वार्षिक प्रतिवेदन
ANNUAL REPORT 2022

भारतीय कृषि प्रणाली अनुसंधान संस्थान
INDIAN INSTITUTE OF FARMING SYSTEMS RESEARCH

भाकृअनुप
ICAR

ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut - 250110, INDIA

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भा.कृ.अनु.प. भारतीय कृषि प्रणाली अनुसंधान संस्थान
मोदीपुरम मेरठ–250110 (उ०प्र०) भारत

ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut-250 110, (U.P.) India

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PREFACE

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (Uttar Pradesh) is a unique institute oriented to take up research on the management of natural resources for holistic improvement of small and marginal farmers through Integrated Farming Systems (IFS). Institute has 71 years of glorious history for its service to the nation through strengthening and evolving farming practices for food, nutritional, livelihood and environmental security. IFS approach is particularly relevant to address many challenges in today's agriculture including profitability, production sustainability, resource use efficiency and climate change.

During the year, the Institute has undertaken various research activities through three research divisions namely Integrated Farming Systems, Organic Agriculture Systems, Cropping Systems and Resource Management and one section namely Technology Transfer and Assessment. Besides this, two national schemes i.e. All India Coordinated Research Project on Integrated Farming Systems (AICRP-IFS) and All India Network Programme on Organic Farming (AINP-OF) were operated with 74 centres covering all 15 Agro-climatic regions and 25 states/UTs and 20 centres covering 10 Agro-climatic regions and 16 states, respectively.

The research projects of Institute during the year included 26 In-House, 29 Outside funded and 03 Consultancy projects. The major accomplishments included sustainable resource management for climate smart IFS, refinement of farming systems for food and nutritional security, development of farm machinery and tools for IFS models, development of package of practices for organic production systems, studies on conservation agriculture and climate resilient approach for adaptation and mitigation of climate change, impact of IFS interventions etc. The up-scaling of technologies were attempted through outreach programmes viz. SCSP and Farmers FIRST by covering a total of 1985 households in 17 villages in four districts of Uttar Pradesh and Uttarakhand. The Institute has also disseminated informations and technologies to farmers through modern IT and social media tools i.e. dedicated Apps, WhatsApp, YouTube, twitter and also organized several *Kisan Gosthis*, field days and awareness programmes.

Over the years, 71 prototype IFS models and 08 Integrated Organic Farming System Models have been developed under AICRP on IFS and AINP-OF, respectively. For up-scaling through state line departments, 32 bankable IFS Models for 23 states have been identified. Organic and Natural Farming farmers from 16 states have been characterized and biochemical characterization of 05 inputs and validation of ITKs (Indigenous Technical Knowledge) have been conducted. Efforts towards research in Natural Farming has also been made with testing of Natural Farming concoctions in rice-wheat cropping system at 04 locations and evaluation of Natural Farming in different ecosystems covering eight major cropping systems in 16 states.

I express my gratitude to Dr Himanshu Pathak, Secretary, DARE and Director General, ICAR, New Delhi; Dr. Trilochan Mohapatra, Ex.-Secretary, DARE and Director General, ICAR, New Delhi and Dr. S.K. Chaudhari, Deputy Director General (NRM), ICAR, New Delhi, for their constant guidance, encouragement and support. I also extend my appreciation and thanks to Dr Rajbir Singh, ADG (AAFCC) of ICAR, New Delhi, Dr. S. Bhaskar, Ex. ADG (AAFCC), ICAR, New Delhi, and other staff members of the NRM division, ICAR HQ for their cooperation and support. The contributions of Dr A.S. Panwar, Ex. Director ICAR-IIFSR are gratefully acknowledged for his guidance and coordination to achieve the targets of the Institute. The support of all the staff including scientific, technical, administrative, supporting and contractual is duly acknowledged for taking up Institute's Programme and activities. Lastly, I would like to acknowledge the sincere efforts of the PME Cell, Heads of divisions/units/sections and editorial committee for compiling and publishing this report in a timely manner.

(Sunil Kumar)

कार्यकारी सारांश

1. संस्थान का नाम व पता: भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ (उत्तर प्रदेश) 250110

2. बजट : (2022-23)

क. संस्थागत (₹ लाख में)

				बजट	व्यय		
प्रावधान	व्यय	सरकारी अनुदान	परिषद के शेयर से मुख्यालय द्वारा प्रदान की गई अतिरिक्त राषि	कुल आवंटन (कॉलम 3+4)	कुल आवंटन से हुआ व्यय	सृजन राजस्व से हुआ व्यय	कुल व्यय (कॉलम 6+7)
1	2	3	4	5	6	7	8
2015.00	**2013.85**	**2015.00**	**100.00**	**2115.00**	**2113.85**	**-**	**2113.85**

ख. वाह्य स्रोत (₹ लाख में)

स्रोत	बजट	व्यय
वाह्य वित्त पोषित परियोजनाएं	237.71	131.48
कुल	**237.71**	**131.48**

ग. राजस्व प्राप्ति (2022-23) (₹ लाख में)

स्रोत	धनराशि
प्रक्षेत्र उत्पाद एवं अन्न, फल, सब्जी, मत्स्य, दूध एवं पशु विक्रय	49.22
लाइसेन्स शुल्क/जल शुल्क	8.73
विविध	3.01
ऋण एवं अग्रिम राशि पर ब्याज	1.02
टी.डी.आर. पर ब्याज	5.74
अन्य (रॉयल्टी और संस्थान शुल्क)	2.59
कुल	**70.38**

3. कर्मचारियों की स्थिति (31.12.2022 तक)

श्रेणी	स्वीकृत	स्थिति	रिक्त
वैज्ञानिक वर्ग			
निदेशक	01	01	00
विभागाध्यक्ष	03	00	03
परियोजना समन्वयक - एआईसीआरपी-आईएफएस	01	00	01
प्रधान वैज्ञानिक	00	03	03+
वरिष्ठ वैज्ञानिक	08	06	02
वैज्ञानिक	28	19	09
उप-योग	**41**	**29**	**12**
तकनीकी कर्मचारी वर्ग			
श्रेणी-3 (टी-6,7/8,7/9)	02	01	01
श्रेणी-2 (टी-3, टी-4 एवं टी-5)	19	09	10
श्रेणी-1 (टी-1 एवं टी-2)	03	03	00
उप-योग	**24**	**13**	**11**
प्रशासनिक कर्मचारी वर्ग			
वरिष्ठ प्रशासनिक अधिकारी	01	01	00
वरिष्ठ वित्त एवं लेखाधिकारी	01	00	01
सहायक प्रशासनिक अधिकारी	02	02	00
सहायक	08	03	05
वरिष्ठ लिपिक	03	03	00
निजी सचिव	02	02	00
व्यक्तिगत सहायक	02	02	00
कनिष्ठ आशुलिपिक	00	01	+01
कनिष्ठ लिपिक	03	02	01
उप-योग	**22**	**16**	**06**
सहायक कर्मचारी वर्ग	25	23	02
कुल योग	**112**	**81**	**31**

परिचय

भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) अपनी स्थापना के बाद से राष्ट्रीय स्तर पर फसल प्रबंधन प्रथाओं के आंकलन और मूल्यांकन के लिए पोषक तत्वों के कुशल उपयोग और उपयुक्त वैकल्पिक फसल प्रणालियों और पद्धतियों को प्रोत्साहित करने; कृषि प्रबंधन पद्धतियों के विकास के क्षेत्र में विगत 71 वर्षो से महत्वपूर्ण योगदान दे रहा है। यद्यपि, वर्ष 2010 के बाद से कृषि के समग्र मुद्दों को संबोधित करने के लिए संस्थान के कार्यक्षेत्र को फसल प्रणाली से कृषि प्रणाली के परिप्रेक्ष्य में बदल दिया गया। वर्तमान में कृषि प्रणाली अनुसंधान; कृषि में उत्पन्न चुनौतियों जैसे लाभप्रद खेती, उत्पादन निरन्तरता, संसाधन प्रयोग दक्षता, खाद्य एवं पोषण सुरक्षा, रोजगार सृजन एवं जलवायु परिवर्तन के हल खोजने में महत्वपूर्ण उपाय के रूप में उभरा है।

यदि संस्थान के संक्षिप्त विकास यात्रा का अध्ययन करें तो ज्ञात होता है कि, वर्तमान आईआईएफएसआर के अनिवार्य अनुसंधान की जड़ें भारत की स्वतंत्रता अवधि से पहले की हैं। इस दिशा में प्रयास चालीस के दशक में मैकाले इंस्टीट्यूट ऑफ सॉयल रिसर्च, एबरडीन यूनिवर्सिटी, डॉ. ए बी स्टीवर्ट को तत्कालीन इंपीरियल काउंसिल ऑफ एग्रीकल्चरल रिसर्च द्वारा सामान्य रूप से उर्वरता और विशेष रूप से उर्वरकों के संबंध में मिट्टी की स्थिति की समीक्षा करने और एक फल के रूप में आवश्यक कदमों का सुझाव देने के लिए आमंत्रित किया गया था, जो कि पर्याप्त जानकारी प्राप्त करने के लिए उठाए जा सकते हैं तथा बहुत ही कम समय में मिट्टी और जलवायु की अलग-अलग स्थितियों के लिए कृषि विभाग किसानों को फसल की पैदावार बढ़ाने के लिए प्रासंगिक निर्देश प्रदान कर सकें। वर्ष 1947 में प्रकाशित उनकी समीक्षा रिपोर्ट से देश में उर्वरक प्रयोग के दर्शन और अभ्यास के महत्व का पता चला। रिपोर्ट में किसानों के खेतों पर सरल उर्वरक परीक्षण और चयनित केंद्रों पर जटिल प्रयोगों के महत्व पर बल दिया गया, जिसके परिणामस्वरूप सन् 1953 में भारत-अमेरिका प्रौद्योगिकी सहयोग समझौते के अन्तर्गत "मिट्टी की उर्वरता और उर्वरक प्रयोग" परियोजना के माध्यम से किसानों के खेतों पर सरल उर्वरक परीक्षणों की शुरुआत हुई।

विकास की उत्तरोत्तर वृद्धि के क्रम में मॉडल एग्रोनोमिक एक्सपेरिमेंट्स अर्थात, सावधानीपूर्वक चयनित केंद्रों पर जटिल प्रयोगों को भी वर्ष 1956 में परियोजना की परिधि में लाया गया और इसका नाम बदलकर "अखिल भारतीय समन्वित सस्य प्रयोग योजना" (एआईसीईएस) कर दिया गया। कालान्तर में यह योजना विज्ञान और प्रौद्योगिकी के विकास के साथ तालमेल बनाए रखने और बढ़ती मांगों को पूरा करने के लिए विकास के विभिन्न चरणों से गुजरी। सस्य-क्रियाओं, सिंचाई, पोषण, रासायनिक खरपतवार नियंत्रण और एकाधिक फसलो को सम्मिलित करते हुए कृषि संबंधी अनुसंधान को शामिल करने के लिए अनुसंधान क्षेत्र का विस्तार किया गया। परन्तु फिर भी मृदा उर्वरता और उर्वरक उपयोग दक्षता पर ध्यान देने पर बल दिया जाता रहा। वर्ष 1968-69 में इस योजना को अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना (एआईसीएआरपी) दो घटकों के साथ-मॉडल कृषि विज्ञान प्रयोग और सरल उर्वरक परीक्षण के रूप में स्वीकृति दी गई।

यद्यपि, हरित क्रांति की शुरुआत के बाद भारत में कृषि अनुसंधान केवल अलग-अलग फसलों पर केंद्रित रहा। किन्तु बहुत जल्द ही सतत् विकास

के लिए एक प्रणालीगत दृष्टिकोण की आवश्यकता महसूस की गई। इस अहसास ने फसल प्रणाली उन्मुख अनुसंधान शुरू करने के लिए प्रेरणा दी और परियोजना को सातवीं पंचवर्षीय योजना के दौरान इस केन्द्र को एक निदेशालय के रूप में उच्चीकृत किया गया और इसे फसल प्रणाली अनुसंधान के लिए परियोजना निदेशालय (पीडीसीएसआर) के रूप में स्थापित किया गया, जो कि मार्च 1989 में मुख्यालय के रूप में कार्यात्मक हो गया था। ग्यारहवीं पंचवर्षीय योजना के दौरान वर्ष 2009-2010 में पीडीसीएसआर को कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) के रूप में पुनः से नामित किया गया। वर्ष 2014 (बारहवीं पंचवर्षीय योजना) के दौरान पीडीएफएसआर को एक पूर्ण संस्थान में उच्चीकृत किया गया और इसका नाम बदलकर भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) कर दिया गया। अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना (74 केंद्रों) एवं जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम (20 सहयोगी केंद्रों) को संस्थान के अभिन्न अंग के रूप में जोड़ा गया जो कि देश के 26 राज्यों/केंद्र शासित प्रदेशों का प्रतिनिधित्व करते हैं। वर्तमान में, संस्थान के अधिदेश को संबोधित करने के लिए तीन अनुसंधान प्रभाग और एक अनुभाग के अलावा एक परियोजना समन्वयन इकाई है।

संस्थान का दृष्टिकोण, उद्देश्य एवं अधिदेश

दृष्टिकोणः एकीकृत कृषि प्रणालियों के माध्यम से छोटे और सीमांत किसानों के समग्र सुधार के लिए प्राकृतिक संसाधनों का प्रबंधन।

उद्देश्यः जलवायु अनुकूल एकीकृत कृषि प्रणालियों के माध्यम से छोटे और सीमांत परिवारों के भोजन, पोषण और आजीविका में सुधार।

अधिदेशः

- उत्पादकता और संसाधन उपयोग दक्षता में सुधार के लिए उत्पादन प्रौद्योगिकियों पर एकीकृत कृषि प्रणालियों में अनुसंधान।
- विभिन्न कृषि स्थितियों के लिए कुशल, आर्थिक रूप से व्यवहार्य और पर्यावरण की दृष्टि से टिकाऊ एकीकृत कृषि प्रणाली मॉडल विकसित करना।
- पद्धति आधारित कृषि उत्पादन प्रौद्योगिकियों का कृषक प्रक्षेत्रों पर परीक्षण, सत्यापन और परिशोधन।
- देश में एकीकृत कृषि प्रणाली अनुसंधान का समन्वयन एवं पर्यवेक्षण।

विगत वर्षो के दौरान आईसीएआर-आईआईएफएसआर निम्नलिखित तीन योजनाओं के माध्यम से क्रियाशील रहा

भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम

वर्तमान में, संस्थान चार प्रमुख विषयवस्तुओं जैसे, एकीकृत कृषि प्रणाली (आईएफएस), फसल प्रणाली एवं संसाधन प्रबंधन (सीएसआरएम), जैविक कृषि प्रणाली (ओएएस) और प्रौद्योगिकी हस्तांतरण एवं मूल्यांकन (टीटीए) के अन्तर्गत शोध केन्द्र एवं कृषक प्रक्षेत्र आधारित अनुसंधान परीक्षण संचालित कर रहा है। इसके अतिरिक्त, संस्थान राष्ट्रीय स्तर की दो परियोजनाओं यथा अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना एवं जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम का समन्वयन एवं पर्यवेक्षण कर रहा है।

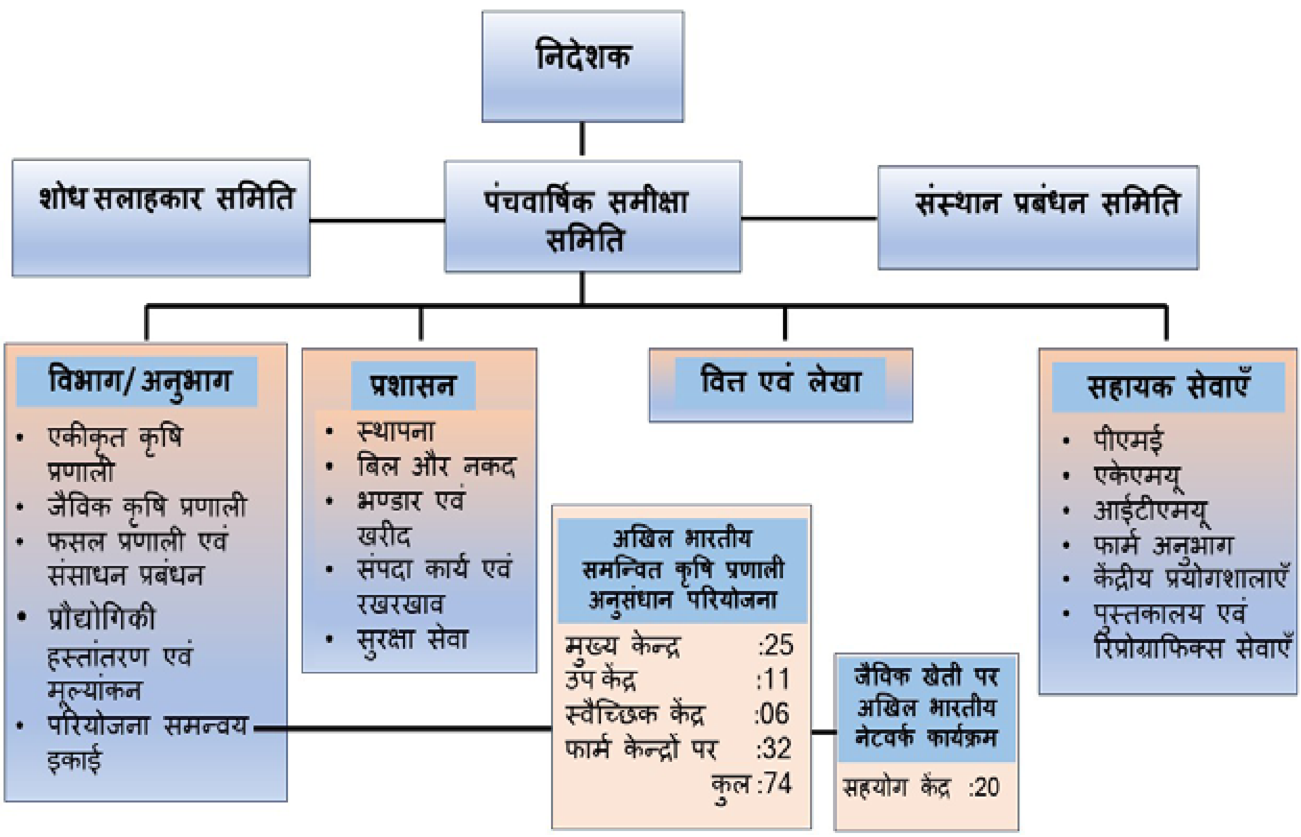
अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना

अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना, वर्ष 2010-11 से योजना के रूप में प्रारम्भ हुई। यह योजना वर्तमान में देश के 15 विभिन्न कृषि-जलवायु क्षेत्रों में स्थित 74 केंद्रों के माध्यम से संचालित हो रही है। यह योजना 34 राज्य कृषि विश्वविद्यालयों, 1 केंद्रीय कृषि विश्वविद्यालय, 6 भारतीय कृषि अनुसंधान परिषद के संस्थानों और 2 सामान्य विश्वविद्यालयों में चल रही है, जो कि देश के 24 प्रदेशों एवं 1 केंद्र शासित प्रदेश का प्रतिनिधित्व करती है। इस प्रकार यह परियोजना लगभग पूरे देश में कार्यक्षेत्र को विस्तारित करती है।

जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम

जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम भी वर्ष 2004-05 से प्रारम्भ की गई एक योजना है और वर्तमान में देश के 10 कृषि-जलवायु क्षेत्रों का प्रतिनिधित्व करने वाले 20 केंद्रों के साथ संचालित हो रही है। यह योजना 11 राज्य कृषि विश्वविद्यालयों, 7 भारतीय कृषि अनुसंधान परिषद के संस्थानों एवं 1 समतुल्य विश्वविद्यालय में चल रही है तथा देश के 16 राज्यों का प्रतिनिधित्व करती है।

संगठनात्मक संरचना



प्रमुख अनुसंधान उपलब्धियाँ

- पश्चिमी उत्तर प्रदेश के छोटे किसानों की आजीविका, भोजन और पोषण सुरक्षा के लिए 1.5 हेक्टेयर क्षेत्र में सब्जी आधारित कृषि प्रणाली मॉडल को परिष्कृत किया गया। मॉडल में अंत-फसल मॉड्यूल के साथ-साथ

फल, धान्य फसलें, सब्जी आधारित मॉड्यूल, खेत की फसल आधारित मॉड्यूल और मुर्गीपालन आधारित मॉड्यूल के साथ तालाब बांध प्रणाली शामिल थी। मॉडल से 4,33,424 रुपये का वार्षिक सकल लाभ, 2,71,403 रुपये का शुद्ध लाभ, और लाभ-लागत अनुपात 2.67 पाया गया तथा मॉडल के अंतर्गत कुल लागत 1,62,021 रुपए पाई गई। विकसित कृषि प्रणाली मॉडल न केवल 5 सदस्यीय कृषक परिवार की भोजन आवश्यकताओं जैसे अनाज, जड़ और कंद वाली फसलें, पत्तेदार और अन्य सब्जियां, फल, गुड़ और मछली की वार्षिक आवश्यकता को पूरा करने में सक्षम है, बल्कि उच्च स्तर की पोषण सुरक्षा को भी सुनिश्चित करता है। बागवानी आधारित एकीकृत कृषि प्रणाली मॉडल एक संतुलित पारिस्थितिकी तंत्र के लिए विविधता प्रदान करने वाली 26 प्रकार की फसलों को समायोजित कर सकता है।

- विभिन्न बागवानी एवं सब्जी वाली फसलों जैसे लौकी, तोरी, करेला, भिंडी, बैंगन, टमाटर, विभिन्न फलों की मानव पहुंच के भीतर (सीढ़ी अथवा बिना सीढ़ी) गुलाब, ग्लेडियोलस आदि की कटाई के लिए एक बहुउद्देशीय बागवानी एवं सब्जी फसल कटाई उपकरण विकसित किया गया है। पारंपरिक तरीकों की तुलना में, उपकरण के उपयोग से सभी पांच फसलों के लिए तनाव सूचकांक काफी कम हो गया था। विशेष रूप से भिंडी, लौकी, तोरी, करेला और बैंगन के फल काटने के लिए तनाव सूचकांक क्रमशः 6.76, 6.03, 5.93, 5.66 और 9.0 से घटकर 2.83, 2.66, 2.66, 3.0 और 2.76 हो गया।

- उत्तर प्रदेश के पश्चिमी मैदानी क्षेत्र में गन्ना-पेड़ी-गेहूं, डेयरी प्रधान कृषि प्रणाली के सीमांत किसानों (0.70 हेक्टेयर) के लिए विकसित समेकित कृषि प्रणाली मॉडल से 139.2 टन गन्ना समकक्ष उपज (एसईवाई) हुई जिसमें फसल प्रणाली (28%), कृषि-उद्यानिकी (16%), मल्टी-लेयर फार्मिंग (18%), डेयरी (29%) और बाड़ वृक्षारोपण (9%) की भागेदारी थी। मॉडल ने 2.10 के लाभ-लागत अनुपात और 396 मानव दिवस रोजगार सृजन के साथ-साथ 2.37 लाख रुपये का शुद्ध लाभ दर्ज किया। अपशिष्ट अवशेषों के पुनर्चक्रण के माध्यम से 96.2 किग्रा नाईट्रोजन, 28.3 किग्रा फास्फोरस और 98.3 किग्रा पोटैशियम का आंतरिक उत्पादन सुनिश्चित हुआ, जिससे रासायनिक उर्वरकों के उपयोग में उल्लेखनीय बचत हुई। इस मॉडल का शुद्ध ग्रीन हाउस गैस उत्सर्जन (-2429.3) किलोग्राम कार्बन-डाई-आक्साईड था, जिससे यह मॉडल जलवायु अनुकूल बन गया। केले से मूल्यवर्धित उत्पाद में छद्म तना मकरंद एवं फूलों का अचार तैयार कर आय में वृद्धि की जा सकती है। विभिन्न फसल प्रणालियों में, सब्जी आधारित फसल प्रणाली में सबसे अधिक ऊर्जा की खपत थी, इसके बाद बायोफोर्टिफाइड चावल- बायोफोर्टिफाइड गेहूं और सरसों-मूंग प्रणाली थी। यद्यपि, बायोफोर्टिफाइड चावल-बायोफोर्टिफाइड गेहूं और सरसों-मूंग प्रणाली के अंतर्गत ऊर्जा उत्पादन और ऊर्जा उपयोग दक्षता अधिक थी।

- अलाभकारी मवेशियों के साथ एक एकड़ क्षेत्र पर एक एकीकृत कृषि प्रणाली (आईएफएस) मॉडल विकसित किया गया है। फसल

मॉड्यूल ने 5.67 के लाभ-लागत अनुपात के साथ उच्चतम लाभप्रदता प्रदर्शित की। अलाभकारी मवेशियों वाले डेयरी मॉड्यूल में सबसे कम लाभ-लागत अनुपात 0.62 था। फसल प्रणाली मॉड्यूल से रुपये 80012 की उच्चतम शुद्ध आय उत्पादन प्राप्त हुआ। कुल मिलाकर, प्रणाली की शुद्ध आय 28,819 रुपये (श्रम लागत सहित) और 91,609 रुपये (श्रम लागत को छोड़कर) क्रमशः 1.15 और 1.95 के लाभ-लागत अनुपात के साथ थी।

- जैविक पोषक तत्व प्रबंधन के लिए सरसों की खली के उपयोग से गोबर की खाद और केंचुआ खाद के उपयोग की तुलना में बासमती चावल और सरसों की उपज में क्रमशः 44-115%और 45-100% का सुधार हुआ। सरसों की खली के उपचार के अंतर्गत जीवाणुओं की संख्या (मुक्त रहने वाले नत्राजन फिक्सर, स्यूडोमोनास, राइजोबियम और कुल बैक्टीरिया) अधिक थी।
- परीक्षण की गई सरसों की कुल प्रजातियों में से तीन उपभेदों अर्थात् एमएम 16,241, एमएम 16,001 और एमएम 17,008 को जैविक प्रबंधन के अंतर्गत बेहतर पाया गया और उनके प्रदर्शन का बहु-स्थानिक स्तर पर परीक्षण किया जा रहा है। जैविक खेती के लिए गेहूं की उपयुक्त किस्में (5-एसआर-05 और डीबीडब्ल्यू 187), बासमती चावल (मालवीय बासमती, पीबी 1609 और पीबी 1718), सरसों (माया, वरुणा और बसंती), सब्जी मटर (प्राची 10 और पीएस 1100) और बैंगन (पूसा हरा बैगन और काशी उत्तम) की भी पहचान की गई।
- उच्च उत्पादकता के साथ फूलगोभी में डाउनी फफूंदी, ग्रीष्मकालीन टमाटर में फल छेदक और फल सड़न के लिए जैविक कीट और रोग प्रबंधन पैकेज विकसित किया गया।
- एआईएनपी-ओएफ, मोदीपुरम केंद्र के अंतर्गत, विभिन्न जैविक उत्पादन प्रणालियों के दीर्घकालिक (2004-05 से) मूल्यांकन में, उच्चतम चावल समकक्ष उपज (17.5 टन/हेक्टेयर) और शुद्ध आय उर्द-टमाटर-सनई (हरी खाद) के अंतर्गत पाया गया, तत्पश्चात भिंडी-मटर-ढैंचा (हरी खाद) का स्थान रहा।
- विभिन्न राज्यों में विकसित आईओएफएस मॉडल के आर्थिक विश्लेषण से पता चलता है कि जैविक खेती प्रणाली के अन्तर्गत मसाला आधारित जैविक खेती प्रणाली से प्रति एकड़ 2.29 लाख की शुद्ध आय प्राप्त की जा सकती है। उत्तर प्रदेश के पश्चिमी मैदानी क्षेत्र के लिए आईओएफएस (1 एकड़) के मूल्यांकन के परिणामों से पता चला कि बासमती धान-सरसों-मूंग प्रणाली ने 1,67,995 रुपये प्रति हेक्टेयर का शुद्ध लाभ प्राप्त किया। बरसीम, जई, मक्का लोबिया और ज्वार-लोबिया के लिए चारे का उपज स्तर क्रमशः 44, 34.5, 46.5 और 48.5 टनप्रति हेक्टेयर पाया गया जो 2 डेयरी पशुओं की आवश्यकता को पूरा कर सकता है। इसके अन्तर्गत जैविक प्रणाली से उत्पादित 259 किलोग्राम शीतकालीन सब्जियां जिनमें अन्य सब्जियों की श्रेणी की 5 सदस्यीय परिवार की आवश्यकता को 98 दिनों के लिए, जड़ और कंद फसलों को 118 दिनों के लिए और पत्तेदार सब्जियों की 86 दिनों की आवश्यकता को पूरा कर सकती हैं।

- जैविक और प्राकृतिक खेती करने वाले किसानों के लक्षण वर्णन के अतिरिक्त 4 राज्यों के लिए उपयुक्त छह फसल प्रणालियों के लिए जैविक खेती प्रथाओं का पैकेज विकसित किया गया है।

- जलवायु अनुकूल उत्पादन प्रणाली पर अध्ययन से पता चला कि कम वर्षा वाले वर्षों में, औसत उपज के आधार पर एकीकृत फसल प्रबंधन सांख्यिकीय रूप से अजैविक उत्पादन प्रणाली के बराबर पाया गया, जबकि जैविक फसल उत्पादन प्रणाली अजैविक उत्पादन प्रणाली से काफी कम (-) 31.0% उपज पाई।

- जम्मू क्षेत्र की विभिन्न कृषि प्रणालियों की विशेषताओं के अनुसार, दलहन-सरसों-गेहूं फसल प्रणाली (लाभ-लागत अनुपात 2.03) से सबसे अधिक प्रतिफल प्राप्त हुआ, इसके बाद चावल-मक्का-सब्जी फसल प्रणाली (लाभ-लागत अनुपात 1.97) का स्थान आता है। जैविक, अजैविक एव एकीकृत कृषि प्रणाली अपनाने वाले खाद्य-सुरक्षित परिवारों के लिए औसत कैलोरी सेवन क्रमशः 2910, 2793 और 2854 किलो कैलोरी था।

- दीर्घकालिक संरक्षण कृषि (सीए) आधारित प्रयोग से पता चला कि सरंक्षण कृषि प्रथाओं को अपनाने से सूक्ष्म जीवों की संख्या (30-107%), जैविक कार्बन (17-44%), पानी की बचत (1.0-18.3%), श्रम की बचत में (27.5-31.7%) सुधार हुआ और ऊर्जा बचत (3.14-23.5%) होती है। इसके अतिरिक्त सरंक्षण कृषि प्रथाओं को अपनाने से पारंपरिक अभ्यास (सीपी) की तुलना में मिट्टी की भौतिक-रासायनिक विशेषताओं पर महत्वपूर्ण सकारात्मक प्रभाव पड़ा। सीपी उपचारों की तुलना में सीए प्रथाओं से युक्त उपचारों में 13.1 से 28.5% अधिक जैविक कार्बन में बढ़ोतरी पाई गई।

- भारत के चावल उत्पादक क्षेत्र में चावल के पुआल का प्रबंधन एक बड़ी चुनौती बन गया है, क्योंकि पुआल को या तो वहीं जला दिया जाता है या खेत से हटा दिया जाता है। इसलिए, संस्थान के अनुसंधान फार्म में शुरू किए गए प्रक्षेत्र प्रयोग के परिणाम बताते हैं कि पूसा डीकंपोजर स्प्रे के साथ अवशेषों को शामिल करने वाले उपचारों में अवशेष जलाने के उपचार की तुलना में बैक्टीरिया, कवक और एक्टिनोमाइसिटीस क्रमशः 48%, 82.6%, 52.9% अधिक दर्ज किया गया। इसके अलावा, पूसा डीकंपोजर स्प्रे के साथ अवशेषों को शामिल करने के उपचार में अवशेष जलाने की तुलना में मिट्टी में 22.8% अधिक जैविक कार्बन दर्ज किया गया।

- उच्च कार्बन स्ट्रेटा में रोपित धान की तुलना में सीधी बुआई वाला धान (डीएसआर) में ग्लोबल वार्मिंग क्षमता (जीडब्ल्यूपी) 11.5% कम पायी गई। मिथेन फ्लक्स डीएसआर के अंतर्गत 170.8 से 608.34 मिलीग्राम /वर्ग मीटर/दिन और रोपाई किए गए चावल के अंतर्गत 200.54 और 1225.87 मिलीग्राम/वर्ग मीटर/दिन के बीच उतार-चढ़ाव रहा। उच्च कार्बन स्तर के अंतर्गत पारम्परिक गेहूं की खेती की तुलना में शून्य जुताई में जीडब्ल्यूपी में 24.3% की वृद्धि हुई। डीसीडीए के अनुप्रयोग ने पारंपरिक जुताई के अंतर्गत उच्च कार्बन और मध्यम कार्बन स्तर के अंतर्गत जीडब्ल्यूपी को

क्रमशः 25.6% और 17.8% कम कर दिया।

- कृत्रिम तंत्रिका नेटवर्क का उपयोग करके आम की पैदावार की भविष्यवाणी करने के लिए इंटेलिजेंट मॉडल का विकास शुरू किया गया है। एप्लिकेशन को एंड्रॉइड स्टूडियो प्लेटफॉर्म, जावा प्रोग्रामिंग लैंग्वेज, एक्सएमएल एसक्यू लाइट डेटाबेस का उपयोग करके विकसित किया जा रहा है। इस मोबाइल ऐप का उद्देश्य किसानों को बागवानी फसलों में प्रणाली/फसल प्रबंधन में सहायता करना है।

- सभी राज्यों के लिए पहली प्रमुख फसल प्रणाली (एफएमसीएस) और दूसरी प्रमुख फसल प्रणाली (एसएमसीएस) की पहचान की गई है और देश के सभी प्रमुख राज्यों, एसीजेड और एईआर के लिए मानचित्र विकसित किए गए हैं। चावल-गेहूं फसल प्रणाली भारत में 15.18 मिलियन हेक्टेयर में विस्तारित अग्रणी फसल प्रणाली है, इसके बाद चावल-परती (10.29 मिलियन हेक्टेयर), कपास-परती (8.81 मिलियन हेक्टेयर), सोयाबीन-गेहूं (4.03 मिलियन हेक्टेयर) और गन्ना-पेड़ी-गेहूं (2.41 मिलियन हेक्टेयर) हैं। वर्ष 2000-01 में रिपोर्ट किए गए क्षेत्र (9.87 मिलियन हेक्टेयर) की तुलना में 2020-21 में चावल-गेहूं का क्षेत्रफल 54% (5.31 मिलियन हेक्टेयर) बढ़ गया।

- उत्तर प्रदेश और उत्तराखंड के पश्चिमी मैदानी क्षेत्र के लिए कृषि प्रणाली मॉड्यूल के कृषक प्रक्षेत्र मूल्यांकन के अंतर्गत प्राप्त आंकड़ों से पता चलता है कि फसल प्रणाली विविधीकरण, एकीकृत फसल प्रबंधन तथा चारा घटक को शामिल करना और डेयरी पशुओं के लिए उचित चारा प्रबंधन जैसे कुछ दृष्टिकोण महत्वपूर्ण भूमिका निभाते हैं जो कि छोटे और सीमांत कृषक परिवारों की आय को क्रमशः 15% और 32.3% बढ़ाने में अहम योगदान करते हैं। इसके अतिरिक्त, सब्जी घटक, पोषण संबंधी रसोई बागवानी और उन्नत चारे की किस्मों के साथ आईएफएस के विविधीकरण ने भी कृषक परिवारों के उचित पोषण में मदद की और भूमिहीन कृषक परिवारों की आजीविका और आय सृजन में 57.7% का सुधार किया।

- एआईसीआरपी-आईएफएस के अंतर्गत पूर्व-प्रमुख फसल प्रणालियों में संतुलित पोषक तत्व प्रबंधन के लिए खेत की फसल की प्रतिक्रिया, बागपत जिले में ओएफआर-I से पता चलता है कि सूक्ष्म पोषक तत्व के साथ एनपीके की अनुशंसित खुराक ने चावल-गेहूं और गन्ना-पेडी-गेहूं दोनों की उपज में सुधार किया है। इसके विपरीत पश्चिमी उत्तर प्रदेश के किसानों में नाइट्रोजन उर्वरकों की अधिक मात्रा के उपयोग की प्रवृत्ति है, जिससे इष्टतम उपज प्राप्त नहीं होती है और शुद्ध आय भी कम हो जाती है, अतः संतुलित पोषक तत्व प्रबंधन खेतों की स्थिरता और लाभप्रदता को संबोधित करने में काफी मददगार साबित होगा। ओएफआर-II के अंतर्गत मौजूदा कृषि प्रणालियों के विविधीकरण से पता चलता है कि एकल फसल घटक (रु.105600 कृषक परिवार) की तुलना में फसल़ डेयरी घटक के साथ मौजूदा कृषि प्रणालियों में विविधीकरण से वार्षिक आय में रु.133900 प्रति कृषक परिवार तक की वृद्धि हुई है। ओएफआर-III के मामले में, अतिरिक्त दलहन फसलों को

