Enhancing Resilience in Agriculture and Adaptive Capacity to Climatic Vulnerability

Experience of NICRA-TDC

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

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

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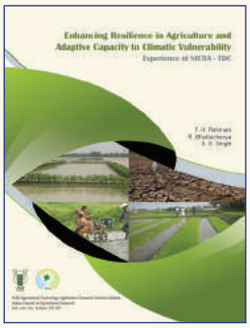

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Contributors:

Dr. N. J. Maitra, Dr. Bhabani Das, Dr. Bikash Roy,
Dr. Nagesh Ram, Dr. Nityananda, Dr. Deokaran,
Dr. S. K. Choudhury, Dr. Ratnesh Kr. Jha
Dr. Mrs. Shobha Rani, Dr. Mrs. Sarda, Dr. Mrs. Arti B Ekka,
Dr. Sudhanshu, Dr. Sanjay Kumar, Dr. Ravi Shankar,
Dr. L. K. Das, Dr. Ranjay Singh, Smt. Kalpana

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Preface

It is a privilege to present the compilation on *Enhancing Resilience in Agriculture and Adaptive Capacity to Climatic Vulnerability* which is a consolidated report of the activities carried out by the KVKs under the Project of National Innovations in Climatic Resilient Agriculture (NICRA), a Nation-wide project in response to the challenge of climate change facing Indian 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 121 climatically vulnerable districts across the country through KVKs.

Location specific resilient practices identified at the village level were implemented in NICRA villages. This involved introduction of drought tolerant and short duration varieties, resilient intercropping systems and in-situ soil moisture conservation practices at the time of sowing which enabled mitigation of drought effectively. The water harvesting potential created in these villages was made use for supplemental irrigation during dry spells, which led to improved performance of rainfed crops at several locations during *kharif*. The surplus harvested water contributed to enhancing the area under rabi cropping and thus facilitated compensatory production during *rabi*. Emphasis was laid on enhancing the green fodder production and its storage to overcome the fodder shortage.

The report aims to highlight the significant achievements done by the KVKs in NICRA adopted villages which are now become hubs of learning on climate resilient agriculture in a short span, opening up opportunities for horizontal and vertical diffusion of the successful interventions in other parts of the districts. It is sure that this publication will bridge the knowledge gap and will contribute towards horizontal spread of these technologies in the similar farming situations. The authors take this opportunity to gratefully acknowledge the co-operation and assistance of all the Heads and Subject Matter Specialists of NICRA KVKs under ICAR-ATARI, Kolkata, all NICRA farmers, VCRMC members, Scientists and Department officials for their valuable contribution in bringing out this publication. The authors also acknowledge the financial support of ICAR-CRIDA, Hyderabad for the study through NICRA.

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Kolkata

Authors

डा. अशोक कुमार सिंह
उप महानिदेशक ;कृषि प्रसारद्ध
Dr. A.K. Singh
Deputy Director General (Agricultural Extension)

भारतीय कृषि अनुसंधान परिषद
कृषि अनुसंधान भवन–1, पूसा, नई दिल्ली 110 012
Indian Council of Agricultural Research
Krishi Anusandhan Bhawan-1, Pusa
New Delhi – 110 012
Ph.: 91-11-25843277 (O), Fax: 91-11-25842968
E-mail: aksicar@gmail.com

Foreward

Climate change is a challenge for global food and nutritional security for a growing human population. In this respect, agriculture has emerged as a major ecosystem of concern and discussion in India. Thus, climate vulnerability has to be adequately addressed by KVKs while implementation of various modules like NRM, Crop Production, Livestock and Fisheries, Institutional Interventions, Capacity building, etc. under NICRA project. Technologies such as on-farm water harvesting in ponds, supplemental irrigation, introduction of early maturing drought tolerant varieties, paddy varieties tolerant for sub-mergence condition, improved drainage, recharging techniques for tube wells, site specific nutrient management and management of sodic soils, mulching, use of zero till drills, custom hiring centres have been mainly focussed in NICRA villages.

Overall, the project has generated enthusiasm among farmers and raised hopes that by combining technology solutions with community mobilization, can help small and marginal farmers to cope with climate variability. However, at local level efforts are required to upscale the lessons learnt through climate smart villages.

I complement the Director and scientists of ICAR-Agriculture Technology Application Research Institute Kolkata, Directors of Extension Education from various State Agricultural Universities for implementing the scheme and its monitoring and coordinating with different stakeholders involved in this project.

I am happy to note that the compilation covering six years of activity of 17 NICRA KVKs, may be useful to concerned stake holders. I congratulate Director and concerned Scientists of ICAR-ATARI Kolkata for bringing out the highlights of achievements.

Dated : 10.04.2018
New Delhi

A. K. Singh)

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विशिष्ट सारांश

जलवायु अनुकूल कृषि में राष्ट्रीय नवाचार (निक्रा) – भारतीय कृषि अनुसंधान परिषद का एक राष्ट्रीय नेटवर्क परियोजना जिसका उद्देश्य अनुकूलन एवं अल्पीकरण हेतु सामरिक अनुसंधान, वर्तमान जलवायु परिवर्तनीयता से मुकाबला करने हेतु किसानों के खेतों में प्रौद्योगिकियों का निरूपण, महत्वपूर्ण अनुसंधान कमियों को दूर करने तथा विभिन्न पणधारियों में क्षमता निर्माण हेतु प्रायोजित एवं प्रतिस्पर्धी अनुसंधान अनुदान है। प्रौद्योगिकी निरूपण घटक (टीडीसी) का औचित्य का मूलाधार राष्ट्रीय कृषि अनुसंधान प्रणाली में विभिन्न प्रकार की जलवायु संबंधित अतिसंवेदनशीलताओं से निपटने के लिए प्रौद्योगिकियों की श्रंखलाओं का अनुकूलन करना है। इस परियोजना के टीडीसी घटक का कार्यान्वयन जिला स्तर पर कृषि विज्ञान केन्द्रों द्वारा भाकृअनुप–कृषि प्रोद्योगिकी अनुप्रयोग अनुसंधान संस्थानों (अटारी) के समन्वयन से किया गया। भाकृअनुप–कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान (अटारी), कोलकाता जिसके अंतर्गत निक्रा कार्यान्वित करने वाले 17 कृषि विज्ञान केन्द्र जो बिहार (7), झारखण्ड (6), पश्चिम बंगाल (3) तथा अंडमान एवं निकोबार द्वीप समूह (1) में फैले हुए हैं, ने जलवायु अनुकूल कृषि में राष्ट्रीय नवाचार कार्यक्रम के प्रौद्योगिकी निरूपण घटकों के अंतर्गत भिन्न भिन्न मॉड्यूलों जैसे प्राकृतिक संसाधन प्रबंधन, फसल उत्पादन, पशुधन एवं मात्स्यिकी तथा संस्थागत हस्तक्षेपों के माध्यम से विभिन्न गतिविधियों को क्रियान्वित किया जिनसे कुल 226464 किसान (प्राकृतिक संसाधन प्रबंधन–40815, फसल उत्पादन–21675, पशुधन एवं मात्स्यिकी–34515, संस्थागत हस्तक्षेप–6158, क्षमता निर्माण–85816 तथा विस्तार गतिविधियों–37485) लाभान्वित हुए।

प्राकृतिक संसाधन प्रबंधन मॉड्यूल के अंतर्गत बाढ़ प्रवण क्षेत्रों में बेहतर निकासी, स्वस्थाने नमी संरक्षण, जल संचयन एवं पुनर्चक्रण हेतु संरचनाओं/प्रक्षेत्र तालाबों/चेक डैम/टैंक/रूफ वाटर हार्वेस्टिंग टैंक, लैंड शेपिंग एवं वर्षा जल संचयन संरचनाओं का निर्माण/पुनरूद्धार, बाढ़ प्रवण क्षेत्रों में बेहतर निकासी, उपयुक्त स्थान पर संरक्षात्मक जुताई, कृत्रिम भौम जल रिचार्ज तथा जल बचत सिंचाई पद्धतियां, हरित खाद, सिंचाई का 5: मॉडल, फसल अवशेष प्रबंधन, प्रक्षेत्र का बंधन, ब्रॉड बेड फर्रो, मृदा परीक्षण आधारित पोषण तत्वों का अनुप्रयोग, सूक्ष्म सिंचाई तकनीकें, कम्पोस्ट पिट आदि पर कार्य किया गया जिससे 8650 हे. क्षेत्र में कार्यरत 40815 किसान लाभान्वित हुए हैं।

रिज़ एवं फर्रो पद्धति तथा ब्रॉड बेड फर्रो पद्धति के माध्यम से स्वस्थाने वर्षा जल प्रबंधन प्रक्षेत्र स्तर पर वर्षा जल संरक्षित करता है तथा अधिशेष जल को सामुदायिक निकासी चैनलों में प्रवाहित करता है। इस जल को भौम जल रिचार्ज हेतु उपयोग किया जा सकता है ताकि वर्षा ऋतु के बाद के फसलों के लिए अनुपूरक सिंचाई उपलब्ध कराया जा सके जो अन्यथा सपाट क्यारियों वाले रोपण में संभव नहीं है। इन पद्धतियों द्वारा, नमी की पैट एवं धारण क्षमता को बनाए रखने में, वृद्धि तथा अधिशेष जल प्रवाह एवं मृदा अपरदन घटाकर मृदा नमी का प्रबंधन किया जाता है। स्वस्थाने नमी प्रबंधन से उच्च उपज वाले उन्नत किस्मों की निष्पादन क्षमता में वृद्धि की जाती है। सतही अधिशेष जल प्रवाह तथा डीप ड्रैनेज जल को वर्षा ऋतु के बाद के फसलों जैसे गेहूं एवं चने की पूरक सिंचाई के लिए उपयोग किया जाता है। अपनाए गए गांवों में इन संरक्षित प्रौद्योगिकियों को निरूपित किया गया जिससे 512.5 हे. क्षेत्र के 2830 किसान लाभान्वित हुए। ब्रॉड बेड फर्रो सिस्टम से अंडमान एवं निकोबार द्वीप समूह के किसानों को सब्जियों तथा चावल हेतु सिंचाई उपलब्ध कराने में सहायता मिली है साथ ही साथ इसमें विभिन्न प्रकार के आईएफएस घटकों जैसे फर्रों में मत्स्य संवर्धन, मेड़ पर चारा फसल एवं जल निकासी सुविधाएं भी सम्मिलित हैं। यह हस्तक्षेप 500 हे. से अधिक क्षेत्र में किया गया जिससे किसानों पर उल्लेखनीय प्रभाव पड़ा है।

पूरक सिंचाई हेतु जल संचयन एवं पुनर्चक्रण – अपनाए गए गांवों में विभिन्न कृषि विज्ञान केन्द्रों द्वारा 5825 किसानों को सम्मिलित कर तालाबों, कुआों एवं नहरों, सैंड चेक डैम के पुनरूद्धार, बांध निर्माण, 5: मॉडल आदि के माध्यम से पूरक सिंचाई हेतु जल संचयन एवं पुनर्चक्रण कार्य का निरूपण किया गया।

संरक्षात्मक जुताई के अंतर्गत रबी फसलों की बुवाई पिछले खरीफ फसल की कटाई पर तथा बुवाई के लिए खेत की तैयारी में मृदा नमी के स्तर पर निर्भर करता है। गेहूं के मामले में 2 से 3 या और अधिक जुताईयों की आवश्यकता होती है ताकि गेहूं के रोपण पूर्व वांछित बारीकी प्राप्त हो सके। लागत एवं आवश्यक ऊर्जा के अतिरिक्त इससे गेहूं के रोपण में विलम्ब होता है जो प्रायः फरवरी/मार्च के तापमान दबाव वाली संवेदनशील अवस्था से टकराता है। इससे उपज में कमी एवं प्रायः किसान को नुकसान होता है। शून्य जुताई प्रौद्योगिकी एक व्यवहार्य एवं प्रायोगिक समाधान प्रस्तुत करता

है जिससे खेत की तैयारी एवं बुवाई के लिए बार बार जुताई से बचा जा सकता है, खेती की लागत में कमी तथा 10–15 दिन पहले रोपाई होती है। बुवाई तारीख को आगे लाना एक अनुकूलन कार्य है जिससे टर्मीनल हीट स्ट्रैस से बचा जा सकता है। यहां शून्य जुताई का अर्थ है चावल की कटाई के बाद खेत में जुताई के बिना खेत में जीरो टिल्ल ड्रिल या हैपी सीडर की सहायता से सीधे गेहूं की ड्रिलिंग की जाती है। निक्रा द्वारा अपनाए गए 15 गांवों के 1236.5 हे. क्षेत्र में 2475 किसानों को सम्मिलित कर गेहूं, धान, मसूर, मटर तथा चने में संरक्षण जुताई का निरूपण किया गया। प्रौद्योगिकियां में मुख्यतः शून्य जुताई ऑपरेशन का अनुसरण किया गया। गेहूं के शून्य जुताई निरूपण में अधिक उपज पायी गयी। सम्पूर्ण क्षेत्र में दलहनों एवं तिलहनों की खेती में शून्य जुताई प्रौद्योगिकी से आशाजनक परिणाम देखे गए। खरीफ ऋतु के दौरान कम वर्षपात में आकस्मिक फसल योजना के रूप में चत्रा, गुमला, सरन, जहानाबाद, औरंगाबाद, कोडर्मा, पलाम में जल की कम आवश्यकता वाली विभिन्न फसलों जैसे ओल (उच्च उपज वाले किस्म गजेन्द्र); फूल गोभी (किस्म एमएसएन–16); धान (पूसा बोल्ड, पूसा 362); टमाटर (किस्म परम एफ1) का प्रवेश कराया गया।

कृत्रिम भौम जल रिचार्ज – निक्रा द्वारा अपनाए गए गांवों के 575 किसानों के 361.5 हे. क्षेत्र में फील्ड बंडिंग, जल प्रबंधन तथा धान में सब–सोयलर द्वारा एसआरआई के माध्यम से कृत्रिम भौम जल रिचार्ज किया गया। सब–सोयलर द्वारा एसआरआई के माध्यम से कृत्रिम भौम जल रिचार्ज से उच्चतम धान उपज (59.5 क्विं/हे) तथा आशाजनक आर्थिक आय दर्ज की गई।

जल बचत सिंचाई पद्धतियां – निक्रा द्वारा अपनाए गए गांवों के 1935 किसानों के 430 हे. खेतों में जल बचत सिंचाई पद्धतियां जैसे चावल में स्प्रिंकलर सिंचाई, लो एनर्जी वाटर एप्लीकेशन (एलईडब्ल्यूए), बैंगन में रैज्ड बेड फर्रो (आरबीएफ), धान में मैक्रो–लिफ्ट इरीगेशन का निरूपण किया गया।

वर्षा जल संचयन (बाह्य–स्थाने) – खरीफ तथा रबी ऋतुओं के दौरान फसल उत्पादन में प्रक्षेत्रों, प्रक्षेत्र तालाबों के अनुकूलन में वृद्धि के लिए वर्षा जल संचयन एवं कुशल उपयोग से एक स्पष्ट बदलाव आया है। यद्यपि जून माह तथा जुलाई के प्रारंभिक अवधि में वर्षपात कम होने पर भी, तीव्र तूफानों से हुई वर्षा से उत्पन्न अधिशेष प्रवाह को किसानों के खेत में बनाए गए तालाबों में संचित किया गया। संचित जल का उपयोग चावल, गेहूं, सब्जियों, चारा आदि के महत्वपूर्ण सिंचाई के लिए किया गया। इससे किसानों को अतिरिक्त उपज एवं फसलों से आय प्राप्त हुई। इस क्षेत्र में कुल 928 वर्षा जल संचयन संरचनाओं का निर्माण किया गया जिनमें 3.05 मिलियन क्यूबिक जल संचित किया जा सकता है और इस जल से 2500 हेक्टेयर क्षेत्र में सिंचाई हो सकती है। इस प्रकार के हस्तक्षेप से फसल की गहनता अधिकतम 250: तक और फसल की औसत गहनता 125: तक बढ़ गई है। इसी प्रकार एक अन्य हस्तक्षेप जैसे 5: मॉडल को मध्यम ऊंचाई के चावल के खेत में अपनाया गया जहां जल धारणीय क्षमता निम्न स्तर की है। विशेषकर विलंबित मानसून या अपर्याप्त वर्षपात में नवोद्भिद पौधों का प्रतिरोपण समय पर नहीं किया जाता है। प्रत्येक भूखंड में 5: मॉडल गड्ढ़ों को खोद कर वर्षा जल संचित किया जा सकता है। संचित जल नमी स्तर में वृद्धि करता है जिससे प्रतिरोपण में सहायता मिलती है तथा बाद की स्थितियों में नमी स्ट्रैस के दौरान सिंचाई भी उपलब्ध हो सकती है। झारखंड के पूर्वी सिंहभूम, गुमला, सरन, चत्रा तथा अन्य जिलों में इस पद्धति को बड़े पैमाने पर अपनाया जाता है।

अन्य निरूपण – अन्य निरूपण जैसे ऑयस्टर मशरूम की खेती, दलहनों के बीजों के उत्पादन के माध्यम से नमी का प्रभावकारी उपयोग, प्रक्षेत्र के पुराने तालाबों की सफाई एवं पुनरूद्धार, कुओं का पुनरूद्धार, वनीय वृक्षों का रोपण, वनीकरण, मृदा परीक्षण आधारित पोषक तत्वों का अनुप्रयोग, विभिन्न फसलों में जैवकीटनाशक, गोरा धान में डोलोमाइट का अनुप्रयोग तथा प्रक्षेत्र के मेड पर उच्च उपज वाले घास का उत्पादन आदि कार्य 7130 किसानों के 1792.5 हेक्टेयर क्षेत्र में किए गए।

फसल उत्पादन मॉड्यूल के अंतर्गत विभिन्न क्षेत्र विशेष हस्तक्षेप, जैसे सूखा, लवणता तथा बाढ़ सहिष्णुता/प्रतिरोधिता वाले किस्मों का प्रवेश, ताप के दबाव से बचने के लिए रबी फसलों के रोपण तिथियों को आगे लाना, जल बचत धान उत्पादन पद्धतियां जैसे एसआरआई, एरोबिक, सीधी बुवाई, विलंबित मानसून के लिए सामुदायिक नर्सरियां, उच्च सततता उपज सूचकांक वाले स्थान विशेष अंतःफसलीकरण पद्धतियां, नई फसलों का प्रवेश/फसल विविधिकरण, समय पर रोपण हेतु कस्टम हायरिंग सेंटर, निम्न तापमान सहिष्णुता, मानसून के बाद के वर्षपात के उपयोग से दलहनों की प्रोन्नति, समेकित फसल/कीट/रोग प्रबंधन, आकस्मिक फसल के रूप में सब्जियां उगाना, समेकित फसल प्रबंधन, समेकित रोग प्रबंधन, आकस्मिक फसल आदि कार्यों को सम्मिलित किया गया जिससे 21675 किसान लाभान्वित हुए।

इन वर्षों के दौरान बिहार और झारखंड राज्य के कई जिलों में

मानसून देर से आई, अतः अनेक अल्पावधि तथा सूखे के प्रति सहिष्णुता वाले किस्मों का निरूपण किया गया ताकि शेष बची मानसून अवधि का प्रभावी उपयोग हो सके। सूखे की प्रतिरोधिता वाले धान, बैंगन, नाइगर, मक्का, अरहर तथा रागी के किस्मों को अपनाए गए गांवों में प्रवेश कराया गया और इस कार्य में 2365 किसानों तथा 2837.5 हेक्टेयर क्षेत्र को सम्मिलित किया गया।

सूखे के प्रति सहिष्णुता वाले धान के किस्मों सहभागी, अंजली, नवीन, अभिषेक को 8115 किसानों के कुल 2150 हेक्टेयर क्षेत्रफल में निरूपित किया गया। दलहन एवं तिलहन, आईसीपीएल–858063ए एमएएल–13 तथा अरहर के पीआरजी 153 किस्मों को 1025 हेक्टेयर क्षेत्र में निरूपित किया गया जिससे अधिकतम आर्थिक आय (लाभः लागतः 3.36) प्राप्त हुई।

लवण सहिष्णुता वाले धान के किस्मों जैसे सीएआरआई धान–5, ऊसर धान–5, जारवा, गीतांजली, एसआर–26बी, अमलमोना का निरूपण 198 किसानों के 373.5 हेक्टेयर क्षेत्र में निरूपित किया गया। जारवा, गीतांजली तथा अमलमोना किस्म लवणता के प्रति अधिकतम सहिष्णुता वाले किस्म प्रमाणित हुए जिनसे अधिकतम उपज 50.5 क्विंटल प्रति हेक्टेयर तथा अधिकतम आर्थिक आय (लाभ लागत अनुपात 2.41) प्राप्त हुई।

बाढ़ सहिष्णुता वाले धान किस्मों जैसे स्वर्णा सब 1, सबिता, दूधेश्वर का निरूपण 120 किसानों के 278 हेक्टेयर क्षेत्र में निरूपित किया गया जिससे 45 क्विंटल प्रति हेक्टेयर की उपज तथा आर्थिक आय 2.45 प्राप्त हुई।

तापीय दबाव से बचने के लिए चावल, गेहूं, मसूर, सरसों, आलू आदि फसलों को रबी ऋतु के दौरान 12 दिन पहले ही बोया गया। इन निरूपणों को अपनाए गए गांवों में दर्शाया गया जिसमें 2460 किसानों के 381.5 हेक्टेयर भूमि को सम्मिलित किया गया।

जल बचत धान की खेती – एसआरआई, अल्प अवधि के किस्में, चावल की सीधी बुवाई, ब्राउन मेन्यूरिंग आदि के माध्यम से धान की जल बचत खेती को 3990 किसानों के 1170 हेक्टेयर क्षेत्र में निरूपित किया गया। सभी हस्तक्षेपों में से सहभागी किस्म के धान की खेती में अधिकतम उपज देखी गई।

विलंबित मानसून की स्थिति का सामना करने हेतु बिहार तथा झारखंड में धान के लिए स्टैगर्ड कम्यूनिटी नर्सरी काफी लोकप्रिय हुई है। 25–30 दिन आयु वाले नवोद्भिद पौधों को जुलाई माह में प्रतिरोपित किया गया ताकि अक्तूबर से पहले प्रकाश संश्लेषण किस्मों का पुष्पण पूर्ण हो सके तथा मध्य नवंबर तक इनकी कटाई हो सके ताकि रबी फसलों को समय पर बोया जा सके। इस प्रकार की पद्धति से खरीफ एवं रबी फसलों का अधिकतम निष्पादन सुनिश्चित होता है। पिछले 10 वर्षों में से 5 वर्षों के दौरान बिहार में असामान्य वर्षपात की स्थितियां रहीं जिससे चावल उत्पादन तथा किसानों की आजीविका पर प्रतिकूल प्रभाव पड़ा है। ऐसा प्रतीत होता है कि जुलाई माह में वर्षा न होने के कारण धान के प्रतिरोपण में विलंब हुआ है जिसके परिणामस्वरूप उत्पादकता पर प्रतिकूल प्रभाव तथा रबी फसलों पर व्यापक नकारात्मक प्रभाव पड़ा है। धान की पछेती प्रतिरोपण से उत्पादकता प्रभावित होती है क्योंकि अधिक आयु के नवोद्भिद पौधे निम्न टिलरिंग क्षमता से अस्वस्थ हो जाते हैं। धान के अतिरिक्त अन्य फसलें, जैसे फूल गोभी, बैंगन तथा टमाटर में भी स्टैगर्ड नर्सरी डेवलेपमेंट अपनाया गया है। इन हस्तक्षेपों को 1515 किसानों के 228 हेक्टेयर क्षेत्र में निरूपित किया गया। सभी निरूपणों में से फूल गोभी के लिए कम्यूनिटी नर्सरी अत्यंत आशाजनक रही जिसकी उपज में अधिकतम वृद्धि तथा आर्थिक आय देखी गई।

विभिन्त अतःफसलीकरण प्रणालियां – सूखाग्रस्त क्षेत्रों में विभिन्न प्रकार के अंतःफसलीकरण प्रणालियों का निरूपण किया गया। परिवर्तनीय वर्षपात स्थितियों के लिए अतःफसलीकरण प्रणालियां एक महत्वपूर्ण अनुकूलन मेकानिज्म माना जाता है। अपनाए गए लगभग सभी गांवों में स्थान विशेष अंतःफसलीकरण हस्तक्षेपों का निरूपण किया गया। ये निरूपण कार्य 3455 किसानों के 536.5 हेक्टेयर क्षेत्र में किया गया। इन सभी अंतःफसलीकरण प्रणालियों में से मक्का + भिंडी को अधिक लोकप्रिय पाया गया यद्यपि अधिकतम आय मिर्च + भिंडी अंतःफसलीकरण में दर्ज की गई।

फसल विविधिकरण – मौजूदा फसल पद्धतियों में नई फसलों के प्रवेश का निरूपण 1085 किसानों के 837.5 हेक्टेयर क्षेत्र में किया गया। अधिकतम आर्थिक आय (लाभः लागत : 6.89) बिहार और झारखंड राज्यों में ओल (किस्म गजेन्द्र) की खेती में दर्ज किया गया।

पशुधन एवं मात्स्यिकी के अंतर्गत पशुधन केंद्रित विभिन्न हस्तक्षेपों पर कार्य किया गया जिसमें सूखा/बाढ़ के दौरान चारा उत्पादन हेतु सामुदायिक भूमि का उपयोग, चारा/खाद्य भंडारण की उन्नत पद्धतियां, पशुधन पर ताप के दबाव को कम करने हेतु उन्नत प्रकार के शरण स्थल, जल की कमी तथा अधिकता के दौरान मत्स्य तालाबों/टैंको का प्रबंधन, नस्ल को उन्नत बनाना, संतुलित

आहार तथा खनिज मिश्रण के माध्यम से संतुलित आहार एवं चारा प्रबंधन, फीड ब्लॉक्स तथा सीलेज तैयारी, ओजोला फीडिंग, कृमि दूर करने एवं टीकाकरण के माध्यम से प्रजनक पशुओं का स्वास्थ्य प्रबंधन, मत्स्य तालाबों की सफाई तथा मत्स्य पालन, शूकर पालन, स्वच्छ दूध एवं चारा उत्पादन सम्मिलित हैं। टीकाकरण कार्यक्रम के अंतर्गत इन हस्तक्षेपों से 14895 यूनिट से 34515 पशुधन स्वामी लाभान्वित हुए।

वर्षा आधारित क्षेत्रों में सूखा या हरित चारे की पर्याप्त आपूर्ति पशुधन की आजीविका के लिए महत्वपूर्ण है। अनेक राज्यों में वर्षपात का विलंब एवं कमी देखी गई है। मिलेट तथा दलहनों की खेती के अंतर्गत भूमि में कमी आई है जो वर्षा आधारित क्षेत्रों में चारा आवश्यकताओं की पूर्ति के कारण है। अनेक फसलों के अल्प अवधि से मध्यम अवधि तक के किस्मों तथा खरीफ एवं रबी ऋतुओं में चारा प्रजातियों को वर्षा आधारित तथा सीमित सिंचाई के अंतर्गत किसानों के खेतों में निरूपित किया गया ताकि आय तथा पशुपालन से कैश फ्लो में सहायता मिल सके। किसानों के खेतों में राइस बीन के उन्नत चारा तथा सीलेज की तैयारी का निरूपण किया गया। अपनाए गए विभिन्न गांवों में विभिन्न प्रकार के चारा उत्पादन के लिए 6070 किसानों को सम्मिलित कर 943 हेक्टेयर सामुदायिक भूमि का उपयाग किया गया। कार्यक्रम के अंतर्गत उत्पादित चारे में बरसिम, जई, सूडान चरी, मक्का, हाइब्रिड नेपियर, संकर नेपियर प्रमुख हैं। इन सभी निरूपणों में से सूडान फली चारा में अधिकतम लाभ (लाभःलागत : 5.59) देखा गया। सिलेज की तैयारी में आशाजनक परिणाम प्राप्त हुए हैं।

अपनाए गए गांवों में मवेशियों के एफएमडी, बकरियों के पीपीआर, कुक्कुट पालन में रानीखेत, बीक्यू टीका, कृमिमुक्त करने आदि हेतु टीकाकरण शिविरों का आयोजन किया गया। टीकाकरण शिविरों के आयोजन के पश्चात मार्त्यता दर लगभग 90: तक घट गई और मवेशियों के दुग्ध उत्पादन में 40: तक वृद्धि दर्ज की गई।

ग्रामीण बैकयार्ड पोल्ट्री (कुरोइलर, निकोबरी पक्षी), खाकी कैम्पबेल बत्तक, शूकर का टी एक्स डी नस्ल, मवेशियों के आहार के रूप में खनिज मिश्रण एवं अजोला का निरूपण 2880 किसानों के खेतों में किया गया। इस हस्तक्षेप के माध्यम से उन्नत रंगीन पक्षी का प्रवेश किया गया जिसने आशाजनक परिणाम दर्शाया है।

बेहतर पौल्ट्री शेड में मार्त्यता दर तथा छायादार क्षेत्र में ताप का कम दबाव दर्ज किया गया। बेहतर शेड में मानक रूप से जगह रखने पर कुक्कुट एवं डेरी पशुओं में बेहतर निष्पादन देखा गया। उन्नत शरण स्थल में बैकयार्ड पौल्ट्री तथा डेरी पशुओं में उच्चतर जीवितता के लिए तापीय दबाव को कम करने संबंधी हस्तक्षेप का निरूपण किया गया।

मिश्रित एवं शिंगटी मत्स्य संवर्धन – 1175 किसानों के खेतों में मौजूद एवं पुनरूद्धरित तालाबों में मिश्रित एवं शिंगटी मत्स्य संवर्धन का निरूपण किया गया। इस हस्तक्षेप के माध्यम से खाकी कैम्पबेल का भी प्रवेश किया गया।

संस्थागत हस्तक्षेप – इस क्षेत्र में 6158 किसानों को सम्मिलित कर 2546 यूनिटों में सीड बैंक, फोडर बैंक, कमोडिटी ग्रुप, कस्टम हायरिंग सेंटर, कलेक्टिव मार्केटिंग ग्रुप, मौसम सूचकांक आधारित बीमा का प्रवेश तथा ग्रामीण मौसम केंद्र के माध्यम से जलवायु संबंधी ज्ञान एवं जागरूकता संबंधी केंद्रो के सुदृढीकरण करने या नए केंद्रों की पहल की गई है।

सीड बैंक – कृषि विज्ञान केंद्रों की सहायता से निक्रा के गांवों में चावल, सोयाबीन, फॉक्सटेल मिलेट, हरा मूंग, अरहर, फिंगर मिलेट, चना, गेहूं, तोरिया तथा सरसों में अल्पावधि, सूखा एवं बाढ़ सहिष्णुता वाले किस्मों के ग्रामीण स्तरीय बीज उत्पादन कार्य किसानों एवं बीज समितियों द्वारा किया गया। आकस्मिक स्थितियों से निपटने के लिए सहिष्णुता वाले किस्मों की उपलब्धता को प्राथमिकता दी गई, विशेषकर धान, सोयाबीन एवं फॉक्सटेल मिलेट में। निक्रा के कुछ गांवों में सूखा सहिष्णुता तथा अल्पावधि के किस्मों के बीजों का उत्पादन नियमित स्रोत बन गए हैं चूंकि इच्छुक किसान एवं बीज समितियों ने इस कार्य को आजीविका गतिविधि के रूप में अपनाया है।

फोडर बैंक – सामान्य रूप से पशुधन के लिए हरित चारा एवं सूखे चारे के उत्पादन के माध्यम से फोडर बैंक की स्थापना की गई, जो सामान्यतः पशु आहार के लिए कम पड़ते हैं। नियमित रूप से तथा आकस्मिक स्थितियों में उपयोग के लिए अन्य जिलों के अनेक निक्रा गांवों में चारा के उन्नत किस्मों सोरगम, मक्का, बाजरा, बरसेम, लूसर्न तथा जई का उत्पादन किया गया।

सामूहिक विपणन : सामूहिक विपणन वह कार्य है जिसके अंतर्गत अनेक उत्पादक अपनी फसलों को बेचने हेतु मिलकर कार्य करते हैं। तथापि इन सदस्यों को अतिरिक्त भंडारण स्थान, फसल का प्रसंस्करण या पैकेजिंग की आवश्यकता होती है और संबंधित खर्च सभी उत्पादक मिलकर उठाते है।

कृषि उत्पाद – कृषि गतिविधियों से उत्पादित खाद्यान्न, पशुधन, कुक्कुट, फल या कोई अन्य वस्तु को कृषि उत्पाद के रूप में परिभाषित किया जा सकता है। कृषि उत्पाद का सामान्य मूल्य चाहे मेजर टर्मीनल, पोर्ट या कामोडिटी फ्यूचर एक्सचेंज में हो, बाजार की विभिन्न स्थितियों से प्रभावित होती हैं जिससे वर्तमान या आपूर्ति एवं मांग का संभावित संतुलन में बदलाव हो सकता है।

ग्रामीण स्तरीय मौसम केन्द्र के माध्यम से जलवायु सूचना सेवाएं– अपनाए गए गांवों में स्वचालित मौसम केन्द्र की स्थापना से किसानों को जलवायु संबंधी सूचनाएं दी गईं। पीआरए के पश्चात ग्रामीण जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) गांव में जलवायु संबंधी समस्याओं का मूल्यांकन एवं बेसलाइन सर्वे करता है। तत्पश्चात वे ग्रामीण स्तरीय मौसम केन्द्र के माध्यम से कृषि विज्ञान केन्द्र तथा संस्थान के अन्य वैज्ञानिकों के सिफारिशों का अनुसरण करते हैं।

ग्रामीण जलवायु जोखिम प्रबंधन समिति (वीसीआरएमसी) – गांवों में जलवायुवीय संवेदनशीलताओं को कम करने तथा इस कार्यक्रम के अंतर्गत इनके उपायों के लिए ग्रामीणों से गहन चिन्तन के पश्चात ग्रामीण जलवायु जोखिम प्रबंधन समिति का गठन किया गया। इसके नाम एक बैंक एकाउंट खोलने के पश्चात जिसे संयुक्त रूप से वीसीआरएमसी के अध्यक्ष तथा संबंधित कृषि विज्ञान केन्द्र के कार्यक्रम समन्वयक परिचालित करेंगे, वीसीआरएमसी क्रियाशील हो गया है। वीसीआरएमसीप प्रक्षेत्र उपकरणों तथा सूक्ष्म–सिंचाई प्रणालियों, के कस्टम हायरिंग, बीज एवं चारा बैंक, सामुदायिक नर्सरियों, रोपण सामग्री एवं निवेशों में किसानों के हिस्से का एकत्रीकरण, गांव में छोटे मौसम केन्द्रों की स्थापना, क्षमता निमार्ण कार्यक्रमों में किसानों की प्रतिभागिता तथा सीखने हेतु एक्सपोजर विजिट का प्रबंधन करता है। इस क्षेत्र में बीज बैंक, चारा बैंक, कमोडिटी ग्रुप्स, समय पर परिचालन हेतु कस्टम हाइरिंग, सामुदायिक नर्सरी का निर्माण, सामूहिक विपणन, ग्राम स्तरीय मौसम केन्द्र के माध्यम से जलवायु संबंधी सूनाएं आदि संस्थागत हस्तक्षेपों को सम्मिलित कर जागरूकता विकसित करती है। कृषि विज्ञान केन्द्र, नवादा, बिहार में गठित प्रकाश वीसीआरएमसी ने बैंक एकाउंट में अधिकतम राशि (रू 3,27,641) जमा किया है और वर्ष 2014 में उत्कृष्ट निष्पादन का राष्ट्रीय पुरस्कार प्राप्त किया है।

कृषि विज्ञान केन्द्र के परामर्श से गांव में कार्यान्वित किए जाने वाले प्रौद्योगिकीय हस्तक्षेपों पर निर्णय लेने के अलावा वीसीआरएमसी प्रक्षेत्र औझारों एवं उपकरणों के कस्टम हायरिंग का पर्यवेक्षण भी करता है जिससे यह किसानों में काफी लोकप्रिय हो गया है और पर्याप्त राशि उत्पन्न हुई है।

जलवायु परिवर्तनशीलता से निपटने के लिए समय पर कृषि कार्य करना महत्वपूर्ण है, विशेषकर बोवाई तथा पालन संबंधी कार्यों के संदर्भ में। भारी मृदाओं में स्वस्थाने मृदा नमी के संरक्षण और अधिशेष जल की निकासी के लिए व्यापक रूप से लचकदार पद्ध तियों को अपनाने हेतु रिज–फर्रो, ब्रॉड बेड फर्रो तथा ऊंची क्यारियों में रोपण के लिए उपकरणों की पहुंच आवश्यक है। वर्षा आधारित क्षेत्रों में छोटे एवं सीमान्त किसानों तक इन उपकरणों की पहुंच महत्वपूर्ण है। इसी प्रकार सिंचाई वाले क्षेत्रों में, रबी फसलों की शून्य जुताई वाली खेती से खरीफ फसलों में अवशेषों के प्रबंधन से अवशेषों को जलाने की समस्या घट जाती है और मृदा स्वास्थ्य तथा जल उपयोग दक्षता बढ़ जाती है। वीसीआरएमसी के सदसय मशीनों/उपकरणों के किराए की दरों का निर्धारण करते हैं। यह समिति किराए से प्राप्त राशि का उपयोग करती है और इसे वीसीआरएमसी के बैंक खाते में जमा करती है। प्राप्त राजस्व को उपकरणों के मरम्मत एवं रखरखाव के लिए उपयोग किया जाता है और 25: राशि सस्टेयनिबिल्टी फंड के लिए निर्धारित की जाती है। विभिन्न प्रकार की मशीनरियों जैसे जीरो टिल ड्रिल, हैपी सीडर, बीबीएफ प्लांटर, ड्रम सीडर, मल्टी क्रॉप प्लांटर, पॉवर वीडर, चैफ कट्टर, कोनोवीडर, डस्टर, स्प्रेयर, लेवलर, एफआईआरबी प्लांटर, सब–सोयलर, जीरो – टिल फिरटी–सीड, डिस्क हैरो, बकेट लेवलर, रीपर, थ्रेशर, कल्टीवेटर, रोटावेटर, पम्पसेट आदि का भंडारण सीएचसी में किया जाता है।

पिछले 6 वर्षों के दौरान क्षमता निर्माण के अंतर्गत विभिन्न विषयों पर कुल 584 पाठ्यक्रमों का आयोजन किया गया जिनसे 85816 किसान एवं कृषक महिलाएं (59947 पुरूष तथा 25869 महिलाएं) लाभान्वित हुए। इन पाठ्यक्रमों में फसल प्रबंधन, प्राकृतिक संसाधन प्रबंधन, पोषक तत्वों का प्रबंधन, समेकित फसल प्रबंधन, फसल विविधिकरण, संसाधन संरक्षण प्रौद्योगिकी, कीट एवं रोग प्रबंधन, पशुधन एवं मात्स्यिकी प्रबंधन, नर्सरी संवर्धन, रोजगार सृजन, न्यूट्रियंट गार्डेन, प्रक्षेत्र उपकरणों एवं औझारों का मरम्मत एवं रखरखाव, समेकित पालन प्रणाली, चारा एवं आहार प्रबंधन, लाख की खेती, महिलाओं के लिए प्रक्षेत्र उपकरणों के उपयोग में नीरसता को कम करना, मूल्य संवर्धन, मानव पोषकता एवं शिशुओं का देखभाल, चूहों का नियंत्रण आदि विषयों को सम्मिलित किया गया।

रिपोर्ट अवधि के दौरान विभिन्न विषयों पर विस्तार गतिविधियां सम्पन्न

की गईं जिनसे 37485 किसान (25504 पुरूष तथा 11981 महिलाएं) लाभान्वित हुए। पद्धति निरूपण, कृषि सलाहकार सेवाएं, पशु स्वास्थ्य जागरूकता शिविर, किसान चौपाल, किसान गोष्ठी, संसाधन संरक्षण प्रौद्योगिकियां, किसान एवं खेत दिवसों का आयोजन, नैदानिक दौरे, सामूहिक चर्चाएं, विश्व पृथ्वी दिवस, प्रौद्योगिकी सप्ताह, किसान मेला आदि विषयों पर विस्तार गतिविधियों का आयोजन किया गया।

निक्रा के सभी 17 कृषि विज्ञान केन्द्रों ने कार्यशालाओं, सेमीनार, संगोष्ठियों, जागरूकता शिविरों के आयोजनों द्वारा वर्ष 2015 में अंतर्राष्ट्रीय मृदा वर्ष तथा वर्ष 2016 में अंतर्राष्ट्रीय दलहन वर्ष मनाया। संबंधित कृषि विज्ञान केन्द्रों में प्रत्येक वर्ष 5 दिसम्बर को विश्व मृदा दिवस मनाया गया और निक्रा गांवों में 28270 मृदा स्वास्थ्य कार्डों का वितरण किया गया।

परियोजना के प्रारम्भ से ही निक्रा के सभी कृषि विज्ञान केन्द्रों ने चालू अन्य विकास योजनाओं के साथ अभिसरण से संसाधनों की उत्पत्ति में उल्लेखनीय उपलब्धियां प्राप्त की। निक्रा क्रियान्वित करने वाले कृषि विज्ञान केन्द्रों ने चालू विकास योजनाओं के साथ अनेक अभिसरण कार्यक्रमों का आयोजन किया। इनमें से प्रमुख विकास योजनाएं एनएआईपी, मनरेगा, राष्ट्रीय सूक्ष्म एवं लघु सिंचाई योजना, प्रधानमंत्री ग्राम सड़क योजना, मुख्यमंत्री सड़क योजना, बैकवर्ड रूरल ग्रांट फंड, सिल्क बोर्ड, सुन्दरवन विकास बोर्ड, एनएफएसएम, आईडब्ल्यूएमपी, आईवीआरआई, वन विभाग, एमईएसओ, आईएपी योजना आदि है। निक्रा क्रियान्वित करने वाले कृषि विज्ञान केन्द्रों ने विभिन्न अभिसरण कार्यक्रमों के एक अंग के रूप में कार्य करते हुए वर्ष 2011 से 2017 के दौरान रू 10,93,59,788 अर्जित किया।

Executive Summary

National Innovations in Climate Resilient Agriculture (NICRA) - A National Network Project of Indian Council of Agricultural Research (ICAR) with the objectives to enhance the resilience of Indian agriculture to climate change and climatic vulnerability through the various components *viz.* strategic research on adaptation and mitigation, technology demonstration on farmers' fields to cope up with current climate variability, sponsored and competitive research grants to fill critical research gaps and capacity building of different stakeholders. The rationale for Technology Demonstration Component (TDC) is based on the premise that an array of technologies is available to cope with different types of climate related vulnerabilities in National Agricultural Research System. 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 (ATARI) Kolkata having seventeen NICRA implementing KVKs spreading across Bihar (7), Jharkhand (6), West Bengal (3) and Andaman & Nicobar Islands (1) which carried out different activities under Technology Demonstration Component of National Innovations in Climate Resilient Agriculture Programme in different modules like Natural Resource Management, Crop Production, Livestock & Fisheries and Institutional Interventions through which 226464 farmers were benefitted (Natural Resource Management-40815, Crop Production - 21675, Livestock and Fisheries - 34515, Institutional Interventions - 6158, Capacity Building -85816 and Extension Activities -37485).

Natural Resource Management module covered improved drainage in flood prone areas, in-situ moisture conservation, construction/renovation of new water harvesting and recycling, structures/farm ponds/ checks dams/tank roof water harvesting tank, land shaping and rainwater harvesting structures, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods, green manuring, 5% model of irrigation, crop residue management, bunding of field, broad bed furrow, soil test based nutrient application, micro irrigation techniques, compost pits etc. which benefitted 40815 practicing farmers in the zone covering an area of 8650 ha.

In-situ rainwater management through ridge and furrow method and broad bed furrow practice conserves rainwater at field level and also drains out excess water into community drainage channels. This water can also be utilized for recharging ground water to provide supplemental irrigation to post-rainy season crops, which is otherwise not possible with flat bed planting. Through these methods, soil moisture is managed by maximizing the use of rainfall through increased infiltration and moisture retention and reducing runoff and soil erosion. The performance of high yielding improved varieties is optimized by in situ moisture management. Surface runoff and deep drainage water is exploited as supplemental irrigation to post-rainy season crops like wheat and chickpea. These conservation technologies have been demonstrated in adopted villages covering 2830 farmers in 512.5 ha area. Broad Bed Furrow System helped the farmers to provide irrigation in vegetables and rice as well as to include various IFS components like fish rearing in the furrows, fodder crops on the beds along with drainage facility in A&N Islands. More than 500 ha area have been brought under this intervention with significant impact among the farmers.

Water harvesting and recycling for supplemental irrigation through renovation of pond, well and canal, sand check dam, making bund, 5% model etc. were demonstrated in adopted villages by the KVKs involving 5825 numbers of farmers.

Under Conservation Tillage sowing of rabi crops depends on the harvesting time of the preceding crop in kharif and also soil moisture status for undertaking land preparation for sowing. In case of wheat, this involves 2 to 3 or even more tillage operations for obtaining appropriate tilth before planting of wheat. In addition to the costs incurred and energy required, this causes delay in planting of wheat which often results in coincidence of vulnerable stage with high temperature stress during February/ March. This often leads to reduction in grain yield and loss to farmer. Zero tillage technology offers a viable and practical solution by avoiding repeated tillage for land preparation and sowing, reducing cost of cultivation and also permits planting early by 10-15 days. Advancement in sowing date is an adaptation to avoid terminal heat stress. Zero-tillage refers to direct drilling of wheat in unploughed paddy fields immediately after rice harvest using zero till drill or happy seeder. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in 15 adopted villages in an area of 1236.5 ha of 2475 numbers of farmers. The technologies followed mainly by zero tillage operation. Wheat with cultivation through ZTD showed significant increased yield. Zero tillage technology showed very promising results in pulse and oilseed cultivation through the entire zone. Introducing different crops like Ol (var. *HYV Gajendra*), Cauliflower (var. *MSN-16*), Paddy (var. *Pusa Bold*, *Pusa 362*), Tomato (var. *Param F1*), *etc* in Chatra, Gumla, Saran, Jehanabad, Aurangabad, Koderma, Palamu as less water requiring crop as contingent crop planning during deficit rainfall in kharif.

Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in paddy in NICRA adopted villages covering 361.5 ha area in 575 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (59.5 q/ha) with a promising economic return.

Water saving irrigation methods like sprinkler irrigation, Low Energy Water Application (LEWA) in rice, Raised Bed Furrow (RBF) in brinjal, micro-lift irrigation in paddy demonstrated

in NICRA adopted villages covering an area of 430 ha in 1935 farmers' fields.

Rainwater harvesting (ex-situ) and efficient use to enhance resilience of farms, farm ponds brought about a perceptible change in crop production during kharif and rabi season. Though the rainfall was less during the months of June and early part of July, the intense storms with rains which generated run-off and was stored in farm ponds created in farmers' field. The harvested water was used for critical irrigations to rice, wheat, vegetables, fodder etc. Farmers realized an additional yield and income from the crops. A total of 928 number of rainwater harvesting structures have been developed throughout the zone which could store 3.05 million cu m of water through which 2500 ha area brought under irrigation. This intervention increased the cropping intensity to the maximum extent up to 250% with an average cropping intensity of 125%. Another intervention like 5% models were created on medium upland rice field where water retention capacity was low. Especially in late monsoon or insufficient rainfall transplanting of seedling are not done in time. By creating 5% model ditches in each plot to harvest and collect the rain water. Stored water increases the moisture level, helps in transplanting and also can provide irrigation during moisture stress later on. East Singhbhum, Gumla, Saran, Chatra and other districts of Jharkhand this practice has been followed in large scale.

Other Demonstrations like oyster mushroom cultivation, effective utilization moisture through seed production of pulses, in-situ vermicomposting in orchards, soil test based nutrient application, cleaning and renovation of old farm pond, renovation of well, planting forest trees, afforestation, soil test based nutrient application, bio pesticides in various crops, dolomite application in gora paddy and cultivation of high yielding grass on farm bund were carried out in 7130 farmers' fields with an area of 1792.5 ha of land.

Under **Crop Production** module different area specific intervention were taken by viz; Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of rabi crops to avoid terminal heat stress, water saving paddy cultivation methods like SRI, aerobic, direct seedling, community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management were covered which benefitted 21675 farmers.

Delayed onset of monsoon was experienced in several districts of Bihar and Jharkhand during these years and a number of short duration and drought tolerant varieties were demonstrated to make effective use of the remaining growing season. Introduction of *drought resistant varieties* of paddy, brinjal, niger, maize pigeon pea, and ragi were demonstrated in adopted villages involving 2365 number of farmers in 2837.5 ha area.

Drought *tolerant paddy varieties* like *Sahbhagi, Anjali, Naveen, Abhishek* were demonstrated in 2150 ha areas of 8115 number of farmers' field. For pulse and oilseeds, *ICPL- 858063, Mal-13* and *PRG 153* varieties of pigeon pea were demonstrated in 1025 ha area and gave the maximum economic return.

Salt tolerant varieties of paddy like *CARI Dhan-5, Usar Dhan-5, Jarava, Geetanjali, SR-26B, Amalmona* were demonstrated in 373.5 ha area in 198 farmers' fields. *Jarava, Geetanjali* and *Amalmona* varieties proved maximum salt tolerant potential by giving highest yield of 50.5 q/ha and more economic return.

Flood tolerent varieties of paddy like *Swarna sub 1, sabita, dudheswar* were demonstrated in 278 ha area in 120 farmers' field by giving yield of 45 q/ha.

To *avoid terminal heat stress* in crops like rice, wheat, lentil, mustard, potato, *etc.* crops were sown in 12 days advance during rabi season. These demonstrations were carried out in adopted villages involving 2460 number of farmers' fields with an area of 381.5 ha land.

Water saving paddy cultivation through SRI, short duration varieties, direct seeded rice, brown manuring etc. have been demonstrated in 1170 ha area of 3990 number of farmers' fields. Among all the interventions paddy cultivation with Sahbhagi variety showed highest increase in yield .

To combat the situation of delayed monsoon, intervention of staggered *community nursery* for paddy has now become very popular in Bihar and Jharkhand. 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. Bihar experienced aberrant rainfall situations in 5 out of the previous 10 years impacting adversely rice production and livelihood of farmers. It appeared that failure of rain in July is responsible as transplanting of 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. Besides paddy other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 228 ha area of 1515 numbers of farmers. Among all the demonstration the community nursery for cauliflower was the most promising one which showed highest increase in yield as well as economic return.

Various *intercropping systems* were demonstrated in regions which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. Intervention on location specific intercropping was demonstrated in almost all adopted villages. The demonstrations were carried out in 536.5 ha area of 3455

number of farmers' fields. Of all these intercropping of maize + ladies finger was found most popular although maximum return was found in Chilli + ladies finger intercropping.

Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in 837.5 ha area of 1085 number of farmers' fields. The maximum economic return was recorded (B:C:: 6.89) in the cultivation of Ol (var. *Gajendra*) in Bihar and Jharkhand.

Livestock and Fisheries module comprising various livestock centric interventions were carried out which include use of community lands for fodder production during drought/ flood, improved fodder/feed storage methods, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water, breed up-gradation, balanced feed and fodder management through mineral mixture, feed blocks and silage making, azolla feeding, breed animal health management through deworming and vaccination, fish pond cleaning and fish farming, pig farming, clean milk and fodder production. These interventions benefitted 34515 livestock owner with 14895 units in vaccination programme.

Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. Delayed onset and deficit rainfall conditions were experienced in several states. There was reduction in area under millets and pulses, which are important to meet the fodder requirements in the rainfed areas. Short and medium duration fodder cultivars of several crops and fodder species both in kharif and rabi seasons were demonstrated in farmers' fields under rainfed and limited irrigation conditions to support income and cash flow from animal husbandry Improved fodder of rice bean and silage making were demonstrated in farmers fields. *Community lands* of an area of 943 ha involving 6070 number of farmers utilized for different fodder production were demonstrated in different adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration legume Sudan grass showed maximum benefit return (B:C:: 5.59). Silage making for 140 numbers and 10 ha of units showed very promising results.

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

Demonstration of *rural backyard poultry (Kuroiler, Nicobari fowl), Khaki Campbell duck, T X D breed* of pig, mineral mixture and azolla as cattle feed were carried out in 2880 number of farmers fields. Improved ornamental bird was introduced through this intervention which also showed very promising results.

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

Composite and cat fish rearing in the existing and renovated ponds were demonstrated in 1175 farmers' fields. Khaki Campbell duck was also introduced through this intervention.

Institutional Interventions module including strengthening the existing or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centres, collective marketing group, introduction of weather index based insurance and climate literacy through a village weather station and awareness developed 2546 units covering of 6158 number of farmers in the Zone.

Seed Bank through Village level seed production of short duration, drought and flood tolerant varieties was taken up by farmers and seed societies in several NICRA villages with the technical support of KVKs in rice, soybean, foxtail millet, green gram, pigeon pea, finger millet, chick pea, 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. It has become a regular practice to source seed of drought tolerant and short duration cultivars from few NICRA villages as interested farmers and seed societies have taken up this as a livelihood activity.

Fodder bank was established in the villages through the production of green fodder and dry fodder which are usually very shortage as feed to livestocks. In several NICRA villages in other districts seed of improved cultivars of fodder sorghum, maize, pearl millet, berseem, lucerne and oats was produced for use in regular and contingency situations.

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

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

Climate literacy service through village level weather station was provided among the farmers through the establishment of automatic weather station in the adopted village. The *Village Climate Risk Management Committee (VCRMC),* after the PRA to assess the climate related problems in the village and baseline survey. Then they followed recommendation by KVK and other institute scientist through village level weather station.

Village Climate Risk Management Committee (VCRMC) was constituted after in-depth discussion with the villagers about

the mitigation of the climatic vulnerabilities of the villages and the strategies to be adopted under this programme. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Programme Coordinator of the KVK concerned. VCRMC manages the custom hiring centre for farm implements and micro-irrigation systems, seed and fodder bank, community nurseries, collection of farmers share in planting material and inputs, establishment of small weather station in the village, participation of farmers in capacity development programs and exposure visits to learning sites. Institutional interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed among the farmers in the Zone. Jay Prakash VCRMC constituted at KVK Nawada, Bihar generated highest amount (Rs. 3, 27,641) in the bank account of VCRMC and got National Award of Best Performing VCRMC in 2014.

The *custom hiring* of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK has now become immensely popular among the farmers and substantial amount has also been generated. Timeliness of agricultural operations is crucial to cope with climate variability, especially in case of sowing and intercultural operations. Access to implements for planting in ridge-furrow, broad bed furrow and raised beds is essential for widespread adoption of resilient practices for in situ soil moisture conservation and drainage of excess water in heavy soils. In rainfed areas, availability of such farm implements to small and marginal farmers is important. Similarly in irrigated areas, residue management of kharif crops through zero till cultivation of rabi crops reduces the problem of burning of residues and adds to the improvement of soil health and increases water use efficiency. The rates for hiring the machines /implements are decided by the members of VCRMC. This committee also uses the revenue generated from hiring charges and deposits in a bank account opened in the name of VCRMC. The revenue is used for repair and maintenance of the implements and 25% share is earmarked as a sustainability fund. Different types of farm machinery are stocked in the CHCs, the most popular being Zero till drill, Happy seeder, BBF planter, drum seeder, multi crop planter, power weeder, chaff cutter, conoweeder, duster, sprayer, leveller, FIRB planter, sub-soiler, zero-till ferti-seed, disc harrow, bucket leveller, reaper, thresher, cultivator, rotavator, pumpset etc.

A total 584 courses were conducted under **Capacity Building** on various thematic areas benefitting 85816 farmers and farmwomen (59947 males and 25869 females) during last six years. Thematic areas cover on crop management, natural resource management, nutrient management, integrated crop management, crop diversification, resource conservation technology, pest and disease management, livestock and fishery management, nursery raising, employment generation, nutrient garden, repair and maintenance of farm machineries and implements, integrated farming system, fodder and feed management, lac cultivation drudgery reduction with farm implements for woman, value addition, human nutrition and child care, rodent control etc.

Extension Activities on various thematic areas benefiting 37485 practicing farmers (25504 males and 11981 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 17 NICRA-KVKs have celebrated International Year of Soils in 2015 and International Year of Pulses in 2016 through conducting workshop, seminar, symposia, awareness camp. December 5 each year was observed as World Soil Day in the respective KVK and distributed 28270 soil health cards among the farmers of NICRA villages.

Resource Generation through Convergence with ongoing other development schemes is one of the most significant activities achieved by all the NICRA KVKs since the inception of the project. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development schemes. The prominent development schemes are NAIP, MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, Chief Minister SadakYojna, Backward Rural Grant Fund, Silk Board, Sunderban Development Board, NFSM, IWMP, IVRI, Forest Department, MESO, IAP Yojana etc. NICRA implementing KVKs being part of the different convergence programmes generated on amount of Rs. 10,93,59,788 lakh during the period of 2011 to 2017.

INTRODUCTION

India is more vulnerable in view of large population depending on agriculture and excessive pressure on natural resources. Indian farmers have evolved various coping mechanisms over time, but these mechanisms are not enough to cope with extreme weather aberrations witnessed in the recent years. In order to deal with climate change and its impact, a Network Project entitled, 'National Innovations in Climate Resilient Agriculture (NICRA)' of Indian Council of Agricultural Research (ICAR) has been launched in February, 2011 aiming to enhance the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration.

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 *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. 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 various steps *viz.* 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.

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

List of districts and KVKs with Climate vulnerability

S. N.	State	NARP Zone	Districts	Climate vulnerability
1	A&N Islands	Coastal Zone	Port Blair	Cyclone
2	Bihar	North West Alluvial Plain Zone (B1-I)	Saran	Flood/Drought
3	Bihar	North West Alluvial Plain Zone (B1-2)	Supaul	Flood/Drought
4	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Buxar	Flood/Drought
5	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Nawadah	Drought
6	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Aurangabad	Drought
7	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Jehanabad	Drought
8	Bihar	South Bihar Alluvial Plain Zone (B1-3)	Banka	Drought
9	Jharkhand	Central and North Eastern Plateau Zone (B1-4)	Koderma	Drought
10	Jharkhand	Western Plateau Zone (B1-4)	Palamu	Drought/Heat wave
11	Jharkhand	South Eastern Plateau Zone (B1-4)	East Singhbhum	Drought/Heat wave
12	Jharkhand	Western Plateau Zone (B1-4)	Gumla	Drought
13	Jharkhand	Western Plateau Zone (B1-4)	Chatra	Drought/Heat wave
14	Jharkhand	South Eastern Plateau Zone (B1-4)	Godda	Drought/Heat wave
15	West Bengal	Terai Zone (WB-2)	Coochbehar	Heavy rainfall
16	West Bengal	Old Alluvial Zone (WB-3)	Malda	Flood
17	West Bengal	Coastal Saline Zone (WB-6)	South 24 Parganas	Cyclonic storm/heavy rainfall within short period

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

Table. Villages adopted by NICRA implementing KVKs of the Zone

Name of KVK	Name of village	Name of KVK	Name of village
Aurangabad	Harigaon	East Singhbhum	Lowkeshra, Barunia and Pathargora
Jehanabad	Sakrorha	Gumla	Gunia
Nawada	Manjhila	Koderma	Chopanadih
Saran	Affaur, Nagra	Godda	Bhelwa and Gunghasa
Supaul	Sadanandpur	Palamu	Dulsulma and Murma
Banka	Merha	Cooch Behar	Khagribari
Buxar	Kukurha	Malda	Brozolaltola, Meherchandtola, Jayramtola and Mahendrotola
Chatra	Mardanpur Gari and Ambadhohar	South 24 Parganas	Bongheri
		Port Blair	Badmaspahad and Port Mount

INTERVENTIONS COVERED WITH THE FOLLOWING MODULES

MODULE I: NATURAL RESOURCE MANAGEMENT

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

MODULE II: CROP PRODUCTION

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

KVK WISE SALIENT ACTIVITIES

WEST BENGAL KVKs

1. S 24 Parganas (Nimpith)

1.1 Village information:

Name of the village	Village: Bongheri
No. of households	406
Total cultivated area (ha)	216.53 ha
Area under rainfed cultivation (ha)	216.53 ha
Major soil type	Clay and Silty-clay
Climatic vulnerability of the village	Cyclone and Intensive rainfall in short time span

1.1.1 Rainfall trend (mm):

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

1.1.2 Detail of climatic vulnerability

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

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

1.1.3 Predominant farm enterprises

i. Cropping pattern:

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

ii. Major cropping system: Paddy based mono-cropping system

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

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

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

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

v. Horticulture crops:

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

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

vii. Livestock:

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

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

Indigenous Breed: 2.54 L/animal/day

Improved Breed: 4.5 L/animal/day

ix. Inland fisheries practiced:

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

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

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

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

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

Economics of inland fishery before renovation of pond in 0.13 ha water area

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

1.1.4 Resource availability:

1.1.4.1 Status of Common Pool Resources (CPRs)

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

1.1.4.2 Water harvesting interventions taken up in the NICRA village

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

1.1.4.3 Status of farm mechanization before start of NICRA: Poor

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

1.1.5 Socio-economic status:

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

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

MODULE WISE INTERVENTIONS

1.2 Module I: Natural Resource Management

1.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Optimization of horticultural production through land embankment development	52	14.34	223	53000	62547	2.18
Ridge and furrow cultivation	5	1.08	257	105854	120674	2.14
Total	**57**	**15.24**				

Impact

A. Optimization of horticultural production through land embankment development:



Due to poor drainage system, the low lying land of the area gets easily inundated after heavy rainfall. Cultivation of long duration paddy again delays the release of lands to be ready for timely vegetable cultivation in *Rabi* season. Raising and strengthening of the land embankment enables the farmers to grow vegetables during rainy season. A peripheral canal is dug out and the earth is added to the existing land embankment to raise it upto 3 feet height and broaden to 5 feet bottom width. On an average 5-10% of the total land thus could be brought under additional cultivation. Vegetables like okra, cowpea and bitter gourd are then cultivated over this strengthened bund (*ail*) during *kharif* season with almost no chance of submergence. During *rabi* season, tomato, french bean, *etc*., are cultivated on the same land embankment. The problem of salinity is also avoided in ail cultivation during *rabi*-summer season. Under traditional practice of deep-water paddy cultivation in 1 ha (10000 m^2) lowland, 20q of paddy could be harvested during *kharif* season. And the same piece of land

remains fallow in the next *rabi* season. The actual cultivable land is 9880 m^2. Whereas, the rest 120 m^2 area is consumed for construction of traditional bund (ail), that remains fallow during both the seasons. In this system of deep-water paddy cultivation, from 1 ha of land, an average net profit of only Rs 12,000/- is generally obtained throughout the year.Under the innovative *ail* cultivation system in 1 ha land, the total cultivable lowland area utilized for deep-water *Kharif* paddy is reduced from 9880 m^2 to 8680 m^2. This results to almost 2.5 q reduction in paddy production equivalent to Rs. 2250/-. The remaining 1200 m^2 area (9880 m^2 - 8680 m^2) is utilized for broadening of the traditional *ail* upto 600 m^2 and rest 600 m^2 for peripheral canal.The modified low land now becomes suitable for paddy cum fish cultivation during *kharif* season as the fish cannot escape due to raising of the embankment, hence, providing an additional crop. Vegetables are cultivated over the broadened *ail*, round the year. An average net profit of Rs. 62,547/- is obtained from vegetable cultivation and paddy cum fish culture per year.

The *ail* cultivation technology played a great role in reducing the migration rate among the rural people. Even women, who used to work as maid-servants in the city, now are engaged in their own village in these vegetable fields.

