas, Suraj Sarkar, Sankar Saha and Bikash Roy (2020). A Study on Use of Black Polythene Mulch as a Climate Smart Technology on Performance of Winter Cucumber and Resource Conservation In Terai Agro-climatic Zone of West Bengal. *Current Journal of Applied Science and Technology, 2020, 39(12): 100-106*
2. T. R. Sahoo, P. Mishra, F. H. Rahman, N. M. Mohapatra and S. N. Mishra (2020). The Response of Green Manuring of Sesbania aculeate on growth and Yield of Rice in Flood Prone Area of Coastal Odisha. *Current Journal of Applied Science and Technology, 2020, 39(11): 13-18*
3. Samima Sultana, Rakesh Roy, Bhabani Das, Adwaita Mondal and F. H. Rahman (2020). Vegetable Based Multitier Cropping System: A Model for Higher Income for the Farmers in Old Alluvial Soils of West Bengal. *Advances in Research, 2020, 21(6): 30-34*
4. L. Dash, S. Das, S. Mohanty, F. H. Rahman, S. K. Sahoo and S. N. Mishra (2020). Platform Based Housing System Improved Health and Reduced Mortality Percentage of Goats in Flood Prone Area of Coastal Odisha. *Advances in Research, 2020, 21(8): 10-17*
5. S. Pradhan, F. H. Rahman, S. Sethy, G. Pradhan and J. Sen (2020). Evaluation of Short Duration Drought Tolerant Rice Varieties in Drought Prone Areas of Subarnapur District of Odisha. *International Journal of Plant & Soil Science, 2020, 32(8): 21-26*
6. H. N. Malik, A. Panda, S. Behera and F. H. Rahman (2020). A Comparative Study

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9. P. Mishra, T. R. Sahoo, F. H. Rahman, N. Mohapatra, P. K. Sahoo, R. K. Mohapatra and S. N. Mishra.. 2020. Effect of Different Mulching on Moisture Content in Soil, Weed Dynamics and Yield of Tomato (Lycopersicon esculentum L.) in Post Flood Situation in Coastal Odisha. *Journal of Experimental Agriculture International, 2020, 42(7)*
10. Ganesh Das, Sankar Saha, F. H. Rahman, Suraj Sarkar, Surajit Sarkar, Sujan Biswa, Sandip Hembram, Prashanta Barman, Samima Sultana, Bikash Roy and Bablu Ganguly (2020). Sustainable Irrigation through Renovation of Pond: A Case Study on Change of Crop Production, Irrigation, Cropping Pattern and Cropping Intensity Level in Sub Himalayan Terai Region of India. *Current Journal of Applied Science and Technology, 2020; 39(21) 7-18*
11. S. K. Joshi, J. Udgata, L. M. Garnayak, F. H. Rahman, A. Phonglosa and D. Parida (2020). Azolla as Feed Supplementation on Growth Performance and Economics of Vanaraja Birds in Backyard System of North Western Odisha. *Journal of Experimental Agriculture International, 2020;42(7): 61-65*
12. Samima Sultana, Ganesh Das, F.H. Rahman and Rakesh Roy (2000). Effect of Arka Mango Special on inflorescence, fruit setting and fruit quality of mango. *Journal of Horticulture, 7(3): 2020*
13. F. H. Rahman, D. Ghorai, S. Sarkar, S. S. Kundu and S. Das (2020). Doubling Farmers' Income through IntegratedFarming System Approach in Purba BarddhamanDistrict of West Bengal. *Current Journal of Applied Science and Technology, 2020, 39(24): 133-141*
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15. N. Mahapatra, F. H. Rahman, P. Mishra, T. R. Sahoo, P. K. Sahoo and S. N. Mishra. (2020). Assessment of Scope and Efficiency of Off-Season Rice Straw Mushroom (Volvariella volvacea L.) Cultivation in Coastal Odisha. *Current Journal of Applied Science and Technology, 2020, 39(27): 28-34*
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19. N. Bommayasamy, L. B. Singh, R. Bhattacharya and F. H. Rahman (2020). Response Of Split Application Of Nitrogen On Yield And Nitrogen Use Efficiency Of Rice Under High Rainfall Area Of Andaman & Nicobar Islands. *Indian Journal of Extension Education Vol. 57, No.32, 2020.*