सम्मिलित करने से उत्पादकता, लाभप्रदता, स्थिरता और पोषण सुरक्षा में समग्र सुधार प्राप्त किया गया।

- फार्मर फर्स्ट परियोजना के दूसरे चरण में, अंगीकृत लिए गए गांवों में किसानों को अलग-अलग हस्तक्षेप दिए गए, जिनमें तिलहन की उन्नत किस्में, गेहूं की उच्च उपज और न गिरने वाली किस्में तथा गन्ने में अंत फसल के रूप में गोभी सरसों की शुरूआत के साथ-साथ चारे की उन्नत किस्में शामिल थीं। बागवानी मॉड्यूल के तहत, पोषण से भरपूर विभिन्न सब्जियों और हरी पत्तेदार सब्जियों के माध्यम से घरेलू पोषण सुरक्षा को बढ़ाने के लिए तकनीकी हस्तक्षेप के रूप में फलों के पौधों और पोषण संबंधी रसोई बागवानी किट को शामिल किया गया। पशुओं के स्वास्थ्य को बनाए रखने और दूध की पैदावार में सुधार के लिए खनिज मिश्रण अनुपूरण लागू किया गया। पंजीकृत किसानों को मौसम आधारित कृषि सलाह प्रदान की गई। ये सभी हस्तक्षेप लाभार्थियों के भोजन, पोषक तत्व सुरक्षा और रोजगार क्षमता को बढ़ा रहे हैं।

- महिलाओं द्वारा प्रौद्योगिकी के उपयोग के संबंध में मौजूदा कृषि प्रणाली के सर्वेक्षण से पता चला है कि गैर-मशीनीकृत (हस्त संचालित उपकरण) संचालन मुख्य रूप से महिला किसानों द्वारा किया जाता है, जैसे हाथ द्वारा बीज बोना (93.3%), चावल की रोपाई मैन्युअल रूप से करना (100%), हाथ से निराई करना (88%), खेत की फसलों की कटाई दरांती से करना (80.6%), बागवानी फसलों की कटाई मैन्युअल रूप से करना (78%), थ्रेशिंग मैन्युअल रूप से करना (53.3%), चारे को सिर पर बोझ के रूप में ले जाना (93.3%) अध्ययन में यह भी पाया गया कि केवल 39% महिलाएँ सशक्त हैं और विचार किए गए 6 उप-संकेतकों में से 52.17% में पर्याप्तता है।

- टीएसपी परियोजना के अंतर्गत रामनगर ब्लॉक में निवेश सहायता के बिना सभी चार प्रकार के प्रक्षेत्रो की कुल आय/बेंचमार्क आय के सुधार में गैर-महत्वपूर्ण कमी पायी गयी। सभी चार प्रकार के कृषि प्रणालियों में हस्तक्षेप के बाद सब्जियों, फलों, दूध और पशु भोजन की खपत के संदर्भ में अनुशंसित आहार भत्ता की तुलना में आहार सेवन में अंतर काफी कम हो गया है। स्थानीय स्तर पर एकीकृत कीट प्रबंधन सम्बंधित निवेश की अनुपलब्धता के कारण विभिन्न फसलों में उन्नत प्रथाओं को आंशिक रूप (72-92%) से अपनाया गया।

- कृषि क्षेत्र में ड्रोन तकनीक के प्रदर्शन के लिए दो ड्रोन खरीदे गए हैं जिनके द्वारा 500 हेक्टेयर में छिड़काव का प्रदर्शन किया जाना है। पायलट प्रशिक्षण और आरपीटीओ लाइसेंस प्राप्त करने के बाद किसानो के खेतो पर प्रदर्शन किया जाना प्रस्तावित है।

- ओडिशा सरकार द्वारा कृषि-पर्यटन अवधारणा के साथ 4 कृषि फार्मों को एकीकृत कृषि प्रणाली गतिविधियों का केंद्र बनाने के लिए विस्तृत परियोजना रिपोर्ट (डीपीआर) बनाई गई। आईसीएआर-आईआईएफएसआर ने पहले ही 3 फार्मों (नयागढ़, सखीगोपाल और सेमिलिगुड़ा फार्म) के लिए डीपीआर प्रस्तुत कर दिया है, जिन्हें ओडिशा सरकार द्वारा अनुमोदित किया गया है।

- विभिन्न स्थानों पर ऑन-फार्म अनुसंधान से

संकेत मिलता है कि पोषक तत्वों नाइट्रोजन, फास्फरोस एंवम पोटैशियम की संस्तुत की गई मात्रा के साथ मांग आधारित सूक्ष्म तत्वों के उपयोग द्वारा चावल-चावल, चावल-गेहूं, मक्का-गेहूं, और चावल-चना प्रणालियों में नाइट्रोजन की कृषि संबंधी दक्षता (एई) को क्रमशः 7, 9, 8, 18 (अनाज उपज किग्रा नाइट्रोजन) से 34, 20, 19 और 47 किग्रा (अनाज उपज - किग्रा नाइट्रोजन) तक बढ़ाया जा सकता है। पोषक तत्वों के लिए फसल प्रणालियों की औसत आर्थिक प्रतिक्रिया नाइट्रोजन, फास्फोरस और पोटैशियम पर निवेश किए गए प्रति रुपये क्रमशः 6.7, 4.0 और 7.0 रुपये का रिटर्न दर्शाती है।

- केरल और तमिलनाडु में आईएफएस योजना के अंतर्गत गैर-प्रतिभागियों की तुलना में आईएफएस कार्यक्रम प्रतिभागियों की सकल आय में 22.6% और शुद्ध आय में 40.5% की उल्लेखनीय वृद्धि हुई है। आहार विविधता संतुलित स्वास्थ्य का संकेतक है, पोषक तत्वों के विभिन्न स्रोतों के साथ गैर-प्रतिभागियों की तुलना में 8.6% का सुधार हुआ है।

- वंचित किसानों की स्थायी आजीविका को बढ़ाने के लिए एससी-एसपी कार्यक्रम के अंतर्गत एकीकृत कृषि प्रणाली दृष्टिकोण लागू किया गया था। यह कार्यक्रम संस्थान स्तर पर और एआईसीआरपी-आईएफएस नेटवर्क के माध्यम से चयनित जिलों में क्रियान्वित किया गया था। तीन जिलों, जिसमे मेरठ, मुजफ्फरनगर और हरिद्वार की कृषि पद्धतियों के आलोचनात्मक विश्लेषण से पता चला कि गन्ना क्षेत्र में, गेहूं की बुआई में देरी होती है क्योंकि खेत समय पर खाली नहीं होते हैं और किसान 3-4 दशक पुरानी गेहूं की किस्में (पीबीडब्ल्यू-226 और पीबीडब्ल्यू-292) उगा रहे हैं। जो इष्टतम से कम उपज देते हैं। इस समस्या को हल करने के लिए, देर से बोई जाने वाली गेहूं की किस्मों जैसे डीबीडब्ल्यू-173 के साथ-साथ जिंक सल्फेट के अनुप्रयोग और प्रभावी खरपतवार नियंत्रण जैसी उन्नत कृषि पद्धतियों की शुरूआत के परिणामस्वरूप उपज में 45% की उल्लेखनीय वृद्धि हुई। गेहूं की उन्नत किस्में अपनाने से किसानों ने पारंपरिक किस्मों की तुलना में 15.7 क्विंटल प्रति हेक्टेयर की अधिक अनाज उपज प्राप्त हुई। सरसों किस्म आरएच-725, गोभी सरसो किस्म जीएससी-7 गन्ने के साथ अंत फसल के रूप में और लहसुन किस्म यमुना सफेद-2 ने कृषि प्रणाली की समग्र लाभप्रदता को और बढ़ाया। पशुधन प्रबंधन में हस्तक्षेप, जैसे साल भर चारे की आपूर्ति के लिए बारहमासी चारा बीएनएच (सीओ-5) का उपयोग करना, खनिज मिश्रण (60 दिनों के लिए 50 ग्राम पशु) प्रदान करना, फेनबेंडाजोल गोलियां देना और पशु मैट का उपयोग करना, जिसके परिणामस्वरूप दूध उत्पादकता में वृद्धि हुई। पोल्ट्री घटक कैरी निर्भीक पोल्ट्री पक्षियों के साथ इच्छुक किसानों को उनकी आय बढ़ाने के लिए भी फायदेमंद था। कुल मिलाकर, कृषि प्रणाली के भीतर महत्वपूर्ण कृषि आदानों में लगभग 4000-5000 रुपये का निवेश करने से, अंगीकृत गए जिलों में अनुसूचित जाति परिवारों की आय में 20,000-25,000 रुपये की वृद्धि हुई। इस दृष्टिकोण ने लक्षित क्षेत्रों में वंचित किसानों की स्थायी आजीविका सुधार में सफलतापूर्वक योगदान दिया।

EXECUTIVE SUMMARY

1. **Name and address of the Institute:** ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut- 25 0110

2. **Budget (2022-23)**

A) Institute Budget (Rs in Lakhs)

Plan (scheme)			Non Scheme	Total	Expenditure		
Provision	Expenditure	Govt. Grant	Allocation internal+ additional amount provided by Hqrs out of Council shares	Total Allocation (col. 3+4)	Exp. Out of Govt. Grant	Exp. Out of revenue generation	Total expenditure (col. 6+7)
1	2	3	4	5	6	7	8
2015.00	**2013.85**	**2015.00**	**100.00**	**2115.00**	**2113.85**	**-**	**2113.85**

B) External sources (in Lakhs)

Source	Budget	Expenditure
Externally funded projects	237.71	131.48
Total	**237.71**	**131.48**

C) Revenue generated (in Lakhs) during 2022-23

Source	Amount
Farm Produce including grains, fruits, vegetables, fish, milk and livestock	49.22
License fee / water charges	8.73
Miscellaneous	3.01
Interest on loan and advances	1.02
Interest on TDR	5.74
Others (Royalty and Inst. Charges)	2.59
Total	**70.30**

Staff position (as on 31.12.2022)

Category	Sanctioned	In Position	Vacant
Scientific			
Director	01	01	00
Head of Division	03	00	03
Project Coordinator-AICRP- IFS	01	00	01
Principal Scientist	00	03	+03
Senior Scientist	08	06	02
Scientist	28	19	9
Sub Total	**41**	**29**	**12**
Technical Staff			
Category-III (T-6, 7/8)	02	01	01
Category-II (T-3,T-4 & T-5)	19	09	10
Category-I (T-1 & T-2)	03	03	00
Sub Total	**24**	**13**	**11**
Administrative Staff			
Sr. Administrative Officer	01	01	00
S F & A O	01	00	01
A A O	02	02	00
Assistant	08	03	05
U D C	03	03	00
P S	02	02	00
P A	02	02	00
Jr. Steno Gr.III	00	01	+01
L D C	03	02	01
Sub Total	**22**	**16**	**06**
Supporting Staff			
Supporting	25	23	02
TOTAL	**112**	81	31

INTRODUCTION

ICAR-Indian Institute of Farming Systems Research (IIFSR) is contributing significantly towards the development of agronomic management practices, encouraging efficient use of nutrients and suitable alternative cropping systems and methodologies for assessment and evaluation of crop management practices at country level since its origin of 71 years. However, since 2010 onwards the mandate of institute was changed from cropping system to farming systems perspective in order to address the holistic issues of agriculture. At present, integrated farming system (IFS) research is considered an effective tool to address many challenges in agriculture today, including profitability, production sustainability, resource use efficiency, food and nutritional security, employability and climate change.

Looking to the brief developmental history of the institute, it is found that the mandated research of the present IIFSR has its roots before India's independence period. Efforts in this direction were initiated with the visit of Dr A B Stewart of Macaulay Institute of Soil Research, Aberdeen, U. K., in forties which led to the base for genesis of Cropping System Research Project. Dr A B Stewart was invited by the then 'Imperial Council of Agricultural Research' to review the status of soil in respect of fertility in general, and manuring in particular, and as a fruit to suggest necessary steps which might be taken to obtain adequate information under different conditions of soil and climate within a very short time so that the agricultural departments could provide relevant instructions to the farmers for increasing the crop yields. His review report, published in 1947, revealed significance of philosophy and practice of fertilizer experimentation in the county. The importance of conducting simple fertilizer trials on cultivator's fields and complex experiments at selected centres was emphasized in the report which on turn led to initiation of "Simple Fertilizer Trials on Cultivators Fields" in 1953 under Indo-American Technology Cooperation Agreement through "Soil Fertility and Fertilizer Use Project."

Subsequent to all these developments, Model Agronomic Experiments, i.e., complex experiments on carefully selected centres, were also brought under the purview of the project in 1956 and it was renamed as 'All India Coordinated Agronomic Experiments Scheme (AICAES)'. With the passage of time, the scheme went through various stages of evolution to keep pace with the development in science and technology and to meet out the increasing demands. The research arena was expanded to include agronomic research encompassing cultural practices, irrigation, nutrition, chemical weed control and multiple cropping. But still the emphasis continued to give focus on soil fertility and fertilizer use efficiency. In 1968-69, the scheme was sanctioned as 'All India Coordinated Agronomic Research Project (AICARP) with two components viz; "Model Agronomic Experiments" and "Simple Fertilizer Trials".

However, after ushering of the green revolution, the agricultural research in India remained centric only on individual crops in isolation. But very soon for the cause of sustainable development need was felt to have system approach. This realization might have given an impetus to start cropping systems-oriented research and the project was upgraded into a Directorate during 7th five-year plan and was established as the 'Project Directorate for Cropping Systems Research (PDCSR), which became functional in March, 1989 with its headquarters at Modipuram, Meerut, U.P. Further, during 11th five-year plan PDCSR has been re-designated as 'Project Directorate for Farming Systems Research (PDFSR)' during 2009-2010. During 2014 (12th five-year plan) PDFSR was upgraded to a full-fledged institute and renamed as "ICAR-Indian Institute of Farming Systems Research" besides AICRP on IFS (74 centres) and AINP-OF (20 co-operating centres) as an integral part of institute, covering States/ UTs. Presently, the institute has three research divisions and one section besides one project coordinating unit to address the mandate.

Vision, mission and mandate of the institute:

Vision:

Management of natural sources for holistic improvement of small and marginal farmers through Integrated Farming Systems.

Mission:

Improve food, nutrition and livelihood of small and marginal households through climate smart Integrated Farming Systems (to make marginal and small households as bountiful).

Mandate:

- ❖ Research in integrated farming systems on production technologies for improving productivity and resource use efficiencies.
- ❖ Develop efficient, economically viable and environmentally sustainable integrated farming system models for different farming situations.
- ❖ On-farm testing, verification and refinement of system-based farm production technologies.
- ❖ Co-ordinate and monitor integrated farming systems research in the country.

During the year ICAR-IIFSR was operating through following three plan schemes:

ICAR-Indian Institute of Farming Systems Research, Modipuram

Presently, institute is operating to conduct on-station and on-farm research trials under four major themes viz., Integrated Farming Systems (IFS), Cropping Systems & Resource Management (CSRM), Organic Agriculture Systems (OAS) and Transfer of Technology & Assessment (TTA) besides a Coordination Unit (CU) to monitor and coordinate the two national level schemes viz., AICRP on Integrated

Farming System and All India Network Project on Organic Farming.

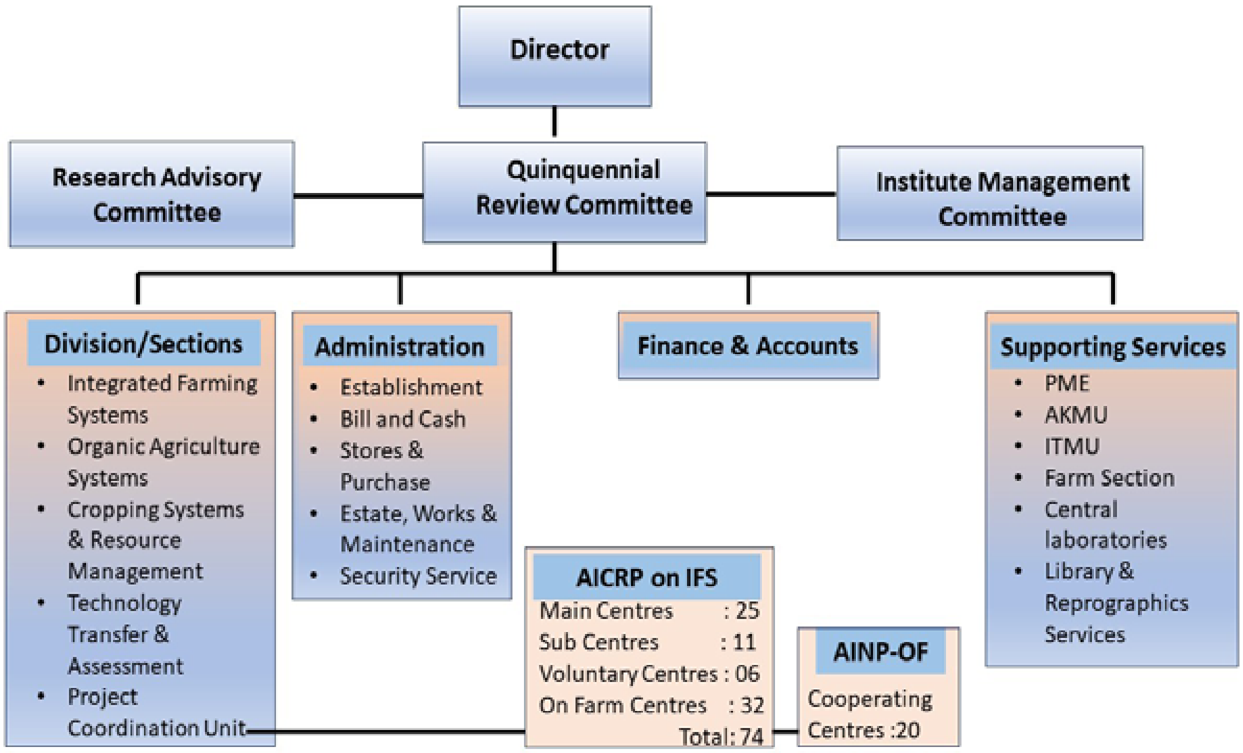
AICRP on Integrated Farming Systems (IFS)

AICRP on Integrated Farming Systems, a plan scheme initiated from 2010-11 operates currently with 74 centers situated in distinct 15 agro-climatic regions of country. The scheme is in operation at 34 SAU's, 1 central university, 6 ICAR institutes and 2 general universities and covers 25 states and 1 union territory, hence approximately covers the entire country.

All India Network Project on Organic Farming (AI-NPOF)

All India Network Project on Organic Farming (AI-NPOF) is also a plan scheme initiated from 2004-05 and operates currently with 20 centers covering 10 agro-climatic regions of the country. The scheme is in operation at 11 SAU's, 7 ICAR institutes and 1 deemed university and covers 16 states of India.

ORGANOGRAM



Salient Research Achievements

- For diversification of the prevalent rice- wheat and sugarcane-ratoon-wheat system, a vegetable-based farming system model (1.5 ha) was refined for small farmers of Western Uttar Pradesh, consisted of fruit crops with inter crop module, vegetable based module, field crop based module and Pond dyke system with poultry based module. The model recorded annual gross returns of Rs 4,33,424, net return of Rs 2,71,403, with cost of cultivation of Rs 1,62,021 and

B:C ratio of 2.67. The developed farming system model not only found capable to meet out the annual need of food viz., cereals, roots & tuber crops, leafy & other vegetables, fruits, jaggery and fish for 5 member farm family but also ensured the high level of nutritional security. The horticulture based integrated farming system model can accommodante 26 types of crops providing diversity for a balanced eco-system.

- A multipurpose horticultural/vegetable crop harvesting tool has been developed to harvest different horticultural crops viz., bottle gourd, sponge gourd, bitter gourd, okra, brinjal, tomatoes, different fruit crops within the reach of human (with/without ladder), roses, gladiolus etc. When compared to conventional methods, the strain index for all five crops was significantly reduced with the use of the tool. Specifically, the strain index for fruit cutting of okra, bottle gourd, sponge gourd, bitter gourd, and brinjal decreased respectively from 6.76, 6.03, 5.93, 5.66, and 9.0, to 2.83, 2.66, 2.66, 3.0, and 2.76.
- IFS model developed for marginal farmers (0.70 ha) of sugarcane-ratoon-wheat + dairy dominated farming system in western plain zone of Uttar Pradesh resulted in 139.2 t sugarcane equivalent yield (SEY) with share from cropping system (28%), agri-horti (16%), multi-layer farming (18%), dairy (29%) and boundary plantation (9%) modules. Model recorded net return of Rs 2.37 lakhs with B:C ratio of 2.10 and 396 man days of employment generation. Through the recycling of waste/residue ensured internal generation of 96.2kg N, 28.3 kg P and 98.3 kg K thus significant saving in mineral fertilizers. Net GHG emission of this IFS model was 2429.3 kg CO_2-e thus making the model as climate smart. Income enhancement could be made by preparing the value-added products like pseudo-stem nectars and flower pickle from banana. Among the different cropping systems, vegetable-based cropping system was having highest energy input followed by biofortified rice- biofortified wheat and mustard-green gram system. However, energy output and energy use efficiency were higher under biofortified rice-biofortified wheat and mustard-green gram system.
- Application of mustard oilcake for organic nutrient management improved the yield of basmati rice and mustard by 44-115% and 45-100% as compared to FYM and vermicompost application, respectively. Bacterial population (free living N fixers, *Pseudomonas, Rhizobium* and total bacteria) was higher under mustard cake applied treatments.

- An integrated farming system (IFS) model was developed on a one-acre area with uneconomical cattle. The crop module showed the highest profitability with a benefit-to-cost ratio (B:C) of 5.67. The dairy module with uneconomical cattle had the lowest B:C ratio of 0.62. The cropping system module generated the highest net income of Rs. 80,012. Overall, the system had a net return of Rs 28,819 (including labour cost) and Rs. 91,609 (excluding labour cost) with B:C ratios of 1.15 and 1.95, respectively.
- Three mustard strains namely MM16A241, MM16A001 and MM17A008 were found superior under organic management among the tested lot and their performance is being tested at multi-location. Suitable varieties of wheat (5-SR-05 and DBW 187), Basmati rice (Malviya Basmati, PB 1609 and PB 1718), mustard (Maya, Varuna and Basanti), vegetable pea (Prachi 10 and PS 1100) and Brinjal (Pusa Hara Baigan and Kashi Uttam) were also identified for organic cultivation.
- Organic pest and disease management package for downy mildew in cauliflower, fruit borer and fruit rot in summer tomato with higher productivity was developed.
- Under AI-NPOF, Modipuram centre in long-term evaluation (since 2004-05) of different production systems, highest relative equivalent yield (REY) (17.5 t/ha) and net return was recorded under black gram-tomato-sunhemp greem manuring followed by okra-vegetable pea-sesbania green manuring (14.2 t REY/ha) with organic production.
- Economic analysis of Integrated Organic Farming System (IOFS) models developed in different states indicates that under organic farming system, a net income of 2.29 lakhs per acre can be obtained from the spices based organic farming systems. Results of evaluation of IOFS (1 acre) for Western Plain Zone of Uttar Pradesh revealed that basmati rice-mustard-moong bean system recorded net return of Rs 1,67,995/ha. Yield level of fodder was found to be 44, 34.5, 46.5 and 48.5 t/ha for berseem, oat, maize + cowpea and sorghum + cowpea, respectively which can meet the requirement of 2 dairy animals. Further, 259 kg of winter vegetables produced from the organic system can meet the 5-member family requirement of other vegetables category for 98 days, roots and tuber crops for 118 days and requirement of leafy vegetables for 86 days.
- Organic Farming Package of Practices for six cropping systems suitable to 4 States have been developed besides characterization of organic and natural farming farmers.

- Study on climate resilient production system revealed that in the deficit rainfall years, the mean yield showed that integrated crop management was found to be statistically at par with inorganic production system whereas organic crop production system registered significantly lower yield i.e. (-31.0%) than the inorganic production system.

- Characterization of various farm system of Jammu region reported the highest returns from the pulse-mustard-wheat cropping system (B: C ratio of 2.03), followed by the rice-maize-vegetable cropping system (B: C ratio of 1.97). The average daily calorie intake for food-secure households practicing organic, inorganic, and integrated farming systems was 2910, 2793, and 2854 kcal, respectively.

- The long-term conservation agriculture (CA) based experiment showed that adoption of CA practices improved the microbial population 30-107%, soil organic carbon (17-44%), water saving (1.0-18.3%), labour saving (27.5-31.7%) and energy saving (3.14-23.5%). Further, adoption of CA practices showed significant positive impacts on soil physicochemical attributes over the conventional practice (CP). Treatments comprised of CA practices recorded 13.1 to 28.5% higher SOC content as compared to CP treatments.

- Management of rice straw has become a major challenge in the rice growing belt of India, as the straw is either burnt in situ or removed from the field. Therefore, results of the field experiment initiated at the research farm of ICAR-IIFSR shows that treatments with residue incorporation along with PUSA decomposer spray recorded respectivly 48%, 82.6%, 52.9% higher bacteria, fungi and actinomycetes population over the residue burning treatment. Further, treatments residue incorporation along with PUSA decomposer spray recorded 22.8% higher soil organic carbon content over the residue burning.

- Global Warming Potential (GWP) reduced by 11.5% in direct seeded rice (DSR) compared to transplanted rice under higher carbon strata. CH_4 flux fluctuated between 170.8 to 608.34 mg m^{-2} day^{-1} under DSR and 200.54 and 1225.87 mg m^{-2} day^{-1} under transplanted rice. GWP increased by 24.3 % in zero tillage compared to conventional wheat plot under higher carbon strata. Application of DCDA, reduced the GWP by 25.6 and 17.8 % under higher carbon and medium carbon strata, respectively under conventional tillage.

- The development of intelligent model for predicting mango yields using artificial neural networks has been taken up. The application is being developed by using the Android Studio platform, Java programming language, XML, and SQLite database. This mobile app is intended to assist farmers with system management/crop management in horticultural crops.

- First Major Cropping System (FMCS) and Second Major Cropping System (SMCS) for all the states have been identified and the maps developed for all major states, ACZs and AER of the country. Rice-wheat cropping system is the leading cropping system in India occupying 15.18 million hectares followed by rice-fallow (10.29 m ha), cotton-fallow (8.81 m ha), soybean-wheat (4.03 m ha) and sugarcane-ratoon-wheat (2.41 m ha). Area under rice-wheat has increased by 54% (5.31 m ha) in 2020-21 as compared to reported area in 2000-01 (9.87 m ha).
- Under on-farm evaluation of farming system modules for Western Plain Zone of Uttar Pradesh and Uttarakhand, the data shows that certain approaches such as cropping system diversification, integrated crop management, inclusion of fodder component and proper feed management for dairy animals plays a crucial role in enhancing the income of small and marginal farm families by 15% and 32.3%, respectively. Further, diversification of IFS with vegetable component, nutritional kitchen gardening and improved fodder varieties also helped in proper nutrition of the farm families and improved the livelihood and income generation of landless farm families by 57.7%.
- On farm crop response to the balanced nutrient management in pre-dominant cropping systems under AICRP-IFS, OFR-I in Baghpat District shows that the recommend dose of NPK along with micronutrient improved the yield both in rice-wheat and sugarcane-ratoon-wheat system. In contrast to this farmer of Western Uttar Pradesh have tendency to apply higher dose of nitrogenous fertilizers which cause suboptimal yield and reduce net return, hence balance nutrient management will go long way to address sustainability and profitability of individual farms. Diversification of existing farming systems under OFR-II shows that as compared to crop component alone (Rs. 105600/household) diversification in the existing farming systems with crop+dairy component increased the annual income to the extent of Rs. 133900/household. In case of OFR-III, the overall improvement in productivity, profitability, sustainability and nutritional security of households with the inclusion of an additional pulse crops to their system was achieved.

- In second phase of Farmer FIRST project, different interventions were given to farmers in adopted villages which comprised of improved varieties of oilseeds, high yielding and lodging resistant varieties of wheat and improved varieties of forage along with introduction of Gobhi sarso as intercrop in sugarcane. Under horticultural module, fruits plants and nutritional kitchen gardening kits were included as technological intervention for enhancing household nutritional security through diverse nutritionally rich vegetables and green leafy vegetables which can be grown at the backyard in small areas. For animal health maintenance and improving their performance in terms of milk yield, mineral mixture supplementation was implemented in households having milch animals. Weather based agro advisory were provided to the registered farmers. All these interventions are enhancing the food, nutrient security and employability of the beneficiaries.

- The survey of existing farming system with respect to technology use by women indicated that non-mechanized (manual/ traditional tools) operations are mainly done by women farmers in terms of seed dibbling manually (93.3%), rice transplanting manually (100%), weeding by using hand hoe (88%), harvesting of field crops by using sickles (80.6%), harvesting of horticultural crops manually (78%), threshing manually (53.3%), carrying of fodder as head load (93.3%). Only 39% of women are empowered and have adequacy in 52.17% of the 6 sub-indicators considered. On average women in the prevailing farming systems of Bazpur block of Udham Singh Nagar District were found disempowered in the five domains of agriculture (5DE score < 0.80).

- Under TSP programme undertaken at Uttarakhand, non-significant reduction in total income/ improvement over the benchmark income was observed in all the four farm types without input support. Dietary gap as compared to recommended dietary allowance (RDA) in terms of vegetables, fruits, milk and animal food consumption has reduced significantly after farming systems interventions in all the four farm types. Partial adoption of improved practices in different crops (72-90%) was observed due to non-availability of inputs (IPM) at local level.

- Two Agricultural spray drones under Agri-Drone Project for demonstration of drone spraying technology in 500 ha area were procured. The farmer field demonstrations will be carried out after pilot training and obtaining RPTO license.

- Detailed Project Report (DPR) was prepared for transforming 4 nos. of Agricultural Farms into a hub of Integrated Farming Systems activities along with a philosophy of Agro-Tourism concept to Govt. of Odisha. ICAR-IIFSR has already submitted DPR for 3 Farms namely Nayagarh, Sakhigopal and Semiliguda Farm which were approved by Govt of Odisha.

- On-Farm Research across different locations indicated that Agronomic Efficiency (AE) of N can be enhanced to 34, 20, 19 and 47 kg (grain yield /kg of N) from 7, 9, 8, 18 (grain yield /kg of N) in rice-rice, rice-wheat, maize-wheat, and rice-chickpea systems, respectively by the application of recommended dose of N with P and K instead of N alone. Mean economic response of cropping systems to applied nutrients indicates a return of Rs 6.7, 4.0 and 7.0 per rupee invested on N, P_2O_5 and K_2O, respectively.

- The gross income was significantly increased by 22.6 % and net income by 40.5 % for IFS programme participants compared to non-participants under IFS scheme in Kerala and Tamil Nadu. Dietary diversity being indicator of balanced health, with different source of nutrients had improved by 8.6 % compared to non-participants.

- An Integrated Farming System approach was implemented under the SC-SP program to enhance the sustainable livelihoods of underprivileged farmers. This program was undertaken in selected districts, both at the institute level and through the AICRP-IFS network. The critical analysis of farming practices of three districts, namely Meerut, Muzaffarnagar, and Haridwar, revealed that in sugarcane belt, wheat sowing is delayed as fields are not vacated timely and farmers grow 3-4 decades old wheat varieties (PBW-226 and PBW-292) which give suboptimal yield. To address this issue, introduction of late-sown wheat varieties like DBW-173 along with improved agricultural practices such as the application of zinc sulphate and effective weed control, resulted in a remarkable (45%) increase in yield. With the adoption of improved variety of wheat, farmers achieved a higher grain yield of 15.7 quintals per hectare as compared to traditional varieties. The introduction of mustard cv. RH-725, Gobhi Sarso cv. GSC-7 as intercrop with sugarcane, and garlic cv. Yamuna Safed-2 further enhanced the overall profitability of the farming system. The intervention of livestock management, such as using perennial fodder BNH (CO-5) for round the year fodder supply, providing mineral mixtures (50g/animal for 60 days), administering Fenbendazole tablets, and using animal mats, resulted in increased milk productivity. The poultry component was also rewarding to interested farmers with the CARI-Nirbheak poultry birds for raising their income. Overall, by investing around Rs 4000-5000 in critical farming inputs within the farming system, the income of SC households was increased by Rs 20,000-25,000 in the adopted districts. This approach successfully contributed to the sustainable livelihood improvement of underprivileged farmers in the target areas.

Weather during 2022

During the reporting year (2022), the onset of southwest monsoon was recorded on 12th July, which was delayed by 15 days. Total annual precipitation of 878.2 mm was received with uneven distribution. This was 17.6 % higher than the normal precipitation of 747.0 mm of the location. Out of the total annual precipitation, Southwest monsoon contributed 62.5 percent of the precipitation. The mean maximum temperature varied from 16.5^{0}C in January to 39.7^{0}C in April while the mean minimum temperature varied between 6.4^{0}C in January to 23.9^{0}C in July. The average relative humidity and sunshine hours were 74.0 percent and 5.7 hours/ day, respectively. There were 44 rainy days with rainfall more than 2.5 mm. The highest daily maximum temperature of 43.8^{0}C was recorded on 4th June and the lowest minimum temperature of 3.10^{0}C was received on 31st January. The summary of the monthly meteorological is presented in Table 1.

The weekly pan evaporation reached to 66.5 mm during the 17th standard meteorological week (SMW) and came down slowly from this week onwards. However, it reached another peak (63.5 mm) during 23rd week and then slowly decreased from this week (Fig. 1 & 2). Highest maximum temperature of 42.8^{0}C was recorded during the 23rd SMW and lowest minimum temperature of 5.6^{0}C was recorded during the 3rdSMW.

Table 1: Monthly meteorological data recorded at Agromet Observatory, ICAR-IIFSR, Modipuram (2022)

Month	Temperature(°C)		Av. RH (%)	Sunshine hours (hr/day)	Rainfall (mm)	Rainy days (nos.)	Pan evaporation (mm)
	Max.	Min.					
January	16.5	6.4	85.0	2.7	111.4	7	31.2
February	22.3	7.7	73.8	6.4	21.1	3	61.9
March	31.3	14.7	70.8	7.4	0.0	0	113.0
April	39.7	19.4	54.7	7.2	1.3	0	205.3

May	37.0	22.1	66.6	6.9	52.1	3	201.7
June	38.4	23.6	62.3	5.4	28.7	2	196.2
July	34.1	23.9	81.1	5.0	213.0	10	97.3
August	33.8	23.7	82.8	6.6	56.5	4	117.5
September	32.5	22.9	83.3	5.3	251.1	12	92.6
October	31.0	18.3	79.4	5.4	143.0	3	59.6
November	27.5	13.1	76.2	4.7	0.0	0	47.1
December	21.5	9.0	72.5	4.9	0.0	0	31.2
Annual	**30.5**	**17.1**	**74.0**	**5.7**	**878.2**	**44**	**1254.6**

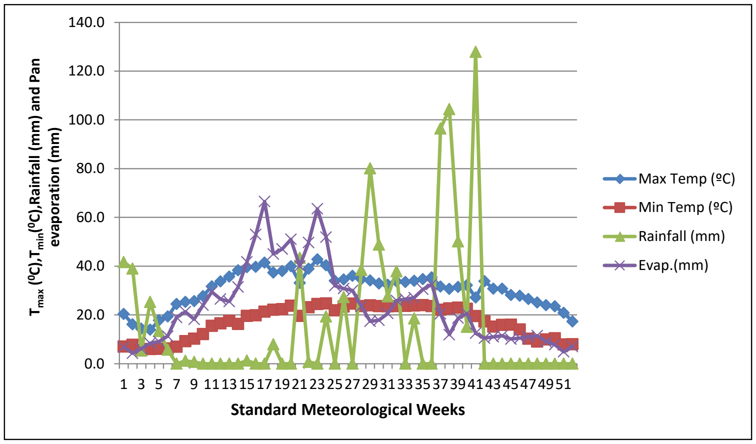


Figure 1: Weekly Pan evaporation, Rainfall, Maximum and Minimum temperature recorded during the year 2022

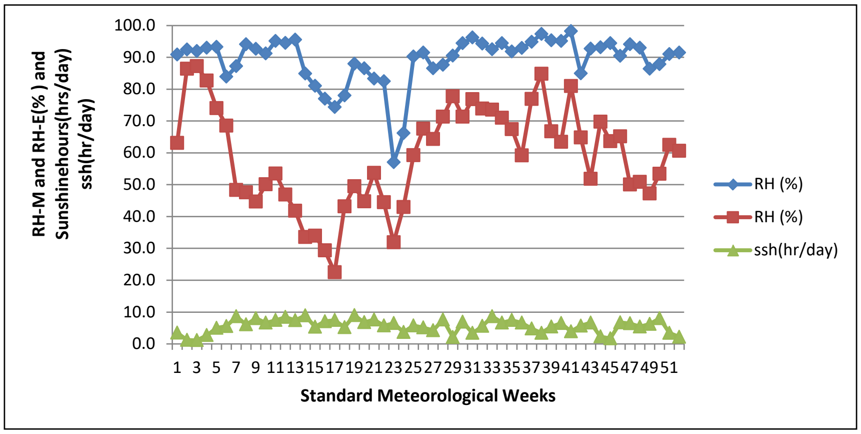


Figure 2: Weekly RH-Morning (RH-M), RH-Evening (RH-E) and Sunshine hours (Ssh) recorded during the year 2022

RESEARCH ACCOMPLISHMENTS

INTEGRATED FARMING SYSTEMS

Project OXX04146: Sustainable resource management for climate smart IFS under AICRP on Integrated Farming Systems, Modipuram centre

IFS model of 0.70 ha comprising cropping system, agri-horti, multi-layer farming, dairy (1 buffalo + 1 cow), boundary plantation, vermicomposting and secondary agriculture was developed to identify ecologically and economically viable enterprises for marginal farmers of sugarcane-ratoon-wheat dominated western plain zone of Uttar Pradesh. Out of total area, 53%, 25%, 17% and 5% area was allocated under cropping system, multi-layer farming, agri-horti and other module, respectively. Performance of different modules during the reporting period is given below.