B. Ridge and furrow cultivation

In small patches of lands, where excavation of pond is not possible, ridge and furrow system is a suitable alternative to harvest freshwater for irrigation during the dry spell. Ridge and furrow cultivation provides a good scope for sustenance of the marginal farmers by growing vegetables on the ridges throughout the year and fish in the furrows in *kharif*. Farmers with small land holdings could increase the profit from multipurpose utilization of the land with this system. In monsoon season the furrow is used for fish cultivation while the ridge is used for vegetable cultivation. In small patches of lands, where excavation of pond is not possible, ridge and furrow system is a suitable alternative to harvest freshwater for irrigation during the dry spell. Ridge and furrow cultivation provides a good scope for sustenance of the marginal farmers by growing vegetables on the ridges throughout the year and fish in the furrows in *kharif*. Previously this land was used only for traditional paddy cultivation. Previously these lowlands were only used for traditional paddy cultivation in *kharif*. From 1 ha of such land a farmer could earn only Rs.18000/- from *kharif* paddy cultivation. After implementing this technology in small holdings, the low lands were converted into multi-cropping land having half of its entire land as ridge, where round the year vegetable cultivation could be possible. The rest of the land, *i.e.* the furrows, stores enough water during rainy season to make pisciculture a successful intervention apart from irrigating the vegetables. By this intervention income increased manifold in case of small holdings. Small and marginal farmers now have an option to remain engaged in their own field throughout the year, fetching a good revenue.

1.2.2 Other Demonstrations:

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	181	73.50	-	-	-	-

Impact

A. Soil health management:

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

Crop	Area (ha)	Saving of Nitrogenous fertilizers use (Kg/ha)
Paddy	54.8	14.00
Chilli	9	65.50
Bittergourd	5	22.50
Okra	5	35.95

B. Community afforestation with mangroves

One of the major interventions taken up was creation of awareness among the community about the benefits of having mangrove vegetation along the river embankment which could absorb the brunt of cyclonic storms and high tides thereby sparing the village from mass destruction.To replenish the diminishing mangroves in their locality along the river bank, initially, a group of young people took interest and started a mangrove nursery with seeds of "*sundari*", *Heritierafoames* distributed from the project fund.

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

1.2.3 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed

RWH structures	No.	Storage capacity (m^3)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Landshaping and rain water harvesting structure	27	34,894	27	6.33	220%
Renovation of defunct water bodies	35	1,07,778	35	4.66	167%
Rejuvenation of 4 Km long canal	1	3,65,760	100	50	135%
Total	**63**	**5,08,432**			

Impact:

A. Land shaping and rainwater harvesting

Most of the cultivable area of the project village is low lying and flood prone. During *Kharif* season,these low lands are only suitable for indigenous flood tolerant paddy varieties that are also long duration and low yielding. The occasional and uncontrolled flooding also reduces the scope of fishery. During post-*kharif*, scarcity of irrigation water, forces the farmers to leave the lands remain fallow. Due to declining trend in total precipitation and its erratic nature, there is always a scarcity of quality irrigation water during and after the *kharif* season.This intervention was taken up for provision of freshwater for multiple cropping including vegetable cultivation in *rabi* season and pisciculture round the year.

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

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

Here the low yielding traditional deep water paddy varieties in the *kharif* season are replaced by short duration HYV paddy and vegetables are introduced in the same land in *rabi* season. Both the widened pond embankment and the land embankment are used for vegetable cultivation throughout the year. At the same time, pisciculture with duck rearing is taken up in the pond. Traditionally, only local, long duration variety of paddy used to be grown in the low-lying land during *kharif* season. Second crop was not possible during *rabi*-summer season due to the late release of land as well as for scarcity of irrigation water. A farmer could earn a meager sum of Rs. 6500/- from a 0.266 ha of land. After intervention with land shaping, traditional

variety of paddy is now replaced by HYV paddy during *kharif* season. The crop is harvested earlier. In *rabi*-summer season, with the help of rain water so harvested in the dugout pond, the raised land is used for vegetable and oil seed cultivation. Pond and land embankment, are also used for year round vegetable cultivation. At the same time, pisciculture with duck rearing in the pond is also practiced. Average net income from a 0.266 ha land is now about Rs. 37035/-

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

Table. Economics of the Land shaping practice:

Traditional practice (0.266 ha)		**Land shaping Plot(0.266 ha)**	
Kharif season	Net income	Kharif season	Net income
Traditional paddy – *Sabita* – 155 days (0.266 ha land)	6500	HYV paddy – *Satabdi* – 120 days (0.17 ha land)	6500.00
		Dolichos bean (0.011 ha land embankment)	3500.00
		Bottle gourd (Aerial cultivation)	850.00
		Ridge gourd (0.015 ha pond embankment)	1625.00
Rabi season		Rabi season	
Fallow	-	Tomato (0.17 ha land)	17200.00
		French bean (0.010 ha land embankment)	2500.00
		Bitter gourd (0.015 ha pond embankment)	1260.00
		Bottle gourd (Aerial cultivation)	850.00
		Year round	
		Fish, prawn & duck (0.05 ha pond)	2750.00
Total	**6500**	**Total:**	**37035.00**
Cropping intensity	100%	Cropping intensity	220%
Man-days created	135	Man-days created	472
B:C	1.3	Cost/Benefit ratio	3.26

B. Renovation of defunct water bodies

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

These derelict ponds were re-excavated and renovated upto a depth of 3ft. more over the existing average depth of 5ft.Proper embankment, inlets and outlets were also made. A portion of the silt was used to spread over the adjoining low lying agricultural field. As a result of desiltation, water storage capacity of the ponds increased and the fresh rainwater harvested in these ponds ensured irrigation to the vegetables during *rabi* season. Option of fishery became more profitable as water storage increased to almost 11 months. The defunct water bodies which could not promise much to the farmers, ensured sufficient rainwater harvesting following their renovation, giving the farmers multiple options of fish culture as well as vegetable cultivation. Previous data reveals that before renovation, the average production of fish from a 0.13 ha. pond was 0.5q whereas after renovation fish production increased to an average 2.8 q. The pond embankment could also be used for growing vegetables like brinjal, okra, tomato, chilli, bitter gourd, bottle gourd *etc*. providing an average production of 5.5 q.

C. Rejuvenation of canal

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

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

- Around 9000 person-days worth earthwork and 6000 person-days worth farm-labour work was generated through this intervention. This in turn helped to check migration of 15000 person-days of labour, outside the project area.
- Thus, localized employment generation in off season helped to save consumption of non-renewable energy through transportation. Considering a 40 min walking (104 Kcal), 40 min cycling (240 Kcal) and 4 hr train/bus traveling per day (1392 Kcal), a total of 1736

Kcal of energy is lost per person, in case of daily migration. (Source: "Dietary Guidance for Indians", a manual by NIN, ICMR, 2011). Through this activity of canal renovation, a total of 2.6 crore Kcal of physical energy could be saved directly and indirectly. The same non-productive energy was effectively utilized locally for employment generation and crop production.

Year	No. of water structures	Total storage capacity	No. of farmers benefitted
2011-12	13 ponds (new) 20 ponds (renovated) 1 canal (renovated)	445299.85 Cu. m	483
2012-13	7 ponds (new) 12 ponds (renovated)	46762.15 Cu. m	19
2014-15	3 ponds (new) 3 ponds (renovated)	10170 Cu. m	6
2016-17	4 ponds (new)	6200 Cu. m	4
Total	**62 ponds and 1 canal (4 km)**	**508432 Cu. m**	**512**

1.3 Module II: Crop Production

1.3.1 Introducing salt tolerant paddy varieties:

Table. Performance of different salt tolerant paddy varieties

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

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

1.3.2 Introducing flood tolerant varieties:

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* Medium land (1'-1.5' water stagnation) Check var. *Dudheswar*	37	9.9	41.8	25.2	65.87	41250	22650	1.55

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

1.3.3 Introduction of new crops/ crop diversification:

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
Sunflower var. *KBSH-44*	25	6	17.20	-	-	22500	29100	2.29
Sunflower var. *DRSH-1*	38	9	18.10	-	-	21715	32585	2.38
Sunflower var. *KBSH-53*	32	7.5	18.75	-	-	26250	39375	2.50
Sweet potato var. *Sree Vardhini*	35	2.8	118.5	-	-	32500	27935	1.86
Greengram var. *PDM-84-139* (Check var. Choiti mung)	12	1.6	9.75	6	62.5	18750	20250	2.08
Total	**142**	**26.9**						

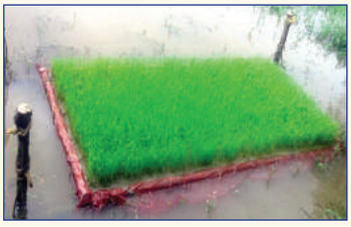
Impact: The village suffers from acute water scarcity and soil salinity during *Rabi* season thus resulting in extensive fallow lands in this season. The only crop that was grown in this season was Greengram. But the productivity of the local variety (*Choiti mung*) was very low (6 q/ha). This variety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

1.3.4 Other Demonstrations:

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
Floating seedbed of paddy (var. *Dudheswar*)	5	0.26	33.0	27.0	22.22	39000	27000	1.69
Staggered seedbed of paddy (var. *Dudheswar*)	5	0.67	32.8	30	9.33	40100	25600	1.63
Double chambered Vermicomposting	6	2	40	25	60.00	12000	16000	2.33
On-farm mass production of Trichoderma viride	10	1.6	-	-	-	-	-	-
Bio-intensive management of Chilli Leaf Curl disease	10	1.6	112	84	33.00	122250	325750	3.66
Total	**36**	**4.33**						

Impact: A. Demonstration on floating seed bed of paddy: The village falls under the coastal agro-ecological zone and suffers from occasional torrential rain during Monsoon. Paddy is the major crop during Monsoon season. More than 75% of the agricultural lands are low lying and hence the *Kharif* paddy suffers prolonged submergence after any intensive precipitation (>60 mm per day). Due to climate change there is an increase in intensity of precipitation during the initial monsoon days (June-July) resulting into prolonged submergence (10-12 days). This causes havoc damage to the seedbed preparation as well as to the standing seedbeds of paddy.The entire seedbed was prepared on a bamboo frame that can float over water so that the paddy seedlings are protected from submergence during excess rainfall.



- A 10ft x 4ft size bamboo frame was prepared. A polythene sheet was covered over the bamboo frame and a thin layer of top soil was spread over it.
- The frame waseither fixed with bamboo poles at four corners and manually lifted with the rise of water level or was fixed with empty plastic vessels to keep it floating.
- Paddy seeds were sown on the floating seedbed

The innovation helped to save the paddy seedbeds from prolonged submergence and subsequent crop loss. The seedbed

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

B. Demonstration on staggered seedbed of paddy

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

- Seeds are sown in different seedbeds in different dates
- So there are batches of seedlings of different ages
- If one batch of seedlings are lost after transplantation due to prolonged water stagnation in main field, other batches of younger seedlings are still saved in the nursery
- So, farmers will have some seedlings for subsistence

C. Vermicomposting

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

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

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

E. Chilli Leaf Curl Disease management:

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

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

1. Seed treatment with Thiamethoxam followed by *Trichoderma viridac*
2. Nursery bed covered with mosquito net
3. Soil test based fertilizer application
4. Seedling dip in Imidacloprid before transplanting
5. Spraying schedule for main crop: Neem oil – Fipronil – Neem oil – Spiromesifen – Neem oil - Difenthiuron

1.4 Module III: Livestock & Fisheries

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

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
Hybrid Napier	78	4.53	855	210	307	15200	70300	5.6

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

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

1.4.2 Preventive vaccination:

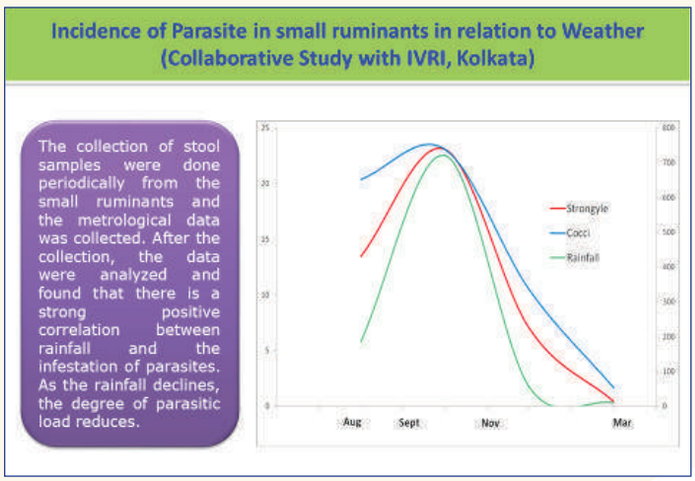
Table. Performance of various vaccination camps organized

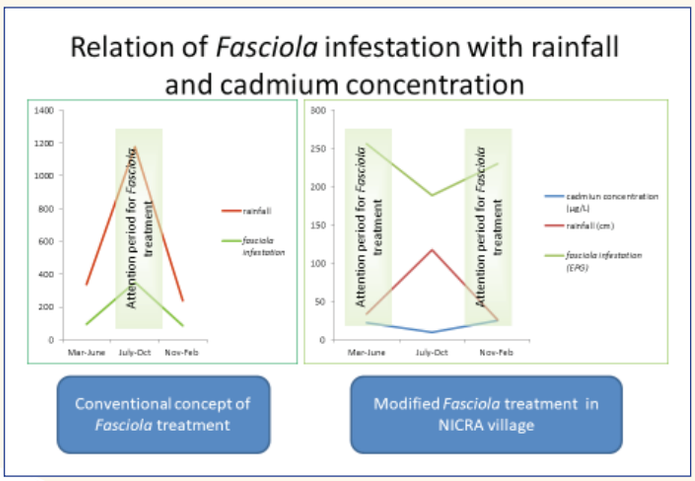
Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		Economics of demonstration (Rs./ha)		
			Demo	Local	Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle &PPR against goat	680	3995	-	-	-	-	-
Deworming & Mineral mixture	850	4430	-	-	-	-	-
Total	**1530**	**8425**					

Impact: The NICRA village of Bongheri is rich in livestock resources. The livestock population comprises of both large and small ruminants as well as a good assortment of poultry birds. However, before the launching of the project in the village, the status of livestock, with respect to health and vitality, was abysmal. Animal health and vaccination camps were organized twice a year to provide the animals with deworming drugs, vitamins and minerals and immunization of animals against H.S., B.Q. and F.M.D.

Supplementation of specific mineral mixture in the diet of the animals was also given due importance after soil analysis, plant analysis, analysis of animal serum followed by supplementation with iron, zinc, cobalt, copper, calcium. Epidemiological studies of parasitological infestations in animals in relation to climate change are being conducted in collaboration with ICAR-NIVEDI, Hebbal. This is done to find out a correlation between the amount of cadmium concentration in the pond water used by the livestock and the incidence of *Fasciola*worm infestation in the snail population of the aquatic bodies in the village.Another study is being conducted in collaboration with Indian Veterinary Research Institute, Kolkata to find out incidence of parasite in small ruminants in relation to weather. For this purpose stool samples were collected periodically from the small ruminants and the meteorological data was also recorded. Thereafter, it was found that a strong positive correlation exists between rainfall and the infestation of parasites. As the rainfall declines, the degree of parasitic load reduces. This study helped to schedule the deworming of animals more effectively.

These steps enabled the enhancement of health and population of livestock in the village.





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

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

Impact: The NICRA village of Bongheri is susceptible to frequent storms and cyclones, rendering it vulnerable to ingress of brackish water from the adjacent river through breaching of embankment. This may lead to mass mortality of the existing freshwater fish like, carps, catfish, snakehead fish and other indigenous fish species. However, the fish *tilapia*, with a wide range of salinity tolerance, has been found to be unaffected due to this sudden change in their environment. The fish is also hardy, omnivorous in nature and can tolerate fluctuation in water temperature.*Tilapia* has good consumer preference and is also popular with the local farming community. However, due to its prolific breeding habit, the fish over populates the pond quite easily leading to reduced growth of all the fish present and also lowers fish production.Hence, monosex tilapia (only male) of *Tilapia nilotica*, procured from the farm of a KVK trained entrepreneur, is converged with NRM interventions like landshaping and renovation of defunct ponds during the past two years.The main aim of introducing monosex tilapia in the NICRA village is to provide the farming community with a stress tolerant fish which can withstand drastic changes in the climate and at the same time maintain a sustainable production from a water body. It was observed that from a 0.13 ha pond, by stocking tilapia @ 5000 nos. a production of 200 – 400kg could be achieved within 8-11 months. At an average selling price of Rs. 100/kg, an income of Rs. 20000-Rs. 40000 could be obtained which gives the farmers just enough profit to sustain their daily protein requirement.

1.4.4 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry with *Nirbheek* breed	35	35 (10 per unit)	Age at first lay-4.5 months' Egg wt. -60 g, Total egg prodn. 180, Body weight at 1 year-2.6 Kg	Age at first lay-6.5 months, Egg wt. -45 g, Total egg prodn. 160, Body weight at 1 year-2.1 Kg	23.81	3280	3500	2.06
Ornamental bird	7	7 (8 pairs per unit)	50 pairs in one year	-	-	3750	20250	6.40
Total	**42**							

Impact: ***a) Farming of stress tolerant poultry bird for marginal and landless farmers:*** Most of the farm families of the NICRA village were used to raising of indigenous poultry birds. However, the production both in terms of meat and eggs was very low. There were also incidence of disease and mortality in this birds due to climatic variations at different

times of the year. Diseases like ranikhet, gumboro, diarrhoea, pneumonia *etc*. were common.

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

b) Ornamental bird rearing:

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

1.4.5 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		Economics of demonstration (Rs./ha)			
			Demo	Local	Gross Cost	Gross Return	Net Return	BCR
Storm resistant 2-tier integrated shelter model for poultry cum ornamental bird	1	1	Poultry: Egg:220/month Meat: 7 kg/yr Ornamental Bird: 150 chicks/yr	Poultry: Egg:150/month Meat: 15.5 kg/yr	12100	28000	15900	2.31

Impact: Storm resistant 2-tier integrated shelter model for backyard poultry cum ornamental bird: Poultry is a popular livelihood option for the villagers. However, due to frequent storms and cyclones, the traditional housing is damaged on and often leading to increased mortality of birds and financial loss to the farmers. So, a double floor, durable housing with iron and net structure was developed and demonstrated to one farmer. The housing accommodates 20 poultry bird at the bottom floor and 20 pairs of ornamental bird at the top floor. The culling % of poultry birds have reduced and the egg production per cycle has increased. The ornamental birds provide an additional income to the family.

1.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Paddy, Lathyrus Paddy var. Dudheswar Lathyrus var. NP-24	12.3 q	Seeds are stored in Metal Seed Bins, kept in the common facility center of the village, managed by the VCRMC. Selected famers contribute and store the seeds as common pool for future use in case of any contingency, like damage of all seedbeds in the village during cyclones or floods, etc.	194	8 no.

Custom hiring center	Power tiller, Paddy Reaper, Paddy thresher, Pumpset, Knapsack sprayer, Conoweeder	21 no. (Rs. 434/hr)	Managed by VCRMC	1683	231.05
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1 unit	Manual reading of the weather parameters are taken and maintained by the VCRMC members.	-	-
	A collaborative venture is going on with Bidhan Chandra Krishi Viswavidyalaya, Kalyani in providing weekly weather forecast for the NICRA village along with recommendations as per the forecasting. The forecast from BCKV is passed on to the NICRA village either by the KVK or directly through SMS. On receiving the forecast and recommendations, the VCRMC members write the same on the display board put up in the RTC from where the villagers become aware of the weeks climate.				

1.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee Bongheri

The committee was formed with the approval of gram sabha including panchayet members, village heads and club members for periodically assessing the scenario of the village with respect to climate change, revolving fund, custom hiring status, selection of beneficiaries, finalizing and implementation of different interventions, *etc*. The committee also looks after social matters in the village and also encourages villagers to take up voluntary activities like setting up of community mangrove nurseries, afforestation drive, repair of roads and breaches in the embankment, renovation of *aila* affected freshwater canal, *etc.* (Members: 20; M: 14, F: 6)

Regular meetings of the VCRMC are held in the small office of Village Resource Centre (VRC) established by Nimpith KVK at a central point in the village.

Some of the major decisions taken by the committee so far are:

- Collection of "sundari"and other mangrove seeds from banks of river Matla by the villagers
- Renovation of the salinity infested 4 km long fresh water canal
- Transplanting of sundari saplings on the river side of the embankment
- Introduction of ornamental bird rearing and stress tolerant fish culture
- Amount to be contributed by the beneficiaries in the revolving fund and for obtaining the services of different farm implements from the custom hiring center
- Organizing animal health camp
- Celebration of important Days

1.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC (as on 31.05.2017)
South 24 Parganas	302 ha	Revolving fund: Rs. 2,26,159.00 Custom hiring: Rs. 31,913.00

Impact: In a remote village of Sundarban where people are constantly engaged in negotiating environmental hazards, leave aside using modern agricultural implements, even thinking of a decent livelihood was a distant dream. The situation worsened after 25th May, 2009 when the cyclone *aila* hit the hamlet of Bongheri. Thereafter, when the NICRA project was launched in the village in the year 2011, the rural people living there once again saw the opportunity to surviveand face nature with renewed vitality and zeal.

The different situation specific interventions in the village were further strengthened by providing various user friendly farm implements under the project and a custom hiring centre(CHC) was set up to provide the farmers with need based equipments on hire basis. Implements like power tiller, pump set, conoweeder, paddy thresher and knapsack sprayer were supplied for the custom hiring centre for farmers to hire on rental basis.

Supply of power tiller for the CHC ensured timely ploughing of the field within a short time and also to give a wider coverage in order to satisfy the need of most of the farmers. Interventions like crop diversification, particularly in the *rabi* season,

was taken up under the project in the module of landshaping. For this availability of irrigation water was ensured through harvesting of rainwater in the newly excavated ponds. Thus, for providing irrigation to the *rabi* crops, pumpsets became very much useful for the willing farmers. Moreover, the area often faces the problem of water logging in monsoon due to lack of proper drainage facilities. It was observed that the farmers used the pumpsets to good effect for draining out the excess rainwater from their field, whenever possible, to save their standing crops. One of the popular implements hired by the farmers was the paddy thresher as almost all of them cultivate paddy for their household purpose. Likewise conoweeders and knapsack sprayers also helped the farmers to execute the different interventions timely and in a proper manner. Under the supervision of the VCRMC, the villagers took resolution in a general meeting to fix the following rates for hiring of the implements. All the implements are kept in an adjoining room of the VCRMC. The smooth functioning of the custom hiring center is reflected in the bank account which has a current balance of Rs. 31913.00 even afterinvesting in repairing of power tillers and pump set twice at the end of two years.

Seed bank

A seed bank of paddy was started in the year 2013 with the participation of 17 farmers. It was decided that each of these farmers who were supplied with 10 kg of seed from the project fund, would contribute back the 10 kg of seed to the seed bank from their produce. This step was highly successful and ensured the working of the seed bank with a total of 170 kg paddy seed. Initially this seed was stored by the farmers under the responsibility of one of them who took the initiative to store this seed in his house.

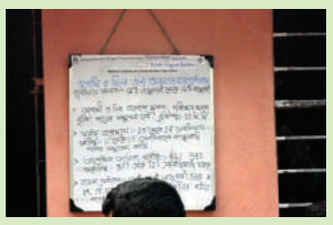
The success of this participatory approach was given a boost by supplying 4 nos. of seed bins to the VCRMC in 2015. During 2015-16 another 4 bins were provided. These bins are now utilized for storing the paddy seeds. Presently, the seed bank contains 450 kg of paddy and 150 kg of Greengram seed for future use.

The success of this approach has now made the VCRMC members to think about procuring more seed bins to store pulse seeds from their fund to meet the rising demand.

NICRA weather station

In a place subjected to the mercy of nature, forecasting imminent changes in the climate may provide the inhabitants with valuable time to save their life, livestock and crops by taking evasive measures. In this direction, establishment of a village weather station at Bongheri came as a great respite for the villagers. For the purpose, Stevenson's screen fitted with thermometers and dry and wet bulbs, rain gauge, anemometer and wind vane was provided under the project. These instruments were fixed near the Village Resource Centre and maintained by the VCRMC members. One of the members was trained to record regular data on maximum and minimum temperature and relative humidity, rainfall, wind velocity and wind direction. The data are recorded in a register and periodically analyzed by the KVK personnel. The data is also displayed in a board outside the VRC in the local language with recommendations for different crops.

Beside this, the KVK has also been collaborating with the Agro-meteorolgy department of the Bidhan Chandra Krishi Viswavidyalaya, Kalyani in providing weekly weather forecast for the NICRA village along with recommendations as per the forecasting.



1.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Climate change	2	50	18	68
Natural Resource Management	8	143	43	186
Crop Management	18	458	146	604
Nutrient Management	3	111	27	138
Integrated Crop Management	1	29	3	32
Crop Diversification	8	151	67	218
Pest and disease management	42	1051	358	1409
Nursery raising	5	101	40	141
Integrated Farming System	1	26	11	37
Livestock and Fishery Management	29	748	573	1321
Fodder and feed management	3	64	32	96
Employment generation	1	10	4	14

1.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Method demonstrations, KMAS Services, Farmers day, Campaign, Popular extension literature, Animal Health Camp, ICAR Foundation day, World Soil Day, NICRA Workshop at ATARI, Kolkata, Scientist visit to field	1871	3089	1316	4405

1.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analyzed	SHC issued	No of Farmers involved
312	312	312	211

1.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs.)
RKVY	Land shaping and Ail cultivation	15,00,000/-
IWMP	Land shaping and Ail cultivation	5,00,000/-
ATMA	Crop demonstration, SHG	2,00,000/-
Irrigation Department	NRM	15,00,000/-
SDB	NRM	2,00,000/-
Total		**39,00,000/-**

Impact: Seeing the unity and enthusiasm among the NICRA villagers, the Government Departments came forward to strengthen the life and livelihood of the cyclone prone Bongheri village. Some of the major works carried out during the project period are pucca river bund construction, road construction, sluice repairing, etc. Now the State Agriculture Department has included the Land Shaping technology in its RKVY scheme. Many farmers are benefitted by these Government Schemes.

1.10 Success stories of NICRA Village Farmers

1. Land shaping helps to rebuild agriculture in Aila hit village

Sri Ananta Naskar is a hard working farmer having 0.26 ha of low lying land. During monsoon season the entire land remains submerged leaving him no other scope than growing low yielding traditional paddy varieties like Morishal. In winter and summer he had no access to irrigation water. He could hardly earn Rs. 4000 to Rs. 5000 per year from farming.He used to migrate to the sub urban areas during winter and summer in search of petty jobs like, daily labourer in construction sites, etc. The women and young members remain at home unsecured during his absence. The "*Aila*", a super cyclone, in 2009, destroyed his only crop of the year. The land was rendered saline that didn't yield any crop for the next two years.

Sri Naskar came to know about the Land Shaping technology in a training programme under NICRA. Later on he visited the KVK to see some of the land shaping plots. He agreed to convert his low lying (2-2.5 ft depth water stagnation), non-profitable piece of land into a medium land (1-1.5 ft water stagnation). A pond was dug in 1/5th area and with the dug up soil the remaining portion of the land was raised by 1 ft. Now the plot could be used for growing short duration HYV varieties like *IET 5656, Swarna sub-1, etc.*, that gave a minimum yield of 40 q/ha. The land and pond embankments were also raised and broaden at the top to accommodate vegetable cultivation throughout the year. The pond water ensured irrigation in winter. So he could take a second crop and take up fishery.

Through landshaping and rainwater harvesting technology, he cultivated HYV paddy in *Kharif* season and okra, chilli, tomato, and brinjal in *rabi* season. He earned a total of Rs.5500/- from paddy, Rs. 37500/- from vegetables and Rs. 8350.00 from fish cultivation in the year 2011-12.

Within the span of just 1 year, Sri Naskar earned a net profit of Rs.32000.00from his small piece of land. Today he is cultivating three crops (Paddy-Potato-Cucurbits) apart from fishery and duckery and earns a net profit of Rs. 1.00 lakh per annum. He does not go out of his village. He is a happy farmer now and his wife is happier.

2. Resilience in fish production through introduction of stress tolerant fish

Another problem of the area is occasional ingress of brackish water into the fresh water ponds, leading to loss of entire fish stocks. Considering this, salinity tolerant fish, like Tilapia, has been introduced into the vulnerable ponds to sustain pisciculture even in extreme situation. The fish is hardy and omnivorous in nature and can tolerate fluctuation in water temperature also.Tilapia has good consumer preference and is also popular with the local farming community. However, due to its prolific breeding habit, the fish over populates the pond quite easily leading to reduced growth of all the fish present and also lowers fish production.

Hence, monosex tilapia (only male) of *Tilapia nilotica*, procured from the farm of a KVK trained entrepreneur, is converged with NRM interventions like landshaping and renovation of defunct ponds during the past two years. The main aim of introducing monosex tilapia in the NICRA village is to provide the farming community with a stress tolerant fish which can withstand drastic changes in the climate and at the same time maintain a sustainable production from a water body.It was observed that by stocking tilapia @ 5000 no. in 0.13 ha pond, a production of 200 – 400kg could be achieved within 8-11 months. At an average selling price of Rs. 100/kg, an income of Rs. 20000/8- to Rs. 40000/- could be obtained which gives the farmers just enough profit to sustain their daily protein requirement.

3. 'Kripakhali' canal – the lifeline of Bongheri farmers Background

Bongheri, a frequent flood prone and cyclone hit coastal village in Sundarban area, is still on its way to recover from the after-shock of "*Aila*". The 4-km long Kripakhali Canal was the only source of fresh water irrigation for 560 farm families covering an area of 200 acre. During *Aila* (super cyclone coupled with flooding) in 2009, the canal was heavily silted up along with brackish water inundation. This resulted in severe reduction of storage capacity and rendered the available water unsuitable for agricultural usage. The defunct sluice gate could not control the further backflow of sea water into the canal. Farmers had no scope of taking a second crop during pre-*kharif* (Summer) or post-*kharif* (*Rabi*). Even the productivity of *Kharif* paddy reduced from 21.12 q/ha in 2007 to 15.86 q/ha in 2010. Area under chilli and other vegetables reduced drastically leading to severe limitation for scope of agricultural labour work. Farmers and farm women had no other choice than opting for seasonal migration during the lean period. The rate of migration increased to 32%. A daily migrant had to travel 40 minute by cycling, 4 hour by train/bus/auto and another 40 minute by walking to reach Kolkata and back. 1736 Kilo Calories of energy were lost, only due to travel, per person per day.

The National Initiative on Climate Resilient Agriculture (NICRA) was launched in this village in 2011 with a promise to bring the smile back to the faces of these 560 farm families. A planned intervention along with the active support of the villagers helped them not to wait longer. The villagers could reap the harvest in the very next season after the intervention.

Intervention

Under the NRM activities of NICRA project, the canal was renovated including re-excavation of the silt all along the 1-km length with a depth varying from 3-4 ft, strengthening of the canal embankment and plantation of trees along the embankment. The defunct sluice gate was renovated through financial assistance from SDB, GoWB.

Impact: As a result, 3600 acre-inch of fresh rainwater could be harvested during 2012 monsoon season. The assured irrigation facilities, thus created, helped the farmers to take up Sunflower in 100 acre, Chilli in 50 acre and other vegetables in another 50 acre. The earth work created job opportunity of 9000 person-days during the period of canal renovation. The increase in agricultural activities assured another 6000 person-days of labour work for the villagers. The villagers now have a happier option to remain attached with their families through out the year as they can take up cultivation during *Rabi* or Summer season. The rate of migration has come down to 8%. Productivity of paddy (now 37 q/ha) has been restored well above the "before *Aila*" average. More importantly, with the assured fresh water irrigation, farmers now have a diversified cropping

choice in the form of different vegetables as well as Oil seeds (sunflower) and Sugarcane. Thus, the overall intervention helped to return Bongheri its "lifeline" of agriculture in true sense.

4. Home based production of *Trichoderma* helps to reduce use of chemical pesticides

In Sunderbans of coastal South 24 Parganas district of West Bengal, there is a growing intensity of soil borne pathogens causing damping off, root rot, collar rot, stem rot, vascular wilt and pests like *Spodopteralitura*, *Leucinodesorbonalis*, thrips, jassids and mealy bugs. Chemical intensive pest management is the most preferable practice of the farmers of this district. Farmers once entangled into the vicious cycle of chemical sprays do hardly recover from the increased cost of cultivation. Indiscriminate use of chemical pesticides, on the other hand, not only threatens the health of the direct consumers but also produce undesirable pressure on the entire food chain of the ecology. Use of biocontrol agents like *Trichoderma viride*, *Pseudomonas fluorescens*, *Metarhiziumanisopliae*, *etc.*, alone or in combination with chemicals, can reduce or eliminate the ill effects of chemicals on human as well as environmental health. As bio-control agents are very delicate and sensitive to theirecological preferences, their adaptation to any new environment (apart from where it has been isolated) is challenging. It has been noticed that a bio-control agent giving a very good performance under *invitro* condition often fails to do so under field condition, especially under the saline and submerged conditions of South 24 Parganas. On the other hand, pesticide dealers/retailers are also least encouraged to promote bio-pesticides due to less self-life of the product, low profit margin and lack of overall demand among farmers. All these together have resulted in limited adoption of bio-pesticides among the farmers. Under such circumstances KVK, Nimpith came out with a novel idea of empowering the rural farmers in producing certain bio-control agents at homestead level. The protocols standardized by National Institute of Plant Health Management (NIPHM), Hyderabad, were followed for this purpose. Rural youths were trained and demonstrated on the "on-farm mass production of microbial pesticides (*Trichoderma viride*)". Ten youths were assisted with necessary inputs for production. They found it very interesting and are now actively engaged in production of *Trichoderma* at their home. Ashim Mondal (21 yr) is now producing *Trichoderma* for seed treatment, seedling treatment and soil treatment. Seedling treatment with *Trichoderma* completely checked crown rot in chilli this year compared to 30% crop loss in last year. Seeing this result, 10-15 neighbouring farmers have requested Ashim to supply them *Trichoderma* for their use. Now Ashim does not want to go to the city, instead he would love to assist his father in farming.Considering the paucity and timely un-availability of quality bio-control agents in the markets of remote areas in Sundarbans, this initiative will certainly bring smile to the farmers who are already aware of the malady of chemical farming. And hope this small effort help us to take a little step towards sustainability of soil health and production of Green Food.

5. Floating seedbed of paddy to escape early season flooding

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

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

a. Timely preparation of seedbed
b. Escape from submergence
c. Early transplanting

Brief description: The entire seedbed is prepared on a bamboo frame that can float over water so that the paddy seedlings are protected from submergence during excess rainfall.

Materials required: bamboo split, string, polythene sheet/ banana leaves, soil and compost, seed, plastic vessels

Process:

- A 10ft x 4ft size bamboo frame is prepared
- A polythene sheet is covered over the bamboo frame and a thin layer of top soil is spread over it.
- The frame is either fixed with bamboo poles at four corners and manually lifted with the rise of water level or fixed with empty plastic vessels to keep it floating.
- Paddy seeds are sown on the floating seedbed

Economics of the intervention:

Crop yields (kg/ha) or productivity of the systems as applicable	Variety: Dudheswar 33 q/ha
Expenses incur (Rs/ha/year)	Rs. 39000/ha/year
Net returns (Rs/ha/year)	Rs. 27000/ha/year
B:C ratio	1.69

Specifications of the practice

- Seed rate of paddy: 50kg/ha
- Floating seedbed size: 10ft x 4ft
- No. of floating seedbeds: 25no./ha
- Age of seedling at transplantation: 24 days

2. Coochbehar

2.1 Village information:

Name of the village and district	Village : Khagribari; District : Coochbehar
No. of households	1686
Total cultivated area (ha)	2010- 534. 2016 - 548
Area under rain-fed cultivation (ha)	Initial (2010) : 362 (68 % of total cultivated area) Present (2017) : 301 (55 % of total cultivated area)
Major soil type (2016)	Sandy Loam : 395 , Loam : 66 , Sandy : 87
Climatic vulnerability of the village	Heavy rainfall

2.1.1 Rainfall trend (mm):

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

2.1.2 Details of climatic vulnerability

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

2.1.3 Predominant farm enterprises

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

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

iii. **Area and productivity of major crops:**

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

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

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

v. Cropping intensity (%): 198%

vi. Horticulture crops:

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

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

Year	Source of irrigation	Area (ha) under irrigation
2011-12	Bore well, pond	185
2012-13	Bore well, pond	196
2013-14	Bore well, pond	201
2014-15	Bore well, pond	211
2015-16	Bore well, pond	225
2016-17	Bore well, pond	246

viii. Livestock:

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

ix. Milk productivity (L/milch animal/day):

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

x. Details data about inland fisheries practiced:

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

2.1.4 Resource availability

2.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status
2011-'12	Canal for drainage and irrigation	2000 m	Needs renovation and desilting
2012-'13	Community water bodies	2000 m	Good

2.1.4.2 Summary of Water harvesting interventions

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

2.1.4.3 Status of farm mechanisation before start of NICRA:

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

2.1.4.4 Socio-economic status:

a. **No. of households: General-** 596; **OBC**-84 ; **SC**- 932; **ST**-74
b. **Literacy rate (%): Male:** 78.12 **Female:** 69.33
c. **Workers engaged in agricultural activity (%):** 29

MODULE WISE INTERVENTIONS

2.2 Module I: Natural Resource Management

2.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Green manuaring (dhaincha) in Paddy	48	7.6	43.1	26450	29580	2.11
Brown manuaring in Paddy	28	3.6	42.1	26450	28280	2.06
Azolla in Paddy	42	6.8	41.2	26450	27110	2.02
Zero Tillage in wheat	313	53.55	29.5	26250	23900	1.91

Zero Tillage in Maize	45	7.79	66.5	32380	39120	2.05
Repair of bund	40	10.8	41.2	26450	27110	2.02
Organic mulching in vegetables (Tomato, brinjal)	64	2.25	260	120000	260000	2.17
Plastic mulching Okra, cucumber	29	5.22	310	114000	134000	2.17
Total	**609**	**97.61**				

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

2.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	33	7.05	10	51000	115000	3.96
Renovation of canal	1	2	-	-	-	-
Bund making leveling in paddy field	12	2	41.2	26450	27110	2.02
Renovation of irrigation channel	42	9.6	42.1	26450	28280	2.06
Total	**88**	**20.65**				

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

2.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	313	53.55	29.5	26250	23900	1.91
Sowing of paddy with ZTD machine	15	2.4	39.2	25330	25630	2.01
Sowing of lentil with ZTD machine	46	7.4	10.10	15250	30200	2.98
Sowing of Maize with ZTD	45	7.79	66.5	32380	39120	2.05
Total	**439**	**71.14**				

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

entire growing season of paddy. Saving of Rs. 7500/- per ha towards mandays requirement and Rs. 1200 per ha towards fuel consumption during land preparation. The technology has resulted in about 28% increase in grain yield, saving of cost in the tune of Rs. 6500/- towards lands preparation and irrigation. 14.28 % increase in grain yield. Saving of 20 L. of diesel per ha towards land preparation and irrigation. Saving of 30 mandays per ha towards entire growing season of paddy. Saving of Rs. 7500/- per ha towards mandays requirement and Rs. 1200/- per ha towards fuel consumption during land preparation.

2.2.4 Artificial ground water recharge:

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 paddy fields (2.5 fit height and width 9 inch width)	40	10.8	41.20	26450	27110	2.02

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

2.2.5 Water saving irrigation methods:

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
Application of biofertilizer in rice (var. *MTU 7029*)	96	16.2	44.1	26450	30880	2.17
Vermi-compost from biodegradable wastes	83	24	7.5	2100	4500	2.14
BBF in Brinjal	38	4.2	301	120000	150900	2.25
BBF in cucumber (var. *Malini*)	32	3.30	310	114000	134000	2.17
Total	**249**	**47.7**				

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

2.2.6 Other Demonstrations:

Table. Performance of other demonstrations

Technology demonstrated (During 2011-12 to 2016-17)	No. of farmers	Area (ha)
Soil test based nutrient application	364	59
Cleaning & renovation of old farm pond	33	7.05
Planting forest trees for biodiversity, forestation	37	3.6
Soil test based nutrient application (FYM/ inorganic fertilizer)	364	59
Bio pesticides in tomato	14	2
Total	**812**	**130.65**

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

as well as cost of procurement of fertilizers and also reduced the harmful effects of heavy use chemical fertilizers than the required amount. Bio pesticides use has led the farmers of the village to be interested and is training themselves for preparing Bio pesticides in their own villages.

2.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

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

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

2.3 Module II: Crop Production

2.3.1 Introducing droughtresistant varieties:

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
Tolerant Varieties to submergence (*SS-1*)	168	26.25	42.40	32.10	32.08	26450	28670	2.08
Maize (var. *DKC 9081*)	45	7.79	66.5	60.40	10.09	32380	39120	2.05
Total	**213**							

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

2.3.2 Introducing flood tolerant varieties:

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 rice variety (var. *Swarna Sub-1*)	168	26.25	42.40	32.10	32.08	26450	28670	2.08
Flood tolerant paddy (var. *Sabita*)	22	3.6	37.4	32.10	16.51	26450	22170	1.84
Total	**190**	**29.85**						

Impact: Around 32% increase in yield over traditional variety MTU-7029. Average net return increase in the tune of Rs. 12490/- per ha. Out total cultivated area of the village nearly 30-35% falls under low to low-medium category of which nearly 50% area under aman paddy cultivated area is covered by the variety. The demonstration was carried out in the last year only in very low land areas. The same needs to be continued 2 years more to judge the acceptability of the variety for specifically low land areas.

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

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
Short duration rice (var. *GB-1*)	198	31.5	43.5	36.8	18.21	26450	30100	2.13
Wheat (var. *DBW-39*)	29	4.8	29.5	24.8	18.95	26250	23900	1.91
Total	**217**	**36.3**						

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

2.3.4 Water saving paddy cultivation methods:

Table.Performances of water saving technologies for paddy cultivation

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

Impact: Though the technology has shown high potentially in *rabi* paddy still it has not been accepted by farmers due to some factors. However upon introduction of paddy transplanter machine and following the principal of water management as followed in case of SRI same potentiality has been observed and now it is gradually becoming popular.

2.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

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

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

2.3.6 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

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

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

2.3.7 Other Demonstrations:

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
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (*WBU-108*) in jute *AZO-PSB* fallows with INM	88	11.60	8.50	6.60	28.78	14250	28250	2.99
Integrated crop management of lentil (*Maitri*)	67	11.3	9.20	7.4	24.32	14500	26900	2.86
Integrated disease management in vegetables (brinjal)	26	4.2	330	270	22.22	123000	141000	2.15

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

2.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		Economics of demonstration (Rs/ha)		
			Demo	Local	Gross Cost	Net Return	BCR
Quality legume fodder Sudan Grass	29	1.94	125	-	8900	7200	1.92
Fodder production of Maize	30	2.9	120	-	10600	7200	1.78
Total	**59**	**4.84**					

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

2.4.2 Improved fodder/feed storage methods:

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
Others (feed enrichment with urea and molasses)	62	68	2.16 lit/ day/ livestock	1.69 lit/ day/ livestock	27.81	6850	3690	1.52
Feed enrichment with mineral mixture	320	406	2.28 lit/ day/ livestock	1.69 lit/ day/ livestock	34.90	7100	4850	1.68
Total	**382**	**474**						

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

2.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	2010	8120	Mortality Rate -14%	Mortality rate-34	Reduction in mortality rate by 20%			
Vaccination HS,BQ	680	2390	Mortality rate- 19%	Mortality rate-41%	Reduction in mortality by 22%			
Deworming (Feben-dazole) & Mineral mixture	990	2480	2.36 lit / day/ livestock	1.69 lit/ livestock/ day	39.60	7800	5900	1.76
Animal Treatment Camp Butox, Prajana, Sulpha Dimadin, Oxytetra cycle	540	1280	-	-	-	-	-	-
Total	**4200**	**14270**						

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

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	20	20 no	16	13	23.08	56000	137000	3.45
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus and lata species cultivation	33	33 no	10	7	42.85	51000	115000	3.96
Total	**53**	**53**						

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

2.4.5 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Replacement of local breed with Khaki Cambell	47	47	285egg/ year/ bird	160 egg/ year/ bird	78	290/bird/ year	1420	5.90

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

2.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity		No. of farmers
	Name of crops / Commodity groups / Implements	Technology used in seed / fodder bank & function of groups	
Seed bank	Rice- Drought tolerant/ Short Duration Var. RajendraSweta,Naveen,JaldiDhan 13,Madhuri	Quality seed	250
Commodity groups	Kitchen Gardening	Improved Variety Seed	90

2.5.1 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	Revenue generated (Rs.) Total under VCRMC
Cooch Behar	93700

2.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	82	1931	147	2078
Crop Management	99	2255	73	2328
Nutrient Management	63	1452	77	1529
Integrated Crop Management	29	625	31	656
Crop Diversification	33	476	39	515
Resource conservation Technology	36	750	53	803
Pest and disease management	90	2106	90	2196
Nursery raising	25	602	26	628

Integrated Farming System	6	119	23	142
Livestock and Fishery Management	90	1892	330	2222
Fodder and feed management	8	169	32	201
Employment generation	12	181	86	267

2.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Method demonstrations, KMAS Services, Farmers day, SHG, Popular extension literature, Animal Health Camp, World earth day, Woman health and nutrition, Technology week, Scientist visit to field	1533	9690	1451	11141

2.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table. SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
450	396	272	394

2.9 Convergence Programme:

Table. Convergence of ongoing development programmes / schemes

Activity	Department	Total	
		Area/no.	Value (Rs.)
Renovation of drainage channel	Department of Soil and water conservation	2 km	700000
Renovation of existing pond	Department of Forestry	3 nos	300000
Azolla	Department of Animal husbandry	600 unit	180000
Banana bunch cover	NABARD	5ha	210000
Vermicompost production	MGNREGS, Khagribari gram panchayat	125	25000
Azolla production	MGNREGS, Khagribari gram panchayat	300	100000
Total			**1,51,5000**

2.10 Success stories of NICRA Village Farmers

1. Renovation of existing pond for harvesting, storing and recycling of rain water

A large area of the village remains uncultivated during *rabi* season as only 32% of total cultivated area is irrigated using bore well by lifting ground water. Though there exist a number of small and large size water bodies but most of them are seasonal and can not be used as source of irrigation during critical stages of *rabi* crops because of the fact that-

Pond renovation work

1. Water holding capacity of the soil is very poor due to coarse texture
2. Average depth of ponds ranges from 5.5 - 7.0 ft from the ground level.

On the other hand the village Khagribari of Cooch Behar district experiences average annual rainfall of about 3000 mm, received mostly during the period from April-August. Considering the huge scope of harvesting the rain water, Cooch Behar KVK undertook the programme to renovate a number of existing water bodies with the following objectives.

1. To utilize the harvested rain water for life saving irrigation to *rabi* crops emphasizing *rabi* vegetables.
2. To convert the seasonal water bodies into perennial one suitable for year round pisciculture.

Total 15 numbers of ponds having average depth of 5-7 ft. were selected for renovation at different corners of the village which remains dry December onwards but ponds having depth of 9 ft. or more can retain water throughout the year. Considering this

depth of selected ponds was increased from 5.5 - 7.0 ft. up to 10.5 - 11 ft (from ground level), so that water to be stored in the water bodies can be used for life saving irrigation to *rabi* crops with special emphasis on vegetables during mid December to mid March. List of 15 farmers, along-with respective increase in storage capacity of the water bodies as well as volume of water used for irrigation presented in the Table below. Details of area coverage under irrigation and no. of irrigation along with net income against are shown in the Table below.

Depth of water (11.6 ft) at renovated pond of UtpalDey

Depth of water (5.6 ft) at pond ofPradip Roy (not renovated)

Table: Effect of pond renovation on area coverage under irrigation and net income

Crop	Area(ha)		No. of irrigation		Yield (q/ha)		Net income (Rs. / ha)	
	2012-13	2010-11	2012-13	2010-11	2012-13	2010-11	2012-13	2010-11
Potato	24	7.8	1	1	255.0	243.0	73410	70400
Wheat	12	2.3	2	1	31.24	27.56	10371	7811
Total	**36**	**10.1**						

Observation

- Total area under cultivation during *boro* season has been increased by 25.9 ha and thereby increasing the cropping intensity from 183% to 188%.
- Total Production of potato & wheat increased by 4224.6 q. (6120-1895.4) & 311.50 q. (374.88 – 63.38) respectively.
- The yield increase recorded in case of potato may be due to timely irrigation; where as in case of wheat yield increase was due to higher number of irrigation.

Horizontal Spread

- Field day was organized with involvement of local Panchayet and farmers from nearby locality. Number of pond owner farmers of the NICRA adopted village showed keen interest to renovate existing pond and approached to KVK as well as Gram Panchayet for financial help as it was not possible for them to execute the work because of high cost involvement. Five nos. of pond has also been renovated with financial support from MGNREGA.

2. Solid Waste Management through Composting

Cowdung manure was only organic manure used by the farmers of the village but the quality of the manure was very poor due to unscientific management. Further, farmers were not at all aware about the recycling of rural farm waste, kitchen waste *etc*. for preparation of organic manure. Considering the above, Cooch Behar Krishi Vigyan Kendra initiated demonstration programme on preparation of compost through NADEP method using locally available organic sources like cowdung, farm/kitchen waste and other locally available organic materials. During three years of the project, 50 nos. of demonstration were carried out at different corners of the village and results are shown in the Table below.

Table: Effect of demonstration on use of organic manure

Average production (ton/year/tank)	Quality of compost	Quality of organic manure before NICRA	Organic manure use before NICRA (Ton)	Organic manure use after NICRA (Ton)
8.1	pH-6.9, OC-23.06%, Tot. N-1.06%, Tot. P2O5-1.12% Tot. K20-0.82%	pH-5.9, OC-22.93%, Tot. N-0.42%, Tot. P2O5-0.18% Tot. K20-0.23%	2,100	2,120

Observation

- Use of organic manure was increased in the tune of 20 ton
- Improvement in quality of organic manure
- Increase in motivation for production and use of compost among other farmers

3. Resource Conservation through Zero Tillage in Wheat

The wheat farmers of *Terai* region are facing the problem of late sowing. Delayed harvesting of *aman* paddy results in delayed sowing of wheat. In *Terai* region, sowing is mostly taking place during later half of December, though November 18-25 is considered as the ideal time for getting maximum yields. For land preparation of wheat, 5-6 ploughing followed by 2 cross harrowings are generally performed and seeds are

broadcasted without application of balanced dose of fertilizers. Considering this CoochBehar KVK took initiative to promote zero tillage technology in wheat for cutting down the time required for land preparation as well as conservation of resources. Large scale demonstration programme was carried out over 28.80 ha involving 179 farmers.

Table: Effect of zero tillage on yield and net return

Technology	Avg. Yield (q/ha)		Net return (Rs./ha)	BCR
	Grain	Straw		
Demonstration	33.20	46.48	19740	1.98
Conventional	24.75	38.95	6998	1.29


Observation

- 34.14 % increase in grain yield
- Saving of 26.02 lit. of diesel per ha towards land preparation and irrigation
- Saving of 43 mandays per ha towards entire growing season of wheat
- Saving of Rs. 8,041 per ha towards mandays requirement and Rs. 1,166 per ha towards fuel consumption during land preparation

4. In-situ moisture conservation

The village receives no or minimum rainfall during winter months and as a result cultivation of *rabi* vegetables and fruits like banana require exploitation of ground water lifted by bore-well. So, demonstration programme was organized by CoochBehar KVK to promote in-situ moisture conservation methods like organic mulching in tomato involving 30 farmers


Table: Effect of organic mulching on irrigation in tomato

Technology	Irrigation			Yield (t/ha)	WUE (kg/ha-cm.)
	No.	Water required (ha- cm.)	Cost (Rs./ ha)		
Conventional	13	51.53	11,115	26.02	504.95
Demonstration	9	39.77	7,695	26.15	657.53

covering 2.54 ha area, poly-mulching banana involving 9 farmers covering 1 ha area. Results of demonstration are presented in Tables.

Observation

Saving of 11.76 ha-cm irrigation water (29.55 %), reduction in cost of irrigation by Rs. 3,420.00 /ha, 30.21% increase in WUE, Less weed population, Fuel savings 57 lit. diesel/h

Table: Effect of poly-mulching on irrigation in banana

Technology	Irrigation			Yield (t/ha)	WUE (kg/ha-cm.)
	No.	Water required (ha- cm.)	Cost (Rs./ ha)		
Conventional	12	43.28	9,270	46.84	1,083
Demonstration	08	33.34	6,180	47.14	1,415


Observation

Saving of 9.94 ha-cm irrigation water (29.8 %), Reduction in cost of irrigation by Rs. 3,090.00, 30.72 % increase in WUE, Less weed population, Fuel savings 51.49 lit. diesel/ha

3. Malda

3.1 Village information:

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

3.1.1 Rainfall trend (mm):

Year	Normal rainfall (mm)	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)
2012	1395.11	76.4	0	0	10
2013	1413.5	88.5	2	0	4
2014	1184.53	78.7	0	1	7
2015	1364.62	83	2	1	8
2016	1479.10	87.6	4	2	2

3.1.2 Predominant farm enterprises:

i. Major cropping system:

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

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

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

iii. Cropping intensity (%): 196.70%

iv. Horticulture crops:

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

v. Area under fodder cultivation and number of farmers growing green fodder:

vi. Livestock:

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

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

3.1.3 Resource availability:

3.1.3.1 Status of common pool resources (CPRs)

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

3.1.3.2 Summary of Water harvesting interventions

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

3.1.3.3 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village: i. Bullock plough: 116; **ii. Bullock cart:** 12; **iii.Thresher:** 05

3.1.3.4 Socio-economic status:

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

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

MODULE WISE INTERVENTIONS

3.2 Module I: Natural Resource Management

3.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Zero Tillage in wheat	305	41.16	43	52200	25700	1.98
Organic mulching in vegetables (Tomato, brinjel)	60	1.06	242	82000	128000	2.5
Mulching	80	0.93	225	85000	165000	2.94
Total	**445**	**43.15**				

Impact: Zero Tillage Wheat: 36.20% yield increase with BC ratio of 1.98 over traditional practice with BC ratio of 1.13 *i.e.* the varietal demonstration in RCT condition is much better than the traditional practice.

Mulching of Tomato and pointed gourd: Around 47% yield increase due to better moisture intension capacity through paddy straw mulching and Less weed immergence.

3.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	32	0.4/unit	38.9	205000.00	389000.00	1.89
Renovation of canal	450	500 mtr	102.5	152500	112850	1.74
Natural mulching	80	0.93	225	85000	165000	2.94
Total	**562**					

Impact: Renovation of pond for fish production and irrigation: Before introduction of NICRA Project, these ponds are mainly used for irrigation and jute retting purposes. After introduction of NICRA Project, these areas are also used for fish production and the fish production is increased to 189% in terms of economic return.

After renovation of existing canal in NICRA adopted village, crop production is increased due to availability of water during dry season.

Natural Mulching: The production is increased due to adding of organic mulch *i.e.* Paddy straw, leaves. This technology also improves soil health nutrient availability. It is also improve water holding capacity of soil.

3.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	305	41.16	43	52200	25700	1.98
Sowing of lentil with ZTD machine	20	3	13.25	17250	81900	4.74
Total	**325**	**44.16**				

Impact: Sowing of wheat with ZTD machine: Around 36.20% yield increase with BC ratio of 1.98 over traditional practice (BC ratio of 1.13) *i.e* the sowing of wheat with ZTD machine is much better than the traditional practice.

2. Sowing of lentil with ZTD machine: Around 40 % yield increase with BC ratio of 4.74% over traditional practice (BC ratio 1.34) which indicate that the ZTD sowing better result.

3.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

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

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

3.2.5 Water saving irrigation methods:

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
Vermi-compost from biodegradable wastes	44	8.665	8.62	17250	32375	2.87

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

3.2.6 Other Demonstrations:

Table. Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Effective utilization moisture through seed production of blackgram after flood	1320	200	13.65	16825	50153	3.99
Cleaning & renovation of old farm pond	32	0.4/unit	38.9	205000.00	389000.00	1.89
Total	**1352**					

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

After renovation of existing canal in NICRA adopted village, crop production is increased due to availability of water during dry season.

3.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Pond	09	6400 cm^3	900	30 ha	189
Canal	01	50000 cm^3	850	150 ha	200

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

3.3 Module II: Crop Production

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

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
Wheat (*DBW39*)	150	20	38.4	28.5	34.73	21375	34305	2.61
Lentil (var. *WBL77*)	30	4.0	15.75	11.25	40.0	17250	81900	4.74
Mustard (var. *NC-1*)	24	11.23	10.32	7.40	39.45	16875	16174	1.96
Mustard (var. *B54*)	30	04	10.05	10.10	47.8	16875	15750	2.07
Total	**234**	**39.23**						

Impact: Wheat: 36.20% yield increase with BC ratio of 1.98 over traditional practice with BC ratio of 1.13 *i.e* the varietal demonstration with advancement of sowing date is much better than normal sowing dates. lentil (*Maitri*): 40 % yield increase with BC ratio of 4.74% over traditional practice (BC ratio 1.34) by flowing integrated crop management practice. **Mustard** (*NC-1*) **:** 39.45% yield increased with BC ratio 1.96 over traditional practice by replacing old variety. **Mustard** (*B 54*) **:** 47.8% yield increased with BC ratio 2.07 over traditional practice by replacing old variety.

3.3.2 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI (var. *MTU -7029*)	115	15.5	61.02	41.25	47.92	73224	41250	2.29
DSR (var. *MTU-7029*)	72	9	42.5	30.45	39.57	49500	8250	1.2
Total	**187**	**24.5**						

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

3.3.3 Community nurseries for delayed monsoon:

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 cauliflower	20	0.03	9	7	30.13	12000	6000	1.5
Community nursery of brinjal	25	0.03	7.5	8	42.23	8000	6890	1.86
Community nursery of tomato	20	0.03	15	12	62.3	10000	8760	1.87
others	35	0.03	8	7	56.32	13546	7600	1.56
Total	**100**	**0.12**						

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

3.3.4 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize (var.X 92 as main crop)+Ladies finger (HYV)	130	17.33	90+5	73	30.13	45000	68400	2.52
Chili (var. Bullet as main crop)+tomato(HYV)	20	1	75+240	275	14.54	72000	64500	3.02
Cucurbits/Gourd + solanaceous vegetables (Multitier horticulture)	10	1.0	30+322	217	62.2	127500	113700	1.89
Total	**160**	**19.33**						

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

3.3.5 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (NC-1)	24	11.23	10.32	7.40	39.45	16875	16174	1.96
Nutritional garden	75	0.5	185	97	90.7	90000	47000	1.91
Tomato under mulching	33	0.33	322	225	43.11	131250	142875	2.08
Total	**132**	**12.06**						

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

3.3.6 Other Demonstrations:

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
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (WBU-108) in jute AZO-PSB fallows with INM	1320	200	13.65	7.5	82	16825	50153	3.99
Integrated crop management of mustard (NC-1)	24	11.23	10.32	7.40	39.45	16875	16174	1.96
Integrated crop management of lentil (Maitri)	20	3	13.25	8.15	62.5	17250	81900	4.74
Integrated fish farming	02	0.5	-	-	-	20000	15000	1.75
IFS	02	2	-	-	-	95000	67000	3.39
Total	**1368**	**216.73**						

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

3.4 Module III: Livestock & Fisheries

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

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
Fodder cultivation with improved varieties Hybrid Napier	105	7.85			145% milk production			
Total	**105**	**7.85**						

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

3.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	1650	12 nos			40% milk and 23% wt gain in goat			

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

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	27	14	58	31	187%	234000.00	346000.00	2.47
Total	**27**	**14**						

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

3.4.4 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	% increase
Replacement of local breed with Khaki Cambell	25	25 unit	165% egg laying
Addition of mineral mixture	80	03 nos/unit	140% milk productio
Low cost Azolla production as supplementary cattle feed	50	50	159% milk productio

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

3.4.5 Improved shelters for reducing heat stress in livestock:

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

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

3.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Blackgram, Paddy, Lathyrus	12.3	Seeds is used in kharif season by the farmers.	10	02
Commodity groups	Kitchen Gardening	15	Improved Variety Seed	20	10
	1group Fingerlings fish		Fish farming		
Custom hiring centre	Water pump, power sprayer, weeder, SRI marker, sprayer, Farm implements, Drum Seeder	20	VCRMC is maintaining this	30	25
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1 unit	Data interpretation of AWS and forecasting/Advisory		

3.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Brajalal Tola

3.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

Table. Revenue generated through Custom hiring Centers and VCRMC in KVKs

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Malda	2011-12 to 2016-17	42054.00

3.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	11	152	86	238
Crop Management	13	267	63	330
Nutrient Management	09	174	51	225
Integrated Crop Management	13	267	63	330
Crop Diversification	12	273	74	347
Resource conservation Technology	8	215	10	225
Pest and disease management	16	425	40	465
Nursery raising	2	41	19	60
Integrated Farming System	2	50	10	60
Fodder and feed management	2	35	15	50
Employment generation	5	55	30	85

3.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Method demonstrations, KMAS Services, Farmers day, Campaign , Popular extension literature, Animal Health Camp, Woman health and nutrition, Technology week, NICRA Workshop at ATARI, Kolkata, Scientist visit to field	1128	7267	2141	9408

3.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table: SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
425	20	400	400

3.9 Convergence Programme:

Table: Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
MGNREGS	Reconstruction of Road	650000/-
MGNREGS	Reconstruction of drainage channel	450000/-
Total		**1100000/-**

3.10 Success stories of NICRA Village Farmers

1. Installation of crocodile bund:

The adopted villages under NICRA Project are situated in flood prone area and nearest to the river Ganges. Recurring incidence of flood and incoming of huge water in the villages not only damage the standing crops but also house and livestock. Main objective of installation of this type of is to prevent the incoming of huge rush of flood water during rainy season.

2. Vermicompost production using vermibag

Shri Rajendra Kumar Mondal of Village: Brojolaltola, PO: Manickchak, DT: Malda after being exposed from Malda KVK started vermin-compost production using vermibag. Shri Mondal is a resident of flood prone area and also a good vegetables farmer. His earlier structure was washed away due

to severe flood. Therefore, he was interested to produce bio-fertilizer in vermin-bag which is portable in nature.

Production:

1. Size of the bag: 4ftX8ft X3ft
2. Production: 18 qtl in 2 times.
3. Self consumption: 10 qtl.
4. Amount sold: 8qtl
5. Sale price per kg : Rs. 5
6. Profit: Rs. 4000/-

Vermi-compost is applied in vegetables like tomato, brinjal, chili, cabbage, cauliflower *etc*. After seeing the performance, Mr. Mondal is willing to extend bio-fertilizer production unit by installing more no. of vermi-bag.

Vermi-compost Production in Vermi-bag

3. Cultivation of azolla as cattle feed

The farmers faced huge problems to arrange feed for the live-stock during the flood period. Considering the farmers' problem, the farm families belonging to relatively upland situation is recommended to cultivate azolla as livestock feed. Use of azolla as green fodder for cattle and poultry birds as protein supplement increase income by Rs. 3600 per animal / lactation. In case of milching animals productivity is obtained 3.6 lt/ lactation/ animal/day whereas it is 2.75 lt/ lactation/ animal/day feeding only dry fodder (*i.e.* 31% increase in milk productivity per lactation per animal).

A & N ISLAND KVK

4. Port Blair

4.1 Village information:

Name of the village	Port Mout and Badmashpahad
No. of households	174
Total cultivated area (ha)	103
Area under rainfed cultivation (ha)	Rainfed
Major soil type	Clay loam
Climatic vulnerability of the village	Drought / Cyclone

4.1.1 Rainfall received (mm):

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

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

4.1.2 Details of the climatic vulnerability

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

The very Severe Cyclonic Storm (VSCS) PHAILIN which hit the Odisha coast originated from a remnant cyclonic circulation from the South China Sea. It lay over north Andaman Sea as a well marked low pressure area on 7th October 2013 as reported by IMD. It concentrated into a depression over the same region on 8th October 2013 near latitude 12.00N and longitude 96.00E. Moving west-northwestwards, it intensified into a deep depression on 9th morning and further into cyclonic storm, 'PHAILIN' in the same day evening. Accordingly the depression moved northwestwards and intensified into a deep depression at 0530 hrs IST of 9th Oct. near 13.00N and 93.50E. Moving west-northwestwards, it crossed Andaman Islands near MayaBandar at 1430 hrs IST of 9th Oct. 2013. Later it intensified into a Cyclonic Storm, PHAILIN and moved over east central Bay of Bengal.