II. Books/Book Chapter

1. Ganesh Das, Surajit Sarkar and F. H. Rahman (2020). Climate Smart Farming and ICT Publisher ISBN-13 979-8682613809, p. 1-76
2. L.B. Singh, B.K. Nanda, N. Bommayasamy, H. Nayek, V.K. Pandey, B.A. Jerard and F.H. Rahman (2021). Climate Resilient Technological Intervention for Sustainable Agriculture Production System for Andaman under TDC-NICRA. Published by ICAR-CIARI Port Blair, India. p. 1-186

III. Technical bulletins

1. Rahman F H, Bhattacharya R. and Roy. S K. 2020. NICRA Annual Report 2019-20, Pub. by Director ICAR-ATARI Kolkata, pp: 1-54
2. Final Report of Technology Demonstration Component of NICRA (2011-2019).
3. Rahman F H, Bhattacharya R and Singh S S. 2019. NICRA Annual Report 2018-19. Pub.by Director ICAR-ATARI Kolkata, pp: 1- 48.
4. F. H. Rahman, R. Bhattacharya and S. K. Roy (2020). NICRA Newsletter: Towards Climate Smart Agriculture, Pub. by ICAR-ATARI Kolkata, Vol. VI, No. 2, pp: 1- 8.
5. F. H. Rahman, R. Bhattacharya and S. Nandi (2021). NICRA Newsletter: Towards Climate Smart Agriculture, Pub. by ICAR-ATARI Kolkata, Vol. VII, No. 1, pp: 1- 8.
6. F. H. Rahman, S. Nandi and R. Bhattacharya (2020). GKMS Newsletter, Pub. by ICAR-ATARI Kolkata, Vol. 1, No. 1, pp: 1- 8.
7. F. H. Rahman, S. Nandi and R. Bhattacharya (2021). GKMS Newsletter, Pub. by ICAR-ATARI Kolkata, Vol. 2, No. 1, pp: 1- 8

IV. Paper presented in national/ international seminars etc.

1. R. Bhattacharya R. and F. H. Rahman (2020). In-situ moisture conservation to cope up the moisture stress condition for different crops grown in Eastern India' in the National Webinar on "Agrochemicals for Upkeeping Environment" organized by the Society for Fertilizers and Environment in collaboration with Bidhan Chandra Krishi Viswavidyalaya, Aug 27-29, 2020.
2. J. Udgata, D. Parida, R. Bhattacharya and F. H. Rahman (2021). Assessment of balane nutrition (N, P, K, Zn and B) and green manurig on yield, nutrient uptake, economics and soil fertility of rainfed rice (Oryza sativa L.) in drought prone areas of Odisha' in the National Webinar on 'Stewardship of Agrochemicals for Upkeeping Environment' organized by the Society for Fertilizers and Environment in collaboration with Bidhan Chandra Krishi Viswavidyalaya, Mar 30-31, 2021.
3. R. Bhattacharya, T. R. Sahoo, P. Mishra, N. M. Mohapatra, S. N. Mishra and F. H. Rahman (2021). The Response of Green Manuring of Sesbania aculeate on growth and yield of rice in flood prone area of coastal Odisha ' in the National Webinar on "Stewardship of Agrochemicals for Upkeeping Environment" organized by the Society for Fertilizers and Environment in collaboration with Bidhan Chandra Krishi Viswavidyalaya, Mar 30-31, 2021

Ongoing farming operations during Covid lockdown

9. Expenditurs Statement During 2020-21

(in Rs.)

Name of KVK	Sanction for the year 2020-21					Total	Expenditure	Closing Blance as on 01.04.2021
	Grants-in-Aid-General (Revenue)			Grants for creation of capital assets (CAPITAL)				
	Operational	TA	SC Sub plan	Equipment	SC-Sub Plan			
ATARI Kolkata	1000000	50000	0	0	0	1050000	555919	494081
South 24 Parganas	0	0	2100000	0	260000	2360000	2360000	0
Coochbehar	0	0	1900000	0	300000	2200000	2193408	6592
Malda	0	0	1000000	0	90000	1090000	1087540	0
Sonepur	1100000	25000	0	0	0	1125000	1125000	0
Kalahandi	929000	25000	0	16000	0	970000	945000	25000
Jharsuguda	980000	25000	0	0	0	1005000	806200	198800
Kendrapara	1604000	30000	0	16000	0	1650000	1650000	0
Ganjam I	1182000	25000	0	16000	0	1223000	1223000	0
Port Blair	725000	25000	0	0	0	750000	592913	254837
Total	**7520000**	**205000**	**5000000**	**48000**	**650000**	**13423000**	**12538980**	**979310**

Annexure -1

NICRA-TDC PROJECT SITES

**West Bengal, Odisha,
A&N Islands**