(i) Cropping system (0.38 ha): Three cropping systems namely Biofortified rice (cv. CR Dhan 310)- biofortified wheat (cv. WB 02) + mustard (cv. RH 725)-green gram (cv. Virat), sweet corn-garlic-vegetable cowpea and maize+ soybean-ryegrass-fodder sorghum were evaluated, respectively, for food, feed and to generate income for the family under changing climate. The results indicates that rice-wheat + mustard-green gram produced 618 kg rice, 337 kg wheat, 136 kg mustard and 126 kg green gram. The straw of rice was recycled as mulch in wheat, mustard and garlic crops. Vegetable based system produced 737 kg sweet corn, 618 kg garlic and 313 kg vegetable cowpea. Fodder system resulted in green fodder production of 10845 kg from ryegrass and 7462 kg from sorghum. Cropping system module produced 36429 kg sugarcane equivalent yield. Total cost of cultivation, gross return and net return of cropping system module was Rs.33415, Rs.125807 and Rs.92392, respectively. Among the different cropping systems, vegetable-based cropping system was having highest energy input followed by biofortified rice, biofortified wheat and mustard-green gram system. However, energy output and energy use efficiency were higher under biofortified rice-biofortified wheat and mustard-green gram system (Table 2).

Table 2: Energy input-output under cropping system module

Cropping system	Energy Input (MJ)	Energy Output (MJ)	Net Energy (MJ)	Energy ratio
Biofortified rice- biofortified wheat + mustard-green gram (0.125 ha)				
Biofortified rice	2007	24272	22265	12.1

Biofortified wheat	852	11691	10839	13.7
Mustard	472	6750	6278	14.3
Green gram	511	4465	3954	8.7
Sweet corn-garlic-cowpea (0.125 ha)				
Sweet corn	1618	12280	10662	7.6
Garlic	1726	9085	7359	5.3
Cowpea	694	2590	1896	3.7
Maize + soybean- ryegrass-sorghum (0.125 ha)				
Ryegrass	1464	3254	1790	2.2
Sorghum	1077	3358	2281	3.1
Total CS module	10421	77745	67324	7.5

(ii) **Agri-horti (0.12 ha):** Agri-horti module is having banana and papaya as fruits with intercropping of turmeric (cv. Vallabh Priya). Frost tolerant banana (cv Monthan) and papaya (cv. Delicious) were planted under agri-horti module. Total of 960 kg banana, 751 kg papaya, and 755 kg turmeric was produced from the module. Agri-horti module produced 22763 kg sugarcane equivalent yield. Total cost of cultivation of agri-horti module was Rs.18000/ha with net returns of Rs. 55980/ha. Pseudostem, leaf and root of banana were analysed for different content. It was found that these residues have very good nutrient content and could be used for the preparation of nutrient rich compost for recycling in the model (Table 3 &4).

Table 3: Nutrient content in different portions of pseudostem of banana

Portion	Total N (%)	Total P (%)	Total K (%)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Fe (ppm)
Lower parts	0.73	0.20	2.82	4.81	1.16	4.62	65.93
Middle parts	0.80	0.18	2.40	1.49	1.15	5.09	52.96
Upper parts	0.78	0.16	3.08	3.76	0.92	3.84	114.17

Table 4: Nutrient content in leaves and roots of banana

Different parts	Total nitrogen (%)	P content (%)	K content (%)
Leaf petiole	0.99	0.15	5.72
Leaf	1.61	0.19	7.08
Root	0.50	0.08	7.47

(iii) Multi-layer farming: Multi-layer farming module (0.18 ha) was established in the IFS model during the year. Under this module, turmeric + green/leafy vegetables (Red Amaranthus- fenugreek-coriander) + cucurbits + fruits (Papaya) are being evaluated with the objective to utilize the underground and above ground for production at the same time. This module produced 25,458 kg SEY with Rs. 39000 as cost of cultivation and resulted in net return of Rs. 43740 (Table 5).

Table 5: Production and economics of multi-layer farming module

Components	Production (kg)	Cost (Rs.)	Gross return (Rs.)	Net returns (Rs.)
Papaya	420	39000	12600	43740
Turmeric	625		18750	
Bottlegourd	4525		45250	
Amaranthus	58		580	
Spinach	84		840	
Coriander	76		1520	
Beetroot	85		1700	
Marigold	75		1500	
Total	25458 (SEY)	39000	82740	43740

(iv) Dairy: The dairy unit is having one buffalo (Murrah) and one indigenous cow. A total of 956.3 litre of milk was produced with cost of production as Rs. 1,19,210 with share of 45%, 15%, 12%, 25% and 3% on labour, concentrates, straw, green fodder and medicine, respectively (Fig.3). Total gross return and net returns from dairy unit was found to be Rs. 1,31,060 and Rs. 11,850, respectively. Net return from dairy module without family labour cost was Rs. 65850. A total of 15.8/t farm yard manure and 1.0/t vermicompost was prepared from the dung of dairy unit.

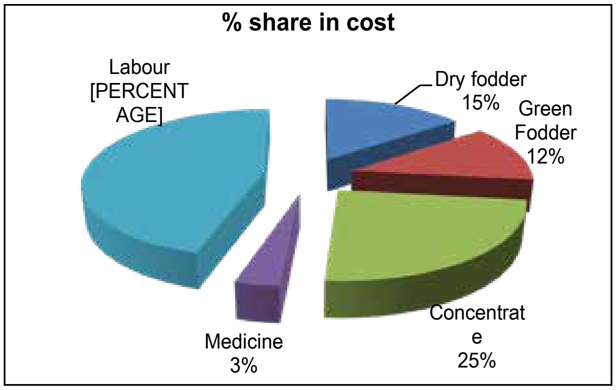


Figure 3: Share in cost of production under dairy in IFS

(v) Boundary plantations: On the boundary of IFS model, guava and karonda hedge has been planted for better utilization of different resources. Similarly, on the bunds of IFS model, bajra napier hybrid (cv. CO-5) is planted. Karonda hedge also act as biological fencing because of its spikes and protects crops from stray animals. During the reporting year total of 550 kg guava, 125 kg of karonda and 9906 kg hybrid napier fodder was harvested and Rs. 33,459 net return was earned.

(vi) Secondary Agriculture (Value addition):

Different value added products from banana were prepared from the marketable surplus.

a. ***Pseudostem nectar***: Mixing sugar syrup (TSS, 66.6±2%) along with banana pseudostem juices in different proportions (0-70%) followed by addition of color, essence and preservatives (sodium benzoate @100ppm) was evaluated. The banana pseudostem nectar with 40% juice (24.8°Brix) had recorded the maximum overall acceptability score (8.3±0.2) with attractive colour, flavour and taste.

Plate 1: Preparation of banana pseudo stem nectars

b. ***Banana flower pickles***: After cleaning and removing all the inedible parts, flower buds were subjected to blanching treatments (0, 2, 4, 6 and 8 min.) and dipping in citric acid (1.0%) solutions for one hour. Banana flowers pickles prepared with 6-minute blanching treatment recorded maximum over all sensory score (8.1). Economics is presented in Table 6.

Plate 2: Preparation of Banana flower pickle

Table 6: Economics of different value-added products of banana

Product (Banana)	Quantity of raw material (kg)	Cost of processing (Rs)	Final quantity (kg)	Total income (Rs)	Net income (Rs)	Income improvement
Pseudo stem nectars	20	520	20	1600	1080	10.8 times
Flower pickles	4	80	2	400	320	16.0 times

Recycling of waste/residue: To build up fertility of soil, residues of different crops were incorporated/added in the IFS model. During the reporting year a total of 18,279 kg of crop residues and farm wastes were recycled within the system. Through incorporation of these farm wastes 135.7 kg N, 37.8 kg P_2O_5 and 206.1 kg K was added in the soil which is equivalent to 295 kg urea, 237 kg SSP and 343 kg MOP fertilizer.

Economics of IFS: Total cost of cultivation of 0.70 ha IFS model was estimated to be Rs. 2,15,025 with gross return Rs. 4,52,324 and net return Rs. 2,37,299. A total of 396 mandays were generated in IFS model. If cost of family labour excluded then total net rerun increased to Rs. 3,56,099 with B:C ratio of 4.70 of IFS model. Among different modules, highest net return per unit area was recorded from agri-horti module followed by cropping system and multi-layer farming module. This IFS model ensured round the year income generation with the earning of more than Rs. 10,000 net return during 9 months (Fig. 4).

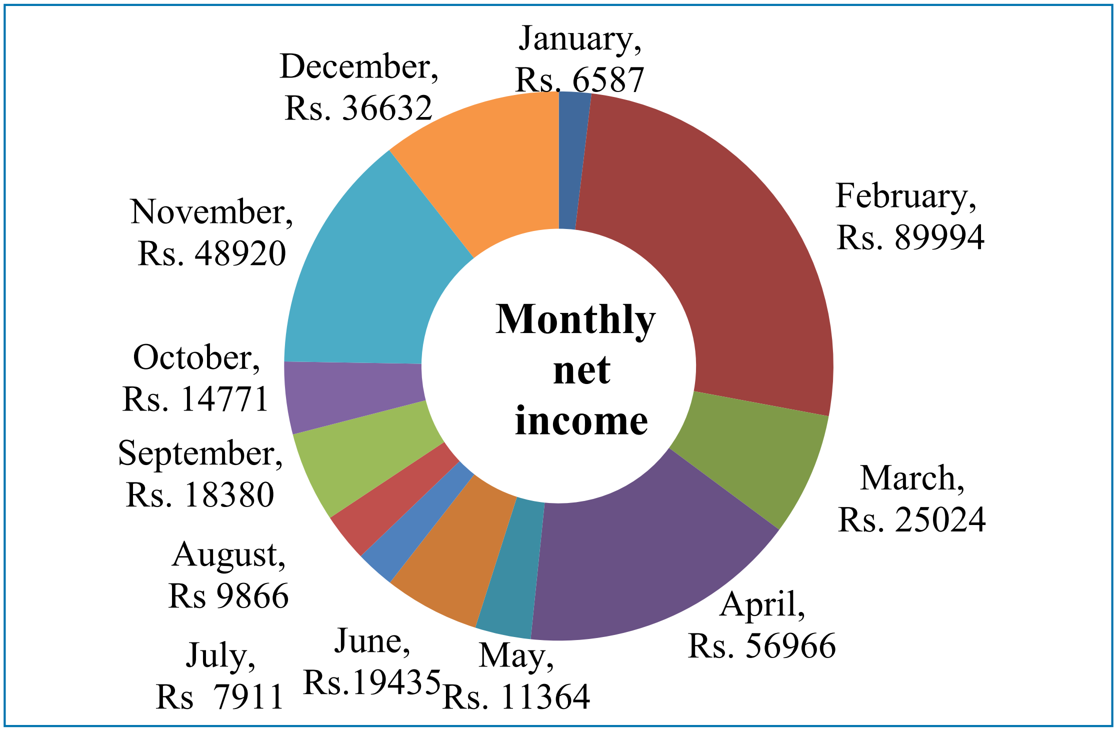


Figure 4: Monthly net return from IFS model


Plate 3: Visit of Dr. Himanshu Pathak (Secretary, DARE and DG, ICAR); Dr. S.K. Chaudhari (DDG, NRM)


Plate 4: Visit of representatives of CIMMYT,CSIRO and SAARC delegates

Project IXX14065: Refinement of vegetable-based farming system models for food and nutritional security of farmers of Western Uttar Pradesh

On-station horticulture based farming system model of 1.5 ha has been developed using 4 different modules viz., module 1- fruit orchards (with intercropping of vegetables), module 2- vegetables, module 3- field crops and module 4- pond dyke system with integration of poultry birds for improving profitability, enhancing productivity and nutritional security of small and marginal farmers particularly of western plain zone of Uttar Pradesh. Module 2 comprising of vegetables, highest area of 34 % under cultivation followed by Module1 (cultivation of fruits + intercropping of vegetables) with a share of 27%. Module 3 (crop based) had 27 % area followed by module 4 (pond dyke system + integration of poultry) to the extent of 7 %. Similarly, the share of different modules involved in the total cost incurred in developing the model has also been studied. Upon studying the economics of the model, it has been reported that total gross returns (GR) obtained from the model were Rs 4, 33, 4240, net returns (NR) were Rs 271403 with cost of cultivation (COC) of Rs 162021 with the B: C ratio of 2.67 as shown in Fig 5. It has been reported that the net returns as well as the gross returns of the model were increasing over the years. This is due to the fact that the fruit trees under module 1 gave good yield. It has been reported that 16 crop families are performing well in this model, 26 types of crops are grown in this model in a year providing a perennial cover of around 39 %. Thus, much diversity is prevalent in the system which is very much essential for a balanced ecosystem.

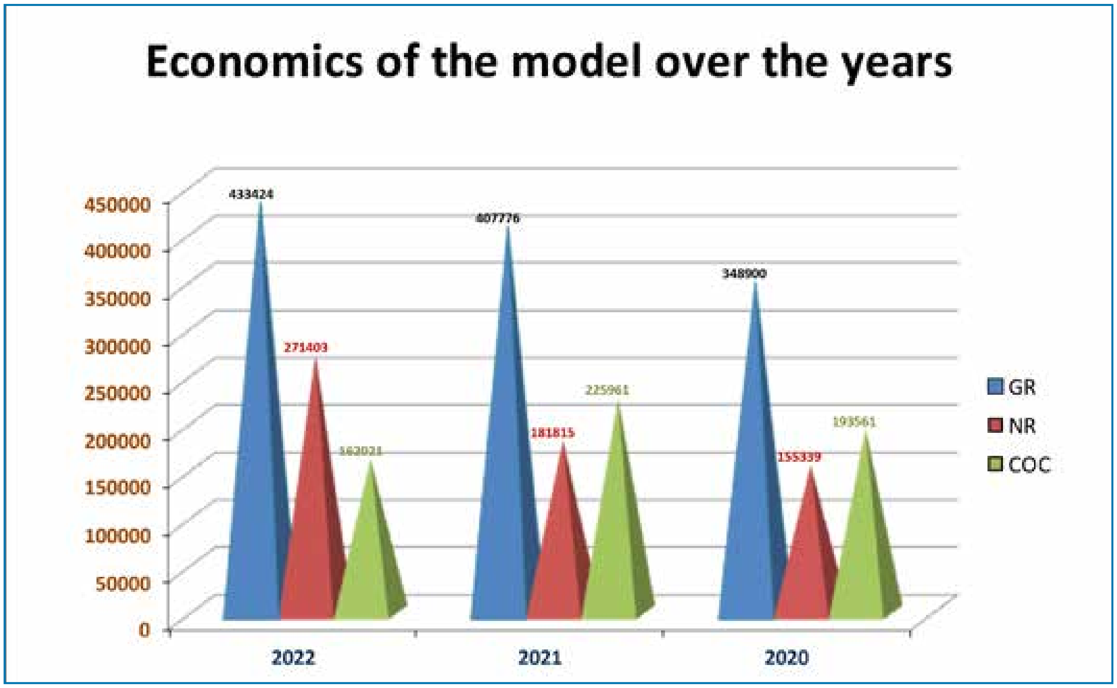


Figure 5: Economics of Horticulture Based Farming System Model for last three years

It has been reported that during year 2020, the production of fish, meat and egg was very low as compared to year 2021 and 2022 but the production of sugarcane, ceareals, millets and green leafy vegetables were almost similar for the years under study as shown in Fig 6. But the production of fruits was reported to be lower in year 2021 than 2020 and 2022. This is because in year 2022, it was off season for production of fruits like mango showing alternate bearing habit. The developed farming system model is able to fulfill the need of the family for food besides ensuring the nutritional security. Through this model, the annual requirement of a 5 member farm family can be met for cereals, roots and tuber crops, green leafy vegetables, other vegetables, fruits, sugar and jaggery and fish. Apart from meeting the annual requirement, the surplus is also obtained from this farming system model which upon selling in the market provides additional income to the farm family. The soil microbiological properties of the model were studied and it was reported that the compared to previous year not much significant difference in the total microbial activity in different systems was found except pond dyke system. Pond water contains readily available nutrients which allow the multiplication of the microbes and better crop growth.

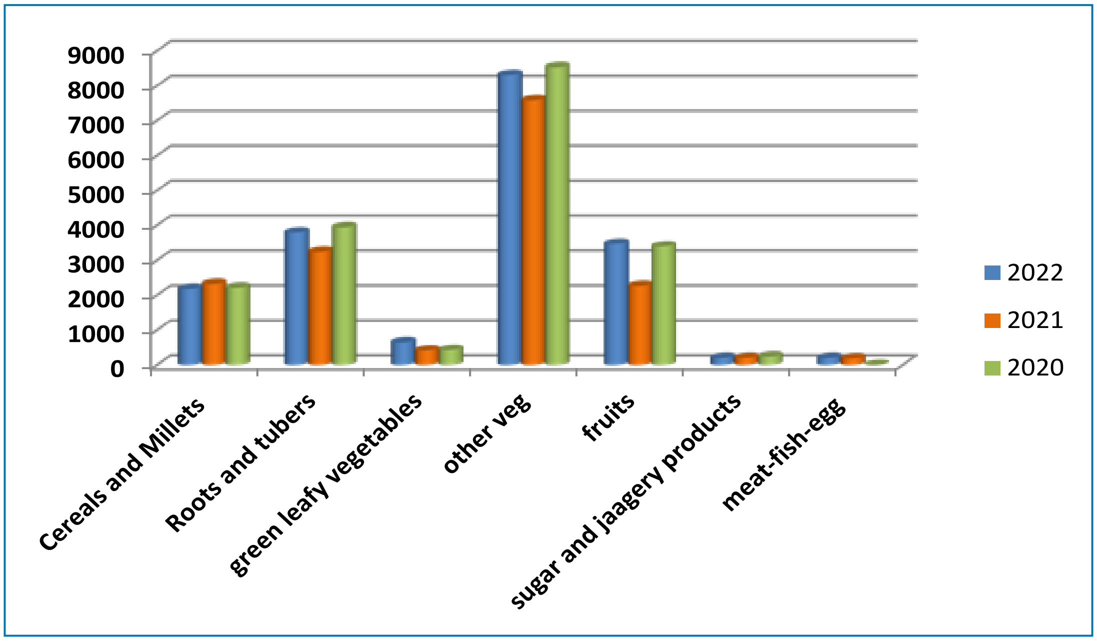


Figure 6: Production scenario of the model for different crops

Figure 7: Pond -dyke module supplemented with poultry component under the developed model at Siwaya Farm

Project IXX19733: Development of fruit based integrated farming system for western plain zone of U.P.

This is an ongoing project for the development of fruit crop based farming system with the objectives of evaluating most suitable intercropping with fruit plants species and assessing the productivity, profitabiltity and sustainability of the system. Plants of three varieties of guava (*Psidium guajava*) viz., Allahabad Safeda, Sardar (L-49) and Sweta, three varieties of Pomegranate (*Punica granatum*) viz., Bhagwa, Arakata and G-137, were planted along with plants of Sweet orange/ Mosambi (*Citrus sinensis*) Nagpur mandarin (*Citrus reticulata*) and Kinnow (Mandarin X Orange). The yield of different cropping systems has been presented in Table 7. The results indicate that there were significant differences in yield levels (REY) of intercropping modules (cereals based, vegetable based and fodder based). Vegetable based intercropping modules was most suitable in all crops their cultivars. It ranged between 178.3 to 186.2 q/ha (REY), which was quite higher than cereal crop based cropping (from 90.3 to 98.8 q/ha) and fodder based cropping system (126.4 to 135.6 q/ha).

Table7: Yield of intercrops in orchard (REY, q/ha)

Cropping system	Guava	Pomegranate	Citrus
Cereals (Rice-wheat-dhiancha)	98 .8	92.4	90.3
Vegetable (cowpea-potato- okra)	186.2	181.7	178.3
Fodder (sorghum- oats- maize)	135.6	131.4	126.4

Economics of the system revealed that the vegetable-based intercropping was the most suitable cropping system and giving highest net return in the guava (Rs 1,03,316/ha) followed by citrus crops (Rs 99,933/ha). The least return was found in pomegranate (Rs 98,513/ha) followed by cereal and fodder crops (Table8).

Table 8: Economics of fruit based farming system (Rs/ha)

Cropping system	Guava			Pomegranate			Citrus		
	Total cost	Gross return	Net return	Total cost	Gross return	Net return	Total cost	Gross return	Net return
Cereals (Rice-wheat-dhaincha)	78283	154303	76020	76345	149890	73545	76070	148695	72625
Vegetable (cowpea-potato-okra)	99418	202734	103316	92567	191080	98513	94100	194033	99933
Fodder (sorghum-oats- maize)	34820	88340	53520	34020	85209	51189	32500	81560	49060

Project IXX16524: Development of regenerative Agroforestry based IFS model for sustainable production and livelihood

The experiment was initiated at the Siwaya Farm, IIFSR, Modipuram in which three tree species, namely *Moringa oleifera* (Drumstick tree), *Tectona grandis* (Teak), and *Dalbergia sissoo* (Shisham), and five different cropping systems were taken in Alley cropping design (6m×**6 m)**. During Kharif of 2022, green gram, maize, pearl millet and sorghum intercrops were grown.

The control group exhibited the maximum straw yield of green gram (5.2 q/ha), maize (22.5 q/ha) and pearl millet (3.28 q/ha). The maximum straw yield of sorghum (17.9 q/ha) was observed in the Moringa group. The grain yield of pearl millet was highest with Moringa (5.6 q/ha). The control group had the maximum grain yield for maize (12.0 q/ha) and pearl millet (11.5 q/ha), while the maximum grain yield for sorghum (3.1 q/ha) was observed in the Shisham group.

Soil under all the three treatment plots and control were analyzed at depths of 0-15, 15-30, 30-45 cm for available nitrogen, phosphorus, potassium, organic carbon, electrical conductivity and pH **(Table 9).** There was no statistically significant difference in terms of available nitrogen under the trees or even at different soil depths. There was significant variation in phosphorus and electrical conductivity of soil at different depths. Interaction of trees and soil depth had significant influence on nitrogen availability and electrical conductivity of the soil, pH of soil was towards neutral throughout the treatments.

Table 9: Baseline soil data under different trees in agroforestry based IFS model.

Treatment	Soil Depth (cm)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)	Organic matter (%)	Electrical conductivity (EC) (dS/m)	pH
Control	0-15	194.43	26.61	155.06	0.30	240.30	8.01
	15-30	294.78	7.96	163.97	0.43	302.35	7.94
	30-45	338.69	1.42	163.97	0.33	240.40	7.90
	Average	275.97	12.00	161.00	0.35	261.02	7.95
Moringa	0-15	341.20	41.49	372.00	1.00	272.54	7.81
	15-30	273.46	38.03	463.21	0.85	259.40	7.88
	30-45	238.34	16.73	358.94	0.74	291.54	7.90
	Average	284.33	32.08	398.05	0.86	274.49	7.86

Teak	0-15	273.46	68.72	444.48	0.96	210.14	7.72
	15-30	240.85	38.72	336.27	0.73	201.38	7.83
	30-45	265.93	33.96	348.50	0.56	200.26	7.82
	Average	260.08	47.13	376.42	0.75	203.93	7.79
Shisham	0-15	278.48	48.41	332.98	1.10	189.00	7.96
	15-30	248.37	47.03	253.46	0.91	246.04	7.90
	30-45 cm	248.37	45.03	397.33	0.91	360.00	7.81
	Average	258.41	46.83	327.92	0.98	265.01	7.89

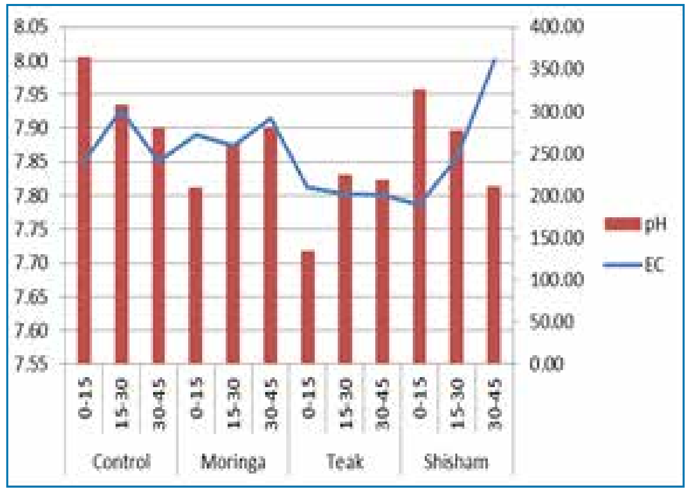


Figure 8: Baseline soil data EC, pH and organic carbon content.

Project IXX18655: Sustainable livelihood generation through IFS involving uneconomic cattle

The project was started on 24 June, 2019. Initially, 05 uneconomic cattle, 21 goats and 500 poultry birds were to be maintained in 01 acre land for the development of profitable farming system model. The objective of the project is to get sustainable livelihood from un-economic animals with proper feeding and caring alongwith components of crop, dairy, goatry and poultry for extra income. The unit of uneconomic cattle was established by the procurement of 5 nondescript/local cows from the Nagar Nigam Gaushala, Partapur, Meerut. However, during the reporting period, only cattle and crop components were taken up. The animals were provided optimum feeding and management. The female were managed with proper feeding and caring to make them fertile. AI was performed using indigenous pure breed selected bull semen to upgrade the progeny. The dung of the animals was converted into vermicompost, for use as a source of nutrients to crops.

(i) Dairy component:

During the year, 2022, five cows and three male calves were maintained in the system. The total milk production from the cows was 1146 litres and gross income from milk was Rs. 51570. Total gross income and net income from dairy unit was found to be Rs. 91020 and Rs. -56193, respectively (Table 10).

Table 10: Economics of dairy component

Animal species	Variable cost (Rs.)	Milk obtained (litres)	FYM prepared (q)	Vermi-compost prepared (q)	Gross income (Rs.)	Net income (Rs.)
05 cows + 03 male grower	147213	1146	183	12	91020	(-)56,193

The cow dung was converted into FYM and vermicompost. During the period, a total of 195.00 q. of FYM and vermicompost were applied to the crop components of the model. (Table 11). By addition of different manures, 127.80 kg nitrogen, 42.60 kg phosphorus and 122.31 kg potash was added in the soil, which is equivalent to 277.83 kg urea, 266.25 kg SSP and 203.85 kg MOP fertilizer.

Table 11: Recycling of FYM and vermi-compost

Type of manure	Qunatity (q)	Nutrient content (%)			Nutrients recycled (kg)		
		N	P	K	N	P	K
FYM	183.00	0.60	0.20	0.57	109.80	36.60	104.31
Vermi-compost	12.00	1.50	0.50	1.50	18.00	6.00	18.00
Total	195.00	-	-	-	127.80	42.60	122.31

(ii) Crop component:

All fodder crops performed very well in the system and overall, 55.85 q fodder was harvested from 2500 m^2 area with a productivity level of 223.16 t/ha. Bajra Napier hybrid gave the highest system productivity of 287.70 t/ha by supplying 14.38 t/ha from an area of 500 m^2 in five cuts, followed by berseem 84.22 t/ha in four cuts, oat 84.0 t/ha in two cuts, sorghum 80.30 t/ha in kharif and 71.60 t/ha in summer fodder, pearl millet with 70.20 t/ha and fodder maize 61.50 t/ha. However, Moringa provided 5.48 q leaf biomass from a 500 m^2 area with a system productivity of 10.96 t/ha. Among bajra napier hybrid varieties BNH (CO-5) performed exceptionally well both as field performance and animal feeding point of view, and no adverse effect observed as animal health. Apart from this, mustard and wheat grain yield of 1.61 q and 5.85 q was obtained from 500 m^2 and 1000 m^2, respectively. Straw yield of 6.05 q was also obtained from wheat.

(iii) Economics of IFS Model consisting of uneconomic cattle

The model consists of crop and dairy modules. The highest net income of Rs. 80,012 was contributed by cropping system module with B:C ratio of 5.67. The overall net return (including labour cost) from the system was Rs. 28,819 with B:C ratio of 1.15, moreover, the overall net return (excluding labour) from the system was Rs. 91,609 with B:C ratio of 1.95 (Table 12).

Table 12: Economics of one acre IFS model consisting of uneconomic cattle

Component	Total yield	Variable cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C ratio
Cropping system	585 kg grain+161 kg oil seed+ 48833 kg green fodder+ 605 kg straw	17134	97146	80,012	5.67
Dairy (05 cows + 03 male growers)	1146 lts milk + 183 q FYM + 12 q Vermicompost	147213	91020	(-)56,193	0.62
Including family labour	Total	164347	188166	28,819	1.15
Excluding family labour	Total	96557	188166	91609	1.95

Project IXX17339: Establishment of ornamental and biofloc fisheries modules for farm livelihood improvement

In India, especially in the western, eastern and southern region, a well flourishing business has been operating with excellent growth potential besides providing employment and entrepreneurship to rural youth. In the northern region, there is a considerable gap whereas demand is high for the ornamental fish. Keeping in view of the demand and potential it is necessary for a demonstration unit to be set up where interested farmers can be provided training and hands on demonstration for setting up an ornamental breeding unit in the back yard. For this purpose a setting up a demonstration unit of ornamental fish breeding as well as a module for breeding culture fish was undertaken. During the reporting period, FRP hatchery consisting of breeding pool, hatching pool and spawn collection chamber were procured and installed in the IFS model. Aquariums were procured and setup. Fishes were acclimatized to the new aquariums and rearing of six species of aquarium fishes was initiated.

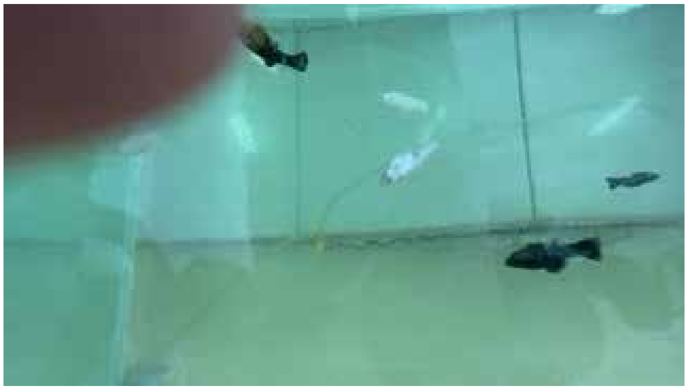



Plate 5: Setting up of aquariums and rearing of brooders


Plate 6: Breeding trial and culture of live feed for juveniles

Culture of live feed (Daphnia, Moina) for the aquarium fishes was also initiated in the spawn rearing tank. A new module as carp breeding hatchery unit consisting of breeding pool, hatching pool and spawn collection chamber in the IFS system was established. One set of breeding trial for Labeo rohita was set. Female fish weighing 1.5 kg was injected with Ovatide @ 0.05 mg/kg body weight and male fishes (two numbers) were injected with 0.2 mg/kg body weight for inducing spawning in the evening. After overnight induction, fishes spawned in the morning and fertilized eggs were transferred to the hatching unit through centrifugal action of water.


Plate 7: Fishes injected with breeding hormones and fertilized eggs in spawning pool

The unit was installed and one breeding trail was conducted but due to late season the eggs had gone into atresia and no fertilization was there due to poor egg quality. Further, on experimental basis for incorporation into IFS model, another module namely rearing and breeding of ornamental fishes for aquarium purposes is being developed. The aquarium fishes namely, gold fishes of different varieties, Koi carp, black and silver molly of various varieties were brought and reared in the plastic tubs as a backyard activity for increasing livelihood security for rural youth and farm women. The fishes are being reared and acclimatized for confined culture without filters. Aeration was provided into the tanks and regular water exchange is being undertaken. Aquariums have been indented and upon receipt shall be setup with heaters, filters and proper aquarium setup. Juvenile fishes shall be reared for adulthood and the trail breeding shall be undertaken to develop breeding protocols and the young ones reared.

		
Plate 8: Rearing of aquarium fishes in plastic tubs	**Plate 9:** Trial Breeding experiment for aquarium fishes	**Plate 10:** Juveniles of black molly

Project IXX14951: Evaluation and identification of farm implements under different farming systems

(i) Assessment of work output and muscular stress

In order to reduce/prevent various kinds of musculoskeletal disorders (MSD's) i.e. a risk factors in farm workers involved in harvesting of various vegetables and fruits vis a vis enhancing productivity and quality the need was felt to find out the possible solutions among the manual harvesting in horticultural and vegetable crops. With this objective a multipurpose horticultural crop harvesting tool is being developed to harvest different horticultural crops viz., bottle gourd, sponge gourd, bitter gourd, okra, brinjal, tomatoes, different fruit crops within the reach of human (with/without ladder), roses, gladiolus etc. To find out the efficiency of developed tool in respect of ergonomic comfort (grip fatigue, strain index) and work output (kg hr^{-1}) a field study was conducted at research experimentation farm of ICAR-IIFSR as well as farmer's field. The comfort of the developed harvesting tool was assessed through four-degree liker scale (strongly disagree, disagree somewhat, agree somewhat and strongly agree) on 30 sample size. The data obtained so were tabulated and analyzed using descriptive and inferential statistical tools (frequency, percentage analysis of variance, t test etc). The newly developed tool was not only found capable in increasing the work efficiency of labour but also reducing the strain index in fruit cutting of five crops viz., okra, bottle guard, sponge guard, bitter guard and brinjal.

Plate 11: Harvesting (a) bottle guard (b) sponge guard with improved tool

Strain index with conventional methods in case of all the five crops were noticed as 6.76, 6.03, 5.93, 5.66 and 9.0 that was reduced to 2.83, 2.66, 2.66, 3.0 and 2.76, respectively, for fruit cutting of okra, bottle guard, sponge guard, bitter guard and brinjal. Grip fatigue was also noticed 2-3 fold lower with improved tool. The detailed results are presented below in Table 13.