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

Rainfall recorded:

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

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

Damage Assessment:

As per the information collected from Directorate of Agriculture, Animal Husbandry and Fisheries and the District Administration by personal contact there was no causality and major damage to agriculture due to *phailin* and *leher* in Andaman Islands. Heavy to very heavy rainfall of around 20 to 34 cm was recorded and wind speed of 40-60 km /hr was forecasted. There was no major damage to standing rice crops except flooding of low lying areas as it coincided with the vegetative phase of rice. There were no reports of loss of livestock except few cases of fowl typhoid (*salmonellosis*) as proper forecast of the possible disease out break has been issued. However, there were very few cases of falling of arecanut trees in the cyclone tract which might account for less than 1% of arecanut plantation areas. In the lowlying areas of Middle Andaman district flooding was observed ranging from one to few hours and erosion of streams (*Louki and Rangat Nallahs*) and adjoining areas. In addition in the coastal areas of Middle Andaman flooding was reported (300 – 500 ha) for few hours which coincided with the high tide. The major cause was drainage congestion.

Tropical cyclone VARDAH (08.12.2016)

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

4.1.3 Predominant farm enterprises

i. **Cropping pattern:** Paddy +Pulses and Vegetables; paddy + Vegetables +vegetables: vegetables +leafy vegetables + pulses

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

iii. **Predominant varieties of major food crops in the village:**

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

iv. **Cropping intensity (%):** Paddy + pulses + vegetables at present the cropping intensity for both the village comes 165% of as compared 100 % before adoption.

v. **Horticulture crops:**

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

vi. **Area under fodder cultivation and number of farmers growing green fodder:**

Year	Source of irrigation	Area (ha) under irrigation
2011-12	Rainfed	5 farmer/ 0.2 ha
2012-13	Rainfed	7 farmer/ 1.5 ha
2013-14	Rainfed	3 farmer/ 3 ha
2014-15	Rainfed	2 farmer/ 0.025 ha
2015-16	Rainfed	6 farmer/ 0.055
2016-17	Rainfed	3 Farmers/ 0.036 ha

vii. **Livestock:**

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

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

Category	No. of Animals
Cattle	17927
Buffalo	985
Goats	27564
Pigs	3075

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

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

viii. **Milk/ Egg & Meat Production:**

Year	Milk (in "000" Tones)	Egg ("in Lack Nos.)	Meat "in ('000' Kgs)"
2011-12	12.259	434.255	145.372
2012-13	11.709	358.548	2553.000
2013-14	9.219	509.989	2573.000

ix. **Details data about inland fisheries practiced:**

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

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

A. Inland water bodies

Minor Irrigation Ponds in A & N Islands used for Pisciculture as on 31st March, 2017

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

B. Reservoirs

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

C. Marine and inland fish production

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

D. Potential fishery resources & infrastructures (based on fsi report) (in mt)

Sl. No	Nation/U.T of A & N Islands	Oceanic	Pelagic	Demersal	Total
1.	India	489200	1357500	458662	2305362
2.	Andaman & Nicobar Islands	60000	56000	32000	148000

E. Exploitation for the last five years (In mt)

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

F. Fishing boats in operation for the last five years

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

G. Fishing gears in operation for the last five years

Sl. No.	Name of the Gears	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Gill Net	2357	2344	2327	2326	4270
2.	Shore Seine Net	31	37	37	37	31
3.	Anchor Net	04	04	04	04	-
4.	Cast Net	975	971	953	950	4411

5.	Hook & Line	3212	3217	3200	3214	15050
6.	Long Line	231	229	227	227	2607
7.	Disco Net	59	58	50	50	-

4.1.4 Resource availability:

4.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before	After
2011-12	Pond	05	05 defunct	NA
2012-13	Pond	05	05 defunct	05 renovated
2013-14	Pond	05	05 defunct	02 renovated
2014-15	Pond	04	02 defunct	04 new created
2015-16	Pond	02	NA	02 new created
2016-17	Sluice gate Convergence	02	02 defunct	02 renovated

4.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

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

4.1.4.3 Status of farm mechanization before start of NICRA: Poor

List of Farm implements available in the village:

i. Deshi (country) plough:
ii. Spade, Garden rake: 76 nos
iii. Knapsack Sprayer: 15 nos
iv. Power tiller: 1 nos
v. Coconut climbing machine: 08

4.1.5 Socio-economic status:

a. **No. of households: General**- 125; **OBC**-45
b. **Literacy rate (%): Male:** 90.27; **Female:** 82.43
c. **Workers engaged in agricultural activity (%):** 63.6%

MODULE WISE INTERVENTIONS

4.2 Module I: Natural Resource Management

4.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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

Technology demonstrated (During 2011-12 to 2016-17)	No. of farmers	Area (ha)	Yield (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Fodder grass on farm bunds	02	0.04		2500	5000	2.6
Mulching (Coconut husk, Paddy straw, Banana leaf)	29	5.5		198050	227885	10.6
Aerial Vegetable cultivation in sloppy land (Bitter gourd)	20	5.6		100900	375360	9.79
Total	**51**	**11.14**				

Impact: Mulching with coconut husk and paddy straw on vegetables and plantation crops (Coconut) was introduced for soil moisture conservation, which reduces the total crop water requirement during the dry spells. It reveals that a higher BCR of 3.7 is obtained for vegetable and plantation crops by practicing the mulching technologies.Mulching with coconut husk and paddy straw on vegetables and plantation crops (Coconut) was introduced for soil moisture conservation, which reduces the total crop water requirement during the dry spells. It reveals that a higher BCR of 1.8 is obtained for vegetable and plantation crops by practicing the mulching technologies. Some of the benefits gained through mulching are as follows:

- It can be incorporated as manures later.
- Influences thermal regime of soil by reducing soil temperature.
- Improves soil moisture storage from rainfall.
- Controls evaporation loss.
- Controls evaporation loss during seed germination.
- Effective utilization of initial soil moisture for crop establishment.

4.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Economics of demonstration (Rs/ha)		
			Gross Cost	Net Return	BCR
Tank cum well irrigation system	9	8.933	890300	813080	14.65
Construction of new dug out pond	6	0.297	420200	43000	2.34
Renovation of pond for fish production and irrigation	1	0.08	-	-	-
New water harvesting structure in the paddy field (Paddy cum fish , Three tier system)	6	1.24	-	-	-
Renovation of old water harvesting structure	1	0.08	-	-	-
Creation of new water harvesting structures through convergence from NAIP Project	6	1.24	-	-	-
Desilting of dug out ponds	14	0.966	85440		
Broad Bed Furrow	7	1.254	176060	16300	3.23
Bund raising of existing small bund	1	0.0187	32400		
Total	**51**	**14.1087**			

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

4.2.3 Water saving irrigation methods:

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
Drip irrigation	3	0.80	-	-	-	-
Vermi-compost from biodegradable wastes	4	0.005	-	-	-	-
Total	**7**	**0.805**				

Impact: Drip Irrigation system: Most of the plantation crops of the islands suffered and yield has been reduced due to the crop water stress during the dry period from mid December to April. Some of the intermittent rainfall needs to be harvested and efficiently applied. For this drip irrigation system has been installed for the plantation crops of the adopted villages. Drip Irrigation system in three farmers' field has been installed to provide life saving irrigation during 5 months of dry period to 0.6 ha of field crops and 0.2 ha plantation crops and spices. The irrigation system has been installed in convergence with the NAIP project of CARI.

Vermi-compost applications in field crops and vegetable cultivation retain more moisture in soil and create suitable condition for better root growth & proliferation. Due to application of vermin compost, crops require less water for irrigation due to conservation of soil moisture and soil microbes increases. Farm waste has been utilized for making of vermin-compost. A total of 4 units of vermin-compost units have been promoted and 2500 g of *Eisenia foetida* released in each unit.

4.2.4 Other Demonstrations:

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
Small irrigation tanks in the recharge zone	02	0.2	-	10000	29500	3.9
Farm mechananization in paddy transplanting	1	0.03	-	29170	8850	1.3
Renovation of old water harvesting structure (farm pond)	1	0.08	-	-	-	-
Cost effective poly house	08	0.04	-	-	-	-
Total	**12**	**0.35**	**-**	**-**	**-**	**-**

Impact: Farm mechanization in paddy transplanting: Paddy transplanter has been successfully demonstrated and operated in 0.03 ha of land where 15 days old seedlings paddy (*Swarna*) is transplanted by the machine. Farm women are more involved in the operation and maintenance training was subsequently imparted. The results showed that the total time taken for transplanting by transplanter was reduced by 95 percent but the nos. of missing plants by mechanical transplanting is increased from 0 to 6 when compared with manual transplanting methods. The yield with the BCR 1.3 was at par with the yield data of the line sowing plots.

4.3 Module II: Crop Production

4.3.1 Introducing drought resistant varieties:

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
Bacterial wilt and drought resistant brinjal		21	4.3	46.2	22.3	103.9	232500	512500	3.3
Drought resistant Dhania		4	0.2	0.5	0.2	150	12500	22500	2.8
Drought resistant Pineapple (*Kew*)		5	1.5	20	16	25	-	-	-
Short duration paddy varieties (*MLT-10*)		2	0.8	3.64	2.98	22	15500	20900	2.3
Short duration pulses (*T-9*)		3	1	0.7	0.4	75	16000	12000	1.8
Drought tolerant paddy (var. *Sahbhagi*)		15	6.1	203.88	158	127	104040	85690	1.95
Paddy cum daincha (*CSR-36, Daincha, 2,4- DEE*)		2	0.8	4950	4380	13	20125	29375	2.46
Leafy vegetables Amaranthus	*CARI AMA-Green*	2	0.10	7.2	5.6	22	18000	38220	2.80
	CARI-AMA-Red	02	0.10	7	5.5	21	18000	38220	2.72
	CARI Poi Selection	04	0.16	5.4	4.7	32	19000	29600	2.56
Drought tolerant paddy varieties (var. *Naveen*)		4	1.7	98.4	78.2	77.90	70450	34170	1.493
Total		**74**	**20.6**						

Impact: Short duration rice varieties of MLT 10 were introduced in late onset of monsoon season to take advantage of the existing water resources available during the season and early cultivation of vegetable crops during *Rabi season*. MLT 10 gave grain yield of 3.6 t/ ha as compared to local check.Drought tolerant *Sahbhagi dhan* is more suitable for upland condition as well as second crop in Andaman and Nicobar Islands which provides new hope to the farmers in drought prone areas. The higher productive tillers of 278/ m^2 obtained with *sahbhagi dhan* were significantly superior to that of control (232 productive tillers/m^2). Panicle length (22.5 cm), numbers of grains/ panicle (192) were registered higher in drought tolerant paddy. Higher grain (4570 kg/ha) was recorded with *sahbhagi dhan* followed by farmers variety which led to 18.7 % higher yield than other cultivar. Higher gross return (Rs. 45700 ha^{-1}) and net return (Rs. 20950 ha^{-1}) with B: C ratio of 1.85. Performance of *sahbhagi dhan* is more acceptability by the farmers. *Sahbhagi dhan* was recorded the maximum number of 363 productive tillers/ m^2 obtained with sahbhagi dhan was significantly superior to that of control (254 productive tillers/m^2). Panicle length (24.9 cm), numbers of grains/ panicle (225) were registered higher in drought tolerant paddy. Higher grain (5428 kg/ha) was recorded with *sahbhagi dhan* followed by farmers variety which led to 30.8 % higher yield than other cultivar. Higher gross return (Rs. 54280 ha^{-1}) and net return (Rs. 27430 ha^{-1}) with B: C ratio of 2.02. Drought

tolerant *Naveen dhan* was demonstrated in drought prone area in one farmer field in an area of 0.1 ha during the rainy season, 2014. The results revealed that significantly higher number of 284 productive tillers/m^2 produced by *Naveen* compared to local check. Naveen recorded more grain yield of 3280 kg/ ha which was 27.6 % higher yield as compared to local check. Even though, Naveen dhan faced moisture stress (48.6% deficit rainfall) during early stage of crop growth. 46.7 % higher rainfall was received as compared to Normal rainfall during October, 2014. Naveen dhan gave highest net return and B:C ratio (Rs. 11300/- and 1.55) while *Swarna* was least profitable (Rs.4200/- and 1.20).KVK demonstrated yellow mosaic virus resistant blackgram variety (*VNB (Bg) - 6*) in five farmers field in an area of 0.4 ha per farmer. Blackgram seed hardening with 100 ppm $ZnSO_4$ increased germination percentage of 29.5 % as compared to untreated seeds in per sqm which also induces better root development which enables absorption of more moisture. Seed hardening develop a more extensive system, thus enabling them to survive better under drought conditions.

Field view on Sahbhagi dhan

4.3.2 Introducing salt tolerant paddy varieties:

Table. Performance of different salt tolerant paddy varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CARI Dhan-5	08	2.5	37.7	30	25.6	20250	14850	1.8
CSR-36	2	0.8	46.20	41.50	11.3	25650	24015	1.94
Total	**10**	**3.3**						

Impact: Salt tolerant variety was demonstrated in sea water inundation of tsunami affected land in adopted villages. CARI Dhan-5 recorded yield of 3770 kg/ ha which was 25.6 % higher yield as compared to local check (Jaya). Salt tolerant variety of *CSR-36* paddywas demonstrated in sea water inundated tsunami affected land during 2013. The results revealed that significantly higher number of 324 productive tillers/ m2 produced by *CSR-36* compared to local check besides it recorded significantly higher panicle length (22.7 cm) and more no of filled grains/panicle (129). *CSR-36* recorded more grain yield of 4620 kg/ha which was 11.3 % higher yield as compared to local check (*Bhavani*). CSR-36 gave highest net return and B:C ratio (Rs. 24015/- and 1.94) while bhavani was least profitable (Rs.15850/- and 1.62).

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

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
Traditional (Bhendi, Bitter gourd) and Non-traditionl vegetable (French bean)	16	1.9	22.9	7.9	90.96	206800	536700	3.36
Bacterial wilt resistant tomato (Var. *Ayush*)	3	0.5	17.5	10.5	76.0	95000	1657510	2.76
Bacterial wilt resistant Brinjal (CIARI-Brinjal 1) 2015-2016	3	0.5	17.5	10.5	76.0	95000	167510	2.76
Maize (var. *CoH (M)-6*)	3	1.0	41.5	32.8	29.6	62250	21800	2.86
Total	**25**							

Impact: *CoH (M)-5* registered the highest grain yield of 41.5 q/ha which was 29.6 per cent higher grain yield over local check. Hybrid maize recorded higher net return of Rs.50375 with the B: C ratio of 3.86.

4.3.4 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

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

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

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

SRI MAT Nursery, planting and weeding

4.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Okra(Mahyco 959) – chilly (Surya)- beans (Arka Komal)	04	0.10	7.5	3.2	134	130000	170000	2.3
Maize (var.X 92 as main crop)+Ladies finger (HYV)	5	2.0	48.0	37.2	29.0	84793	60463	2.5
Tissue culture banana under coconut and pond dyke	07	1.9	-	-	-	-	-	-
Leafy vegetables spice tree perennial species (False Coriander (CARI Broad Dhania), Suckers Clove, Nutmeg, Cinnamon and Black pepper)	06	1.22	-	-	-	-	-	-
Total	**22**	**5.22**						

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

4.3.6 Introduction of new crops/ crop diversification:

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. QPM-5)	07	2.2	5.2	35	49	92,000	64,000	1.43

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

4.3.7 Other Demonstrations:

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
Utilization of residual soil moisture and soil enrichment through short duration black gram	22	2.62	7.0	3.5	100	35000	20500	2.41
Varietal evaluation (Pumpkin var. BSS-749 RANA)	10	04	13.0	8.5	53	75000	55000	1.7
Intergrated fish culture	40	4.0	1.5	0.7	71	53300	111000	3.8
Total	**72**							

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

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



Promotion of Integrated Farming System

4.4 Module III: Livestock & Fisheries

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

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
Fodder Napier (Var. *Co-3*)	10	3.086	320	160	100	24000	108000	1.86
Total	**10**	**3.086**						



Fodder Napier

Fodder cowpea

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

4.4.2 Improved fodder/feed storage methods:

Table. Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder cultivation with improved varieties (Hybrid Napier)	12	1.7	200t/ha	80t/ha	300	8000	16000	4.8
Fodder cowpea (*CoFC8*)	12	3.06	93	57	161.1	16800	20250	2.2
Total	**24**							

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

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

4.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination for Ranikhet and Foot and Mouth Disease	14	480	Two animal health camps were conducted in both the villages in collaboration with Directorate of Animal Husbandry and Veterinary Services, Port Blair.					
Mineral supplementation	08	08	14.663	17.413	113.60	7500	23700	4.16
Animal health and awareness camp on FMD	06	180	NA	NA	NA	NA	NA	NA
Total	**28**							

Impact: Mineral Supplementation to dairy cattle based farmers for higher milk production: The milk yields in crossbred animals were recorded about 4 litres on average before the supplementation in Port Mort village which was below the potential yield of the animal. The present intervention was done in lactating dairy animals by supplementation of the exogenous source of Ca and P @ 1650 mg and 850 mg per 100 ml/ animal / day respectively. The treatment was given to four milch animals for 30 days and the result revealed increase in the milk yield to a tune of about 1.20 litres per animal.

Animal health and awareness camp

A total of two numbers of animal health camp were organized with the collaboration of AH&VS of A&N Administration. During the camp, 65 animals including cow, goat and 168 poultry birds. The animals were thoroughly diagnosed and treated Humpsore being the major problem identified causing reduction in milk production. The farmers were exposed to prophylactic measure to control humpsore in milch animals. Deworming in animals and birds, mineral mixture and vitamin supplements were given under the health camp.

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	40	3.2	0.2	0.1	100	11500	58500	6.08

Cat fish culture	02	0.08						
Renovation of defunct fish ponds and tilapia, singhi, magur, annabus & lata species cultivation	03	0.18	0.2	0.1	100	10000	40000	5.0
Total	**45**	**3.46**						

Impact: Composite fish culture: Fish fingerling of *Catla*, *Rohu* and *Mrigal* was distributed to 24 selected farmers in the NICRA adopted villages. Freshwater prawn seed was not available so could not be provided this year. Other inputs like lime and vegetable seeds (bottle gourd, bitter gourd and cucumber) were provided to the farmers for cultivation in ponds' dykes. Fish culture is in continuous process and will be harvested in June, 2012. Farm Pond cleaning for storage of Water and ground water recharge

As per our advice,six farmers have cleaned and desilted their ponds manually for storage of rain water as these ponds were totally unutilized and covered with grasses and other vegetations. The farmers themselves engaged the labourers. After the cleaning, these ponds retained the water in summer months and farmers used this water to irrigate their field crops (app. 3.0 ha) as well as for their farm animals. Fish fingerlings (Av. 50 gms) were also given to the farmers for culture in the month of October, 2012 which now attained the average weight of 750 gms. This season efforts will be taken to dewater the remaining ponds completely so that de-silting could be done for more water storage. Two ponds have been developed into an integrated farm model and efforts will be made to develop all the ponds into integrated model.

Four farmers have cleaned and renovated their ponds for storage of rain water. After the cleaning, rain water is stored in the pond and farmers used this water to irrigate their field crops (app. 1.0 ha) as well as for their farm animals during the summer months (Jan to till date). Fish fingerlings (Av. 40 gms) were also given to the farmers for culture in the month of December, 2013 which now attained the average weight of 150-250 gms. Since, December, 17, 2013. No rain is recorded in Andaman and Nicobar Islands and ponds are on the verge of drying. Due to increase in water storage capacity in farm ponds, moisture in the adjacent field increased and good amount of greenery have been developed, which is available for animals in summer days.

4.4.5 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Backyard poultry (Improved Nicobari fowl)	06	06	180 eggs	75 eggs	140	13050	31950	3.4
Improved poultry birds (Nicorock)	05	47	140 eggs	80 eggs	75	2450	3450	2.41
Improved poultry birds (Vanraja)	12	120	1.4 kg meat/ bird	2.3 kg/ bird	64.2	4960	6080	2.26
Improved breed of Pig (T & D)	03	03	120 kg /animal	75 kg / animal	60	7500	17500	3.3
Total	**26**	**176**						

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

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

Backyard poultry production with improved Nicobari and Vanraja birds:

A total no. of 160 numbers of Vanraja bird were distributed among the four numbers of farmers along with 30 Nicobari birds were distributed to three numbers of farmers. The Nicobari birds regarded as one who possess some resistant

to common diseases of the bird is suitable under backyard. The production characteristics revealed that the bird can well thrives in this condition and performed better in terms of egg production as compared to other indigenous bird.

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

4.4.6 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Improved shelters for poultry and livestock	23	23							
Others, Open shed under plantation	05	0.02	15 lit	10 lit	50	10000	16750	6750	1.7

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

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

For dairy and farm animals, one open shelter is made under the coconut garden by the farmer as per our advice where he keeps his animals during day and night time. Farmers himself noticed that animals are not stressed in the hot days and there is increase in milk production. He cleans the shed regularly.

Before Adoption

After Adoption

Ventilated cost effective sheds for poultry and live stocks

Development of rural poultry (desi birds)

To check the mass mortality, disease resistant Nicobari fowl were introduced. A total no. of 140 Nicobari fowl were given to 7 farmers for enhancement of egg production and breed up gradation of desi birds to develop disease resistant stocks.

4.5 Module IV: Institutional Interventions

4.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Custom hiring centre	Power tiller, Pump set, Knapsack sprayer, Coconut Climber, Arecanut dehusker, Thresher, Drag net, Vegetables	1 no./280/hr , 1no./100/day, 1no./50/day, 1no./10/ day, 1no./30/day	Farm operation	20	20
Collective marketing	Vegetables	10	Andaman Bazar	10	
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	12	Weather forecast	60	60
	Rabi crops		Weather information and advice for life irrigation to crops	79	53
others	Animal Health Camp (goat farming-1; BBF-6; Promotion of Poultry and Duckery- 775; Drip iirigation-3; Animal Health Camp-85)	955	Information through PRI members	260	73

4.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee (VCRMC), KVK, Port Blair

4.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

Table. Revenue generated through Custom hiring Centres and VCRMC in KVK, Port Blair

Name of Implement	Revenue (Rs)					
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Power Tiller, Sprayer, Coconut Dehusker, Drum seeder, Chaff cutter	1864	13137	19068	21994	31516	40886
Total	**Rs. 128465**					

4.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	2	29	14	43
Crop Management	2	2	0	2
Integrated Crop Management	6	94	59	153
Crop Diversification	5	84	30	114
Resource conservation Technology	1	16	12	28
Pest and disease management	4	62	42	104
Nursery raising	1	29	6	35
Integrated Farming System	1	7	18	23
Livestock and Fishery Management	16	197	187	384
Fodder and feed management	12	80	56	136

4.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Exposure visits, Field Day, Group Discussion, Method demonstrations, Kishan Gosthi/Kisan Mela, Woman health and nutrition, Scientist visit to field	385	1755	1377	3132

4.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
350	75	75	350

4.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
Sluice Gate	Construction of sluice gate, Zilla Parishad	7.5 lakhs
Gryones	APWD, Hard rocks tied with ropes are placed along sea road.	25.7 lakhs
Drainage improvement	In convergence with MNREGA for drainage of excess water	3.3 lakhs
Rain water harvesting through BBF/paddy cum Fish culture	Under NAIP project of CIARI	3.5 lakhs
Total		**40.00 lakhs**

Impact:

1. **Sluice Gate**: In full moon and dark moon sea water intrusion affected 125 ha paddy land at Port Mout and Badmash Pahad village, new bund and Sluice gate have been constructed to check the sea water intrusion in the paddy fields through convergence with Gram Panchayat, Zilla Parishad and APWD.
2. **Gryones:** Agricultural lands facing the sea shore as well as adjacent land areas were regularly getting damaged by the intrusion of sea water, wave actions. This resulted into damaging the cultivable land areas. To check the intrusion, 0.25 m- 1.5 m diameters hardrocks are tied in a bunch with ropes (Gryone) and are placed alongside of the sea shore of Badmashpahad village for a distance of stretch of 2.0 Km. The work has been completed on a convergence mode with Andaman Public Works Division (APWD), Port Blair for safe guard of the land areas for cultivation.
3. **Drainage improvement through MNREGA for excess water flow:** About 12 ha area was always flooded either with sea water or freshwater and these land was without any use. KVK approached the Gram Pradhan of the area for improvement of drainage system in the area and the Gram Pradhan has taken initiatives for cleaning of drainage through MNREGA and about 1800 mt long drainage system was improved involving an amount of 3.3 lakh. This resulted in improvement of drainage of excess water and drying of the area. Which helped in summer months and the area could be used for grazing of farm animals of the villagers.

Drainage improvement through MNREGA

Rain water harvesting by CARI through BBF/ Paddy cum Fish culture: Under the NAIP project of CARI, the fund was utilized for construction of Broad Bed Furrow system and paddy-cum –fish culture system in the adopted village of NICRA with a cost of Rs. 3.5 lacks for an area of about 0.5 ha. The fellow land developed through this has been under use for vegetable and fish culture giving additional income to the farmers.

4.10 Success stories of NICRA Village Farmers

1. Shri Suresh Roy – A role model vegetable farmer in the NICRA, adopted village

Shri Suresh Roy age 41, resident of Badmash Pahad Village in the South Andaman District, a migrated farm labour – a simple man at first glance, but blessed with an inquisitive mind became the model as a progressive farmer with leased land. He earned his livelihood by cultivating traditional vegetables like Okra, Brinjal, Bitter gourd, Pumpkin, Cucumber, Sweet potato on his small patch of 1.4 ha leased land, employing indigenous and traditional cultivation methods. In 2011, Krishi

Vigyan Kendra, Central Island Agricultural Research Institute (CIARI), Port Blair, adopted vegetable cultivation with the technical intervention of mulching from paddy straw, coconut and arecanut leaf/ husk, and growing of selected drought resistant crops on scientific methods under NICRA project guidelines. Always eager to learn, Shri Roy was one of the first to enroll in the programme, after a series of skill development training in the village by KVK. Armed with the training inputs**,** Shri Roy meticulously began to put his skill into practice. Initial orientation, encouragement from the KVK team and their frequent visits set him on the path towards progress. Soon, he had implemented Scientific intervention of varietal/ aerial cultivation of vegetables on his land that minimized inputs from an ingenious system of raising Crops, Sweet potato (*CARI-SP 1*), French Bean (*IIHR-909*), Chilies (*LCA-353*), Pumkin (*Ardhaman red*), Cucumber (*Point set*), Brijal (*CARI Brinjal-1*), Bitter gourd (*Rakhushi*), False coriander (*CARI Broad Dhania*) and Marigold (*Pusa narangi*) and received maximum output. As a result, his land yielded round the year crops production and as a source of regular income.

He wasted nothing, making optimum use of all the farm waste. Very soon, his farm became a completely self-sustaining entity, where all the requisite was met from within the system itself. His net income increased from 12000/- per month to Rs. 0.85/- lakh per year. Shri Roy is today reaping the benefits of having adopted new methods. His success has attracted media attention and his beautiful farm was covered by All India Radio, Port Blair. Despite being some sort of a celebrity in his area, he has not forgotten his earlier struggles days and continues to grow and learn. An award-winning man (Best Farmer –Kisan Mela - 2012), he is quite an inspiration for others and a role model in the neighbouring villages.



2. Ridge and furrow Vegetable cultivation system in fellow land

Shri Sanjay Kumar Saha is an unemployed educated youth has come in contact of KVK under the NICRA project since its inception in Feb., 2011 and with our continuous efforts and contact, he got motivated for cultivation of vegetables in ridge and furrow method in his low fellow land where he lost his entire vegetable crops last year due to heavy rains during February, 2011. On our advice, he engaged two laborers for making the ridge and furrow under our guidance. Timely availability of quality seed materials is a constraint in Andaman and to encourage the youth, timely supplied of inputs was ensured and the Vegetable seeds, seedlings, pesticides and fertilizers were provided from NICRA fund.When the seed was sown in January, 2012, heavy rainfall occurs (125 mm) on the 8th day for three days continuously and all the excess water was drained out from his fields without any damage to his newly germinated plants. Again after 25 days of sowing, heavy rainfall (165 mm) occurred in February, 2012 and only because of proper drainage, no damage to the crops was noticed. Shri Sanjay Saha invested Rs. 53,000/ for cultivation of vegetable in 1400 sqm area and got Rs 96,000/- rupees as income from sale of vegetables.In the same area, maximum farmers have lost their vegetable crops because of non availability of drainage facilities.After seeing the benefits of this method of cultivation and to save the crops five nearby farmers have also adopted the ridge and furrow techniques for cultivation of vegetables in their fellow lands.


3. Cross ventilated shed at NICRA Village

A major part of our island ecosystem is characterized as humid tropic and is subjected to extend periods of high ambient temperature and humidity. Thermal stress tend to lower feed intake of poultry birds which in turn reduces their productivity in terms of yield, body weight and reproductive performance. An improved shelters technology for reducing the heat stress in poultry was introduce to improve the economic condition of the farmers.After discussion with the farmers it was revealed that every year there is a mass mortality in the indigenous non descriptive desi birds in villages under backyard condition. During the field visit by KVK team it was noticed that the housing facilities for the birds are improper and unhygienic during monsoon and post monsoon days causing mass mortality. Secondly, farmers used to rear the birds in natural scavenging conditions and mortality of birds may be due to

consumption of dirty stagnant water.

Closed shed system

Raised platform shed

One training on Animal husbandry practices was arranged from 20 to 22 december, 2011 for the farmers of both the NICRA villages namely Port Mout and Badmaspahar in South Andaman. Emphasis was given on proper housing of Animals and birds. During training programme they were advised to renovate the shelter and provide proper cross ventilation to remove the gas from their fecal materials mainly during night time. A farmer named Shri Sohan Prasad of Port Mout Village came in contact with the KVK staff. Before training he was providing shelter for the birds in closed condition to protect the birds from predators *i.e.* wild cats, water monitor lizard and street dog. Because of closed housing condition, birds were suffering due to supply of insufficient oxygen, inhaling poisonous gas which was release from their fecal material. Birds mortality was higher (50 to 80%) due to disease, poor housing and feeding. After motivated during training programme, Sh. Sohan Prasad constructed cross ventilated house with locally available materials and also provided clean drinking water for the birds. The mortality came down to 30 % and there was no attack of predators. It is concluded that housing and water was the major cause of high mortality in poultry birds. After observing his activities many farmers also renovated their poultry /animal house to get more benefit from the venture.

Netted house of neighbouring farmers

4. System of Rice Intensification

The System of Rice Intensification has been demonstrated in 4 farmer's field under National Initiative on Climate Resilient Agriculture (NICRA) during *Kharif*, 2011. The demonstrations have been carried out in two villages namely Badmaspahar and Port Mout in South Andaman.

NICRA KVK, Port Blair was organized three days training and explained about the SRI method of Paddy cultivation and motivated to adopt it in some farmers field. Even though, farmers were feared to plant single seedlings per hill due to occurrence of high intensity and unexpected rainfall. SRI was demonstrated with *BPT-5204* paddy varieties in Badmaspahar village. The demonstration soil was clay loam having pH 6.8, 0.6 % organic carbon content, low in available N (137 kg/ha). The seedlings of MAT nursery were transplanted at specified age with respective spacing and number of seedlings hill-1. In case of SRI nursery, the seedlings were transported along with roots cutting like cake without disturbing the soil and the seedlings were separated along with nursery soil and used for transplanting.

MAT Nursery

Seedling transplanting

The recommended dose of fertilizer @ 90: 60: 40 kg NPK were applied as urea, single super phosphate and muriate of potash as per the schedule *i.e.*, 25% N, 100% P was applied as basal; 50% N and 50 % K applied at tillering stage; 25 % N and 50 % K applied at Panicle initiation stage.

Transplanting of early,widely, single seedling

The highest plant height of 122.5 cm was recorded under farmers method of planting. As the plant density increases, mutual shading and competition for light might cause an elongation of stem to facilitate more light interception which leads to lodge easily because of its week culm. Among the planting method, SRI practice resulted in numerically higher LAI (5.22) and root length (24.5 cm) compared to farmers method of planting. The highest root dry weight was recorded with spacing of 25 x 25 cm (16.4 g/hill) than farmers practices. Planting of 25 x 25 cm was reduced plant height and increase root growth as well as enhance the culm strength. It helps in resisting plant against lodging at reproductive stage.

Cono weeding

Among planting method, number of productive tillers exhibited variation due to planting method. Higher productive tiller formation resulted with SRI method of planting. Maximum numbers of 385 productive tillers/m^2 were obtained with SRI method was superior than that of farmers practices (255 productive tillers/m^2). Panicle length (25.1 cm), numbers of grains/ panicle (132) were registered higher at the spacing of 25 x 25 cm in SRI method. Higher grain (48.4 q/ha) and straw yield (75.7 q/ha) was recorded with SRI planting followed by farmers practices. SRI method of planting led to 53.6 % higher yield than traditional method of planting. Higher yield under SRI was mainly due to more number of

Complete lodging - normal planting

productive tillers/hill, No of grains/ panicle and panicle weight consequently higher uptake of nutrients from soil. SRI practiced resulted in higher B: C ratio of 2.49 compared to farmers practice.

However, at higher density with more root growth per unit area, the rice plant could access a much larger volume of soil and absorbed greater amount of nutrients from the soil and the resultant above ground growth intercepted more light, favours greater production of panicles. The beneficial effect and better plant performance at 25 x 25 cm spacing on growth and yield structure and nutrient uptake of rice led to higher grain yield. Higher straw yield of rice was obtained due to taller plants, more number of total tillers and higher quantity of total biomass accumulation.

No lodging - SRI planting

One more advantage Sri Swaran Singh farmers had realized was criss cross cono weeding in which all the weeds were incorporated in the field compared to conventional planting where conoweeding was not possible. Farmers also observed deeper roots under SRI leading less chance of lodging of crop at maturity which makes comfortable harvesting. The yield recorded was also higher under SRI 53.6% compared to normal planting. Further, farmers kept the harvested produce as seeds due to clean and viable seeds they got from SRI method and intends to extend the area under SRI in the forthcoming year.

JHARKHAND KVKs

5. Gumla

5.1 Village information:

Name of the village	Gunia, (Cluster village Belagara and Burhu)
No. of households	Gunia (320), Belagara (334) and Burhu(110)
Total cultivated area (ha)	Gunia (583.00), Belagara (498.00) & Burhu (382.00)
Area under rainfed cultivation (ha)	1463.00
Major soil type	Red laterite, Sandy loam, and Clay loam
Climatic vulnerability of the village	Drought, heat wave, cold wave and hailstorm

5.1.1 Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	1178.40	1390.94	79	01	-	2	890.00	396.80	11.66
2012	1178.40	1128.60	63	-	1	-	686.89	333.38	80.31
2013	1178.40	1156.50	82	-	1	3	708.40	333.25	78.10
2014	1178.40	1164.90	90	1	-	-	679.30	415.90	24.40
2015	1178.40	1034.98	92	1	-	2	650.00	207.08	90.60
2016	1178.40	1061.64	95	-	-	--	800.50	126.60	30.24

5.1.2 Details of the climatic vulnerability

Major climatic vulnerabilities experiences during the last five year (2011-16) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought like situation occurred during grand growth stage and flowering stage in Paddy and other *kharif* crops like ragi, groundnut and blackgram, which affect the crop severely. In the year 2012, 2013, 2015 and 2016 the rainfall received during the month of June was less than normal rainfall (2015.3 mm) which vary from 12.0 to 71.7%

less than normal. In past five years the year 2014 was the only which received 8.81% excess rainfall in the month of June. June, July and August is the major month which has decided the cropping and their extent of coverage. NICRA village experiences two better year *i.e.* 2011 and 2016 in which rainfall received was 890.00 and 800.50 mm respectively more than normal *i.e.* 770.6 mm (June – August) and rest of year 2012, 2013, 2014 and 2015 experienced less rainfall. However the no. of rainy days was experiences better in 2011 (79 days), 2013 (82 days), 2014 (90 days), 2015 (92 days) and 2016 (95 days).

In 2012 intermittent drought like situation occurs in village Gunia during flowering stages of paddy. About 200 ha of standing paddy was badly affected by the water stress situation, which was safely control and manage by the coping strategies of water management.

Some important climatic vulnerability experienced during the past five year (2011-16) is under follows-

- In 2011 water stress like situation in Rabi and summer crop and their extent was 50 ha.
- In 2012 intermittent drought like situation raises in standing paddy during flowering stage and their extent was more than 200 ha.
- In 2012 water stress situation raises during crown root initiation stages of Wheat and their extent was 100 ha area.
- In 2013 severe cold waves was observed during last week of December and January, badly affected the Potato and Mustard crop and their extent was 25 ha.
- In 2013 hail storm was experienced in nearby villages of NICRA village and their extent was in 21 villages and affected more than 500 ha standing paddy.
- In 2014 and 2015 severe infestation of false smut was observed in Hybrid paddy in the month of October and their extent was 10 ha in nearby village of NICRA cluster.
- In 2016 heavy rainfall damaged the maize crop and their extent was 250 ha in nearby village of Gunia.

5.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy- Wheat-Vegetables
Maize-Fallow	Maize-Vegetables /Wheat/ Mustard
Blackgram-Fallow	Blackgram-Pea/Mustard
Niger-Fallow	Ragi/Groundnut-Vegetables
Ragi-Fallow	Niger-Fallow/Vegetables

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

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ ha)
Paddy	*Lalat, Abhishek, Sahbhagi/ Hybrids*	710	755.00	1075.00	28.00
Blackgram	*Shekhar, PU-30 & Utra*	205	72.00	103.00	8.80
Wheat	*K-9107, PBW-343, K-9107 & HD-2733*	125	75.00	75.00	28.60
Groundnut	*TG-22*	58	21.00	70.00	14.60
Mustard	*Pusa Bold, Pusa Mahak*	47	72.00	45.00	11.00
Groundnut+Redgram, Maize+Redgram	*TG-22 + Asha Suwan-1 + Asha*	22	19.00	42.00	10.00

iv. Cropping intensity (%) in NICRA Village: 86.15% (Before NICRA), 118.40% (After NICRA)

Gumla District: 104.20% (2010), 117.72 (2016)

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Potato	37.00	150.00	*Kufri Lalima* and *Sathi*	37.50
Tomato	32.50	132.00	*Selection-22, Super rasna, Nandini & Laxmi*	30.50
Brinjal	2.80	140.00	Local & hybrid	1.80

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Okra	11.00	120.00	Arka Anamika/ hybrids	10.00
Cow pea	8.00	60.00	*Ravina*,Local	6.50
Bitter gourd	3.00	120.00	*Chama, Selection-1*	2.00
Bottle gourd	8.50	132.00	*Gaurav, Anokhi,Warad*	6.50
Pea	42.00	84.00	*Swarnamukti* and *Arkel*	42.00
Watermelon	15.00	152.00	Hybrid	15 .00

vi. Area under fodder cultivation and number of farmers growing green fodder:

Year	Source of irrigation	Area (ha) under irrigation
2011- 12	Lift & Pond	2.60
2012- 13	Lift & Pond	2.64
2013- 14	Lift & Pond	6.90
2014- 15	Lift & Pond	7.00
2015- 16	Lift & Pond	2.64
2016- 17	Lift & Pond	2.60

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle: Cross breed	22	12	0.7	FMD & HS & BQ	50-55	2
Indigenous breed	2814	503	-	FMD & HS & BQ		
Buffaloes	484	78	-	FMD & HS & BQ		
Goat	2081	288	20.0	PPR		7
Pig	497	36	45.0	Swine fever		5
Poultry	5441	348	28.0	Rani khet		12

viii. Milk productivity (L/milch animal/day): Cow Cross breed 5-8 L/day & Indigenous breed 1-4 L/day

ix. Details data about inland fisheries practiced: Pond (17 No.), Dova (25 No.)

5.1.4 Resource availability:

5.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011- 12	Pond	11 units	All defunct (11 Units)	Renovated (11 Units)
2012- 13	Pond	11 units	All defunct (11 Units)	Renovated (04 Units)
2013- 14	Pond	13 units	Defunct (07 Units)	02 units new pond created
2014- 15	Pond WHS (5% Model)	13 units 06 units (New)	Defunct (07 Units)-	Renovated (03 Units) 06 units
2015- 16	Pond WHS (5% Model)	13 units 07 units (New)	Defunct (04 Units)-	-7 units
2016- 17	Pond WHS (5% Model)	13 units 12 units (New)	Defunct (04 Units)-	-12 units

Total no. of defunct Pond : 11 units

Total No. of renovated ponds : 07 units

New created Ponds : 02 units

WHS (5% model) : 25 units

5.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

Structures/Years of Construction	Category*		Total 5 years	
RWHS			Area (Ha)	No. of farmers involved
No. of farm ponds	Constructed		25.5	58
	Repaired/ Renovated		84.3	127
	Repaired/ Renovated		16.9	40
Percolation tanks/ Recharge pits (No.)	Constructed		0.8	8
	Repaired/ Renovated		17.6	44
No. of Check dams	Constructed		147	240
Sand Bag Check dam (No.)	Constructed	Repaired	411	550
		Renovated	3037.6	6110
Chanal	Cleaning/Desilting/ Renovation		214	208
5% model (Dobha)	Constructed		25	25
Irrigation lift device (No)	Constructed	Repaired	79	158
		Renovated	220	480
	Repaired/ Renovated (Under NICRA)		105	154
Drip irrigation System	Constructed		3.2	22
Field bunding	Created		24	54
Jalkund	Constructed		18.06	21

* 2013-14 – Other 02 unit lift irrigation devices were installed by State govt. minor irrigation department, Gumla

* 2014-15 – Other 04 units lift irrigation devices were installed by State govt. minor irrigation department, Gumla

* 2015-16 - Other 01 unit lift irrigation device was installed by mukhiya (PRI member)

5.1.4.3 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Power tiller 01 No.
ii. Pump set 15 No.
iii. Spray Machine 04 No.
iv. Winnowing fan 03 No.

5.1.5 Socio-economic status:

a) No. of households – General: 21; **OBC:** 121; **SC:** 24; **ST:** 598

b) Literacy rate (%): 45.85 **:: Male:** 52.25, **Female:** 39.50

c) Workers engaged in agricultural activity (%): 86

MODULE WISE INTERVENTIONS

5.2 Module I: Natural Resource Management

5.2.1 In-situ Moisture Conservation - Resource Conse rvation Technology:

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
Summer Ploughing inPaddy (var. *Lalat, Sonpiya*)	75	35.40	30.10	17959.00	15032.00	1.84
Green manuaring (dhaincha) in Paddy (var. *Lalat, sahbhagi Dhan*)	49	11.00	35.21	24000.00	18246.00	1.76
Green manuaring (dhaincha) in Potato(var. *Sathi*)	02	1.00	189.62	48500.00	84234.00	2.73
Brown manuaring in Paddy (var. *Anjali*)	08	2.00	25.00	16795.00	10660.00	1.64
Azolla in Paddy (var. *Lalat*)	08	3.00	34.13	18500.00	15250.00	1.82
Zero Tillage in wheat (var. *PBW-343*, var. *HD-2733*, var. *K*-7903), Lentil (var. *NDL-1*), Maize (var. *HQPM-1*, var. *Jaunpuri makka*, var. *HQPM-7*)	38	13.1	27.00	13500.00	16200.00	2.20
SWI I wheat var. (*HUW-234*)	27	5.30	33.81	21147.00	21087.00	2.00
Para wheat var. (*HUW*-234)	01	0.20	17.20	11800.00	7120.00	1.60
Wheat sowing on raised bed method	04	2.00	35.50	18000.00	21050.00	2.16
Redgram sowing on paddy field bund	18	5.00	-	-	-	-
Use of plant leaf mulching in Ginger	21	6.00	123.55	68950.00	252100.00	4.65
Use of paddy straw, forest leaves in Mango	40	12.26	-	-	-	-
Total	**283**	**96.26**				

Impact: Out of seven interventions, intervention like summer ploughing is being widely accepted by the farmers of NICRA and adjoining villages, and their extent was more than 1000 ha. Through this intervention, moisture availabilities extent has been increased and standing crop may face 10-15 days water stress without any damage as per farmer feedback. Intervention like Green manuring especially of *Dhaincha* is also being widely accepted in low land paddy field and their extent was 20-25% of the total paddy field. Through the application of this intervention farmers of NICRA village cut down one top dressing of urea in low land paddy and by this way they succeeded to save Rs. 200-300/ha. In situ conservation of Dhaincha not only improved the soil fertility but also enhanced the moisture extent duration in successing crops as per farmer feedback. Intervention like zero tillage wheat sowing and mulching was also practiced by the farmers of NICRA and adjoining villages but their adoption % was low *i.e.* 15-20% in wheat and vegetable area.

5.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	18	05 units				
Renovation of canal for Paddy (var. *Anjali*)	18	24.00	30.62	19650.00	17094.00	1.87
Renovation of canal for Wheat (var. *PBW- 343*)	60	20.00	27.32	17700.00	15084.00	1.85
5% Model (paddy var. *Lalat*)	25	25.00 units	33.80	21500.00	18340.00	1.85

Technology demonstrated		No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
					Gross Cost	Net Return	BCR
Bora bandh	Wheat (var. PBW-343)	35	50.00	32.00	17300.00	17900.00	2.03
	Okra (Avinash)	09	5.00	98.60	31200.00	67400.00	3.16
	Bottle gourd (Warad)	12	7.00	105.00	24300.00	38700.00	2.59
	Paddy (Lalat)	190	242.00	26.68	19700.00	12316.00	1.62
	Wheat (K-9107)	304	107.00	31.18	27500.00	14973.00	1.54
Renovation of Well for irrigation		44	44.00 units (17.60) ha				
Total		**715.00**					

Impact: Before conducting the demonstration on water harvesting, available water harvesting structures (Water resource map) were studied out in details and their reservoir capacity. And accordingly the renovation, creation and cleaning was undertaken as in intervention for better water harvesting and their use. Under renovation 5 pond was renovated while 44 no. of well (Bari as well as Done well) were renovated. The reason behind the renovation of the well was to save the existing well from filling by the run off soil. Through this intervention 106.9 cubic meter water is safely recharged in each well. In this way 4703.36 cubic meter water stored in 44 wells, which is being utilized by the farmers not only for the day to day activities but they have succeeded in cultivating the crops in 1 to 1.5 acre/ per well with ensured irrigation. Motivation towards re-cycling of available water in existing Masaria dam through intervention of canal cleaning has open the door and eyes of farmers and policy makers for switching over to double or multiple cropping. Which has been praticised since 2012 and farmers of the village cultivated Rabi and summer crop in more than 300 ha area/ year. Before NICRA the cropping intensity of the village was 86.15% only while today it is 117.7%. This has happened only due to action through people participation, whatever the water was stored in the dam was previously not utilized for cropping purpose, however the canal passes through the villages but it was defunct. By seeing the impact of canal cleaning state government came forward and renovated 7 km canal.

5.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	11	5.20	29.03	18415.00	17173.00	1.93
Sowing of Maize with ZTD machine	20	5.50	33.30	18247.00	16756.00	1.92
Sowing of lentil with ZTD machine	07	2.4	12.80	10500.00	21500.00	3.04
Total	**38**	**13.1**				

Impact: By the use of zero tillage machine especially in wheat sowing, opened the door for residual mixture utilization in medium and low land area. Through this intervention farmers has succeeded not only in saving the irrigation cost *i.e.* pre sowing irrigation but also time and production cost. However the impact of adoption is slow but encouraging. Farmer's saw the result in field in respect to yield recovery and lowering the production cost, saving of time (one week) in sowing attracted farmers for their use in coming year.

5.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	54	24.00	28.07	19582.00	13344.00	1.68
Ground water recharge through SRI by sub-soiler	21	12.4	37.09	21075.00	19424.00	1.92
Total	**75**	**36.4**				

Impact: Keeping the slogan **"Khet ka pani khet me aur gaon ka pani gaon me"** in the centre KVK has tried to educate the farmers to conserve the maximum of rainwater in their field through field bunding and in pond with an objective to recharge the ground water. Before NICRA farmers were aware about the importance of field bunding but they did not apply rigorously on their field as a result huge volume of water along with fertile top soil was washed out in nearby rivulets, nalas and rivers. Which resulted in siltation, water table of their existing borewells and wells went down. Keeping the vibrancy of the situation intervention field bunding was taken as an initiative as a mass campaign and 24 ha of farm field was bunded well during 2011-16 under NICRA. This initiative has left a big impact and farmers of NICRA and adjoining villages came forward and done field bunding properly every year in more than 800 ha area. Even through Sand bag check dam during off season, ground water has maintained 12-15 feet in wells and 130-140 feet in bore wells which was earlier went down to 4-5 feet in wells and 180-200 feet in bore wells. By seeing the result of NICRA initiative in cluster villages, state government has started the scheme known as "Medh Bandi" with the support of Rs 5000/- per ha to the beneficiaries as a promotional activities. In 2017-18 NICRA implementing block Ghaghra, 143 ha field was bunded under this scheme

5.2.5 Water saving irrigation methods:

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 Mango	04	0.80				
Total	**04**	**0.80**				

Impact: To maximize the water use efficiency the demonstration was made on micro irrigation system and their application. Through these demonstrations (Drip as well as sprinkler) 20-25% irrigation water was saved in fruit plants like Mango, Banana and Guava as well as in crops. While their maximum use is being done in commercial vegetable Pea, Gram and Linseed crop cultivation in adjoining villages of NICRA. More than 50 no. of micro irrigation unit has been provided by ATMA under NFSM. The extent of their application in the area is more than 200 ha especially in *Rabi* crops.

5.2.6 Other Demonstrations:

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
In-situ vermicomposting in orchards	10	7.31	Boom stage			
Paddy with Bird purchar (var. *Sahbhagi Dhan*)	04	2.00	38.53	32480	17609	1.54
Use of Bio pesticides in tomato, redgram	37	3.00	157.25	45500.00	111750.00	3.45
Use of Dolomite in gora paddy	18	6.00	21.62	11400.00	8058.00	1.70
Cultivation of high yielding grass on farm bund	04	2.20	-			
Total	**73**	**30.51**				

Impact: Before NICRA no any planned unit of vermicompost production was available in the village. After NICRA 36 vermicompost production units were established with the production capacity of 1.75 q/ unit/ cycle. Keeping the animal population in the centre mass awareness programmes were organized for compost enrichment. As a result more than 200 farm families has already been associated with vermicompost production. The extent of adoption is 25-30% in the adjoining villages. With the use of vermicompost farmers has been able to produce quality product through this intervention efficiency of available compost is being enhanced as well as structure of soil changed slowly. As a result the water holding capacity of red laterite soil is also being enhanced as per farmers' feedback.

5.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed

RWH structures	No.	Storage capacity (Lit. in Lakh.)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
New Pond	02	63.3	02	4.50	133.33
5% Model (Dova)	25	25.0	25	25.00	110
Pond Renovation	05	238.7	18	18.31	130

RWH structures	No.	Storage capacity (Lit. in Lakh.)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Bora bandh (Temporary check dam)	21	-	550	411.00	200
Repaired well	44	-	44	17.60	300
Jalkund	37	1.11	21	18.06	100
Percolation tank	02	0.56	02	0.20	100
Pakka check dam	02	-	49	40.00	175
Community pond	02	60.40	21	5.40	200
Canal Renovated (4 Km long)	04	-	208	214.00	142.80
Inlet & Outlet Cleaning (Ponds)	14	-	37	-	100
Canal Cleaning	01	-	10	6.00	200

Impact: Before implementation of the specific design intervention our core aim was to develop/ undertake the need based low cost initiative, which is farmer affordable, sustainable and replicable. Keeping the aim in the centre, KVK has focused on farmer involvement process and started the work by knowing and understanding the climate vulnerable current factors. In every module easily acceptable and replicable intervention was undertaken which has great potential to fight against the existing vulnerabilities. Based on their available resources plan was made and implemented. The major constraint was monocropping practices; however the river Masaria is flowing across the cluster villages of Gunia. The sound plan/ Initiative was formulated with farmer participation to restrict the flow of river up to the certain level without disturbing the regular and natural flow by making small "Sand Bag Check Dam" that is popularly called as "Bora Bandi" and the plan was implemented first time in 2011. Quickly this initiative has left the broad impact and farmers have succeeded to cultivate the wheat crop in more than 100 ha areas, which was a miracle for the area. This initiative catches the eyes of district administration and other stakeholders. Press and electronic media have given a wide coverage to popularize the low cost initiative. Sand bag Check Dam initiative not only prepared the land ready for double or multiple crops but enhanced and recharged the water table, which was undergone 7-8 ft in hot summer. After the intervention it has came to 3-4 ft. Through this successful intervention KVK has been praised by the State Level awards in Water conservation area by Dainik Jagran Samman and honored by Hon'ble Agriculture Minister Govt. of Jharkhand. KVK has also succeeded in capturing the zonal level award under NICRA. The details of impact under Sand Bag Check Dam initiative is under follows:-

Bora bandh	2011-12	2012-13	2013-14	2014-15	2015-16	Grand total
NICRA initiative (No)	01	02	02	03	03	11
Replication of model in other village (No)	08	14	16	18	70	126
Safe Kharif paddy harvested and area expansion in Rabi & Summer (in acre)	250.00	580.00	700.00	920.00	3500.00	5950.00

5.3 Module II: Crop Production

5.3.1 Introducing drought resistant varieties:

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
Paddy (var. *Sahbhagi Dhan, Anjali*)	88	40.20	32.60	27.50	18.55	27180	15200	1.56
DSR Transplanting (var. *Lalat*)	40	23.00	27.60	24.43	11.40	18233	15807	1.87
Maize (var. *Suwan-1, HQPM-1, Super Gold, PMH-1*)	186	50.20	33.69	26.50	29.15	20725	20555	1.99
Drought tolerant ragi (var. *GPU-28*)	164	33.00	17.70	13.30	35.60	13282	11357	1.85
Pea (var. *Swarnamuki*)	24	4.00	84.64	46.20	83.20	45400	123880	3.73
Niger (var. *Birsa Niger- 1*)	59	24.00	3.52	2.25	63.96	6780	3373	1.55
Red gram (var. *Narendra Arhar - 1, PGR-158*)	22	4.60	14.40	11.30	28.23	21000	32270	2.53

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Horse gram (var. *Birsa kulthi-1*)	05	2.00	7.32	6.12	19.60	10400	11560	2.11
Groundnut (var. *ICGV-350*)	01	0.025	15.39	10.65	44.50	16500	29670	2.79
Blackgram (var. *Uttra, Pant U-19, Sekhar*)	29	11.04	8.70	5.30	64.15	10100	16000	2.58
Total	**628**	**184.165**						

Impact: Keeping the rain water avaibilities in the center, short duration drought tolerant crop varieties was demonstrated in 89.90 ha area during 2011-16 in NICRA village. Which was successfully harvested with B:C ratio ranging from1.55 to 3.20 in crop like Paddy (var. *Anjali*), wheat (var. *K-9107*), Toria (var. *PT-303*), Lentil (var. *K-75*), mustard (var. *SL-203*, *Bonex gold* and *Pusa Mahak*), Linseed (var.-*Sekhar*), Sweet potato (var.-*Birsa sakerkand-1*), and Niger (var. *Birsa Niger-1,3* and *JNC-6*).The extent of area under respective crop varieties ranges from 20-55%. The maximum extent of the crop varieties was in Paddy (var.- *Anjali*) , Wheat (Var. *K-9107*) and Niger (var. *Birsa niger-1*). The yield enhancement is being observed in the tune of 25-110%.

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

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
Short duration rice (var. *Anjali*)	05	3.00	30.60	22.80	34.21	18000	12600	1.70
Wheat (var. *PBW-343*)	118	32.1	32.68	26.50	23.32	17300	18648	2.07
Toria (var. *PT- 303*)	15	5.00	6.88	4.73	45.44	13245	11259	1.85
Lentil (var. *K- 75*)	02	1.00	10.86	7.80	39.23	12980	19600	2.51
Mustard (var. *S L -203*)	60	19.40	8.80	7.20	22.22	9790	21010	3.14
Linseed (var. *Shekhar*)	08	2.00	8.85	5.92	51.01	10250	15180	2.48
Sweet Potato (var. *Birsa Sakarkand*- 1)	12	3.40	164.6	105.0	54.40	40750	90890	3.23
Niger (var. *Birsa Niger*- 1)	59	24.00	3.52	2.25	63.96	6780	3373	1.50
Total	**279**	**89.90**						

Impact: Intervention advancement of planting/ sowing dates in crop like Paddy, Wheat, Lentil, Toria and Niger resulted in better yield and income recovery. As the NICRA village experiences Rice-Fallow system earlier, because of use of long duration paddy variety restrict the timely sowing of *Rabi* crop. Now this intervention is being adopted in all the cluster as well as in the adjoining villages, and the extent is 40-50% of net cultivated areas. Advancement of sowing date switching mono-cropping to double cropping.

5.3.3 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
SRI (var. *Lalat*)	20	11.40	35.41	27.29	30.09	19633	17505	1.89
SRI (var. *Basanti*)	01	1.00	42.15	36.13	16.66	25400	25180	1.99
Paddy Seed (var. *Sahbhagi* Dhan)	04	1.75	32.05	27.50	16.81	19380	15650	1.80
Aerobic Rice (var. *Anjali*) cultivation	49	17.20	25.96	19.75	31.56	15708	11332	1.72
Paddy Seed (var. *IR-64*)	02	0.32	32.61	24.50	33.10	19650	19482	1.99
DSR (var. *Lalat*)	40	23.00	27.60	24.43	11.40	18233	15807	1.87
Total	**159**	**65.67**						

Impact: Intervention like DSR, Aerobic and SRI requires about 900-950 mm of water while puddle irrigated rice requires about 900-2250 mm of water. The reduced crop duration and intermittent irrigation keeping the soil moist in SRI, rather than flooding under normal leads to saving 30-40% of water.

5.3.4 Community nurseries for delayed monsoon:

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
Paddy (var. *Lalat*)	43	11.0	31.20	24.50	27.34	19650	17790	1.90
Community nursery of paddy (var. *Lalat*)	108	36.35	32.20	27.68	20.36	20048	15327	1.76
Community nursery of tomato (var. *Laxmi*)	20	8.0	242.47	170.60	42.13	39500	105982	3.68
Total	**216**	**72.52**						

Impact: In past five years NICRA cluster and adjoining villages experienced deficient and untimely rainfall in July and first fortnight of August. Which resulted in delayed transplanting of old age seedlings (40-45 days). Transplanting of aged seedlings lead to low tillering resulted in poor crop yield. In order to address this problem KVK encouraged farmers of the village to grow community nursery with staggered date of sowing. This enabled farmers to access seedlings as and when needed by the progress of monsoon. And accordingly demonstration was conducted in four villages convening 216 no. of farmers. By the application of this approach farmers benefitted with an additional yield of 20 q/ha (52.17% increase in yield) compared to farmers who transplanted over aged seedlings. Initiative community nursery raising has also left the wide impact through successful coverage of paddy also in the district and also state to by seeing the impact of community nursery state govt. has taken to replicate this model in 43 block across the state with the investment of 43.00 lakhs in 2013.

5.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Groundnut + Redgram	36	13.40	16.03	14.21	14.82	27379	34281	2.29
Maize + Redgram	23	6.20	36.32	22.51	64.01	18363	22517	2.23
Groundnut + Maize	03	0.40	19.20	12.60	52.38	21500	36100	2.67
Paddy + Redgram	22	8.00	35.26	22.86	54.24	12000	16208	2.35
Ragi + Redgram	12	3.00	35.60	13.80	157.79	10500	25100	3.39
Redgram + Sorghum	02	1.00	10.40	8.86	17.38	16080	15120	1.94
Total	**98**	**32.00**						

5.3.6 Introduction of Horticulture crops/ crop diversification:

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
Sesame	06	2.00	5.58	3.40	64.12	18725	14755	1.79
Okra	38	17.75	128.29	85.30	50.39	25500	51474	3.01
Bitter Gourd	51	3.6	5.58	3.40	64.12	18725	14755	1.79
Bottle Gourd	113	7.50	5.58	3.40	64.12	18725	14755	1.79
Cow Pea	06	2.00	5.58	3.40	64.12	18725	14755	1.79
Sponge Gourd	23	1.508	5.58	3.40	64.12	18725	14755	1.79
Ridge Gourd	06	2.00	5.58	3.40	64.12	18725	14755	1.79
Tomato	24	18.5	5.58	3.40	64.12	18725	14755	1.79
Chilli	03	4.30	5.58	3.40	64.12	18725	14755	1.79
Brinjal	03	0.08	5.58	3.40	64.12	18725	14755	1.79
Total	**304**	**50.254**						

5.3.7 Other Demonstrations:

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
Integrated pest management in Mango	10	7.31	100.5	74.6	34.7			
Integrated pest management in Potato	26	8.00	153.92	125.20	23.79	76167.00	89198.00	2.17
Integrated pest management in Mustard (var. *pusa gold*)	04	1.00	9.90	9.00	10.00	18300.00	16350.00	1.89
Integrated pest management in Tomato (var. *Laxmi*)	10	3.00	105.00	92.00	14.13	44000.00	40000.00	1.90
Integrated pest management in Black gram (var. *Shekhar*)	10	4.00	8.14	6.10	33.44	10960.00	13460.00	2.23
Integrated pest management in Groundnut (var. *TG-22*)	18	6.00	15.25	12.12	25.00	21200.00	24550.00	2.15
Integrated pest management in Redgram (var. *Asha*)	19	12.00	10.65	7.55	42.65	17300.00	20400.00	2.18
Total	**97**	**41.31**						

Impact: Successful intervention like sand bag check dam, community paddy nursery raising, intercropping viz Redgram + Groundnut, Redgram + Maize, Drough tolerant crop variety Niger (*Birsa Niger -3*), Ragi (Variety – *GPU 28*), Paddy (Variety – *Sahbhagi Dhan*, *Lalat* and *Anjali*) and Wheat (Variety – *K 910*) has left the significant impact in area expansion, crop diversification and risk management with their intervention cropping intensity of the adjoining village has gone up to 185-200%. Other intervention is breed replacement with improved breed T&D in pig and Beetle in goat has been extended in 15 Villages and 45 farm family is directly benefitted with their intervention. Promotion of custom hiring has left the positive impact and make the farming cost effective. By seeing the response towards accessing of farm machineries/ equipments State Gov. has already implemented the scheme of establishing custom hiring centre in 45 bloks worth of Rs. 12 lakh in each block.