Table 13: Assessment of work output and muscular stress during harvesting of various vegetable crops with conventional and improved methods

Crop	Parameters	Performance by developed tool			F value	P value
		Conventional	Improved -1	Improved -2		
Okra	Work output (kg hr^{-1})	7.01	7.68	7.20	0.65	NS
	Strain index	6.76^{a}	2.83^{b}	3.76^{b}	11.01^{**}	0.009
	Grip fatigue (%)	2.99^{a}	1.19^{b}	1.53^{b}	83.16^{**}	4.21e-5

Bottle gourd	Work output (kg hr^{-1})	193.20	213.59	-	-6.87**	0.0023
	Strain index	6.03	2.66	-	3.96**	0.016
	Grip fatigue (%)	3.27	1.99	-	3.91**	0.017
Sponge gourd	Work output (kg hr^{-1})	39.12	42.71	-	-4.12**	0.014
	Strain index	5.93	2.66	-	3.58*	0.023
	Grip fatigue (%)	3.46	1.46	-	8.02**	0.0013
Bitter gourd	Work output (kg hr^{-1})	57.31	62.96	-	-12.97**	0.00020
	Strain index	5.66	3.0	-	4.70**	0.009
	Grip fatigue (%)	3.45	3.15	-	0.57	NS
Brinjal	Work output (kg hr^{-1})	142.15	100.84	-	8.86**	0.00089
	Strain index	9.0	2.76	-	5.43**	0.0051
	Grip fatigue (%)	3.23	2.31	-	0.28	NS

*For okra harvesting : Conventional: Without tool, Improved-1 :Ring cutter; Improved 2: ICAR-IIFSR multipurpose horticultural crop harvesting tool, *F*-value = Calculated value of F, *p*= Probability value for differences of means more than two groups assuming single factor at 5 % level of significance. Values with different superscripts in a column (a,b) differ significantly ($p \leq 0.05$) analyzed through post hoc test.

*For other crops: conventional: Knife/no tool, Improved^{-1}: ICAR-IIFSR multipurpose horticultural crop harvesting tool, *t*-value = Calculated value of t, *p*= Probability value for differences of two sample means assuming equal variances at a 5% level of significance.

(ii) Comfort assessment: The comfort parameters of the multipurpose harvesting tool were assessed on the basis of four degree of liker scale i.e. strongly disagree, disagree somewhat, agree somewhat and strongly agree. 100 percent farmers have responded as strongly agree in terms of tool's functionality, safety, high product quality, easy to carry, no handle hardness, no blisters, good tactile feeling, good fit in hand, absence of slippery handle, solid design, no roughness on hand surface. However, 6.66 % farmers somewhat agree on posture tool's good working posture, 13.33% farmers somewhat agree on the tool's easiness in use, no muscle cramp, easy handling. Similarly 33.33% farmers somewhat agree on the tool's response towards no pain in muscle, no numbness in fingers, no peak pressure in hand, 40% farmers somewhat agree on light weight of tool, 66.66% farmers were somewhat agree less force exerted by the tool. Rest of the farmers responded as strongly agree on the above variables (Fig. 10). Around 2 to 3% production loss was observed during convention plucking whereas no loss was observed during plucking with improved tools (Fig 9).

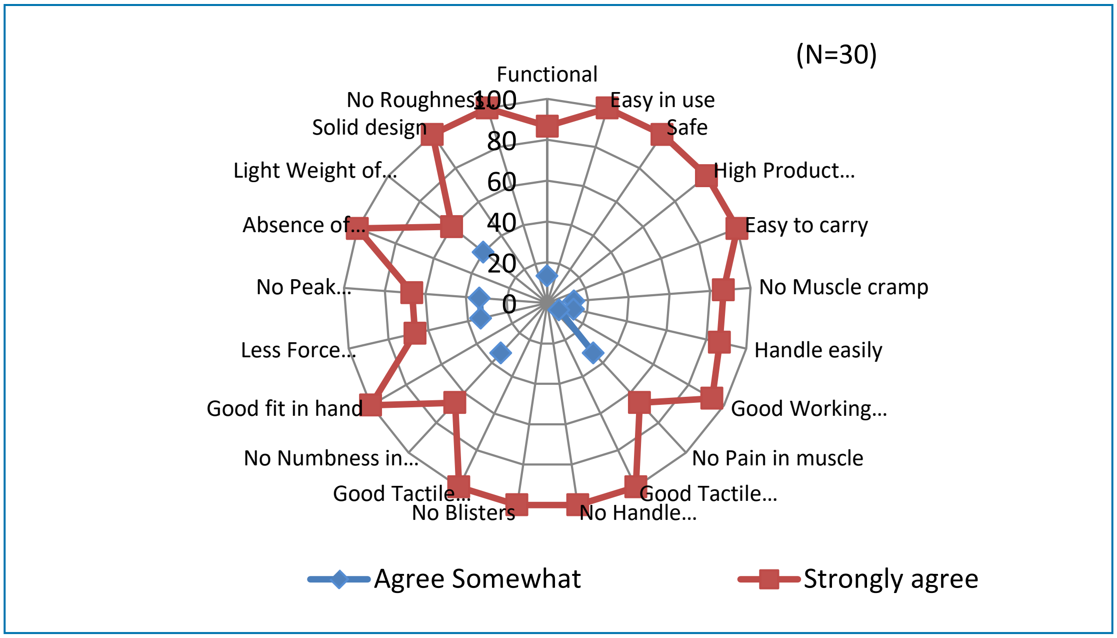


Figure 9: Comfort assessment of multipurpose harvesting tool

Plate 12. Harvesting okra with improved tool

Plate 13: Harvesting (a) brinjal and (b) bittergaurd with improved tool.

Project Code OXX5170: Influence of pesticides application in IFS model on fisheries module and measurement of GHGs emission from aquaculture ponds

Under this project pesticide usage in terms of their active ingredient and pesticide classes were enumerated along with testing for their residues in fish pond water, soil and fish samples through residual studies. Database of pesticide usage and quantification of active ingredients in 25 IFS models was analyzed. IFS models were categorized into low (less than 0.2 kg a.i./ha), medium (between 0.2 to 0.4 kg a.i./ ha) and high (above 0.4 kg a.i./ ha). The experimental results revealed pesticide usage varied in the range of 0.005 to 1.92 kg a.i./ ha. Alternate eco-friendly strategies such as mulching, intercropping, mechanical weeding aided in reduction of pesticide usage in the IFS models. At Karamana centre, water samples from all the four IFS fish ponds were analyzed for organochlorine, synthetic pyrethroids and herbicides. Results revealed that all samples were free from pesticide residues. Soil samples from all the IFS models at Karamana were analyzed for OC, SP, carbamates and herbicides (altogether 98 compounds were tested). All samples were found to be pesticide free. Further, Fish samples from homestead, coconut and banana-based IFS models were analyzed for pesticide residues (OC, SP and herbicides), and were found to be free from residues. There is only very limited use of pesticides in the IFS models developed in the models. Milk samples from all the four IFS models and fish samples from coconut-based IFS model were tested for pesticide residues (OC, OP and SP compounds). As per test results, all these samples are free from pesticide residues. Manual and mechanical weed management also contributed towards reducing herbicide use in the IFS models. Study on GHG emission in terms of CH_4 g ha^{-1} d^{-1} conducted at Ludhiana centre revealed 23.4 g ha^{-1} d^{-1} as compared to that of 32.5 g ha^{-1} d^{-1} in the previous years. Overall result from the study at different locations suggested lesser use of pesticides and chemicals in the IFS models which were also corroborated by lab analysis studies at selected centre confirming the results. Further, integrated management of weeds through alternative approaches reduced overall chemicals/pesticide usage in the system.

Project IXX18172: AICRP on Integrated Farming Systems On-station (National)

Under All India Coordinated Research Project (AICRP) on Integrated Farming Systems (IFS) on station experimentation, sustainable resource management for climate smart IFS were implemented starting from 2017-18 with revised objectives, across different agro-climatic zones, and continued through reporting period of 2021-22 which are as follows:

- To identify ecologically and economically viable enterprises for different regions under climate change scenario.
- To undertake resource budgeting in systems perspective with special reference to soil, water, nutrients and energy.
- To evaluate the low carbon production modules in the system.
- To identify and evaluate secondary agriculture avenues in farming systems perspective for attracting rural youth.

The study of climate smart IFS across agroclimatic zones during 2021-22 depicted that;-

- REY(t) varied between 10.24 (LGP) to 41.00 in Trans Gangetic Plains (TGP).
- Animal feed cost as percentage of market input cost varied from 5.7% in Lower Gangetic Plains (LGP) to 78.8 % in Islands.
- Net returns per rupee invested varied from 0.2 (West coast plains and hills) to 1.29 in Eastern Himalayan region (EHR).
- Water productivity (Rs/m^3) was highest being in West coast plains and hills (254.8).
- Improvement in soil OC over initial status in the range of 2.4 % (Eastern Plateau and Hills) to 69.7 % (Island).
- Energy input and output ration varied from 0.06 (Eastern Himalayan region) to 2.27 Upper Gangetic Plains (UGP).
- Employment generated was highest in Southern Plateau and hills (738.4) and lowest in Islands (210 days).
- Sustaibale Value Index (SVI) varied between 0.4 to 0.8.
- Mean net Green House Gas (GHG) emission as estimated was negative in all agroclimatic region except Eastern Himalayan Region (EHR) which was only 3.5.

Project IXX15140: Assessing the role and contribution of Integrated Farming Systems for addressing One Health at household and landscape levels

As the project is in beginning stage, therefore data collection is in progress. However, analysis of the cropping systems component was completed for SK Nagar (Arid Agroecosystem) and Jorhat (Humid) for the period of 2020-21. At S K Nagar (Gujarat), eight different cropping systems were evaluated viz. groundnut-potato-pearl millet, castor-castor-greengram, groundnut-wheat+lucern-greengram, Bt cotton + sunhemp-castor-bittergourd, green gram-fennel+cauliflower-fennel, fodder sorghum-lucerne, pearl millet-potato-groundnut, and Bt cotton-wheat-fodder sorghum. On the basis of diversification of cropping systems, crop sequence (Pearl millet-potato-groundnut) recorded maximum rice equivalent yield (217 q/ha), gross return (3,83,602 Rs./ha) and net return (2,28,402 Rs./ha) while, net return per rupees invested (2.27) was highest in fodder based system (Sorghum - lucerne for fodder/seed). The system profitability (625.8 Rs/day) and system productivity (26.3 kg/ha/day) were recorded higher under the treatment of crop sequence Pearl millet-potato-groundnut. The highest available soil N (242.78 kg/ha), available soil P (31.72 kg/ha) and available soil K (217.60 kg/ha) was noted in groundnut-potato-pearl millet cropping sequence, whereas, organic carbon (3.83 g/kg) were recorded highest in crop sequence of Bt cotton- wheat-fodder sorghum. Ten cropping systems such as rice-fallow-autumn rice, rice-toria-fallow, pigeonpea-vegetable pea-autumn rice (DS), soybean-toria-black gram, rice-rajmash-cowpea, rice-toria-black gram, teosinte-oat-cowpea, teosinte-oat-rice bean, ridge gourd-broccoli-okra and bitter gourd-tomato-french bean were evaluated at Jorhat (Assam). The highest REY of 472.0 q/ha was observed with bitter gourd-tomato-french bean system over other systems. After three years of completion of cropping system, available soil N was higher (238 kg/ha) under soybean-toria-black gram system. Therefore, above system can be used as soil quality enhancer system and may be taken up in rotation with other systems

Project IXX19503: AICRP on Integrated Farming Systems- On Farm Research (National)

The AICRP on IFS (On Farm Reserch-OFR) is being operational at 32 centers with the following objectives

1. On-Farm crop response to plant nutrients in predominant cropping systems.
2. Diversification of existing farming systems under marginal household conditions (Innovative approach).
3. On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers (Holistic approach).

1. On-Farm crop response to plant nutrients in predominant cropping systems

Increasing the nutrient use efficiency in major food production systems has always been a major concern because of escalating costs of production of crops, especially with regard to nutrient management. 'Researcher-designed farmer managed trials' were conducted through farmer participatory research covering the major food production systems in India. A total of 456 trials; 24 in rice-rice, 216 in rice–wheat, 48 in maize-wheat, 36 in rice-mustard, 24 each in rice-maize, rice-okra, pear millet-mustard, pear millet-wheat and soybean-wheat, 12 in maize-chickpea. Across various NARP zones and cropping systems, farmer's package resulted in lower yield compared to recommended package owing to the lower application of N, P_2O_5, K_2O and micronutrients. On-farm system yield gap between recommended dose of N, P_2O_5, K_2O+ micronutrient and farmer's package were found to be higher in rice-rice, rice-wheat, maize-wheat, and rice-mustard cropping systems. Application of micronutrients based on soil test resulted in additional yield of in rice-rice, rice-wheat, maize-wheat, and rice-mustard systems. In all the NARP zones and systems, application of recommended N, P_2O_5 and K_2O alone or N, P_2O_5, K_2O and micronutrient resulted in higher yield and use efficiency of nutrients. Suboptimal application in terms of number and quantity resulted in significantly lower yield and use efficiency of nutrients especially nitrogen.

Significant findings are outlined as under:

- On-farm nutrient response trials (432 no's) conducted in various NARP zones, across the locations and systems indicated, nutrient application gap of 16, 25, 56 and 95 per cent in N, P_2O_5, K_2O and micro nutrient between farmers practice and recommended nutrient package. The same is also reflected in system yield of major cropping systems.
- It was recorded that application of NPK gave 1359, 2086 and 1415 kg/ha higher yield over the farmers' practice, which can be further increased up to 1866, 2633 and 1804 kg/ha in rice-wheat, maize-wheat, and rice-chickpea systems, respectively, with the addition of soil test-based micronutrients.
- Agronomic Efficiency (AE) of N can be enhanced to 34, 20, 19 and 47 kg (grain yield /kg of N) from 7, 9, 8, 18 (grain yield /kg of N) in rice-rice, rice-wheat, maize-wheat, and rice-chickpea systems, respectively, by application of recommended dose of N with P and K instead of N alone.
- Mean economic response of cropping systems to applied nutrients indicates, a return of Rs 6.7, 4.0 and 7.0 per rupee invested on N, P_2O_5 and K_2O respectively.

2. Diversification of existing farming systems under marginal household conditions

The experiment in farming systems perspective was initiated with the background that 63 % households in India are in marginal category with average land holding size of 0.38 ha. Due to their size of holding, marginal farm households do not have sufficient marketable surplus for getting the decent livelihood and are most vulnerable to climate related risks. The assumptions made are marginal households are having family members of 5 with crop + livestock as the dominant farming systems and if this system is diversified, sufficient marketable surplus can be generated for sustainable livelihood.

The experiment was designed with innovative approach in which changes are made compulsorily in all components of farming systems by way of introducing new crops, livestock species and product or processing techniques in marginal households aiming to increase the marketable surplus and income of the family from a less land resource. The major strength of marginal household is having sufficient manpower (due to family size) for farm operations. After benchmarking, modules comprising of cropping system diversification (most efficient cropping systems was synthesized keeping in view of the farmers resources, perception, willingness, market and requirement other components in the system), livestock diversification [(Mineral mixture + deworming+ round the year fodder supply for existing components) + introduction of location specific low cost livestock components viz.,back yard poultry, duckery, piggery, goat etc)], product diversification (Preparation of mineral mixture/value addition of market surplus products/Kitchen /roof gardening) and capacity building (Training of farm households on farming systems including post- harvest and value addition and assessing its impact) were implemented in randomly selected 24 marginal farm households in each district.

Impact analysis indicates that high yielding varieties and mineral mixture with deworming were adopted and continued by all farmers during post-intervention period. Horticulture component and small ruminants e.g. poultry, goat etc. was less adopted mainly in North India due to weather and social acceptability issues.

3. On-Farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers

The experiment was designed with holistic approach where in improvement of productivity of existing components of the farming system was concentrated by appropriate interventions besides farmer opinion-based introduction of new components in optional module. Benchmarking of all components was done before making interventions in different modules. Four modules comprising of crop (low cost interventions in existing cropping systems based constraint analysis), livestock (low cost interventions in existing livestock components based on constraint analysis), on farm processing and value addition (on farm agro processing and value addition of marketable surplus produces) and optional (Introduction of additional components based on households perception) were implemented in 2 farm households in each village comprising of 1 marginal and small household. The experiment was implemented in randomly selected 12 marginal farm households in each district. Results across the locations indicated significant improvement in net income to the farmers due to interventions made in various modules for improving the existing farming systems.

ORGANIC AGRICULTURE SYSTEM

Project IXX19584: Status of organic agriculture in Western Himalayan Region

The present study aimed to characterize the status of various farming systems and their impacts on the livelihoods of farmers in Jammu. A total of 120 farmers were selected using multistage strategies. Among them, 40 practiced organic farming, 40 practiced inorganic farming, and 40 practiced integrated farming system, with different interventions. Descriptive statistics were calculated to analyze the socio-economic data. Propensity score matching (PSM) was applied using kernel matching and radius matching methods to assess the impact of organic, inorganic, and integrated farming on employment creation and income generation for farmers. The results of the baseline survey revealed that out of the 120 sampled farmers, they were categorized as: landless (15%), marginal (18%), small (44%), medium (14%), and large (9%). The farming system with the highest employment duration for male farmers was Crop +Livestock+Poultry+Horticulture (C+L+P+H) under integrated farms, with 152.5 man-days/year. For organic and inorganic farming systems, the values were 125.5 man-days/year and 104.5 man-days/year, respectively. The highest returns were obtained from the pulse-mustard-wheat cropping system, with a benefit-to-cost ratio of 2.03, followed by the rice-maize-vegetable cropping system, with a benefit-to-cost ratio of 1.97. The average calorie intake for food-secure households practicing organic, inorganic, and integrated farming systems was 2910, 2793, and 2854 kcal, respectively. To assess the livelihood patterns using the asset pentagon approach, improvements in net worth were found based on different capitals of farm households practicing organic, inorganic, and integrated farming. Additionally, a constraint-facing index (CFI) was calculated based on the different problems identified to suggest policy recommendations.

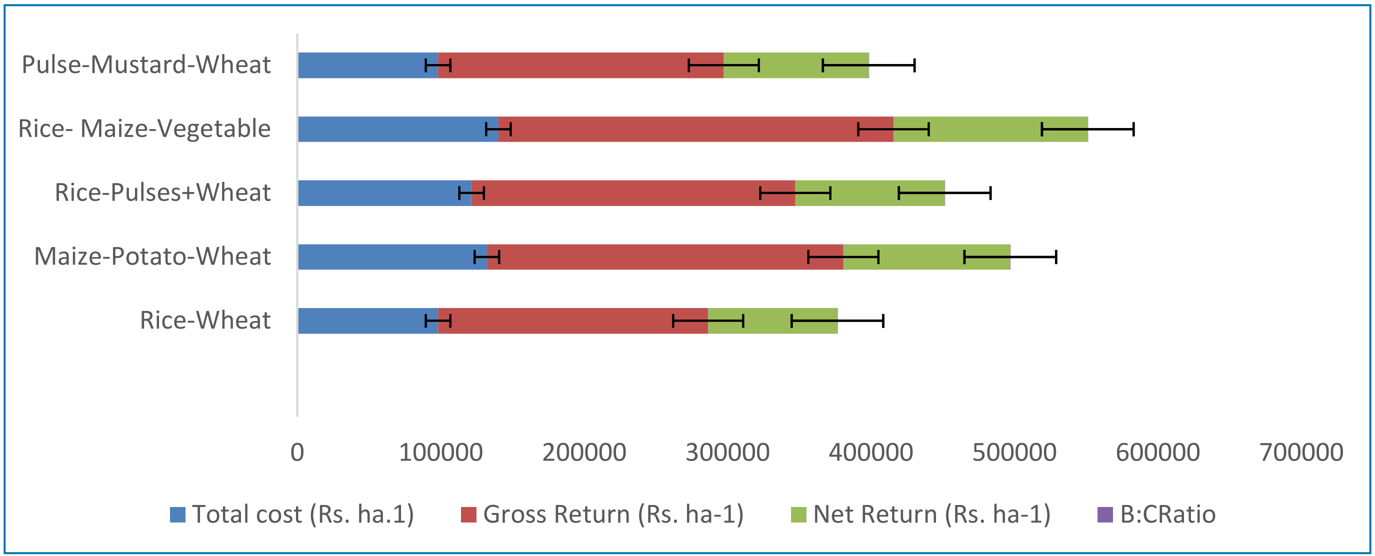


Figure 10: Cost and returns of major cropping patterns of district Jammu

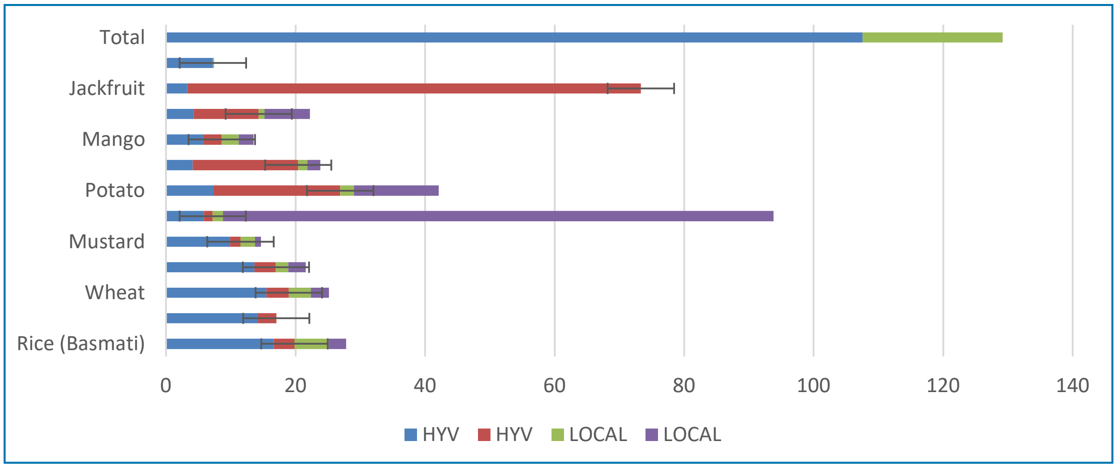


Figure 11:Major crops are grown by sample farmers of district Jammu

The surveyed farmers were found to produce homestead vegetables for their own consumption, with an average production of 105 kg and 257 kg during the summer and winter seasons, respectively. They utilized available spaces such as open sunny places, roofs, marshy lands, slightly marshy areas, backyards, etc., for this purpose. Additionally, most of the farm holdings maintained approximately 3 to 4 fruit trees either in the main farm area or in border/ bund areas. The average annual yield per farm family was found to be 10 kg of mango, 60 kg of jackfruit, 30 kg of banana, 5 kg of papaya, and 8 kg of guava for their own consumption.

Plate 14: Interaction with farmers during the survey of Districts Udhampur and Reasi

Project IXX18385: Crop improvement for organic production system

a. Varietal development of Mustard for organic production system

A total of 15 new strains have been developed by taking different parents' progenies under organic environment. Out of which, during the year of 2021-22, 09 strains (F_7 progeny) were tested in station trial against RH 749 (Check) under organic environment (Table 14). Results revealed that three strains namely MM 16A 241(I J 31xEC 597313), MM 16A 001(I J 31xEC 597313) and MM 17A 008 (MJA 25xMJR 3) performed significantly superior over check (RH 749) in terms of seed yield and other attributes (Table.15)

Table 14: Nine homozygous strains of mustard isolated from F_7 individual plant progenies across the crosses

S.No.	Strains developed and isolated from F_7	Parentage
1.	M M16A 001	IJ 31x EC 597313
2.	M M16A 081	IJ 31x EC 597313
3.	M M 16A 082	IJ 31x EC 597313
4.	M M 16A 083	IJ 31x EC 597313
5.	M M 16A 241	IJ 31x EC 597313
6.	M M 16A 242	IJ 31x EC 597313
7.	M M 16B 001	MJA 38 x MJR 9
8.	M M16B 002	MJA 38 x MJR 9
9.	M M17A 008	MJA 25 x MJR 3

Table 15: Performance of newly developed organic strains of mustard in station trial 2022 against RH 749 (standard check)

S. No.	Organic Strains	Days to maturity	Plant height (cm)	Harvest index (%)	Biological yield (kg/ ha)	Seed yield (kg/ha)
1	MM 16A 001	137.00	187.00	34.05	6,912.54	2,352.92
2	MM 16A 081	139.66	162.33	33.31	4,644.59	1,541.31
3	MM 16A 082	139.66	156.33	29.09	5,097.58	1,481.50
4	MM 16A 083	139.66	139.33	34.43	4,925.92	1,696.15
5	MM 16A 241	135.66	213.33	34.72	7,242.28	2,514.95
6	MM 17A 008	138.66	208.33	29.40	7,408.52	2,176.56

7	MM 16A 242	138.66	167.00	32.58	5,127.72	1,673.17
8	MM 16B 001	136.33	177.33	29.44	5,512.52	1,388.14
9	MM 16B 002	134.33	153.00	30.32	4,625.32	1,396.53
10	RH 749 (Standard -Check)	138.33	162.33	31.71	6,200.93	1,955.74
	C. D.(p=0.05)	1.58	16.40	3.76	715.60	202.05
	C. V. (%)	0.66	5.49	6.83	7.175	6.43

b. Performance evaluation of released varieties under organic production system

(i) Mustard

During the year of 2021-22, twenty numbers of mustard varieties developed by various Institutes and Agricultural Universities were also tested under organic environment. Though, most of the varieties did not respond well in western plain zone of U.P. under organic production system. However, the variety Maya registered highest seed yield (2420.60kg/ha) which was 54.89 percent superior over standard check (RH 749). Varuna and Basanti were also found significantly superior over RH 749 by 43.95 and 40.76 percent producing seed yield of 1948.33 and 1843.60 kg/ha, respectively (Table 16)

Table 16: Performance of mustard varieties under organic environment (2022)

S. No.	Varieties	Days to maturity	Plant height (cm)	Biological. yield (kg/ ha)	Harvest index%	Seed yield (kg/ ha)
1.	Rohani	137.66	165.00	5399.42	27.31	1474.59
2.	Maya	138.33	197.66	7963.77	30.44	2420.60
3.	Azad Mahak	138.66	169.66	4748.08	27.97	1324.16
4.	Ashirvad	141.00	175.00	4453.54	32.17	1431.61
5.	Urvashi	140.00	137.00	4178.24	33.44	1395.55
6.	Vaibhav	136.66	152.00	3489.12	32.98	1197.93
7.	Basanti	136.66	172.66	5905.02	31.15	1843.60
8.	Vardan	136.33	163.66	3936.68	28.37	1088.77
9.	Varuna	137.66	170.00	5950.60	32.74	1948.33
10.	Pitambari	121.66	186.66	2617.71	62.79	1641.31
11.	RH 749	137.33	147.00	3626.95	30.07	1091.74
12.	RB 50	140.66	178.33	4107.86	34.99	1437.54

13.	RH 9801	137.33	131.00	2785.42	32.28	899.57
14.	RH 0119	137.33	156.00	3536.55	31.16	1104.75
15.	RH 9304	137.00	145.00	2959.08	34.99	1035.92
16.	RH 8812	139.00	140.33	2600.42	37.73	904.01
17.	RH 761	139.00	146.33	2595.47	37.56	913.67
18.	RH 725	137.66	148.66	3517.03	28.81	1013.69
19.	RH 406	137.00	122.66	2708.85	35.55	961.32
20.	RH 30	137.00	130.00	2799.25	37.18	1040.16
C. D.(p=0.05)		1.93	19.12	413.63	4.04	189.17
C. V. (%)		0.85	7.59	6.24	7.20	8.71

(ii) Wheat

In order to ascertain the response of various wheat varieties under organic management practices, eleven wheat varieties were tested during the crop season of 2021-22. Out of those, three varieties viz; 5-SR-05, DBW 187 and 3-SR-02 not only gave highest yield in terms of grain yield i.e. 42.81 q/ha, 42.44 q/ha and 37.07 q/ha respectively but were also found comparatively superior in biological as well as the straw yield (Table 17).

Table 17: Performance of wheat varieties under organic environment (2022)

S. No.	Varieties	Days to maturity	Plant height (cm)	Biological yield (q/ ha)	Harvest index (%)	Grain (yield (q/ha)
1.	DBW 71	114	76.33	90.38	27.95	25.33
2.	5-SR-05	118	92.93	115.14	37.34	42.81
3.	3-SR-02	116	77.86	110.75	33.86	37.07
4.	HD 3086	119	78.33	94.70	31.23	29.63
5.	DBW 187	120	82.20	114.50	37.08	42.44
6.	DBW 222	118	89.43	93.27	28.47	26.42
7.	WB 02	113	79.26	87.99	31.99	28.00
8.	PBW 226	113	73.70	84.49	31.81	26.66
9.	PBW 173	119	85.36	90.46	23.61	22.53
10.	HD 3226	121	80.06	97.23	27.32	26.98

11.	DBW-621-50	118	76.20	96.56	27.90	29.92
C. D.(p=0.05)		1.12	6.41	16.22	5.29	4.59
C. V. (%)		0.56	4.60	9.67	11.16	8.80

(iii) Rice

To explore the potential of rice under organic environment, 10 basmati rice varieties were tested. Out of those, Malviya Basmati recorded highest grain yield (57.30q/h) under organic conditions, while the second best in grain yield were PB 1609 and PB 1718 varieties. Therefore, Malviya Basmati, PB 1609 and PB 1718 can be suggested for organic cultivation (Table 18).

Table 18: Performance of Basmati rice varieties under organic environment (2022)

S. No.	Varieties	Physiological maturity	Biological yield (q/ha)	Harvest index (%)	Seed yield (q/ ha)
1.	Pant Basmati 2	98	161.70	28.29	45.76
2.	PB 1718	93	161.80	31.75	51.38
3.	PB 1	94	131.04	35.65	46.72
4.	Basmati 564	92	151.20	32.47	49.10
5.	PB 1728	98	145.40	21.53	31.31
6.	Malviya Basmati	98	185.59	30.87	57.30
7.	PB 1509	84	105.10	33.60	35.32
8.	PB 1609	91	147.60	35.72	52.72
9.	PB 1637	91	140.75	35.72	50.27
10.	PB-6	93	129.20	24.32	31.42
C. D.(p=0.05)		2.36	8.65	3.36	2.56
C. V. (%)		1.02	6.64	7.83	6.26

Project IXX14937: Nutrient management in different cropping systems under organic production systems

Experiment 1: Nutrient management using mustard oil cake in basmati rice-mustard cropping system under organic farming

Yields, system productivity and economics

Field experiments was conducted during 2019-2022 to test the performance of basmati rice – mustard cropping system by using various doses of mustard oil cake (MC) revealed a significant improvement in yield of both of the crops (Table 19). Highest grain yield of basmati rice i.e. 4565 kg/ha was recorded with the application of 5.0 t/ha MC in *kharif* + 5.0 t/ha MC in *rabi* (T1) followed by application of 5.0 t/ha MC in

Kharif + FYM & vermicompost (VC) in *Rabi* (T2). An increase in grain yield of rice by 115 %, 73% and 76% over the treatment of FYM & VC only (T11) was observed respectively in the treatments of 5.0 t/ha MC (T1), 2.5 t/ha MC (T4) and 1.25 t/ha MC (T7). Similarly, pooled seed yield of mustard was recorded highest under application of 5.0 t/ha MC in *kharif* + 5.0 t/ha MC in *rabi* (T1). Seed yield of mustard was improved by 107%, 75% and 53% with the application of 5.0 t/ha MC (T3), 2.5t/ha MC (T4) and 1.25 t/ha MC (T7) respectively, as compared to application of FYM & VC (T11). Among different organic nutrient management treatments highest net return of Rs. 1,10,249/ha was received with the application of 2.5 t/ha MC in *kharif* + 2.5 t/ha MC in *rabi* (T4) followed by application of 2.5 t/ha MC in *kharif* + FYM & VC in *rabi* (T5). This study concludes that, application of 1.25t- 2.5 t/ha MC significantly improves the productivity as well as profitability of basmati rice – mustard cropping system and mustard cake need to be integral part of nutrient management under organic farming to meet out crop nutrient demand.

Table 19: Effect of mustard oil cake application on system productivity and economics of Basmati rice-mustard system

Treatments	Rice yield (kg/ha)	Mustard seed yield (kg/ha)	Rice equivalent yield (t/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
T1- 5.0 t/ha MC (*kharif*) + 5.0 t/ha MC (*rabi*)	4565	2647	10.42	230774	318561	87787	1.39
T2- 5.0 t/ha MC (*kharif*) + FYM & VC (*rabi*)	4459	1764	8.37	158120	262117	103997	1.67
T3- FYM & VC (*kharif*) + 5.0 t/ha MC (*rabi*)	2417	2656	8.28	166341	245074	78734	1.48
T4- 2.5 t/ha MC (*kharif*) + 2.5 t/ha MC (*rabi*)	3661	2233	8.58	144883	262520	117638	1.82
T5- 2.5 t/ha MC (*kharif*) + FYM & VC (*rabi*)	3735	1562	7.20	117228	225722	108494	1.93
T6- FYM & VC (*kharif*) + 2.5 t/ha MC (*rabi*)	2182	2174	6.99	121341	208346	87006	1.72
T7- 1.25 t/ha MC (*kharif*) + 1.25 t/ha MC (*rabi*)	3055	1951	7.35	118128	224957	106829	1.91
T8- 1.25 t/ha MC (*kharif*) + FYM & VC (*rabi*)	3073	1600	6.63	105907	204790	98882	1.94
T9- FYM & VC (*kharif*) + 1.25 t/ha MC (*rabi*)	2177	1925	6.43	105907	193335	87427	1.83
T10- Inorganic	3806	2067	7.45	62258	218836	156578	3.51

T11- FYM & VC (*kharif*) + FYM & VC (*rabi*)	2119	1327	5.05	93686	155506	61819	1.67
SEm±	67.9	95.7	0.22	-	-	-	-
CD (P=0.05)	201.2	283.8	0.66	-	-	-	-

MC- Mustard Cake, FYM- Farm Yard Manure, VC- Vermi Compost

Plate 15: Experimental view of Basmati rice field

Plate 16: Experimental view of Mustard field

The effect of different doses of organic inputs viz., mustard oil cake, FYM and vermicompost on soil health was also recorded. This has been done by counting the populations of bacteria (on nutrient agar, Kings B agar, Jensen agar, CRYEMA), fungi (on Rose Bengal agar and Trichoderma selective medium), actinomycetes besides the activities of various enzymes involved in nutrient mineralization and glomalin content as an indicator of carbon and nitrogen sequestration. The highest bacterial population was found in T1 (5.0 t/ha MC in *kharif* + 5.0 t/ha MC in *rabi*) may be due to greater nutrient availability however the fungal population, glomalin content and enzymatic activities were recorded highest in T6 (FYM & VC in *kharif*, 2.5 t/ha MC in *rabi*). This presumably may be due to the excess amount of organic matter added to the field through addition of FYM and VC which needs mineralization of nutrients by the secretion of soil enzymes (Table 20).

Table 20: CFU* (g/soil) of different microbial communities in soil of different treatments

Treatment	Bacteria on NA ($\times10^{-6}$)	Fungi ($\times10^{-3}$)	Actino-mycetes ($\times10^{-4}$)	Bacteria on Kings B ($\times10^{-5}$)	Free living N fixers $\times10^{-3}$)	Tricho-derma ($\times10^{-3}$)	Rhizobium ($\times10^{-3}$)
T1- 5.0 t/ha MC (*kharif*) + 5.0 t/ha MC (*rabi*)	137	33	29	86	231	25	54
T2- 5.0 t/ha MC (*kharif*) + FYM & VC (*rabi*)	173	53	48	61	175	50	27
T3- FYM & VC (*kharif*) + 5.0 t/ha MC (*rabi*)	88	33	30	59	185	22	28
T4- 2.5 t/ha MC (*kharif*) + 2.5 t/ha MC (*rabi*)	102	32	29	62	210	32	47
T5- 2.5 t/ha MC (*kharif*) + FYM & VC (*rabi*)	145	44	39	108	206	36	40
T6- FYM & VC (*kharif*) + 2.5 t/ha MC (*rabi*)	46	63	58	57	173	52	36
T7- 1.25 t/ha MC (*kharif*) + 1.25 t/ha MC (*rabi*)	39	26	25	94	136	18	15
T8- 1.25 t/ha MC (*kharif*) + FYM & VC (*rabi*)	51	41	38	53	129	22	25
T9- FYM & VC (*kharif*) + 1.25 t/ha MC (*rabi*)	117	36	32	49	169	33	24
T10- Inorganic	51	29	27	30	91	19	21
T11- FYM & VC (*kharif*) + FYM & VC (*rabi*)	55	57	52	50	184	52	22

* CFU (Colony Forming Units)

Project IXX14913: Development of pest and disease management package for organic farming

Organic farming is a holistic food production management systems which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. Nitrogen and pest management are key factors deciding the success of crop under organic farming. The present project is aimed to develop a complete package for pest and disease management for major crops of Western U.P. for organic cultivation. This could serve as a model for developing same kind of package for other parts of the country. The developed packages could be directly utilized by the organic farmers of the region.

Three pest and disease management packages viz., organic pest and disease management package; integrated pest and disease management package and inorganic pest and disease management package were evaluated under field conditions. All the nutrient and pest management practices of each package were applied as per the scheduled time and dose. Observations of different package were recorded on cauliflower, tomato and brinjal crops.

(i) Effect of different pest and disease management package on cauliflower

Data recorded at curd initiation stage revealed a significantly higher plant growth (leaf area 1757.89 cc/plant) in case of integrated management system. Average fresh biomass and curd yield at harvest was also recorded highest under integrated management system followed by inorganic and organic system. Maximum curd yield (454 q/ha) was recorded in integrated disease management system in which, organic and inorganic nutrient and pest management practices were used in combination followed by inorganic (404 q/ha) and organic system (326q/ha) (Table 21). A reduction in curd yield by 19.29 and 28.20% as compared to inorganic and integrated systems respectively was observed in organic system of pest management.

At late stage of curd initiation cauliflower suffers by only one disease i.e. downy mildew (*Peronospora parasitica*). During the season of November-February no other pest and disease was recorded. Maximum downy mildew severity (12.97%) was recorded in case of inorganic management system followed by integrated system (9.37%) and least (5.83%) in case of organic management system (Fig 12).

Table 21: Effect of different pest and disease management package on growth parameters and curd yield of cauliflower

Treatment	Final Plant population/ plot	Avg. Leaf area (cc/ plant)	Avg. fresh biomass/plant at harvest (kg.)	Avg. curd wt. /plant at harvest (kg.)	Curd yield (q/ ha)
1. Organic pest and disease management package	71.00	1592.01	2.57	1.28	326.07
2. Integrated pest and disease management package	69.33	1757.89	2.81	1.52	454.15
3. Inorganic pest and disease management package	69.00	1694.38	2.65	1.48	404.00
CD (p=0.05)=	NS	46.60	0.098	0.150	17.65

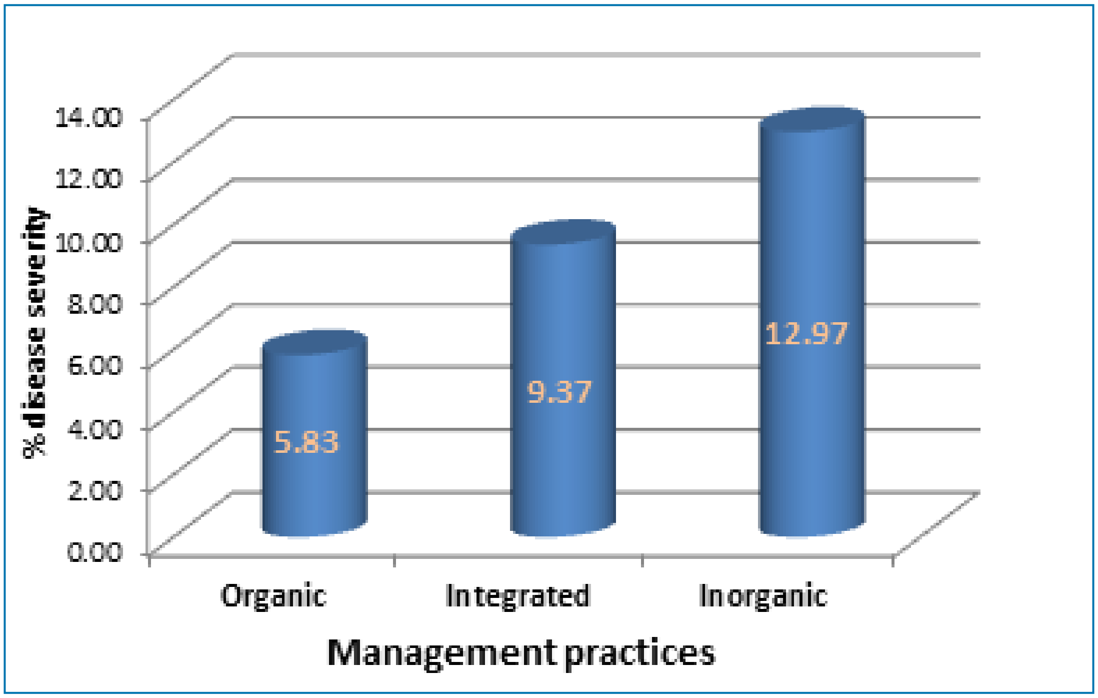


Figure 12: Effect of different management practices on downy mildew severity in cauliflower

(ii) Effect of different pest and disease management package on tomato

Fruit borer (*Helicoverpa armigera*) and fruit rot disease caused by the fungus *Phytophthora infestans* were observed to cause significant losses in marketable fruit yield of tomato. Maximum damage (23.38%) to fruit yield caused by fruit rot disease was observed in case of inorganic pest and disease management system and minimum (16.73%) in case of integrated management system. While, infestation of fruit borer (*Helicoverpa armigera*) was found least in case of organic pest and disease management package and maximum under inorganic system (Table 22). Maximum fruit yield (219.58q/ha) of summer tomato was recorded in case of organic pest and disease management package followed by integrated management system (179.45q/ha) (Fig 13).

Table 22: Yield loss in yield of tomato caused by different pests and diseases

Pest and disease treatment	Average loss in fruit yield of tomato (%)		
	Yield loss due to fruit borer (*Helicoverpa armigera*) (%)	Yield loss due to fruit rot (*Phytophthora infestans*) (%)	Total yield loss (%)
Organic	12.95	17.95	30.90
Integrated	13.42	16.73	30.14
Inorganic	16.88	23.38	40.25
Average	14.42	19.35	40.25

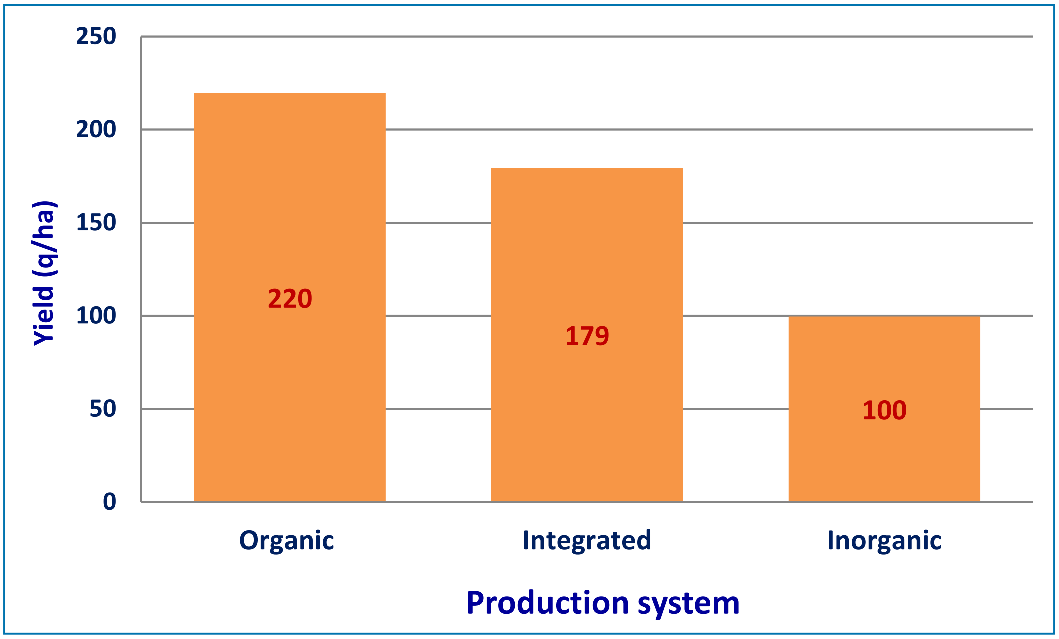


Figure 13: Effect of different management practices on marketable fruit yield of tomato

(iii) Effect of different pest and disease management package on Brinjal

In Brinjal, fruit and shoot borer (*Lucinodes arbonalis*) was recorded as major problem in causing 26.87% average loss in fruit yield across the treatments. Fruit cracking was another physiological disorder responsible for 10.05% average loss in fruit yield in the month of January and February. *Sclerotinia* fruit rot was also recorded as a major disease which caused only about 1.62% average yield loss across the treatments (Table 23). Maximum infestation (37%) of fruit and shoot borer was recorded under organic treatment followed by integrated and organic management systems. It indicates that, fruit and shoot borer remains a big challenge for organic production system of brinjal (Fig 14).

Table 23: Yield loss (%) in brinjal caused by various stresses in different treatments

Pest and disease treatment	Fruit & Shoot Borer (%)	Fruit rot (%)	Fruit cracking (%)	Total (%)
1. Organic	29.56	1.86	10.00	41.42
2. Integrated	22.46	1.34	9.73	33.53
3. Inorganic	28.59	1.67	10.43	40.69
Average	**26.87**	**1.62**	**10.05**	

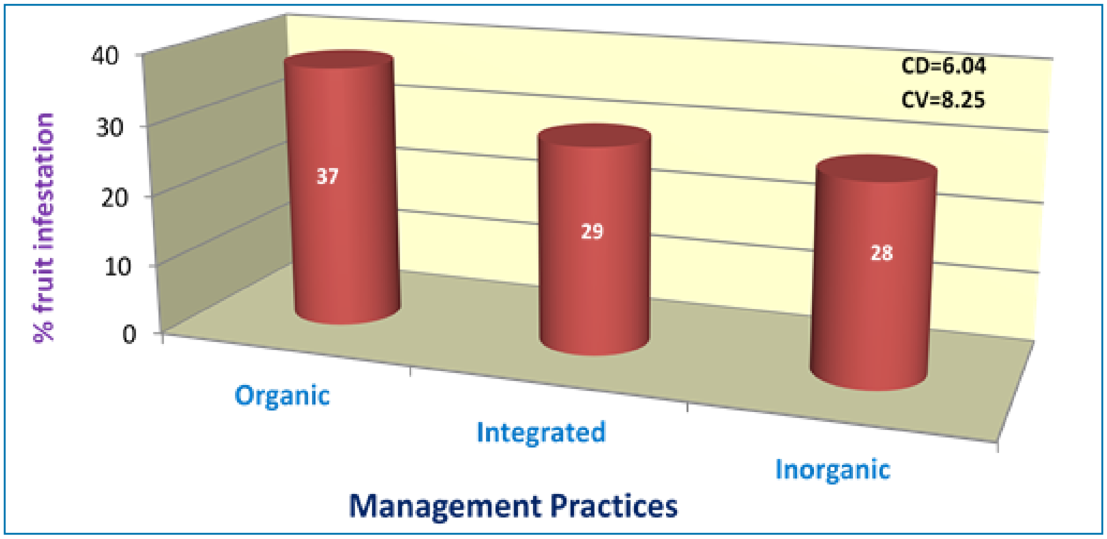


Figure 14: Effect of different practices on fruit infestation by *Lucinodes arbonalis* in brinjal

Maximum marketable fruit yield (322.37q/ha) of brinjal was recorded under integrated pest and disease management system and it was at par with organic treatment (322.05q/ha) (Fig15).

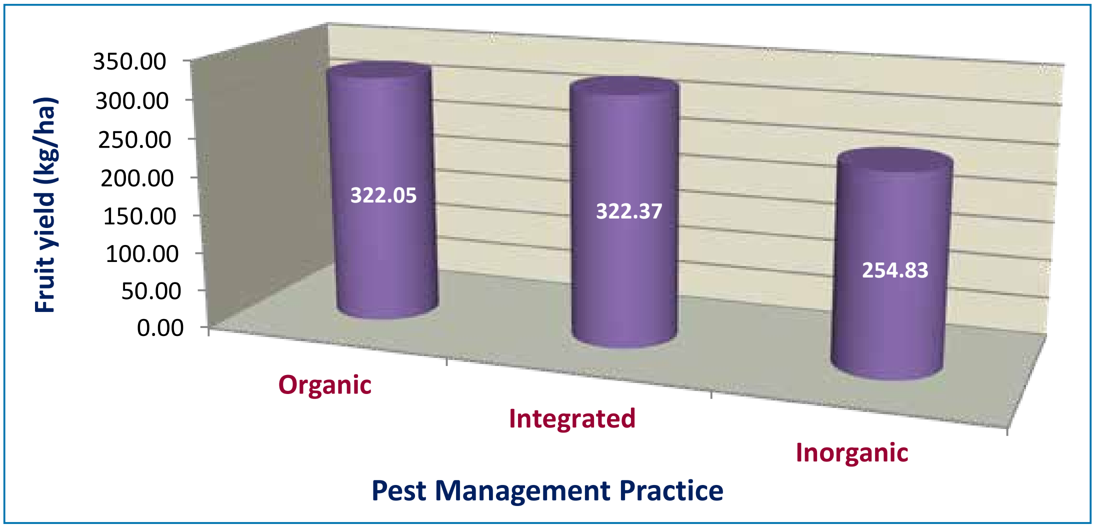


Figure 15: Effect of different management practices on marketable fruit yield of brinjal

(iv) Effect of different pest and disease management package on soil microbiological properties

Different pest and disease management practices showed significant changes in the population of different group of microorganisms in the soil. Among the different treatments, the bacterial population was found highest under organic management system followed by integrated crop management. Lowest microbial population was recorded under inorganic treatments. The fungal and actino-bacterial population was found highest under integrated management practices which could be due to the application of rice straw as mulch under integrated pest and disease management system (Table 24).

Table 24: Population of different microbial communities in soil of different pest and disease management systems (per gram of soil)

Crop	Pest and disease treatments	Bacteria on NA (×10^{-6})	Bacteria on Kings B (×10^{-5})	Fungi (×10^{-3})	Actino-mycetes (×10^{-4})	Tricho-derma (×10^{-3})	Free living N Fixers (×10^{-3})
Tomato	Organic	38.0	25.0	12.3	36.0	14.6	49.7
	Inorganic	8.1	9.18	4.3	28.8	8.2	44.7
	Integrated	17.6	20.6	12.1	41.3	17.2	48.3
Brinjal	Organic	23.8	21.1	21.9	44.6	16.0	48.9
	Inorganic	9.3	7.14	12.3	30.9	7.9	31.8
	Integrated	20.4	17.7	27.4	42.1	23.8	39.7
Cauliflower	Organic	20.6	38.8	14.6	44.6	19.7	44.6
	Inorganic	15.2	26.6	10.6	30.9	15.3	30.9
	Integrated	15.4	36.5	22.0	42.1	21.0	42.1

Maximum curd yield (454 q/ha) of cauliflower was recorded in integrated disease management system in which, organic and inorganic nutrient and pest management practices were used in combination. It was followed by inorganic system (404 q/ha) and minimum in organic system (326 q/ha). Maximum fruit yield (219.58 q/ha) of summer tomato was recorded in case of organic pest and disease management package followed by integrated management system (179.45 q/ha). However, in case of Brinjal, maximum fruit yield was recorded under integrated system (322.37 q/ha) and it was at par (322.05 q/ha) with organic pest and disease management system.

Project OXX02390: All India Network Programme on Organic Farming (AINP-OF), Modipuram centre

Experiment 1: Evaluation of organic, inorganic and integrated production system

Crop management practices significantly affected the performance of different cropping systems. The highest yield of black rice and okra was recorded under 100% organic management. However, highest yield of finger millet, black gram, barley, tomato and vegetable pea were recorded under 100% inorganic management followed by state recommendation. Irrespective of cropping systems, highest system REY was found under 100% organic management if 25% premium prices are provided over normal prices (Table 25). Among the different cropping system, highest REY (17.5t/ha) was recorded under black gram-tomato-sunhemp green manuring system followed by okra-vegetable pea-sesbania green manuring system. Similarly, system net return (Rs. 242979/ha) was also recorded highest under black gram-tomato-sunhemp green manuring system and 100% organic management (Fig 16).

Table 25: Performance of different cropping system under different crop management

Treatment	System REY (kg/ha)			
	Black rice-lentil-cowpea	Finger millet-barley-sesbania GM	Okra-vegetable pea-sesbania GM	Black gram-tomato-sunhemp GM
100% Organic	3688	7798	14166	17473
50% organic+ NF inputs	2842	5600	12412	14536
50% organic + 50% inorganic	2809	6979	10745	16836
25% organic + 25% inorganic + NF inputs	2388	4669	9535	12642
100% inorganic	2781	7238	11574	17043
State Recommedation GM Green manure	2828	7576	11105	17520

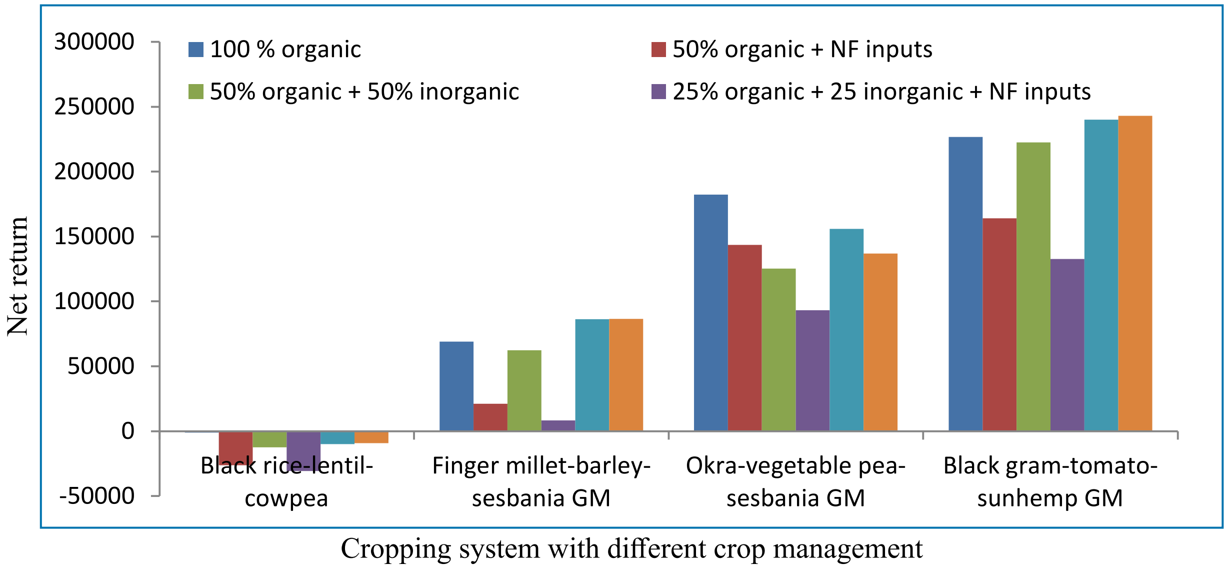


Figure 16: Net return (Rs./ha) under different cropping systems with different crop management

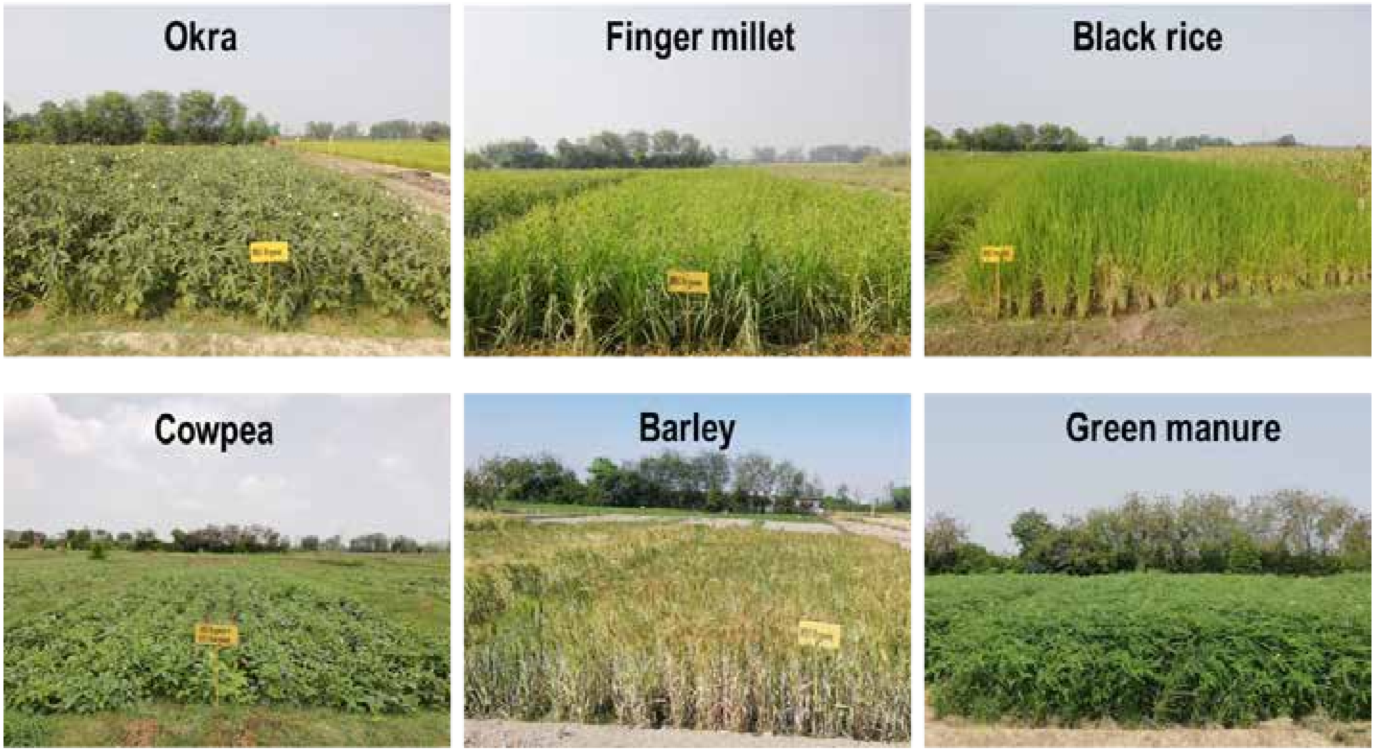


Plate 17: Performance of different crops under organic management.

Experiment 2: Evaluation of different varieties of major crops under organic production management

Performance of different varieties of vegetable pea and brinjal under organic production was evaluated. Among the different varieties of vegetable pea, highest pod yield was found for Prachi 10 followed by PS 100. Similarly highest gross return and net return was found for Prachi 10. Similarly, among different varieties of brinjal, highest fruit yield was recorded of Pusa Hara Baigan followed by Kashi Uttam variety. Therefore, results show that these varieties can be recommended for cultivation under organic farming in Upper Indo Gangetic Plains.

Experiment 3: Geo - referenced characterization of organic/SPNF farmers

Geo-reference characterization survey of 15 farmers (10 organic +5 natural) of Muzaffarnagar, Bulandshahar, Hapur, and Sambhal districts was performed. Organic grower were having 3.31 average land holding while natural farming practitioners were having 1.06 ha. There was 4.91, 13.60, 29.31 and 31.68 percent yield gap in wheat, basmati rice, sugarcane and mustard at farmers field as compared to the on–station experimental fields,respectively. Lack of marketing facilities, low/no premium price, lower productivity and gap in package of practices, lack of availability of organic inputs, lack of technical knowledge and advisory services, lack of dedicated processing facilities for organic inputs were major constraints identified during the survey.

Plate 18: Geo-reference survey of different organic growers

Experiment 4: Evaluation of natural farming practices in different agro-ecology

Under natural farming experiment, nine different management practices including control, scientific organic farming package, complete natural farming and integrated crop management were used under maize-wheat cropping system. Yield of maize was recorded highest under integrated crop management followed by scientific organic farming package. Heavy weed infestation was encountered as a major problem under natural farming treatments. Productivity of wheat was also highest under integrated crop management followed by scientific organic management system. Complete natural farming practices adoption provided 23.4% high system rice equivalent yield (REY) as compared to natural farming without concoctions (beejamrit, jeevamrit and ghanjeevamrit) (NF-1). Better gross and net return was found under integrated crop management followed by scientific organic farming package with premium prices (Fig. 17).

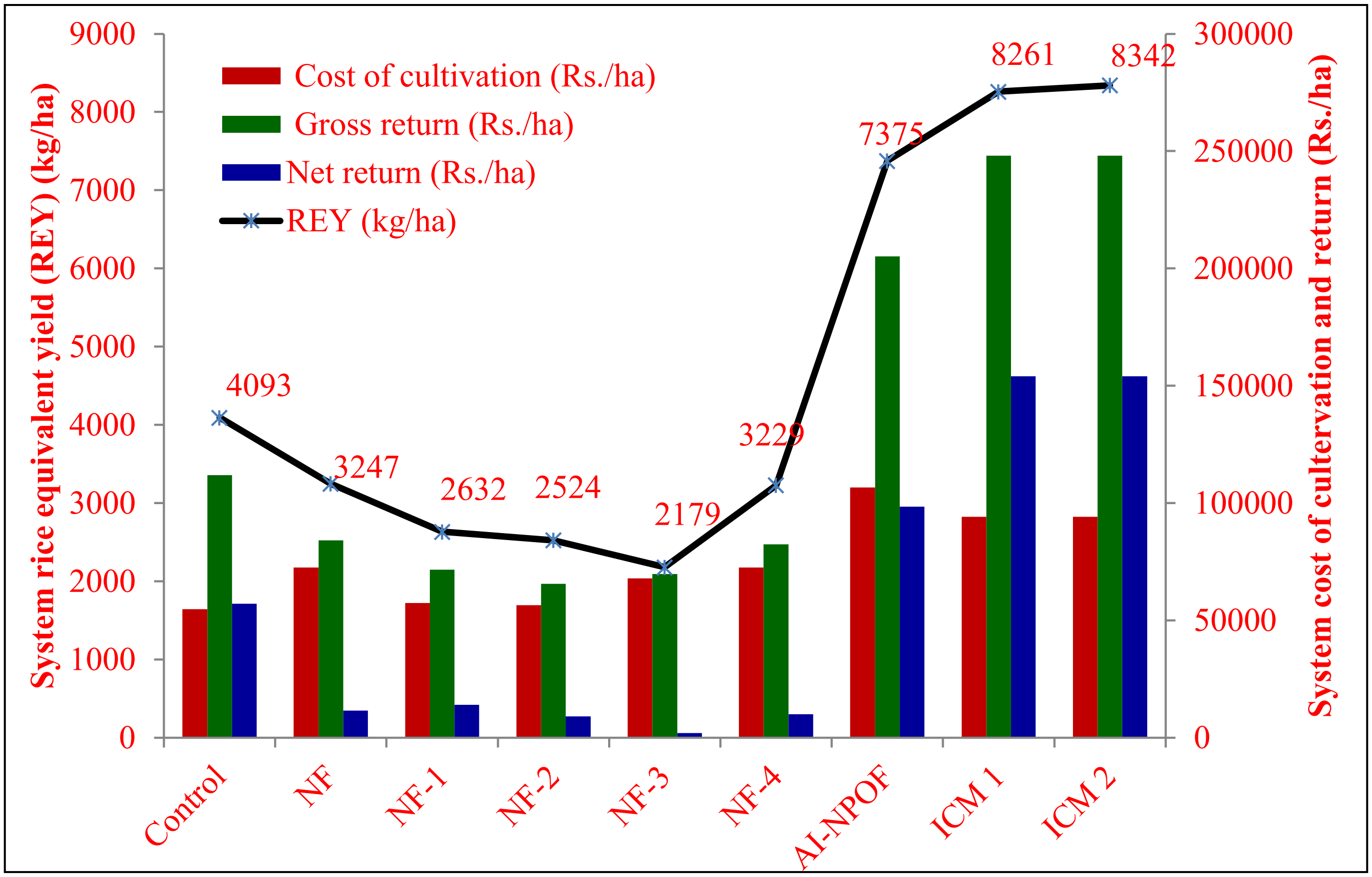


Figure 17: Productivity and profitability of maize-wheat system under natural farming.

Project IXX16458:All India Network Programme on Organic Farming (National)

All India Network Programme on Organic Farming (AI-NPOF), a plan scheme initiated from 2004-05 operates currently with 20 centres covering 10 agro-climatic regions. The scheme is in operation at 11 SAU's, 7 ICAR institutes and 1 special heritage university and covers 16 states. Activities of the scheme have been organized in to 4 programmes namely characterization of organic practices and inputs adopted by organic growers, development of scientific package of practices for organic production (Table 26), organic farming systems assessment and farming systems and capacity building including policy support to Central and State Agencies, organic farming system assessment (Table 26, 27&29). Programme-wise salient progress made under the scheme is give below.

Table 26: Characterization of organic inputs and practices (Programme 1)

Output parameter	Up to 2020-21	2021-22
Geo-tagged characterization of farmers	4721 organic farmers in 16 states; 83 natural farming farmers in 8 States	725 organic farmers in 14 states; 139 natural farming farmers in 8 states

Bio-chemical characterization and molecular identification of microbial population of indigenous organic inputs	12(Shasyagavya, Panchagavya,Kunapajala, Ghanjeevamrit, Jeevamrit, Beejamrit, Vermiwash, Dashparni, Cow urine based solution, Matkakhad, Neemastra, Brahmastra) 13 bacterial isolates Accession number generated-36 are in process	Beejamrit, Ghanjeevamrit and Jeevamrit prepared from cow dung and cow urine of indigenous, HF and its mixtures at 5 locations (Calicut, Coimbatore, Ludhiana, Udaipur and Narendrapur)
Documentation and validation of organic ITKs	11 (pest management practices including storage pests)	7 (nutrient, pest management practices for rice, maize, blackgram, soybean and vegetables)

During the year, 725 organic and 139 natural farming farmers from 16 States have been characterized and yield gap between farmers and scientific organic farming package of major crops analysed over the years.

Table 27: Development of scientific package of practices for organic production (Programme 2)

Output parameter	**Up to 2020-21**	**2021-22**
Scientific package of practices for organic crop production in systems perspective	PoPs of 62 cropping systems for 16 States (44 cropping systems from 2014-2021)	PoPs of 6 cropping systems for 4 States
Identification of varieties for major crops for organic farming in systems perspective	520 varieties of 21 crops, 104 varieties identified for 15 cropping systems	79 varieties identified for 18 cropping systems (Traditional, HYV, Specialty purpose)
Weed management packages for selected crops and systems	13 cropping systems for 13 states	Experiment concluded
Insect-disease management package	12 cropping systems for 7 states and 11 crops for 4 states	7 cropping systems for 4 states (insect management); 3 cropping systems for 3 states (disease management)
Natural Farming practices evaluation in different agro-ecology	-	8 cropping systems in progress at 20 locations in 16 states
Farmer participatory validation of natural and organic farming packages	5 cropping systems in 5 States	6 cropping systems in 6 states (92 farmers)

Organic farming packages developed: During the year organic farming packages for 6 cropping systems have been developed. State-wise details of packages developed are given in Table 28.

Table 28: Organic farming packages developed for different states

State	Cropping System
Gujarat	Greengram-coriander-vegetable cowpea Greengram-fennel-fallow
Rajasthan	Sweetcorn + blackgram – chickpea Soybean-fenugreek
Sikkim	Maize-soybean-buckwheat
Uttarakhand	Finger millet + black soybean -wheat + toria

Table 29: Organic Farming Systems Assessment (Programme 3)

Output parameter	Up to 2020-21	2021-22
One acre integrated organic farming systems established	8 for 8 States	3 are in progress
States covered	7 (Chhattisgarh, Gujarat, Kerala, Meghalaya, Rajasthan, Sikkim, Tamil Nadu)	Uttar Pradesh, Uttarakhand and Punjab in progress
Major production systems covered	Spices, Tubers Hills, Rainfed and Irrigated	Diversified systems
Components	Field crops, horticulture crops, plantations, pest repellent plants, dairy, ducks, fish	Field crops, horticulture crops, plantations, pest repellent plants, dairy, ducks, fish
Net income range	Rs 0.59 to 2.16 lakhs/acre during 2020-21	Rs 0.30 to 2.29 lakhs /acre during 2021-22
Major advantage	Quality and timely availability of organic inputs ensured	Improved recycling and reduced market input cost

Table 30: Capacity building including policy support to Central and State agencies (Programme 4)

Output parameter	Up to 2020-21	2021-22
Model value chain development	Initiated in 6 villages in 4 states during 2020-21	13 villages in 5 districts of 5 states covering 275 farmers
Certified Farm Advisor (s) on Organic Farming (CFA on OF)	120 from 18 States	63 from 14 States
Input to parliament questions	100	59

Mass awareness campaign	2 (11763 participants)	2
Registered groups	1 (Manar Vanadesa Organic Farmers group), 1 PGS group	1 regional council in Haryana by CFA

Project IXX13033:Development of Integrated Organic Farming System (IOFS) models for different regions of India

Institute-AINP-OF linked project aims for developing and refining low external input based sustainable organic agriculture by ensuring cost effective quality inputs for organic farming. As an Inter-Institutional project involving 10 centres of All India Network Programme on Organic Farming and at the institute headquarters, the integrated organic farming system models are being established to study the rate of reducing external market inputs by various means. The details of the IOFS models developed or being developed in different agro-climatic regions are given in Table 30.

Table 30: IOFS models being developed in different regions of India

Sl. No	ACZ	NARP	Number of models	Location
1.	Eastern Himalaya	Sub tropical hill zone (ML-1)	1	Umiam (ML)
		Tropical to temperate with lower to higher hills, alpine zone and snow bound areas	1	Gangtok (SK)
2.	Upper Gangetic Plains	Western Plain zone (UP-1)	1	Modipuram (UP)
3.	Upper Gangetic Plains	Bhabar and Tarai zone (UK-2)	1	Pantnagar (UK)
4	Trans Gangetic plains	Central Plain zone (PB-3)	1	Ludhiana (PB)
5	Central Plateau and Hills region	Sub-humid Southern Plain and Aravalli Hills (RJ-7)	1	Udaipur (RJ)
6	Eastern Plateau and Hills region	Chhattisgarh Plain zone (CG-1)	1	Raipur (CG)
7	Southern Plateau and Hills	Western zone (TN-3)	1	Coimbatore (TN)
8	West Coast Plains and Ghat	Northern zone (KE-1)	1	Calicut (KL)
		Southern zone (KE-2)	1	Thiruvananthapuram (KL)
9	Gujarat Plains and Hills	North Gujarat zone (GJ-4)	1	SK Nagar (GJ)
	Total		**11**	**10 States**

ACZ-Agroclimatic zone, NARP-National Agricultural Research Project, ML-Meghalaya, SK-Sikkim, UP-Uttar Pradesh, UK-Uttarakhand, PB-Punjab, RJ-Rajasthan, CG-Chhattisgarh, TN-Tamil Nadu, KL-Kerala, GJ-Gujarat

Development of IOFS model for Western Plain Zone of U.P.

Composition

1. Food systems (basmati rice-durum wheat-sesbania in 0.15 ha, basmati rice-mustard-green gram in 0.05 ha)
2. Fodder systems: (Sorghum + cowpea-maize+cowpea-oat and maize + cowpea-sorghum + cowpea-berseem) in 0.1 ha
3. Kitchen garden in 0.1 ha
4. Pest repellent plants 0.05 ha
5. Dairy (1 buffalo and 1 cow)

(i) Performance of food crops under low input organic management

Performance of the basmati rice and durum wheat along with different varieties under organic production system indicates that the yield of the system and economics gets improved significantly over the years (Table 31, 32 & 33). During the year, basmati rice (cv. PB 1121) and wheat (cv. DBW 187) recorded higher net returns of Rs 1,18,635/ha with better net return per rupee invested and B:C ratio under organic production system.