5.4 Module III: Livestock & Fisheries

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

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
Fodder production of *Sudan chari*	16	4.00	650.30	285.65	127.65	12500	52530	5.20
Fodder production of Sudan chari (var. *MP chari*)	03	1.00	350.00	-	-	8550	26450	4.10
Fodder cultivation with improved varieties Hybrid Napier	09	0.42	1258.00	246.00	411.39	19600	118800	7.06
Sorghum (var. *Moti*, *PC-23*)	09	1.50	696.20	265.00	3050	20600	56220	4.10
Nutryfeed	01	0.40	390.60	-	-	23100	74550	4.23
Oats	06	0.80	341.00	-	-	25100	12420	1.50
Total	**44**	**8.12**						

5.4.2 Improved fodder/feed storage methods:

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
Wheat Thresher	103	72.21	33.58	-	-	400	600	2.50
Self life enhance of Paddy Straw through Plastic cover	30	30 Units	300.00	240.00	25.00	3000	27000	10.0

5.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle	150	778 No						
Vaccination HS,BQ	289	1138 No						
Vaccination for PPR in goat	343	1071 No						
Animal health camp	100	440 No						
De-worming	223	1289 No						
Vaccination in pig	05	37 No						
Total	**1110**	**4753**						

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming in Pond	65	37 units	6.02 q/ha	1.89 q/ha	218.75	27547	32533	2.18
Composite Fish Farming in Dova	06	06 units	5.0 kg/unit	1.50 kg/unit	233.33	200	400	3.00
Total	**71**	**43 units**						

5.4.5 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (per ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Backyard poultry breed Banraja	02	10 No	2.00 kg	0.60 kg	233.33	360	440	2.22
Backyard poultry breed Garmapriya	02	10 No	1.90 kg	0.55 kg	245.54	360	400	2.11
Duck Farming breed Khaki Cambell	05	20 No	2.00 Kg	0.60 kg	233.33	300	700	3.33
Improved breed of Pig (T & D)	05	10 No	77.5 kg	25 kg	210.00	2625	10725	5.1
Improved breed (Duck)	02	02 units	1.80	1.20	33.30	90.00	180.00	3.00
Improved breed (Poultry)	03	03 Units	1.75	1.20	31.42	114	96	1.84
Total	**19**	**50 No & 05 units**						

Impact: Under livestock management module T&D breed of pig is being widely popularized through development of breed unit of piggery at farmer's door, and adopted farmer has succeeded in earning of Rs. 1 lakh to 3 lakh per year during last five years. By seeing the impact of piggery for livelihood in sustainable way, animal husbandry department of Gumla has developed the unit in 15 villages with input support. All the 15 units are being linked with NICRA intervention "Breed Unit" for supplying of improved piglets. Details of diffusion of piglet and goat buck are given below which has significant impact for livelihood support in the district and how this intervention is being scaled up.

5.4.6 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based Shelter (Pigeon Farming)	01	01 unit							
Improved shelters for pig	03	03 units							
Improved shelters for Duck	01	01 unit							

5.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions (During 2011-12 to 2016-17)	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Paddy var. Lalat	138.47	Participatory seed production though seed village	168	59.86
Fodder bank	Jowar	103.95	Fodder use in drought spill/ heavy rain	206	82.00
Commodity groups	Beej utpadan sameti	34.50	Participatory seed production though seed village	-	-
Custom hiring centre	Power tiller, Guntur Pump, Rotavator (4), Zero till seed drill, Napasack Spreyer, Power Spreyer, Paddy thresher, Maize sheller	16 no	Managed by VCRMC	361	232.35
Collective marketing	Paddy	1.00	-	-	-
Vermi compost	Production of vermi compost	1.75q/units	-	28	36
Climate literacy through a village level weather station	Automatic Wether Station	1 unit	Weather related information's	764 house hold	-
Crop insurance	Paddy	-	-	209	117.70

5.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee Gunia

5.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17 Area (ha)	Revenue generated (Rs.) Total under VCRMC
Gumla	233.55 ha	1,13,025.00

Impact: Under custom hiring module KVK has succeeded to popularize and accessing of farm machineries among the resource poor tribal farmer. Which has big impact in timely operation, cost saving and facing labour crunch during peak period. By seeing the importance and impact of custom hiring approaches State govt. came forward and undertaken the initiative to implement this model in 45villages with a cost of Rs. 562.50 Lakhs.

Implement name	2016-17		
	Farmers benefitted	Area (ha)	Revenue (Rs.)
Diesel Pump	00	00	00
Conoweeder	00	00	00
Winnowing fan	4	2	100
Wheat thresher	39	12	12500
Power tiller	00	00	00
Gutur Pump	00	00	00
Burdizocastator	00	00	00
Napsack Spreyer	03	02	100
Power spreyer	02	03	100
Paddy Thresher	04	02	100
Seed drill	01	01	100
Seed treatment drum	00	00	00
Hedge cutter	00	00	00
Maize sheller	02	03	2750
Rotavetor	01	6	3200
Total			22490
Bank Interest			4666
Total			**27157**

5.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	16	251	89	340
Crop Management	06	81	41	122
Nutrient Management	13	192	102	294
Integrated Crop Management	4	82	14	96
Crop Diversification	1	18	Nil	18
Pest and disease management	15	261	95	356
Nursery raising	1	15	8	23
Livestock and Fishery Management	9	127	56	183
Farm Implements and Machineries	2	28	3	31
Value Edition (Thoga Making)	02	Nil	43	43

5.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Parthenium Awareness, Parthenium Awareness, World food Day, Exposure visits, Field Day, Group Discussion, Van mahotsawa, World Metrology Day, ICAR Day, SHG, Campaign, Popular extension literature, Environmental day, Gram Sabha, Kishan Gosthi, Farmer to Farmer interaction (DDG Ag. Ext.) ICAR, Technology week, NICRA Workshop	76	4046	2627	6672

5.8 Soil Health Cards distributionduring 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
260	260	260	260

5.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme /Programme	Nature of work	Amount (Rs. Lakh.)
MNEREGA	Well Digging (New), Dova Digging, Goat shed,Poultry house Pond Renovation	16.32
NFSM	Micro irrigation System, Diesel Pump, Demonstration on paddy Demonstration on Moong Conoweeder	2.00
Miner irrigation	Canal renovation, Irrigation Device, Check Dam	80.00
Drinking Water & sanitation	Drinking water supply system with solar	20.00
Block	Road Panchayet Bhawan	31.00
Electric	Electricity	00
Total		**158.03**

5.10 Success stories of NICRA Village Farmers

1. Plastic cup seedling-a new idea

Sri Gopal gope of village burhu is a marginal farmer. He has 5 acres of rainfed medium land. Six members of his family is fully engaged in commercialized farming. He tried to cultivate vegetables in 2 acres of land year round. He succeeds to get better income in *rabi* and *summer* season. But during *Kharif* season he failed to get good crop stand as per his effort and desire. His past experience always resulted better return with technological refinement in crop management. His positive approach and self testing idea resulted in innovative idea for safe and early raising of cucurbitaceous seedling in plastic tea cups.

Plastic cup seedling raising idea became a boon for him and adjoining villegers, who involved in commercial vegetable cultivation. Sri Gope told that most of the farmers grow vegetables for commercial purpose and they succeed in his practices also. But the challenge is to stay in the market during rainy season. He sow the seed in cup in different dates with a view to escape the damage by heavy rain. By this innovative idea he succeeded to earn Rs. 30000 to 40000/- Rupees per acre during rainy season. While before this idea he earned Rs. 10000 to 12000 Rupees per acre only.

2. Judicious use of Mango planted bed by growing of mustard as a leafy vegetable

By seeing the innovative practices of Sri Jagarnath Oraon 15 beneficiaries especially of Belagara village came forward and started the cultivation of leafy vegetable salad crop. This innovative idea diffuses so fastly which again compelling the second user to grow fertility improvement crop like Black gram, even dhaincha in kharif crop around the mango, with an objective to improve the texture and fertility of soil for better harvest of leafy crop in rabi and summer season. Now the idea has not enhancing the income in tune of 3500 to 5000 per 100 mango plants but succeeded in enhancing the survival rate of mango orchard. This became the boon practices for successful survival of mango orchard in the district.

3. Up scaling of integrated farming system in Tribal areas

Gumla is a tribal dominated district of Jharkhand. About 70% farmers belongs from scheduled tribe community. In general land holding is small and their livelihood mostly depends on

forest based products, Livestock rearing and Crop production. By nature they are meat lovers and hence huge demand exists for poultry, pork and meat. Hence in order to maximize farm productivity and income the technology interventions through Integrated farming system were developed in participatory mode by the KVK Gumla on farmer s field.

Considering the physical, social and economical limitation of the district, a small Integrated Farming System model was developed in the field of Samsai Oraon (Tribal farmer and retired from Indian Army) in Belagarha village of Ghaghra block during 2010-11 to 2013-14. The model comprises in two ha area in the vicinity of tribal settlement and integrated with six components. The critical input assistance was provided under NICRA. Technological intervention was made through 03 piglets (Cross breed T & D), Fifty thousand Fingerlings for fish production, high yielding paddy variety (*Lalat*), Maize (*Suwan-1*), Plantation of Sixty Mango fruit plant, Vegetable seed crop Pumpkin (*Var. – Arka Suryamukhi*), One Vermicompost unit for waste recycle and renovation of well (one unit). The capacity Building programme and technological backstopping was provided to the villagers in whom the beneficiary farmers also participated. Besides all these components priority was given on pig farming intervention as per his interest and enthusiasm, and accordingly the well managed housing facilities with all the necessities was developed under NICRA in his homestead in 2011-12.

Sri Baneshwar Oraon has an experience of farming since 2006. He has a total holding of 4 acres. Out of this he uses to grow vegetables in 0.50 acre during summer and in 1.50 acre during winter season apart from cereals, Pulses and Oilseeds. He came in contact with the scientist involved in NICRA Project of KVK KVK provided training, Bio fertilizer and need based pesticides. As per his plan and technology interventions *viz* fertilizer management including quality compost, Biozyme and NPK (12:32:16), Zinc sulphate use he growed Tomato (*Var.-laxmi*) and 145-55 in 30 acre and (Chilli *Var.-Surayamukhi*) in (10 acre) in different dates. Need based irrigation and plant protection measures was undertaken. Sound market strategies were established with VEGFED for better post harvest management. By this way Sri Oraon and his group has succeeded to harvest 240 tones of Tomato and 60 tones of chilli and earned a gross income of Rs. 2160000 in Tomato and Rs. 900000 in Chilli with a Gross investment of Rs. 1050000 in Tomato and Rs 420000 in Chilli. The B:C ratio was found in 2.05 and 2.14 respectively.

6. Chatra

6.1 Village information:

Name of the village	Mardanpur Gari and Ambadhohar
No. of households	102
Total cultivated area (ha)	720 ha
Area under rainfed cultivation (ha)	240
Major soil type	Sandy Loam
Climatic vulnerability of the village	Drought and Heat wave

6.1.1 Rainfall Trend in mm:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011-12	1153.51	1028.20	51	21	14	06	997.40	1.20	29.60
2012-13	1153.51	1063.90	44	19	11	03	954.00	102.0	7.90
2013-14	1153.51	740.00	48	19	11	02	501.80	201.0	37.20
2014-15	1153.51	1163.50	59	21	10	04	729.60	59.00	146.30
2015-16	1153.51	877.20	44	21	13	04	851.20	0.00	260.0
2016-17	1153.51	14.59.00	46	20	10	06	1364.00	47.00	48.00

6.1.2 Details of the climatic vulnerability

Major Climate vulnerabilities experiences during the last five year (2011-16) were moisture stress and intermittent drought in Kharif season, Heat wave in summer and cold wave in *rabi* season, Which affect directley or indiretely production and productivity of the crops, vegetable and animals of the district.

It also reflect through, Table in the year 2013-14, 2014-15 and

2016-17 rainfall received 48.80, 75.00 and 92.00mm against normal rainfall 167.1 which directly affect the transplanting of the rice and sowing of maize+ redgram crops in the district. In the year 2013-14, 2015-16 in the month of September the rainfall occurs 65mm, 35mm and 210.8mm, Which directly affect the growth of rice and cereal crops intermittent drought like situation it also affect *rabi* crops because moisture content in soil were less.

- Moisture stress and intermittent drought in *Kharif* season
- Heat wave in *Rabi* and *summer*
- Cold wave in *Rabi* season

6.1.3 Predominant farm enterprises

i. Major cropping system:

Rice + Wheat

Maize + Redgram

Maize + Oilseed + Vegetable

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha)
Rice	Local, *Lalat, Anjali, Vandana, Shahbhagi, IR36, Naveen, Pro. Agro 6444*	352	102
Wheat	*Helna, K7025, K9107, HD2643, HUW 234*	62	68
Maize	*Suwan composit 1, HQP1, Birsa Makka 1. Birsa Vikash Makka 2, Priya*	74	76
Redgram	*Narendra Arhar-1, Birsa Arhar-1, Bahar*	36	39
Vegetable	Tomato- *Arla Alok, Arka Abha, Indo American, Swarna lalima*	79	87
	Capsicum – *California wonder, Yellow wonder, Arki Moni, Hybrid, Bharat Indara*		
	Brinjal – *Pusa Purpal goal, Pusa Purpal round, Banarash Jaint, Swarn Pratibha, Swarn Shyamali*		
Oilseed	*Shiwani, T9, Pusa Bold, Karanti*	28	39

iii. Cropping intensity (%): 140%

iv. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Tomato	25	195	*Rohit-2, Arla Alok, Arka Abha, Indo American, Swarna lalima*	25
Potato	23	186	*Kafri chandramukhi, Kafri Lalima*	23
Brinjal	24	188	*Pusa Purpal goal, Pusa Purpal round, Banarash Jaint, Swarn Pratibha, Swarn Shyamali*	24
Capsicum	10	192	*California wonder, Yellow wonder, Arki Moni, Hybrid, Bharat Indara*	10
Cauliflower	12	187	*Arli Kuwari, Pusa Katki, Pusa Dipali, Pusa Him Jyoti,Sonobol, Himani, Swati, Pusa Hybrid 1*	12

v. Area under fodder cultivation and number of farmers growing green fodder:

Year	Source of irrigation	Area (ha) under irrigation
2011-12	Pond, Well	02
2012-13	Pond, Well	06
2013-14	Pond, Well	09
2014-15	Pond, Well	12
2015-16	Pond, Well	14
2016-17	Pond, Well	16

vi. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cow, Buffalo, Goat, Pig	750	102	20	HS&HSBQ-HSBQ, FMD, Anthrex, PPR, Swan Fever Ecto parasite, Gumbrow	2 time in a year	10-15

vii. Milk productivity (L/milch animal/day): 2.5 L /animal/day

viii. Details data about inland fisheries practiced: 2 ha

6.1.4 Resource availability

6.1.4.1 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2012-13	2013-14	2014-15	2015-16	2016-17
1	No. of farm ponds/Jalkund	Repaired/ Renovated	01				
2	Community pond /tank	Constructed				01	01
		Repaired/ Renovated		04			
3	Percolation tanks/ Recharge pits (No.)	Repaired/ Renovated			01		01
5	No. of Check dams	Constructed		01			
6	Permanent check dam/Sand Bag Check dam (No.)	Constructed			01		

6.1.4.2 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Pump set 05 (2hp); ii. Sprayer Hand Operated - 02

6.1.5 Socio-economic status:

a) No. of households: OBC- 02; **SC**- 04; **ST**- 96

b) Literacy rate (%): 69% :: **Male:** 51% **Female:** 40%

c) Workers engaged in agricultural activity (%): 72

MODULE WISE INTERVENTIONS

6.2 Module I: Natural Resource Management

6.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var. *Lalat*)	80	220	25	19000	21000	2.10
Green manuaring (dhaincha) in Paddy (var. *Lalat*)	120	90	28	20500	24300	2.18
Brown manuaring in Paddy (var. *Anjali*)	40	60	23	18000	18800	2.04
Zero Tillage in wheat	96	68	19	16000	25800	2.61
Zero Tillage in Maize	128	104	16	15800	11400	1.72
Repair of bund	380	600	25	19000	21000	2.10
Optimization of horticultural production through land embankment development	20	20	60	24000	36000	2.5

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Organic mulching in vegetables (Tomato, brinjal)	90	70	142	45000	68600	2.52
Mulching (Paddy straw)	70	40	152	48000	73600	2.53
Plastic mulching tomato	40	70	162	53000	76600	2.44
Use plant leaf mulching in ginger	40	80	109	42000	12500	3.89
Use paddy straw, forest leaves in elephant foot yam	30	70	98	48000	138200	3.87
Total	**1134**	**1492**				

Impact: Out of fifteen interventions, summer ploughing become popular among farmers of NICRA village and their extent was more than 500ha, through water holding capacity of the soil increase and also minimize insect pest and weed infestation in crops, intervention like brown manuring enhance the productivity of upland rice and green manuring also become popular among farmers because it reduce use of chemical fertilizer and increase yield upto 20% compare to farmers practices, (mulching through available local material in vegetable like rice, straw plant leaf reduce 25% water requirement) according to farmers feedback, sowing of wheat through zero till drill become popular among the farmers of NICRA and adjoining village. Government of Jharkhand also taking decision in this intervention and 180 zero till drill machine distributed in the district and about 3500ha area covered under wheat cultivation through zero tillage machine.

6.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	01	1.5	80	190000	130000	1.68
Bora bandh	01	20	10 ha area come under irrigation			
Renovation of Well for irrigation	15	10	20	15000	25000	2.66
Bund making leveling in paddy field	380	600	28	24000	20800	1.86
New water harvesting structure in the paddy field	20	30	35	29000	27000	1.93
Renovation of old water harvesting structure in paddy field	40	15	28	26000	18800	1.72
Newly Check dam	19	20	26	27500	14100	1.51
Total	**476**	**696.5**				

Impact: Under Natural resource for water management intervention, renovation of pond (2 nos) bora Bandh (1 nos) renovation of well for irrigation (12 nos) bund makings leveling in rice field (350 ha), New water harvesting structure (5 nos) and newly check dam (1 nos) were constructed in NICRA village. It was observed that the capacity of renovated pond has 1645184 cubic feet and its command area was 105ha in rice and 33 has covered in wheat cultivation. This harvested structure has been also utilized in summer season for vegetable cultivation and covered about 7ha area. It was also observed that the cropping intensity of NICRA village increases from 80% to 140% only due to rainwater harvesting structure.

6.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	80	70	22	19000	22800	2.20
Sowing of paddy with ZTD machine	75	80	16	14000	11600	1.82
Sowing of lentil with ZTD machine	90	70	14	16000	14800	1.82

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of chick pea with ZTD machine	110	40	14	17500	17500	2.0
Sowing of paddy with power tiller (Direct seeded)	70	40	17	14500	12700	1.87
Sowing of pea(Arkel) with ZTD	20	30	14	13900	14100	2.01
Total	**445**	**330**				

Impact: After harvesting of rice crop the use of residual moisture for sowing of wheat, gram, lentil, pea in medium land and low land areas through application of zero till drill machine. The zero tillage machine save field preparation, irrigation, time *etc*. Therefore cost of cultivation becomes low compare to general practices, hence benefit cost ratio becomes high. By seeing the impact of zero till drill machine district agriculture department provided 180 zero till drill machine in district. In Chatra district about 3500ha area were covered through zero till drill machine.

6.2.4 Artificial ground water recharge:

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 paddy fields (2.5 feet height and width 9 inch width)	380	600	28	17000	13800	1.81

Impact: Before NICRA Project their field as a result huge volume of water along with fertile top soil was washed out in nearby rivulets, nalas and rivers. Which resulted in siltation, water table of their existing borewells and wells went down. Keeping the vibrancy of the situation intervention field bunding was taken as an initiative as a mass campaign and 30 ha of farm field was bunded well during 2011-16 under NICRA. This initiative has left a big impact and farmers of NICRA and adjoining villages came forward and done field bunding properly every year in more than 600 ha area. State Government has started the scheme known as "Medh Bandi" with the support of Rs 5000/- per ha to the beneficiaries as a promotional activities.

6.2.5 Water saving irrigation methods:

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
Application of biofertilizer in rice (var. *MTU 7029*)	380	210	22	17000	18200	2.07
Vermi-compost from biodegradable wastes (Vegetable)	80	40	108	48000	60000	2.25
Production of pigeon pea on farm bund	20	10	6	3000	15000	6.0
Total	**480**	**260**				

Impact: For increasing the water use efficiency the demonstration was conducted on micro irrigation system and their application. Through these demonstration (Sprinkler) 30% water save in field crops like wheat, gram and lentil cultivation in NICRA village, More than 60 no of sprinkler irrigation system, provided by ATMA under NFSF scheme. The extent of their application in the area is more than 550 ha especially in *Rabi* crops.

6.2.6 Other Demonstrations:

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
In-situ vermicomposting in orchards	60	04	-	-	-	-
Soil test based nutrient application	210	480	25	16000	24000	2.50
Renovation of old water harvesting structure (Well)	15	10	30	24000	24000	2.0
Soil test based nutrient application (FYM/ inorganic fertilizer)	30	10	26	21000	20600	1.98
Bio pesticides in tomato	20	15	98	41000	57000	2.39
Dolomite in gora paddy	40	60	13	6000	14800	3.46
Total	**375**	**579**				

Impact : For mitigating the climate effect, vermicompost applied in orchard plant, soil test best nutrient application recommended in field crops as well as vegetable, bio pesticide in vegetable crops are recommended for reducing the hazardous effect of insecticide and pesticide. This intervention increase (30%) productivity and (35%) profitability of respective crops as per as farmers feedback.

6.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Siltation Pond	1	1645184 cubic feet	40	42	220
Farm pond	2	11645 cubic feet	10	5	210
Well	10	-	10	10	200

Impact: Under NICRA project opportunity has been given to constructed new water harvesting structure or renovate the old water harvesting structure for better conservation of excess rainwater in village. During the year from 2011 to 2016, 1 old pond was renovated, 2 new pond was constructed with help of NGO and 10 well was also renovated. The total rainwater stored in harvesting structure about 1656829 cubic feet and 57 ha area has been irrigated through this structure of different crops.

6.3 Module II: Crop Production

6.3.1 Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	80	70	24	17	41.17	18000	20400	2.13
Drought resistant paddy (var. *Anjali*)	90	80	23	14	64.28	18000	18800	2.04
Sowing of drought tolerant paddy (var. *Sahbhagi*) with ZTD machine	90	40	22	14	57.19	19000	16200	1.85
Drought tolerant paddy varieties (var. *Naveen*)	80	40	26	18	44.44	19000	22600	2.18
DSR Transplanting (var. *Sahbhagi*)	10	40	21	14	50.00	18000	15600	1.86
DSR Transplanting (var. *Abhishek*)	15	30	24	15	60.00	19200	19200	2.0
Drought tolerant ragi (var. *A-404*)	30	22	9	5	80.00	9000	5400	1.6
Drought tolerant pigeon pea (*Narendra Arhar-1*)	30	60	15	9	66.66	13000	24500	2.88
Niger (var. *Birsa Niger* -1)	60	210	5	3	66.00	5100	9900	2.94
Horse gram (var. *Birsa kulthi*-1)	30	80	9	5	80.00	7500	8700	2.16
Contingent Crops Horse gram	30	55	9	5	80.00	7500	8700	2.16
Drought resistant brinjal (var. *Swarn Shree, Swarn Mani*)	30	45	115	70	64.28	45000	47000	2.04
Wheat (var. *Helna*)	45	32	28	17	64.70	21000	26600	2.26
Total	**360**	**614**						

Impact: For mitigating the climate effect drought tolerant crop varieties demonstrated in NICRA village. It gives 15% to 50% high yield compare to farmers varieties respectively. The extent of area under respective crops varies ranges from 35 to 65%. It also give 35 to 50% extra income compare to farmers varieties.

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

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
Wheat (var. *K9107*)	83	30	35	28	25.00	19000	26500	2.39
Mustard (var. *Mahak*)	85	36	11.50	9.30	23.64	14500	20000	2.37
Total	**168**	**66**						

Impact: Intervention advancement of sowing dates of wheat and mustard resulted in better yield and income recovery. As the NICRA village experiences rice fallow system earlier, because of use of long duration rice varieties restrict the timely sowing of *Rabi* crops. Due to introduction of short duration of rice varieties. Now this intervention is being adopted in all the adopted villages as well as in the adjoining villages, and the extent is 60% of net cultivated area. Advancement of sowing date switching mono-cropping to double cropping. It also protect crops on earlier arrival of heat wave which reduce quality of grain and yield.

6.3.3 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	52	40	38	21	80.95	22000	38800	2.76
Aerobic Rice (var. *Anjali*) cultivation	60	35	23	19	21.05	18000	18000	2.04
Direct seeded brown manured rice	40	28	22	17	29.41	18000	17200	1.95
Zero tilled rice	55	35	23	16	43.75	19500	17300	1.88
Total	**207**	**138**						

Impact: Intervention like DSR, Aerobic and SRI requires about 900-950 mm of water while puddle irrigated rice requires about 900-2250 mm of water. The reduced crop duration and intermittent irrigation keeping the soil moist in SRI, rather than flooding under normal leads to saving 35-45% of water.

6.3.4 Community nurseries for delayed monsoon:

Table. Performance of Community nurseries

Technology demonstrated	No. of farmers	Area (ha)
Raised Community nursery of paddy (var. *Anjali, Vandana, Abhishek, Shahvb, Abhishek Naveen*)	120	40
Community nursery of cauliflower, brinjal, tomato	110	0.45
Total	**230**	**40.45**

Impact: In order to address this issue under NICRA project KVK encouraged farmers of the village to grow community nursery with staggered date of sowing where water body available. This enabled farmers to access seedlings as and when needed by the progress of monsoon. Keeping this fact under consideration KVK conducted demonstration in NICRA village covering 120 farmers under 40ha of land (2011-16). Resultant after this intervention farmers got contingent tender seedling (10 to 15 days old) when rainfall arrived. Due to this intervention farmers got 30% to 60% extra yield when rainfall arrived late. This intervention widely accepted by farmers in all block of the district, now this technology covered 1000ha area of the district.

6.3.5 Locaton specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize + Redgram	110	80	Maize – 32 Red gram- 14	28 -	14.28 100	12000	24400	3.03
Total	**110**	**80**						

Impact: Mixed cropping of maize and Red gram is common practices in the district which increase cost of cultivation due to manual weeding, Under NICRA project inter cropping of Maize + Red gram (1:1) demonstrated which gave 60% extra yield compare to farmers practices.

6.3.6 Introduction of new crops/ crop diversification:

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
Onion(var. *N-53*)	25	12	120	70	71.42	48000	48000	2.0
Tomato (var. *Param F1*)	60	30	160	90	77.77	8800	72000	1.81
Chilli (var. *Surajmukhi*)	12	17	102	70	45.71	70000	83000	2.18
Cabbage (var. *OM-3*)	10	22	170	70	142.85	45000	91000	3.02
Radish	17	04	70	40	75.00	21000	49000	3.33
Cauliflower snowball	20	10	122	72	69.44	48000	49600	2.03
Brinjal (var. *Swarmsjree*)	20	07	108	65	66.15	42000	33600	1.80
Turmeric (var. *Rajendra soniya*)	08	04	160	78	105.12	72000	88000	2.17
Ginger (var. *Nadiya*)	09	03	111	71	56.33	51000	71100	2.39
Lentil (Short duration variety *PL – 406*)	12	06	14	9	55.55	13000	15000	2.15
Linseed (Short duration variety *T 397)*	07	08	8	5	60.00	6600	13400	3.03
Tomato under mulching	20	26	160	90	77.77	58000	54000	1.93
Total	**220**	**149**						

Impact: Farmers generally grow traditional crop like rice, maize *etc*, for family consumption vegetable are also grow with Desi varieties resultant given poor yield. But after intensification by improved varieties and package of practices farmers get 40% extra yield and 25% extra income, under diversification according to farming situation new vegetable crops like, hybrid tomato, capsicum, off season cauliflower introduce in village and farmers got some time 100% additional income through this intervention.

6.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrated (During 2011-12 to 2016-17)	No. of farmers	Unit/ Area (ha)
Berseem	10	02
Quality legume fodder Sudan Grass	35	40
Fodder production of Maize/Sudan	40	28
Fodder cultivation with improved varieties Hybrid Napier	10	06
Sorghum	20	04
Oat (Kent)	10	03
Total	**125**	**83**

6.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)
Vaccination camp against FMD Cattle & PPR against goat	280	790
Vaccination HS,BQ	690	820
Vaccination for PPR in goat and Ranikhet in Poultry.	290	600
Animal health camp (HS+BQ)	144	600
Deworming (Febendazole) and Mineral mixture	417	931
Animal Treatment Camp Butox, Prajana,Sulpha Dimadin ,Oxytetra cycle	900	12
Total	**2721**	**3753**

Impact: Generally farmers are not aware about vaccination of animals. But NICRA village KVK organized at least two vaccination camp before rainy and Winter season in preventive measures of animals.

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	20	1.5	80	38	110.52	140000	180000	2.28
Total	**20**							

6.4.4 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (egg/bird)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Replacement of local breed with Khaki Campbell (Three bird)	132	396	660 (egg)	340 (egg)	94.11	1700	3300	1.94 (First year)
Improved breed of Pig (T & D) (2F +1M)	10	60	9 piglet/ house	5 piglet one harr.	80.00	29000	26000	1.89
Total	142							

Impact: Under livestock management module Khaki Campbell more popular in NICRA Village because the production of egg of Khaki Campbell about 94% more than local breed of bird. Hence net return of the farmers just double w.r.t. local bird. In NICRA village T&D breed of pig is being widely popularized through development of breed unit of piggery at farmer's door, and adopted farmer has succeeded in earning of Rs. 1 lakh to 3 lakh per year during last five years. By seeing the impact of piggery for livelihood in sustainable way, animal husbandry department of Chatra has developed the unit in 10 villages with input support. All the 10 units are being linked with NICRA intervention "Breed Unit" for supplying of improved piglets.

6.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. /Area (ha)
	Name of crops / Commodity groups / Implements	Quantity (q)	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri	30	Quality seed	-	-
Commodity groups	Kitchen Gardening	20	Improved Variety Seed	20	01
Custom hiring centre	3HP Pump set	-	-	48	26
Collective marketing	Onion/ Vegetable		-		
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1	Manual reading of the weather parameters are taken		

6.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Risk Management Committee, Mardanpur, Chatra

6.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Chatra	64582.00	64582.00

Impact : Under custom hiring module KVK has succeeded to popularize and accessing of farm machineries among the resource poor tribal farmer. Which has big impact in timely operation, cost saving and facing labour crunch during peak period. By seeing the importance and impact of custom hiring approaches State govt., came forward and undertaken the initiative to implements this model in each block of district. The state government supply 15 implements including tractor with trolly, rotavator and open block level implements bank. This scheme supervision by soil conservation department of district and fixed a nominal rate of each implements for custom hiring.

6.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	17	301	227	578
Crop Management	18	401	270	671
Nutrient Management	6	98	88	186
Integrated Crop Management	14	316	242	558
Crop Diversification	13	249	177	603
Pest and disease management	6	132	90	222
Resource Conservation Technology	07	166	132	289
Integrated Farming System	02	48	36	84
Livestock and Fishery Management	04	96	70	156
Farm Implements and Machinaries	01	24	20	44
Employment generation	02	38	40	78

6.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Field Day, Group Discussion, Method demonstrations, KMAS Services, Farmers day, SHG, Campaign, Popular extension literature, Animal Health Camp, Kishan Gosthi, Technology week, NICRA Workshop at ATARI, Kolkata, Scientist visit to field	697	4434	4699	9133

6.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
1720	1720	1720	1720

6.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs. Lakh)
Soil Conservation office	Dhobha	6.00
BOI Chatra	Skill oriented training	12.00
MANREGA	Construction of new pond under MANREGA	6.70
MANREGA	Construction of new pond under MANREGA	6.40
WADI Project of NABARD with TDF	Plantation of fruit plants in 80 ha areas	3.50
Total		**34.60**

6.10 Success stories of Village Farmers

1. Pea Cultivation by utilization of residual moisture in NICRA Village of Chatra in Jharkhand

Sri Arnish Kujur is a marginal farmer of village Mardanpur of Chatra district in Jharkhand. He has about 2 ha of land under cultivation. He took suggestion from the KVK and started pea cultivation with minimum tillage for proper utilization of residual moisture after harvesting of paddy. Quality seed (var *Arkel*) and chemical fertilizers were provided from the project to him.

He judiciously used FYM with balanced dose of nutrients (N:P:K::20:40:20) during the land preparation. Crop pea (var *Arkel*) with was sown in the last week of November. Crop was harvested early and sold in the market @ Rs. 30 to 35/kg in the month of January. He earned Rs. 1,15,000/- by sale of 35 q of pods in one ha of land. Sri Kujur spent Rs. 52,000/- and earned about Rs. 1,35,000/- per ha with a net income of Rs.73,000/- per ha in a short span of time by cultivation of vegetable peas through utilization of residual moisture. He also motivated other farmers for cultivation of vegetable pea after harvesting of paddy

2. Rice *varieties Anjali, Bandana* proved to be a boon for climate resilience.

Mardanpur village in Chatra block of Chatra district adopted under National Innovation of Climate Resilient agriculture project (NICRA) by KVK Chatra in the year 2012. It was revealed that majority of the farmers was facing the problem of low productivity in rice due to several factors like drought tolerant varieties imbalanced use to nutrients, moistures stress in growth stage and incidence of pests and diseases. After farmers participatory planning it was decided to demonstrate. such varieties which are 90-100days duration and having 10-15 days dry spell tolerant capacity along with balance does of nutrients. The KVK earlier had conducted on form trails with three varieties *i.e. Anjali, Bandana* and *Abhishek*, out of which *Anjali and Bandana* were found to be best performance in drought like situation in the district.

Community level seedling was raised where water body available and 21 days old seedling were transplanted at the spacing of 25 cm x 15 cm @ 1 and 2 seedling per hill. Initially farmers were not ready to prepare 2.5 ft x 0.75 ft bund before onset of monsoon for rain water managementafter persuasion through exposure visit to KVK farm then agreed to prepare bund around the field, one weeding was done by cono-weeder after 20-30 days after transplanting. The crop stand was so attractive even 10 days 2 dry spell during growth stage. Farmers from nearby village after visited the demonstration sites and enquired about the varieties and other management practices. The average productivity was recorded to be 26 q/ha an increase of 85 percent over the existing varieties and management *i.e.* 14 q/ha. This bought a spectacular change in rice production scenario. As a result about 350 ha are covered with this varieties in the village, and now a days about 6000 ha area of the district covered with this varieties. This news was also highlighted by news paper.


'निकरा' ने मरदनपुर के किसानों को दिखाई राह


दैनिक जागरण
उम्मीदें 2016
मरदनपुर के किसानों ने जल संरक्षण की दिखाई राह

7. East Singhbhum

7.1 Village information:

Name of the village	Lowkeshra, Barunia and Pathergora
No. of households	593
Total cultivated area (ha)	465
Area under rainfed cultivation (ha)	425
Major soil type	Sandy loam
Climatic vulnerability of the village	Drought and Heat wave

7.1.1 Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	1199.7	1750.40	83	6	1	7	1089.8	286.7	213.0
2012	1199.7	1345.40	86	3	2	4	1033.3	116.7	171.9
2013	1199.7	1673.0	74	10	2	9	1008.2	383.0	340.6
2014	1199.7	1222.80	77	0	10	5	877.6	127.0	142.8
2015	1199.7	1502.60	70	8	2	7	1155.20	70.8	299.3
2016	1199.7	1258.30	67	11	7	6	1072.90	5.2	181.9

7.1.2 Deatails of the climatic vulnerability

The major vulnerabilities experiences during the last five year *i.e*; from 2011 to 2016 were very erratic, late and early cessation of monsoon, heavy rainfall within two three days and more than 10 days dry spell. In general paddy transplantation shifted from last week of June to 20th July.

In the year 2013 (146.2 mm), 2014 (109.0 mm), 2015 (142 mm), 2016 (189.6 mm) rainfall received during the month of June were less than the normal (218.8mm) which vary from 49.65 % to 100% less than the normal. The June 2012 was the only month which received 2 % higher rainfall than the normal and farmers start their normal ploughing and sowing/ transplanting works. Though the year 2012, 2013, 2015 and 2016 received total of more (1320.60 mm, 1731.80 mm, 1525.30 mm & 1260mm respectively) but its distribution was very erratic which affects upland paddy panicle initiations along with its booting stages during August month, when continuous dry spell occurred. Mid and low land paddy were also affected at that time as their tillers number reduced. During the above years paddy crops suffers frequently dry spell during September and that favours stem borer and leaf hopper.

However, the year 2014 received total of 1147.40 mm rainfall which was less than normal rainfall. Through the onset of monsoon was 6 day late but continuous dry spell affected upland, midland and also low land paddy very drastically and more 50% reduction in upland paddy has been seen during this period. During October 2014 to February 2015 NICRA villages also experienced dry spelled conditions due to which panicle initiation and flowering stages of midland and upland paddy suffered. Due to insufficient and erratic rainfall situation during 2014-15, water table and water level of well and ponds depletes and most of the places become dry due to which farmers couldn't provide 3 irrigation in wheat and mustard, which drastically reduced their yield (>30%). In wheat crop, due to variation in temperature (8.7 to 39.50 C) spikes length reduced and its flowing also affected in the due to heat wave (> 320C) at the end of February. The variation in humidity was also observed from 21 to 84 % which favours insect pest and disease infestation.

7.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy- Wheat-Vegetables / Paddy-Gram-Vegetables
Maize-Fallow	Maize-Vegetables /Wheat/Mustard
Pigeon pea-Fallow	Blackgram-Pea/Mustard

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Paddy	*Naveen/ Sahabhagi/ CR Dhan-40/ GB-1*	624	326
Pigeon pea	*ICPL 87119/ ICPL-858063*	60	30
Green Gram	*Samrat*	25	8
Black Gram	*Pant U-31*	30	6
Mustard	*Bharat Sarson-1*	49	10
Linseed	*Subhra/ Padmini*	58	9

iii. Cropping intensity (%): 139

iv. Horticulture crops:

Crop	Area (ha)
Brinjal	10
Tomato	15
Okra	10
Radish	1
Bitter Gourd	2
Bottle Gourd	2
Sponge Gourd	3
Ginger	1
Turmeric	4
Colocasia	2.5
Amaranthus sps.	8
Spinach	2
Cauliflower	5
Cabbage	3

v. Area under fodder cultivation and number of farmers growing green fodder:

Source of irrigation	Area (ha) under irrigation
Tanks/ponds	80
Open wells	10
Bore wells	-
Lift irrigation	25
Other sources (Nala)	10
5% model	40

vi. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle: Cross breed	14	6	0.7	FMD & HS & BQ	50-55	2
Indigenous breed	642	284	-	FMD & HS & BQ		
Buffaloes	54	24	-	FMD & HS & BQ		
Goat	2094	556	20.0	PPR		7
Pig	485	42	45.0	Swine fever		5
Poultry	6080	498	28.0	Rani khet		12

vii. Milk productivity (L/milch animal/day): Cow Cross breed 4-7 L/day & Indigenous breed 1-4 L/day

7.1.4 Resource availability:

7.1.4.1 Status of common pool resources (CPRs)

CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
		Before NICRA	After NICRA
Pond	20 unit	12 Defunct	4 Renovated
Check Dam	2 unit		
5% model	38 unit		30 unit
Well	24 unit	16 Defunct	3 well renovated

7.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	TOTAL No.
1	No. of farm ponds/Jalkund	Repaired/ Renovated	12
2	Percolation tanks/ Recharge pits (No.)	Constructed	38
		Repaired/ Renovated	30
3	No. of Check dams	Repaired/ Renovated	3
4	Permanent check dam/Sand Bag Check dam (No.)	Constructed	1
5	Drainage Channel (length in meter)	Cleaning/desilting	500
6	Recharging of wells		11

7.1.4.3 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Power Tiller- 1 ii.Pump Sets- 4 iii. Paddy Thresher- 3

iv.Fertilizer Broadcaster- 5 v. Sprayer- 5 vi. Conoweder-10

vii. Weighing machine-1 viii.Zero Tillage Machine ix.Mini Dal Mil-1 x. Mini Oil mil -1

7.1.5 Socio-economic status:

- **a) No. of households – OBC:** 69 , **SC-** 184 , **ST-** 372
- **b) Literacy rate (%): Male:** 70 **Female:** 15
- **c) Workers engaged in agricultural activity (%):** 50

MODULE WISE INTERVENTIONS

7.2 Module I: Natural Resource Management

7.2.1 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
Summer Ploughing in Paddy (var. *Sahabhagi* & *Naveen*)	25	10	37.9	21500	36000	2.72
Green manuaring (dhaincha) in Paddy (var. *Naveen*)	30	10	41.50	22500	40000	2.81
Brown manuaring in Paddy (var. *Anjali*)	10	2	38.6	22500	37000	2.68
Zero Tillage in Chickpea	15	5	7.9	20000	11250	1.56
Plastic mulching Okra, cucumber	118	21	98.60	31200	67400	3.16
Use plant leaf mulching in ginger	15	3	190	110000	1030000	9.65
Use paddy straw, forest leaves in elephant foot yam	20	2	324	196000	290000	2.47
Total	**233**	**53**				

7.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
5% Model (Paddy)	70	38 no	37.9	21500	36000	2.72
Renovation of Well for irrigation (Okra, Cucumber, leafy vegetable)	20	11 no	98.60	31200	67400	3.16
Total	**90**					

7.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of chick pea with ZTD machine	10	5	7.9	20000	11250	1.56
Sowing of paddy with power tiller	80	10	37.9	21500	36000	2.72
Total	**90**	**15**				

7.2.4 Other Demonstrations:

Table. Performance of other demonstrations

Technology demonstrated	No. of farmers	Area (ha)
Cleaning and renovation of old farm pond	60	90
Renovation of old water harvesting structure (Well)	20	16
Planting forest trees for biodiversity, forestation	40	20
Total	**120**	**126**

7.2.5 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Desilting Pond	4	2400003 ft	25	40	187
Checkdam	2	1500003 ft	80	60	125
5% model	38	570003 ft	40	45	130
Desiliting drainage channel	1		60	40	112
Repaired well	4	15003 ft	12	6	224

7.3 Module II: Crop Production

7.3.1. Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	64	30	39.5	29.00	36.20	21500	36000	2.72
Drought resistant paddy (var. *Anjali*)	35	15	37.6	29.00	29.65	13000	16000	2.23
Drought tolerant paddy varieties (var. *Naveen*)	59	25	38.9	29.00	34.14	17850	28950	2.62
DSR Transplanting (var. *Abhishek*)	46	20	34.3	29.00	18.27	13000	16000	2.23
Drought tolerant pigeon pea (var. *ICPL 88039*)	30	10	12	8	50.0	13000	27000	3.07
Total	**234**	**100**						

7.3.2 Introducing salt tolerant paddy varieties:

Table. Performance of different salt tolerant paddy varieties

Technology demonstrated (Salt tolerant varieties)	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
CR Dhan-5	15	5	38.5	29		20500	18000	1.87
Total	**15**	**5**						

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

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
Short duration rice (var. *GB-1*)	40	15	41.3	31.00	33.22	21500	33220	2.54
Wheat (var. *K-9107*)	32	6.88	32.33	18	79.61	19000	22000	2.16
Mustard (var. *Bharat Sarson-1*)	25	5	8.25	5.10	62.00	9500	15250	2.60
Mustard (var. *Pusa Gold*)	13	4.32	7.5	5.5	36.36	8000	18250	3.28
Total	**110**	**31.20**						

7.3.4 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	75	10	39	19.5	100	17850	28950	2.62
SRI (var. *MTU -7029*)	40	2.53	48	39	23	20000	37600	2.88
DSR (var. *Anjali*)	50	4.7	29	19.5	49	13000	16000	2.23
Total	**165**	**17.23**						

7.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize + Arhar	12	1				25000	64760	3.39
Arhar + Moong	22	8				13000	22000	2.69
Total	**34**	**9**						

7.3.6 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (var. *Pusa bold*)	13	4.32	7.5	5.5	36.36	8000	18250	3.28
Gram (var. *Pusa 362*)	25	5	17	8	112.5	17200	20084	2.16
Tomato	8	0.5	180	90	100	55000	125000	3.27
Brinjal (var. *VNR 212*)	10	2	254	172	47.67	62500	89900	2.26
Turmeric (var. *Rajendra soniya*)	10	3.4	220	125	76.00	75000	805000	8.52
Ginger (var. Nadiya)	8	2.3	190	105	80395	110000	1030000	9.65
Total	**74**	**17.52**						

7.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Berseem	6	1.85	1.63					
Fodder cultivation with improved varieties Hybrid Napier	3	0.6	875	275	218.18	19000	97000	5.96
Total	**9**	**2.45**						

7.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle & PPR against goat	344	1345 no						
Vaccination for PPR in goat and Ranikhet in Poultry.	180	780 birds						
Total	**524**							

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	15	150000 fingerling	Body weight in 6th month-0.900kg	Body weight in 6th month-0.500kg		10500	70500	7.7
Total	**15**							

7.4.4 Livestock demonstration:

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
Backyard poultry (*Vanraja*)	20	180				210/ birds	120/birds	2.33
Replacement of local breed with Khaki Cambell	50	309				200/ birds	340/birds	2.7
Improved breed of Pig (T & D)	6	24						

7.4.5 Improved shelters for reducing heat stress in livestock:

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
Improved shelters for pig	3					4500	11000	6500	2.22
Total	**3**								

7.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri	40	Quality seed	40	15
Commodity groups	Kitchen Gardening	20	Improved Variety Seed	40	12
Custom hiring centre	Power tiller	22100.00	-	30	19
Collective marketing	Onion/ Vegetable	30	-	10	11
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1	Manual reading of the weather parameter are taken		

7.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee, East Singhbhum

7.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	Revenue generated (Rs.) Total under VCRMC
East Singhbhum	64000.00

7.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	19	640	348	988
Crop Management	37	850	740	1590
Nutrient Management	14	270	124	394
Integrated Crop Management	08	150	129	279
Crop Diversification	05	66	40	106
Resource conservation Technology	10	150	146	296
Pest and disease management	16	226	165	391
Nursery raising	14	218	212	430
Integrated Farming System	06	97	90	187
Livestock and Fishery Management	08	145	100	245
LAC Cultivation	01	20	20	40
Employment generation	04	62	40	102

7.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Popular extension literature, Animal Health Camp, Kishan Gosthi, Technology week, NICRA Workshop at ATARI, Kolkata, Scientist visit to field	299	1494	711	2205

7.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
180	180	180	470

7.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
MESO	Well (15 feet Dia & 30 feet deep) in Lowkeshra Village	150000
ATMA	Kisan Mela & Training cum Exposure visit	180000
Pradhan mantri Sadak Yojna	3 KM Pakka Road in Pathergora village, 1 KM Pakka Road in Lowkeshra Village	30000000
MANREGA	2 pond in Lowkeshra village	200000
	Kachcha irrigation Channel (400feet) Barunia Village	100000
District Animal Husbandry Department	Poultry farm, Pig breeding farm	200000
MANREGA	Pig Farm	250000
Mukhiya Fund	Repair of Road	450000
Tata Steel (CSR activities)	Pond digging	720000
Fisheries Department	Fingerlings -150000	30000
District Agriculture Officer	Vermincompost – 70 unit	350000
ITDA, East Singhbhum	Power tiller-1 no, Paddy transplanter-1, Cultivator-1 no, Diesel pumset-2	480000
MESO	Powertiller , Roter, Paddy transplanter	160000
Total		**3570000**

7.10 Success stories of NICRA Village Farmers

1. Crop + Pig cum duck cum fish system turns fortune

Sri Matu Mardi 38 years old rural youth of village Lowkeshra, Musabani has transformed himself as a progressive farmers after the inception of NICRA project in his village. He used to cultivate rice as mono-crop with traditional method and domesticate livestock like pig, poultry and sheep. He has a pond of 100 feet × 100 feet × 5 feet depth but was unproductive for many years due to lack of knowledge and awareness about integrated farming system. He neither stocked composite species of fishes nor integrated improved duck, pig breed and crops cultivation. On an average he get net profit of Rs. 29400.00 with the investment of Rs. 80000.00.

After getting guidance by the KVK scientists he constructed small hut during summer 2012, on the bank of pond. He clean the pond by removing all unwanted vegetation and cleaned the pond. He make outlet of pig house in to the pond and also add lime 4q/ha and cow dung 10q/ha in that pond on advise of the KVK scientists. In the month of July 2012 he added different species of fishes namely *Rohu*, *Katla*, *Mrigal*, Common carp, Grass Carp *etc*. as suggested by Scientists. Along with these he was supplied with 15 improved Khaki Campbell ducklings with 2(m) + 4 (F) pig (T × D) breed and in nearby adjoining areas he cultivated crops (*eg*. Mustard, Wheat, Gram) and vegetable (*eg*. Bitter gourd, Onion and Okra) and started integrating farming system in his land. Pig and duck excreta were the main source which benefited fishes, pond water was used to irrigate *Rabi* season crops whenever needed and vegetable wastes used as feed of duck and pig.

The overall productivity was found to increase tremendously and with investment of total amount of Rs. 141900.00 annually, he get net profit of Rs. 171500.00 in the first year (2013) that was ever noticed and gained by him earlier. The cost of cultivation will reduced in the coming year as he has not to invest money in pig, duck and infrastructure.

Now observing the benefits harnessed by Matu about 45% farmers in the localities having ponds have trying to adopt this model of farming system.

Sl no	Crop/ Enterprises	Pre NICRA				Post NICRA			
		Gross Return (Rs/ ha)	Cost of Cultivation (Rs/ha)	Net Return (Rs/ ha)	B:C	Gross Return (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Return (Rs/ha)	B:C
1.	Rice	32,000	15000	17000	2.13	48000	18000	30000	2.67
2	Wheat	-	-	-	-	35000	20000	15000	1.75
3	Pig	7,000	4000	3000	1.75	115000	40000	75000	2.88
4	Poultry	2,000	8,00	1400	2.5	4000	1200	3000	3.33
5	Duckery	--				5000	1700	3500	2.94
6	Fishery	7,000	3,000	4000	2.33	20000	5000	15000	4.00
7	Others (Veg+Spices)	62,000	56,000	4000	1.11	90000	60000	30000	1.5
	Total	**110000.00**	**78800.00**	**29400.00**		**317000**	**145900**	**171500**	



2. Adoptation of 5% Model for life saving irrigation of the crops

Sri Basant Mardi is inter passed 27 years old, rural youth of village Pathargora has adopted 5% model in 1.0 acre area of mid land situation, where paddy suffer moisture stress at the time flowering and grain filling in case of early cessation of monsoon. The 5% model ditches in each plot to harvest and collect the rain water has increases stored water and the moisture level which also helps in transplanting rice with available moisture in the 5 % model. Later stored water also used as life saving irrigation in case of early cessation of monsoon.

The another advantages of 5% model is that, after harvesting paddy famers can go for early vegetable cultivation in the same land with the stored water in these ditches. Earlier these lands remain fallow but now they are getting vegetable as a cash crop.

After cultivation of rice, tomato, cauliflower, raddish and frenchbean his net return were Rs. 25000/-, 37,900/-, 96,700/-, 30,000/- and 50,000/- per ha respectively.

By adopting 5% model, Sri Basant Mardi is happy and satisfied that he can saved his main crop paddy from moisture stress and also getting vegetable as a cash crops from same acre of land.

3. Duck farming- assured source of nutrition and income

Khaki Campbel ducks can sustain and perform well under harsh and adverse environment prevailing in free range backyard farming with a small water body (ditch, water channel or a pond). On the basis of its performance studied under front line demonstration it was decided to promote duck rearing in the backyard as an additional source of income and better resource management. 10 farm families were selected and trained. They were given 140 ducks of about 2.5 months.

Promising features studied are

- Attractive body features
- Better survivability
- Low to negligible input cost
- Large egg size
- Better disease tolerance

Among the various beneficiaries studied Sri Moti Mardi's story is found interesting and most successful one. Seeing his interest and dedication he was given 4 females and two male ducklings. As per the advice given he trained the ducks to go to nearby water body (a ditch). He fed fresh cooked rice with gruel and dried fishmeal thrice daily for a month to the ducklings

followed by two meals /day. He served soft palatable chopped green grass from his vegetable field. He is also feeding azolla as a source of protein to the ducks. The ducks grew healthy and females started laying eggs after 24 weeks of age.

The family of Sri Mardi comprising four adults and three kids often availed eggs in their food. The nutritive value of daily food increased well in quality. The net income through duck rearing (sell of egg, ducks) was Rs 7500/- in 1.5 years. Today Shri Mardi is very fond of keeping ducks as an alternate source of income. At the same time he is very satisfied to have tremendous increase in the quality of food his family is consuming after having egg production in surplus. He is able to nurture second generation ducks using desi hens to hatch the eggs. Today they have eight females and three male ducks.

8. Godda

8.1 Village information:

Name of the village	Bhelwa and Gunghasa (Pauriahaat Block)
No. of households	147 (Bhelwa) + 198 (Gunghasa) = 345
Total cultivated area (ha)	234 (Bhelwa) + 316 (Gunghasa) = 550
Area under rainfed cultivation (ha)	169 (Bhelwa) + 301 (Gunghasa)= 470
Major soil type	Sandy loan to Red laterite
Climatic vulnerability of the village	Rainfall: uneven and erratic rainfall, High/Low Temperature, Heat Wave, Cyclonic rainfall & hail storm, Dry spell

8.1.1 Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	*Summer*
2015-16	1094.8	1260.8	110	3	1	0	0	866.2	38.8	355.8
2016-17	1094.8	897	91	0	0	0	0	702.1	14.4	180.5

8.1.2 Details of the climatic vulnerability

Major climatic vulnerabilities experiences during the last two years (2015-17) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought like situation occurred during growth and flowering stage in Paddy and other *kharif* crops like pigeon pea, groundnut and maize, which affect the crop severely. The total rain fall received 1260.8 mm in the year 2015-16 was more than the normal (1094 mm) whereas in the year 2016-17 it was 897 mm which was less than the normal. The rainfall received during the month of June (241.3 mm) was more than normal rainfall (186.9 mm) in the year 2015-16 and was less (108.2 mm) than the normal in the year 2016-17. During growth and flowering stage the rainfall was less in the month of September and October in the year 2015-16 and in August and October in the year 2016-17. However in *Kharif* the no. of rainy days was experiences better in 2015-16 (70 days) in comparison to 2016-17 (61 days). In 2015-16 and 2016-17 the intermittent drought like situation occurs in village Bhelwa and Gunghasa during flowering stages of paddy. The paddy crop was badly affected by the water stress situation, which was safely controlled and managed by the coping strategies of water management.

8.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy- Mustard-Vegetables
Maize-Fallow	Maize-Vegetables /Mustard
Cowpea-Fallow	Cowpea/Chickpea/Vegetables
Pigeonpea-Fallow	Pigeonpea/Vegetables

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

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)
Paddy	*MTU – 7029/Hybrids*	110	70	77	40.5
Pigeonpea	*NDA-1*	105	25	29	8.9

Chikpea	*PG-186/JAKI 9218*	77	12	17	10.1
Mustard	*Pusa Mahak*	86	12	16.3	9.2
Maize	*SCMH-411 / HQPM-1*	55	25	28	37.8

iv. Cropping intensity (%): 100% (Before NICRA), 126.00% (After NICRA)

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Potato	9.80	185.00	*Kufri jyoti / Kufri lalima*	6.50
Brinjal	12.60	195.00	Local / Hybrid	8.40
Tomato	2.5	350.00	*S-22, Pusa ruby, Hybrids*	2.1
Chilli	0.75	120.40	*G-4, Local, Hybrids*	0.6
Cauli flower	1.25	154.80	*Snowball-16, Hybrids*	1.25
Cabbage	1.46	280.80	*Pride of India*	1.46
Bottle gourd	1.2	145.00	*Pusa Meghdoot, PSPL,* Local	0.8
Bitter gourd	1.4	125.00	*Priya, Pusa do mausami /* local	0.97
Ladies finger	3.2	145.00	*Varsa uphar / Arka Anamika/* hybrids	2.8

vi. Area under fodder cultivation and number of farmers growing green fodder:

Year	Source of irrigation	Area (ha) under irrigation
2015-16	Lift & Pond	1.20
2016-17	Lift & Pond	1.68

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle	675	168	7.7	FMD & HS & BQ	25-28	7
Buffaloes	102	29	-	FMD & HS & BQ		2
Goat	1701	252	2.70	PPR		12
Pig	368	156	2.8	Swine fever		28
Poultry	3835	282	28.00	Rani khet		32
Sheep	18	5	-	PPR		11

viii. Milk productivity (L/milch animal/day): Cow Cross breed 6-9 L/day and Indigenous breed 1-4 L/day

ix. Details data about inland fisheries practiced: Pond (4 No.)

8.1.4 Resource availability:

8.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)
2015-16	pond	2 units	2 Units
2016-17	pond	2 units	2 Units

8.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2015-16		2016-17	
			Area (ha)	Farmers involved (No)	Area (ha)	Farmers involved (No)
1	Community pond /tank	Constructed			01 unit (80 ha)	40
		Repaired/ Renovated	01 units (35 ha)	25	01 unit (35 ha)	30
2	Construction of ring well (15' depth with 15' diameter)		01 unit (80 ha)	35		

8.1.4.3 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Pump set- 06 No. ii. Spray Machine- 04 No.

8.1.5 Socio-economic status:

a) No. of households – OBC: 135 , **SC**-12 , **ST**- 198

b) Literacy rate (%): 48.20:: **Male:** 58.11 **Female:** 27.32

c) Workers engaged in agricultural activity (%): 92

MODULE WISE INTERVENTIONS

8.2 Module I: Natural Resource Management

8.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var. *Sahbhagi*)	32	10	43	37700	3100	1.82:1
Repair of bund (Paddy)	110	52	41	37700	27900	1.74:1
Total	**142**	**62**				

Impact: Due to these interventions like summer ploughing and bunding in paddy field being widely accepted by the farmers of NICRA and adjoining villages, and their extent was more than 200 ha. Through these interventions, moisture availabilities extent has been increased and standing crops did not face any water stress situation as per farmer's feedback. Apart from water stress situation the other advantages like residual moisture availability during the succeeding crop was also felt by the farmers.

8.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Bund making leveling in paddy field	110	52	41	37700	27900	1.74:1

Impact: Before conducting the demonstration on water harvesting, available water harvesting structures (Water resource map) were studied out in details and their reservoir capacity. And accordingly the renovation, creation and cleaning was undertaken as intervention for better water harvesting and their use. Under renovation 2 ponds were renovated while 1 no. of ring well near the bank of the river has been undertaken in Bhelwa village. The reason behind the renovation of the well was to save the existing well from silting by the sand of the river. Through this intervention the continuous recharge process of the well has started throughout the year. Due to this farmers of NICRA village started taking multiple crops instead of mono cropping in an area of 180 ha. Before NICRA the cropping intensity of the village was 100% only while today it is 126%. This has happened only due to active participation of the farmers.

8.2.3 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	110	52	41	37700	27900	1.74:1

Impact: To conserve the moisture and recharge the ground water table by utilizing the concept of the slogan **"Khet ka pani khet me aur gaon ka pani gaon me"** was utilized for the betterment of the farmers. Before NICRA project the farmers were not practicing the proper bunding of their paddy fields, as a result the chances of crop failure was more as well as the scarcity of moisture at the time of field preparation during *Rabi* was common phenomena. Keeping the severity of the situation in mind the field bunding intervention was undertaken as an initiative in an area of 52 ha with 110 farmers.This initiative has made a big impact among the farmers of NICRA and its adjoining villages, as a result farmers of NICRA and its adjoining villages came forward to adopt field bunding properly every year in more than 250 ha. area.

8.2.4 Water saving irrigation methods:

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
Drip in Tomato	7	1	775	96400	291100	4.02:1

Impact: To maximize the water use efficiency the demonstration was made on micro irrigation system and their application. Through this demonstration (Drip as well as sprinkler) 40-60% irrigation water was saved in vegetable crops. The nutrient loss during the irrigation process was also checked. The quality of the produce also improved the yield of vegetables. The farmers of NICRA and adjoining villages took interest to adopt this technology and they have applied for drip irrigation in the Dept. of Agriculture and horticulture.

8.3 Module II: Crop Production

8.3.1 Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	110	9.8	44	38.25	15.01	37600	28300	1.75:1
Drought resistant paddy (var. *Heera*)	47	6.6	23	19	21.05	26000	62000	1.24:1
Maize (var. *SCMH-411*)	54	8.5	70	44	59.07	33681.5	43318.5	2.29:1
Maize (*HQPM* - 1)	47	3.5	62	37	67.56	30480	37720	2.23:1
Drought tolerant pigeon pea (var. *NDA* - 1)	40	2.0	16.8	13.0	19.2	27600	73200	3.65:1
Wheat (*WR-544*)	16	3.8	35	29	20.68	32500	23500	1.72:1
Total	**314**	**34.2**						

Impact: The extent of area under respective crop varieties ranges from 25-60%. The maximum extent of the crop varieties was in Paddy (var.- *Sahbhagi*), Maize (var. *SCMH-411, HQPM - 1*), pigeon pea (var. *NDA - 1*) and wheat (var. *-WR-544*). The yield enhancement is being observed in the tune of 15.01 to 67.56%.

8.3.2 Introducing salt tolerant paddy varieties:

Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
SRI (var. *MTU -7029*)	45	9	61.25	45	36.6	36100	55700	2.54:1
Total	**45**	**9**						

Impact: This intervention imparted a good impact among the NICRA villagers. The percentage increase in yield of demonstration plot was observed upto an extent of 36.6 percent over traditional method of cultivation with a reduced cost of cultivation. The BC Ratio of 2.54:1 was also recorded by adopting this method only. The progressive farmers started to increase the area of cultivation through this method.

8.3.3 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated)	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Pigeon pea (*NDA - 1*) + Groundnut (*AK – 12-24*)	8	2	15 (Pigeon Pea) + 9 (Groundnut)	31500 (Pigeon Pea) 24746 (Groundnut)	43500 (Pigeon Pea) 20254 (Groundnut)	2.38:1 (Pigeon Pea) 1.82:1 (Groundnut)

Table: Elephant foot yam based multilayer vegetable cropping system

Crop	EFY Yield (Kg/ha)	Yield of crop (Kg/ha)	Gross cost (Rs./ha)	Net returns (Rs./ha)	BCR
EFY+ Ridge gourd	35000	14000	160000	389500	3.43:1
EFY+ Bitter gourd	35800	15000	166400	496900	3.99:1
EFY+ Bottle gourd	35500	25000	173400	430850	3.48:1

Impact: Intercropping gives an additional yield as well as income per unit area than sole cropping. Considering this theory 2 demonstrations were conducted one in field crop and another in horticultural crops. The farmers were very happy by realizing the yield as well as income through intercropping of above demonstration. The farmers demanded for training regarding intercropping in other crops also.

8.3.4 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (var. *Pusa -27*)	28	5	12	9.5	26.31	17250	12750	1.74:1
Gram (Var – *JAKI 9218*)	22	14.2	14.55	10.8	34.72	25051	24224	1.95
Tomato (var. *Super Laxmi F1*)	56	1.0	517.5	353.5	46.39	82400	176350	3.14:1
Chilli (var. *KA-2*)	39	0.35	166.85	121	37.88	49222.5	301267.5	7.10
Cabbage (var. *Disha F1*)	39	0.60	510	315	61.9	61100	193900	4.17:1
Cauliflower (var. *Shweta F1*)	39	0.50	243.2	156.4	55.45	63100	131460	3.08:1
Brinjal (var. *Swarna Prativa*)	17	0.25	260.5	195.6	33.18	58625	175825	4.0:1
Tomato under mulching	15	0.25	690	520	32.69	98570	246430	3.5:1
Sweet Potato (*Var. S-14*)	10	1.0	150	122	22.95	91400	178600	2.95:1
Bottle gourd (Hybrid)	53	0.75	175	145	20.68	25000	62500	3.50:1
Cowpea (Improved)	32	0.50	90	67	34.32	31250	58750	2.88:1
Radish (Improved)	32	0.05	225	160	40.62	75250	149750	2.99:1
Ridge gourd (Improved)	53	0.65	155	115	34.78	55900	114600	3.05:1
Garden Pea (Improved)	29	0.25	96.8	68.2	42	44700	100500	3.25:1
Beans (Improved)	29	0.25	87.4	-	-	34000	88360	3.60:1
Carrot (Improved)	29	0.20	176	145	21.38	54550	121450	3.23:1
Beet (Improved)	29	0.10	216.4	-	-	110000	149680	2.36:1
Coriander (Improved)	29	0.75	13.2	9.4	40.42	24500	28300	2.15:1
Cucumber (Hybrid)	53	0.32	186	135	37.8	52200	96600	2.85:1
Lady's finger (Hybrid)	53	0.85	195	145	34.5	75000	159000	3.12:1
Total	**800**	**34.57**						

Impact: A number of demonstrations in an area of 34.57 ha with 800 numbers of farmers have been conducted regarding Introduction of new crop varieties and crop diversification. These demonstrations provided better conditions for food security and enabled farmers to grow quality produce and surplus products for sale at market. The farmers of adjoining villages of NICRA also adopted the above varieties and crops in their farming situation.