Table 31: Basmati rice performance in basmati rice-durum wheat-sesbania system

Year and Basmati rice variety	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	NRPRI	B:C ratio
Basmati Rice						
2017 (PB 1)	2653	3233	59533	14283	0.3	1.3
2018 (PB 1121)	3000	3480	66960	28560	0.7	1.7
2019						
PB 1718	3255	4155	108038	63698	1.4	2.4
PB 1728	3048	3965	101353	57013	1.3	2.3
PB 1637	3104	3976	103060	60320	1.4	2.4
2020						
PB 1718	2996	3926	109140	58460	1.2	2.2
PB 1728	2780	3602	101160	51020	1.0	2.0
PB 1637	2858	3688	103920	55380	1.1	2.1
2021						
PB-1	2100	5380	56880	28880	1.0	2.0

CR-310	3020	5600	75380	47380	1.7	2.7
PB-6	3060	7118	80120	52080	1.9	2.9
2022						
PB 1692	2050	3750	61440	36440	1.4	2.4
PB 1	2125	3975	63975	38975	1.5	2.5
PB 1121	2225	4530	65035	40035	1.6	2.6

*NRPRI: Net returns per rupee invested

Table 32: Durum wheat performance in basmati rice-durum wheat-sesbania system

Year and variety	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	NRPRI	B:C ratio
Durum wheat						
2016-17 (MPO JW 1215)	2600	2700	65500	34720	1.1	2.1
2017-18 (MPO JW 1215)	2624	3223	68597	41317	1.5	2.5
2018-19 (MPO JW 1215)	2737	3312	79502	52222	1.9	2.9
2019-20						
HD 2067	4270	4510	125040	80680	1.8	2.8
JW 3288	4486	5056	159860	113640	2.5	3.5
HD 3086	4400	4996	130580	86220	1.9	2.9
2020-21						
HD 2067	4060	4304	117000	72800	1.6	2.6
JW 3288	4230	4852	149920	105560	2.4	3.4
HD 3086	4120	4792	122500	78080	1.8	2.8
2021-22						
DBW222	4270	4710	104200	74200	2.4	3.4
DBW187	4450	4900	108600	78600	2.6	3.6
PBW343	3975	4425	98600	67600	2.1	3.1
HD2967	4000	4650	98600	68600	2.3	3.3

Table 33: Sesbania in basmati rice-durum wheat-sesbania system

Sesbania (Green biomass) (kg/ha)	
2018	24000
2019	25167
2020	24233
2021	24000
2022	24600

Performance of basmati rice-mustard mungbean system also found to be improving over the years under low external input based organic production system. System recorded net return of Rs 1,67,995/ha during 2021-22 (Table 34).

Table 34: Performance of basmati rice-mustard-mung bean system over the years

Year and variety	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	NR-PRI	B:C ratio
Basmati rice						
2017 (PB 1)	2480	3500	56600	11350	0.3	1.3
2018 (PB 1509)	2800	3420	62840	24440	0.6	1.6
2019 (PB 1509)	2970	3805	98613	59913	1.5	2.5
2020 (PB 1509)	2716	3452	98620	54160	2.2	3.2
2021 (PB 1509)	3760	6436	92200	64200	2.3	3.3
2022 (PR 126)	2300	4860	66120	41120	1.6	2.6
Mustard						
2017-18 (RH 749)	2000	7140	110710	90430	4.5	5.5
2018-19 (RH 749)	2600	7520	138820	119540	6.2	7.2
2019-20 (RH 749)	2440	7280	160280	126620	4.8	5.8
2020-21 (RH 749)	2520	7220	162280	126620	3.6	4.6
2021-22 (RH 725)	2125	7225	116875	96875	4.8	5.8
Green gram						
2018 (Pant Mung 5)	800	1000	60000	39220	1.9	2.9
2019 (Pant Mung 5)	886	1049	83555	61825	2.8	3.8
2020 (Pant Mung 5)	564	2670	55040	20500	1.6	2.6
2021 (Pant Mung 5)	480	2570	51000	20500	0.7	1.7
2022 (IPM-2-3)	650	1000	45000	30000	2.0	3.0

(ii) Performance of fodder module: Performance of fodder system indicated that growing of maize + copwpea, sorghum + cowpea during *kharif* and berseem and oat during *Rabi* can meet the green fodder requirement for 2 animals from 0.10 ha area is given in Table 35. Yield level was found to be 44, 34.5, 46.5 and 48.5 t/ha, respectively for berseem, oat, maize + cowpea and sorghum + cowpea during 2021-22 (Table 35).

Table 35: Performance of module for fodder production

Perticulars	***Kharif***		***Rabi***	
Area	0.05 ha	0.05 ha	0.05 ha	0.05 ha
Cropping System	Maize + cowpea	Sorghum + cowpea	Berseem	Oat
2019-20				
Sowing	25 May, 2019	26 May, 2019	29 October, 2019	2 November, 2019
Harvesting	15-25 August, 2019	25 August -4 September, 2019	1 January – 20 March, 2020	15 January -10 February, 2020
Yield (t/ha)	53.3	55.3	43.0	31.0
2020-21				
Sowing	18 May ,2020	18 May, 2020	13 November, 2020	13 November, 2020
Harvesting	13 September, 2020	27 July, 2020	5 January – 20 March, 2021	16 January -12 February, 2021
Yield (t/ha)	92.7	85.1	41.0	34.0
2021-22				
Sowing	18 June, 2021	18 June, 2021	18 November, 2021	18 November, 2021
Harvesting	26-30 September, 2021	19-16 September 2021	18 January - 8 April, 2022	28 January to 5 March, 2022
Yield (t/ha)	44.5	46.5	44.0	34.5
2022-23				
Sowing	16 June 2022	20 June 2022	20 November 2022	20 November 2022
Harvesting	24-28 September 2022	8-14 September 2022	-	-
Yield (t/ha)	46.5	48.5		

(iii) Nutritional organic kitchen garden

A total of 9 vegetables were evaluated in 1000 m^2 for *Rabi* season in the nutritional kitchen garden under organic management. Total of 259 kg of winter vegetables produced can meet the 5 member family requirement of other vegetables category for 98 days, roots and tuber crops for 118 days and requirement of leafy vegetables for 86 days alone (Table 36). Nutrition garden enhance dietary diversity by providing micronutrients through constant supply of vegetables sufficient to meet the family's requirements and achieving nutritional security with smaller investment.

Table 36: Vegetables evaluated in organic nutritional kitchen system for *Rabi*

Category **	**Name of vegetables**	**Area (m^2)**	**Yield (kg)**	**Daily requirement (vegetables) for 5 member family (Heavy work)****	**No. of days vegetables requirement can be met for 5 member family**
Other vegetables	Pea (*R*)	100	18	0.02 kg of other vegetables per person per day (1.0 kg for 5 person/ day)	18
	Broccoli (*R*)	100	43		43
	Cauliflower (*R*)	100	27		27
	Fenugreek (*R*)	100	10		10
Total			**98**		**98**
Roots and tuber crops	Radish (*R*)	100	32	0.02 kg of roots and tuber crops per person per day (1.0 kg for 5 person/ day)	32
	Beetroot (*R*)	100	14		14
	Potato (*R*)	200	72		72
Total			**118**		**118**
Leafy vegetables	Spinach (*R*)	100	25	0.01 kg of leafy vegetables per person per day (0.5 kg for 5 person/ day)	50
	Coriander (*R*)	100	18		36
Total			**43**		**86**
Grand Total (Kitchen system)			**259**		

*** Source – Dietary guidelines for Indian A – Manual (2nd Edition 2011) NIN Publication, Hyderabad*

Plate 19: Vegetables and tuber crops cultivation in the plots

(iv) Pest repellent system

The pest repellent system comprised of about 0.05ha area and contains different toxic plants/ shrubs which are used for on-farm preparation of various herbal products for management of insect-pests and diseases in crops. The composition of plant species in this unit is given as below in Table 37:

Table 37: Pest repellent plant species of IOFS Model used in different concoctions

S. No.	Name of plant	No. of plants	Preparations being prepared
1	Neem (*Azadirachta indica*)	2	Dashparni, Neemastra, Brahmastra, Agniastra, broad spectrum solution, chilli-garlic-extract (CGE).
2	Custard apple (*Annona reticulata*)	2	Dashparni, Brahmastra
3	Akha/Madar *(Calotropis gigantean)*	2	Dashparni
4	Dhatura (*Daturametel*)	5	Dashparni, Brahmastra

5	Karanj (*Pongamia pinnata*)	3	Dashparni, Brahmastra
6	Kaner –Yellow (*Thevetia nerifolia*)	2	Dashparni
7	Gurhal (*Hibiscus rosa-sinensis*)	2	Dashparni
8	Nerium (*Nerium odorum*)	5	Dashparni
9	Lemon (*Citrus limon*)	1	Dashparni
10	Nirgundi (*Vitex negundo*)	2	Dashparni
11	Chandani (*Tabernaemontana divaricata*)	2	Dashparni
12	Jatropha sp.	2	Dashparni
13	Castor (*Ricinus communis*)	1	Dashparni
14	Turmeric (*Curcuma longa*)	15	Dashparni
15	Beal (*Aegle marmelos*)	1	Dashparni
16	Mango (*Mangifera indica*)	3	Dashparni
17	Ber (*Zyzyphus mauritiana*)	1	Dashparni
18	Guava (*Psidium guojava*)	2	Dashparni
19	Tulsi (*Occimum sanctum*)	5	Dashparni
20	Ginger (*Zingiber officinale*)	20	Dashparni
21	Guruch/Giloya/Amrita (*Tinospora cordifolia*)	1	Dashparni
22	Besram (*Ipomoea carnea*)	2	Dashparni, CGE
23	Chilli	20	CGE
24	Garlic	20m^2	CGE

(v) Preparation being prepared for pest and disease management in crops and demonstration to stakeholders

During the year, 600 L Dashparni extract, 60 L chilli-garlic extract, 150 L Panchgavya, 50 L fermented buttermilk, 200 L Neemastra, 100 L Beejamrit and 15 kg of *Trichoderma* were prepared and demonstrated to different stakeholders for nutrient/pest/disease management under organic production system.


पंचगव्य
अवयव: गाय का गोबर, गोमूत्र,
दही, घी, गन्ना रस, नारियल
पका केला, खमीर और पानी


दशपर्णी अर्क
अवयव: नीम, धतूरा, मदार, कनेर,
हल्दी, अरण्ड, करंज, बेल, आम,
अमरूद की पत्ती, गोमूत्र, लहसुन,
अदरक, तम्बाकू व मिर्च


पंचगव्य

Plate 20: Prepration of Dashparni extract, Panchgavya, Neemastra and Beejamrit

Integrated Organic Farming System (IOFS) model for other regions through AI-NPOF

Seven IOFS models are under evaluation in 6 states namely Gujarat, Kerala, Meghalaya, Rajasthan, Sikkim and Tamil Nadu. The economic analysis of the system indicates that under organic farming system, a net income of 2.29 lakhs per acre can be obtained from the spices based organic farming systems (Table 38).

Table 38: Performance of IOFS model at different locations

State (Location)	Components	Area (ha)	Net returns (Rs)
Gujarat (SK Nagar)	Field crop based system (Groundnut-wheat-green gram; Fodder bajra-fodder maize+oat-fodder bajra; Marigold and hybrid napier as boundary plantation), 2 cows; vermicompost	0.40	39,656
Kerala (Calicut)	Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost) 2 cows	0.40	2,29,387
Kerala (Thiruvananthapuram)	Cassava + vegetable cowpea, Taro, Maize, Napier grass, greengram, blackgram, groundnut, Lemon, Karonda, Lemon grass, Vermicompost, 2 cows	0.30	30,402
Meghalaya (Umiam)	Field & horticulture based system (Cereals + pulses + vegetables + fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost	0.43	69,462

Udaipur (Rajasthan)	Field crop based system (Sweet corn + blackgram-wheat; Fodder maize + cowpea-berseem-sesbania; tomato-cowpea; guava, compost unit of NADEP, vermicompost, enriched compost, vermiwash, BD 500, BD 501 & earthworm multiplication) + 2 cows	0.45	82,069
Sikkim (Gangtok)	Crops (Maize–Pahenlo dal (mash)–Vegetable pea, Maize–Pahenlo dal–Buckwheat , Cauliflower–Spinach–Coriander–Broccoli–Fenugreek) , 1 cow & 1 calf, fishery and poultry (25 vanaraja birds)	0.60	37,300
Tamil Nadu (Coimbatore)	Field crop based system (Cotton, maize, sorghum, okra, fodder, pest repellant cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow, 1 heifer & 1bull calf + vermicompost + boundary plantations (*Gliricidia, coconut*)	0.40	59,716

Project IXX17318:Estimation and valuation of ecosystem services from organic and natural farming systems in different agro-ecology

The experiment was conducted under AINP-OF at eight locations namely Modipuram, Ludhiana and Pantnagar in maize + cowpea (fodder) - wheat + chickpea; Bajaura, Gangtok and Almora in soybean + maize for grain -vegetable pea + green coriander and Coimbatore and Dharwad in cotton + green gram -rabi sorghum +chickpea cropping systems to monitor soil health, estimate and value the ecosystem services from organic and natural farming systems. All the parameters were monitored under Control (CM_1), Complete Natural Farming package (CM_2), AI-NPOF package (CM_3), Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic sources) (CM_4) and Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic sources with application of need-based pesticides for pest management) (CM_5). During 2021-22, intercropping only incorporated in CM_2 treatment. In valuation of the produced capital, CM_3, CM_4 and CM_5 recorded higher net produced capital over control treatment by 72.4-200.7%, 112.7-521.9% and 114.2-467.3% respectively at three locations *i.e.* Bajaura, Ludhiana and Modipuram. At Gangtok location 27.9% net produced capital was higher under CM_3 treatment as compared to CM_1, while CM_4 and CM_5 treatment was not incorporated in the experiment. At Coimbatore, net produced capital obtained was negative under CM_1 treatment. Hence all other treatment were significantly better than CM_1. At Dharwad centre, CM_4 and CM_5 treatment increased the net produced capital by 17.3-28.4%. Similarly, CM_3, CM_4 and CM_5 treatment increased the net produced capital by 32.0-747.2%, 50.8-1226.2% and 51.9-1225.7% as compared to CM_2 treatment at four locations i.e., Bajaura, Coimbatore, Ludhiana and Modipuram. While, net produced capital was recorded 2.2- 25.9% under CM_2 treatment as compared to CM_3, CM_4 and CM_5 treatment at Gangtok, Almora and Dharwad centre.

Project IXX13036:Identification of climate resilient production system for different ecology

The study was conducted using the data of 12 years of field experimentation on growing of rice-groundnut under three contrast production systems like organic (supply of 100% nutrients through organic sources and complete organic management as per NPOP standards), inorganic and integrated crop management or towards organic (supply of nutrients through 50% organic + 50% inorganic with complete organic management) during kharif seasons (2004-05 to 2015-16) at Karjat, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, formerly Konkan Krishi Vidyapeeth, Dapoli (Maharashtra) with latitude 18°92' N and longitude 73°33' with altitude of 25.0 m MSL clay-loam soil. The experimental site falls under Western Plateau and Hills (IX) ACR as per Planning Commission of India. The climate of Karjat is coastal in nature where 2906.0 mm is annual rainfall which received normally from 84 rainy days.

The evaluation of production systems in terms of productivity of rabi groundnut was done using the long term rainfall data (1985 to 2016). To find out the climatic normals, long-term meteorological data sets for the period of 1985-2003 were used whereas data sets for the period of 2004-2016 were used for evaluation of the season/years as deficit rainfall year with <20.0% rainfall and high rainfall year with >20.0% rainfall from the average rainfall of the crop season i.e. 2761.mm. The years having crop season rainfall between ±20.0% rainfall from the average then the crop season was treated as normal rainfall season. Out of 12 years of experimentation, it was found that crop was exposed to 6, 4 and 2 times to normal, high and deficit rainfall season, respectively (Table. 39).

Table 39: Rainfall status of the crop seasons over the years (2004-2016)

Year	Crop seasonal rainfall	Percent deviation from average crop season rainfall		Rainfall status of seasons
2004	3065	(+)	11.0	Normal
2005	3957	(+)	43.3	High
2006	2934	(+)	6.3	Normal

2007	2114	(-)	23.4	Deficit
2008	3673	(+)	33.0	High
2009	1999	(-)	27.6	Deficit
2010	4148	(+)	50.2	High
2011	4145	(+)	50.1	High
2012	3085	(+)	11.7	Normal
2013	2694	(-)	2.4	Normal
2014	3309	(+)	19.8	Normal
2015	2356	(-)	14.7	Normal
2016	3235	(+)	11.0	Normal

To know the discrete differences among the production systems, standard error of mean of groundnut yield was calculated. Climate resilient production systems were identified by working out percent gain (+/-) in yield over inorganic management during normal, high and deficit rainfall years.

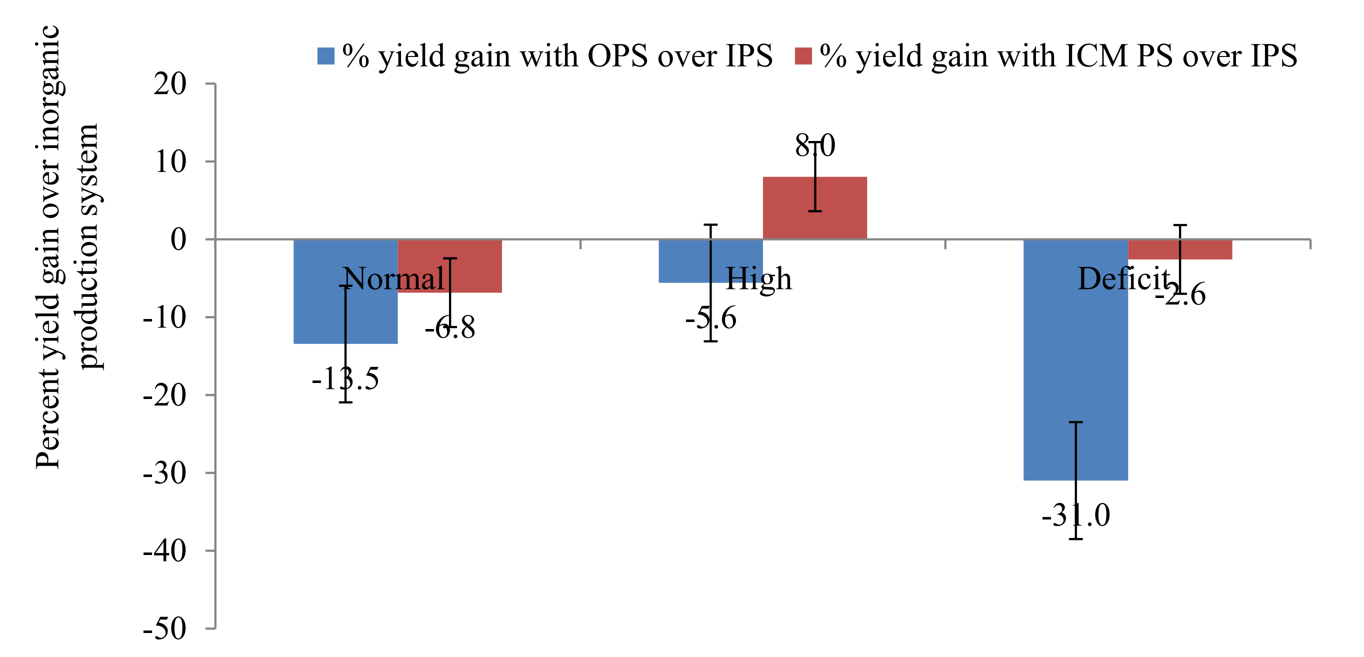


Figure 14: Comparative study of percent yield gain with organic production system (OPS) and integrated crop management production systems (ICM PS) over inorganic production system for groundnut yield at Karjat, Maharashtra

Groundnut cultivated under organic production systems could not be able to maintain the yield at par with inorganic production system under any situation of crop season in terms of rainfall precipitation. However, there was no significant difference in percent yield gain under organic and integrated crop management production systems under normal rainfall situation. Comparative study under high rainfall crop season revealed significant difference in percent gain in yield between organic production systems and integrated crop management production system where ICM performed better with (+) 8% higher yield over inorganic production system. In the deficit rainfall years, the mean yield showed that ICM was found to be statistically at par with inorganic production system whereas organic crop production system registered significantly lower yield i.e. (-) 31.0% lower than the inorganic production system (Fig. 14).

Study on effect of rainfall situations during crop season on the grain yield of groundnut in a particular production system revealed no significant effect of annual rainfall amount under organic production system. Under deficit rainfall condition, inorganic production system yielded higher groundnut compared to organic production system, however, the yield was at par with integrated production system (Fig.15)

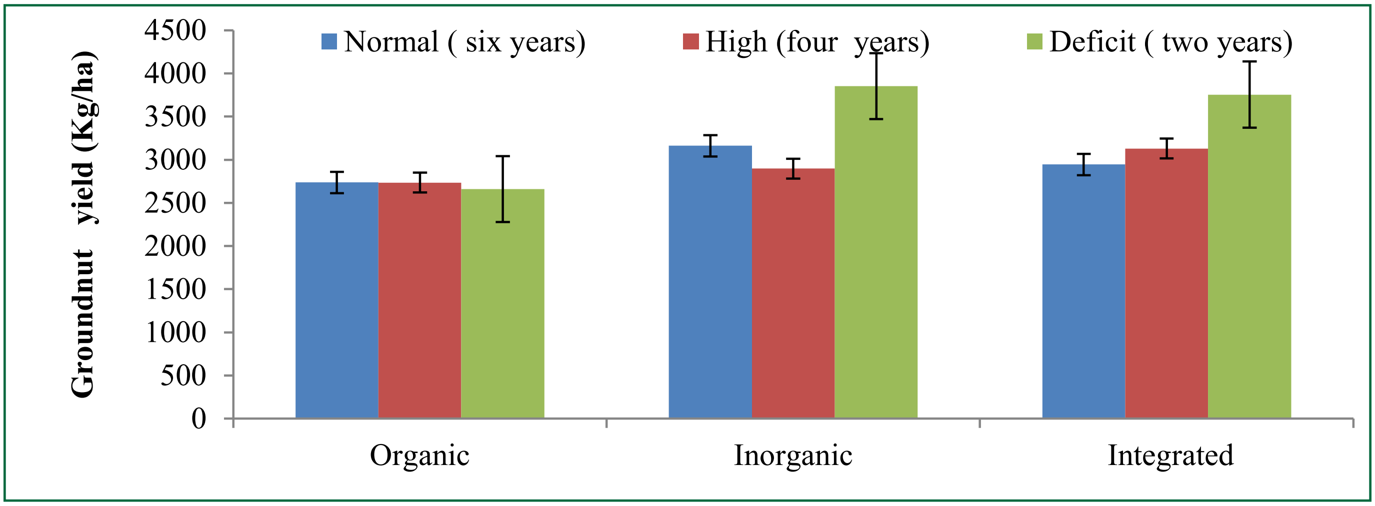


Figure 15:Effect of rainfall situations during crop season on the yield of groundnut in a particular production system at Karjat, Maharashtra

Project OXX5580:The Economics of Ecosystems and Biodiversity: Agriculture and Food initiative in Uttar Pradesh, India

The project is implemented in five districts (Aligarh, Bulandsahar, Hamirpur, Meerut and Mirzapur) of Uttar Pradesh with objective to analyse impact of organic farming and agroforestry on ecosystem services i.e., produced, natural, social and human capitals for policy, institutional and governance solutions for sustainable food production. The scoping report and stakeholder workshop successfully completed as deliverable 1 and 7.

Plate 21: State Stakeholder Workshop, 20th Sep, 2022, Modipuram

Plate 22: National Stakeholder Workshop, 9-10 Nov., 2022, N. Delhi

Project IXX14928: **Development of protocol for value added products from organic sugarcane**

Immune boosting organicJaggery were prepared from organically grown sugarcane viz. CoS 8272 by using previously optimized herbs and spice (Mulethi, 1.0%+Safed musli,0.1%+Tulsi oil, 0.1%+ Cinamon, 1.0%). Shelf life studies of prepared products were conducted after being stored them under different packaging materialsviz., polypropylene (PP, 200 gauge), metalized polyester (MP, 200 gauge), glass jars (GJ, 250g) and PET plastic jars (PJ, 250g). The 250g quantity of each one product were packed and stored at ambient storage condition of Modipuram, Meerut and refrigerated condition (5ºC & 35±2%RH) for a period of 180 days. The packed samples qualities were evaluated in terms of changes in moisture content, hardness, colour and overall sensory attributes. Both the ambient and refrigerated stored samples were evaluated at 30 days and 60 days intervals for total period of 180-360 days. The stored samples were evaluated for their qualities viz., moisture content, hardness, colour value and overall sensory attributes regularly at an interval of 30-60 days. Results revealed a minimum change in moisture content, hardness, colour value and overall organoleptic score by 8.47, 15.07, 5.4 and 8.64%, respectively in samples packed in PET Jars. However, the maximum changes were recorded in jaggery samples kept open condition (Table 40, 41,42 and 43). Among different packaging materials tested, immune boosting organic jaggery recorded the maximum storage life of 180 days when packed in PET plastic jars followed by metalized polyester (MP, 200 gauge) at ambient storage.

Table 40: Variation in moisture content (db) of immune boosting jaggery packed in different packaging materials during the storage period.

Sl. No.	Treatments	Moisture content (%)						
		Days						
		0	30	60	90	120	150	180
1.	Open (control)	11.8±0.16	10.6±0.15	10.3±0.18	8.7±0.21	12.1±0.26	16.8±0.31	19.8±0.22
2.	LDPE, 100 gauge	11.8±0.16	12.1±0.13	12.3±0.11	12.9±0.08	13.8±0.12	14.5±0.14	15.2±0.17
3.	LDPE, 200 gauge	11.8±0.16	12.0±0.09	12.1±0.07	12.5±0.09	14.1±0.15	14.4±0.10	14.7±0.12
4.	PP, 200 gauge	11.8±0.16	12.1±0.17	12.3±0.15	12.6±0.11	12.9±0.11	13.3±0.13	13.7±0.16
5.	MP, 200 gauge	11.8±0.16	12.1±0.14	12.2±0.08	12.4±0.12	12.7±0.09	12.9±0.10	13.4±0.14
6.	Glass jars	11.8±0.16	12.2±0.11	12.4±0.13	12.8±0.11	13.3±0.15	13.7±0.12	14.1±0.11
7.	PET jars	11.8±0.16	11.9±0.13	11.9±0.07	12.0±0.09	12.2±0.11	12.6±0.08	12.8±0.19

Table 41: Variation in hardness (Kgf) of immune boosting jaggery packed in different packaging materials during the storage period.

Sl. No.	**Treatments**	**Hardness (Kgf)**						
		Days						
		0	**30**	**60**	**90**	**120**	**150**	**180**
1.	Open (control)	14.6±0.31	14.7±0.30	14.9±0.34	15.2±0.33	10.2±0.37	6.9±0.31	6.1±0.25
2.	LDPE, 100 gauge	14.6±0.31	14.5±0.29	14.4±0.32	14.1±0.31	13.5±0.28	10.6±0.25	9.7±0.33
3.	LDPE, 200 gauge	14.6±0.31	14.3±0.32	14.4±0.33	14.4±0.31	13.2±0.23	12.4±0.31	10.2±0.30
4.	PP, 200 gauge	14.6±0.31	14.5±0.30	14.5±0.30	14.5±0.31	14.1±0.31	12.9±0.35	10.9±0.27
5.	MP, 200 gauge	14.6±0.31	14.5±0.28	14.7±0.37	14.4±0.31	13.8±0.35	13.4±0.27	11.2±0.31
6.	Glass jars	14.6±0.31	14.6±0.21	14.5±0.31	14.3±0.31	12.8±0.34	12.4±0.31	9.8±0.27
7.	PET jars	14.6±0.31	14.7±0.23	14.8±0.31	14.5±0.31	14.4±0.33	13.8±0.26	12.4±0.32

Table 42: Variation in colour (Lightness value) of immune boosting jaggery packed in different packaging materials during the storage period.

Sl. No.	**Treatments**	**Colour (Lightness, L value)**						
		Days						
		0	**30**	**60**	**90**	**120**	**150**	**180**
1.	Open (control)	42.4±2.31	41.2±2.15	40.2±2.14	36.4±2.62	33.3±2.83	30.5±2.22	26.7±2.66
2.	LDPE, 100 gauge	42.4±2.31	40.4±2.18	40.6±2.11	37.2±2.62	35.4±2.22	33.5±2.33	31.3±2.54

3.	LDPE, 200 gauge	42.4±2.31	41.6±2.11	41.8±2.05	40.6±2.55	37.3±2.34	35.6±2.31	34.5±2.30
4.	PP, 200 gauge	42.4±2.31	42.2±2.21	42.1±2.44	41.8±2.37	40.6±2.33	39.7±2.29	37.4±2.32
5.	MP, 200 gauge	42.4±2.31	42.2±2.13	42.0±2.30	41.9±2.34	41.1±2.62	40.1±2.41	39.0±2.22
6.	Glass jars	42.4±2.31	42.0±2.22	41.9±2.33	41.1±2.41	39.8±2.29	37.8±2.52	35.8±2.35
7.	PET jars	42.4±2.31	42.3±2.06	42.2±2.35	41.9±2.06	41.6±2.33	41.7±2.32	40.1±2.09

Table 43: Variation in overall acceptability (OA) score of immune boosting jaggery packed in different packaging materials during the storage period.

Sl. No.	Treatments	Overall Acceptability (OA) Score						
		Days						
		0	30	60	90	120	150	180
1.	Open (control)	8.1±0.2	7.4±0.2	7.2±0.3	6.7±0.2	6.3±0.2	6.1±0.3	5.5±0.2
2.	LDPE, 100 gauge	8.1±0.2	7.8±0.3	7.6±0.1	7.5±0.3	7.1±0.1	6.8±0.2	6.4±0.2
3.	LDPE, 200 gauge	8.1±0.2	7.8±0.2	7.7±0.2	7.5±0.1	7.4±0.1	7.1±0.2	6.8±0.1
4.	PP, 200 gauge	8.1±0.2	7.8±0.3	7.8±0.3	7.7±0.2	7.5±0.3	7.3±0.1	7.1±0.2
5.	MP, 200 gauge	8.1±0.2	8.0±0.2	8.0±0.1	8.1±0.3	7.8±0.2	7.5±0.1	7.3±0.3
6.	Glass jars	8.1±0.2	7.8±0.1	7.8±0.1	7.5±0.2	7.3±0.3	7.1±0.2	6.9±0.1
7.	PET jars	8.1±0.2	8.0±0.1	8.0±0.2	7.9±0.3	7.7±0.2	7.6±0.1	7.4±0.2

Storage studies for immune boosting organic liquid jaggery

Immune boosting organic liquid Jaggery were prepared from organically grown sugarcane viz. Co 0232 by using previously optimized herbs and spice (Cinamon, 0.1%+ Safforon,0.01%). For this storage studies, 250g of products were packed in different packaging materials viz., 500g PET bottles (PB), 400g PET jars (PJ), 500g glass bottles (GB) and 400g glass jars (GJ). The packed products were stored in both ambient storage condition of Modipuram, Meerut and refrigerated condition (5ºC & 35±2%RH). The packed samples qualities were evaluated for their changes in, colour, TSS and overall sensory attributes for a total period of 180 days and studied by taking samples regularly at an interval of 30 days. Results revealed the least changes in colour value, TSS and overall organoleptic score, respectively by 23.47, 5.46 and 9.64% in glass bottles. However, the maximum changes in these attributes were recorded when samples kept in plastic jars (Table 44, 45 and 46). Among different packaging materials tested, the liquid organic jaggery products were found viable for a period of 180 days when packed in glass bottles followed by PET bottles at ambient storage conditions.

Table 44. Variation in colour (Lightness value) of immune boosting liquid jaggery packed in different packaging materials during the storage period

Sl. No.	Treatments	Colour (Lightness, L value)						
		Days						
		0	30	60	90	120	150	180
1.	PET jars	32.4±1.90	30.2±2.01	26.2±2.12	23.1±2.22	20.9±2.05	17.5±2.03	14.4±1.81
2.	PET bottles	32.4±1.90	31.3±2.03	29.2±2.11	25.1±2.07	24.9±2.12	22.5±2.13	21.3±2.21
3.	Glass jars	32.4±1.90	31.0±2.02	28.2±2.11	26.1±2.20	23.5±2.13	20.6±2.03	18.8±1.07
4.	Glass bottles	32.4±1.90	32.2±2.11	31.8±2.12	30.2±2.12	29.3±2.13	27.5±2.10	24.8±1.23

Table 45. Variation in TSS (%) of immune boosting liquid jaggery packed in different packaging materials during the storage period

Sl. No.	Treatments	TSS (%)						
		Days						
		0	30	60	90	120	150	180
1.	PET jars	82.4±4.22	83.6±4.15	82.8±5.12	84.2±4.05	85.8±4.16	87.2±4.04	89.1±3.92
2.	PET bottles	82.4±4.22	83.7±4.18	84.5±4.31	85.9±4.23	86.2±4.20	86.9±4.12	87.7±4.15
3.	Glass jars	82.4±4.22	83.9±4.18	84.8±4.31	85.3±4.16	86.2±4.11	87.9±4.25	88.5±4.08
4.	Glass bottles	82.4±4.22	82.9±4.07	83.5±5.11	85.4±4.31	86.1±4.25	86.4±4.08	86.9±4.05

Table 46. Variation in overall acceptability (OA) score of immune boosting liquid jaggery packed in different packaging materials during the storage period

Sl. No.	Treatments	Overall Acceptability (OA) Score						
		Days						
		0	30	60	90	120	150	180
1.	PET jars	8.3±0.3	7.7±0.2	7.2±0.3	6.7±0.2	6.3±0.2	6.1±0.3	5.5±0.2
2.	PET bottles	8.3±0.3	7.9±0.1	7.6±0.1	7.5±0.3	7.3±0.1	7.2±0.2	7.0±0.2
3.	Glass jars	8.3±0.3	7.8±0.2	7.6±0.2	7.4±0.1	7.3±0.1	7.1±0.2	6.8±0.1
4.	Glass bottles	8.3±0.3	8.1±0.3	7.9±0.3	7.7±0.2	7.7±0.3	7.6±0.1	7.5±0.2

CROPPING SYSTEMS AND RESOURCE MANAGEMENT

ProjectIXX18251: Evaluation of different cropping sequences for crop intensification under CA practices (Consortium Research Platform on Conservation Agriculture-CRP on CA)

The present field experiment is continuing since 2015 under the umbrella of Consortium Research Platform on Conservation Agriculture (CRP on CA).The experiment comprising of eight cropping sequences i.e. rice-wheat (CP); rice-wheat-green gram (CA); rice-wheat-sesbania (CP); maize-wheat-green gram (CA); maize (cob)-mustard-green gram (CA); rice-wheat-sesbania (CA); sugarcane-ratoon-wheat (CP); sugarcane+greengram-ratoon-wheat (CA) were taken-up under both conservation (CA) and conventional agricultural (CP) practices. The main principles of conservation agriculture are minimum soil disturbance, crop diversification and permanent soil cover aimings to increase and sustain the soil organic matter (SOM). This increased SOM has an advantageous effect on soil physico-chemical and biological attributes. Table 47 shows the effect of different conservation of agricultural practices on soil microbial population under diversified cropping systems.

Table 47: Impacts of conservation agriculture practices on soil microbial population under diversified cropping systems

Treatments	Microbial population on different growth media (CFU/g dry soil)						
	Bacteria	Fungi	Actinomycetes	Pseudom-onas	Free living N fixers	Trichoderma	Rhizobi-um
T_1: R-W (CP)	1.8×10^7	2.3×10^4	2.5×10^5	5.3×10^6	1.2×10^5	9.3×10^4	2.7×10^4
T_2: R-W-GG (CA)	4.4×10^7	5.5×10^4	4.1×10^5	6.3×10^6	1.5×10^5	25.7×10^4	3.5×10^4
T_3: R-W-S (CP)	3.4×10^7	3.0×10^4	2.9×10^5	8.0×10^6	1.5×10^5	7.3×10^4	2.9×10^4
T_4: M-W-GG (CA)	2.0×10^7	4.7×10^4	2.6×10^5	5.6×10^6	1.3×10^5	12.7×10^4	3.7×10^4
T_5: M (cob)-M-GG (CA)	2.6×10^7	4.6×10^4	4.1×10^5	6.7×10^6	1.7×10^5	27.7×10^4	4.7×10^4
T_6: R-W-S (CA)	7.7×10^7	3.8×10^4	5.3×10^5	10.2×10^6	1.8×10^5	28.3×10^4	5.4×10^4
T_7: SR-R+W(CP)	3.2×10^7	3.5×10^4	2.1×10^5	6.4×10^6	1.1×10^5	6.0×10^4	3.2×10^4
T_8: SR+ GG-R+W (CA)	3.3×10^7	3.8×10^4	3.0×10^5	7.9×10^6	1.5×10^5	15.7×10^4	3.4×10^4

R- Rice, W-Wheat, GG-Greengram, M-Maize,S- Sesbania, M-Mustard, SR-Sugarcane, R+Ratoon

The data presented in Table 47 revealed that treatment comprised of CA practices along with summer legumes i.e. T_2, T_4, T_5, T_6 and T_8 recorded 144, 11, 44, 327 and 83% higher bacterial population over T_1 treatment. On an average, treatments comprised of CA practices recorded 103% (T_2), 30% (T_4), 107% (T_5), 149% (T_6) and 53% (T_8) higher microbial population as compared to rice-wheat (CP) treatment, respectively. Similarly, the significantly higher soil organic carbon content (43.6, 41.5, 18.6 and 17.5%) was recorded in treatments T_6, T_4, T_2 and T_8 over the treatment T_1. Maximum residue retention (15.10 t ha^{-1}) was recorded in M-M-GG (CA) followed by R-W-GG (CA) (12.20 t ha^{-1}). Mean residue retention in CA practices (9.59 t ha^{-1}) was 3.25 times higher than CP (2.95 t ha^{-1}). Among the treatments comprised of conservation agricultural practices, maximum water saving (18.26%) was recorded with SRW-CA followed by M-M-GG-CA (17.9%). Maximum labour (31.73%) was saved with M-M-GG (CA) followed by R-W-CA (29%) and R-W-GG-CA (27.53%).