8.4 Module III: Livestock & Fisheries

8.4.1 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (mortality)		% decrease	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against PPR against goat	112	170	2% mortality	58% mortality	56%	3000	4500	2.5:1
Total	**112**	**170**						

8.4.2 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Backyard poultry Improved (Chevero)	10	30	150 eggs/ year	50 eggs/ year	200%	300	750	3.5:1
Improved breed of Goat (Black bangal)	6	6	25 kg.	17 kg.	47.06	3530	970	1.27:1
Low cost Azolla production as supplementary cattle feed	10	40	2.22	1.25	77.29	200/m2	400/m2	3.00:1
Total	**26**	**76**						

8.4.3 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output mortality (%)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Improved shelters for poultry and livestock	20	1	0% mortality	5% mortality	5% reduction in mortality	20000	50000	30000	2.5:1

8.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. /Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Paddy *Sahbhagi*	112	Seed	110	9.8
	Wheat straw	108	Urea treatment	80	8.8
	Paddy and Wheat Straw	90	VCRMC is maintaining this	70	9.2
Commodity groups	Kitchen Gardening	60	Improved Variety Seed	60	7.2
Custom hiring centre	Power sprayer, Pumping Set	02	Implements is provided to the Group for hiring purpose	53	100
Climate literacy through a village level weather station	Thremometer	01	Data interpretation of AWS and forecasting/Advisory		

8.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee, Bhelwa

8.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

Revenue generated through Custom hiring Centers and VCRMC in KVKs

Name of KVK	2015-16 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Godda	2016-17	45000

Impact: Under custom hiring module KVK has succeeded to popularize the concept of custom hiring centres of farm machineries among the resource poor tribal farmers. Which has big impact in timely operation, cost saving and facing labour scarcity during peak period. By realizing the importance and impact of custom hiring approaches State govt. came forward and undertook the initiative to implement this model in other villages of Godda districts.

8.6 Capacity Building organized during 2015-16 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	2	54	0	54
Integrated Crop Management	7	157	45	202
Pest and disease management	4	85	22	67
Employment generation	1	15	10	25
Farm implements and machineries	1	28	5	33
Value addition	1	0	28	28

8.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Awareness, Exposure visits, Field Day, SHG, Integrated farming system	19	349	187	536

8.8 Soil Health Cards distribution during 2015-16 and 2016-17

Table- SHC card distribution at NICRA adopted villages

Year	No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
2015-16	35	35	35	35

8.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
District Dairy Development, Godda	13 Cows to BPL family	767000
MNREGA	Goat Shed - 03	201000
Block scheme	Sabha Bhavan	295000
Crop Production	Chickpea (Var.: JAKI – 9218) in 10 ha	97500
Creation of irrigation well under NRM	Installation of lift irrigation with the help of World Vision India. Installation of Drip with the help of Department of Soil Conservation	250000 40000
Crop Production	Plantation of fruit tree with the help of Department of Horticulture	12000
	Demonstration of HQPM under NFSM by ATMA, Godda	7000
Institutional Intervention	Construction of community platform through MNREGA	65000
Total		**17,34,500**

8.10 Success stories of NICRA Village Farmers

Elephant foot yam based multilayer vegetable cropping system

Sri Amrit lal Singh has been cultivating cucurbits like sponge gourd, ridge gourd, and bottle gourd since long back. They were also cultivating elephant foot yam but of Desi variety having high calcium oxylate content causing more acridity and less acceptability. Generally they sow elephant foot yams in the back yard of their houses. Both the crops were cultivated in separate land.

The improved variety of elephant foot yam (*Gajendra*) and hybrid variety of bottle gourd (*Mahima*), ridge gourd (local) and bitter gourd (*US – 6214*) was grown simultaneously in the same piece of land with leafy vegetables. So, it has been named elephant foot yam based multilayer vegetable cropping system.

Elephant foot yam (EFY) variety *Gajendra* was planted during the second fortnight of June at 75cm x 75cm spacing in the plot size of 1000m^2. A pit Size of 30 cm x 30 cm x 30 cm was dug out and 2 kg well decomposed cow manure was filled 3/4th of pit. 500 g cut tubers of elephant foot yam were treated with cow dung slurry (one kg of fresh cow dug in one litre of water) one day before planting on the pit and then filled the pit with the remaining soil and small mound was formed on the pit. The seeds (hybrid) of cucurbits bitter gourd, ridge gourd, and bottle gourd were sown in between two rows of main crop *i.e.* elephant foot yam at the recommended spacing for each crop.

EFY + bottle gourd

All the plots were fertilized with 150 Kg N, 100 Kg P_2O_5 and 150 Kg K_2O/ ha. Half dose of nitrogen and potash and full dose of phosphorus were applied at the time of planting of main crop in pits and rest half of nitrogen and potash were applied after harvesting the companion crops *i.e.* at 95 days after planting (DAP). Recommended dose of fertilizer was also given to the companion crops *i.e.* bottle gourd, ridge gourd and bitter gourd as per schedule. All other cultural practices as per schedule for the cultivation of main crop as well as companion crops were followed to raise healthy crop. Now net return is Rs. 389500/ha for EFY+ Ridge gourd, Rs. 496900/ha for EFY+ Bitter gourd and Rs. 430850/ha for EFY+ Bottle gourd.

EFY + Ridge gourd

EFY + bitter gourd

9. Koderma

9.1 Village information:

Name of the village	Village – Chopnadih
No. of households	195(Yadav (108), Mahto (35), Ravidas (52))
Total cultivated area (ha)	148 ha
Area under rainfed cultivation (ha)	136 ha
Major soil type	Red soil 37 ha (25%), Sandy loam 74 ha (50%), Gravel 37 ha(25%)
Climatic vulnerability of the village	Drought and Heat wave

9.1.1 Rainfall trend (mm)

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	1011.9	888.3	32	1	1	4	888.3	230	60.6
2012	910.3	426.7	21	3	1	4	426.7	136	101
2013	1001.3	570.2	18	1	1	3	570.2	211	36.5
2014	960.4	1046.4	42	0	0	3	1046.4	321	56.4
2015	890.5	725	36	0	0	3	725	201	40.2
2016	915.4	980	37	1	0	4	980	220	24.5

9.1.2 Datails of the climatic vulnerability

Major climatic vulnerabilities experiences during the last five year (2011-16) were erratic, untimely and excess rainfall. Some time intermittent drought like situation occurred during early stage and flowering stage in Paddy and other *rabi* crops like mustard, pigeon pea, chick pea and horse gram which affect the crop severely. In the year 2012 and 2013 the rainfall received during the month of June was less than normal rainfall (1001.3 mm) which vary from 22.0 to 85.2% less than normal. In past five years the year 2014 was the only which received 8.95% excess rainfall in the month of June. June, July and August is the major month which has decided the cropping and their extent of coverage. In the year of 2014 and 2016 NICRA village (Chopnahdih) experienced better rainfall compare to other ones, the maximum rainfall received 1046.4 and 980 mm respectively. However the no. of rainy days was experiences better in 2014 (42 days) and 2016 (37 days). In 2012 intermittent drought like situation occurs in NICRA village (Chopnahdih) during flowering stages of paddy. About 140 ha of standing paddy was badly affected by the water stress situation, which was safely control and manage by the coping strategies of water management and utilization of pond water to provide life saving irrigation in cultivated field.

9.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy-mustard/Wheat/Vegetables
	Maize/ Ragi- Chick pea/ Vegetables
	Ragi- Horse Gram /Vegetables/ Niger
	Maize- Chick Pea / Niger / Vegetables
	Paddy- Niger/mustard/Wheat- Summer Mung/Veg.

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

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
PADDY	*Sahbhagidhan*	31	18.6
Pigeon pea	*NDA-2*	68	15.9
Wheat	*K-9107*	65	16.2
Chick Pea	*GNJ-1581*	78	18.3

iv. Cropping intensity (%) in NICRA Village: - 50.12% (Before NICRA), 162.18% (After NICRA); Koderma District: - 112 %

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
ONION	0.5	7	A.F.D.R	0.5
BRINJAL	0.2	232	-	0.2

vi. Area under fodder cultivation and number of farmers growing green fodder: 4.6ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle (*Raksha- triovac*)	375	800		H.S.,B.Q.andF.M.D	100	20-25%
Milch Cow (*Mifa gold*)	200	96		-	-	-
Cattle (*Curazan fort*)	375	800		Endoparasite	-	-

viii. Milk productivity (litres/milch animal/day):

Type of animal	Avg. Milk yield(Lit./day) Before intervention of NICRA	Avg.Milk yield(Lit./day) After intervention of NICRA	Increase in milk yield (%)
Deshi cow	1.25	1.75	40
Cross bred cow	5.5	6.75	22.72
Buffalo	3.75	4.75	26.66

9.1.4 Resource availability

9.1.4.1 Summary of Water harvesting interventions taken up in the NICRA village

Structures/ Years of Construction	Category		Total	
			Farmers involved (No.)	
RWHS	Repaired/ Renovated		41.5	225
5% model (Dobha)	Constructed		31	26
Irrigation lift device (No)	Constructed	NICRA	33	191
		Impact	20	210
	Repaired/ Renovated (Under NICRA)		105	124
Drip irrigation System	Constructed		1.3	19
Field bunding	Created		54	24
Jalkund	Constructed		8.06	18

9.1.4.2 Status of farm mechanization before start of NICRA:

S.N	Farm Implement	No. before NICRA	No. after NICRA
1	Power tiller	1	4
2	Pump set	1	5
3	Spray Machine	0	10
4	Winnowing fan	0	1
5	Zero tillage machine	0	4
6	Conoweeder	0	2
7	Knapsack sprayer	0	4
8	Paddy thresher	0	5
9	Rotavator	0	2

9.1.5 Socio-economic status:

a. **No. of households- General :** 115, **OBC:** 26, **SC:** 45 , **ST-**21

b. **Literacy rate (%):** 80-85%:: **Male:** 53.25%; **Female:** 47.28%

c. **Workers engaged in agricultural activity (%):** 70-80

MODULE WISE INTERVENTIONS

9.2 Module I: Natural Resource Management

9.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var. *Abhishek* and *Sahbhagi dhan*)	161	49.5	40.2	17672.8	16320.2	1.8
Azolla in Paddy (var. *Abhishek* and *Sahbhagidhan*)	23	2.5	36.7	15742.2	14890.0	1.5
Zero Tillage in wheat	47	15	23.73	12020	14800	1.66
Repair of bund	86	20.5	-	-	-	-
Optimization of horticultural production through land embankment development	13	3.6	18.2	8962.8	6532.2	1.4
Plastic mulching in bringal	11	0.45	118.48	30912	70352	1.3
Total	**341**	**91.55**				

Impact: Keeping the in-situ moisture conservation in the centre different resource conservation technology *viz* summer ploughing, bunding, leveling, use of azolla in paddy field, Direct seeded Rice, wheat sown by zero tillage, relay cropping, poly and straw mulching in vegetables were demonstrated in 51.6 ha within 115 farmers. These in-situ moisture conservation techniques were widely adopted by the farmers of NICRA villagers' and in besides villages, and it is being extended up to 91.55 ha within 341 farmers. Through this intervention, moisture availabilities extent has been increased and standing crop may face 10-15 days water stress without any damage as per farmer feedback.

9.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for Paddy (var. *Anjali*)	46	15	32.6	22856.2	19865.2	1.9
Renovation of pond for Wheat (var. K-307)	36	21	28.6	16785.8	14867.2	1.6
5% Model (paddy var. *Sahbhagidhan*)	27	14	38.6	25987.1	21347.1	1.6
Total	**109**	**50**				

Impact: Irrigation facilities are important limitation in rainfed farming. NICRA and adjacent village have also been faced these problems for crop and livestock too. Keeping the existing available resources in the centre KVK has started brainstorming for mitigating this vulnerability through natural resource management under NICRA project.Before conducting the demonstration for water harvesting, available water harvesting structures (Water resource map) were studied out in details and their reservoir capacity. And accordingly the renovation, creation and cleaning were undertaken as in intervention for better water harvesting and their use. Under renovation 09 ponds were renovated. The reason behind the renovation of the pond was to save the existing well from filling by the run off soil. Through this intervention 90.2 cubic meter water is safely recharged in each pond.

9.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmer	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	20	6.2	35.6	20150	18151	1.11
Sowing of Mustard with ZTD machine	15	5.2	28.62	16528	15123	1.09
Total	**35**	**11.4**				

Impact: By the use of zero tillage machine especially in wheat sowing, opened the door for residual moisture utilization in medium and low land area. Through this intervention farmers has succeeded not only in saving the irrigation cost *i.e.* pre sowing irrigation but also time and production cost. However the impact of adoption is slow but encouraging. Farmer's saw the result in field in respect to yield recovery and lowering the production cost, saving of time.

9.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	165	323.06	32.2	20982.1	15670.1	1.8
Ground water recharge through SRI	134	223.62	35.8	24587.9	22098.3	2.1
Total	**299**	**546.68**				

Impact: Before NICRA farmers were aware about the importance of field bunding but they did not apply rigorously on their field as a result huge volume of water along with fertile top soil was washed out in nearby river. Which resulted in siltation, water level of their existing wells became low. Keeping the vibrancy of the situation intervention field bunding was taken as an initiative as a mass campaign and 30 ha of farm field was bunded well during 2011-16 under NICRA. This initiative has left a big impact and farmers of NICRA and adjacent villages came forward and done field bunding properly every year in more than 547 ha area.

9.2.5 Water saving irrigation methods:

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 Mango	10	1.2				
Total	**10**	**1.2**				

Impact: To maximize the water use efficiency the demonstration was made on micro irrigation system and their application. Through these demonstrations (drip as well as sprinkler) 30-35% irrigation water was saved in vegetables plants like cabbage, cauliflower, tomato, beans and brinjal. While their maximum use is being done in commercial Vegetable Pea, Gram and Linseed crop cultivation in adjoining villages of NICRA.

9.2.6 Other Demonstrations:

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
In-situ vermin composting in village	10	2.31	Boom stage			
Cleaning & renovation of old farm pond	39	25.9	-			
Renovation of old water harvesting structure (Well)	10	26.2	-			
Use of Bio pesticides in tomato	35	4.5	165.7	48976.2	80954.5	2.5
Total	**94**	**58.91**				

Impact: Before NICRA intervention no one were interested in doing vermi compost production in village or such well constructed unit of it was found even in adjacent villages. After NICRA intervension 10 vermi compost production units were established with the production capacity of 2.0q per unit in the year. In the extent of adoption 32 units were established in the adjoining villages. With the use of vermi compost farmers has been able to produce quality product through this intervention efficiency of available compost is being enhanced, structure of soil and water holding capacity started changing slowly.

9.3 Module II: Crop Production

9.3.1. Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	134	54	33	19	38.53	18857	24106.2	2.3
Drought resistant paddy (var. *Anjali*)	128	36.5	35.31	26.41	48.60	20470	2234	2.5
Sowing of drought tolerant paddy (var. Sahbhagi) with ZTD machine	134	54	33	19	38.53	18857.8	24106.2	2.3
Drought tolerant paddy varieties (var. IR-64)	65	20	32	12	32.92	16987.2	28632.1	2.1
DSR Transplanting (var. *Sahbhagi, Abhishek)*	319	156	34.32	16.64	32.7	17852.6	22559.4	1.92
Drought tolerant ragi (*Birsa Madua-1*)	156	35	38.52	17.16	52.14	17543.1	13987.3	2.5
Drought tolerant pigeon pea (var. *NDA-1,2, Bahar*)	95	25	40	12.4	60.12	26790.1	22.865.1	2.3
Niger (var. *Birsa Niger -1*)	112	13.2	10	7.58	91	9120	15050	2.6
Horse gram (var. *Birsa kulthi-1*)	35	5	5	6.5	85	6620	10658	1:6
Contingent Crops Horse gram	66	8.5	7.1	5.1	33.33	8676	1767.6	2.4
Drought resistant brinjal	17	0.55	162.48	111.9	27.65	42612	93852	1.9
Wheat (*K-307*)	256	25.2	50.2	20.2	60.2	30654.2	26235.8	2.3
Total	**1517**	**432.95**						

Impact: Short duration drought tolerance rice variety *Sahbhagi dhan* was demonstrated on 134 farmers' field covering 54 ha area. The yield was increased with tune of 38.53 per cent over farmers practice (cv. *Mansuri*). Farmers observed that these varieties mature about 15 days before their traditional variety which solve their shortage of fodder for animals and also prevent late drought condition.

Demonstration of direct seeded rice were conducted in 156 ha land covering 319 farmers. The yield was increased with tune 32.7 per cent over traditional method (~17q/ha). This was due to farmers wait for rainfall for their transplanting, they transplant one month age seedling and DSR also reduce about 7 days in maturity of crop. Demonstration of other varieties *i.e. vandana*, *CR 40* and also hybrid (*PHB 71* and *Arize 6444*), among above all varieties farmers prefer *Sahbhagidhan* due to its economic yield and quality of rice.

9.3.2. Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	134	54	33	19	38.53	18857	24106	2.3
SRI (var. *MTU -1010, Rajendra subhasini*	130	50	30	21	40.00	19019	25097	2.5
Paddy Seed (var. *Sahbhagi*)	134	54	33	19	38.53	18857.8	24106	2.3
Aerobic Rice (var. *Anjali*) cultivation	128	36.5	35.31	26.41	48.60	20470	22340	2.5
Direct seeded brown manured rice	105	32	33.73	23.12	62.12	5009.2	10321	2.4
DSR (var. *Anjali*)	45	7.5	14.94	11.64	17.25	11260	10940	1.1
Zero tilled rice	262	90.5	68.35	45.42	87.14	39327	46446	4.8
Total	**808**	**274.5**						

Impact: Intervention like DSR, Aerobic and SRI requires about 900-950 mm of water while puddle irrigated rice requires about 900-2250 mm of water. The reduced crop duration and intermittent irrigation keeping the soil moist in SRI, rather than flooding under normal leads to saving 30-40% of water.

9.3.3 Community nurseries for delayed monsoon:

Table. Performance of Community nurseries

Technology demonstrated	No. of farmers	Area (ha)
Raised Community nursery of paddy	58	4.85
Community nursery of cauliflower, Brinjal, Tomato	85	2.5
Total	**143**	**7.35**

Impact: In past five years NICRA cluster and adjoining villages experienced deficient and untimely rainfall in July and first fortnight of August. Which resulted in delayed transplanting of old age seedlings (40-45 days). Transplanting of aged seedlings lead to low tillering resulted in poor crop yield. In order to address this problem KVK encouraged farmers of the village to grow community nursery with staggered date of sowing. This enabled farmers to access seedlings as and when needed by the progress of monsoon. And accordingly demonstration was conducted in four villages convening 216 no. of farmers. By the application of this approach farmers benefitted with an additional yield of 20 q/ha (52.17% increase in yield) compared to farmers who transplanted over aged seedlings.

9.3.4 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Arhar + black gram	49	8	13.14	7.33	62.78	12660	26880	2.5
Wheat + Mustard	107	36.2	78.11	24.89	23	20460	21570	1.6
Chili +Ladies finger	5	0.5	5	5	10	5243	3278	1.6
Millet (var. *Birsa madua -1*)	35	6.2	32	21	25.2	4793.2	3680	1.9
Total	**196**	**50.9**						

9.3.5 Other Demonstrations:

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
Promotion of Pulses utilizing post-monsoon rainfall: Blackgram (WBU-108) in jute AZO-PSB fallows with INM	49	8	13	7.33	62.7	12660	26880	2.5
Integrated crop management of mustard, Lentil	132	11.2	132	58	55.30	13616	9214	2.2
Integrated disease management in vegetables	25	3.7	25	12	50.3	3869.2	2314.1	1.5
Demonstration short duration vegetables as contingent crop Tomato	10	2	2	10	50.1	3620	2165	1.8
Contingency crop Brinjal, Cauliflower, Radis	30	6	6	30	50.1	6936	3122	1.66
Total	**246**	**30.9**						

9.4 Module III: Livestock & Fisheries

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

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
Fodder production of Maize/Sudan	37	8	2200	-	-	-	-	-
Fodder cultivation with improved varieties Hybrid Napier,	44	13	1800	-				
Total	**81**	**21**						

9.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)
Ring vaccination against FMD in Cattle and PPR in goat	1400	1000
Mass Vaccination for HS and BQ	2400	1200
Ring vaccination for PPR in goat and Mass vaccination in Poultry against Ranikhet.	600	200
Total	**4400**	**2400**

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)
Disease and nutrition management with Twice Deworming (Febendazole) and incorporation Mineral mixture in feed.	800	375
Control of ectoparasite for inhance production with Butox,	800	375
Round the year endoparaite management in cattle	800	375
Ring Vaccination of cattle with Raksha triovac	2650	2021
Total	**9450**	**5546**

Impact: Vaccination in Goat

- Goat is the backbone of rural community especially landless or laborer class. In village Chopnadih (selected for NICRA project) farmers facing problem of goat mortality up to 40 per cent during wet season, having symptoms in diseased goat that, sudden onset of fever with rectal temperature 40 to 410C followed by anorexia, depression, watery ocular and nasal discharge which becomes mucopurulent later on. The discharge became catarrhal and crusts are formed which occlude the nasal passage narcotic area also developed in some cases. On the lips, gums, checks and corners of month mucosal erosions develop and tongue becomes thick with necrotic areas. Conjunctivae of animal are congested and there is professed catarrhal discharge. After 3-4 days of development of fever animal showed diarrhea with is professed and mucoid followed by dysentery. Later on in the later stages animals showed coughing and dyspnoea. By showing the symptoms and high mortality rate, it may be Peste des Petits Ruminants (PPR), the best way to control this disease outbreak is vaccination with Raksha PPR before onset of monsoon. In NICRA village (chopnadih) organized a vaccination camp for controlling PPR. Vaccinated all the goats (600 nos) of that on 2nd July 2011 . Farmers were very happy and realized that these vaccinations are very useful to controlling the epidemic of PPR. They realized that this technology very economical and feasible in use.
- Vaccination of all the cattle (700) with Raksha triovac to prevent highly contagious disease *i.e.* HS, BQ & FMD. These diseases cause huge mortality in cattle and buffaloes. During epidemic of these disease causes mortality up to 30-40% and morbidity 100%. After vaccination no epidemic of diseases were seen in the cattle of Chopnadih village.
- Low milk yield was observed in cattle of Chopnadih due to deficiency of macro and micro mineral to overcome this problem Agrimin fort was incorporated in feed of 175 dairy cow covering 125 farmers. Used mineral mixture @ 30 gm per day in feed for 45 days. It increased milk yield /day and increase net income of Rs. 3000/- per cow.
- To enhance the income of rural people Khakhi Campbell, a drought tolerant breed was introduced in NICRA village Chopnadih. 100 ducks were demonstrated among 15 farmers. These breed perform well in less water condition. The body weights of the ducks were increased 31 per cent more in comparison with local breed (1200 g). The survivability under village condition be at par deshi duck and not required any special management.

9.4.3 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Backyard poultry breed CARI Nirbheek	10	5 No	2.30 kg	0.70 kg	233.33	360	440	2.22
Backyard poultry breed Divyan Red	15	10 No	2.10 kg	0.65 kg	245.54	360	400	2.11
Duck Farming breed Khaki Cambell	05	20 No	2.30 Kg	0.90 kg	233.33	300	700	3.33
Total	**30**	**35**						

Impact: Under livestock management module Khakhi campbell drought tolerant bred is being widely popularized among the rural women of the district, and adopted farmer has succeeded in earning of Rs. 10,000 thousand to 15,000 thousand per year during last five years. By seeing the impact of duckary for livelihood in sustainable way, animal husbandry department, NGOS and ATMA of has developed several unit the unit in 25 villages with input support.

9.4.4 Improved shelters for reducing heat stress in livestock:

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
Improved shelters for Broiler	02	02 unit							
Improved shelters for Duck	01	01 unit							
Total	**03**	**03**							

9.5 Module IV: Institutional Intervention

9.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/No. /Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. *Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri*	20	Quality seed	30	20
	Other crops	20		25	18
Commodity groups	Kitchen Gardening	15	Improved Variety Seed	20	15
Collective marketing	Onion/ Vegetable	13	-	10	12
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1 unit	Manual reading of the weather parameter are taken	-	-

9.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee, Koderma

9.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17 Area (ha)	Revenue generated (Rs.) Total under VCRMC
Koderma	225.33	56658

Impact: Under custom hiring module KVK has succeeded to popularize and accessing of farm machineries among the resource poor tribal farmer. This has big impact in timely operation, cost saving and facing labor crunch during peakperiod.

9.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	26	890	346	1236
Crop Management	37	662	175	837
Nutrient Management	3	65	20	85
Integrated Crop Management	8	217	58	275
Crop Diversification	10	580	129	709
Pest and disease management	9	221	66	287
Nursery raising	1	Nil	21	21

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Resource conservation technology	27	765	247	1012
Livestock and Fishery Management	16	1236	285	1521
Fodder and feed management	2	60	28	88
Employment generation	1	26	31	57

9.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Field Day, Group Discussion, Method demonstrations, SHG, Animal Health Camp, Kishan Gosthi, Woman awareness, Technology week, Scientist visit to field	6	167	89	256

9.8 Convergence Programme:

Table- Convergence of ongoing development programmers / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
Dova-10	Irrigation	8,000000.00
Zero tillage machine	RCT	40,000.00
Rejuvenation of exiting pond-2	Irrigation	17,00000.00
Vermicompost unit-10	Increase moisture retention capacity & organic carbon of soil	200000.00
Green House-3 with irrigation facilities (Sprinkler)	Vegetable production	6,00,000.00
Poly house-3 with irrigation facilities (Sprinkler)	Vegetable production	6,00,000.00
Food storage house- 5	Safe storage of food grain	2,50,000.00
Total		**99,40,000.00**

9.9 Success Stories of NICRA Village Farmers

1. Zero Tillage Technique- Viable Technology for Accelerating Wheat Productivity

Shi Sahdev Yadav a progressive farmer of village and post Chopnadih, Block Markachho, District Koderma, Jharkhand having about 10 acre agricultural land, his main occupation is agriculture. The major crop he grown in *Kharif* rice and in *Rabi* wheat in 2 ha and 0.5 ha each gram & linseed. He participated in an on campus training conducted by Krishi Vigyan Kendra, Koderma (NICRA) held on "Zero tillage (ZT) technique".After training course Shri Sahdev Yadav was ready to sow rice with zero tillage technique (DSR) during *Kharif* 2015. The farmers were surprised to see satisfactory germination which was 2 days earlier than conventional method and dark green colour wheat seedlings but none of them agreed that this technology was successful till the final yield data were available. After 2nd irrigation few farmers changed their idea about the technology after seeing the more number of tillering which was more than the conventional method in same variety and profuse growth with less weed population. At the time of crop cutting all the 28 farmers who were present at the site were observed that by adoption of this technology, the yield of wheat increased with the tune of 21.4% over conventional method (28 q/ha) and Sri Sahdev Yadav told that by adopting this technology it saves about Rs. 2940/- in cost of cultivation (ploughing –Rs. 2400/-, seed – Rs. 300/- & labour – Rs. 240/-). He also observed that this technology saves irrigation water because it took less time for water to flow across the field in no-till compared to normal tilled plots for the first irrigation. He also told that sowing was advanced 8 days as compared to conventional method, this was due to saving in land preparation and sowing, which was also a reason for the additional yield obtained under zero tillage in late condition which is predominantly due to late harvesting of *Swarna Mahsoori* (*MTU 7029*). It reduces the use of diesel fuel which prevent air pollution due to reduction in CO_2 emission. He observed that changing one hectare of land to zero tillage system saved about 18 liters diesel. Considering all the above, an additional advantage of about Rs. 9540/-/ha came due to adoption of zero tillage technology. Success of this technology in the field of Sri Sahdev Yadav, village chopnadih not only proved a boon for farmers of the same village but also served as an example to trigger the ongoing efforts of scientists of KVK, Koderma (NICRA) and other extension workers in the district.

The first year's results were very successful and encouraged

by the performance of the technique and developed confidence in Sri Sahdev Yadav During *rabi* 2014-2015. He increased the area of wheat from 1.5 ha and sown their total area of wheat, mustard, gram and linseed by zero tillage machine and also on hired basis in the fields of nearby farmers of the same village and neighboring villagers in about 22 ha wheat in 2015-2016. He charge Rs. 50/- per hour and in one hour he sown about 1.0 acre NICRA CHC. Success of this technology encouraged other farmers of the village and resulted other progressive farmer of the same village.

2. Construction of Nadi Jalkund

In the village Chopnadih, during rainy season the volume of water flow in the river is in huge amount with fast current but the water recedes quickly, after the termination of rain, water flows below the sand. The farm families residing near the river bank, lift water with the help of diesel pump by making small ditches and irrigate *rabi* crop grown in small area. These ditches easily get choked within short period of time due to sand sliding during operation. Considering availability of sufficient water under the sand bed, wastage of farmers' time in maintaining the ditch and eagerness of farmers in increasing area under rabi cultivation, with farmers' participation it was decided that empty oil drum should be used for developing kund (water tank). Hole should be make with hot iron rod of about 6 mm in diameter at 10 cm distance. Make a perforated cylinder by removing both the upper and lower lids and make drill small pores in the body of plastic drum, joint two drum in vertical with iron nails at each point. Then this drum inserted in the sand bed by removing the sand inside the drum manually. This drum inserted in the river left about 40-50 cm. 2 HP diesel pump can operate continuously for more than 8 hours after dipping valve of suction pipe in the water available in the kund, connection of suction pipe with motor pump fixed on higher elevation than the kund. Even with the continuous operation of pump, the water depth in kund was maintained upto almost greaterthan 2/3rd of the kund, with replenishment of water from river bed.

This technology saved the money, time and increased the cropping intensity and also the productivity by regular availability of water in kund helped in increasing area under sequence crop after rice harvest.

3. Community Rice Nursery

Rice is the major *Kharif* crop of Jharkhand in general and, particular in Koderma district. Early season drought is the major climatic challenge for this region. Sowing of rice nursery in dry field in Rohini Nakshtra is common practice in Koderma district. Farmers' start rice transplanting after sufficient rain fall occurs and sufficient rain water collected in field for puddling. In this situation farmers generally transplanted 30 to 50 days old seedlings, even some times they transplant more than two months old nursery during early drought (as in the case of 2009 & 2010 *kharif*), which is common for the region. Due to delayed monsoon the farmers could not able to transplanting optimum aged seedlings. This practice cause drastically reduction in crop yield. Under NICRA project we organize a group meeting of rice grower and decided to grow community nursery of rice at different duration (staggered). Three farmers *i.e.* Sri Jagdish Yadav, Sri Gajo Mahto and Rajoo sown rice nursery cv. *Abhishek* and *Sahbhagi* at 10 days interval, starting at 26th June 2011. They contributed their seedlings whenever other farmers shown desire to transplant seedling. This gave very good result due to timely availability seedlings of optimum age. Generally, most of the farmers able to transplant rice with seedlings of optimum age. Farmers observed that this system is very good, but initially farmers do not agree to give their nursery without completing their fields.

10. Palamu

10.1 Village information:

Name of the village	Dulsulma and Murma
No. of households	361
Total cultivated area (ha)	215.14 ha
Area under rainfed cultivation (ha)	136.79
Major soil type	Sandy, sandy loam, loamy sand, loam, Sily clay loam, clay
Climatic vulnerability of the village	Drought and Heat wave

10.1.1 Rainfall trend (mm)

Year	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)
2012-13	1349.3	59	2	-	6
2013-14	966.6	66	5	2	1
2014-15	538.9	49	6	3	1
2015-16	929.8	47	23	-	1
2016-17	1629.6	59	29	-	1

10.1.2 Details of the climatic vulnerability

Major climatic vulnerabilities experiences during the last five year (2011-16) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought like situation occurred during grand growth stage and flowering stage in Paddy and other *kharif* crops like ragi, groundnut and blackgram, which affect the crop severely. In the year 2012, 2013, 2015 and 2016 the rainfall received during the month of June was less than normal rainfall (2015.3 mm) which vary from 12.0 to 71.7% less than normal. In past five years the year 2014 was the only which received 8.81% excess rainfall in the month of June. June, July and August is the major month which has decided the cropping and their extent of coverage. NICRA village experiences two better year *i.e.* 2011 and 2016 in which rainfall received was 890.00 and 800.50 mm respectively more than normal *i.e.* 770.6 mm (June – August) and rest of year 2012, 2013, 2014 and 2015 experienced less rainfall. However the no. of rainy days was experiences better in 2011 (79 days), 2013 (82 days), 2014 (90 days), 2015 (92 days) and 2016 (95 days).

In 2012 intermittent drought like situation occurs in village Murma and dulsulma during flowering stages of paddy. About 20 ha of standing paddy was badly affected by the water stress situation, which was safely control and manage by the coping strategies of water management.

Some important climatic vulnerability experienced during the past five year (2011-16) is under follows-

- In 2011 water stress like situation in *Rabi* and summer crop and their extent was 50 ha.
- In 2012 intermittent drought like situation raises in standing paddy during flowering stage and their extent was more than 20 ha.
- In 2012 water stress situation raises during crown root initiation stages of Wheat and their extent was 100 ha area.
- In 2013 severe cold waves was observed during last week of December and January, badly affected the potato and mustard crop and their extent was 25 ha.
- In 2013 hail storm was experienced in nearby villages of NICRA village and their extent was in 21 villages and affected more than 500 ha standing paddy.
- In 2014 and 2015 severe infestation of false smut was observed in Hybrid paddy in the month of October and their extent was 10 ha in nearby village of NICRA cluster.
- In 2016 heavy rainfall damaged the maize crop and their extent was 250 ha in nearby village of palamu

10.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy- Wheat-Vegetables
Maize-Fallow	Maize-Vegetables /Wheat/Mustard
Blackgram-Fallow	Blackgram-Pea/Mustard
Niger-Fallow	Ragi/Groundnut-Vegetables
Ragi-Fallow	Niger-Fallow/Vegetables

ii. Major cropping system: Crop + Animal Husbandry + Horticulture

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)
Paddy	Sahbhagi	152	10 ha	10	42
Pigeon Pea	Bahar	50	25	10	18
Maize	HQPM -1	89	10	15	4.8
Wheat	K -9107	180	28.5		

iv. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)
Turmeric	1	200	*Rajendra Sonia*
Sem (Bean)	2	12	*Dolicus Lablab*
Ole	1	75	*Gajendra*

v. Area under fodder cultivation and number of farmers growing green fodder: 3 ha

vi. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cow	450	140	-	ecto and endoparasites	150 %	15 %
Goat	105	60	Black Bengal			

vii. Milk productivity (L/milch animal/day): Cow Cross breed 4-7 L/day and Indigenous breed 1-3 L/day

viii. productivity (L/milch animal/day): Pond (5 No.), Dova (6 No.)

10.1.4 Resource availability:

10.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)
2011-12	Pond	4 units	All defunct (4 Units)
2012-13	Pond	5 units	All defunct (5 Units)
2013-14	Pond	4units	Defunct (04 Units)
2014-15	Pond WHS (5% Model)	25 units 06 units (New)	Defunct (25 Units) -
2015-16	Pond WHS (5% Model)	11 units 07 units (New)	Defunct (7 Units) -
2016-17	Pond WHS (5% Model)	6 units	Defunct (03 Units)

10.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1	No. of farm ponds/Jalkund	Constructed			45	10		2
2	Community pond /tank	Constructed		4		2		1
3	Percolation tanks/ Recharge pits (No.)	Constructed	50	50				16
4	Recharging of open/ tube wells with silt trap/ Borewell/well	Constructed	9	21			17	1
	well	Repaired/ Renovated			10			
5	No. of Check dams	Constructed				1		-
6	Permanent check dam/ Sand Bag Check dam (No.)	Constructed	4				1	1
7	Drainage Channel (length in meter)	Cleaning/desilting		2	1 (3.5 km)	1	1	-
8	Arhars/pynes etc	Renovated						2
9	Recharging of wells		9	9			15	3
10	Open well		54	51		45	40	26

10.1.4.3 List of Farm implements available in the village:

Maize Sheller, Dutch hoe, Paddy thresher, Conno Paddy weeder, Naveen sickle, Bhaivao Sickel, Sprayer, Duster, Zero tillage machine, Power tiller, Drum seeder, Vaccinator, small weather station and GPS, Computer with UPS, Ridger-seeder

10.1.5 Socio-economic status:

a. **No. of households – OBC:** 22, **SC**-72 , **ST**-226
b. **Literacy rate (%): Male:** 27% **Female:** 4.3 %

MODULE WISE INTERVENTIONS

10.2 Module I: Natural Resource Management

10.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var. *Lalat*)	45	10.00	29.00	17959.00	15032.00	1.84
Zero Tillage in wheat, Maize	03	1.50	176.32	48500.00	84234.00	2.73
Repair of bund	03	3.00	34.13	18500.00	15250.00	1.82
Up gradation of mono cropped land to multiple one with integration of fish	01	2.00	26.00	13500.00	16200.00	2.20
Optimization of horticultural production through land embankment development	02	2.10	30.80	17430.00	20730.00	2.18
Optimization of horticultural crops through land embankment	02	0.30	24.65	21365.00	15880.00	1.74
Organic mulching in vegetables (Tomato, brinjel)	02	2.10	11.10	10500.00	21500.00	3.04
Mulching	01	2.00	31.20	20240.00	21208.00	2.04
Plastic mulching Okra, cucumber	01	0.20	22.35	19560.00	14460.00	1.73
Use paddy straw, forest leaves in elephant foot yam	03	2.00	21.00	16500.00	10700.00	1.68
Total	**63**	**25.20**				

Impact : Out of seven interventions, intervention like summer ploughing is being widely accepted by the farmers of NICRA and adjoining villages, and their extent was more than 1000 ha. Through this intervention, moisture availabilities extent has been increased and standing crop may face 10-15 days water stress without any damage as per farmer feedback. Intervention like Green manuring especially of Dhaincha is also being widely accepted in low land paddy field and their extent was 20-25% of the total paddy field. Through the application of this intervention farmers of NICRA village cut down one top dressing of urea in low land paddy and by this way they succeeded to save Rs. 200-300/-/ha. In situ conservation of Dhaincha not only improved the soil fertility but also enhanced the moisture extent duration in successing crops as per farmer feedback. Intervention like zero tillage wheat sowing and mulching was also practiced by the farmers of NICRA and adjoining villages but their adoption % was low *i.e.* 15-20% in wheat and vegetable area.

10.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	17	04 units		17	04 units	
Renovation of canal	21	21.00	30.62	18	24.00	30.62
5% Model	45	25.00	27.32	60	20.00	27.32
Renovation of Well for irrigation	13	05 units		18	05 units	
Bund making leveling in paddy field	12	21.00	30.62	18	24.00	30.62
Natural mulching	13	20.00	27.32	60	20.00	27.32
Digging of small pits in Diara land for cucubits	14	24.00 units	33.80	25	25.00 units	33.80
Total	**135**					

Impact: Before conducting the demonstration on water harvesting, available water harvesting structures (Water resource map) were studied out in details and their reservoir capacity. Accordingly the renovation, creation and cleaning was undertaken as in intervention for better water harvesting and their use. Under renovation 5 pond was renovated while 40 no. of well were renovated. The reason behind the renovation of the well was to save the existing well from filling by the run off soil. Through this intervention 106.9 cubic meter water is safely recharged in each well.

10.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	11	5.20	29.03	18415.00	17173.00	1.93
Sowing of paddy with ZTD machine	12	5.50	33.30	18247.00	16756.00	1.92
Sowing of lentil with ZTD machine	03	2.4	12.80	10500.00	21500.00	3.04
Sowing of chick pea with ZTD machine	10	5.20	29.03	18415.00	17173.00	1.93
Sowing of paddy with power tiller	11	5.50	33.30	18247.00	16756.00	1.92
Total	**47**	**23.80**				

Impact: By the use of zero tillage machine especially in wheat sowing, opened the door for residual mixture utilization in medium and low land area. Through this intervention farmers has succeeded not only in saving the irrigation cost, but also save time and production cost. However the impact of adoption is slow but encouraging. Farmer's saw the result in field in respect to yield recovery and lowering the production cost, saving of time (one week) in sowing attracted farmers for their use in coming year.

10.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	23	23.00	28.07	19582.00	13344.00	54
Ground water recharge through SRI by sub-soiler	21	22.00	28.07	19582.00	13344.00	54
Total	**44**	**45.00**				

Impact: Before NICRA farmers were aware about the importance of field bunding but they did not apply rigorously on their field as a result huge volume of water along with fertile top soil was washed out in nearby rivulets, nalas and rivers. Which resulted in siltation, water table of their existing borewells and wells went down. Keeping the vibrancy of the situation intervention field bunding was taken as an initiative as a mass campaign and 24 ha of farm field was bunded well during 2011-16 under NICRA. This initiative has left a big impact and farmers of NICRA and adjoining villages came forward and done field bunding, properly every year in more than 800 ha area.

10.2.5 Water saving irrigation methods:

Table. Performance of different water saving irrigation methods

Technology demonstrated	No. of farmers	Area (ha)
Vermi-compost from biodegradable wastes	09	0.90

Impact: To maximize the water use efficiency the demonstration was made on Vermi-compost from biodegradable wastes system and their application. Through these demonstrations (Vermi-compost from biodegradable wastes) 20-25% production was saved in fruit plants like Mango, Banana and Guava as well as in crops. While their maximum use is being done in commercial vegetable Pea, Gram and Linseed crop cultivation in adjoining villages of NICRA. More than 30 no. of Vermi-compost from biodegradable wastes unit has been provided by ATMA under NFSM.

10.2.6 Other Demonstrations:

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
In-situ vermicomposting in orchards	09	6.31	Boom stage			
Cleaning and renovation of old farm pond	16	21.10	38.53	32480	17619	1.54
Renovation of old water harvesting structure (Well)	14	22.00	157.25	46755	11175	2.75
Planting forest trees for biodiversity, forestation	03	0.22	21.62	12760	8146	3.14
Cultivation of high yielding grass on farm bund	03	2.10	-	-	-	-
Total	**45**	**31.73**				

Impact: Before NICRA no any planned unit of vermi compost production was available in the village After NICRA 36 vermi compost production units were established with the production capacity of 1.75 q/ unit/ cycle. Keeping the animal population in the centre Mass awareness programmes were organized for compost enrichment,. As a result more than 190 farm families has already been associated with vermicompost production. The extent of adoption is 25-30% in the adjoining villages. With the use of vermicompost farmers has been able to produce quality product through this intervention efficiency of available compost is being enhanced as well as structure of soil changed slowly. As a result the water holding capacity of red laterite soil is also being enhanced as per farmers' feedback.

10.2.7 Rainwater harvesting structures developed:

RWH structures	No.	Storage capacity (Lit. in Lakh.)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
New Pond	02	63.3	02	4.50	133.33
5% Model (Dova)	23	25.0	25	25.00	110
Pond Renovation	05	238.7	18	18.31	130
Repaired well	33	-	44	17.60	300
Percolation tank	02	0.56	02	0.20	100
Community pond	02	60.40	21	5.40	200
Canal Renovated	02	-	208	214.00	142.80
Inlet & Outlet Cleaning (Ponds)	12	-	37	-	100
Canal Cleaning	01	-	10	6.00	200

10.3 Module II: Crop Production

10.3.1 Introducing drought resistant varieties:

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Paddy (var. *Sahbhagi Dhan*)	30	10.00	32.60	27.50	18.55	27180	15200	1.56
DSR Transplanting (var. *Navin*)	35	20.00	27.60	24.43	11.40	18233	15807	1.87
Maize (var. *HQPM - 1*)	02	5.00	33.37	26.05	28.09	21650	18394	1.85
Maize (var. *Kanchan*)	04	5.00	33.76	23.80	41.85	22305	18207	1.81
Drought tolerant ragi (var. *A404*)	46	10.00	17.70	13.30	35.60	13282	11357	1.85
Niger (var. *Birsa Niger- 1*)	48	10.00	3.52	2.25	63.96	6780	3373	1.55
Red gram (var.-*Narendra Arhar* - 1)	40	10.00	14.40	11.30	28.23	21000	32270	2.53
Horse gram (var. *Birsa kulthi-1*)	35	10.00	7.32	6.12	19.60	10400	11560	2.11
Blackgram (var. *Shekhar*)	37	10.00	7.80	6.20	25.81	14500	16700	2.15
Total	**277**	**90.00**						

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

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
Horse Gram var. *Birsa klthi-1*	127	25	8.7	3.0	290	4000	9050	2.26:1
Mustard var. *Siwani*	233	30	8.5	4.2	202	4500	29500	6.55:1
SRI var. *sahbhagi*	20	10	45	20	225	10000	26000	2.6;1
Potato var. *Kufri Kanchan*	233	241	21.0	90	233	40000	170000	4.2:1
Gram var. *KPG-59*	356	36	18.2	7.0	260	5000	27000	5.4:1
Wheat var. *UP-262*	247	60	20.2	8.5	-	-	-	-
Lac Cultivation var. *ranginee*	100	500	21.3	19.7	-	-	-	-

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Paddy Seed *Sahbhagi*	45	5	55	22	8	8000	2900	3.6:1
Horse Gram *Birsa Kulthi*-1	55	5	8.7	3	290	4000	9050	2:26:1
Maize *HQPM*-1	48	5	43	32	56.25	6000	37000	6:1:1
Ol Seed *Gajendra*	20	0.4	78	25	212	74000	1090000	14:8:1
Veg. seed Sem (dolicus lablab)	150	2	10	7	43	1000	3000	3:1
Veg. Seed (Hybrid Seed)	18	2	20000	12000	67	18300	10700	5.56:1
Brood Lac *Ranginee*	100	5	-	-	100	300	2320	7:73:3
Paddy Seed *Sahbhagi*	45	5	55	22	8	8000	2900	3.6:1
Horse Gram *Birsa Kulthi-1*	55	5	8.7	3	290	4000	9050	2:26:1
Maize *HQPM-1*	48	5	43	32	56.25	6000	37000	6:1:1
Ol Seed *Gajendra*	20	0.4	78	25	212	74000	1090000	14:8:1
Veg. seed Sem (dolicus lablab)	150	2	10	7	43	1000	3000	3:1
Total	**2070**	**706.8**						

10.4 Module IV: Institutional Interventions

10.4.1 Table. Details of the various institutional interventions

Interventions	Name of crops / Commodity groups / Implements	Technology used in seed / fodder bank & function of groups
Seed bank	Rice- Drought tolerant/ Short Duration Var. *Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri*	Quality seed
Commodity groups	Kitchen Gardening	Improved Variety Seed

10.4.2 Village Climate Risk Management Committee (VCRMC)

Name of KVK	2011-12 to 2016-17 Area (ha)	Revenue generated (Rs.) Total under VCRMC
Palamu	123.54 ha	1,03457.00

10.5 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	16	251	89	340
Crop Management	7	81	41	122
Nutrient Management	13	192	102	294
Integrated Crop Management	4	82	14	96
Crop Diversification	1	18	Nil	18
Pest and disease management	15	261	95	356
Nursery raising	1	15	8	23
Integrated Farming System	2	28	3	31
Livestock and Fishery Management	9	127	56	183
Resource conservation technology	7	111	34	145
Employment generation	3	12	50	62

10.6 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Parthenium Awareness, World food Day, Exposure visits, Field Day, Group Discussion, Van mahotsawa, World Metrology Day, ICAR Day, SHG, Campaign, Environmental day, Gram Sabha, Kishan Gosthi, Farmer to Farmer interaction (DDG Ag. Ext.) ICAR, Technology week, NICRA Workshop	240	1600 House hold		

10.7 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
1910	1450	1450	1450

10.8 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
MNEREGA	Well Digging (New), Dova Digging	1000000
	Goat shed	144000
		320000
NFSM	Pond Renovation, Diesel Pump, Conoweeder	60000
Miner irrigation	Canal renovation of Malaya dam, Irrigation Device	10000000
Block	Road, Panchayet Bhawan	500000
BAIF	Vaccination	50000
Fishery department, Palamu	Jeera, 70 Lakh	49000
DAO, Palamu	Mize seed	14000
Total		**12137000**

10.9 Success stories of NICRA Village Farmers

1. Vermin compost for sustainable crop production

Sri Vishwas Singh of Murma Village under block Satbarwa Dist. Palamu was previously undertaking integrated farming system like ole production, turmeric and Ginger production and vegetable production by use of only inorganic fertilizers and cow- dung. It was his own perception that the land poor in organic content gives poor yield until and unless sufficient amount of inorganic fertilizer is applied. Sri Vishwas Singh was unable to get profit due to high input cost particularly in nutrient management. He attend a training programme on integrated plant nutrient management organized by NICRA. KVK, Palamu.

In the supervision of NICRA, KVK, Palamu. He constructed a pit of 10'x 3.5' x 2.5' size and purchased 1000 earth worms to start Vermi composting during January to February. Now, he is producing about 100 quintal of Vermicompost annually from Vermicompost units and used at own farm. He also selling the Vermicompost @ Rs. 7/- per kg.

His own experience of satisfaction of improving the soil health, good quality of the produce and a great residual effect of the compost for nest crop.

Now his net returns changes from 9000/- Rs. per ha per year to 12000/- Rs. per ha per year.

2. Fish farming as community approach

Sri Udai Singh is a progressive farmer of Palamu district .He was doing work in the field of fish farming. He got training from KVK, Palamu and other national organization (such as National Fishery Development Board, Hyderabad) in the farming in a common pond of village Murma. He has form a committee. With help of KVK, Palamu. 71 families involved in this village and he is active member of the committee. He

purchase spawn of fish such as *Katla*, *Rehu*, *Mrigal* and grass carp from Ramsager, West Bengal and got production of fish as about 15-20 quintal per season as a community approach.

Now his net returns changes from 22000/- Rs. per ha per year to 305000/- Rs. per ha per year.

3. Cultivation of Elephant foot yam bring happiness

Elephant foot yam which had good yield potential as well as economic returns. Elephant foot yam was found being cultivated in scattered way dominated by wild or local varieties having high acridity with very limited market as well as economic potential. The KVK (NICRA) brought a high yielding variety *Gajendra*.

Mahaveer Singh cultivated the crop as per recommended package of practices that included, seed treatment, preparation of fields, proper spacing, application of manures and fertilizer as well as other practices regarding pests and disease management. After harvesting the crop, average yield was found to be 445q/ha against the 210q/ha of local variety. This exercise was provided to be a master stock as they got 25 % higher rate than the market price of elephant foot yam.

Now his net returns changes from Rs. 290000/- per ha per year to Rs. 1096000 /- per ha per year.

4. Entrepreneurship in mushroom cultivation

Smt. Sumitra Devi, Village Dulsulma, Block Satbarwa, Palamu started mushroom cultivation on an experimental basis. She started it in a small room with 10 mushroom beds. The mushrrom started growing and became ready for harvest by the 20th day. Each bed yielded around 800g. Some of the harvest was used for the family and rest was sold. The demand of mushroom increased day by day. In this way Sumitra Devi Is earning approximately Rs. 4,000-5,000/- per month. Now she has become a known person among the successful entrepreneurs. Newspaper, radio and Doordarshan highlighted her achievements which made a tremendous impact on other unemployed rural youth.

Today, Smt. Sumitra Devi is not only a self–reliant successful woman, but is also helping many youth in making their living. She is a source of inspiration for many around her. She feel her great satisfaction and happiness to earn something for her family and community.

BIHAR KVKs

11. Aurangabad

11.1 Village information:

Name of the village	Harigoan
No. of households	151
Total cultivated area (ha)	100
Area under rainfed cultivation (ha)	80
Major soil type	Clay to clay loam
Climatic vulnerability of the village	Drought and Heat wave

11.1.1 Rainfall trend (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	1124.09	971.6	56	02	-	-	952.00	1.62	201.38
2012	1124.09	878.77	52	3	1	-	794.85	67.84	64.58
2013	1124.09	837.45	79	1	-	2	696.55	140.9	100.97
2014	1124.09	631.33	57	2	2	-	484.51	117.06	64.26
2015	1124.09	174.65	82	-	-	3	165.35	9.30	1.75
2016	1124.09	1426.40	73	1	1	1	1214.60	207.60	123.00

11.1.2 Details of the climatic vulnerability

Major climatic vulnerabilities experiences during the last five year (2011-16) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought like situation occurred during growth stage and flowering stage in Paddy and other *kharif* crops like wheat, lentil and chick pea, which affect the crop severely. In the year 2011, 2012, 2013, 2015 and 2016 the rainfall received during the month of June was less than normal rainfall, which vary from 15.0 to 80% less than normal. June, July and August is the major month which has decided the cropping and their extent of coverage. NICRA village experiences one better year *i.e.* 2016 in which rainfall received was 1214.60 mm respectively more than normal *i.e.* 1058 mm (June to September) and rest of year 2011, 2012, 2013, 2014 and 2015 experienced less rainfall. However the no. of rainy days was experiences better in 2015 (82 days) and 2013 (79 days).Intermittent drought like situation occurs in village Harogoan during flowering stages of paddy. About 65 ha of standing paddy was badly affected by the water stress situation, which was safely control and manage by the coping strategies of water management.

11.1.3 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Fallow	Paddy- lentil/chick pea
lentil-Fallow	lentil-moong

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

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)
Paddy	*MTU-7029, R. Sweta, Sahabhagi, susk Samrat*	136	78	92.00	42.50
Wheat	*HD-2985, PBW-343, DBW-14*	47	36	36.00	28.60
lentil	*HUL-57, PL-08*	42	27	25.00	10.60
Chick pea	*ZAKI-1581, PG 186,*	38	14	18.00	14.00

iv. Cropping intensity (%) in NICRA Village: -105% (Before NICRA), 165% (After NICRA)

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Potato	4.00	155.00	*Kufri Jyoti, Kufri Pokhraj, Kufri Ashoka*	2.50
Tomato	0.50	158.00	*Arka Rakshak, Awinash-2*	0.25
Brinjal	1.00	135.00	*Local* and *PH-6*	0.50
Bottle gourd	0.50	152.00	*Narendra Rashmi*	-

vi. Area under fodder cultivation and number of farmers growing green fodder: 9.50 ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle: Cross breed	9	5	4.0	FMD & HS & BQ	50-55	5
Indigenous breed	226	55	-	FMD & HS & BQ		
Buffaloes	87	26	-	FMD & HS & BQ		
Goat	100	24	6.0	PPR		10
Poultry	326	33	3.0	Rani khet		20

viii. Milk productivity (L/milch animal/day): Cow Cross breed 8-10L/day and Indigenous breed 2-3 L/dayxii) Details data about inland fisheries practiced: Pond (9 No.)

11.1.4 Resource availability:

11.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011- 12	Pond	2 units	All defunct	-
2012- 13	Open well	3 units	All defunct	All renovated
2013- 14	Pond	5 units	-	05 units new pond created
2014- 15	Pond Arhars	7 units 1 units	- defunct	02 units new pond created Renovated
2015- 16	Pond	9 units	-	02 units new pond created
2016- 17	Pond	9 units		-

Total no. of defunct Pond :- 2 units; **New created ponds** - 09 units

New created Ponds :- 09 units

Arhars:- 01 uni

11.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

Structures/Years of Construction	Category	Total	
		Area (ha)	Farmers involved (No.)
No. of farm ponds	Constructed	0.9	9
Percolation tanks/ Recharge pits (No.)	Constructed	0.8	8
	Repaired/ Renovated	0.3	3
Chanal	Cleaning/Desilting/ Renovation	2.2km	40
Sprinkler irrigation System	Constructed	8	52

11.1.4.3 Status of farm mechanisation before start of NICRA: Poor

List of Farm implements available in the village:

i. Tractor 03 No.

ii. Pump set 31 No.

iii. Spray Machine 01 No.

iv. Winnowing fan 02 No.

v. Thresher 02 No.

6. Socio-economic status:

a. **No. of households – General:** 31 ; **OBC:** 94 ; **SC:** 12

b. **Literacy rate (%): Male:** 36.9 **Female:** 24.9

c. **Workers engaged in agricultural activity (%):** 77

MODULE WISE INTERVENTIONS

11.2 Module I: Natural Resource Management

11.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Zero Tillage in Paddy (var. – *Rajendra Bhagwati*)	30	20.5	49.25	53095	35800	3.07
Summer ploughing(var. – *Rajendra Sweta*)	32	23	52.18	83488	55038	2.93
Zero Tillage in Paddy with brown manuring (var. – *Sahbhagi*)	32	4	35.5	47925	23490	1.96
Paddy cultivation through SRI(var. – *Rajendra Subhasni*)	28	6	42.0	65100	3365	2.1
Paddy sowing Through drum seeder in puddled condition(var. – *Sahbhagi*)	14	2	36.35	39985	11235	1.39
Zero Tillage in wheat (var. *WR – 544*)	27	20	33.87	43354	24504	2.30
Zero Tillage in Lentil (var. – *Arun*)	45	20	10.5	42000	31425	3.97
Total	**208**	**98.5**				

Impact: To ensure and enhance the moisture availabilities in the field several frontline demonstrations was conducted in NICRA village with an objective to reduce the cost of cultivation, time saving, energy saving, soil health management, enhancement of water holding capacity and sequential cropping. Keeping the in-situ moisture conservation in the centre different resource conservation technology *viz* zero tillage in wheat, zero tillage in lentil, zero tillage in paddy,Paddy cultivation through SRI, Paddy sowing Through drum seeder in puddled condition, Zero Tillage in Paddy with brown manuring were demonstrated in 98.5 ha among 208 farmers during 2011-16. Among this interventions, intervention like summer ploughing and direct seeded rice is being widely accepted by the farmers of NICRA and adjoining villages.

11.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	29	09 units				
Renovation of canal for Paddy (var. *Rajendra Sweta*)	48	36	49.25	53095	35800	3.07
Renovation of canal for Wheat (var. *HD-2733*)	36	22	33.87	43354	24504	2.30
Total	**113**					

Impact: Water is the major constraint in rainfed farming. NICRA village has also been experienced the crisis of water from decades. Not only the cropping but also for livelihood. Keeping the existing available resources in the centre KVK has started brainstorming for mitigating this vulnerability through natural resource management under NICRA project.

Before conducting the demonstration, work discus in VCRMC meetting on water harvesting, available water harvesting structures were studied out in details and their reservoir capacity. Accordingly the construction was undertaken as in intervention for better water harvesting and their use. Under construction 9 pond was constructed. In this way 70000.00 cubic meter water stored in 9 pond, which is being utilized by the farmers not only for the day to day activities but they have succeeded in cultivating the crops with ensured irrigation. Motivation towards re-cycling of available water in Arha(canal) through intervention of canal renovation has open the door and eyes of farmers and policy makers for switching over to double or multiple cropping. Farmers of the village started cultivated of *Rabi* and summer crop.

11.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	16	11	30.20	38656	18706	1.94
Sowing of chick pea with ZTD machine	8	13	16.22	39450	27200	3.22
Sowing of lentil with ZTD machine	11	16	12.25	30625	22125	3.60
Total	**35**	**40**				

Impact: Zero tillage technology especially in wheat sowing, farmers adapting this technology in late sown area. Through this intervention farmers has succeeded not only in saving the irrigation cost *i.e.* pre sowing irrigation but also time and production cost. Some farmers zero tillage technology adapted in paddy. However the impact of adoption is slow but encouraging. Farmer's saw the result in field in respect to yield recovery and lowering the production cost, saving of time (one week) in sowing attracted farmers for their use in coming year.

11.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	10	5	42.80	52164	18664	1.56
Ground water recharge through canal	42	33	39.35	47820	18320	1.62
Total	**52**	**38**				

Impact: The KVK has tried to educate the farmers to conserve the rainwater in their field through field bunding and in pond with an objective to recharge the ground water. Before NICRA farmers were making of field bunding but they did not apply sufficient height on their field as a result huge volume of water along with fertile top soil was washed out in nearby rivulets, nalas and rivers. Which resulted in siltation, of Arha. Even through renovated Arha during off season, ground water has maintained 20-25 feet in wells. During rainy season, rain water stored in renovated Arha and this water used for irrigate the rabi crops and drinking for animals.

11.2.5 Water saving irrigation methods:

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
Sprinkler Irrigation system for wheat	31	11	34.23	54768	30618	2.26
Sprinkler Irrigation system for Lentil	28	6	16.12	74152	57402	4.43
Sprinkler Irrigation system for Chick pea	23	5	16.00	80000	65500	5.52
Total	**82**	**22**				

Impact: To maximize the water use efficiency the demonstration was made on sprinkler irrigation system and their application. Through these demonstrations) 20-25% irrigation water was saved in wheat crops. In Aurangabad district before NICRA, there is no any farmers give the irrigation. 52 no. of sprinkler irrigation unit has been provided by NICRA and DHO.

11.2.6 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed

RWH structures	No.	Storage capacity (Lit. in Lakh.)	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
New Pond	09	70	9	10	165
Canal Renovated (2.2 Km long)	01	2700	32	48	210

Impact: Technology demonstration component (TDC) of NICRA has given a great opportunity to work with the farmers to address current climate variability with matching responses. Getting existing technologies into the hands of small and marginal farmers and developing new technologies/initiatives fighting against the vulnerabilities to meet the demand of changing climate. Based on their available resources plan was made and implemented. The major constraint was loss of moisture during sowing of *rabi* crops; however the Arha is existing in the villages of Harigoan but their capacity is very low due to siltation. The sound plan/ initiative was renovated of Arha. Quickly this initiative has left the broad impact and farmers have succeeded to cultivate the more area in *rabi* crops.

11.3 Module II: Crop Production

11.3.1 Introducing drought resistant varieties:

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
Paddy (var. *Sahbhagi Dhan*)	38	10.00	34.00	30.00	13.00	45900	11900	1.32
Paddy (var. *Susk samrat*)	31	10.00	32.50	30.00	8.33	43875	21700	1.97
Wheat (*HD-2985*)	28	8	28.25	21.00	34.52	42410	18310	1.77
Wheat (var. *PBW 343*)	36	10	40.50	28.50	42.10	51904	33054	2.75
Wheat (var. *WR-44*)	25	8	32.25	23.50	37.23	43673	25324	2.38
Lentil (var. *HUL-57*)	19	6	14.85	9.23	60.88	68310	52465	4.31
Lentil (var. *IPL-406*)	9	4	10.47	7.75	35.09	48162	32317	3.04
Lentil (var. *PL-639*)	11	5	11.78	8.75	34.62	48375	20250	3.89
Chick pea (*Pusa-256*)	19	5	12.24	8.00	53.00	46550	28500	3.04
Chick pea (*PG-186*)	16	4	16.00	11.25	42.22	80000	65500	5.52
Total	**232**	**70**						

Impact: Keeping the rain water avaibilities in the center, short duration drought tolerant crop varieties was demonstrated in 70.00 ha area during 2011-16 in NICRA village. Which was successfully harvested with B:C ratio ranging from1.32 to 5.52 in crop like Paddy (var. *Sahbhagi*, *Susk samrat*), wheat (var. - *HD-2985*, *PBW 343*), Lentil (var.- *HUL-57*) and Chick pea (*Pusa-256*). The yield enhancement is being observed in the tune of 8-60%.

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

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
Short duration rice (var. *Sahbhagi*)	37	12	38.12	32.30	18.01858	41932	13032	1.45
Short duration rice (var. *Susk Samrat*)	17	4	41.37	34.50	21.26935	55850	28600	2.05
Short duration rice (var. *Abhishek*)	15	3	42.00	36.23	17.86378	52500	32750	2.65
Wheat (var. *PBW-343, HD-2733, HD-2985*)	66	16	80.12	53.22	21.30031	42450	18300	1.75
Lentil (var. *HUL- 57*, var. *Arun*)	42	9	14.23	10.12	12.72446	108720	85920	4.77
Chick Pea (var. *PG-186*)	21	5	16.22	11.42	14.86068	39450	27200	3.22
Chick Pea (var. *PUSA-256*)	32	7	17.04	12.22	14.9226	96300	76800	4.94
Total	**230**	**56**						

Impact: Advancement of planting/ sowing dates in Paddy crop is not secure because farmers depend on rainfall, incase of *rabi* crops like wheat, lentil, chick pea resulted in better yield and income recovery. Advancement of sowing dates in rabi crop by farmers perform by use of use of short duration of paddy in *kharif*.