Project IXX18176: Effect of rice straw retention, incorporation and residue decomposition on productivity, profitability, soil health and environment under rice-wheat based cropping system

Management of rice straw has become a major challenge in the rice growing belt of India, as the straw is either burnt in-situ or removed from the field. These traditional methods have a negative impact on long-term soil fertility. Therefore, a field experiment has been initiated since April, 2021 (Rabi season) to identify the effect of in-situ rice residue management practices on in-season nutrient cycling and soil health, productivity, profitability and environment under the predominant rice-wheat cropping system of Upper Indo-Gangetic Plain of India. The treatments comprised residue burning (T_1); full residue retention (T_2); full residue incorporation (T_3); full residue retention+pusa decomposer (T_4), and full residue incorporation+ pusa decomposer (T_5). Impacts of different in situ residue management on various plant growth parameters, yield and yield attributes were recorded during the crop growth period. Table 48 contains the data related to the effect of different residue management practices and application of Pusa decomposer on soil microbial population under rice-wheat cropping system.

Table 48: Impacts of in-situ residue management and application of Pusa decomposer on soil microbial population under rice-wheat cropping system

Treatments	Microbial population on different growth media (CFU/g dry soil)						
	Bacteria	Fungi	Actinom-ycetes	Pseudomo-nas	Free living N fixers	Trichod-erma	Rhizobium
T_1	2.7×10^7	2.3×10^4	1.7×10^5	3.1×10^6	0.9×10^5	1.6×10^4	1.7×10^4
T_2	2.7×10^7	2.4×10^4	2.2×10^5	4.0×10^6	1.9×10^5	1.6×10^4	1.8×10^4

T_3	2.9×10^7	3.2×10^4	2.1×10^5	4.1×10^6	1.2×10^5	1.8×10^4	2.5×10^4
T_4	3.7×10^7	4.0×10^4	2.5×10^5	4.2×10^6	1.4×10^5	2.0×10^4	2.8×10^4
T_5	4.0×10^7	4.2×10^4	2.6×10^5	3.9×10^6	1.7×10^5	2.6×10^4	3.9×10^4

The data depicted in Table 48 recorded that incorporation of crop residue either through retention and/or incorporation was found superior over the residue burning. Treatment T_5, T_4, T_3 and T_2 recorded 63.6%, 47.1%, 27.1% and 18.6% higher total microbial population over the residue burning (T_1) treatment. In terms of bacteria, fungi and actinomycetes population, treatments with combined application of residue incorporation and Pusa decomposer spray (T_5 and T_4) recorded 48 and 37%, 82.6 and 73.9%, 52.9 and 47.1% higher bacteria, fungi and actinomycetes over the residue burning treatment. Further, treatments T_4 and T_5 recorded 22.8 and 20.5% higher soil organic carbon (SOC) over the treatment T_1. NDVI, is an excellent tool for measuring the health and vigour of the field crops and detecting the suitable changes in plant health. The treatments RR+PD and RI+PD showed 13.8 and 15.6% higher NDVI values over the residue burning. Similarly, SPAD is used to measure the crop nitrogen status. Higher SPAD values of 24.9 and 28.6% in RR+PD and RI+PD treatments over the residue burning and sole residue management treatments respectively, were recorded which shows the higher availability of nitrogen to the crops in these treatments by the rapid mineralization of crop residues.

Project IXX18168: Adaptation and mitigation potential through Cropping System/Farming System approach (NICRA)

A field experiment was conducted in 2020-21 at Modipuram under irrigated conditions to assess the quantum of greenhouse gases emission from rice-wheat cropping system under different organic carbon strata (medium and high) under different establishment techniques and various sources of nitrogen. It was found that global warming potential (GWP) increased by 3.9% in zero tillage plot as compared to conventional practice under higher carbon strata. However, under medium carbon strata, it was increased by 21.5% (Table 49). The higher GWP under zero till wheat might be due to direct contact of atmospheric oxygen with surface applied nitrogenous fertilizer leads to formation of nitrous oxide which is less under conventional methods. The crop productivity was reduced to the tune of 8.3 and 4.4% in zero tillage practice as compared to conventional practice in conjunction with recommended doses of fertilizers (RDF) at higher and medium carbon stratas, respectively. Application of dichorionic di-amniotic (DCDA), resulting reduction the GWP (Global Warming

Potential) by 33.2 and 4.9% under higher and medium carbon stratas, respectively, under conventional tillage practice, while the reduction of GWP by 25.0 and 9.7% under high carbon and medium carbon, respectively, under zero tillage practice. Carbon equivalent emissions (CEE) of zero tillage (28.08 kg C/ha) was higher as compared to conventional (27.04 kg C/ha) under RDF with respect to higher carbon strata (Table 50). The temporal N_2O fluctuation during the crop cycle is given in Fig 16. N_2O flux fluctuated between 0.60 and 15.93 mg m^{-2} day^{-1} under zero tillage and 0.38 and 9.47 mg m^{-2} day^{-1} under conventional tillage with respect to high carbon strata, while it ranged between 0.38 and 9.16 mg m^{-2} day^{-1} under zero tillage and 0.46 and 4.23 mg m^{-2} day^{-1} under conventional tillage with respect to medium carbon strata.

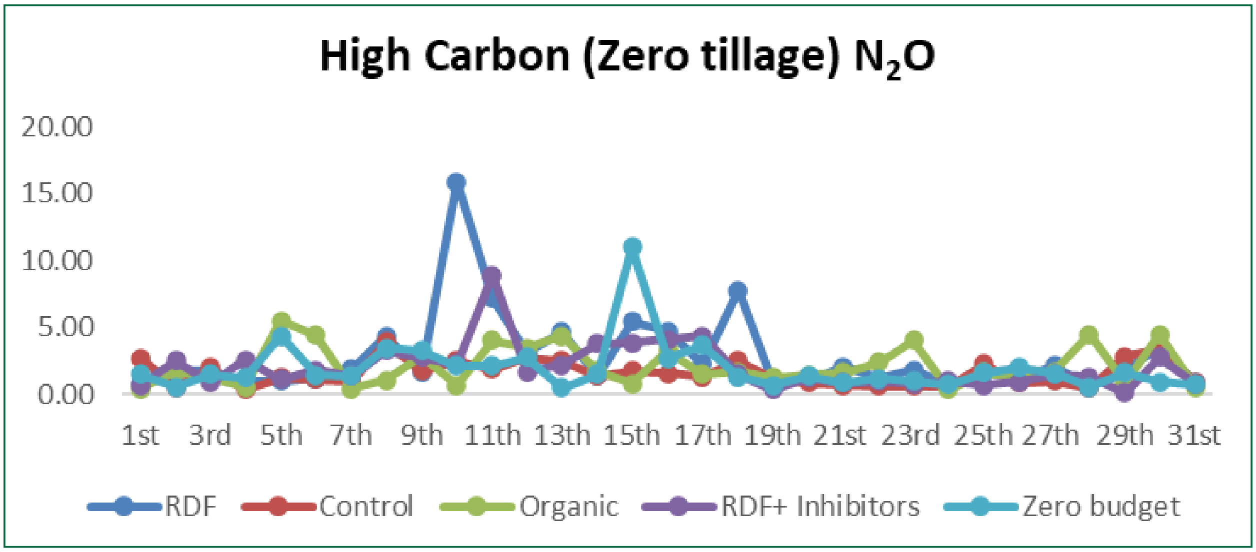
Table 49: Seasonal flux of GHG from the wheat under different establishment methods and different source of nitrogen combinations during 2021-22

Main plot treatments	Sub-plot treatments	High carbon			Medium carbon		
		N_2O emission (kg/ha)	GWP (kg CO_2-eq/ha)	Yield (q/ha)	N_2O emission (kg/ha)	GWP (kg CO_2-eq/ha)	Yield (q/ha)
Zero-tillage	RDF	0.35	102.96	51.92	0.33	98.07	48.77
	Control	0.22	65.50	10.87	0.20	58.42	10.28
	Organic	0.26	77.83	36.74	0.28	83.72	38.95
	RDF+ Inhibitors	0.25	74.31	55.25	0.24	72.93	52.98
	NFC*	0.24	72.69	21.14	0.21	63.72	17.95
Conventional	RDF	0.33	99.13	56.63	0.27	80.74	51.02
	Control	0.20	59.15	11.50	0.17	51.30	11.88
	Organic	0.27	80.37	38.46	0.26	77.21	38.78
	RDF+ Inhibitors	0.22	66.26	60.67	0.26	76.80	58.83
	NFC	0.22	66.06	22.82	0.21	63.90	21.09

*NFC: Natural Farming Concoctions

Table 50: Seasonal flux of GHG from the wheat under different establishment methods and different source of nitrogen combinations during 2021-22

Main plot treatments	Sub-plot Treatments	High Carbon			Medium Carbon		
		Carbon equivalent emissions (CEE) (kg C/ha)	Total C fixed (kg/ha)	Carbon efficiency ratio (CER)	Carbon equivalent emissions (CEE) (kg C/ha)	Total C fixed (kg/ha)	Carbon efficiency ratio (CER)
Zero tillage	RDF	28.08	2180.59	77.66	26.75	2048.16	76.58
	Control	17.86	456.70	25.57	15.93	431.73	27.10
	Organic	21.23	1543.03	72.69	22.83	1635.81	71.64
	RDF+ Inhibitors	20.27	2320.29	114.49	19.89	2225.24	111.88
	NFC	19.83	887.68	44.78	17.38	754.11	43.40
Conventional	RDF	27.04	2378.54	87.97	22.02	2142.76	97.31
	Control	16.13	483.19	29.95	13.99	499.08	35.67
	Organic	21.92	1615.30	73.69	21.06	1628.92	77.36
	RDF+ Inhibitors	18.07	2548.00	141.00	20.95	2470.81	117.96
	NFC	18.02	958.43	53.20	17.43	885.78	50.83



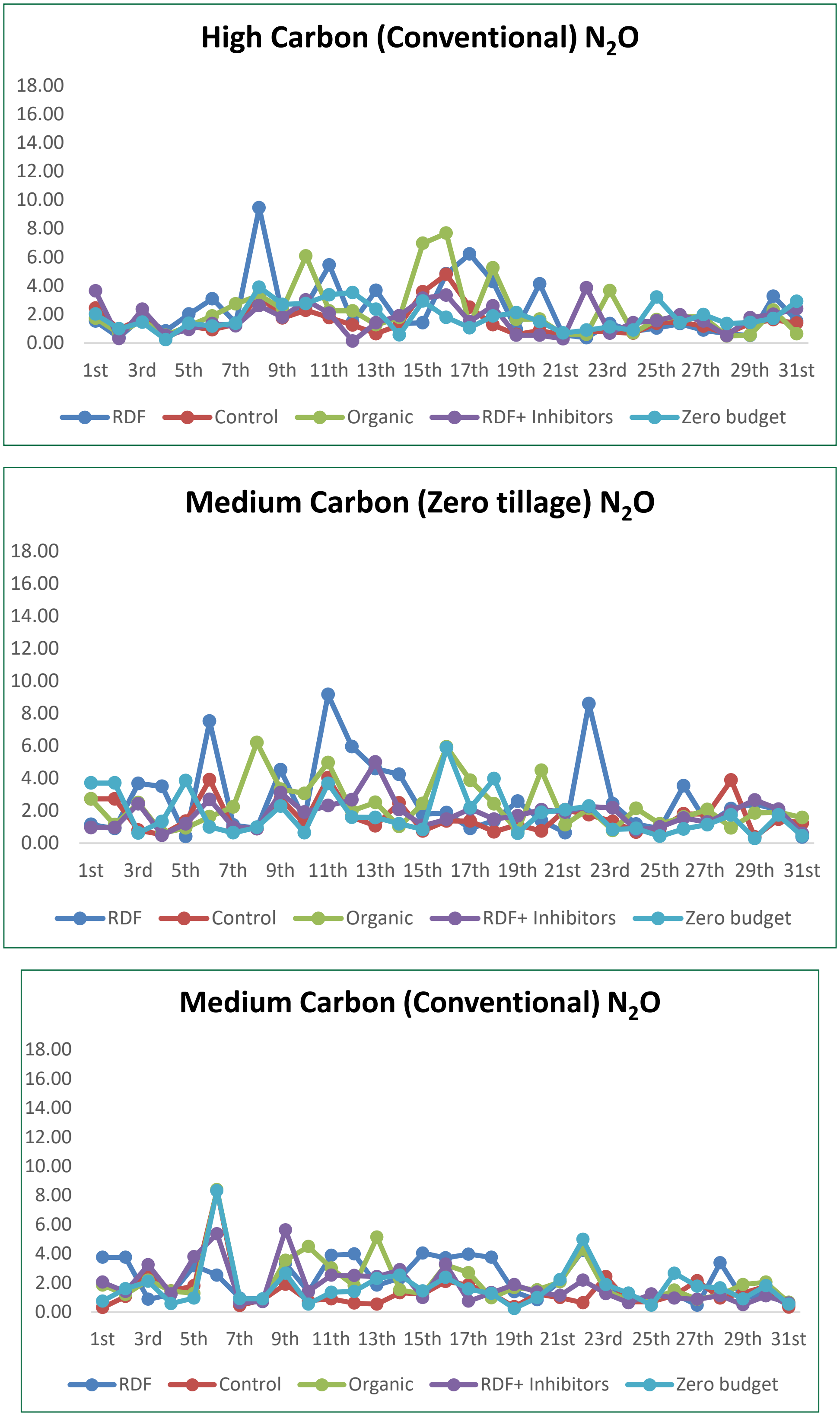


Figure 16: Temporal variation of N_2O flux (mg/m^2/day) under different establishment methods and source of nitrogen with respect to high and medium soil carbon strata (a) High Carbon (Zero tillage) (b) High Carbon (Conventional) (c) Medium Carbon (Zero tillage) and (d) Medium Carbon (Conventional).

Project IXX17320: Development of an intelligent model for predicting mango yields using artificial neural networks

The main objective of this project is to develop a mobile App to assist mango crop growers as well as researchers in selection of mango varieties; planting schedule; disease, pest, weed management; weather information; yield forecast (based on the ANN model); soil testing labs; prevailing Government schemes related to mango farming; contact to IIFSR Kisan Helpline, etc. Therefore, resource-poor farmers can be benefitted more from the help of IT (Information Technology) / Artificial intelligence, which can help an average Indian farmer to get relevant, timely information.

The application is being developed using the Android Studio platform, Java programming language, XML, and SQLite database. The neural network (Back-propagation algorithm) is being used to create a feature of yield prediction network model that can contain three layers of neurons: an input layer, a hidden layer (which is optional), and an output layer. So far, two hidden layers are employed with four neurons in each hidden layer. The final number of hidden layers and number of neurons will be determined by conducting fair numbers of training schedules on data sets (Table 51).

Table 51: Design of an Artificial Neural Network Schema for data training

Input layer	Covariates	1	Fertilizer (Urea)
		2	Fertilizer (DAP)
		3	Fertilizer (Murate of potash)
		4	Fruit weight
		5	Shoot length
		6	Shoot thickness
		7	Beginning of harvest
		8	Monsoon rainfall
		9	Monsoon Max Temp
		10	Monsoon Min Temp
	Number of units[a]		10
Hidden layer (s)	Rescaling method of covariates		Adjusted normalized
	Number of hidden layers		2
	Number of units in hidden layers 1[a]		4
	Number of units in hidden layer 2[a]		4
	Activation function		Hyperbolic tangent

Output layer	Dependent variables 1	Mango yield
	Number of units	1
	Rescaling method for scale dependents	Adjusted normalized
	Activation function	Identity
	Error function	Sum of squares

Where: ‘a’ is variable

Nearly 70% of the functionality task of this App has been completed. This is an application of emerging smart farming technology tool in agriculture. This mAgriculture application is intended to assist farmers with system management / crop management in horticultural crops. Most of the important information of this App is described in the Hindi language also.

This Application includes information on the following topics:

1. About Institute: ICAR-IIFSR
2. Registration and Login of the user
3. State/District Bazar (Mandi) rate
4. State Agriculture Dept. (web sites information)
5. Contact to IIFSR Kisan helpline
6. Mango varieties, planting schedule
7. Disease, pest, weed management
8. Weather information
9. Yield forecast information (Algorithm: Back-propagation algorithm to create a feature of yield prediction network model)
10. Information on Soil testing labs and Govt schemes

Technical specifications of the developed Android Mobile App

1	Version release	Beta 1.0
2	Platform	Android Studio (chipmunk 2021.21)
3	AVD Emulator	Pixel 5 API 27
4	Android Gradale plugin version	3.2-7.2
5	Minimum SDK version	32
6	Database	SQLite
7	Language	Java, XML
8	Developer	ICAR-IIFSR

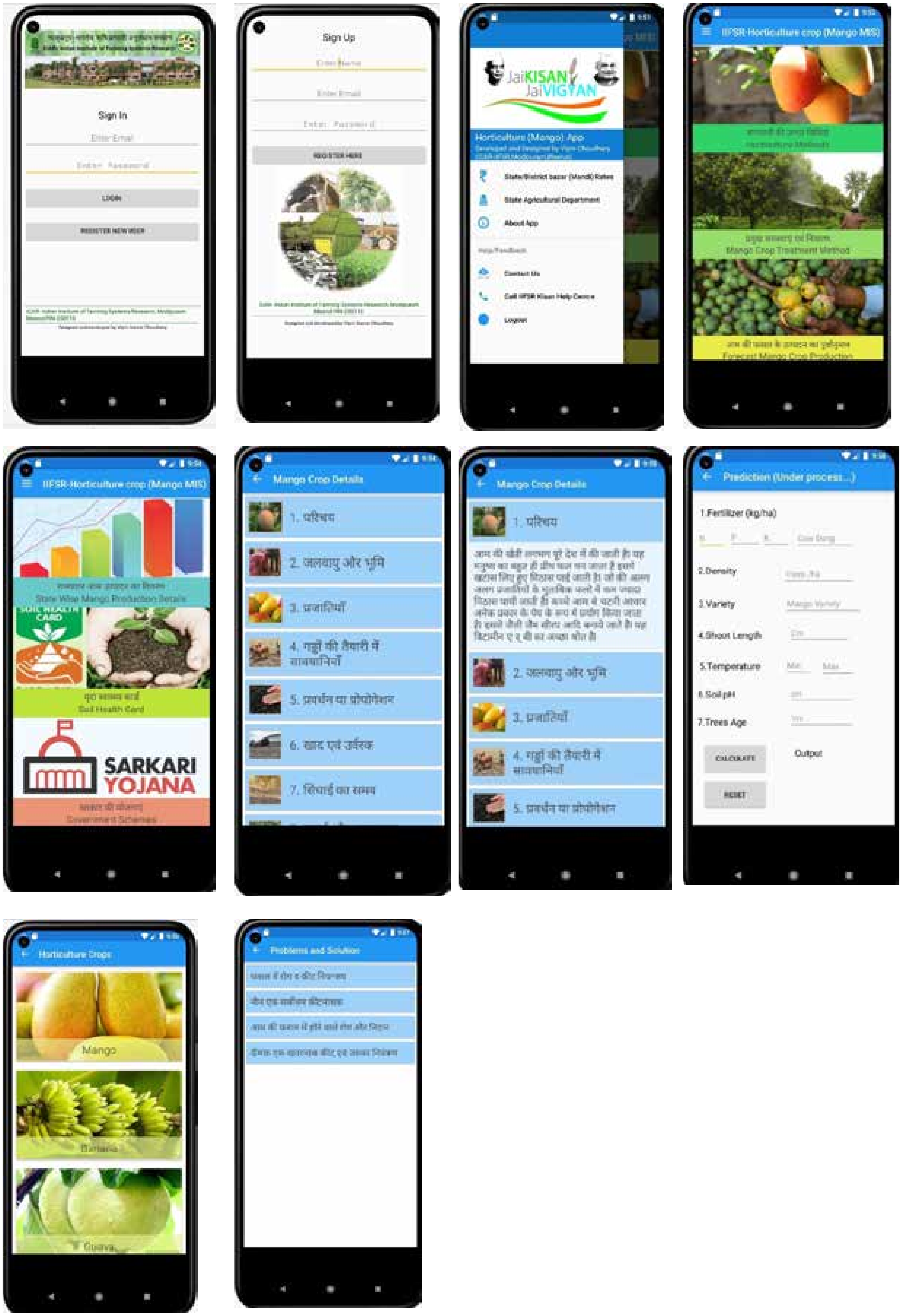


Plate 23: Screenshots of Android Mobile App features created

The outcome of this project will be in form of an efficient android mobile app that will be enabling for managing mango crop, besides improving the farming system management. Moreover, this app can also be scaled up to manage other prominent horticultural crops and to provide more helpful information for Farming Systems, as perdomain expertssuggestions.

Project IXX18678: Performance of faba bean with different intercropping system

Faba bean (Vicia faba L.) is a leguminous crop. It is mainly used for animal feeding in developed countries and for human consumption in developing countries. Its value as a feed and food crop is due to its high lysine-rich protein, vitamins, minerals, and carbohydrates, which make it one of the best solutions to the malnutrition, mainly in developing countries of the world. The crop is one of the most efficient atmospheric nitrogen fixers, which can contribute in enrichments of our soil. Due to yield instability, its potential could not be exploited till date but over the period of time, some varieties have been developed that can give a stable yields. To explore the possibility of faba bean cultivation in Western U.P. this experiment under the AICRN on Potential Crops was started at IIFSR, Modipuram from Rabi 2020. During the year 2021-22 it was observed that instead of sole cultivation of Faba bean intercropping with seasonal crops gives higher FEY (Faba bean equivalent yield). The highest FEY was observed in faba bean + wheat (4:9) with 34.4 q/ha which was even higher than sole wheat cultivation 34.2 q/ha fb, faba bean+ mustard (3:1) with 31.1 q/ha fb, faba bean + field pea (2:2) with 24.7 q/ha. Intercropping of faba bean with mustard at (1:1) and (2:2) row ratio, a strong competition was recorded in both crops, faba bean as well as mustard yield was reduced and over all yield is less than sole crop (Table 52). Height of faba bean in mustard was higher more than normal in search of light. This has led pod setting at the double height of the regular pod setting height in case of faba bean. In case of mustard, in the absence of proper aeration, the yield was recorded less than the sole crop. On other hand, no competition of faba bean with field pea and wheat were observed. But in case of different combination of faba bean + wheat row ratio of 4:9 was superior to 2:9 or 6:9; and faba bean + field pea (2:2) was superior to (1:1).

Table 52: Performance of faba bean with different intercropping systems

Sr. No.	Treatment Detail	Main crop yield (q/ha)	Intercrop yield (q/ha)	Faba bean equivalent yield (q/ha)
T1	Sole faba bean at 30 cm	18.18	0	18.2
T2	Sole field pea at 30 cm	15.23	0	17.8
T3	Sole wheat at 20 cm	52.02	0	34.2

T4	Sole mustard at 30 cm	20.44	0	31.7
T5	Faba bean + field pea (1:1)	13.11	6.73	21.0
T6	Faba bean + field pea (2:2)	12.88	10.16	24.7
T7	Faba bean + wheat (2:9)	2.87	45.46	32.8
T8	Faba bean + wheat (4:9)	9.81	37.33	34.4
T9	Faba bean + wheat (6:9)	8.94	33.61	31.1
T10	Faba bean+ mustard (1:1)	6.44	5.31	14.7
T11	Faba bean+ mustard (2:2)	6.88	6.0	16.2
T12	Faba bean+ mustard (3:1)	13.17	11.57	31.1
Sem (±)		2.672	1.794	2.937
C.D. (p< 5%)		7.682	5.152	8.435
C.V.		8.931	9.614	7.728

Plate 24: Faba bean trial with different intercropping at field

Plate 25: Performance of Faba bean with intercropping

Project IXX16181: Updating of Cropping System Atlas of India and Preparation of Futuristic Crop Plan for 2030, 2040 and 2050

Cropping system atlas was developed by ICAR-PDFSR (IIFSR) during 2001. At that time, it has been estimated that more than 250 double cropping system, 30 major cropping system spread throughout the country. In last two decades, lot of changes occured due to government policies, depletion in natural resources, research activities, extension activities, land improvement programme, increase in purchasing power and food habits and these all are impacting on cropping systems over the years. Other than this government emphasizing on crop diversification. So before implementation of crop diversification there is requirement to understand the detail of present scenario in country. This needs to be captured for planning of the future agriculture. Therefore, the project entitled as "Updating of Cropping System Atlas of India and Preparation of Futuristic Crop Plan for 2030, 2040 and 2050 was formulated with the following objectives:

1. To update the cropping system Atlas as per current scenario.
2. To identify the changes in cropping systems between 2000-01 to 2019-2020.
3. To develop a suitable futuristic crops/ cropping plan for 2030, 2040 and 2050 considering water availability, food requirement, socio-economic aspect and climate change using conventional and DSSAT/APSIM simulation models.

For the development of futuristic crop plan for different crops different parameters like as Relative Spread Index (RSI), Relative Yield Index (RYI) and Sustainabale Yield Index (SYI) were used in integration of Soil-Climate Suitability Index (SCSI). SCSI classification has been given in Table 53. Highly suitable (S1), Moderatly Suitable (S2), Marginally suitable (S3) and Not suitable (N) .

Table 53: Criteria for potential areas

RSI, RYI and SYI	S1, S2
Most efficient areas(HS, HY, High SYI)	Potential Areas (Most Efficient)
Efficient areas(HS, LY, Medium SYI)	Moderately Potential Areas (Efficient)
Moderately efficient areas(LS, HY, Moderate SYI)	Marginally Potential Areas (Less Efficient)
Other categories	: Not suitable

For development of cropping system atlas, primary data on cropping system was collected in systematic manner with the help of AICRP-IFS and NPOF centre along with KVKs through ATARIs. Because of Covid-19 pandemic difficulties faced in primary data collection, secondary data from (https://aps.dac.gov.in) site and available on other source from state departments site were taken and first major cropping system (FMCS) and second major cropping system (SMCS) were identified and maps developed accordingly.

Futuristic crop plan (Agroclimatic zone crop plan, Agroecological region crop plan, State and District crop plan) has been prepared for 14 crops viz. rice, wheat, maize, sorghum, pearl millet, pigeon pea, chick pea, mustard groundnut, soybean, cotton, sugarcane, potato and onion (Table 54). Futuristic crop plan map has been developed for all the season crops grown viz; Kharif, Autumn, Rabi and Summer. Along with Futuristic Crop Plan (FCP) maps First Major Cropping System (FMCS) and Second Major Cropping System (SMCS) are identified and maps also developed for all major states, ACZs and AER of the country (Fig 17).

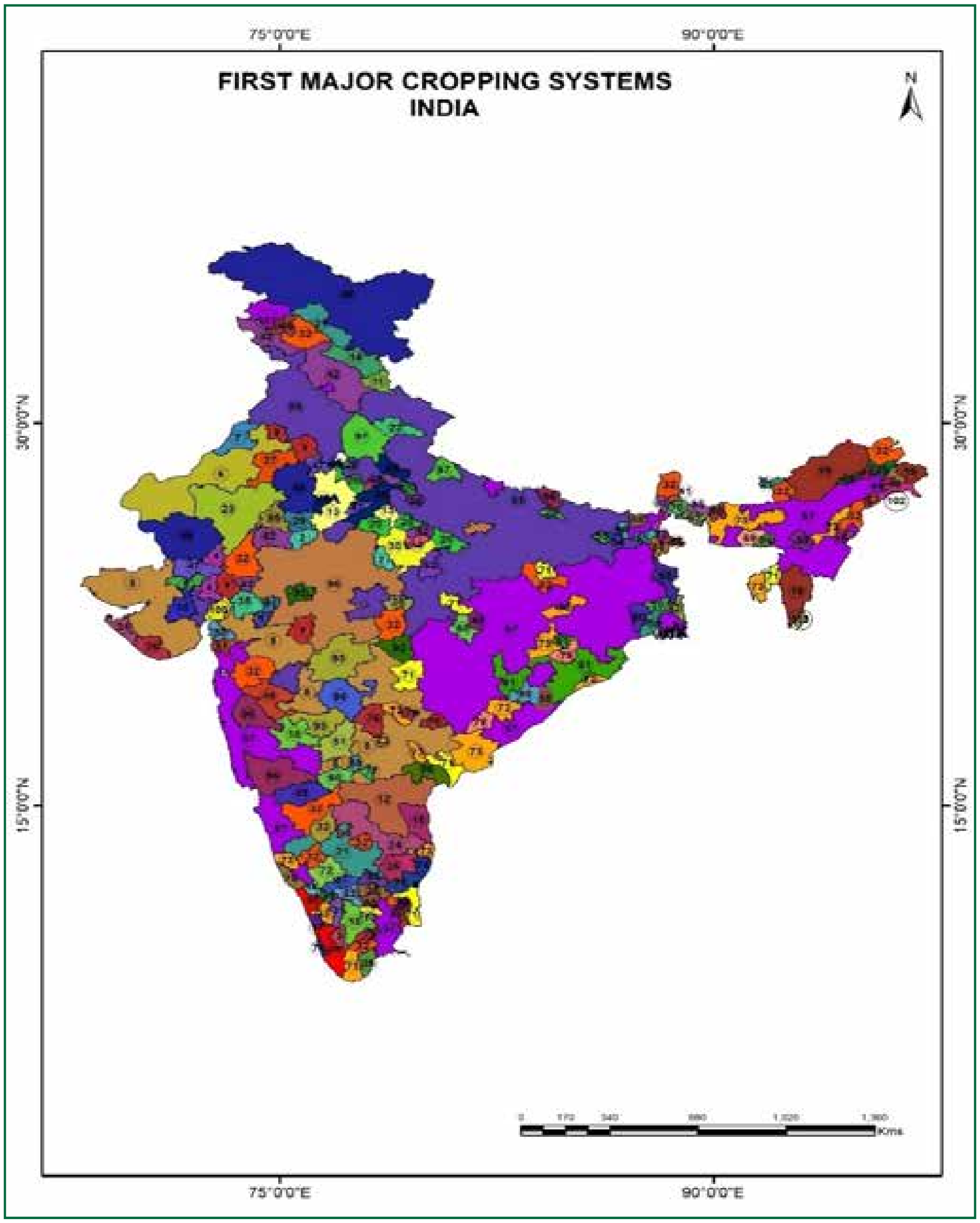


Figure17: First major cropping system (FMCS)

Table 54: Area under major cropping system and changes over last two decades

Cropping Systems	Present area (m ha)	Twenty years back (m ha)	Change in (m ha)	Change (%)
Sugarcane-ratoon-wheat	2.41	0.97	1.44	148.4
Soybean-wheat	4.03	2.20	1.83	83.2
Cotton-wheat	1.95	1.10	0.85	77.3
Rice-wheat	15.18	9.87	5.31	53.8
Rice-rice	3.00	5.89	-2.89	-49.1
Rice-vegetable	0.96	1.24	-0.28	-22.6
Pearl millet-wheat	1.97	2.26	-0.29	-12.8
Maize-wheat	1.66	1.86	-0.20	-10.7
Kodokuttki-fallow	0.07	0.65	-0.58	-89.8
Soybean-fallow	0.35	1.17	-0.82	-70.0
Sorghum-fallow	0.30	0.90	-0.60	-66.7
Fallow-wheat	1.15	2.08	-0.93	-44.8
Fallow-gram	1.78	2.40	-0.62	-25.8
Fallow-rabi sorghum	1.11	1.43	-0.32	-22.0
Fallow-mustard	1.11	1.30	-0.20	-15.1
Rice-fallow	10.29	11.65	-1.36	-11.7
Pearlmillet-fallow	2.60	2.46	0.14	5.7
Cotton-fallow/redgram	8.81	2.55	6.26	245.7
Pigeon pea-fallow	1.30	0.26	1.04	397.7
Groundnut-fallow/wheat	2.92	0.48	2.44	507.3
Maize-fallow	2.81	0.36	2.46	689.6
Cluster bean-fallow	1.92	NR	-	-
Green gram-fallow	1.40	NR	-	-

Rice, wheat and sugarcane have replaced other crops in North and central India. Similarly, mono-cropping pattern has emerged in last two decade replacing minor crops number of cropping system from 250 to 225. In case of rice-wheat, around 5 mha area increased in last two decades (Table 55). Area wise highest contribution is reported from Uttar Pradesh (2.3 mha) but as per percent contribution, Madhya Pradesh stands at first position with 161% increase in area. All the 22 districts of Punjab are now having Rice-wheat as a first major cropping system. However, twenty year back, maize-wheat and cotton-wheat were also having their presence but rice-wheat has replaced maize-wheat totally from 0.5 mha to 0.1 mha. In case of cotton-wheat, overall area has not changed but it has forced to shift it on second position in cotton belt of the Punjab, also.

Table 55: Major contributor state in area acreage under rice-wheat

State	Twenty year ago (mha)	Present (mha)	Area contributor (mha)	Increase (%)
Uttar Pradesh including Uttarakhand	4.12	6.39	2.3	55
Madhya Pradesh	0.59	1.55	1.0	161
Punjab	1.75	2.99	1.25	71
Haryana	0.87	1.54	0.67	77
Bihar	1.51	1.93	0.4	28

TECHNOLOGY TRANSFER AND ASSESSMENT SECTION

Project OXX04208: Cluster based on-farm participatory research in farming systems perspective under Tribal Sub Plan in Uttarakhand

The study area comprised of Tribal farming systems of Tarai and Bhabhar zone, Uttarakhand of Western Himalayan Region, India which is located at (29°15'30 N to 29°16'0.07 N, 79°2'39E to 79°3'0 E) in Ramnagar block of Nainital District. It is characterized by the average altitudes ranging from 195 to 268 m amsl. An impact assessment survey (without input support) was performed in the year 2021-22 in the 100 tribal farm families comprising of a cluster of three tribal villages viz. Thari, Veerpur Tara and Mallapuri.