11.3.3 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
SRI (var. *Suhasini*)	15	5	52.40	38.70	35.40	104800	76350	3.68
Paddy Seed (var. *Sahbhagi Dhan*)	12	5	32.5	30.25	7.40	43875	21700	1.97
Paddy Seed (var. *Rajendra Sweta*)	15	5	52.00	41.00	26.82	78000	55745	3.50
DSR (var. *Sahbhagi*)	13	6	42.00	40.00	5.00	52500	32750	2.65
Total	**55**	**21**						

Impact: Intervention like DSR requires less water and manpower due to sowing in dry field while puddle irrigated rice requires more water and less manpower water. The reduced the crop duration and intermittent irrigation keeping the soil moist in DSR and SRI, rather than flooding under normal leads to saving 25-30% of water.

11.3.4 Community nurseries for delayed monsoon:

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
Paddy (var. *Rajendra Sweta*)	22	10.0	34.00	30.00	13.33	19690	17790	1.90
Total	**22**	**10**						

Impact: Villages experienced deficient and untimely rainfall in July and first fortnight of August. Which resulted in delayed transplanting of old age seedlings (40-45 days). Transplanting of aged seedlings lead to low tillering resulted in poor crop yield. Farmers of the village to grow community nursery in adjacent village where availability of water. By the application of this approach farmers increase the paddy yield upto 13.00% compared to farmers who transplanted over aged seedlings.

11.4 Module III: Livestock & Fisheries

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

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
Maize	3	0.5	-	-	-	-	-	-

11.4.2 Improved fodder/feed storage methods:

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
Cowpea	4	1	288.58	-	-	12000	-	-
Ricebean	5	1	170.63	-	-	18500	-	-
Barseem	3	0.5	210.00	115.69	81.51	18200	-	-
Total	**12**	**2.5**						

11.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle	450	1287 No						
Animal health camp	528	1441 No						
Total	**978**	**2728 No**						

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming in Pond	9	9 units						
Total	**9**	**9 units**						

11.4.5 Livestock demonstration:

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
Backyard poultry breed Banraja	25	30No						
Backyard poultry breed Garmapriya	25	30 No						
Improved breed of goat (Black Bengal and Jamnapari)	10	2 No						
Total	**60**	**62 No**						

11.5 Module IV: Institutional Interventions

Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. /Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Paddy Var Sahbhagi & R.Sweta	80.00	Participatory seed production	05	3.00
Fodder bank	Wheat straw	145.00	Mechanization through wheat	105	105
Custom hiring centre	Power tiller	-	-	33	14.25
Vermi compost	Production of vermi compost	1.75 q/units	-	28	36
Climate literacy through a village level weather station	AWS	1 unit	Weather related information's	97 house hold	-

11.5.1 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk Management Committee Gunia

11.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17 Area (ha)	Revenue generated (Rs.) Total under VCRMC
Aurangabad	142.35 ha	92,150.00

Impact: Under custom hiring module KVK has succeeded to popularize and accessing of farm machineries among the resource poor tribal farmer. Which has big impact in timely operation, cost saving and facing labour crunch during peak period.

11.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	8	143	43	186
Crop Management	6	81	41	122
Nutrient Management	8	231	18	249
Integrated Crop Management	4	82	14	96
Crop Diversification	1	18	Nil	18
Pest and disease management	11	455	65	520
Nursery raising	6	129	5	134
Integrated Farming System	1	26	11	37
Livestock and Fishery Management	7	484	57	541
Fodder and feed management	3	64	32	96
Employment generation	3	12	50	62

11.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Animal health camp Cum FMD vaccination awareness , Awareness, Companied parthenium reduction, Field day	18	917	169	1086

11.8 Soil Health Cards distribution during 2011-12 to 2016-17:

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
150	150	150	150

11.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs. Lakh.)
National micro irrigation system project	Sprinkler irrigation system	10.052
Adrash Dairy gram yojna	Chilling plant	14.820
Pradhan mantra gram sadak yojna	Construction of road (4 km)	176.00
IAP yojna	PACS Godown	17.690
Rastriya Krishi vikash yojna	PACS Godown	11.450
Rastriya Krishi vikash yojna	Threshing floor	0.780
Animl Husbandry Department (Under construction)	Veterinary Hospital	40.00000
Rastriya Krishi vikash yojna (Under process)	Rice mil	34.400
Total		**305.192**

11.10 Success stories of NICRA Village Farmers

1. Irrigation in pulses crops

In this village no farmers give the irrigation in pulses crops. Sri Sanjay Vidyarthi has purchased the sprinkler irrigation system and apply the irrigation in pulse crops (lentil and chick pea). Sri Vidyarti was found 63 % more yield as compared to without irrigation. Sprinkler irrigation in chick pea found highest net return of Rs 32540/ha, followed by without irrigation of Rs 20000 per ha.

Sprinkler system provides uniform irrigation in pulses as compared to flood irrigation. In this system there is no problem of water logging. This system adopted by farmer is profitable and is being used as a model for other farmers. at present time 51 farmers

used irrigation system in Harigoan village.

2. Water harvesting and fish cultivation

Sri Ramashish Singh has not grow of crops on proper time due to unavailability of irrigation facilities. He constructed one pond in 10000 sq. ft. for storage of rain water. After construction of ponds about 0.5 ha irrigate from this field. He also planted the horticultural crops on bund of pond. Before construction of pond he earned Rs 6000/- per year from this land. Now Sri Singh earned Rs. 40000/- from only this pond. Surrounding area of pond can easily irrigate and increase the yield and farmers also produce the fish. Water harvesting structure adopted by farmer is profitable and is being used as a model for other farmers. in this contest now more nine farmers constructed the pond in Harigoan village.


वर्षा के अभाव में वैकल्पिक खेती पर कृषि विभाग का जोर

औरंगाबाद | संवाद सूत्र

12. Banka

12.1 Village information:

Name of the village	Merha
No. of households	176
Total cultivated area (ha)	110 ha
Area under rainfed cultivation (ha)	70 ha
Major soil type	Acidic soil
Climatic vulnerability of the village	Drought

12.1.2 Rainfall trend of the district

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif	*Rabi*	*Summer*
2015-16	1156.3	822.2	12	1	-	1	-	584.5	21.4	216.3
2016-17	1156.3	1031.8	13	1	-	2	-	884.0	12.3	198.5

12.1.3 Datails of the climatic vulnerability

NICRA village normally received delayed onset of monsoon, uneven distribution of rainfall, less rainfall and prolonged dry spell are the problems, due to these problem the normal cultivation of crop has interfered and farmers got problems in cultivation of crops in *kharif* season. Near about 20 ha area has affected under these problems.Thus, major climatic vulnerabilities experiences during the last two year (2015-16) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought like situation occurred during grand growth stage and flowering stage in Paddy and other *kharif* crops like ragi, groundnut and black gram, which affect the crop severely.

12.1.4 Predominant farm enterprises

i. Cropping pattern: Rice

ii. Major cropping system: rice-wheat cropping system

iii. Area and productivity of major crops:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)	Productivity (q/ha)
Paddy	*Sahbhagi*	75	35	90	2952	32.8
	R. Mahsuri-1	50	30			
Wheat	*HD-2967*	50	20	40	928	23.2
	HI-1563					
Chickpea	*GNG-1581*	75	30	30	243	8.1
	PG-186					
Lentil	*HUL-57*	16	05			

iv. Cropping intensity (%): Before NICRA- 112%, After NICRA- 187%

v. Area under fodder cultivation and number of farmers growing green fodder:

Year	Source of irrigation	Area (ha) under irrigation
2015-16	Seasonal river and check dam	2.0

vi. Livestock in the village:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Goat	625	127	22	PPR Vaccination	93%	15%
Cow/Boffalo	255	113	52	HS+BQ+FMD	91%	9%

vii. Milk productivity (L/milch animal/day): 05

12.1.5 Resource availability:

12.1.5.1 Status of common pool resources (CPRs)

CPR	Area (ha) or Numbers	Past status (before start of NICRA)	Current status (after start of NICRA)
Sprinkler irrigation	2	No	Yes
Rotavator	10	No	Yes
M B Plough	5	No	Yes
Seed-cum-ferti drill (9 tynes)	3	No	Yes
Seed-cum-ferti drill (11 tynes)	3	No	Yes
Post hole digger	-	No	Yes
Power sprayer	1	No	Yes

12.1.5.2 Summary of Water harvesting interventions taken up in the NICRA village

Sl.no	Structures/Years of Construction	Category	2015-16	2016-17
1	No. of Check dams	Constructed	1	
2	Drainage Channel (length in meter)	Cleaning/desilting	1	1
4	Recharging of wells		1	1

12.1.6 Socio-economic status:

a. **No. of households: General –** 1; **OBC –** 157; **SC –** 6; **ST-** 12

b. **Literacy rate (%): Male:** 80%; **Female:** 55%

c. **Workers engaged in agricultural activity (%):** 70%

MODULE WISE INTERVENTIONS

12.2 Module I: Natural Resource Management

12.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var. *Lalat*)	20	05	32.3	26300	32950	1:2.25
Green manuaring in Paddy (var. *Lalat*)	10	02	35.6	25900	33300	1:2.28
Brown manuaring in Paddy (var. *Anjali*)	5	01	33.1	25100	32900	1:2.25
Zero Tillage in wheat	4	01	30.2	28100	38320	1:2.36
Zero Tillage in Maize	5	01	28.1	24000	32300	1:2.34
Repair of bund	10	02	30.5	22300	31325	1:2.31
Fruits production on land embankment	10	1.5	36.2	21020	34128	1:2.29
Organic mulching in	20	2.5	29.1	24121	33185	1:2.24
Plastic mulching in vegetables	5	1	31.2	20120	32265	1:2.21
Total	**79**	**17**				

Impact: Summer ploughing is a best technique to eradicate weeds from field, insect pest control through summer deep ploughing, disease control through inoculum damage of pathogen as well as improves soil structure alternate wetting and drying, soil aeration which helps in multiplication of micro-organisms and organic matter decomposition is hastened resulting in higher nutrient availability to the plants.

On the way of rainfed situation rice cultivar *sahbhagi* have a special quality to tolerate dry spell of mansoon and physically show as a normal plant and produce better in a dry situation. It adaptation increased by 20%.

Zero tillage in wheat is good technology to sowing the wheat crop. It has different advantage has been seen in Merha village:

1. Suited for poorly drained soil which is situated in sloppy areas and excellent incorporation as well as well tilled seed bed.
2. A good practice to conserve water and energy.
3. Fifteen day before ripe crop as compared to conventional practice.

12.2.2 Water harvesting and recycling for supplemental irrigation:

Table.Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Bora bandh	25	1	-	-	-	-
Renovation of Well for irrigation	20	1	-	-	-	-
Bund making leveling in paddy field	14	3	-	-	-	-
Natural mulching	05	1	-	-	-	-
Renovation of irrigation channel	05	2	-	-	-	-
Renovation of common pond	06	1	-	-	-	-
Total	**75**	**9**				

Impact: Bora bandh: Bora bandh practice is done in village. Runoff water has discharged from the large channels of water storage and some water has used in paddy crop and all the water have lossed through runoff and it was made useless. After the bora bandh practice maximum water have used in paddy irrigation and one most important thing is that the water conserved for a long time and use for life saving irrigation in *rabi* wheat crop which has left followed at earlier which have bora band practice was not applied. 2.5 ha area increased under *rabi* cultivation.

12.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	20	5	28.1	26100.00	38160.00	2.46:1
Sowing of paddy with ZTD machine	30	10	34.2	27900.00	40166.00	2.48:1
Total	**50**	**15**				

Impact: Sowing of wheat with ZTD machine: This is the new technology for this village and this methods have more benefits to farmers as given below:

1. Energy saving
2. Water and labour saving due to no land preparation.
3. Escape from western winds at the time of maturity.
4. Time saving is more pronounced as compared to conventional cultivation
5. Crop matures 15 days before as compared to normal cultivation and there was saving of one irrigation.

Sowing of paddy with ZTD machine:

1. No transplanting
2. Early sowing
3. Water and labour saving
4. Time saving is more pronounced as compared to conventional cultivation.
5. Crop matures 15 days before as compared to normal cultivation and it was usefull in timely sown of wheat and chick pea.

12.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	18	3	32.80	23100.00	26100.00	2.12:1
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	5	0.5	33.10	23500.00	26150.00	2.11:1
Total	**23**	**3.5**				

Impact: Field bunding for paddy: It is the most important intervention for water conservation and especially for rice cultivation as rice requires more water as compared to other crops. Field bunding increases area of the paddy field as well as 15% production also. One is the more important thing is that on the same field, the rice is harvesting at their maturity time and after harvesting of previous crop the moisture is present more for the sowing ofsucceceding chick pea and wheat crops for the *rabi* crop production.

Water management through bunding of paddy fields: It is also a most important intervention specially for water conservation and it is a structure to harvest runoff water and water stagnant for a long time in the paddy crop. One is the more important thing is that on the same field, the dry spell of Monsoon are coming at the time of rice growing period it has more and enough water to tolerate in the same situation and there is no effect of dry spells.

12.2.5 Water saving irrigation methods:

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
Vermi-compost from biodegradable wastes	10	0.2	-	-	-	-
Production of pigeon pea (var. *PRG-158*) on farm bund	50	03	12.40	18100.00	45150.00	2.50:1
Total	**60**	**3.2**				

Impact: Vermi-compost from biodegradable wastes: Vermicompost adoption is a good practice for this village it have many more quality to increase yields as well as it improves physical properties of soil to increase fertility level of soil.

Production of pigeon pea on farm bund: Bund sowing is the traditional technique to cultivate pigeon pea in NICRA village. These techniques have more benefits to the farmer as given below:

- Due to lack of moisture in uplands crop is cultivated on the bund of paddy field.
- Cover the space which has been gone in bunding *i.e.* judicious used of bunds.
- Extra crop takes from bund sowing.
- No risk of crop falure.
- Extra income.

12.2.6 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Pond	1	23466 m3	50		

12.3 Module II: Crop Production

12.3.1 Introducing droughtresistant varieties:

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 paddy (var. *Sahbhagi*)	110	55	32.0	20.6	37.38	24600.00	24750.00	2.01:1
Sowing of drought tolerant paddy (var. *Sahbhagi*) with ZTD machine	10	02	32.9	21.1	35.86	22100.00	27250.00	2.23:1

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Sowing of drought tolerant paddy (var. *Sahbhagi*) with Drum seeder machine	10	02	31.9	20.9	34.48	23100.00	24750.00	2.07:1
DSR Transplanting (var. *Sahbhagi*)	10	03	29.9	20.1	32.77	22100.00	24750.00	2.11:1
Contingent Crops Horse gram	15	03	7.10	4.00	27.75	15500.00	20000.00	2.29:1
Total	**155**	**65**						

12.3.2 Location specific intercropping systems with high sustainable yield index:

Table.Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Maize + Redgram+ jute	20	03	26.4	19.1	23.86	32500.00	59150.00	2.82:1

12.3.3 Introduction of new crops/ crop diversification:

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
Oal (Var. *HYV. Gajendra*)	2	0.01	25.6	18.9	25.41	25200.00	28750.00	2.8:1

12.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs/ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Berseem	04	0.1	623.00	522.00	19.34	80.90	129.15	1.44:1

12.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (Nos)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle and PPR against goat	115	400	8.1	58.5	50.4	2000	400000	200:1
Vaccination HS,BQ	85	111	0	5	2.5	220	15000	7:1
Proper De-worming	115	2200	5.45	5.20	4.8	33	675	20:1
Total	**315**	**2711**						

Impact: Mortality of goats decreased by one time vaccination and net income village increased by Rs. 4.0 lac

12.4.3 Livestock demonstration:

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
Others (stylo)	04	12	8.44	5.62	50:8	98.72	197	1.99:11.75:1
Clitoria	04	12	7.55	5.62	34	96.00	168	1.4:1
Berseem	10	20	6.23	5.22	19.34	88.90	129.15	1.4:1
Gwar	09	20	6.32	5.62	12.45	91.24	129.96	1.7:1
Cowpea	11	25	7.34	5.62	30	95.72	161.00	1.9:1
UMMB Block	04	18	8.16	9.10	11.50	12	10.4	
Total	**42**	**107**	**44.04**					

12.5 Module IV: Institutional Interventions

12.5.1 Table. Details of the various institutional interventions

Interventios	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. Rajendra Sweta, Naveen, JaldiDhan 13, Madhuri	30	Quality seed	38	19
Commodity groups	Kitchen Gardening	22	Improved Variety Seed	12	11
Custom hiring centre	Power tiller	1	-	21	
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1	Manual reading of weather parameter are taken	-	-
	Wheat	25	Quality Seed	35	15

12.5.2 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Banka	20150.00	20150.00

12.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Climate change	2	50	18	68
Natural Resource Management	8	143	43	186
Crop Management	18	458	146	604
Nutrient Management	3	111	27	138
Integrated Crop Management	1	29	3	32
Crop Diversification	8	151	67	218
Pest and disease management	42	1051	358	1409
Nursery raising	5	101	40	141
Integrated Farming System	1	26	11	37
Livestock and Fishery Management	29	748	573	1321
Fodder and feed management	3	64	32	96
Employment generation	1	10	4	14

12.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Awareness, Exposure visits, Field Day, Group Discussion, Method demonstrations, Method demonstrations, Campaign (Swacchataabhiyan), Animal Health Camp, Krishak Chaupal, Soil health day	2	71	38	109

12.8 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes in NICRA implementing KVKs

Development Scheme/Programme	Nature of work	Amount (Rs.)
Dairy Development	Sponcered Scientific Diary	10.00 lac

12.9 Success stories of NICRA Village Farmers

1. **Rainfed paddy cultivar *Sahbhagi*:** Rice is a major crop of Banka District and it covers maximum area in Banka as well as NICRA village. This village is received less rainfall, uneven distribution of rainfall due to climatic vulnarabilty as well as undulated topography and delayed onset of mansoon so that rice cultivation is more or less low in area asa well as production also. Rainfed rice *sahbhagi* a good cultivar to cultivate this crop for paddy production. It have more properties regarding climate resilient to harvest more production such as low water requirement, long dry spells tolerate efficiency, short duration cultivar and others. It popular as a boon for NICRA villagers by own property. One is the more important thing is that it gives good and optimum time for *rabi* sowing. By the cultivation of this rainfed cultivar villagers have rice for eating and straw for livestock production. Before this cultivar production village have less amount of livestock due to non availibity of atraw and other material to feed livestock.
2. **Dairy development in Rainfed area:** after the initiation of NICRA a dairy developed by farmers by the guidance of KVK Banka. At initiation stage dairy started with 10 cows. After the success of this innovation district dairy development officer interested to promote the dairy sanctioned loan of 20 cows, presently they are selling 200-250 kg milk per day. It is suceced due to round year geen fodder production and inrichment of straw by producing Rainfed rice *Sahbhagi* dhan.

13. Jehanabad

13.1 Village information:

Name of the village	Sakrorha
No. of households	350
Total cultivated area (ha)	250 ha
Area under rainfed cultivation (ha)	50
Major soil type	Clay loam
Climatic vulnerability of the village	Drought

13.1.2 Rainfall received (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	952.0	952	35	3	1	5	952	0	0
2012	952.0	1013.5	47	2	2	7	981..5	32	0
2013	952.0	525.5	23	2	3	2	463.5	6	56
2014	952.0	658.5	20	5	1	3	561.9	52	44.6
2015	952.0	284.15	34	2	3	0	276.65	7.5	0
2016	952.0	846.7	47	-	-	3	843.2	3.5	0

13.1.3 Details of the climatic vulnerability

Drought is major climatic vulnerabilities of this village. During the last five year (2011-16), farmers of the village experienced erratic, untimely and deficient rainfall and intermittent drought like situation occurred during different growth stage of Paddy and pigeon pea in *kharif* season, which affect the crop severely. In the year 2011-16, the rainfall received during the month of June was less than normal rainfall (mm) which varied from 41 % to 98 % less than normal. Month of June to October is very important month which decides the cropping, extent of coverage as well as better production of paddy crop during *kharif*. During kharif season, NICRA village experienced excess rainfall than normal only in year 2012 which is 981.5 mm which is more than normal 944 mm (June – October) and rest of year 2011, 2013, 2014, 2015 and 2016 experienced less rainfall. No. of rainy days experienced in the village was 35 days, 47 days, 23 days, 20 days, 34 days and 47 days, respectively during year 2011, 2012, 2012, 2013, 2014, 2015 and 2016.

In year 2013, 2014 and 2015 intermittent drought like situation occured in NICRA village Sakrorha during *kharif* paddy cultivation. About 170 ha of standing paddy was badly affected by the water stress situation, which was safely controlled and manage by the coping strategies of water management mainly through renovated ponds and checkdams.

Some important climatic vulnerability experienced during the past six years (2011-16) are as follows:

- During 2011 to 2016, the village experienced 3,2,2,5,2 and 0 number of dry spells of 10-15 days duration in respective years in *kharif* season and during *rabi*, summer, farmers of the village depends only on ground water.
- NICRA village also faced dry spells of even more than 15 days duration which were 1,2,3,1,3 and 0 no. of dry spells in respective years during *kharif* paddy cultivation.

13.1.4 Predominant farm enterprises

i. Cropping pattern: Paddy-Wheat

ii. Major cropping system: Paddy-Wheat/pulses/spices -Green gram/veg.

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Paddy	*Sahabhagi , Abhishek, Susk samarat, Prabhat, Komal, chandan, Kanchan, R. Sweta, R. Mahsoori-1, MTU 7029*	183	120
Wheat	*HD 2985, HD 2733,PBW 373, PBW 343, PBW 373*	165	78
Lentil	*HUL 57, KLS-218, Arun*	95	50
Chickpea	*BGM 547, GNG 1581, P-256*	91	41

iv. Cropping intensity (%): 200 %

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Okra	1	165.4	Hybrid	0.25
Bittergourd	1	142.8	Hybrid	2.0
Brinjal	0.8	332	Hybrid	0.8

vi. Area under fodder cultivation and number of farmers growing green fodder: 6 ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle, Goat, Poultry, pigs	1240	80	60%	FMD, H.S.+B.Q, PPR, ranikht	90%	10-20%

viii. Milk productivity (litres/milch animal/day): cow, buffalo (cross breed) 6-8 lit/cattle/day and Indigenous breed 1-3 lit/day

ix. Details data about inland fisheries practiced: Pond (2 No.), pyne depression (2 No.)

13.1.5 Resource availability:

13.1.5.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011-12	Aahar, pyne,pond	4 aahar, 6 pynes, 5 defunct ponds	All having shallow depth	-
2012-13	Aahar, pyne,pond	4 aahar, 6 pynes, 5 ponds	All having shallow depth	4 pond renovated and 1 Aahar converted into pond
2013-14	Aahar, pyne,pond	4 aahar, 6 pynes, 5 ponds	3 aahar and 6 pynes having shallow depth,	deepening of 1 pyne in convergence mode with MANREGA
2014-15	Aahar, pyne,pond, checkdam	4 aahar, 6 pynes, 5 ponds, 3 checkdams	3 aahar and 5 pynes having shallow depth	3 chekdams constructed on different locations of pynes, deepening of 2 pynes
2015-16	Aahar, pyne,pond, chekdam, 5% model pond	4 aahar, 6 pynes, 7 ponds, 7 checkdams, 5 miniature ponds	3 aahar and 3 pynes having shallow depth	2 Aahar converted into new ponds, 4 chekdams constructed on different locations of pynes, 3 pynes renovated, 4 dugout pits (Jalkunds) constructed, 5 miniature pond (5% model) constructed in paddy fields
2016-17	Aahar, pyne,pond, chekdam, 5% model pond, open well	5 defunct open wells	1 defunct aahar, 5 defunct open wells	1 chekdams construction on pynes is under progress, 3 open wells renovated

New check dam constructed	: 7 units	New created Ponds	: 02 units
Chech dam under construction	: 01 unit	New Miniature pond (5% model) constructed	: 05 units
Total No. of renovated ponds	: 05 units	Pyne renovation	: 05 units

13.1.5.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	Total
1	No. of farm ponds/Jalkund	Repaired/ Renovated	7
2	No. of Check dams	Constructed	8
3	Arhars/pynes etc	Renovated	3
4	Recharging of wells	Renovated	8
5	Dug out pits	Constructed	4
6	Miniature ponds (5 % model)	Constructed	5
7	No of open wells	Renovated	3

13.1.5.3 Status of farm mechanisation before start of NICRA:

List of Farm implements available in the village:	
before start of NICRA	**After NICRA**
Irrigation pump sets: 20 Power tiller : 01 No. Spray Machine : 05 No. Winnowing fan : 02 No. Cultivator : 03 No. Chaff cutter : 06 No.	i) Zero till seed cum fertilizer drill:01 ii) Self propelled walking type Reaper:01 iii) Power Tiller:01 iv) Rotavator:01 v) M.B.Plough:01 vi) Disc Harrow:01 vii) Sprinkler System:01 viii) Leveller:01 ix) DSR machine:01 x) Paddy transplanter:01

13.1.6 Socio-economic status:

a. **No. of households – General:** 160; **OBC:** 136; **SC:** 15; **ST:** 45

b. **Literacy rate (%): 60.06 %: Male:** 71.07 % **Female:** 49.52 %

c. **Workers engaged in agricultural activity (%):** 90 %

MODULE WISE INTERVENTIONS

13.2 Module I: Natural Resource Management

13.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Green manuaring (dhaincha) in Paddy (var. *R.Sweta*)	25	17	43.3	34000	29651	1.87
Repair of bund in paddy (*R.Mahsoori-1*)	69	47	45.2	34000	32444	1.95
Land Leveling in paddy field (*R.Mahsoori-1*)	17	9.6	44.3	34000	31121	1.92
Plastic mulching Okra	15	1.0	165.4	48800	157950	4.24
Use paddy straw in bitterguard	28	3.5	142.8	38000	176200	5.64
Total	**154**	**97.6**				

Impact: To save irrigation water and check weed growth in vegetables, the technology of mulching was demonstrated in NICRA village. Two types of mulching material were used as- plastic and straw mulching. Plastic mulching was done on 15 farmers fields in 1.0 ha area in okra crop whereas straw mulching was demonstrated on 3.5 ha area in bitter gourd involving 28 farmers. Farmers observed that mulching controls the growth of weed. Moreover, water requirement is almost half in case of mulching than the normal requirement of general cropping. Use of straw mulching was much economical than plastic mulching. The production is also higher due to less weed population. Like wise green manuring (Dhaincha) was demonstrated in 17 ha among 25 farmers before paddy cultivation and the effect has been observed in paddy as less requirement of nitrogenous fertilizer in paddy cultivation. Due to low bund height and delayed monsoon condition, farmers were unable to use the rain water properly for paddy cultivation. Strengthening of field bunds has been demonstrated in this village in convergence with MNREGA, Jehanabad for in-situ moisture conservation of rain water.Keeping in view the moisture conservation in paddy field, the bund height and width of farmer's field has been increased in 47 ha area covering 69 farmers as a result moisture retention increased and 12.5 % increase in paddy yield was also observed.Farmers were motivated to level their undulated land and now they are able to apply irrigation water uniformly. Land levelling has been performed for promotion of in situ moisture conservation in 9.6 ha area among 17 farmers

13.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation, paddy, *R.Mahsoori-1*	647	270.5	45.2	34000	32444	1.95
Construction of miniature pond in paddy field (5% Model), paddy var. *R. Sweta*	10	1.32	43.3	34000	29651	1.87
Renovation of Well for irrigation, Mustard	3	1.2	15.6	18000	44400	3.47
Digging of small pits in pynes for paddy (*sahbhagi*)	8	3.2	41.88	27000	32050.80	2.19
Recharging of wells, mustard (*Laxmi*)	116	14.6	15.6	18000	44400	3.47
Desiltation of defunct water harvesting structures, Renovation of pyne (*R. Mahsoori-1*)	297	129	46.7	34000	34649	2.02
Newly Check dam , Paddy (var. *R. Mahsoori-1*)	307	157	46.7	34000	34649	2.02
Total	**1388**	**576.82**				

Impact: Farmers of Sakrorha village are using stored water mainly for supplemental irrigation in *kharif* paddy and timely raising of community paddy nursery. This intervention provided protective irrigation in 576.82 ha among 1388 farmers. Harvested water is used for supplemental /life saving irrigation in paddy crop, which prevented crop failure and created irrigation capacity of 414942.3 cubic ft. About 90 % increase has been observed in cultivation area lying around the pond. Due to ground water recharge by such water harvesting structures, ground water table of the village also raised. This intervention benefited farmers of Sakrorha village particularly by saving nursery rice under delayed monsoon condition. In *Rabi* season also Pond water is being used for moisture retention for all *Rabi* crops (Wheat, oilseed, pulses, barley, oat) and upto at least first irrigation in wheat *i.e.* life saving irrigation in *Rabi* crops.

Village Sakrorha is surrounded by a network of pynes which flows only during monsoon season. Due to lack of sufficient number of barriers at different locations of pynes, water flowing in the pynes goes out of this village area (lower area) and finally falls in nalas(drainage channels) and rivers. All through 8 Check dams have been constructed at different location of pynes to buildup water head and to divert the flowing water in farmer's paddy field which helped in diverting 1028407.4 cubic ft water and provided irrigation in additional 60 ha area benefitting around 120 farmers each year. Pyne renovation work of these channels has been performed in 3.2 km in convergence with MNREGA, Jehanabad covering 129 ha area of 297 farmers and farmers are lifting the water for irrigation of paddy crop.

Five miniature water ponds have been dugout in 5 % portion of each plot having 1/3rd acre size of 5 farmers to harvest and store runoff water for supplemental irrigation during dry spells. 1.32 ha among 10 farmers.

Several open wells of the village are in defunct and dried condition out of which three open irrigation wells were renovated. Deposited silts were removed from these wells as a result water storage capacity of the wells has been increased. Now, 3 farmers and their neighbouring farmers also are using, the stored water for irrigation of oilseed crop (Mustard) and kitchen gardens covering an area of 1.2 ha.

13.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine (var. *HD-2733, HD 2985, HW-2045*)	72	77.5	39.5	30500	33687.5	2.10
Sowing of paddy with ZTD machine (*R. Sweta, BPT-5204*)	13	8	43	34000	29210	1.86
Sowing of chick pea(var. *P-256*) with Rotavaor	27	37.5	22	20500	89500	5.37
Sowing of paddy with power tiller, Lentil (var. *Arun, HUL-57*)	30	21.5	15.8	18800	43610	3.32
Sowing of Tori(Var. *RAUTS-17*), rotavator	12	5	8	8500	15500	2.8
Sowing of lentil (*KLS-218*) with rotavator	5	1.5	16	11300	52700	5.6
Total	**159**	**151.0**				

Impact: Demonstration on wheat sowing by zero tillage conducted in 15 ha area among 20 farmers each year. This technique saved labour, diesel, time (10-15 days) and irrigation requirement due to efficient utilization of residual moisture of field. Sowing of wheat with zero tillage machine in the standing stubble of rice without any tillage has been an innovative practice adopted by the farmers in the village. Production of wheat by zero tillage was recorded to be 39.5 q/ha which is 14.49 % more than traditional cultivation (34.5 q/ha). Sowing of wheat through ZTD farmers saved Rs. 2000 per ha in different agronomical practices.

Delayed monsoon affected timely transplantation of paddy and farmers get reduced paddy yield.Keeping in view,direct seeded rice/ drum seeded rice was demonstrated in the village. Demonstration of direct seeded rice was conducted in 8 ha land with paddy variety *R. Sweta* and *BPT* 5204 among 13 farmers. The yield was increased to the tune of 17.8 to 24.1 per cent over traditional method (36.5 q/ha). Maturity period was found 7 days less in DSR. It saved the time of sowing and helped in utilizing first shower of monsoon in providing irrigation.

13.2.4 Artificial ground water recharge:

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 paddy fields (Var. *R. Mahsoori-1*)	69	47	45.2	34000	32444	1.95

Impact: Due to low bund height and delayed monsoon condition, farmers were unable to use the rain water properly for paddy cultivation. Strengthening of field bunds has been demonstrated in this village in convergence with MNREGA, Jehanabad for in-situ moisture conservation of rain water. Keeping in view the moisture conservation in paddy field, the bund height and width of farmer's field has been increased in 47 ha area covering 69 farmers as a result moisture retention increased and 12.5 % increase in paddy yield was also observed.

13.2.5 Water saving irrigation methods:

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
Sprinkler irrigation in rai (var. *R.Suflam, Bio-902*)	19	4	16.8	18000	40800	3.27
Sprinkler irrigation in Green gram (*HUM-16*)	4	1.5	14	11500	31500	3.6
Sprinkler irrigation in Wheat (Var. *HD-2733, PBW 343, HD 2985, HW-2045*)	104	33	41.6	30500	37100	2.22
Sprinkler irrigation in lentil (Var. *Arun, KLS-218, HUL-57, PL-6, PL-8*)	128	33.1	16.4	18500	46280	3.50
Sprinkler irrigation in Omum (Var. *R. Abha*)	3	0.5	12.4	17200	44800	3.60
Sprinkler irrigation in Gram (var. *Pusa-256*)	9	4	22.6	22050	49705	3.25
Water saving paddy cultivation methods (SRI) var sahbhagi	24	19	42	27200	29920	2.1
Water saving paddy cultivation methods (direct seeding by seeder) *sahbhagi*	16	21.3	36.6	21500	28276	2.31
Water saving paddy cultivation methods (direct seeding by seeder) *Prabhat*	12	20.5	33.2	24000	22812	1.95
Total	**319**	**124.9**				

Impact: Farmers of this village have used the sprinkler irrigation system in *Rabi* crops like Wheat, lentil, gram and mustard and by dint of this system they saved water, irrigation cost and reduced labour requirement in irrigation. Keeping in view less availability of irrigation water in *rabi* season, demonstration on sprinkler system has been done in wheat (var. *HD-2733, PBW 343, HD 2985, HW-2045*) in 33 ha, Lentil (var. *Arun, KLS-218, HUL-57, PL-6, PL-8*) in 33.1 ha, Gram (*Pusa-256*) in 4.0 ha, Rai (*R. Suflam, Bio-902*) in 4 ha, Green gram (var. *HUM-16*) in 1.5 ha and Omum (*R. Abha*) in 0.5 ha.. Water saving paddy cultivation methods like SRI and direct seeding by paddy seeder has also been intervened among farmers of this village. SRI method of paddy cultivation demonstrated in 19 ha area among 24 farmers and as a effect enhancement in paddy yield as well as less requirement of irrigation water was observed with a B:C ratio of 2.1. Direct seeding by drum seeder was demonstrated in 22.3 ha among 20 farmers with paddy var. Sahabhagi & Prabhat and up to 29.32 % yield increase has been observed.

13.2.6 Other Demonstrations:

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
In-Situ moisture conservation through Vermicompost utilization	40	16	160 q/unit/yr	19425	64575	4.32

Impact: 20 units of vermi compost have been established in NICRA village Sakrorha in convergence with DAO, Jehanabad. In-situ vermicomposting was done by spreading of cow dung, crop residues and worm. Use of vermicompost resulted into increase in water holding capacity of soil and it also improved the soil health. This practice is performed in the village in 16 ha among 40 farmers and farmers observed increase in irrigation interval and reduced water consumption.

13.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Pond renovation	2	64800 cubic ft	22	8	100
Check dam	1	187200 cubic ft	36	12	100
Desilting of old drainage channel (Renovation of Pyne), 1.3 km	1	190125 cubic ft	36	21	100
Renovation of defunct open well	3	15700 cubic ft	3	3	150
Total	**7**				

Impact: During year 2016-17, water harvesting structure like 2 ponds and 1 check dam have been renovated. These structures helped in supplemental irrigation of paddy during dry spells of *Kharif* season for paddy cultivation whereas water collected in 3 renovated open wells have been utilized for oilseed and vegetable irrigation under kitchen gardens during *Rabi* season. All these structures developed the irrigation potential by 44 ha and enhanced the cropping intensity by 100-150 percent.

13.3 Module II: Crop Production

13.3.1 Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	191	206.5	41.88	32.80	27.68	27000	32050.80	2.19
Short duration rice (var. *Sabour ardhjal, Abhishek, Susk samarat, Prabhat, Komal, Chandan*)	145	90.46	137.9	118.3	33.92	26000	25544	2.01
Low water requiring crop, Lentil (*KLS-218, Rhizobium*)	5	3	13.5	11.1	14.40	16800	24712	2.47
Low water requiring crop, Lentil (*Arun+Rhizobium*)	43	10	13.00	11.8	10.16	16700	23275	2.39
Wheat *HD 2733*	45	16	41	34.5	18.84	33800	32825	1.97
Short duration Wheat (*PBW 373*), Lentil (*KLS-218*), Chickpea (*GNG 1581*), Field pea *Prakash, Mustard Laxmi gold, Rai (Pusa bold)*	251	50	33.8	31.5	7.30	26500	25045	2.78
Total	**680**	**375.46**						

Impact: Farmers of this village were practicing long duration paddy and due to weak monsoon, they were getting low yield. Short duration drought tolerance paddy variety *Sahbhagi* was demonstrated on 191 farmers' field covering 206.5 ha area after initiation of the Project. The yield was increased withthe tune of 15.34 per cent over farmers practice. Farmers observed that the variety mature about 15-20 days before their traditional variety which solve their shortage of fodder for animals and also prevented late drought condition. Besides this variety, Short duration paddy variety *Sabour Ardhjal, Susksmarat, Abhishek, Prabhat* were also demonstrated among 14.5 farmers in 90.46 ha area. During *Rabi* season short duration wheat (*HD 2967*) was practiced in 50 ha among 251 farmers in which about 9% yield increase was obtained.

Wheat has been major crop in *Rabi* season in this village but due to less water availability of surface water, farmers have given more emphasis on cultivation of pulses. The cultivation

of improved varieties of pulses crops were promoted in NICRA village as an alternate option in drought situation as these are low water requiring crops. At the same time these are high remunerative crop with high market value. in *Rabi* season Lentil (Var. *Arun, HUL 57, KLS-218*) in 27.0 ha, Gram (*P-256, GNG 1581, BGM 547*) in 4 ha, linseed (var. *Azad Alsi-1, Garima*) in 15 ha , mustard (*Laxmi gold*) in 8 ha, rai (*Pusa bold*) in 3.5 ha and field pea (*Prakash*) have been intervened in 3.5 ha. These varieties gave 18-42% more yield than local varieties.

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

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
Short duration Potato (var. Pukhraj)	35	12.5	215	185	16.21	45000	86000	2.86
Lentil (var. Arun)	49	4	16	12	33.33	13000	35000	3.7
Lentil (*KLS-218, HUL-57, PL-6, PL-8*) improved seed	84	14.1	16	12	33.33	15000	49000	4.2
Total	**168**	**30.6**						

Impact: After harvesting of short duration paddy, farmers of the village practiced short duration potato and Lentil crop cultivation as advancement of *Rabi* crop sowing dates. Potato var. Pokhraj and lentil (Var. *Arun, KLS-218, HUL-57, PL-6, PL-8*) was sown in 12.5 ha and 18.1 ha, respectively in the first week of October and farmers got 16.2 % increased yield of potato and 33.3 % more yield in lentil cultivation.

13.3.3 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI (*Sahabhagi*)	24	19	42	28.3	48.40	27200	29920	2.1
Water saving technology through Drum seeder Paddy (var. *Sahabhagi*)	8	1.8	36.6	28.3	29.32	21500	28276	2.31
Water saving technology through Drum seeder Paddy (var. *Prabhat*)	12	20.5	33.2	32.8	4.0	24000	22812	1.95
Direct Sowing of paddy by ZT (var. *R. Sweta*)	8	4	43	36.5	17.81	34000	29210	1.86
Direct Sowing of paddy by ZT (var. *BPT 5204*)	5	4	45.3	36.5	24.11	34000	32591	1.96
Total	**57**	**58.3**						

Impact: Water saving paddy cultivation methods like SRI and direct seeding by paddy seeder has also been intervened among farmers of this village. SRI method of paddy cultivation demonstrated in 19 ha area among 24 farmers and as a effect enhancement in paddy yield as well as less requirement of irrigation water was observed with a B:C ratio of 2.1. Direct seeding by drum seeder was demonstrated in 22.3 ha among 20 farmers with paddy var. *Sahabhagi* and *Prabhat* and up to 29.32 % yield increase has been observed. Delayed monsoon affected timely transplantation of paddy and farmers get reduced paddy yield. Keeping in view, direct seeded rice/ drum seeded rice was demonstrated in the village. Demonstration of direct seeded rice was conducted in 8 ha land with paddy variety *R. Sweta* and *BPT 5204* among 13 farmers. The yield was increased to the tune of 17.8 to 24.1 per cent over traditional method (36.5 q/ha). Maturity period was found 7 days less in DSR. It saved the time of sowing and helped in utilizing first shower of monsoon in providing irrigation.

13.3.4 Community nurseries for delayed monsoon:

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 paddy (Paddy Var. *MTU-7029, Sahabhagi, Sabour Ardhjal*)	75	4.7	2.9	2.0	25.5	2700	3205	2.21

Impact: Paddy is the major *Kharif* crop of the village but due to delayed monsoon, farmers were motivated to grow community paddy nursery in 4.7 ha area and compared with traditional nursery (in normal situations of individual farming) which shows significant savings and requires 40 percent less area than traditional method. Paddy nursery of medium, short and long varieties were raised at a common place phase wise in nearby area of renovated ponds then seedling has been transplanted by different farmers in their field to cope with the climatic hazards as delayed monsoon as well as to advance the transplanting time.

13.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Potato (*Pukhraj*) +maize (*Laxhmi*)	35	3	86(potato) 128(Maize)	-	22	34000	93400	3.7
Redgram (*Bahar*) +Millet (*GPU-28*)	5	2	22(redgram) +12.8(millet)	-	24	13000	75520	6.8
Potato (*Pukhraj*)+radish (*puas chetki*)	4	2	193.5(potato) +38.4(radish)	-	25	47000	84460	2.79
Redgramm (*NDA-1*) + jwar (local)	2	1.5	continue+ 140(jwar)	-	21	16000		
Maize (*Laxmi*) + jwar (local)	3	1.2	38(Maize) +145(jwar)	-	19	17000	25000	2.47
Maize(*Shaktiman-5*, 40%) +Potato (*Pokhraj* 60%)	5	3	34.4+192	-	25	65950	171114	3.59
Linseed (*Garima, 5%*) + Chickpea (*P-256, 95%*)	29	28	0.5+20.5	-	28	21800	51700	3.37
Lentil (*Arun, 80%*) + Mustard (*P Gold, 20%*)	38	22	12.6+3.1	-	17	18800	43370	3.31
Total	**121**	**62.7**						

Impact: To promote use of soil moisture and nutrient from different layer of soil farmers have motivated for intercropping/ mixed cropping. Different farmers practiced different pattern like- Linseed + Gram, Lentil + mustard, Red gram + Millet *etc*. One most benefits from mixed cropping is that there is no need of separate field for crop is that there is no need of separate field for crop and they able to fulfill their requirements. Other benefit is that two crop taken at a time. If one crop fails other may compensate to some extent and no extra inputs given for supplemental crop.

13.3.6 Introduction of new crops/ crop diversification:

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
Redgram (*NDA-1*)	29	12.5	24.6	20.3	21.18	18300	88710	5.84
P-9+Rhizobium	10	2	24.9	20.3	22.66	18400	89915	5.88
Gram (*P-256*)	108	32	20.8	16.0	30.0	21500	51300	3.38
Sesamum (*Krishna*)	5	2	6.2	5.5	12.72	17400	11120	1.63
Linseed (*Garima*)	49	10	9.8	8.0	22.5	14800	19500	2.45
Para crop Linseed (*Garima*)	4	1	5.8	4.2	38.09	12600	16400	2.30
Maize (*Shaktiman*-5)	10	2	90	60	50	47950	69950	2.45
Laxhmi	35	3.5	160	140	14.28	22600	73400	4.2
Finger millet (Var. *GPU-45,VR-708,VL-352,RAU-8*)	14	4	7.4	4.2	76.19	6000	23600	4.93
Finger millet (*GPU-28*)	16	1.3	32	25	28	10500	23100	3.2

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Pearl millet (Pusa composit 612)	10	4	15.8	13.2	22.81	9000	14700	2.63
Coriander (P. Haritima)	39	2.75	15.7	11.6	35.34	13500	57150	5.23
Turmeric(Rajendra Sonia)	30	0.85	382	30.8	24.03	88000	676000	8.68
Fenugreek (R. Kanti)	7	0.5	18.1	15.1	39.13	18100	54300	4.00
Nigella(R. Shyama)	10	0.6	17.5	14.3	30.13	24500	80500	4.29
Omum (R. Abha)	3	0.5	12.2	10.2	25.35	17200	43800	3.55
Elephant Footyam(Gajendra)	32	6.25	352	29.8	41.23	128000	576000	5.5
Carrot (Pusa Keshar)	12	0.25	128	120	6.7	18000	58800	4.2
Radish (Pusa Chetki)	15	0.25	128	121	5.8	16000	35200	3.2
Tori (RAU TS-17)	6	1	10	8	25	14600	39400	3.6
Rai (Bio-902)	10	2	13	10	30	15000	42000	3.8
Nutritional garden- Veg.	14	14	92	-	Year round availability of vegetable for household consumption	12000	58800	5.83
Total	**468**	**114.95**						

Impact: In condition of delayed monsoon where paddy cultivation was difficult, farmers were motivated to orient towards diversification in agriculture and adopt improved varieties of other crops like red gram var. *NDA-1*, finger millet (var. *GPU-45, VR-708, VL-352, RAU-8*) and pearl millet (*Pusa composit 612, 443*) in *kharif* season. Whereas in *rabi* season demonstration on low water requiring crops linseed (var. *Azad Alsi-1, Garima*) as well aspara crop of linseed var. (*Garima*) in 15 ha among 65 farmers and spices crop as coriander (*P. Haritima*), fenugreek (*R.* Kanti), Nigella (*R. Shyama*) andomum (*R. Abha*), turmeric (*R. Sonia*) in 4.2 ha and elephant footyam (*Gajendra*) in 6.25 ha has also been conducted. Due to late monsoon in that area some farmers are not able to grow paddy in kharif season, they were motivated to cultivate Pigeon pea var. *NDA-1, Malviya-13, PRG-118* in the month of June- July and var. P-9 in September covering 14 ha among 38 farmers.

13.4 Module III: Livestock & Fisheries

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

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
Oat (JHO-822)	100	7.4	485	366	32.51	18100	20700	2.14
Oat (Kent)	183	20.5	493	366	34.70	18200	21240	2.17
Berseem (Vardan)	269	15.8	694	510	36.08	16000	18700	2.17
JHB-146	40	4.5	686	510	34.50	16000	18300	2.14
Shorghum (M.P.Chari)	47	14	406	314	29.30	17600	14880	1.85
Fodder Maize (African tall)	16	2.5	602	478	25.94	17600	30560	2.74
Cow pea (Kashi kanchan)	6	0.5	650	321	26.62	16560	31770	2.54
Total	**661**	**65.2**						

Impact: Most of the farmers of this village are marginal having agriculture + Livestock farming system. It was observed that continuous use of rice and wheat straw for feeding without use of green fodder is one of the reasons for the poor health of milch animals leading to low milk production in the village (2-3 l/animal/day). Hence the livestock owning farmers were motivated to take up fodder cultivation. In this regard a fodder (Oat var. *kent*) seed bank is also running in the village for the availability of fodder seed of oat (var. kent). One Silage unit has to be constructed for the availability of dry fodder (in convergence mode by NDDB and COMFED, Bihar) for which site selection has been done and materials have been procured. Besides these, villagers are involved in general cultivation of fodder crops. It was observed that during *kharif*, shorghum (R. Chari) yielded 39.3 % and fodder maize (African Tall) gave 25.94 % more yield as compared to local variety. Similarly,

improved variety of oat-*JHO-822* and kent gave 32.51 % and 34.43 % more yield than local. Increase in availability of quality fodder throughout the year resulted into an increase in milk production by 59% and on an average, each farmer's income by Rs.60/- per L/animal/day.

13.4.2 Improved fodder/feed storage methods:

Table. Performance of improved fodder

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Yield (lit/day/cow)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Fodder grass on farm bund (Shorghum Var. M.P.Chari)	31	4	60	45	33.33	1050	3750	4.57
Feed enrichment in cattle through mineral mixture (Sudhamin) convergence with COMFED, Jehanabad	87	260	12.13	10.10	2.03	30337	60638	2.9
Feed enrichment in calf and cattle through balance ration in convergence with COMFED, Jehanabad	14	24	11.56	11.10	0.46	8414	1990	1.2
Pashu chocolate made by machine	1	1	11.38	10.78	0.6	8550	1692	1.19
Low cost Azolla production as supplementary cattle feed	2	2	10.66	10.00	0.66	8400	1176	1.14
Total	**135**	**291**						

Impact: Farmers were provided seeds of fodder crops shorghum var. M.P. Chari for fodder production on on farm bund. This technology has been intervened in 4 ha among 31 farmers which is provided green fodder for cattle and the fodder crop on bund work as a mean of strenthening the bund also. Mineral mixture (Sudhamin) for 260 cattle in convergence with COMFED, Jehanabad and software calculated balance ratio for 24 calf and cattle in convergence with COMFED, Jehanabad have been intervened respectively for 87 and 14 farmers. Besides, pashu chocolate were made and provided to the cattle for nutrient supplement whereas Azolla has been produced for supplement feed for cattle by means 2 units already established by NICRA Project. These interventions resulted into increase of milk production upto 33.3 %.

13.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (l/cow/lactation)		% increase	Economics of demonstration (Rs./yr)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle in convergence with COMFED, Jehanabad	155	320 animals	20% mortality decrease/7.8 lit	10-20% mortality, 7.0 lit	10%, 0.8 lit	36530	21970	1.6
Vaccination camp against FMD Cattle in convergence with dist. animal husbandry deptt., Jehanabad	55	120 animals	20% mortality decrease, 8.22 lit	10-20% mortality, 8.0 lit	10 %, 0.78 lit	36630	24370	1.6
Vaccine(HS+BQ), Dewormer (febendazole)	358	1180	55 % mortality	65 %mortality	60% survival	34353	98949	3.8
Vaccine(HS+BQ) in convergence with dist. animal husbandry deptt., Jehanabad	80	200	100% mortality decrease, 6.2 lit	70 to 80% mortality , 6.0 lit	80 %	36400	101000	1.2
De-worming of animals Fenbendazole (in convergence with COMFED, Jehanabad) @ Rs. 35/lit	266	585	25% production increased, 7.5 lit	30-40% production decrease also growth performance, 7.0 lit	5-15 %, 0.5 lit	40839	37236	1.92

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (l/cow/lactation)		% increase	Economics of demonstration (Rs./yr)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccine(PPR), dewormer (Febendazole) and Mineral mixture	57	420	10%Mortality decreases	100% mortality	90 % survival	2050	4200	2.04
Vaccine(PPR), dewormer (Febendazole) and Mineral mixture in convergence with dist. animal husbandary dept., Jehanabad	26	96	10% mortality decrease	80 to 100% mortality	90 %	2050	4200	2.04
Vaccination for PPR in goat in convergence with ICAR-RCER, Patna	20	50	10 % mortality	90-100 % mortality	90% Survival	2050	4200	2.04
Animal health check-up for cow & buffaloes (in convergence with BVC, Patna)	26	60	25% production increased, 10.8 lit	30-40% production decrease, 8.8 lit	15 %	325	264	1.2
Animal health check-up(in convergence with dist animal husbandary dept., Jehanabad	257	437	25% production increased, 10.84 lit	30-40% production decrease, 8.8 lit	15 %	325	264	1.2
Vaccination in poultry Ranikhet vaccination in convergence with dist. animal husbandary dept., Jehanabad	31	150 birds	70% mortality decrease	80 to 90% mortality	20 %	5400	2400	2.25
Total	**1331**							

Impact: An adverse effect has been observed on animal health due to climate change variations. Preventive vaccination in cattle (Cow and Buffalo) against FMD to 440 animals and deworming of animals were demonstrated in convergence with COMFED, Jehanabad whereas animal health checkup programmes organized in convergence with Bihar Veterinary College, Patna. Besides, HS+BQ vaccination in 1380 animals and deworming in 585 animals was also done. In addition, animal health check-up (in convergence with dist animal husbandary dept., Jehanabad) of 437 cattle were done. Preventive vaccination of Ranikhet for 150 poultry in convergence with dist. animal husbandary dept., Jehanabad and PPR vaccines alongwith dewormer and mineral mixture for 516 goats in convergence with dist. animal husbandary dept., Jehanabad and 50 goats were vaccinated for PPR of goat by ICAR-RCER, Patna. Farmers of the village observed decrease in mortality by 5 to 90 % and increse in milk production by 0.5 to 0.8 liter/day/ cattle.

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Management of fish ponds / tanks during water scarcity and excess water, duck raring (*Khakhi campbell*)	26	118	6000 egg/ year	-	-	13020	76980	6.9
Composite Fish Farming (Fish breed *Rohu, katla, grasscarp, naini*)	1	0.2 ha	12 q/ha	3 q/ha	300	46500	133500	3.87
Total	**27**							

Impact: Fish raring of breed *Rohu, katla, grasscarp, naini* has been done in one renovated pond in 0.2 ha area alongwith duck raring (Khakhi Chambal) and farmers produced 12 quintal fish from this pond besides 6000 eggs per year from duck raring.

13.4.5 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Improved breed of Pig (T & D)	8	16	65 kg/pig growth/yr	35 kg/pig growth/yr	46.2	19600	107120	6.43
Goat (Sirihi)	9	62	10% mortality	30% mortality	20	15000	147000	10.8
Back yard Poultry (Vanraja, Grampriya)	103	2100 chicks	10 % mortality	35 % mortality	25	16000	56500	4.65
Total	**210**							

Impact: Goatry has been an alternate enterprise in drought situation for livelihood improvement. Improved goat breed (Sirohi, Black Bangal) has been demonstrated to the farmers. Animal health camp and vaccination programme(against PPR disease of livestock and mineral mixture distribution) was organized in NICRA Village in which 566 goats of the village were vaccinated. After vaccination farmers realized that this intervention are very useful in controlling the epidemic of PPR. They realized that this technology very economical and feasible in use.

The landless farmers were provided egg laying chicks as backyard poultry, for their economical stability in stress situation of climate. In these villages more than 60 % of people are landless. For the development of these farmers back yard poultry has been introduced and 350 poultry (Banraja and Grampriya) has been supplied to the farmers and afterwards vaccination of Ranikhet was also done.

13.4.6 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based poultry Shelter (Bamboo+Paddy straw+mud)	30	30	Temperature, Mortality 10% decreases	Mortality 80%	Survival 70%	1750	18000	16750	10.2

Impact: A low cost bamboo based poultry shelter for poultry birds has been designed in NICRA village with dimension of 6'x3'x2.5' and the same is portable and its suitable for 20 birds. The environmental temperature is minimized by covering with jute bags. It has been a successful intervention which can withstand with high heat and adverse climatic situation and decrease the mortality rate upto 20-30%. It is most suitable for low socio-economic farmer and its cost come approx- Rs. 1200/unit. On their own expense five farmers of this village made this shelter.

13.5 Module IV: Institutional Interventions

13.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration var. *Rajendra Sweta*,	85 q	Quality seed	150	40
Fodder bank	Oat / VCRMC & others farmers	75.1 q	var. *JHO-851, 822,99-2, Kent*, Produced seed is stored and sold to neighbouring villagers as well as dairy cooperative	139	20

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Commodity groups	Kitchen Gardening	20 q	Improved Variety Seed	51	20
	Fertilizer procurement/storage/ Sale counter	28 q	Farmers through PACS and cooperative society	59	21
Custom hiring centre	Power tiller	Rs.200/day	Technology demo for timely field preparation	11	17
Collective marketing	Clean milk production		Hygienic milk marketing	181	55
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	1 unit	Manual reading of weather parameter are teken	-	-
Community irrigation	Use of stored pond water	Share basis	Sharing of stored pond water	98	55.5

Impact: Keeping in view the year round fodder availability for cattle, seed bank has been established in the village and oat (Jai) crop was demonstrated among 139 farmers as a result farmers have stocked 75.1 q Jai seed var. *Kent* till now which was sold to neighbouring villages as well as dairy cooperatives. Under custom hiring center there are machines like zero tillage machine, power reaper, power tiller, M. B. Plough, tractor drawn leveller, rotavator, disk harrow, sprinkler set that is provided to the farmers on hiring basis varying from Rs. 50/-/ day for leveler to Rs. 200/-/day for power tiller and power reaper and the amount thus generated is kept in saving account of VCRMC. On the other hand farmers nearer to the ponds are using water stored in pond for supplemental irrigation of crop on share basis especially in peak hours. Hygienic milk production and marketing is performed by the villagers and milk is sold to Magadh dairy cooperative.

13.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Sakrorha, Jehanabad

13.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Jehanabad	25830	95211

Impact: A custom hiring center is continuously run by village climate risk management committee (VCRMC) of NICRA village. Farmers of this village hired different implements form VCRMC like zero tillage machine for timely wheat sowing, power reaper for harvesting of paddy and wheat, M. B. Plough for summer ploughing before paddy cultivation, tractor drawn leveller for leveling paddy fields, rotavator for seedbed preparation of paddy, chickpea and lentil, power tiller for lentil field preparation and sprinkler system for Wheat, lentil, gram, rai, omum irrigation and amount Rs. 25830/- has been deposited by the farmers in revolving fund account of VCRMC.

13.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	8	143	43	186
Crop Management	4	76	9	85
Nutrient Management	1	13	Nil	13
Integrated Crop Management	1	29	3	32
Crop Diversification	2	42	5	47
Resource conservation Technology	4	56	22	78
Pest and disease management	8	173	21	194
Nursery raising	1	16	3	19
Integrated Farming System	1	26	11	37
Livestock and Fishery Management	10	196	32	228
Fodder and feed management	1	15	3	18
Employment generation	2	36	5	41

13.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Commodity group, Group Discussion, Method demonstrations, NICRA Workshop at ATARI, Kolkata, Kisan mela organized by BAU Sabour, IFS	1126	3265	948	4213

13.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
152	152	152	152

13.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs.)
Deptt. of Animal Husbandry, Bihar Govt.	Animal Health Camp (Vaccination & Deworming)	13000.00
COMFED, Bihar Govt.	Animal Health Camp (Vaccination & Deworming)	14000.00
ICAR-RCER, Patna	Animal Health Camp (Vaccination & Deworming)	2500.00
MANREGA, Modanganj, Jehanabad	Pyne renovation	1311014.00
	Strengthening of field bunds (Paddy)	1960995.00
	Strengthening of pyne bund	567639.00
DAO, Jehanabad (Deptt. of Agriculture)	Vermicompost production	600000.00
Forest Department, Jehanabad	Papaya Plantation	30000.00
Magadh Dairy Cooperative, Gaya	Marketing of Fodder	48400.00
NDDB, Gujrat&COMFED, Bihar	Silage unit	25000.00
Total		**4572548**

13.10 Success Stories of NICRA villeges farmers

1. Integrated Farming System

Sri Suresh Singh is a progressive farmer of village Sakrorha of Jehanabad district (Bihar). Due to global warming and climate change, village sakrorha is facing drought like situation. The geographical condition is such that the water table of the village is low that's why there is less no. of tube wells in the village. Due to water crisis, he was facing crop failure, livestock was also facing heat stress that resulted in low milk production and fertility problem and ultimately low profit from agriculture and allied activities. Sakrorha village was lacking of suitable/ capable water harvesting structure. The pyne system was good but most portion in defunct stage.

Around the pond, he has developed an Integrated Farming System having crop production, vegetable production and plantation of tick wood, Seasom, Guava around pond, goat farming, dairy farming, fish farming, duck farming, vermicompost unit and fodder production.

He acquired modern techniques and technology from KVK scientists and cultivating the crops using improved agricultural implements. He has installed a Biogas plant on his dairy farm and besides using it for cooking purpose, he also use the biogas slurry as bio-compost. He established a goat farm with six local goats reared under stall fed intensive management. Initially he faced number of problems like high cost of production, mortality and low price of produce but now goatry has been the successful venture for Sri Suresh Singh and consequently his goat farming project has emerged as viable and profitable. He uses modern agricultural implements for performing agricultural operation on time. Zero tillage machine to save agricultural inputs like seed, fertilizer and water, Sprinkler system to irrigate wheat and pulses, Power reaper for harvesting of wheat, paddy and Jai, rotavator for quality field preparation.

Presently he has 3 buffalos, 5 cows, 55 goats, 18 duck and culturing fish (*Rahu, Katla, Grass carp*) in his pond. He is also running a milk society under name "Sakrorha Dugdh Utlpadak Sahyog Samity" and selling fodder seed to Magadh dairy, Gaya. Now, Sri Suresh Singh is a source of inspiration for so many farmers. His annual income 10.41 lakhs per year from

agriculture and animal husbandary.

Impact in social system:

- The farmers of neighboring villages follow him as master trainer for improved cultivation practices as well as use of farm implements for farm mechanization.
- 55 No. of goatry units have been established in his village and marginal as well as small farmers of surrounding village are also adopting goatry as alternate enterprise
- In the whole village number of dairy farmers increased and 42 units established which concurrently increased the number of members of dairy society and collection from this village and areas increased
- number of farmers benefitted from the water stored in his farm pond in form of community irrigation




2. Animal Husbandry as a source of Income

Sri Sant Kumar Sinha is an educated farmer of village Sakrorha in Jehanabad district. His educational qualification is M.A. He is a teacher in private school and having 5 acre of cultivable land and approx 12 year of farming experience. Initially he started farming on traditional knowledge of farming system but due to his innovative nature he thought to adopt an enterprise other than agriculture. Meanwhile, a project NICRA started to face draught like situation in his village. He came in contact KVK scientists and besides farming he is now engaged in animal husbandry, poultry farming and duck farming.

For poultry farming, he is using poultry housing structure specially designed by KVK which can withstand heat and temperature.

He did farming purely on economic basis and on the basis of market demand. He started dairy farming with indigenous breed of cows and buffalo but the benefit was low because of low milk production. Now he replaced all cattle with improved breed and supply milk to dairy cooperative running in the village. He is also member of "Dugdh utpadak sahayog samiti", Sakrorha. His daily milk production is 40 kg. per day. He also sale calf every year.

Besides growing crop in both *rabi* and *kharif* season, he started growing different types of fodder crop throughout year for his cattle. Among the crop he generally cultivates high yielding variety, the variety which can withstand heat and temperature, short duration variety, draught tolerant variety *etc.*

He has a nutrition garden. Guava, papaya, mango, elephantfootyam *etc.* are present in his nutrition garden. Besides nutrition garden, he has a vermicompost unit and using cow dung in this unit the dependency on chemical fertilizer has been reduced.

He is also involved in agroforestry (like tick wood, seasom).

He uses following modern agricultural implements for performing agricultural operation on time.

1. Power tiller for quality field preparation.
2. Zero tillage machine for wheat sowing keeping in view with resource conservation like saving of water, seed, fertilizer and labour.

His annual income is approx Rs. 393640.00 from all sources as below :-

3. Use of Zero Tillage Technology

Sri Devendra Kumar is a progressive farmer. Rice-wheat is major cropping system in his village. During *rabi* season, wheat is prominent crop. He sow wheat after 3-4 ploughing followed by planking and broadcast seed and fertilizer, which causes delay in wheat sowing and involved high cost of cultivation also. He came in contact with Krishi Vigyan Kendra, Jehanabad where he got technical training by Scientist (Agril. Eng.) on use of improved agricultural implements and machineries and he used 11 rows zero till seed cum fertilizer drill for wheat sowing. Zero tillage technology saved Rs. 3000/- per ha in cost of ploughing, labour as well as irrigation water. This technology advanced wheat sowing by 8-10 days and caused an yield increase of 15-18 % as well less weed infestation.

By using this technology the cost of cultivation is lower, less water is required for irrigation and gave better yield.

Table: Economics of the farm:

Crop/Livestock/ Fish/ Enterprise	Area (Acre)/No.	Cost of Production *(per unit)	Return (Rs. Per unit)	Net Income (Rs. per unit)
Paddy	14	23500	54900	31490
Wheat (ZTSFD)	10	24000	64600	40600
Chickpea	2	22500	154000	131500
Lentil	2	16500	96000	79500
Mustard/rapeseed	2	16000	48000	32000
Total	**30**			**315090**

*includes cost of input, labour and others including marketing and transport of the products.

Table: Income level before adopting such farming:

Enterprise	Area (Acre)/ No.	Cost of Production *(per unit)	Return (Rs. Per unit)	Net Income *(per unit)
Wheat (Broadcasting method)	10	27000	54400	27400

14. Nawada

14.1 Village information:

Name of the village	Manjhila
No. of households	272
Total cultivated area (ha)	114.0 ha
Area under rainfed cultivation (ha)	88.0 ha
Major soil type	Sandy loam, Clay Loam
Climatic vulnerability of the village	Drought and Heat wave

14.1.2 Rainfall trend of the district

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
12-13	98.37	256.47	61	01	-	-	741.61	21.27	-
13-14	98.37	997.11	65	01	-	1	255.23	286.96	315.71
14-15	98.37	94.00	41	01	01	0	543.25	63.0	297
15-16	98.37	65.80	48	01	01	-	1183.50	23.75	332.75
16-17	98.37	505.25	70	-	01	1	325.25	26.25	471.75

Note :- Weather station installed in Aug, 2012

14.1.3 Details of the climatic vulnerability

Rainfall (mm): Major climatic variability experienced during the study period (2011-16) were untimely, erratic, sometime heavyrainfall and sometime drought like situation in *kharif* season at the time of flowering stage of paddy and other crops. Two years *i.e.*, 2011-12 *i.e.*, total rainfall was 1053.71 mm which was followed by 2013-14; whereas in 2015-16 the total rainfall was *i.e.*, 997.8 and 658.0 mm respectively. Rainfall during 2012-13 was very low which affected the *kharif* crops. The dry spell of ten days during the year 2011-16 was 6 days and dry spell of 15 days was 3 days during 2014, 2015, 2016 and 20 days dry spell during these years was 4 times. Farmers during these dry spell irrigated their *kharif* paddy with water stored in their ponds and pynes as life saving irrigation.

The intensive rainfall/day more than 60 mm was experienced during 2011-12 and 2013-14. Rainfall during *kharif* was maximum during 2011-12 and 2014-15, whereas, in *Rabi* season maximum rainfall was 164.0 mm. In summer maximum rainfall observed 258.5 mm was in 204-15. No flood like situation occurred during the year 2011-12 to 2016-17.

14.1.4 Predominant farm enterprises

i. Cropping pattern: Paddy + Gram, Paddy +Wheat, Pigeon pea

Before NICRA	After NICRA
Paddy-Wheat	Paddy-Wheat-Vegetable
Pigeon pea	Maize-Vegetable/Wheat- Mustard
Gram –Fellow	Paddy-Gram
Lentil-Fellow	Maduwa-Vegetable

ii. Major cropping system: Mono, Double and multiple cropping

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)
Maize	*Shaurya*	62	3.60		
Pigeonpea	*MAL-13*	63	11.0		
Lentil	*IPL- 406*	30	4.0		

iv. Cropping intensity (%): 131% (Before NICRA) and 234.44% (After NICRA)

v. Horticulture Crops:

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Lobia	0.5	10.5	Kashi Kanchan	2.0
Brinjal	1.0	24.50	Swarna Pratibha	3.5

vi. Area under fodder cultivation and number of farmers growing green fodder: 1.20 ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Indigenous	766	215	-	HSB & FMD	30-40	3
Buffalo	203	70	-	HSB & FMD	30-40	4
Goat	612	121	-	PPR	30-40	5

viii. Milk productivity (L/milch animal/day): Cow Cross bread -4.2 L, Indigenous cow - 3.5 L

ix. Details data about inland fisheries practiced: 4 Ponds

14.1.5 Resource availability:

14.1.5.1 Status of Common Pool Resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before	After
2011-12	Pond	3	All defunct	Renovated -01 and pond created -06
	Water reservoir	5	All defunct	Renovated - 03
	Well	26	All defunct	
	PYNE	2520 mt	All defunct	
2012-13	Pond	2	All defunct	Created - 02
	Water reservoir	2	All defunct	
	Well	26	All defunct	Renovated- 02
	Pyne	2520 mt	All defunct	845 mt
2013-14	Pond	02	All defunct	Created - 02
	Well	24	All defunct	Renovated- 09
	Pyne	1675 mt	All defunct	
	Water reservoir	02	All defunct	Renovated - 02

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before	After
2014-15	Pond	02	All defunct	Created- 04
	Well	15	All defunct	Renovated-10
	Pyne	1675 mt	All defunct	1065 mt cleaning
2015-16	Pond	02	All defunct	Renovated- 02
	Well	05	All defunct	Renovated - 05
	Pyne	610 mt	All defunct	610 mt. cleaning
2016-17	Pond	-	All defunct	Created - 04

14.1.5.2 Summary of Water harvesting interventions taken up in the NICRA village

S. No.	Structures/Years of Construction	Category	2011-'12	2012-13	2013-14	2014-15	2015-16	2016-17
1	No. of farm ponds/Jalkund	Constructed	06	02	02	04	-	04
		Repaired/ Renovated	01	-	-	-	01	-
2	Community pond /tank	Repaired/ Renovated	-	-	-	01	-	-
4	Recharging of open/tube wells with silt trap	Repaired/ Renovated	-	2	9	10	5	-
7	Drainage Channel (length in meter)	Cleaning/ desilting	-	845 mt.	-	1065 mt	610 mt	-
8	Aahars/pynes etc	Renovated	03	-	02	-	-	-

14.1.5.3 Status of farm mechanization before start of NICRA: 01

List of Farm implements available in the village:

S. No.	Implements	No. of implements
1	Paddy thresher	16
2	Leveler	01
3	ZT machine	01
4	Diesel pump	02
5	Electronic balance	01
6	Metal Bin	15
7	Kubota Power Operator	01
8	Soil Mini Lab	01
9	Sprinkler	01
10	Sprayer	04
11	Wheel hoe	20
12	Duster	04
13	Connow weeder	20

14.1.6 Socio-economic status:

a. **No. of households – General:** 20; **OBC:** 85; **SC**: 194

b. **Literacy rate (%):** 39.10%; **Male**: 49.45%, **Female:** 28.75%

c. **Workers engaged in agricultural activity (%):** 79%

MODULE WISE INTERVENTIONS

14.2 Module I: Natural Resource Management

14.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
ZT wheat var. *HD2733, HD2824*	210	90	42.2	19400	35980	2.85:1
ZT Gram (*GNG469*)	30	5.0	16.5	22350	76650	4.42:1
ZT Chickpea (Var. *KWR108*)	4	1.0	18.3	11834	46726	4.94:1
ZT Lentil (*DPL62*)	7	1.0	16.2	51840	40806	4.69:1
ZT Paddy (*Sahbhagi*)	8	3.0	42.25	35912	21625	2.31:1
Raising bunds	178	54	-	16000	11500	2.39:1
Brown manuring (*Sahbhagi*)	8	3.0	42.25	35921	21625	2.3:1
SRI Paddy (*Sahbhagi*)	8	3.3	40.60	23250	25470	2.09:1
Optimization of horticulture crops through land embankment	81	2.0	24.50	29500	117800	4.99:1
Total	**534**	**162.3**				

Impact: The villages under NICRA programme are drought prone area. The farmers were facing scarcity of water for irrigation as well as drinking water. The problem of drought was solved by the varieties of different crops and the technical guidance by KVK, Nawada. In order to save the moisture or to enhance the moisture in the farmers field many frontline demonstration was conducted in the NICRA village with an objective to reduce the cost of cultivation, time and energy saving, increasing the water holding capacity of soil, soil health management, resource conservation through cultivation of cereals and pulses, moisture conservation by raising the bunds, brown manuring. These demonstrations were done in 162.3 ha area and the farmers benefitted by these demonstrations were 537 during the year 2011-16. In the drought prone area drought tolerant paddy variety *Sahbhagi* performed well both under transplanting and DSR. Drought tolerant variety of different crops like Ragi (var. *GPU-28*), Pigeonpea (var. *MAL-13*), Horsegram (var. *Birsa Kulthi-1*) also performed well under the drought condition with higher yield with lesser input.

Out of these technologies Zero Tillage Technology in wheat with var. *HD2733* was greater in NICRA adopted villages of the district. Secondly the farmers adopted raising of bunds; through this interventions moisture availability extent has increased and now the crops may face 10-15 days water stress without any damage. The interventions included cultivation of paddy, wheat and lentil. The adoption per cent has increased as compared to the crops with traditional practices. These interventions have increased the farmers' income and the technologies have also been up-scaled in the nearby villages.

14.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of Well for irrigation	145	26	Increase stared water for irrigation	Increase area 5.2	Irrigation 0 ha.	-
Bund making leveling in paddy field	34	15.0	42.25	23250	25470	2.09 :1
New water harvesting structure in the paddy field	379	9.0	35.5	50,000	56,800	1.1 :3
Renovation of old water harvesting structure in paddy field	95	2	5.0	Additional increases in yield due to supplementary irrigation		
Raising of land embankment	144	39.0	-	16,000	11,500	2.39:1
Renovation of pyne	407	2520 mt. Increase supplement irrigation	Increase in supplementary irrigation in additional 110 ha.			
Total	**1204**					

Impact of each intervention: The area under NICRA village were facing problem of water harvesting and ground water recharge. Later under NICRA project different villages in different activities like constructuion and renovation of ponds, wells, irrigation channels and bund making and leveling in paddy field were performed. Construction of ponds helped in ground water recharge in the area as well as the farmers started fish farming for income generation. The water from the ponds was use by the farmers for irrigating paddy, wheat and other crop. This ensured irrigation in the area which helped increase in the crop production. Renovation of pyne led to increase in supplemental irrigation in additional 110 ha of land. It helps in additional increase in yield due to supplementary irrigation.

14.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	210	90	42.2	19400	35980	2.85 :1
Sowing of paddy with ZTD machine	8	3.0	42.25	35921	21625	2.3 :1
Sowing of lentil with ZTD machine	7	1.0	16.20	51840	40806	4.69 :1
Sowing of chick pea with ZTD machine	34	6.0	16.50	22350	76650	4.42 :1
Sowing of wheat (*K-9107*) with ZTD	178	80	42.2	19400	35980	2.85 :1
Total	**437**	**180**	-			

Impact: With Zero tillage in NICRA village the structure of soil improved, the porosity and water holding capacity of the soil and organic carbon also improved. Timely seed sowing saved the cultivation cost by Rs. 3500-4000/-/ha. Use of Zero Tillage technology in paddy crop has reduced the labour problem and increase in paddy production. So farmers are happy to adopt ZT technology in paddy crop they are positive towards this technology. Impact of technology is encouraging the farmers of other villages also.

14.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	144	39.0	21.62	11400	8058	1.7
Ground water recharge through SRI by sub-soiler	11	3.3	38.53	32480	17609	1.54
Total	**155**	**42.3**				

Impact: Problem of NICRA village was mainly run- off water during rainy season. In this aspect farmers of Manjhila village were educated to conserve the maximum rain water in their field by making field bunding for paddy and recharge of ground water by adopting SRI method of rice cultivation with the objective to conserve the village water in village only. Earlier before NICRA , huge amount of water and and fertile soil used to washed away in the nearby pynes, *aahar* and *nalas* which result in siltation and downfall of water table in the borewells and the wells.

During 2011-16 under NICRA programme 39.0 hectares of land was bunded benefitting 144 farmers with net return Rs. 8058/-/ha. Through the SRI technology ground water recharged and the total 3.3 hectares of land was cultivated by 11 farmers through SRI method with net return of Rs. 17609/-/ha. by seeing the result of initiative taken under NICRA programme, farmers of other villages also started medhbandhi. Farmers of Manjhila village who were not doing farm bunding are now happy as their net sown area and net income has increased.

14.2.5 Other demonstration

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
Cleaning and renovation of old farm pond	95	2.0	Additional increase in yield due to supplement irrigation			
Renovation of old water harvesting structure (Well)	145	26.0	Increased irrigation area			
Planting forest trees for biodiversity, forestation	6	2.8				
Renovation of old pine	407	2520 mt.	Reduced water losses and increase in supplementary irrigation			
Cultivation of high yielding grass on farm bund	97	2	-	-	-	-
Total	**750**	**-**				

14.2.6 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
New Pond	18		379	9.91	367.0
Pyne	3	-	125	110.0	164.8
Renovation of Pond	2	-	95	5.0	145.0
Renovated and Repaired well	28	-	230	6.0	177.27
Renovated defunct water bodies	03	307	125	22.0	651.0
Total	**52**				

Impact: In the Manjhila cluster village under NICRA programme the major constraint is rainfed farming. This village experience crisis of water during all seasons. Due to this reason KVK Nawada thought to mitigate this problem under NICRA project.

In NICRA villages total eighteen number of ponds have been excavated and one community pond which was defunct has been renovated with the total area 79.0 ha which was not cultivated in the *Rabi* season is now cultivated under *Rabi* crops with cereals and vegetables. Twenty-eight numbers

of well was desilted and renovated. These water structures benefitted about 230 farmers. The reason to renovate the well was to save the existing structures to recharge the water. In these well approx. 2693.04 cubic meter of water is stored in 26 well which is being utilized by the farmers and the farming families for irrigation and day to day activities. 26298.87 m^3 water is stored during rainy season in eighteen ponds and 379 farmers are benefitted with this pond. Total 79 ha of land is irrigated through these ponds in these four villages namely, Upprelli Manjhila, Gadi Manjhila, Dudhiatand, Amarpur and Vidrasagar. Cropping intensity of NICRA villages increased. These water harvesting structures have increased the water table 2.3 ft and provide supplementary irrigation in 5.90 ha of area in *kharif* paddy. Water is also available during transplanting period and also for the drinking of animals. Increased productivity is recorded upto 40 to 42% in cereals and pulses. Total 379 farmers benefitted with these structures and they are producing fish in their ponds.

14.3 Module II: Crop Production

14.3.1 Introducing drought resistant varieties:

Table. Performance of different drought tolerant 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
Paddy (*Sabhagi*)	76	13.5	40.80	36.20	12.70	24750	32370	2.30
SRI (*Sahbhagi*)	30	3.5	60.20	38.50	56.36	28275	28915	2.02
ZT (*Sahbhagi*)	08	3.0	42.25	36.80	24.22	16400	21625	2.31
Maize (*GK3017*)	105	7.5	40.20	18.70	114.97	18750	37530	3.0
Pigeonpea (*MAL-13*)	288	66.0	19.50	13.80	41.30	16875	51375	4.04
Gram (*GNG469*)	181	19.0	16.50	12.20	35.24	22350	76650	4.42
Lentil (*DPL 62*)	45	6.0	16.20	10.50	54.28	15150	4150	3.74
Kulthi (*Birsa-1*)	128	12	15.60	10.50	48.57	7550	31450	5.16
Urd (*Utra*)	46	5.17	6.70	4.50	30.12	17300	12850	1.74
Barley	6	0.25	10.0	6.70	27.72	8500	11600	2.36
Maduwa	30	2.3	12.40	8.91	38.48	7350	17450	3.37
Lobia (*Kashi kanchan*)	15	0.5	10.5	8.82	36.52	46250	54250	2.17
Brinjal (*Swarna Pratibha*)	56	1.0	24.50	17.20	44.24	29500	117800	4.99
ZT Wheat (*HD2733*)	30	12.0	42.07	37.02	14.82	29400	35980	2.85
Total	**1044**	**151.72**						

Impact: As the water availability in the NICRA villages was not sufficient to cultivate all varieties of paddy, short duration drought tolerant crop verities of cereal, pulses and vegetables was demonstrated in hamlets of Manjhila which in terms increased their BCR which ranged from 1.74 to 5.16 in crops of Paddy, Wheat, Maize, Pigeonpea, Gram, Lentil, Kulthi, Urd, Barley, Ragi, Lobia and Brinjal. The variety of Paddy was *Sahbhagi*, timely sown variety of Wheat- *HD2733*, *kharif* Maize- *GK3017*, *DKC 7074*, *Shaurya*, *Pigeonpea- MAL-13*, Gram- *Awrodhi*, *GNG469*, Lentil- *DPL-62*, *Kulthi- Birsa-1*, *Urd- Utra* with vegetables like Brinjal- *Swarna Pratibha* and Lobia- *Kashi Kanchan*.

The increase in yield of maize ranged between 114.97 to 153.34 per cent, whereas in paddy the increase in yield ranged between 12.70 to 56.36 per cent. It is clear from the table that farmer's net sown area and net return increased with the introduction of drought resistant varieties.

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

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
Redgram (var. *MAL-13*)	288	66.0	19.50	13.80	41.30	16875	51375	4.04
Gram (var. *Awrodhi, KWR 108*)	97	11.79	18.5	15.20	21.71	21500	45100	3.09
Lentil (var. *DPL- 62*)	45	6.0	16.20	10.50	54.28	15150	4150	3.74
Brinjal (var. *Swarna Pratibha*)	56	1.0	24.50	17.20	44.24	29500	117800	4.99
Wheat (Var. *HD2733*)	16	3.0	43.50	35.80	21.50	26250	39000	2.48
Total	**502**	**87.79**						

Impact: The demonstrations were carried out in five NICRA adopted villages involving 502 numbers of farmers, with an area of 87.79 ha land. To avoid thermal heat stress the crops like Wheat (var. *HD2733*), Redgram (var. *MAL-13*), Gram (var. *Awrodhi* and *KWR 108*), Lentil (var. *DPL 62*) and Brinjal (var. *Swarna Pratibha*) were sown in one fortnight before the normal sowing during *Rabi* season. The production of different crops increased as a result of the early sowing which matched their terminal heat resulting in their better performance.

14.3.3 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Water saving technology through SRI	30	3.5	60.20	38.50	56.36	28275	28915	2.02
Paddy Seed (var. Sahbhagi)	76	13.5	4.80	36.20	12.70	24750	32370	2.30
Direct seeded brown manured rice	8	3.0	42.26	-	-	35921	21625	2.3
Sowing of paddy (var. Sahbhagi) with ZTT machine	31	3.0	42.20	35.40	19.20	23200	32310	2.39
Total	**145**	**23.00**						

Impact: Water saving cultivation of paddy through SRI method and the drought tolerant variety of rice required less water. The cultivation of the Paddy var. *Sahbhagi* requires less water in the drought prone area of the NICRA village. Paddy var. *Sahbhagi* showed higher yield with 12.70% increase yield over check variety. Twenty-one farmers adopted ZTT for sowing of this paddy variety with ZT technology and cultivated over 3.0 ha of lands which showed 19.20% increase in yield compared to transplanting method. This variety is performing well under the drought area, so this is suitable for the water scarcity locations of the NICRA villages.

14.3.4 Community nurseries for delayed monsoon:

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
Raised Community nursery of paddy (var. *Sahbhagi*)	371	3.0	40.80	36.20	12.70	24750	32370	2.30

Impact: Community nurseries of Paddy (var. *Sahbhagi*) are running under the NICRA villages. This provided easy reach of the nursery of paddy with minimum cost and it also provided the opportunities to fulfill the peak demand of the nursery in timely sown paddy cultivation in the villages of NICRA. Total 371 no. of farmers raised the Paddy (var. *Sahbhagi*) nursery over area of 3.0 ha and increase in yield recorded is higher by 12.70 than the individual farming or individual raising of the Paddy seedling.

14.3.5 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Wheat + Mustard	40	9.3	More yield/ unit area	-	27.01	22875	30775	2.34
Gram + Coriander	10	1.5		-	66.69	14934	35106	3.35
Redgram + Urd	6	1.0		-	23.62	17250	57500	4.22
Total	**56**	**11.8**						

Impact: Intervention on location specific intercropping was demonstrated in five NICRA adopted villages. The demonstration were carried out in 11.8 ha land of 56 numbers of farmer fields. Various intercropping systems were demonstrated which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. The intercropping of Wheat + Mustard, Gram + Coriander and Redgram + Urd resulted in higher production with better quality. The intercrops provided the main crop with certain nutrients and protection from the pest and pathogens, it also added to fertility of the soil. The intercropping of Redgram + Urd was found popular and it also provided income to the farmers by selling of intercrops.

14.3.6 Introduction of new crops/ crop diversification:

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
Kulthi (*Birsa -1*)	128	12.0	15.60	10.50	48.57	755	31450	5.16
Urd (*Utra*)	46	5.17	6.70	12.75	57.25	17300	12850	1.74
Maduwa	30	2.3	12.40	7.40	61.32	7350	17450	3.37
Lobia (*Kashi Kanchan*)	15	0.5	10.5	98.09	48.07	46250	54250	2.17
Brinjal (*Swarna Pratibha*)	56	1.0	24.50	17.20	44.24	29500	117800	4.99
Maize (*Shaurya*)	116	7.60	43.60	17.20	153.34	19500	41540	3.13
Gram (*GNG 469*)	181	19.0	16.50	12.20	35.24	22350	76650	4.42
Total	**572**	**47.57**						

Impact: The demonstration was conducted in five NICRA adopted villages. These demonstration were carried out in 47.57 ha land of 572 numbers of farmer fields. The crop diversification through introducing new crops in prevailing cropping patterns. The farmers were practicing old cropping systems. In place of old cropping systems the farmers introduced Gram, Kulthi, Maduwa , Lobia , Brinjal and Maize under the different systems. This resulted more production and income to the farmers which added diversification to the farming system.

14.3.7 Other Demonstrations:

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
Contingency crop Brinjal (var. PUSA Uttam)	56	1.0	24.50	17.20	44.24	29500	117800	4.99
Orchard Development with IPM	31	3.8	25.31	18.30	45.31	28735	128305	5.11
Soil reclamation: Levelling /bunding	9	6.0	21.20	15.45	47.34	16000	11500	2.39
Integrated Farming System	1	0.6	20.31	17.20	42.28	12400	42400	4.41
Seed production of Sahbhagi	31	5.0	42.20	35.40	19.20	23200	32310	2.39
Total	**128**	**16.4**						

Impact: The demonstration was conducted in five NICRA adopted villages. These demonstration were carried out in 16.4 ha land of 128 numbers of farmer fields. The demonstration like Contingency crop of Brinjal, Orchard development with Integrated Pest Management (IPM), Soil reclamation: Levelling /bunding, Integrated Farming System and Seed production were practiced by the farmers. Out of these demonstration, contingency cropping of Brinjal and Integrated Farming System revealed better economic return.

14.4 Module III: Livestock & Fisheries

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

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 (*Sweet Sudan*)	38	1.5	15.5	11.5	34.7	5100	3900	1.76
Sudan (*GK909*)	37	1.0	16.0	11.5	39.1	5200	4300	1.82
Sudan SX17	104	3.20	16.5	11.5	43.4	9500	13950	2.46
Total	**179**	**5.25**						

Impact: The community land under NICRA village was provided seed of Barseem, Maize and Sudan for fodder production during drought or floods. The farmers started growing Barseem and Maize for their livestocks which improved health condition of the animals and increased milk yield. Varieties of Sudan *viz*., *Sweet Sudan*, GK909 and SX17 were grown by 179 farmers in these areas under area of 5.25 ha which contributed to increased production efficiency of milk and meat.

14.4.2 Improved fodder/feed storage methods

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
Paddy straw and wheat Straw	Maintain by VCRMC		Committee is involve in purchase and sale					

14.4.3 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination camp against FMD Cattle	1098	4012	Morbidity reduced 92-95%	Morbidity rate reduced upto 30-34%	-	-	-	-
Vaccination HS,BQ	1098	4012	90% mortality reduced, increase milk yield average from 2.5 to 2.75 lit/day/ cow	4% mortality reduced, average milk yield 2.0 lit/ day/cow	37.14	4350	5175	2.18
Vaccination for PPR	586	3104	Mortality reduced 90-95%	Sporadic outbreak	-	-	-	-
Animal Treatment Camp Norflox-TZ, Rumentas, Butox, Prajana, Oxy-tetracycline	544	1950	Reduced occurrence of disease 92-94%	Occurrence of disease 50-60%	80.0	-	-	-
Proper deworming of Goats	344	1864	Increased body weight (12.47kg)	Body weight (10.46kg)	19.21	215	603	3.80
Total	**3670**	**14942**						

Impact: Vaccination camps were organized against FMD, HS, BQ in cattle and PPR in goats in 5 different NICRA adopted villages. Mortality and morbidity rate reduced upto 90% and average milk yield increased 20 to 30% and the body weight of goats increased approx. 20% by the deworming. It helps in weight gain may be attributed to decreased stress and better fodder consumption of the animals. It contributes to the prevention and control of animal diseases and protects farmers against the waste of agricultural resources. It stimulate the animals own defense system and prepare the animals to better resistance the impact of pathogenic microbes. It helps to improve in health condition of the animals.

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	30	1.4	960	315	173	22500	48500	3.15
Total	**30**	**1.4**						

14.4.5 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Goat Unit	70	70	Improve health increasing meat yield 7.3 kg	Poor health Av. Meat yield 6.0 kg	21.66	325	590	2.81
Backyard poultry (Divyan Red)	50	50	125 eggs (Increase additional income)	65 eggs (Low income)	92.30	3450	5110	2.48
Total	**120**							

Impact: The goat and poultry birds which were distributed under NICRA village provided higher meat yield and more eggs. This acted as source of income generation among the farmers and more number of farmers are willing to engage in the poultry bird industry in the nearby villages also. It helps in nutritional security of the farmers.

14.4.6 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Mud based Shelter Bamboo + Paddy straw + Mud	50	01	Improve in health	-	-	45250			

Impact: Few farmers in NICRA village were not having shelter for their cattle and poultry. The improved shelter provided to the farmers for reducing heat stress in dairy animals and low mortality in poultry. Standard spacing in improved shade resulted better performance in poultry and dairy animals. It reduced heat stress for higher survivability of poultry and dairy animals and was demonstrated of improved shelters. It helps to improve health condition of the dairy animals and poultry under the adverse conditions.

14.5 Module IV: Institutional Interventions

14.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity (q) /Number/ Rent/ Charges	Technology used in seed/ fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. Sahbhagi	136.2	Quality seed	101	16.3
Fodder bank	Paddy and Wheat Straw	140.5	VCRMC is maintaining this	Committee involve purchase and sell	
Custom hiring centre	Power tiller	20	Implements is provided to the VCRMC for hiring purpose		22
Climate literacy through a village level weather station	Temperature, Relative humidity, Rainfall, Wind speed and direction	1	Manual data of weather parameter are taken	150	-
	Weather station SMS/Voice SMS		Data interpretation of AWS and forecasting/Advisory	150	-

Impact: For strengthening the existing institutional interventions or initiating new ones relating to seed bank, custom hiring centers, commodity groups and introduction of weather index and climate literacy through a village weather station at the NICRA adopted villages for the help of farmers. The farmers used different farm implements provided by the custom hiring centres. This ensured timely sowing of seed and fodder. The farm implement helped in timely sowing, harvesting and threshing of the crops. Implements like Power tiller, mould bold plough, rotavator, zero till seed drill and Power Duster are provided to the group for hiring purpose.

14.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Jay Prakash VCRMC

14.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17 (Area in hectare)	Revenue generated (Rs.) Total under VCRMC
Nawada	422	327641

Impact: Custom hiring centers for farm implements were established in NICRA villages. A committee of farmers manages the custom hiring centers. The rates for hiring the machinery/implements are decided by the VCRMC. The committee also uses the revenue 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. The farm implement and machinery provided by the custom hiring centres were used by the farmers for cultivation of crops and fodder. The farmers hired these machinery which helped in sowing, intercultural operations, harvesting and threshing. It also saved time, inputs, labour. The revenue generated by VCRMC was Rs. 327641/- by cultivation in 422 ha of land.

14.6 Capacity Building organized

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Climate change	3	50	18	68
Natural Resource Management	7	143	43	186
Crop Management	20	458	146	604
Nutrient Management	5	111	27	138
Integrated Crop Management	2	29	3	32
Crop Diversification	18	151	67	218
Pest and disease management	52	1051	358	1409
Nursery raising	8	101	40	141
Integrated Farming System	4	26	11	37
Livestock and Fishery Management	32	748	573	1321
Fodder and feed management	5	64	32	96
Employment generation	6	10	4	14

14.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Method demonstration, SHG, IFS, Kishan Gosthi, Scientist visit to field	293	4652	1625	6277

14.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
220	220	220	220

14.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs.)
Vaccination camp by Block Animal Husbandry Officer Bihar Govt.	Vaccination camp and animal treatment camp	8,000
MGNREGA	Brick soling in Vidyasagar village	5,00,000
BRGF	PCC in Manjhila village	88,000
13th finance commission, GOI	Anganwadi building	4,80,000
CM Gram Sadak Yojana	Pakka Road Gadi Manjhila to Bhaluahi village	82,00,000
4th finance commission, GOI	Drainage line Gadi Manjhila	1,50,000
BHO, Govt. of Bihar	Vaccination of FMD	10,000
MLA fund	PCC road	1,99,500
14th finance commission, GOI	Sinking	75,000
Total		**9710500**

Impact: A number of interventions were taken up by five NICRA villages under different convergence programme. The developmental programmes which are operational at the village level have contributed to the scaling up of proven interventions. Huge numbers of convergence programmes was carried out by implementing with ongoing development programmes or schemes. The prominent development schemes are MGNREGA, BRGF, 13th finance commission (GOI) and CM Gram Sadak Yojana which have taken up activities like Brick soling, PCC, construction of Anganwadi building, Pakka road, Drainage line, Renovation of Aahar, Sinking, Land leveling, Renovation of irrigation channel and Plantation. In case of animal husbandry interventions such as animal vaccination camp, health camp and timely availability of medicines were organized to fulfill the requirement of the farmers. Capacity building of the farmers was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programmes.

14.10 Success stories of NICRA villeges farmers

Improving the Resilience of Poor Farmers by Reclaiming Cultivable Wastelands

The cluster of villages Vidyasagar and Gadimajhila, Nawada is predominantly inhabited by Rajvanshi and Ravidas communities.The undulated lands are located in the fringe areas of forests and not cultivated despite being fertile. These were completely unprotected from grazing animals and rainwater harvesting and storage structures (ahars) could not convey water due to their higher elevation. The cultivable fallow was brought back into crop production by motivating the community to participate in reclaiming the lands by bunding and leveling. About 15 ha

was planted with pigeon pea during kharif leading to a harvest of 10,000 kg of pigeon pea worth Rs.3,50,000/-. For the first

time, the farmers of these villages could realize such a harvest and this helped them to appreciate the worth of their land

Details of project cost and worth of crops produced

Name of the village/s	Area (ha)	No. of farmers	Cost to project (Rs.)*	Crop(s) cultivated	Value of crops produced (Rs.)	Remarks
Vidhyasagar and Gadi Manjhila	15	34	220500 -	Pigeon pea and short duration paddy (2011-12)	92000	Crop cultivated in 4 ha as work completed in late *rabi*
				Pigeon pea (2012-13)	350000	Crop cultivated in 15 ha
Upper Manjhila	4	13	51440	Pigeon pea	48000	Crop cultivated in 04 ha
Upper Manjhila	24	107	363000	Chickpea in rabi	270000	Crop cultivated in 24 ha
Total	**43**	**154**	**634940**		**760000**	

*Does not include farmers contribution in form of labour (approx. 10%).

Integrated Farming System model for improving livelihood of the poor farmers

A pond of dimension 42m x 27m x 13m was excavated to Sri Vinod kumar s/o Sri Rupesh Yadav Village- Gadi Mnajhila, Block– Kawakol, District Nawada in the year 2013-14 under NICRA project. After excavation the rain water was harvested (stored) in the pond. In year 2014-15 in *kharif* the stored water was utilized in the transplanting of the kharif paddy in 01 ha and for supplementary irrigation in the dry spell. The fish-keeping was started. The fruits and forest species is transplanted on the bank of pond. On the bund Pigeonpea is shown and harvested. On the side strip of pond the vegetable is grown in kharif rabi and zaid by utilizing the water from pond as per need. The water is available throughout the year in this pond due to automatic recharging capability of the pond. The farmer is planning to establish Dairy unit besides the pond to generate more income. The return from this pond is given below.

The net profit earned Rs. 42,400 (Fourty two thousand and four hundreds) in a year by adoption of IFS model .

Economic

Crop	Are (Acr)	Cost of production	Return (Rs)	Net Income
Pigeonpea	0.2	1350	8700	7350
Vegetable Cabage Cauliflower Spong guard Okra Bottle guard	02	1500 1650 1200 1150 550	8000 10000 3000 3600 1500	6500 8350 1800 2450 950
Fish	0.2	5000	20000	15000
Total	**0.6**	**12400**	**54800**	**42400/-**

15. SARAN

15.1 Village information:

Name of the village	Affaur/Darihara
No. of households	4130
Total cultivated area (ha)	2000
Area under rainfed cultivation (ha)	1400
Major soil type	Clay Loam
Climatic vulnerability of the village	Drought/Flood

15.1.2 Rainfall trend of the district:

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Water inundation floods > 10 days (No. of events)	Rainfall (mm)		
								Kharif (Jul-Oct)	Rabi (Nov-Mar)	Summer (Apr-Jun)
2011	1140	597.3	54	2	1	1	0	15.2	487.6	100.2
2012	1140	867.0	59	0	2	3	0	8.3	790.5	60.5
2013	1140	877.0	91	3	0	2	0	260.7	623.3	80.3
2014	1140	915.5	85	2	0	3	0	115.3	719.5	34.7
2015	1140	681.5	64	2	1	1	0	113.5	482.0	54.5
2016	1140	519.0	55	1	1	2	0	22.0	492.0	10.2

15.1.3 Deatils of the climatic vulnerability

- Late onset of monsoon, midseason drought, insufficient rainfall in 2011, No rainfall from 23 September to 10th October (Hathia Nakshatra)
- Late onset of monsoon (12th July) Insufficient Rainfall in2012, Negligible rainfall from 23 September to 10th October (Hathia Nakshatra). Rainfall in March 2012 severely damaged the standing crops of *Rabi* crops
- Timely and sufficient rainfall from 25th May to 6th June, 2013 (147.25 mm) in Rohini Nakshtra induced the farmers to go for seedling growing but low rainfall in later stages and mid-season drought was observed

- Timely rainfall from 25th May to 6th June (32.25 mm) in Rohini Nakshtra induced the farmers to go for seedling growing but low rainfall in later stages and mid-season drought was observed in 2014, Negligible rainfall in October (Hathia Nakshatra), Rainfall from 11th October to 23rd October (Chitra Nakshtra) proved detrimental to the crop
- No rainfall from 25th May to 6th June (Rohini Nakshtra), only 5 cm rainfall from 7th June to 21 June (Mrigshira Nakshtra) and only 83 cm rainfall from 22 June to 5 July (Ardra Nakshtra) Insufficient rainfall, Midseason drought in 2015, Negligible rainfall in October (Hathia Nakshatra), Rainfall from 11th October to 23rd October (Chitra Nakshtra) proved detrimental to the crop
- No rainfall from 25th May to 6th June (Rohini Nakshtra), only 4.75 cm rainfall from 7th June to 21 June (Mrigshira Nakshtra) and 101.6 cm rainfall from 22 June to 5 July (Ardra Nakshtra), No rainfall from 23 September to 10th October (Hathia Nakshatra) in 2016 Insufficient rainfall, Midseason drought

15.1.4 Predominant farm enterprises

i. Cropping pattern:

Before NICRA	After NICRA
Paddy-Wheat	Paddy-Wheat-Vegetables
	Paddy-Wheat-Green Gram/Vegetables
	Paddy – Maize + Potato - Green Gram
Maize-Wheat	Maize-Mustard-Green Gram/Vegetables
	Maize-Wheat-Green Gram
Pigeon Pea-Fallow	Pigeon Pea + Turmeric
Paddy-Rapeseed and Mustard	Paddy-Rapeseed and Mustard-Vegetables
Paddy-Potato	Paddy-Potato-Vegetables/Green Gram/Sesame
Maize-Potato	Maize-Potato-Vegetables

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

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village	Area (ha)	Yield (q/ha)
Paddy	*Sahbhagi, Rajendra Bhagwati, Prabhat, Usar Dhan-3, Heera*	1350	900	1125	44.69
Wheat	*PBW-343, HD-2967, HD-2733, K-9107, K-307, WR-544, DBW-14*	1404	936	1170	38.31
Maize	*Shaktimaan-1, Shaktiman-2, Shaktiman-3, Shaktiman-4*	1122	748	935	51.08
Potato	*Kufri Pukharaj, Kufri Ashoka*	120	80	100	287.30
Rapeseed and Mustard	*Rajendra Suphalam, Pusa Mahak*	240	160	200	15.96

iv. Cropping intensity (%) in NICRA Village: - 137 % (Before NICRA), 240 % (After NICRA)

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Cowpea	20	104	*CP-4, KashiKanchan, Narendra Lobia-1*	17
Brinjal	20	287	*Pant Samrat, Pant Rituraj*	17
Lady's Finger	20	136	*Arka Abhay, Kashi Vibhuti*	17
Tomato	20	287	*Kashi Amrit, Kashi Sharad, Kashi Vishesh*	17
Chili	10	96	*Pant Mirch-3, Kashi Anmol*	9
Onion	10	335	*Arka Niketan, Arka kalyan, N-53*	9

Crop	Area (ha)	Yield (q/ ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Carrot	2	192	*Pusa Kesha, American Beauty*	2
Raddish	2	200	*ArkaNishant, Pusa Himani, Pusa Chetaki*	2
Bitter Gourd	5	160	*ArkaHarit, Priya, Coimbatore Long*	4
Musk Melon	10	399	*ArkaJeet*	9
Cauliflower	10	287	*Pusa Deepali, Pusa Shubhra*	9
Cabbage	10	295	*Pride of India, Pusa Drum Head*	9
Onion	5	80	*ArkaNiketan, Arkakalyan, N-53*	4
Pea	10	176	*AjadMatar, Jawahr Matar-3, Jawahar Matar-4, Kashi Shakti*	9
Garlic	3	176	*Jamuna Safed-4. G-1, G-41*	3
Pointed Gourd	3	184	*Rajendra Parwal-1, Rajendra Parwal-2*	3
Sponge Gourd	10	176	*Rajendra nenua-1, Pusa Priya*	9
Ridge Gourd	10	207	*Deshi, Chaitali, CO-1. CO-2*	9
Pumpkin	10	399	*Pusa Meghdoot, Pusa Navin, ArkaBahar*	9
Water Melon	10	399	*Yellow King, Apple melon*	9
Lady's Finger	30	136	*ArkaAbhay, KashiVibhuti*	26
Tomato	20	287	*KashiAmrit, KashiSharad, KashiVishesh*	17
Chili	20	96	*Pant Mirch-3, KashiAnmol*	17
Arui	20	207	*Cauvur, Rajendra Arvi-1, MuktaKeshi*	17
Minor Vegetables	5	192		4

vi. Area under fodder cultivation and number of farmers growing green fodder: 30 ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Indigenous breed	1000	750	60	FMD & HS & BQ	100	1
Buffaloes	1000	750	60	FMD & HS & BQ	100	0
Goat	1500	600	70	PPR	100	1
Pig	50	10	10	Swine fever	100	5
Poultry	5000	10	100	Ranikhet	100	2
Sheep	150	4	20		100	2

viii. Milk productivity (litres/milch animal/day): Cow Cross breed 5-8 lit/day& Indigenous breed 1-4 lit/day

ix. Detailed data about inland fisheries practiced: Pond (17 No.)

15.1.5 Resource availability:

15.1.5.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011- 12	Community Pond	4 units	Defunct	Renovated
2011-12	Pond (5% Model)	1 unit	Defunct	Renovated
2011-12	Drainage Channel	4 units	Defunct	Renovated
2012-13	Community Pond	1 unit	Defunct	Renovated
2012-13	Open Wells	3 units	Defunct	Renovated
2013-14	Community Pond	9 units	Defunct	Renovated
2013-14	Open Wells	13 Units	Defunct	Renovated
2013-14	Farm Pond	2 units	-	Renovated
2014-15	Check Dam	2 units	Defunct	Renovated

15.1.5.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	2011-12
1	No. of farm ponds/Jalkund	Constructed	4
		Repaired/ Renovated	14
2	Recharging of open/tube wells with silt trap	Repaired/ Renovated	16
		Repaired/ Renovated	2
3	Drainage Channel	Cleaning/desilting	4

15.1.5.3 Status of farm mechanization before start of NICRA:

List of Farm implements available in the village:

Bullock drawn machinery	Nos	Tractor drawn	Nos
Country ploughs	30	Tractors	5
Seeding Implements	0	Power tiller	2
Blade harrow / Bhakar	0	MB plough	2
Bullock carts	4	Cultivators	5
Sprayers	10	Disc harrows	2
		Rotavator	4
		Seed-ferti-drill	0
		Planter	0
		Threshers	5
		Chaff cutters	100
		Diesel pump sets	200
		Electric pump sets	5
		Trailers	5

15.1.6 Socio-economic status:

a. **No. of households – General:** 1325; **OBC** – 1935; **SC**- 870

b. **Literacy rate (%): Male:** 72%; **Female:** 59%

c. **Workers engaged in agricultural activity (%):** 49%

MODULE WISE INTERVENTIONS

15.2 Module I: Natural Resource Management

15.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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

Technology demonstrate	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Return	Net Return	BCR
Application of paddy straw as natural mulch in brinjal	4	2	275	169000	126741	4.12
Moisture retention/Soil resilience by incorporating green manuring crop-Green Gram	12	5	7	35000	17898	2.12
Yield of succeeding rice after green gram	12	5	36	47000	17936	1.66
Application of natural mulch in Vegetables	1	0.5	120	76000	38906	2.11
Pitcher Irrigation	1	0.5	155	97000	61576	2.82

Technology demonstrate	No. of farmers	Area (ha)	Yield (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Return	Net Return	BCR
Application of high doses of Organic Manure, Vermicompost (200q/10q)	1	0.5	132	83200	47653	2.41
Interculturing in Maize by hand hoe	10	5	78	117000	86246	3.92
Leveling of the field and cultivation of paddy	30	25	34	45000	10892	1.32
Drum Seeder in rice	8	2.5	42	56000	30506	2.26
Zero tillage in Rice	7	2.5	43	57000	37110	2.86
FIRB Planted Rice	6	2.5	38	50500	27572	2.27
Direct Sown Rice	9	15	35	47000	23510	2.00
Application of PVC pipes in place of open Channels for irrigation of rice	10	10	30	41000	9245	1.33
Furrow Irrigation through FIRB Planter in rice	13	5	38	50500	27572	2.27
Check Basin Method	5	2	34	46000	15759	1.53
In-situ vermicomposting in Mango orchard	50	20	109	218000	191161	8.37
In- situ moisture conservation in brinjal with paddy straw	04	01	262	161200	118226	2.75
Compost/vermi compost	10	4	105	210000	183161	6.82
Soil test based nutrient application	300	200	40	51000	21222	1.71
Bund Making and leveling (Paddy)	10	3	34	46000	15759	1.521
Digging of small pits in Diara Lands and then filling with compost and keeping the level below soil surface and the growing of cucurbits in the pits (Pumpkin)	5	2	300	164000	120708	3.89
Raising of Land embankment in paddy followed by Pumpkin	23	3	300	164000	120708	3.89
Levelling /bunding and flooding for leaching of salt in Paddy	12	10	35	46500	25404	2.2
Scraping before paddy	12	5	38	50500	27541	2.27
Incorporation of green gram into the soil after two plucking followed by rice	26	10	7	35000	17898	2.12
	26	10	36	47000	17936	1.66
Total	**607**	**353.5**				

Impact: Paddy straw was spread in the brinjal crop @ 50 q/ha as thin layer all around. The number of irrigation was decreased by 2 (4 in untreated crop, 2 in mulch crop) due to in situ moisture conservation and soil temperature regulation. When green gram and Sesbania wereincorporated in paddy-wheat system, moisture retention was for a longer period for organic matter build up in the soil resulting into less water demand by the succeeding crop. This has a great impact in the neighboring villages and in the whole district. Though this was not a new practice for the NICRA village, its impact was so tremendous that even Department of Agriculture, Government of Bihar accepted this intervention in their technical programme. Application of high doses of Organic Manure/Vermicompost (200q/10q) also enhanced the moisture retention capacity of the soil and resulted in saving of irrigation water apart from increase in yield. Due to Interculturing operation in maize, soil capillaries were broken and natural mulch was created. This also resulted in saving of water. Farm bunding and leveling of the fields checked the surface run off of water. This increased moisture retention, reduced weed population, increased the WUE and NUE of the soil apart from ground water recharge. Digging of small pits in Diara Lands and then filling with compost and keeping the level below soil surface and the growing of cucurbits in the pits increased moisture retention by 5 days heat tolerance was also increased (survival percentage of plants increased by 11%) in pumpkin crop and irrigation through pitcher/sprinkler/1 inch delivery tube was possible instead of flooding, thereby saving 2 ha cm of water. This practice was so popular now that whole of Diara Land in and around Saran district have adopted.

15.2.2 Water harvesting and recycling for supplemental irrigation:

Table.Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Return	Net Return	BCR
Renovation of old water harvesting structure	100	50	3000 cubic meter additional water	437600	338000	3.99
Ground water recharge	09	05	52	72000	40356	1.27
Tank silt application in the field	11	04	5-11% yield increase	32645	22445	2.20
Improved drainage system	10	06		90525	23025	1.34
Drainage channel	27	16	36	65450	8950	1.16
Water harvesting structure new-Paddy, wheat	2	0.15	32	44000	12265	1.38
Raising of Land embankment-Pumpkin, brinjal	46	6	300	164000	120708	3.89
Cleaning and renovation of wells –Lady's finger	13	13	125	124000	86906	3.43
Renovation of Check dams-long gourd	10	1	160	100000	65988	3.02
Cleaning of ponds-Fish	6	1	40.00	400000	340000	5.66
Drainage channel-Paddy	23	6	31	48000	16525	1.57
Total	**257**	**108**				

Impact: Due to renovation of old water harvesting structures, additional water was available for life saving irrigation in the rice nurseries and for pre-sowing irrigation in wheat. This resulted into timely sowing of both wheat and rice, thereby saving the crop from terminal heat. Productivity of Paddy was increased by 23% and that of wheat was by 39% due life saving supplemental irrigation. Also, vegetable cultivation was made possible due to assured irrigation resulting into 23% increase in cropping intensity. Apart from paddy and wheat, vegetables were taken in area of assured irrigation. Also there was an increase in ground water by 2.5 ft., increase in fuel efficiency of pump sets by 3%, increase in cusec of water discharge by 6% and decrease in saving of time in irrigating one ha of land by 5%. The renovation of old water harvesting structures have a great impact and the MNREGA as well as the Department of Agriculture, Government of Bihar have accepted this in their developmental programmes.

15.2.3 Conservation tillage:

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
Direct Seeded Brown Manured rice (Dry Seeding)	10	2.5	38	50500	25281	2.00
Zero Tilled Rice, wheat	8	2.5	43	57000	36445	2.77
FIRB Planted Rice, wheat	13	5	38	50500	27572	2.27
Sowing of paddy by drum seeder	7	2.5	42	56000	30506	2.26
System of rice and wheat Intensification	15	4	49	64000	36078	2.29
Direct Seeded Brown Manured rice (Dry seeding)	10	2.5	38	50500	25281	2.00
Water management in Paddy	4	6	38	50500	21262	1.73
Total	**67**	**25**				

Impact: Direct Seeded Brown Manured Rice: Transplanted rice is taken only after onset of monsoon. This delays rice cultivation as well as following wheat cultivation, thereby reducing overall crop productivity and system productivity. When Direct seeded rice was taken with Sesbania as mix crop (2:1) and brown manured by 2-4, D at 35 DAS, the yield was enhanced by 26.67%. The yield enhancement was attributed not only due to establishment method/high seed rate/effect of Sesbania in mulching/nutrient addition/water saving/killing of weeds by 2-4, D/ acting 2-4, D as anti-transpirant but also time of sowing. Also, the first shower of monsoon that is almost wasted in seedling raising was used when the crop was sown in time with lifesaving irrigation.

Zero Tilled Rice: At least 15 days before sowing of rice, glyphosate was sprayed over the field @ 2.5 l/ha and rice was sown direct by Zero tillage Machine @ 40 kg/ha. The crop was irrigated 2-3 days after sowing where there was moisture stress. This enabled timely sowing of paddy/good crop stand/ uniform germination/ weedless micro climate, resource conservation/7-10 days early maturity giving space for timely sowing of wheat, thereby enhancing crop/system productivity.

FIRB Planted Rice: At least 15 days before sowing of rice, glyphosate was sprayed over the field @ 2.5 l/ha. Pre-sowing irrigation was done for easy cultivation of the field; however certain farmers waited for monsoon to break and then started sowing the crop with FIRB planter. Field preparation was done and paddy was sown by FIRB planter. This ensured timely sowing of paddy/good crop stand/uniform germination/ weedless micro climate, Resource conservation 7-10 days early maturity giving space for timely sowing of wheat, thereby enhancing crop/system productivity.

Sowing of paddy by drum seeder: At least 15 days before sowing of rice, glyphosate was sprayed over the field@ 2.5 l/ ha. After irrigating the field/after sufficient rainfall, the field was germinated thoroughly and pre-germinated seeds were sown direct by drum seeder as wet seeding. Butachlor was sprayed in the field at 2-3 DAS as pre emergence @ 3 liter/ ha with sufficient moisture in the field to avoid weeds. Crop matured 7-10 days earlier giving space for timely sowing of wheat, thereby enhancing crop/system productivity.

Zero Tillage sown Wheat: Sowing of wheat is delayed due to late harvest of paddy or due to moisture stress demanding pre-sowing irrigation. Pre-sowing irrigation again demands to wait for a week to become the soil cultivable. This in turn, delays sowing and ultimately the crop suffers terminal heat at the time of milking and grain filling. When crop was sown with zero tillage under moisture stress condition and the crop was irrigated just 2-.3 DAS, there was uniform germination, good crop stand, proper spacing was maintained. This allowed timely sowing that ensured timely harvest and crop was escaped from terminal heat. Though yield data is yet to be taken

FIRB Planted wheat: Just after paddy harvest, thorough ploughing of the field was done and wheat was sown by FIRB planter.This allowed timely sowing, less seed rate, less fertilizer and less weed growth. Also, water requirement of the filed was quite less, though number of irrigation was higher as compared to conventional system due to irrigation in the furrowed. Some smart farmers irrigated only alter rows only and yet others stopped irrigating when water reached just 2/3 of the furrow. Farmers generally irrigate the crop at milking stage but due to high wind speed of the westerly winds, the crop lodges and yield is reduced. Again, if they do not irrigate the crop due to high wind speed, crop faces acute moisture stress and yield is reduced. Sowing the crop on buds in East west direction allows the wind to pass through the gaps and irrigation becomes possible without lodging effect. Crop matures 5-7 days earlier thus escaping it from terminal heat.

15.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)			
				Gross Cost	Gross Return	Net Return	BCR
Renovation of old water harvesting structure	100	50	3000	99600	437600	338000	3.99
Ground water recharge	09	05	52	31644	72000	40356	1.27
Improved drainage system	10	06	75	67500	90525	23025	1.34
Renovation of water Reservoir	24	4	25	64500	79542	15042	1.23
Drainage channel	27	16	36	56500	65450	8950	1.16
Total	**170**	**81**					

Impact: Farm bunding and leveling of the fields checked the surface run off of water. This increased moisture retention, reduced weed population, increased the WUE and NUE of the soil apart from ground water recharge. Due to artificial ground water recharge, there was an increase in ground water by 2.5 ft., increase in fuel efficiency of pump sets by 3%, increase in case of water discharge by 6% and decrease in saving of time in irrigating one ha of land by 5%. The drainage channels drained the inundated water in the Diara lands and about 60 ha of land was made free for cultivation. The renovation of old water harvesting structures have a great impact and the MNREGA as well as the Department of Agriculture, Government of Bihar have accepted this in their developmental programmes.

15.2.5 Water saving irrigation methods:

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
Sprinkler irrigation in Guava, Mango, litchi	2	1	110	165000	136772	6.02

Pitcher Irrigation in Brinjal	1	0.5	155	97000	61576	2.82
Pitcher Irrigation in pumpkin	1	0.5	175	109000	73576	3.16
Application of PVC pipes in place of open Channels for irrigation of rice	10	10	30	41000	9245	1.33
Furrow Irrigation through FIRB Planter in rice, wheat	13	5	38	50500	27572	2.27
Micro Irrigation in long gourd	3	2	30% water saving,30% reduction in energy,20% reduction in Labour,30% decrease in fertilizer consumption Yield of long gourd	100000	65988	3.02
Check Basin Method	5	2	34	46000	15759	1.53
Total	**35**	**21**				

Impact: Due to micro-irrigation systems there was 30% water saving, 30% reduction in energy, 20% reduction in Labour and 30% decrease in fertilizer consumption apart from yield increase in the crops. Direct Seeded Brown Manured Rice resulted in saving of irrigation water due soil organic matter build up and mulching. There was saving of at least 20% water in Zero tilled Rice and wheat and 40% water saving in FIRB planted wheat and paddy. In the FIRB Planted wheat and rice, the number of irrigation was higher as compared to conventional system but overall consumption of water was very less. Some smart farmers irrigated only alternate rows and yet others stopped irrigating when water reached just 2/3 of the furrow. Farmers generally irrigate the crop at milking stage but due to high wind speed of the westerly winds, the crop lodges and yield is reduced. Again, if they do not irrigate the crop due to high wind speed, crop faces acute moisture stress and yield is reduced. Sowing the crop on buds in East west direction allows the wind to pass through the gaps and irrigation becomes possible without lodging effect. Crop matures 5-7 days earlier thus escaping it from terminal heat.

In the System of Rice Intensification There was no continuous ponding of water in the field and the crop was provided only light irrigation just to keep the soil moist. This allowed sufficient water saving. Aeration of soil/ line sowing/ root development and heavy tillering gave higher yield as compared to conventional transplanting system.

Water Management in Paddy: In conventionally transplantedrice fields, light irrigation was provided just to keep the soil moist and no continuous ponding of water was allowed. Also, lifesaving irrigation was given when there was cracking in the field. This allowed saving of water and yield was high because of enhanced aeration and root growth.

15.2.6 Other Demonstrations:

Table. Performance of other demonstrations

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Return	Net Return	BCR
Technology demonstration on solar cooker/LPG (The cow dung that was used for making cake for fuel was made free for incorporation and addition of 200 q of compost to the soil) Cabbage	26	0	.265	159000	117140	3.91
Wind Brake (Seeds of water melons/Musk melons/ pumpkins/cucumber/long gourd *etc*. are not get covered through high wind blowing sands, thereby preventing the seeds from deepening into the soil, apart from providing moisture conservation and heat tolerance) Water Melon	28	7	300	240000	189052	4.83
Seedling Raising by SHGs/FIGs	22	10	15000 seedlings	75000	50450	3.15
Intercropping of Elephant Foot Yam in Plantation crops (Green Semal)	5	2	300	240000	173990	3.73
Crop residue/green manures/brown manures/ conservation tillage/sitting of herds of sheep/silts form ponds/poultry manures and taking potato + maize as intercrop (220 q Potato and 40 qMaize)	22	14	220 q of potato and 40 q of maize)	216000	149000	3.32

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Return	Net Return	BCR
Levelling /bunding and flooding for leaching of salt in paddy	12	10	35	46500	25404	2.2
Scraping in paddy	12	5	38	50500	27541	2.27
Soil test based nutrient application	320	220	53	69501	27885	1.68
Poly-vermi-beds (Saving of agricultural wastes/ farm weeds/Road side weeds like Parthenium/Pond weeds like water hyacinth/cow dung) Potato	63	126	330	200000	135320	3.17
Pit method of composting in place of heap method (Potato)	24	24	320	192000	123943	2.89
Total	**431**	**385**				

Impact: The cow dung that was used for making cake for fuel was made free for incorporation and addition of 200 q of compost to the soil.Yield of subsequent vegetable crop of Cabbage was increased by 41% (Yield 275 q/ha) Seeds of water melons/Musk melons/pumpkins/cucumber/long gourd *etc*. are not got covered through high wind blowing sands, thereby preventing the seeds from deepening into the soil, apart from providing moisture conservation and heat tolerance. In poly-vermi beds and vermin-pits, agricultural wastes/farm weeds/ Road side weeds like Parthenium and pond weeds like water hyacinth were incorporated in Vermicompost and this was used in potato resulting into increased production of potato both qualitatively and quantitatively,

15.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity (cu m)	No. of farmers benefited		Protective irrigation potential (ha)		Increase in cropping intensity %
			Before	After	Before	After	
Pond	1	5875	1	24	2	5	8
Inlet Channel	1	2880	0	23	1	2	13
Leveling of land eroded due to flood	2	0	0	226	0	0	29
Bund Making	30	0	0	25	0	0	25
Total	**34**	**8755**					

15.3 Module II: Crop Production

15.3.1 Introducing drought resistant varieties:

Table. Performance of different drought tolerant varieties

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Technology demonstration on drought tolerant variety "*Sahbhagi*", *DBU -14, Heera*	45	20	48	60	31167	64000	32833	2.12
Short Duration Variety under late sown condition (Late monsoon) with lifesaving irrigation	10	5	36	20	31474	48000	16525	1.57
Management of moisture	40	100	42	40	25494	56741	30506	2.26
Varietal Evaluation Red Gram, Safflower	14	1	18	50	18243	78000	59757	4.27
Red Gram	14	1	18.90	54.41	18243	81900	63657	4.49
Mulching in Brinjal	4	1	288.75	5.63	42974	177450	13447	4.13
Heat Tolerant Varieties *DBU -14* (Wheat), *DBU -14* (Wheat)	11	6	36	17.82	30542	48783	18240	1.60
Total	**138**	**134**						

Impact : Drought tolerant variety *Sahbhagi* excelled all other existing varieties under drought condition. Even Hybrids could not compete this variety under stress condition.Late onset of monsoon has become a feature in Saran district. In such situation, short duration rice varieties like *Prabhat*, MTU 1010, *Sahbhagi*, *Heera* and *Rajendra Bhagwati* were found better in sustaining under water stress and gave considerable high return. These varieties have become very popular in the district and the Department of Agriculture, Government of Bihar has taken up both *Sahbhagi* and *Rajendra Bhagwati* in their technical programmes.

Late sown wheat variety: Farmers procure timely-sown wheat varieties like *PBW 343*, but sow them late due to long duration rice variety or due to moisture stress in early *Rabi* Season.. Thus, the crop of wheat suffers terminal heat and gives low yield. Replacing timely sown late variety *PBW 343* with late sown *PBW-373*, *HW 2045* and *DBW-14* gave good crop stand and escaped terminal heat.

15.3.2 Introducing salt tolerant paddy varieties:

Table. Performance of different salt tolerant paddy varieties

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Salt tolerant Varieties *CSR*-36,	10	2	35	16.67	21095	46500	25404	2.2
Salinity tolerant management	48	56	33	17.85	31734	4400	12265	1.38
Salt tolerant Varieties *Usar Dhan-3*	10	2	35	16.67	21095	46500	25404	2.2
Salt tolerant Varieties	10	2	36.75	20.10	21095	48825	27730	2.31
High yielding Varieties	10	2	45.15	47.55	20554	59850	39296	2.91
Leveling /bunding and flooding for leaching of salt	12	05	36.75	20.10	21095	48825	27730	2.31
Scraping	10	05	39.90	30.39	22928	53025	30097	2.31
Total	**110**	**74**						

Impact: The pH of the soil has gone upto 10 at several locations. In these conditions paddy and wheat cultivation could be possible only due to introduction of salinity tolerant variety *CSR-36*, *Usar Dhan-3* of paddy and *RAJ 3077* and *KRL-19* of wheat, which resulted in assured production of crops. Leveling, bund making, flooding and scraping proved better technology for improvement of saline soils and now prevalent in all adjoining villages.

15.3.3 Introducing flood tolerant varieties:

Table. Performance of different flood tolerant varieties

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Technology demonstration on Flood Tolerant Variety *Swarna Sub*-1	45	20	48	60	31167	64000	32833	2.12
Water management in Paddy	4	6	38	26.67	29238	50500	21262	1.73
Management of moisture	40	100	42	40	25494	56741	30506	2.26
Varieties Management to submergence	10	36	38	26.66	22928	50500	27572	2.27
Total	**99**	**162**						

Impact: In Diara land flood is normal phenomenon. When water level is high, the adjoining Tal lands and chaur lands are also inundated. In that situation, no existing varieties of paddy exist. *Swarna sub*-1 survived in that situation also and gave assured returns. This variety has become so popular under flash flood conditions that Department of Agriculture, Government of Bihar has taken up both this variety in their technical programmes. Also, the short duration varieties like *Sahbhagi*, *Prabaht* and *Rajendra Bhagwati* fit in the Rice-Wheat Cropping System under flash flood condition after the flood water receivers.

15.3.4 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Direct Seeded Brown Manured rice (Dry Seeding)	10	2.5	38	26.67	25219	50500	25281	2.00
Direct Seeded Rice (wet Seeding)	15	10	35	16.67	21095	46500	25404	2.2
Zero Tilled Rice	8	2.5	43	43.33	20554	57000	36445	2.77
FIRB Planted Rice	13	5	38	26.67	22928	50500	27572	2.27
Sowing of paddy by drum seeder	7	2.5	42	40	25494	56000	30506	2.26
System of Rice Intensification	12	5	52	73.33	32288	72000	39712	2.23
Water management in Paddy	4	6	38	26.67	29238	50500	21262	1.73
Community nursery	15	8	34	13.33	25309	45000	19690	1.78
Levelling /bunding and flooring for leaching of salt	12	05	35	16.67	21095	46500	25404	2.2
Scraping	10	05	38	26.67	22928	50500	27541	2.27
Management of moisture	40	100	42	40	25494	56741	30506	2.26
SRI	178	59.6	52	73.33	32288	72000	39712	2.23
Direct seeded brown manured rice	16	07	38	26.66	22928	50500	27572	2.27
Zero tilled rice	12	02	42	40	20554	57000	36445	2.77
SWI	49	20	50	61.29	27921	64000	36078	2.29
Total	**391**	**110.1**						

Impact: Water Management in Paddy: In conventionally transplantedrice fields, light irrigation was provided just to keep the soil moist and no continuous ponding of water was allowed. Also, lifesaving irrigation was given when there was cracking in the field. This allowed saving of water and yield was high because of enhanced aeration and root growth.

15.3.5 Community nurseries for delayed monsoon:

Table. Performance of Community nurseries

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Community nursery	15	8	34	13.33	25309	45000	19690	1.78
Aged seedling Planting	20	08	35	16.67	21095	46500	25404	2.2
Total	**35**	**16**						

Impact: In the last 15 years, Saran district has experienced deficient and untimely rainfall, late onset of monsoon and also early withdrawal of monsoon which resulted into delayed transplanting of old age seedlings (40-45 days). Transplanting of aged seedlings lead to low tillering resulted in poor crop yield. In order to address this problem, Community Nursery was encouraged in which nurseries of rice were grown at 15 days interval in staggered manner. This enabled farmers to access seedlings as and when needed by the progress of monsoon.

Since there are a number of small farmers in the village and the nursery area is again very small. Farmers are unable to sow nursery due to late onset of monsoon. Also, the nurseries located at different places face grazing problems. Community Nursery located near the community ponds receive lifesaving irrigation, easily managed and fit to different transplanting windows as and when the monsoon comes. This approach benefitted the farmers with an additional yield of 20 q/ha.

The rain fall pattern of Saran district shows that the monsoon is generally delayed by 4-6 weeks. The sowing time of rice nursery starts with onset of RohiniNakshtra (25th May to 7th June) for long duration paddy, MrigshiraNakshtra (8th June to 21st June) for medium duration paddy and ArdraNakshtra (22nd June to 5th July) but since monsoon is delayed, the seedlings sown during these periods attain 40 to 50 days age with very limited tillering capacity. Therefore, if such aged nursery is transplanted after monsoon, there is very less yield. If nursery is sown in staggered manner at 15 days interval and if 8-10 days seedling for SRI and 18-30 days seedlings are used for conventional transplanting, there is higher production and higher economic return even if the previous two-three nurseries are cut and fed to the animals and their cost of cultivation is added in the last nursery.

15.3.6 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Crop intensification through inclusion of green gram in Rice-wheat system	12	5	7 Green gram	-	15806	35000	19194	2.21
Contingent Crops Horse gram	25	5	18	50	31167	64000	32833	2.12
Specific inter cropping system	25	05	43	43.33	20554	57000	36445	2.77
In the kitchen gardens of Farmers	20	2	275	2.62	42259	169000	126741	4.12
Total	**82**	**17**						

15.3.7 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
Crop intensification through inclusion of green gram in Rice-wheat system	12	5	7 Green gram	-	15806	35000	19194	2.21
Crop Diversification through replacement of rice by maize in rice-wheat cropping system	5	12	62 (Maize)	160	25414	70000	44585	2.75
Crop diversification through Wheat, coriander	230	40	36	20	25627	46000	20372	1.79
Total	**247**	**57**						

Impact: The rice wheat cropping system is the most prevalent cropping system of Saran district. Continuous rice wheat cropping system has led to deterioration in soil quality, receding ground water table, declination in factor productivity as well as environmental problems. Due to moisture stress and climatic vulnerability, the farmers are at risk. So scientific intercropping for intensifying and diversifying the prevalent rice-wheat cropping system was found better for assured returns under the resources available.

15.3.8 INM/IPM/ICM

Table. Performance of other demonstration

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
System of Nutrient Management	250	50	49	63.33	27921	64321	36078	2.26
Integrated Pest management	250	50	34	13.33	30240	46000	15759	1.52
Pest and disease Management	49	40	45	36.36	30753	11700	86246	3.2
ICM	250	50	44	46.66	25254	58741	32741	2.29
Total	**799**	**190**						

Impact: Integrated Nutrient management, Integrated Pest Management, Integrated Weed Management and Integrated Crop management approach resulted into 15-50 % yield enhancement under similar conditions.

15.3.9 Other Demonstrations

Technology demonstrate	No. of farmers	Area (ha)	Output (q/ha)	% increase	Economics of demonstration (Rs./ha)			
					Gross Cost	Gross Return	Net Return	BCR
QPM	52	7	78	160	30753	117000	86246	3.92
Scraping	10	05	38	26.67	22928	50500	27541	2.27
Levelling /bunding and flooring for leaching of salt	12	05	35	16.67	21095	46500	25404	2.2
kitchen garden	20	2	275	2.62	42259	169000	126741	4.12
Varietal Evaluation Red Gram, Safflower, Brinjal	14	1	18	50	18243	78000	59757	4.27
Protective Cultivation through Nets	22	4	35.70	16.67	30240	48300	18060	1.60
Total	**130**	**24**						

Impact: Quality Protein Maize and Kitchen gardening resulted in Nutritional security of the farmers, farm women and the children. Apart from crop diversification, high yield was obtained in place of rice which is a more water demanding crop. This technology became very popular in the district.

15.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Use of community lands for fodder production during droughts / floods Maize/ Sudan	100	25	500	400	25	22890	100000	77109	4.509
fodder Use of community lands for fodder production during droughts Fodder production of Maize/ Sudan	500	25	500	400	25	22890	100000	77109	4.50

Impact: Fodder is always an issue for the animals and is least bothered intervention for the farmers but in times of Climatic vulnerability like flood and drought, it is in high demand. Sowing of fodder crops like maize and Sudan in community lands and in farmers own land has become very popular. Apart from, enhanced milk yield, health and infertility problems were also addressed due to timely and adequate supply of green fodder. It has also been observed that farmers growing Maize as grain crop, fetch more returns when sell the produce as fodder during flood and drought.

15.4.2 Improved fodder/feed storage methods:

Table. Performance of improved fodder

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Improved fodder/feed storage methods Silage Making	10	4.00	7.00	4.00	75	15	175	160	11.66
Feed enrichment Urea treatment	50	2.00	8.00	3.00	75	20	190	170	10.82
Azolla production as fodder	10	50.00	8.00	6.00	33.33	18	150	132	8.33
Use of community lands for fodder production during droughts / floodsFodder production of Maize/Sudan	10	2.00	525.00	408.00	28.68	22890.00	105000.00	82110.00	4.59
Total	**80**	**58.00**							

Impac: Green fodder is in abundance in the peak growing seasons but in times of Climatic vulnerability like flood and drought, it is in high demand. At that time, people have to purchase from outside at high cost for life saving of the animals. Silage making and Azolla production increased the milk production apart from health improvement and infertility issues. Urea treatment and staking of the rice straw was also very popular for the NICRA village and the adjoining areas.

15.4.3 Preventive vaccination/Health check ups

Table. Performance of various vaccination camps organized

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Preventive vaccinationFMD	500	0	7	1	600	20	175	155	8.75
Animals health check-up for General and reproductive Diseases	500								
Scheduled of De -worming	500	0	7	5	40	22	175	153	7.95
Total	**1500**								

Impact: Health Checkup camps, Deworming, preventive medicines and vaccination in collaboration with the Department of Animal Husbandry and Department of Dairy Development, Government of Bihar proved better for the general health and milk production apart from repeat breeding, infertility issues and diseases like FMD, HS and BQ.

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

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

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Fish farming Finger ling , pond liningin ponds	5	5	40	30	33.13	60000	400000	340000	5.66
Renovation of defunct fish ponds	14	14	40	30	33.33	60000	400000	340000	5.66
Total	**19**	**19**							

Impact: Renovation of defunct water harvesting structures and ponds, and cleaning of ponds by removal of obnoxious weeds like water hyacinth, made fish production easy in the NICRA village. It was customized that in each pond, water level will be maintained up to 75% of its capacity, and 50% of that will be used for life saving irrigation and rest water shall be used for fish production. This enhanced the fish production by 40%.

15.4.5 Livestock demonstration/Breed Upgradation

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Breed Up gradation	25	25	7	5	40	22	175	153	7.954
Total	**25**	**25**							

Impact: Though indigenous breeds of cattle are more adaptive then cross breeds but certain breeds of cattle, buffalo and goat are better milk producer and better stress bearing capacity. Such animals were promoted in the NICRA village by castration of the males and making available the desired breeds of males. This strategy became more popular in the NICRA village and other adjoining areas**.**

15.4.6 Improved shelters for reducing heat stress in livestock:

Table. Performance of improved shelters for poultry and dairy animals

Technology demonstrate	No. of farmers	Unit/ No. / Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)			
			Demo	Local		Gross Cost	Gross Return	Net Return	BCR
Improved shelters for reducing heat stress in livestock	10	0	7	4	75	10	175	165	17.5
Total	**10**								

Impact: In the Diara lands and Tal lands, there is a vast tract of fields having no plantation at all. In such grazing lands, the animals face heat stroke and become sick. For such situations, huts were constructed in such areas and water availability was made for their drinking.

15.5 Module IV: Institutional Interventions

15.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			Critical input (Breed / Variety / Medicine doses)	No. of farmers	Unit / No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups			
Seed bank	Paddy	10 q	Seed production and storage	Foundation seed	20	One

Interventions	Details of activity			Critical input (Breed / Variety / Medicine doses)	No. of farmers	Unit / No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups			
Seedling Bank	Forest Plants	20000	Seedling production through SHGs	Seeds/Polythene	10	One
Fodder bank	Maize	One		Seed/Ingredients	20	One
Commodity groups	Fertilizer procurement/ storage/sale counter	1	Farmers own through PACS and cooperative societies			
Custom hiring centre	Farm Implements	One each	Technology Demonstration	Zero-till ferti-seed drill/Leveler/ bund maker/FIRB planter/ drum seeder/weedicide sprayer/ connoweeder/marker/subsoiler/ weighing machine/Rotavator/ Reaper, thresher wheat, thresher paddy, Disc harrow, cultivator, sugarcane cutter planter, bucket leveler		
Collective marketing	Vegetables	1	Cooperative arrangement		50	25
Climate literacy through a village level weather station	Weather station	1	Data interpretation of the AWS and then forecasting/ Advisory	Cost of SMS/Voice SMS/ Internet	100	100
Any other (Pl. specify)	Awareness Programme on NICRA	Launching of the NICRA project/ Lecture/government officers/door to door approach		NICRA Caps/NICRA T-shirts	Whole village	Whole village

Impact: The NICRA village has been provided with foundation seeds of cereals, pulses and oilseeds. Apart from increase in production, some seeds were preserved for future contingent plans for climate vulnerable situations. Weather Advisory Services were also made through SMS and through web sites and whatsapp. The Custom Hiring Center has a great impact on the whole state and the Department of Agriculture, Government of Bihar has accepted this in their technical programmes. The Climatic condition force the farmers to go beyond the general practice of cultivation and in such situation, it is only possible to go for timely sowing if farm machines are available to the farmers. But at the same time it is not possible for all the farmers to purchase the implements. Under such circumstances, the Custom Hiring Center is very helpful and popular.

15.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC:

Name of the VCRMC	Name of the village	No. of members
VCRMC Affaur	Affaur	20
VCRMC Darihara	Darihara	20

15.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

Name of the village/KVK	Name of the implements/equipment purchased	Cost of implements/equipment
Darihara, KVK (Common to both the villages), Affaur	Zero-till ferti-seed drill, Leveler, drum seeder, weedicide sprayer (Two), Connoweeder 10, Marker 10, subsoiler, Rotavator, Leveler, bund maker, drum seeder, FIRB planter, weedicide sprayer (Two), Reaper-Tractor Mounted, Reaper-Self Propelled,Thresher, Disc harrow, Cultivator, sugarcane cutter planter, Bucket leveler, Weighing Machine, GPS, computer, printer, UPS and Battery, Small weather station	621380

Table. Revenue generated through Custom hiring Centers and VCRMC in KVKs

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Saran		60000.00

Impact: The Custom Hiring Center has a great impact on the whole state and the Department of Agriculture, Government of Bihar has accepted this in their technical programmes. The climatic condition force the farmers to go beyond the general practice of cultivation and in such situation, it is only possible to go for timely sowing if farm machines are available to the farmers. But at the same time it is not possible for all the farmers to purchase the implements. Under such circumstances, the Custom Hiring Center is very helpful and popular.

15.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Climate change	2	50	18	68
Natural Resource Management	8	143	43	186
Crop Management	3	221	383	604
Nutrient Management	3	111	27	138
Integrated Crop Management	1	29	3	32
Crop Diversification	6	50	45	95
Resource conservation Technology	7	150	20	170
Pest and disease management	42	1051	358	1409
Nursery raising	5	101	40	141
Integrated Farming System	1	26	11	37
Livestock and Fishery Management	29	748	573	1321
Fodder and feed management	3	64	32	96
Employment generation	1	10	4	14

15.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Awareness, Demonstration, Exposure Visit, Farmers day, Field Day Count, Field Visit, Group discussion, Agro advisory services, Awareness, Diagnostic visits, Exposure visits, Farmers day, Field Day, Crop diversification, Crop management, Employment generation, Farm implements and machineries, Fodder and feed management, Live stock management, Natural resource management, Nutrient management, Pest and disease management, Resource conservation technologies, Method demonstrations, Agro advisory , s services, Awarenes, Exposure visits, Field Day, Group discussion, Animal Health Checkup camps	823	12343	156	12499

15.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
500	500	500	234

15.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs.)
MNREGA	Water harvesting structures, Renovation of Ponds and drainage channels/irrigation channels, land leveling and site development	200000
Department of Agriculture, Saran	National Mission on Oilseeds and Oil Palm, National Food Security Mission, National Horticulture Mission, State Plan for Promotion of Organic Agriculture, Rashtriya Krishi Vikas Yojana, Mukhya Mantri Tibra Beej Vistar Yojana, Village Seed Production Programme, Farm Mechanization	150000
District Soil and Water Testing Laboratory, Saran	GPS based soil sampling and analysis, Issue of Soil Health Card	85000
Department of Veterinary and Animal Husbandry, Saran	Animal health checkup camp, De-worming	100000
Total		**435000**

15.10 Success stories of NICRA Village Farmers

1. Climate Smart Agriculture - A new hope for farmers

Sri Narmadeshwar Giri is a farmer from Affaur village of Saran district. He is doing vegetable production since long time but he used to apply all sorts of chemicals in managing the pests and diseases as vegetable growers normally do. Though he earned a good profit out of his enterprise but his cost of cultivation was too high. Also, the soil health of his farm was going down and down through the years. He did not follow scientific crop rotation out of ignorance. He started Organic Vegetable Production followed crop rotation of vegetables to cope up with diseases and insect pest infestation. Composts and Vermicompost along with some other fertilizers are being used by him in managing the nutrient demand of the crop. Now he evolved a relay cropping system of vegetables with paddy [Brinjal-tomato-cucumber/long melon-Paddy]. Sowing of brinjal in nursery was done by 15th August and transplanting in the main field by 15th September at 6 feet ×3 feet distance on permanent beds. Seedlings of tomato were raised in a separate nursery in last week of November and transplanting was done in between the rows of brinjal at a distance of 4 feet. Now cucumber and long melon was sown directly in between the plants of tomato at a distance of 2 feet by 25th February. Sesbania was grown in the field by 25-30th May and it was incorporated in the field at 45 days duration irrespective of monsoon break with supplemental irrigation. Short duration paddy was then taken in the field after puddling.

2. Climate Smart Technology could bring a Radical Change

Sri Umeshwar Singh belongs to village Affaur of Nagra Block of Saran district. He has 20 acres of land but most of his lands were not being commercially utilized for agriculture. He used to invest a lot of money in agriculture but he could get only marginal profit. After getting training from KVK, he became enthusiastic and started agriculture with a great zeal.

First of all, he managed his horticultural garden of Guava and Mango and intensive cultivation of maize, turmeric and rapeseed were introduced as intercrop. He also introduced natural mulching in the guava garden and in situ vermicomposting. This could help him not only in getting additional yield but also enhanced production of horticultural crops. By using Micro-irrigation from government support, he could save irrigation water being wasted otherwise in flood irrigation. Then he could manage to adopt the Climate Resilient Agriculture of the NICRA project being run in his village. As Chairman of the Village Climatic Risk Management Committee, he used his past expertise and experiences in application of Climate Smart Agriculture and propounded different innovative ideas to fight the climatic challenges. Being the Chairman of Primary Agriculture Credit Society (PACS), he could manage to supply the agricultural inputs like fertilizer in time to the whole village. Again, as a dealer of Public Distribution System, he is helping the community to use alternative energy sources like kerosene in place of cow dung cake that may be used otherwise as organic source for the farm land. After getting renovation of ponds and application of that tank silt in the field, he could manage not only the pond for additional water accumulation for irrigation and for fish culture but also he made his agricultural lands fertile. The people of the whole Saran district try to adopt the interventions of NICRA and observe that Climate Smart Technologies have made a radical change in the farming community.

3. Crop Diversification and Crop Intensification

Sri Ramakant Singh, from Darihara village of Saran distrcit left his police job due to some family problem and started agriculture with continuous hard work and devotion. But the only point of distraction was his land situation as most of his farming area fell either in the Diara lands or in the Chaur lands with periodical inundation each year and only *Rabi* crops was possible. Though his lands were fertile but due to flood during rainy season and drought during summer months all his farm was devastated.

When came in contact with KVK and after receiving some varieties suitable for drought and flood situations, his could get the confidence about cultivation in such situations. And when he came to know the Climate Resilient Technologies under NICRA, he started all sorts of Crop Diversification and Crop Intensification for assured economic returns. He renovated one of his defunct ponds under NICRA and started intensive cropping through supplemental lifesaving irrigation. Rice-Maize+Potato, Rice-Wheat-GreenGram, System of Rice Intensification, System of wheat Intensification and Zero tillage are the few technologies that he adopted in due course.

Under the banner of NICRA he promoted *Swarna sub*-1 for flash flood situations and *Sahbhagi* for drought situations. This made Diara and Tal farmers confident about agricultural practices. In Diara lands, he introduced some new vegetable production techniques for saving the seedlings during high temperature and westerly winds. Farmers are now observing lower mortality of cucurbits and melons with higher production without any additional investment. A junk of about 50 ha of fallow land was made fertile and cultivable under NICRA with tremendous Rapeseed production and credit goes to Sri Rama Kant Singh.

16. Supaul

16.1 Village information:

Name of the village	Sadanandpur
No. of households	1271
Total cultivated area (ha)	2200 ha
Area under rain fed cultivation (ha)	900
Major soil type	Sandy loam
Climatic vulnerability of the village	Flood and drought

16.1.2 Rainfall trend of the district (mm):

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	*Rabi*	*Summer*
2011	1344.00	1400.00	32	-	-	2	1173.04	48	179
2012	1344.00	1236.3	41	1	-	-	1139.30	12	84.6
2013	1344.00	1074.55	37	-	1	1	1004.6	0	69.95
2014	1344.00	1081.51	50	-	1	3	897.28	10.99	73.20
2015	1344.00	832.95	28	1	-	2	617.05	17.9	73.2
2016	1344.00	1406.6	51	1	-	2	1237.9	0	168.9

16.1.3 Deatails of the climatic vulnerability

The village Sadanandpur is affected with climate Vulnerability such as flood, drought, heat wave and cold. About 30% of the village is flood prone due to seepage from river Koshi. The small land holding and poor economic condition of the farmers further intensify the problem of the farmers. Two times in last few years has been observed the occasional flooding with 8-10 days submergence. Heat wave in the month of March has been observed. In the year 2016-17 two dry spell of 12 days has been observed in the month of August. Also flooding in the month of July 2016 has been observed due to excess rainfall of 63.9 mm and resulted in 10 % crop loss.

16.1.4 Predominant farm enterprises: Agriculture and Livestock

i. Cropping pattern: Kharif-Paddy Vegetables, Rabi-Wheat, Sunflower, Potato, Maize, etc. Summer- Jute, Moong(Green Gram)

ii. Major cropping system: Paddy-wheat-Moong, Paddy-Wheat-Jute

iii. Predominant varieties of major food crops:

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Paddy	*R. Mansoori, BB 11 Sahbhagi, SS1, Kranti, Hybrid*	250	200
Wheat	*DBW 14, NL, WR 544 HUW234*	200	125
Potato	*K Kanchan, K ashoka, K pukhraj*	210	52
Jute	*JRO 66, JRO 524*	40	50

iv. Cropping intensity (%): 300

v. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Potato	50	160	K Ashoka, K Kanchan, Pokhraj	50
Cucurbits	5	180	Hybid	5

vi. Area under fodder cultivation and number of farmers growing green fodder: 4.25 ha

vii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Dairy Cattle	800	500	30	FMD and HS BQ	80	
Buffalo	830	440	15	FMD and HS BQ		
Goat	2500	800	0	PPR	20	

viii. Milk productivity (litres/milch animal/day): 2.5 to 3.0 lit/day

ix. Details data about inland fisheries practiced: In 10 ponds of total area 2 ha

16.1.5 Resource availability:

16.1.5.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011-12	Drainage channel	150		Constructed
2012-13	Drainage channel	150		Constructed
2013-14	Rennovated Pond	5	Defunct 5 units	Rennovated
2014-15	Bamboo Boring	30		Installation
2015-16	Bamboo Boring	10		Installation
2016-17	Bamboo Boring,	6		Installation
	Pond construction	4		Newly constructed

16.1.5.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	Total
1	No. of farm ponds/Jalkund	Constructed	4
2	Bamboo boring	New Installation	62

16.1.5.3 Status of farm mechanization before start of NICRA: Mechanization before the start of NICRA project were limited to the use of cultivator for ploughing and pump sets for flood irrigation mainly

16.1.5.4 List of Farm implements available in the village:

1. Tractor 2. Power tiller 3. Rotavator 4. Cultivator 5. Zero till seed cum fertilizer drill 6. Knapsack sprayer 7. Rocker sprayer 8. Pump sets 9. Paddy and Wheat Threshers 10. MB Plough 11. Grubber 12. Ridger 13. Reaper.

16.1.6 Socio-economic status:

a. **No. of households: OBC:** 1170, **SC:** 135,

b. **Literacy rate (%): Male:** 53 :: **Female:** 38

c. **Workers engaged in agricultural activity (%):** 90%

MODULE WISE INTERVENTIONS

16.2 Module I: Natural Resource Management

16.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Azolla in Paddy (var. *Lalat*)	15	4	40	31028	35378	2.14
Zero Tillage in wheat	55	23	24	15591	19856	2.27
Organic mulching in vegetables (Tomato, brinjal)	45	19	175	22500	82500	4.6
Plastic mulching Okra, cucumber	123	7				
Total	**238**	**53**				

Impact: In-situ moisture conservation practices such as Zero-tillage saved time, labour, capital and minimized the others resources of the farmers. In ZTT, farmers have saved about 25 lit. of diesel fuel/ha. Subsequently, it has also reduced carbon emission about 90 kg/ha. In addition to this, ZTT technologies helped farmers and make them able to save 25-30% of water. Whereas, yield enhancement of 20-25% in paddy has been observed.Cucurbits mulching: - Mulching for vegetables particularly in cucurbits & okra has provided the farmers which in turn helped the farmers from infestation of weeds and conserve moisture. In terms of saving of resources, mulching intervention has saved 30-40% irrigation water. Yield enhancement of 30-40% has been observed in different cucurbits crops.

16.2.2 Water harvesting and recycling for supplemental irrigation:

Table. Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/Unit	Output (q/ha)	Economics of demonstration (Rs/ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation	5	0.5/5 nos	25(crop) 20 fish	24000 60000	21000 200000	2.00 4.33
Renovation of canal	50	150 m				
Construction of new Ponds	4	0.6 ha				
De-siltation of defunct water harvesting structures	20	0.65 (5 nos)	14.50	59000	180800	3.19
10 bamboo boring	262	4 (68 nos)	23	15680	18820	2.2
Total	**341**					

Impact: Pond Renovation: Renovation of ponds has increased the water storage capacity by 3500m^3. It can be useful to provide supplemental irrigation for more than 2 ha areas. In addition to this, farmers are capable for rearing fish with proper pond management and feed supplements which ultimately increased the farmer income by Rs. 10000-15000/- pond/year. Beside this, these renovated ponds provide drinking water facility for 400-500 animals.

Bamboo Boring Installation: The NICRA adopted village Sadanandpur is effected with both drought and flood. The installation of sixty bamboo borings has brought about 200 ha area under supplemental irrigation. Now the farmers are able to provide supplemental irrigation in case of deficit or no rainfall situation. In today's context , they have different crop options to get more return from vegetables in the upland area and fruit plants like banana in place of rice – wheat system.

Drainage channel:- The construction of 150m long drainage channel helped the farmers from water lodging situation upto more than 8-10 ha.

16.2.3 Conservation tillage:

Table. Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat with ZTD machine	55	23	24	15591	19856	2.27

16.2.4 Water saving irrigation methods:

Table. Performance of different water saving irrigation methods

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Irrigation system (micro lift Irrigation system) for paddy	15	4	40	31028	35378	2.14
Application of biofertilizer in rice (var. *MTU 7029*)	80	50	32	28000	16800	1.6
NEDEP Vermi bed	40	30	33	28200	17800	1.63
Total	**135**	**84**				

Impact: Compost production: As the soil of village is sandy loam in nature, hence farmer have opted to promote organic compost production at their own level and for that 45 NADEP compost pit and HDPE vermi-bed have been given among 45 famers. The demonstration of NADEP compost unit and HDPE vermin bed has created the organic fertilizer production potential of the village about 150 tons in a year. These quantities are sufficient for about 60 ha area which reduced the farmer's expenditure on chemical fertilizer up to 20 – 25 %.

16.2.5 Other Demonstrations:

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
Planting forest trees for biodiversity, mahoguni forestation	140	4.0	30	25700	31500	2.5
Soil test based nutrient application (FYM/ inorganic fertilizer) in paddy	50	40	28	17500	24500	2.4
Cultivation of high yielding grass on farm bund Hybrid Napier Bazra	20	1	100	22000	46000	3.0
Total	**210**	**45**				

Impac: Crop Management practices: The interventions on different management practices like integrated crop management; nutrient management, weed management *etc*. have impacted the farmers in many ways. New knowledge or technology gained not only to ensure their crops but also enhance the productivity. They know and acquaintance to maintain the soil health by different agronomical and management practices like incorporation of *daincha* and *moong* residual effect to the soil.

16.2.6 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Desilting Pond	5	5.25 acre m	20	8.0	30
Pond	4	3.25 acre m	22	10.0	30
Total	**9**	**8.50 acre m**			

Impact: Renovation of ponds has increases the water storage capacity by 3500m^3. It can be useful to provide supplemental irrigation in more than two ha area. In addition, farmers are rearing fish with proper pond management and feed supplement. It has increased the farmer's income by 10-15 thousand per pond per year. Four new ponds have been constructed in the village. The cummulative storage capacity of these ponds is 6500m^3. It is being utilized for multiple purposes like water harvesting, fish rearing and life saving irrigation to the crop. It also provides drinking water to free grazing animals during hot summer.

16.3 Module II: Crop Production

16.3.1 Introducing drought resistant varieties:

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 paddy (var. *Sahbhagi*)	163	121	29.66	21.7	31.7	24300	19160	2.27
Short duration paddy Prabhat	31	10	31.2	23.3	33.73	19425	18795	2.18
Sowing of drought tolerant paddy (var. *Sahbhagi*) with Drum seeder machine	62	12	29	24	20.5	20250	23550	2.145
Maize (var. *DHM-117*)	34	3	65	58	12	20500	51000	3.48
Drought tolerant pigeon pea (var. *P-9*)	26	15	14.5	10.4	39.4	12500	31000	3.48
Red gram (var. *NDA-1*)	30	5	13.5	8.5	28	12500	48250	4.8
Total	**346**	**166**						

Impact: Crop based Intervention: The wheat crop varieties against terminal heat like *DBW-14, HD-2985, WR - 544 etc*. has performed well in comparison to local variety like NL. The average yield enhancement with this intervention ranges from 25-50 %. The farmers have not only ensured their crop but also save the investment by reducing the seed rate. They uses seed rate of 80-120 kg/ acre in case of local variety while above demonstrated varieties have reduced seed rate (50-60 kg/per acre). The paddy crop varieties for drought and flood tolerant like *Sahbhagi* and *SS-1* have helped the farmers to ensure their paddy crop. The enhancement in yield achieved upto 18- 20 % in case of short duration variety, 25-30 % for drought tolerant and 35 to 42 % in case of flood tolerant varieties. All these interventions enabled them to prefer with respect to suitability of variety and climate vulnearability.

Direct seeded Rice (DSR): The intervention on different methods of rice cultivation, the farmers have opted widely the practice of DSR method owing to labour problem during uprooting of paddy seedlings and transplanting it to the puddled field. It saves 30 to 35 man days per ha in comparison of transplanted paddy. It also saves time, labour, capital involves in raising seedlings as no seedling raising is needed in case of DSR.

16.3.2 Introducing flood tolerant varieties:

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 rice variety (Var. *Swarna Sub-1*)	191	66	35.61	25.91	41.29	22426	27336	2.22

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

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
Wheat (var. *WR-544*)	29	13.25	46.1	32	44	20400	34920	2.71
Maize (var. *DHM 117*)	34	3	65	59	12	20500	51000	3.48
Mustard (var. *R. Suflam*)	230	56	9.05	6.125	47.25	15375	19425	2.27
Potato (var. *K. Ashoka*)	39	3.1	205	157.5	30	65250	47250	1.72
Total	**332**	**75.35**						

16.3.4 Water saving paddy cultivation methods:

Table. Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Paddy Seed (var. *Sahbhagi*)	163	121	29.66	21.7	31.7	24300	19160	2.27
DSR (var. *Sahbhagi*)	62	12	29	24	20.5	20250	23550	2.145
Total	**225**	**133**						

Impact : The intervention on rice cultivation method, DSR has farmers taken hand to hand as it has relieved them from being worried about the laborer for uprooting of paddy seedlings and transplanting it to the puddled field. It saves 30 to 35 man days per ha in comparison of transplanted paddy. It also saves time, labor, capital involves in raising seedlings as no seedling raising is needed in case of DSR

16.3.5 Community nurseries for delayed monsoon:

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 Bottle guard, Sponge guard	19	0.6	160	125	28	75000	187500	3.2
Total	**19**	**0.6**						

Impact: The raising of early summer vegetable seedling in open field in this area start in last week of February due to cold wave that continue till the last week of February or extend up to the first week of March. This intervention has helped the farmers a lot to raise the seedling of early summer vegetable in one month advance and farmers are able to bring their produce early in the market and fetch good price.

16.3.6 Location specific intercropping systems with high sustainable yield index:

Table. Performance of different location specific intercropping systems

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Potato (var. *Pukhraj*), Radish (var. *Pusa chetki*)	50	2.0	LER 1.42	LER 1.42	19	66500	84000	2.26
Wheat, Mustard	15	5	LER 1.61	LER 1.48	8.7	19500	37690	2.9
Total	**65**	**2.5**						

Impact: Vegetable Seedling raising under poly tunnel: The raising of early summer vegetable seedling in open field in this area start in last week of February due to cold wave that continue till the last week of February or extend up to the first week of March. This intervention has helped the farmers to raise the seedling of early summer vegetable one month advance and farmers are able to bring their produce early in the market and fetch good price.

16.3.7 Introduction of new crops/ crop diversification:

Table. Performance of different crop diversification in NICRA villages

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Mustard (var. *R. Suflam*)	230	56	9.05	6.125	47.25	15375	19425	2.27
Red Gram (var. *NDF-1*)	30	15	13.5	8.5	28	12500	48250	4.8
Potato (*K. Kanchan*)	8	10.9	220	155	50	65500	66500	2.02
Tomato (var. *K. Ashoka*)	39	13.0	205	157.5	30	65250	47250	1.72
Cucurbits	42	3.5	150	112.5	34	71500	178750	3.5
Green gram (*tmv-13*)	41	10	170	121.2	35	61500	47050	3.2
Lemon Grass (var. *CKG 25*)	35	10	50	45	30	20000	7500	1.37
mENTHA (var. *Koshi-16*)	10	3.0	60	40	50	12535	48255	4.9
Sunflower (var. *KBSH-44, Krishna-3303*)	97	20	75	55	60	15375	19400	2.29
Papaya (Short duration variety *T 397*)	40	10.4	80	70	33	12555	47271	4.3
Banana (*G-9*)	66	20.25	66	51	22	12078	46127	3.2
Okra, cauliflower	123	7	120	70	71.4	36000	60000	3.2
Cucubits under mulching	45	19	175	125	0.40	23000	82500	4.6
Total	**806**	**198.05**						

16.3.8 Other Demonstrations:

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
Promotion of stem rot resistant Jute (var. *JBO-2003H*)	50	9	19	15	26.66	25500	32500	2.39
Integrated crop management of mustard (*NC-1*); lentil (Maitri);	282	24.85	22	19	27.33	27.00	34500	2.73
Integrated disease management in vegetables	88	10	230	170	35	68600	46400	1.67
Contingency crop Brinjal (var. *PUSA Uttam*); Cauliflower (var *PUSA Sharad*); Radish (var. *PUSA Chetki*)	76	17	27	19	42.10	23834	15833	1.66
IFS	2	0.5	151	121	10	1227000	559000	1.45
late blight disease of potato	88	10	2.30	170	35	68600	46400	1.67
Mushroom	93	13.2	9.66	5	93.33	277	817	3.94
Forest tree plantation	140	4	Mahogani trees plantation					
Total	**819**	**88.55**						

16.4 Module III: Livestock & Fisheries

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

Table. Performance of different fodder demonstration in community lands

Technology demonstrated	No. of farmers	Unit/ Area (ha)	Output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Berseem Vardan	67	4	565	350	61.9	45200	161600	4.57
Berseem multicut	34	2	350	250	40	50000	90000	2.81
Quality legume fodder Berseem (var. *Muskavi*)	137	8.8	488.3	306	59.57	45167	150167	4.32
Quality legume fodder Sudan chari	38	4.0	562	351	60.1	45222	168550	4.58
Fodder cultivation with improved varieties Hybrid Napier	10	0.01	92	61	50	21500	45000	2.88
Total	**286**	**18.81**						

Impact: Fodder production and feed supplement: The intervention on fodder production with the demonstration of Barseem, Oat, Hybrid Napier Bazra etc. has helped the farmers to provide quality fodder to their cattle's during drought and flood situation. This has not only improved the cattle health but also increases the milk production by 80-100 litters in one lactation period. The feed supplement area specific mineral mixture, Goumix has increases the milk production by 1.5 kg per day.

16.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination HS,BQ/FMD	333	1000	0/100	15/100				
Animal Treatment Camp Butox, Prajana, Sulpha Dimadin, Oxytetra cycle	325	1100						
Proper De-worming	638	913	6.9 kg/day/cattle	6.7 kg/day/cattle	4500			
Total	**1296**							

Impact: Animal Health: Preventive vaccination, Deworming, Improved shelters for reducing heat stress in livestock *etc*. has improved the health of the animals and increased the milk production by 0.2 kg per day per milch animal.

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

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
Renovation of defunct fish ponds and tilapia, Singhi, Magur, Annabus & lata species cultivation	5	5						
Mango	36	16	14.25	10.25	39.0	57500	146400	3.54
Pond	36	16	14.25	10.25	39.0	57500	146400	3.54
Total	**77**	**37**						

16.4.4 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry Gram	16	500	2 kg	1 kg	100%	1500		
Addition of mineral mixture	447	632	4.5kg/day	3.0kg/- day	50	13500		
Total	**163**	**1132**						

16.5 Module IV: Institutional Interventions

16.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. *Rajendra Sweta, Naveen, Jaldi Dhan 13, Madhuri*	20	Quality seed	65	40
Commodity groups	Kitchen Gardening		Improved Variety Seed	25	30
Custom hiring centre	Power tiller	2	Implement supplied to the farmers from CHC	50	53
Collective marketing	Onion/ Vegetable	1	-	40	18
Climate literacy through a village level weather station	Temperature, Relative humidity, Rainfall, Wind speed and direction	1 unit	Weather forecast	Villege farmers	-
	Weather station SMS/Voice SMS		Data interpretation of AWS and forecasting/Advisory	”	
	Automatic weather station	1	Manual reading of weather parameter	”	

16.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Village Climate Risk management Committee

16.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Supaul		87485

16.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	7	280	30	310
Crop Management	20	691	73	764
Nutrient Management	1	35	NIl	35
Farm implements and machinary	15	365	64	429
Crop Diversification	5	124	45	169
Nutritional garden	1	17	8	25
Nursery raising	8	193	14	207
Protected cultivation	2	34	14	48
Livestock and Fishery Management	13	321	92	413
Fodder and feed management	6	169	41	210
Value edition	4	90	35	125

The different capacity building activities like training on various topics, exposure visits, methods demonstration *etc*. has increased the knowledge base of the farming community and now they are able to save their crop from damage by different factors up to some extent. To strength their knowledge base and to adapt the new and climate resilient technologies, 157 numbers of trainings have been organized. In which about 4938 male and 464 females have been trained on different subject like Polytunnel, Zero tillage technology, Mulching, Farm machinery and implements, Micro irrigation, pest and diseases management, Nutrient management, Application of bio-fertilizer, micro irrigation, scientific cultivation of major crops like paddy, wheat, jute etc. Now farmers are somehow capable of selection of appropriate verities, and timely application of plant protection measures, seed treatment etc. Whereas institutional setup like formation of village climate risks management committee (VCRMC), seed bank custom hiring center (CHC) *etc*. has brought together different group of people. There is also a saving bank account in the name of VCRMC has been opened to save the contribution received from custom hiring center. This saving account has a total sum of deposits Rs.87485/- at the end of year 2016-17 This has enabled them to put collective efforts and work together for their own as well as betterment of the community in the climate changing scenario.

16.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Diagnostic visit, Exposure visits, Field Day, Group Discussion, Method demonstrations, Method demonstrations, Popular extension literature, Animal Health Camp, World earth day, Krishak Chaupal, Technology week, NICRA Workshop at ATARI, Kolkata, Scientist visit to field	1343	8862	1210	10072

16.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
250	200	200	200

16.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme/Programme	Nature of work	Amount (Rs.)
Animal Vaccination	Vaccination of cattle, Bufallow *etc*.	12500

16.10 Success stories of NICRA Village Farmers

1. Success Story of Ramanand Sah

Sri Ramanand Sah, S/o Sri Khushi Lal Sah, Ward No – 2, Village Sadanandpur is a 30 years old and progressive farmer of the NICRA project Village Sadanandpur. He is also an active member and secretory of the VCRMC. He own 16 acres of land. He has grown improved variety of Jute crop, JRO-66 in 2.5 acres of land. He got bumper yield of 20 q/ha whereas traditional variety has given the yield of 14 q/ha. A 42% yield increase has been achieved. He has applied scientific method of Jute cultivation like use of new and improved variety, balance fertilizers dose and application of bio fertilizers like PSB and *aztobactor* at the rate of 5 kg each per hectare. Low yield 14 q/ha of Jute crop had started demotivating the farmers to take Jute crop. But few steps taken by him as mentioned above has helped him as well as other fellow farmers to take Jute crop. With the help from NICRA project of KVK Supaul the gross return of Rs. 60,000 per hectare with increase of 43% over traditional variety has been achieved. The lands were left barren after the harvests of jute are now getting cultivated with short duration Paddy var *Prabhat*. The income of the farmers has been increased significantly.

2. Success Story of Sri Bindeshwari Mandal

Sri Bindeshwari Mandal is a 40 Years old progressive farmer of the NICRA project village Sadanandpur. He is an active member of village climate risk management committee (VCRMC). He owns 4 acres of irrigated land, 3 milch animal /d 2 drought animals. He is having a farming experience of 25 years. He has adopted Direct Seeded Rice from last three years. He has learned about DSR from training and demonstration given by the KVK, Supaul under NICRA project. He has cultivated 2 Acres of land through DSR method. He has achieved 26 qt/ha of yield in comparison of 22 q/ha in case of traditional practice. There is an increase of 18% in yield has been observed where as his gross return has been increased by Rs. 5600.00. There is also a good saving of labor and time and capital. The labor requirement for transplanting one hectare of paddy is about 40 whereas in DSR it requires hardly one man days to sow paddy in one hectare area. He is happy with this method of district seeding. He is also motivating other fellow farmers in the village to adapt Direct seeded Rice (DSR). With his efforts the numbers of DSR practicing farmers are increasing.

3. Bamboo boring successful intervention

Sadanandpur, a NICRA project village of KVK Supaul. The total household, of the village is 1271. Its geographical area is about 2200 ha in which irrigated area are 700 ha which were only 400 ha before the initiation of the NICRA project. The appropriate and required irrigation facility is the major problem in the village. Because of this farmers are unable to provide irrigation to the crop as and when required. This leads to poor yield and reduced income from Agriculture. Geographical condition makes this village prone to suffer from flood and drought both. This village is situated adjacent to the east embankment of river *Koshi*. This village gets more seepage water when the water level in the *Koshi* river rises and low lying area gets flooded. However upland area remains deprived of water. This leads to poor yield and reduced farmers income.

Keeping in view of the above problem, the KVK on priority basis established 50 number of bamboo boring in last two years to provide the supplemental irrigation to ensure the crop. The establishment of these bamboos boring has increased the irrigated area from 400 ha to 700 ha. This has also helped the farmers to get better crop of paddy, wheat, jute potato, summer vegetable, mustard, winter vegetable etc. The productivity of the major crop likes paddy, wheat, jute, potato *etc.* has been enhance by 30-40%.

17. Buxar

17.1 Village information:

Name of the village	Kukurha
No. of households	890
Total cultivated area (ha)	622.25
Area under rain fed cultivation (ha)	522.69
Major soil type	Loam to Clay loam
Climatic vulnerability of the village	Drought and Heat wave

17.1.2 Rainfall trend of the district

Year	Normal rainfall (mm)	Total rainfall (mm) Jan-Dec	Rainy days (No.)	Dry spells > 10-15 days (No.)	Dry spells > 15 days (No.)	No. of highest rainfall intensity events (>60mm)	Rainfall (mm)		
							Kharif	Rabi	Summer
2011	1021.5	716.49	33	1	-	-	621.74	25.7	16.18
2012	1021.5	914.16	26	-	-	-	815.5	180	49.46
2013	1021.5	681.4	19	03	01	1	681.4	50.0	58.5
2014	1021.5	621.40	26	1	8	-	453.3	137	37.1
2015	1021.5	865.70	32	1	6	-	783.7	61.5	18.5.0
2016	1021.5	416.00	19	1	1	-	396.7	16.8	54.6
2017	1021.5	800.02	21	1	2	3	800.0	-	-

Major climatic vulnerabilities experiences during the last five year (2011-16) were erratic, untimely and excess or heavy rainfall. Some time intermittent drought, cold wave like situation occurred during grand growth stage and flowering stage in Paddy and other kharif crops like paddy, pigeonpea and sorghum , which affect the crop severely. In the year 2012, 2013, 2015 and 2016 the rainfall received during the month of June was less than normal rainfall (1021.5 mm) which vary from 35 to 64% less than normal

17.1.3 Predominant farm enterprises

i. **Cropping pattern:** Rice-Wheat/Chick pea/ Lentil-Moong/ MP Chari/

ii. **Major cropping system:** Rice-Wheat

iii. **Area and productivity of major crops:**

Crop	Area (ha)	Yield (q/ha)
Paddy	457.0	44.20
Bajra	36.0	16.75
Wheat	415.0	37.20
Chick pea	55.5	15.20
Lentil	68.8	14.75
Oat	12.4	480
Pea	11.50	14.70
MP Chari	8.0	495.0

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

Crop	Name of the variety/ hybrid (s)	No. of farmers using improved varieties / hybrids	Area under improved varieties / hybrids (ha) in the village
Paddy	*MTU 7029, BPT 5204, Naveen, Sahbhagi, Sushk Samrat, Rajendra Sweta, Induri Sambha PRH-10, CR 909*	498	536.0
Sorghum	*MP CHARI*	53	14.4
Wheat	*PBW 502, LOK 1, WR 546, DBW 17, HD 2967, HD 2985, HUW 234, DBW 17, HD 2967*	384	403.0
Chick pea	*AWRODHI, WR 544, GNG 1581, BGM 547*	83	56.8
Lentil	*HUL 57, ARUN, IPL 81*	71	25.0
Mustard	*PUSA 28*	52	14.4

v. **Cropping intensity (%):** 200

vi. Horticulture crops:

Crop	Area (ha)	Yield (q/ha)	Name of the variety/ hybrid (s)	Area under improved varieties / hybrids (ha) in the village
Mango	1.20	95.0	Malda, Dashehri, Loknayak, Amrapali	1.20

vii. Area under fodder cultivation and number of farmers growing green fodder: Total area 18.5 ha. /255 farmers

viii. Livestock:

Livestock type	Total number	No. of livestock owner	Share of improved breeds (%)	Major livestock diseases	Extent of vaccination (%)	Mortality rate (%) due to diseases
Cattle, sheep,fish fingerlings	716,565, 1000	286,3,2	60	FMD, HS, BQ, Mastitis, Degnala	60	2

ix. Milk productivity (L/milch animal/day): 6-8L per day

x. Details data about inland fisheries practiced: 2 ponds

17.1.4.Resource availability

17.1.4.1 Status of common pool resources (CPRs)

Year	CPR	Area (ha) or Numbers	Current status (before start of NICRA)	
			Before NICRA	After NICRA
2011-12	Pond	3 unit	2 unit	1 unit
2012-13	Pond	4 unit	2 unit	2 unit
2013-14	Pond	6 new	2 unit	5 unit
2014-15	Pond WHS	7 new	2 unit	9 unit
2015-16	Pond WHS	10 new	2 unit	10 unit
2016-17	Pond WHS	10 new	2 unit	10 unit

17.1.4.2 Summary of Water harvesting interventions taken up in the NICRA village

	Structures/Years of Construction	Category	Total
1	No. of farm ponds/Jalkund	Constructed	14
		Repaired/ Renovated	02
2	Community pond /tank	Repaired/ Renovated	01
3	Recharging of open/tube wells with silt trap	Repaired/ Renovated	26
4	Arhars/pynesetc	Renovated	05

17.1.4.3 Status of farm mechanization before start of NICRA: Poor

List of Farm implements available in the village:

i. Tractor 15 No.
ii. Thresher 05 No
iii. Tube well 439 (shallow) & 01 (deep)
iv. Winnowing fan 275No

17.1.5 Socio-economic status:

a. No. of households- General: 5; **OBC**- 763; **SC**- 98; **ST**- 24
b. Literacy rate (%): 46.45 :: **Male:** 54.50; **Female:** 38.36
c. Average family income from agricultural and allied activities
d. Workers engaged in agricultural activity (%): 87

MODULE WISE INTERVENTIONS

17.2 Module I: Natural Resource Management

17.2.1 In-situ Moisture Conservation - Resource Conservation Technology:

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
Summer Ploughing in Paddy (var.*MTU 7029*)	65	43.5	59.20.	29120	50800	2.74
Green manuaring (dhaincha) in Paddy (var. *BPT 5204*)	30	15	61.6	29610	53550	2.80
Brown manuaring in Paddy (var. *Naveen*)	20	10	54.52	31200	40195	2.28
Raising bund height around rice	45	20	53	30400	39030	2.20
Green manuring of paddy	55	10	54.2	31100	39902	2.28
Zero Tillage in wheat, Chickpea *JG11*, lentil var. *Arun*	197	133	42.44	25500	37488	2.47
Pulses production in farm bund, Pigeonpea var. *Narendra Arhar 2*	50	2.5	14.6	20670	37730	2.82
Paddy Crop residue management through Happy seeder for wheat var. *HD2967*	25	7.5	40.50	26600	28075	2.05
Low energy water application in Paddy var. *BPT 5204*	40	20	48.35	27350	27285	1.99
Furrow irrigation on raised bed system in wheat var. *PBW 502*	20	12.5	36.25	24820	24117	1.97
Organic mulching in vegetables (Okra) var. *Arka Anamika*	30	1.5	280	58500	137500	3.35
Total	**577**	**275.5**				

17.2.2 Water harvesting and recycling for supplemental irrigation:

Table.Performances of water harvesting and recycling for supplemental irrigation

Technology demonstrated	No. of farmers	Area (ha)/ Unit	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Renovation of pond for fish production and irrigation (Paddy var. *BPT5204*)	22	16	49.4	27400	39290	2.43
Bora bandhfor paddy crop var. *MTU7029*	25	8	61.6	29610	53550	2.80
Renovation of retention wall cum drainage for irrigation paddy var. *BPT 5204*	35	45	59.20	29120	50800	2.74
Bund making levelling in paddy field	45	20	53	30400	39030	2.20
Natural mulching	15	7	5	25400	37280	2.34
New water harvesting structure/ Retention wall cum drainage in the Paddy field	22	12.25	46.0	29700	56700	2.9
Total	**164**	**108.25**				

17.2.3 Conservation tillage:

Table.Performance of ZTD in various crops

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Sowing of wheat, paddy, lentil, chickpea, wheat, pea with ZTD machine	197	133	42.44	25500	37488	2.47
Total	**197**	**133**				

Impact: Keeping the slogan "Khetka pani khet me aur gaon ka pani gaon me" in the centre KVK has tried to educate the farmers to conserve the maximum of rainwater in their field through field bunding and in pond with an objective to recharge the ground water. Before NICRA farmers were aware about the importance of field bunding but they did not apply vigorously on their field as a result huge volume of water along with fertile top soil was washed out in nearby rivulets, nalas and rivers. Which resulted in siltation, water table of their existing borewells and wells went down. Keeping the vibrancy of the situation intervention field bunding was taken as an initiative as a mass campaign and 24 ha of farm field was bunded well during 2011-16 under NICRA. This initiative has left a big impact and farmers of NICRA and adjoining villages came forward and done field bunding properly every year in more than 800 ha area. Even through Sand bag check dam during off season, ground water has maintained 12-15 feet in wells and 130-140 feet in bore wells which was earlier went down to 4-5 feet in wells and 180-200 feet in bore wells

17.2.4 Artificial ground water recharge:

Table. Performance of artificial ground water recharge technologies demonstrated

Technology demonstrated	No. of farmers	Area (ha)	Output (q/ha)	Economics of demonstration (Rs./ha)		
				Gross Cost	Net Return	BCR
Field bunding for paddy	45	20	53	30400	39030	2.20
Water management through bunding of paddy fields (2.5 fit height and width 9 inch width)	25	8	61.6	29610	53550	2.80
Deep Summer Ploughing in Paddy (var. *MTU 7029*)	65	43.5	59.20.	29120	50800	2.74
Total	**135**					

17.2.5 Water saving irrigation methods:

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) HDP PIPE Delivery with LEWA for paddy	45	20	48.35	27350	27285	1.99
Application of biofertilizer in rice (var. *MTU 7029*)	77	30.8	66.25	29640	53172	2.79
Vermi-compost from biodegradable wastes	26	31.2	12.75/unit	3900/unit	3650/unit	1.93
Production of pigeon pea (var. *PRG-158*) on farm bund	11	10.25	14.30	21847	35353	2.61
Furrow irrigation on raised bed system in wheat var. *PBW 502*	20	12.5	36.25	24820	24117	1.97
LEWA in rice (var. *Rajendra sweta*)	33	20	48.35	27350	27285	1.99
Organic mulching in vegetables (Okara) var. *Arka Anamika*	30	21.5	280	58500	137500	3.35
Total	**242**	**146.25**				

17.2.6 Other Demonstrations:

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
In-situ vermicomposting in orchards	30	1.5	40.21	24755	35518	2.34
Soil test based nutrient application in wheat PBW502	86	20	41.20	24945	33417	2.33
Soil test based nutrient application (FYM/ inorganic fertilizer) on Onion	18	12.50	245.0	52600	167900	4.19
Role of rhizobium culture on yield of summer green gram var. SLM 668	30	14.00	12.25	19320	35805	2.85
Demonstration on multitier cropping system (mango and guava plant)	09	12.62	10.35	18230	34085	2.58
Production of Pigeonpea on farm bund Var.PRG 158	11	20.5	14.30	21847	35353	2.61
Nutrients management through rice-wheat crop manager tools for wheat var. PBW154	15	5.0	39.5	25850	31425	2.21
Total	**199**	**106.12**				

17.2.7 Rainwater harvesting structures developed:

Table: KVK wise rainwater harvesting structures developed during 2016-17

RWH structures	No.	Storage capacity	No. of farmers	Protective irrigation potential (ha)	Increase in cropping intensity (%)
Farm pond	08	20954.3 m^3	08	17.30	133
Checkdam	02	14000 m^3	110	68	100
Bora bandh (Temporary checkdam)	02	755 m^3	18	10.5	100
Total	**12**	**35709.3 m^3**			

Impact: Before implementation of the specific design intervention our core aim was to develop/ undertake the need based low cost initiative, which is farmer affordable, sustainable and replicable. Keeping the aim in the centre, KVK has focused on farmer involvement process and started the work by knowing and understanding the climate vulnerable current factors. In every module easily acceptable and replicable intervention was undertaken which has great potential to fight against the existing vulnerabilities. Based on their available resources plan was made and implemented. The major constraint was monocropping practices due to erratic, low rain fall and decreasing ground water level; however there was full scope for rain water harvesting , recycling and raising ground water level at village . under NICRA activities eight rain water harvesting structure were excavated at farmers field resulted 17.7 ha area irrigated in paddy field as well as 7.5 ha area of pre rabi irrigation of 23 farmers.

17.3 Module II: Crop Production

17.3.1 Introducing droughtresistant varieties:

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 paddy (var. *Sahbhagi, Naveen, Shusk smart*)	23	32.30	45	4O.25	11.80	28500	32250	2.13
Red gram (var. *PGR-158*)	11	10.5	14.30	12.70	12.59	21847	35353	2.61
Contingent Crops ToriyaVar. *B54*	55	12.0	15.5	13.30	16.54	18900	18687	1.98
Short duration vegetables as contingent crop Tomato var. *PUSA Gaurav, Brinjal* var. *PUSA Uttam*, Cauliflower var. *PUSA Sharad*,	100	12.00	350	290	20.6	43500	166500	4.82
Drought resistant WHEAT	10	22.0	37.5	30.25	23.96	25320	25305	1.99
Short duration variety of Bajra (var. *HHB67* and *VBH380*); Paddy Var. *Jaldi Dhan* 13, *Indurisambha*; Wheat (Var. *Lok1*)	115	30	31.25	26.6	17.48	18270	17948	1.75
Disease resistance (YMV) Moong (var. *SML-668*)	40	34	12.15	11.25	8.00	21320	34570	2.60
Total	**354**	**152.8**						

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

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
Wheat (var. WR-544);(HD2985)	10	12.0	37.5	30.25	23.96	25320	25305	1.99
Lentil (var. Arun)	45	10	11.60	9.40	23.40	20265	21495	2.06
Total	**55**	**22.0**						

17.3.3 Water saving paddy cultivation methods:

Table.Performances of water saving technologies for paddy cultivation

Technology demonstrated	No. of farmers	Area (ha)	Yield (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Direct seeded brown manured rice	12	4.0	49.4	40.25	22.7	27400	39290	2.43
Zero tilled rice	14	7.70	43.5	40.25	8.08	21700	37025	2.7
Total	**26**	**11.70**						

17.3.4 Community nurseries for delayed monsoon:

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
Raised Community nursery of paddy (var. *Naveen*)	31	13.5	45	40.25	11.8	28500	32250	2.3
Nursery Management of paddy (var. *Rajendrasweta, Indurisambha, Jaldi dhan 13*)	14	11.4	45.5	40.25	13.04	28210	28665	2.01
Paddy (var. *Indurisambha*)	03	10.30	45.25	40.25	12.42	27300	29262	2.07
Community nursery of paddy (var. *Jaldi dhan 13*), cauliflower (var. *pusasaral*), *brinjal* (var. *pusauttam*), tomato (var. *Pusa Gaurav*)	05	11.0	44	40.25	9.31	26500	28500	2.07
Total	**53**	**45.9**						

17.3.5 Introduction of new crops/ crop diversification:

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
Gram (var. *Pusa 362*)	25	16.25	14.5	13.0	11.53	16800	28150	2.67
Bajra (var. *HHB67, VBH380*)	115	30.5	31.25	26.6	17.48	18270	17948	1.75
Total	**140**	**46.75**						

17.3.6 Other Demonstrations:

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
Disease resistance moonbean (Var. *SML668*)	11	11.0	12.15	11.25	8	21320	34570	2.60
Short duration moong bean	06	11.5	11.25	9.75	15.38	24800	25825	2.04
Vegetable pea KashiUday	20	22.0	52	46	13.04	25500	26500	2.30
Improve onion variety AFLR	53	25.0	352	320	10	43300	132100	3.04
IPM in Chickpea, Rice	40	15	12.50	11.20	11.60	16500	21000	2.85
Mushroom	35	35	45Kg/u	-	-	1260/unit	2340	2.85
Total	**165**	**117.0**						

17.4 Module III: Livestock & Fisheries

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

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
Berseemvar. Muskavi	66	11.25	960	750	28	28800	67200	3.33
Quality legume fodder Oat (var. *JHO-822*)	38	14.0	500	425	17.60	23400	26600	2.13
Sorghum (Moti)/ MP Chari	45	13.94	380	325	16.92	21400	16600	1.77
Cowpea	02	20.5	330	280	18	23500	18560	5.61
Total	**151**	**59.69**						

17.4.2 Preventive vaccination:

Table. Performance of various vaccination camps organized

Technology demonstrated	No. of farmers	Unit/ No./ Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Vaccination HS,BQ	250	35.00	-	-	-	-	-	-
Animal Treatment Camp Butox, Prajana,SulphaDimadin ,Oxytetra cycle	150	32.00	-	-	-	-	-	-
Proper De-worming	190	32.10	-	-	-	-	-	-
Fish farming	05	30.60	5.5	-	-	19500	41500	3.12
Total	**595**	**129.70**						

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

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

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output (q/ha)		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Composite Fish Farming	01	35x22x1.75mt	5.9	-	-	20780	44470	3.14
	01	29.8x17.3x1.10 mt	3.5	-	-	12485	26070	3.09
Total	**02**							

17.4.4 Livestock demonstration:

Table. Performance of livestock demonstration in NICRA adopted villages

Technology demonstrated	No. of farmers	Unit/ No. / Area (ha)	Measurable indicators of output		% increase	Economics of demonstration (Rs./ha)		
			Demo	Local		Gross Cost	Net Return	BCR
Rural backyard poultry Kuroiler Birds day old chicks	160	378	1.0 kg of four month	0.75 kg of four month	33	80/bird	20/bird	1.25
Total	**160**							

17.5 Module IV: Institutional Interventions

17.5.1 Table. Details of the various institutional interventions

Interventions	Details of activity			No. of farmers	Unit/ No. / Area (ha)
	Name of crops / Commodity groups / Implements	Quantity(q) / Number / Rent / Charges	Technology used in seed / fodder bank & function of groups		
Seed bank	Rice- Drought tolerant/ Short Duration Var. RajendraSweta,Naveen,Jaldi Dhan 13,Madhuri	400 Kg	Quality seed(TL)	5	2
Commodity groups	Kitchen Gardening	12 ha	Improved Variety Seed	9	3
Custom hiring centre	Power tiller	5 no	Managed by VCRMC	152	40
Collective marketing	Onion/ Vegetable	01	Manual reading of weather parameters	01	12
Climate literacy through a village level weather station	Temperature, Relative humidity, Rain fall, Wind speed and direction	500		Villege farmers	

17.5.2 Village Climate Risk Management Committee (VCRMC)

Name of the VCRMC: Kukurha Buxar

17.5.3 Custom Hiring of Farm Implements and Machinery at NICRA Adopted villages

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

Name of KVK	2011-12 to 2016-17	Revenue generated (Rs.) Total under VCRMC
Buxar		18500

17.6 Capacity Building organized during 2011-12 to 2016-17

Thematic area	No. of Courses	No. of beneficiaries		
		Male	Female	Total
Natural Resource Management	26	510	10	520
Resource conservation technology	12	240	Nil	240
Nutrient Management	46	875	50	925
Repair and Maintanance of farm machinery and implemenbts	1	20	Nil	20
Value adition	2	25	25	50
Pest and disease management	6	135	10	145
Nursery raising	2	60	10	70
farm implements and machinary	1	20	Nil	20
Livestock and Fishery Management	26	525	5	530
Fodder and feed management	1	30	Nil	30
Employment generation	1	40	10	50

17.7 Extension Activities conducted during 2011-12 to 2016-17

Name of the activity	Number of Programmes	No. of beneficiaries		
		Male	Female	Total
Agro advisory Services, Awareness, Exposure visits, Field Day, Group Discussion, Method demonstrations, KMAS Services, Farmers day, SHG, Campaign, Environmental day, Gram Sabha, Kishan Gosthi, Farmer to Farmer interaction (DDG Ag. Ext.) ICAR, Technology week, NICRA Workshop	1123	5617	1019	6636

17.8 Soil Health Cards distribution during 2011-12 to 2016-17

Table- SHC card distribution at NICRA adopted villages

No of soil samples collected	No. of samples analysed	SHC issued	No of Farmers involved
266	266	266	266

17.9 Convergence Programme:

Table- Convergence of ongoing development programmes / schemes

Development Scheme /Programme	Nature of work	Amount (Rs.)
MNEREGA	Earth and Brick soling at Dakshin Tola & Pachim Tola	105540
	Earth work for Harijan Tola, kabir groud *etc.*	5800000
DRDA	Installation of 02 bio-gas unit	48000
Total		**5953540**

17.10 Success Story of NICRA villeges farmers

1. Multifarious use of water harvesting structures for sustainable livelihood

The previous dry spell has lasted for three consecutive years in the district. Drought situation has resulted in depleting groundwater levels at Kukurha village Block Itarhi Buxar. The collected rainfall data from the district and NICRA project survey for the last five years (2006-10) averages 891 mm.

A demonstration action in this regard was carried out at farmers' field under NICRA activities in the year 2011-12 to provide life saving irrigation to the crops and livestock under drought condition by conserving runoff water and recharging ground

water. Four water harvesting structures (WHS) encompassing a total area of 0.27 ha of 1.5 m depth which was 10 percent of the farmers' field was excavated and the reshaping cost of WHS cum secondary reservoir at farmers field was Rs 191/ m^3. During monsoon season, the runoff water from catchment area filled the pond with a total volume of 4259m^3 water enough to provide irrigation to 42 ha land with 1cm^3 water in

rice/ vegetable and pre sowing irrigation for wheat. Besides it recharged the ground water level by 2-3 ft.

The multifarious use of water was made by Polyculture of fish and duck production in these water harvesting structures. These farmers just provided feed *viz.*, Rice bran and mustard oil cake to fish and soaked paddy to ducks. In a small sized (27m X 27m X1.75 m) pond with 500 fingerlings and 21 ducks the farmer could reap a net income of Rs. 1200/ per annum from fish and Rs. 1285/ - from Ducks in six months. At some farmers' ponds predation of Ducks from its natural enemies cats caused mortality.

2. Happy Seeder: A viable option to avoid burning of rice residue

The productivity of rice and wheat has recently stagnated and declined owing to climate change and reduced soil

productivity, posing a serious threat to the sustainability of the rice-wheat cropping system. Combine harvester have recently been introduced with exponential growth in mechanical harvesting of wheat in the better endowed rice-wheat growing area of eastern India. The Farmers of district Buxar, generally burn rice residue prior to wheat sowing as the cheap and easy option to clean their fields but burning leads to losses of soil organic matter and nutrient (especially N, P, K, S and C) and creates environmental pollution. The demonstration of Happy seeder in the adopted village has provided an alternative to avoid burning for managing rice residues and allows direct drilling of wheat in standing as well as loose crop residues. The demonstration was made in 5 ha area at 10 farmer's field. The farmers experience reveals that it saves soil moisture and fewer emergences of weeds as well as increasing time interval between irrigation due to residue is working as mulch.


3. In-situ moisture conservation through RCT (Crop residue management through happy Seeder)

The crop residue management through happy seeder was demonstrated on wheat, at 10 farmers field in 50 ha area covered, which added 4.2 tones residue, resulted 35.5 q/ha yield was obtained against the local practice 13.78 percent increased yield. The cost of cultivation was reduced by sowing through happy seeder and checks the wheat germination and improves soil fertility.


4. Low Energy Water Application (LEWA) for water saving under drought condition

Farmers practice flood irrigation. Efficient use of available water is the need of the hour. Irrigation water for field crops is available when monsoon is normal. No micro irrigation system exists in the village and paucity of water for irrigation limits the acreage under plough and farmer are applying flood irrigation. Low Energy Water Application (LEWA) demonstration at farmers' field was made for efficient water usage in Paddy crop. Eight demonstrations in total 4 hectares of land were conducted. The average yield was 48.35q/ha of paddy at farmers' field. The BC ratio of demo was 1.99. The technology reduces operational cost, time, energy and water.


5. Community Rain Water harvesting structures for life saving irrigation at NICRA Project adopted village

The Hume pipe outlet, retention wall 90m and drainage channel 2,320mt length was constructed in existing community rain water harvesting structure by the minor irrigation department, Buxar with technical support of KVK at village Kukurha. To avoid evaporation and less of water covering more irrigated area in farmer's field. RWH was strengthened to irrigate about 120 ha area under rice cultivation during the less/no rainfall and water is used in short duration *Rabi* crops likes vegetables, oilseed and pulses crop to fetch the additional income to the farmers. It is very much useful to recharge the ground water which can solve the problems of minimization of CO_2.


6. Mushroom production for Nutritional security and income generation

Oyster Mushroom production was conducted in 50 units for marginal and landless farmers for nutritional security and income generation. Every demonstration containing 10 cubes gives Rs. 1,480/- in 30 to 40 days of interval obtaining the yield 18 kg/10 cubes @ Rs. 80/kg. the cultivation of Mushroom is very much popularized in Buxar district and day by day demands increased in hotels and local market. The cultivation is very much popularized and entrepreneurship developed by 06 farmers


NICRA-TDC Project Sites

West Bengal, Bihar, Jharkhand, Andaman and Nicobar Islands

Notes