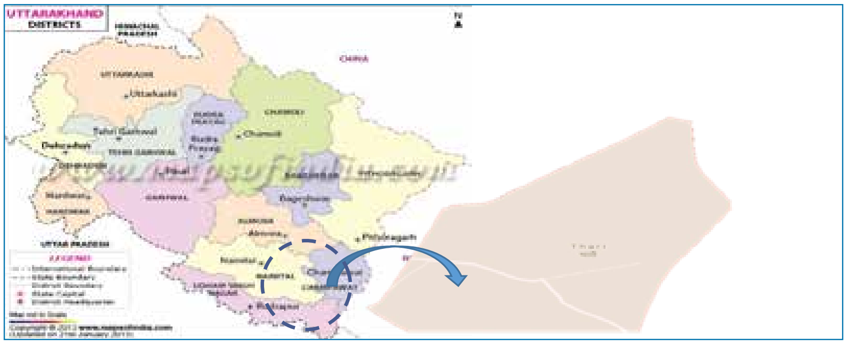


Figure 18: Map of the selected tribal cluster from Tarai and Bhabhar Zone

Table 56: Adoption of interventions without input support (2021-22)

S. No	Farming systems intervention	Net benefit realized due to interventions (Rs/year)	Adoption (%)	Partial adoption (%)	Discontinued (%)	Remarks
1	Varietal change in crops (Wheat) + Line sowing + improved tools					
i)	HD2967	6876.2	84.00	-	14.00	High yielding variety, desired variety required by the seed plants.
ii)	HD3086	7250.0	28.00	-	72.00	High yielding variety but specific seed (varietal) requirements by the seed plants, non-timely payment by govt. mundies.
iii)	WB2	-900.00	04.00	-	96.00	Better nutritional quality and taste but lesser production.
iv)	DBW173	1542.8	32.00		68.00	Better in yield, lodging resistant variety
2.	Varietal change in crops (Rice) + improved tools + (IPM) trichocards/pheromone traps					
i)	PB 1718	9222	-	72	28	High value varieties but underrated payment of Basmati Rice by Govt/Semi Govt. Mandies. Non-availability of (IPM) at local level. Traps modified with indigenous structure
ii)	PB 1728	8111	-	40	60	
iii)	PB 1509	7400	-	08	92	
iv)	PB 1637	3100	-	04	96	
3	Crop Diversification (Pulses) + Improved tools + (IPM) trichocards					
i)	Blackgram (PU 31)	4222.70	-	92	08	Reduced expenditure on purchase of pulse from market. Non-availability of (IPM) at local level.
ii)	Lentil (PL8)	2733.3	-	100	-	
4	Crop Diversification (oilseed) + Line sowing+ Improved tools					
	Mustard (RH 749)	3600	20 (66)	-	10 (33)	Reduced expenditure on purchase of food oil from market

5.	Round the year Nutritional kitchen gardening + Improved tools + (IPM) trichocards/pheromone traps + PPE					
(i)	Improved variety of radish, spinach, fenugreek, coriander, carrot, green /red podded french bean, genetically Bio fortified Vitamin A rich golden sweet potato varieties	2623.12	-	80	20	Reduced expenditure on purchase of vegetables from market, high yielding varieties, non-availability of sweet potato seed and (IPM) at local level. Traps modified with indigenous structure.
(ii)	Improved varieties of brinjal, bottle gourd, cowpea, ridge gourd, okra	3027.08	-	100	-	Reduced expenditure on purchase of vegetables from market, high yielding varieties non-availability of (IPM) at local level.
(iii)	Improved varieties of Mango (Chausa/Langra) guava (Pant Prabhat) lemon (Pant Lemon 1) and litchi (Rose cented)	1656.25	-	100	-	Reduced expenditure on purchase of fruits from market, high yielding varieties non-availability of (IPM) at local level.
6.	Improved breed of backyard poultry (CARI Nirbheek) +mineral mixture+-calcium+vitamin mixture+drinkers)	6100	-	12 (20)	48 (80)	Non availability of improved breed.
7.	Diet, nutrient and health management in animals through mineral mixture, calcium vitamin mixture medicine	11521.33	48 (80)	-	-	Improvement in animal health and milk yield, availability of inputs in local market.
8.	Year round mushroom production (button, milky oyster)	39000	2(25)	-	6 (75)	Non-availability of spawn at local level. adopted by one nearby tribal farmer of Lalitpur village
9.	Vermicomposting	4333.33	7 (35)	-	14 (65)	Time, labour and input constraint

10.	Primary Processing through SHG formulation					
(i)	Chilly/turmeric/ coriander powder/ maize flour	3066.66	2 gps (100)	-	-	Additional income generation
11	Use of tools and implements through custom hiring	-	1 CHC (100)	-	-	Additional income generation through labour and time saving, précised operation.
12	Scientific nursery preparation using portrays	-	-	3(15)	-	Time, labour and input constraints.

Data pertaining to Table 56 shows the impact of farming system interventions towards adoption and net benefit realized by the farmers. Discontinuation of best performing Basmati Rice (var.PB1718) by (28%) of farmers and best performing wheat var. HD 3086 by 72% farmers was observed due to underrated payment by Govt/ Semi govt Mandies and specific seed (varietal) requirements by the seed plants/non-timely payment by govt. mandies. Partial adoption of improved practices in different crops (72-90%) was found due to non-availability of inputs (IPM) at local level. Non availability of poultry chicks of improved breeds, higher requirement of labour and non-availability input (spawn) for mushroom was the major constraints in adoption of IFS technologies in the study area. However, one nearby tribal farmer of Lalitpur village had adopted the mushroom module by getting the skill and knowledge through capacity building programmes organized. Primary processing through SHG formulation was adopted by both the groups (100 % tribal women). Improved tools and implements were used by 100 % members of custom hiring centers. Scientific nursery preparation was partially adopted by 15% of tribal farmers due to non-availability of high yielding vegetable seeds and other inputs required for nursery preparation.



Plate 26: Adoption of nutritional kitchen gardening module (without input support)

Plate 27: Adoption of vermicomposting (without input support)

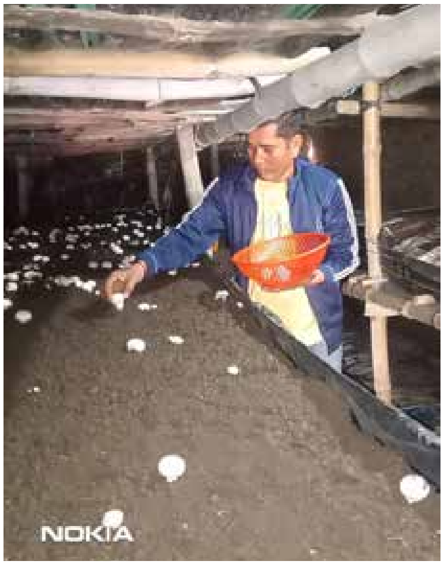


Plate 28: Adoption of mushroom (without input support)

Plate 29: Adoption of improved tools through custom hiring in Thari (b) Veerpur Tara

Plate 30: Adoption of modified version of pheromome traps

Project IXX19734: Ensuring food and nutritional security through Integrated Farming Systems in Western Plain Zone of Uttar Pradesh (Farmer First- 2nd Phase)

The second phase of the project has been initiated from April 2022 at six villages namely, Mubarikpur, Rukanpur, Tigai, Tabita, Dudhli and Madkarimpur in Khatauli block of Muzaffarnagar district of Uttar Pradesh. Benchmark survey of the adopted villages was undertaken by surveying 461 households from the cluster with the objective of identifying the existing farming systems and their constraints and to plan technological intervention for sustenance and income enhancement. The farming systems approach consisted of refinement of existing farming systems as well as alternative approach wherever feasible.

Plate 31: (a) Tigai Village **(b) Mubarikpur village** **(c) Tabeta village**

In Mubarikpur, 113 households were surveyed for benchmark characterization as per the standard format on participatory rural appraisal collected from the key informants of villages. The data revealed that about 36% households belong to marginal and small households while a major chunk of households also belong to landless category. Details of landholdings, farming systems and cropping systems is presented in Fig. 19-21.

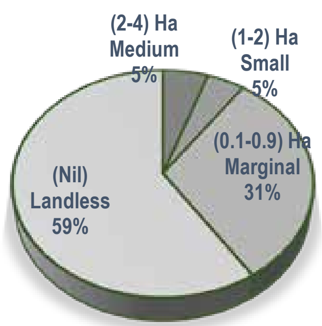


Figure 19: Land holding scenario in Mubarikpur

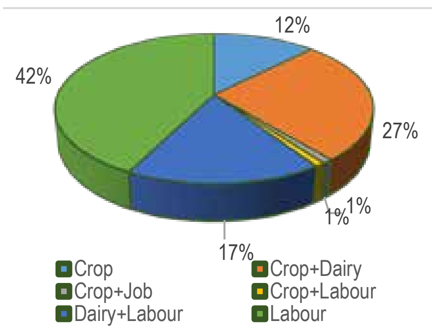


Figure 20: Prevalent farming systems in Mubarikpur

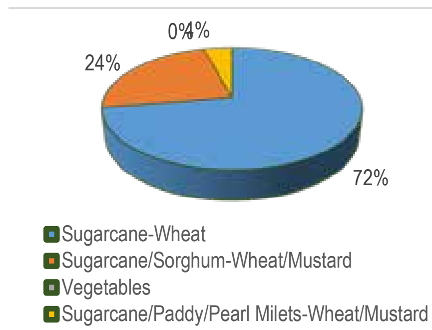


Figure 21: Prevalent cropping systems in the village

In Rukanpur, survey of 82 households revealed crop+ dairy to be dominating farming systems of the region with major area on sugarcane-wheat based system cropping system with more than 60% of farm households belonging to marginal and small category of landholdings. Details of landholdings, farming systems and cropping systems is presented in fig. 22-24.

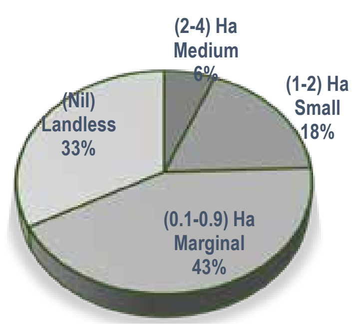


Figure 22: land holding scenario in Rukanpur

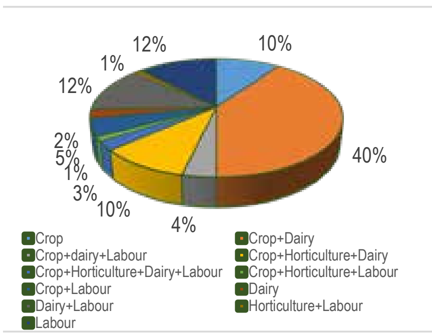


Figure23: Prevalent farming systems in Rukanpur

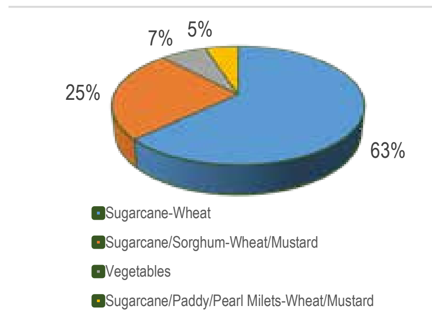


Figure 24: Prevalent cropping systems in the village

Plate 32: Mustard (RH 725) under demo demonstration at Rukanpur

Similar results were recorded for Tigai, Tabita, Dudli and Madhkareempur villages. Accordingly interventions were planned keeping in mind the existing cropping/farming systems including livestock and other components besides planning for capacity development. Under cropping systems, improved mustard seed (RH 725) for higher yield and Pant Shweta for quality mustard oil were sown during the reporting period at farmers field. Keeping in mind the higher yield and lodging tolerant wheat variety DBW 187 was sown at farmers field during Rabi 2022. For fulfilling the fodder need of the livestock component improved Berseem (BL 7) and oat were introduced in the fodder module. Gobhi Sarson (GSC7) were introduced as intercrop in the sugarcane for feed and oil purpose.

Plate 33: Gobhi sarson (GSC7 as an Intercrop in sugarcane) Mubarikpur.

Under horticultural module, fruits plants and nutritional kitchen gardening kits were included as technological intervention for enhancing household nutritional security through diverse nutritionally rich vegetables and green leafy vegetables which can be grown at the backyard in small areas. For animal health maintenance and improving their performance in terms of milk yield, mineral mixture supplementation was implemented in households having milch animals.

Plate 34: Intervention in horticultural and nutritional kitchen garden module in adopted villages under Farmer First Programme (a) Mubarikpur (b) Rukanpur (c) Tigai

Plate 35: Mineral mixture supplementation for livestock health in Tigaiat

Plate 36: Technological backstopping for community fish pond in Tigai

Under this project anticipated weather based agroadvisory were provided to the registered farmers under the project. Month wise details of agroadvisory is given in Fig.25. During the months of June and July, maximum number of Agroadvisories (04) were provided.

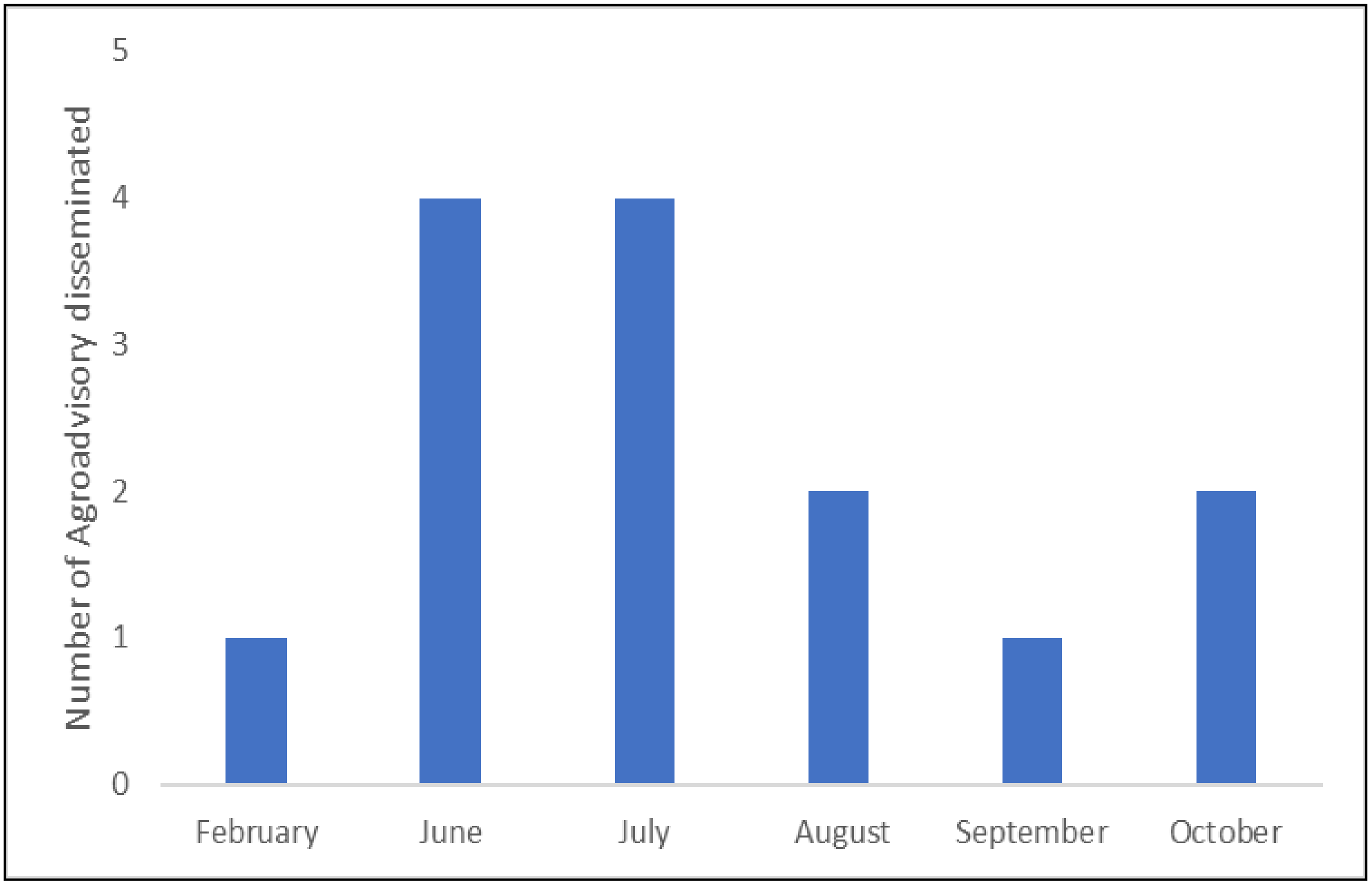


Figure 25: Month wise agro-advisories provided to the farmers

The Agroadvisory was based on the forecasted weather mainly rainfall intensity and number of rainy days. The weather information was amalgamated with the various improved technologies of the integrated farming systems with the objective to reduce the aberrant weather risk and also to curtail the cost of cultivation through upholding the irrigation, agrochemicals spray etc .

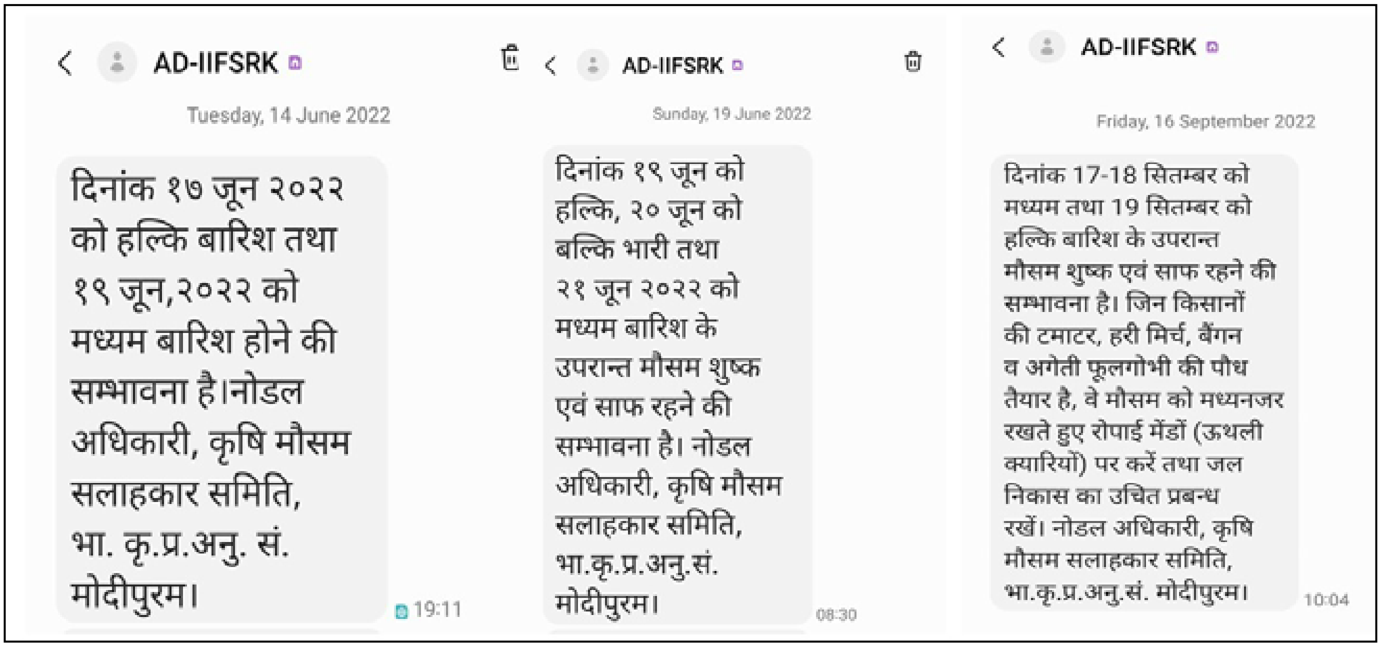


Figure 26: Snapshot of Agro-advisories disseminated to the various stakeholders including registered farmers of the Muzaffarnagar of Uttar Pradesh during 2022.

For capacity building and awareness creation Kisan Gosthi and Field Days were organized in the study cluster including Mahila Krishak Gosthi for gender mainstreaming. Scientist -farmer Interaction Pogramme was organized in Rukanpur, Mubarikpur and Tigai villages under Farmer FIRST Programme during various months. Swachhata Pakkahwada was also organized in this villages during December, 2022.

Figure 27-29: Snapshot of capacity building programme organized during 2022 in adopted villages under Farmer FIRST programme (a) Tigai (b) Mubarikpur (c) Madhkareempur

Project IXX14064: On-farm evaluation of farming system modules for profitability and livelihood improvement of different farmers categories of Western Plain Zone of Utter Pradesh and Uttarakhand

Lack of awareness about improved farming practices is one of the major factors resulting in lower productivity and profitability of agricultural enterprises therefore, the appropriate dissemination of technologies especially to small and marginal stakeholders is highly required besides enhancing their knowledge, skill and attitude towards farming. Hence, the study was conducted with following objectives: (i) To develop farming system model for profitability and livelihood improvement of different categories of farmers, and (ii) Validation and refinement of on-station technologies at farmers' field. The study was conducted in four villages of Muzaffarnagar (U.P.) and Haridwar (U.K.) via selecting a total number of 120 farmers (30 farmers from each village). Performa of Integrated farming system (IFS) Schedule being developed by ICAR-IIFSR was used for collection of socio-economic information of the farmers of selected villages. The data related to increase in mean net income of adopted small farm families after intervention of various IFS components is being presented in the Table 57.

Table 57: Improvement in net income through Existing Vs Improved Farming Systems of small farm households of the study

Farming system (s)	No. of households (% of studied farmers)	Mean holding size (ha)	Mean family size (Nos.)	Mean net income (Rs. In lakhs)
Existing System				
1. Sugarcane-ratoon-wheat + dairy (2 buffalo or 1B+1C)*	42 (35%)	3.02	5-6	4.08 (lakhs/ha)
2. Rice-wheat-sorghum + dairy (2 buffalo or 1B+1C)				
Improved/diversified systems				
1. Sugarcane+ spice/vegetable-ratoon-wheat + dairy (2 buffalos)	42 (35%)	3.02	5-6	4.70 (lakhs/ha) 15% higher over existing
2. Rice-berseem/ mustard + dairy (2 cows or 1C + 1B)				
3. Rice-wheat- maize+ dairy (2 cows)				
4. Maize/jowar-wheat-cowpea + dairy (2 buffalos)				

*B-Buffalo, C- Cow

The data clearly revealed that the 42 number of farmers those followed sugarcane-ratoon-wheat + dairy (2 buffalos or 1B+1C) and rice-wheat-sorghum + dairy (2 buffalos or 1B+1C) farming systems were generating the net income of Rs. 4.08 lakh/ha before intervention of IFS components in the study. After intervention of sugarcane+ spice/vegetable-ratoon-wheat + dairy (2 buffalos), rice-berseem/ mustard + dairy (2 cows or 1C + 1B), rice-wheat- maize+ dairy (2 cows) and maize/jowar-wheat-cowpea + dairy (2 buffalos) as the seeds of crop were provided by us were found to increase their net income by 15.2%. A total of 40 farm families those belong to marginal farmer's category were also studied and the data related to increase their net income are represented in Table 58. This category of farmers followed the rice-mustard + dairy (2 buffalo or 1C + 1B) and rice-wheat-sorghum + dairy (2 buffalos or 1C + 1B) farming systems by which on an average they generated a net annual income of Rs. 1.10 lakh/ha.

Table 58: Improvement in net income through Existing Vs Improved Farming Systems of marginal farm households of the study

Farming system (s)	No. of households (% of studied farmers)	Mean holding size (ha)	Mean family size (Nos.)	Mean net income (Rs. in lakhs)
Existing System				
1. Rice-mustard + dairy (2 buffalo or 1C + 1B)	40 (33.3%)	0.72	5-6	1.10 (lakhs/ha)
2. Rice-wheat-sorghum + dairy (2 buffalo or 1C + 1B)				
Improved/diversified systems				
1. Crop diversification (vegetable based)+ sorghum-berseem+ dairy (2 cows) + composting + NKG	40 (35%)	0.72	5-6	1.46 (lakhs/ha) 32.3% higher over existing
2. Rice-wheat/mustard-maize+ dairy (2 cows or 1C + 1B)+ composting + NKG				

*NKG- Nutritional Kitchen Garden

Once these cropping systems were diversified with suitable vegetable based system + sorghum-berseem+ dairy (2 cows) + composting + NKG and Rice-wheat/mustard-maize+ dairy (2 cows or 1C + 1B) + composting + NKG, the net annual income increased by 32.3%. Various IFS components were also implemented to 25 farm families of landless farmers. The data illustrated in Table 59 showed that before the intervention of IFS component to such farm families their average annual income was only 0.26 lakh/ farm family that was increased to the extent of 57.7% with the adoption of Nutritional Kitchen Gardening along with the dairy component.

Table 59: Improvement in net income through Existing Vs Improved Farming Systems of landless farm households of the study

Farming system (s)	No. of households (% of studied farmers)	Mean holding size (ha)	Mean family size (Nos.)	Mean net income (Rs. In lakhs)
Existing System				
1. Dairy (1 cow/buffalo and/or small ruminants)	25 (20.83%)	-	6-7	0.26
Improved/diversified systems				
1. Improved rearing practices of livestock (cow/ buffalo) + nutritional kitchen gardening)	25 (20.83%)	-	6-7	0.41 57.7% higher over existing

Therefore, it can be concluded that certain approaches such as cropping system diversification, integrated crop management, inclusion of fodder component and proper feed management for dairy animals plays a crucial role in enhancing the income of marginal and small farm families. Further, diversification of IFS with vegetable component and nutritional kitchen gardening also helped in proper nutrition of the farm families.

Project IXX13035: Weather based on-farm technological interventions in farming systems perspective for improving livelihood of farm households

The study was initiated after signing of MoU between C-DAC, Mumbai and ICAR-IIFSR, Modipuram to use C-DAC platform for real time dissemination of the weather based agroadvisory for farmers of Uttar Pradesh emphasising the latest technological interventions.

Plate 37: Snapshot of Agro advisories disseminated to the various stakeholders including registered farmers of the various districts of Uttar Pradesh during 2022

Monthwise SMS Utilization Report						
S No	Sender Id Status	Month,year	Usage	Failed SMS Due to Mismatch with Template/Content	Total Sent SMS	Total Usage
1	TRAI	October, 2022	0	0	0	Usage Details
2	NON-TRAI	October, 2022	5500	694	4806	Usage Details
3	TRAI	September, 2022	0	0	0	Usage Details
4	NON-TRAI	September, 2022	625	10	615	Usage Details
5	TRAI	August, 2022	0	0	0	Usage Details
6	NON-TRAI	August, 2022	7919	1346	6573	Usage Details
7	TRAI	July, 2022	0	0	0	Usage Details
8	NON-TRAI	July, 2022	27579	8453	19126	Usage Details
9	TRAI	June, 2022	0	0	0	Usage Details
10	NON-TRAI	June, 2022	25137	9101	16036	Usage Details
11	TRAI	February, 2022	0	0	0	Usage Details
12	NON-TRAI	February, 2022	2196	208	1988	Usage Details
13	TRAI	September, 2021	0	0	0	Usage Details

Plate 38: Month wise report of push SMS services used for real time dissemination of technological interventions based agro advisories to the registered farmers of various districts of Uttar Pradesh

For smooth dissemination of agroadvisory, district wise group has been created namely Muzaffarnagar, Meerut, Baghpat and Varanasi. About 1000 farmers have been registered for adoption of weather based technological interventions in farming systems. Twice in a week or need based in anticipation of forecast of rainfall and other extreme weather, agroadvisories are being developed through involvement of multi-disciplinary scientist and disseminated to the registered mobile of the farmers of these districts for risk management towards extreme or bad weather condition. Agroadvisory also include latest technologies for input application to reduce the cost of cultivation and also enhance the productivity of the major crops and livestock components of the existing farming systems of the respective districts of Uttar Pradesh. Month wise SMS broadcasted is given in Plate 32. The highest number (19126) of SMS were sent in the month of July followed by June and August 2022.

Project IXX18170: Scaling and impact assessment of integrated farming system for livelihood of farmers

The study undertaken to evaluate the capacity building to upscale the IFS and impact of IFS on farmers livelihood in Kerala, Tamil Nadu and Telangana. The primary data collected from 4 districts of Tamil Nadu i.e Erode, Salem, Dindigal, and Tenkasi; Thiruvananthapuram and Alappuzha in Kerala. With a sample of 193 farmers who are beneficiaries of government scheme and another 174 farmers as counter factual making a total of 367 under study households. Coarsened Exact Matching (CEM) technique was employed to evaluate the impact of IFS on farmers income and household dietary diversity.

The consumption pattern of IFS households has been presented in Fig. 30. On an average the consumption of all the major food components were higher for participating households compared to others. Higher increase in consumption of cereals and fruits and vegetables, whereas marginal increase in pulse, oil seeds and milk consumption were noticed.

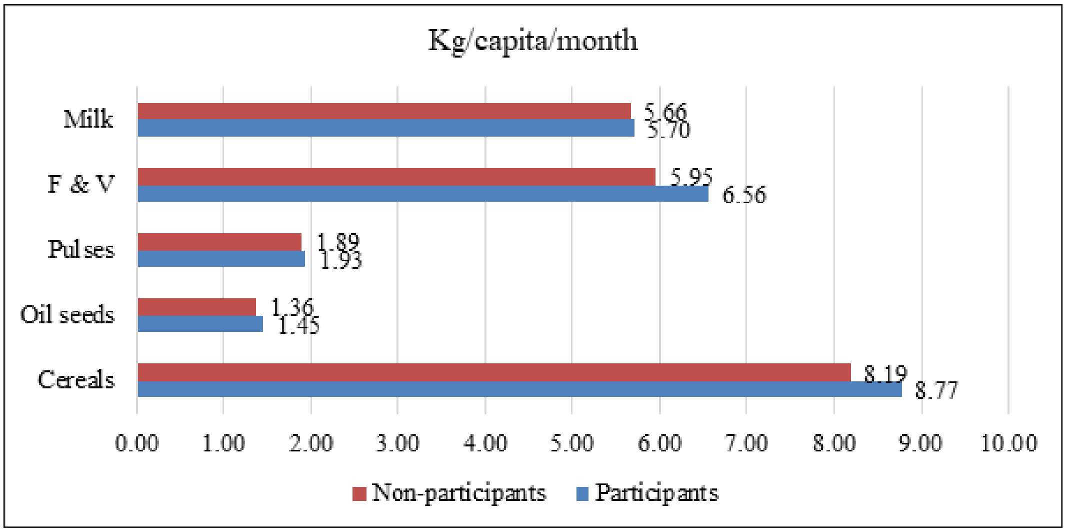


Figure 30: Consumption pattern of sample households

The matching techniques using ATT was calculated for outcome variables like income and dietary diversity (Table 60). The gross income significantly increased by 22.6 percent and income by 40.5 percent for IFS programme participants compared to non-participants. No significant difference was observed in terms of cost of cultivation. The dietary diversity being indicator of balanced health, with different source of nutrients had improved by 8.6 percent compared to non-participants.

Table 60: Average treatment effect of IFS on outcome variable

N=367	ATT	SE	Percent higher than outcome mean
Gross income (Rs/ha)	36,165**	17071	22.65 %
Net income (Rs/ ha)	35,852**	16115	40.46 %
Cost of cultivation (Rs/ ha)	-5,053 ^{NS}	2151	-
Household dietary diversity score	0.48*	0.25	8.64 %

The IFS beneficiaries have more diversified farming systems than non-participants with horticulture and animal component generating higher net income. The matching results show that there is positive and significant impact on the gross and net income through adoption of IFS. The improvement in the dietary diversity is also testimony for farming system approach of programme implementation. The results indicated that there is requirement of formulating the farming systems-based approach to promote programme planning among farmers groups for better income and livelihood.

Project IXX18677: AICRP- IFS OFR, Modipuram Centre

OFR 1: On-Farm crop response to balance plant nutrient management in predominant cropping systems

Under AICRP on Integrated Farming Systems, OFR-Modipuram new district Baghpat was selected in 2021 with two objectives (i) to assess the response of nutrients in major crops and cropping systems in different agro - climatic zones/ ecosystems and (ii) to estimate the impact of nutrients application on soil health status. Under this, two blocks were selected i.e. high productive (Chaprauli) and low productive (Binauli). From these two blocks villages namely Lum, Kakaripur and Ramala from Chaprauli block and Idrishpur, Adampur and Kanad from Binauli block were selected. From each one of the village a total of 10 numbers of farmers were selected for OFR experiment. In this experiment, two prominent cropping systems viz., sugarcane–ratoon–wheat and rice –wheat were evaluated for 6 nutrient management practices vis a vis farmers practice. In sugarcane–ratoon–wheat system, the highest system equivalent yield in terms of wheat (10303kg/ha), cost of cultivation (Rs. 79750) and highest system net return (Rs. 197526) were recorded with the treatment having recommended dose of NPK fertilizers along with $ZnSO_4$ + Boron @25 kg/ha.Highest nutrient response in terms of rupees investment was recorded with the NPK+Zn+Be treatment (Rs. 2.44/Re). The highest nutrient response in terms of gross returns per rupee invested was recorded when recommended doses of NPK+Zn+B were applied. The recommend dose of NPK (120:60:60kg/ha) along with zinc (25kg/ha) had produced maximum grain and straw of wheat (54.70 q/ha and 61.80 q/ha).Application of recommend dose of NPK fertilizers (120:60:60kg/ha) and micronutrients in rice consequently recorded 55.5% and 69.0% increase in grain yield over the farmer practice and control treatments.

OFR 2: Diversification of existing farming systems under marginal household conditions

The experiment under diversification of farming system was conducted with the objectives (i) to enhance the productivity and profitability of marginal farmers through IFS approach (ii) to improve the livelihood and nutritional security through diversification approach and (iii) to estimate the impact of capacity building on diversification of crop + livestock system. The average land holding size of 24 households of such category is 0.84/ha. As compared to crop component alone (Rs.105600/household) diversification in the existing farming systems through crop+dairy component was found capable to increase their annual income to the extent of Rs.133900/household.Thus, such farmers got an additional net profit of Rs.30900/household through adoption of IFS components i.e. crop+dairy. As a result presently 62.5% farmers have adopted crop+dairy component in these areas. Knowledge and skills of farmers were also upgraded with the inclusion of various training programmes.

OFR 3:On-Farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers.

The overall improvement in productivity, profitability, sustainability and nutritional security of households with the inclusion of an additional pulse crops to their system was achieved. Vegetable requirement of farm households were fulfilled by intervention of kitchen gardening. Round the year fodder availability was augmented by growing crops integrating perrinials and seasonals. Different capacity building programmes on intercropping of sugarcane with pulses and oil seeds were organized for improving profitability and livelihood of small and marginal farmers. Various trainings were also conducted on production of vegetables as nutritional kitchen gardening. Apart from these training on IPM and INM in crops, role of animal feed supplements (mineral mixture and calcium) in animal diet and trainings on importance of green fodder production for animals in existing farming system were also conducted.

Project IXX14203: Characterization of existing farming systems of Uttarakhand

The study area comprised of the existing farming systems of Udham Singh Nagar District, Uttarakhand. A Survey was conducted to analyse the women empowerment in farming systems, work participation, technology use by gender and technological solutions identified in existing farming systems of Uttarakhand district. The total sample comprised of a random sample of 30 households i.e. (1 District x 1 block/ district x 3 villages/ block x 10 households) using a stratified sampling frame. Chakarpur (Bhoodpuri), Khambari (Mashra), Pahadpur (Nagadpuri) villages of Bazpur block (low productive), USN District of Tarai and Bhabhar zone of Uttarakhand (>1000 m above sea level) were surveyed. Both the quantitative and qualitative data were used in the study. Data was collected by personal interview method using pre-tested structured questionnaire through face to face interaction with the men and women farmers.

Table 61: Work participation and technology use by gender in Tarai and Bharabhar Zone of Uttarakhand

S.No.	Farm Operation	Technology used	Work participation (%)			Time involvement (hrs/ annum)	
			Male	Female	Joint	Male	Female
1.	Land preparation	Mechanized (Tractor, cultivator, harrow)	100	-	-	264.6	-
		Non –mechanized (hand hoe, spade)	-	16.6	-	-	25.6
2.	Seed treatment	Non-mechanized (Manual)	23.3	-	-	8.0	-
3.	Seed dibbling	Non-mechanized (Manual)	13.3	81.1	6.6	8.0	15.7
4.	Line sowing	Mechanized (Seed drill)	93.3	-		17.85	-
5.	Nursery planting	Non-mechanized (Manual)	20.3	46.6		10.2	22.28
6.	Rice transplanting	Non-mechanized (Manual)	-	100		-	89.48
7.	Fertilizer application	Non-mechanized (Manual)	-	42.5		-	9.33
		Mechanized (Seed drill)	80.5	-		12.2	-
8.	Pesticide application	Mechanized (Battery operated sprayer, engine operated sprayer)	100	-		8.88	-
9.	FYM preparation	Non-mechanized (Manual)	76.6	20.2	3.2	22.08	16.0

10.	Weeding	Non-mechanized (Hand hoe)	23	53	24	32.04	46.81
11.	Harvesting of field crops	Mechanized (Combine Harvestor)	36.66	-		8.2	-
		Non-mechanized (Sickles)	18.3	73.5	8.2	20.3	42.9
12.	Harvesting of horticultural crops	Non-mechanized (Hand hoe, manual)	28	58	14	22	30
13.	Threshing	Mechanized (Thresher, Combine Harvestor)	100	-		16	-
		Non-mechanized (manual beating)	-	53.3		-	24
14.	Carrying of fodder	Mechanized (Cart)	6.6	-		300	
		Non-mechanized (Head load)	-	93.3			730

Data presented in Table 61, indicated that mechanized operations are mainly done by men farmers for land preparation by using tractor, cultivator, harrow (100 %), line sowing by using seed drill (93.3%), fertilizer application by using seed drill (80.5%) pesticide application by using battery/engine operated sprayer (100%), harvesting of field crops by using combine harvester (36.66%), threshing by using thresher/ combine harvester (100%) etc. However, the non-mechanized (manual/traditional tools) operations are mainly done by women farmers for seed dibbling manually (81.1%), nursery planting manually (46.6%), paddy transplanting manually (100%), fertilizer application manually (42.5%), weeding by using hand hoe (53% solely and 24% jointly), harvesting of field crops by using sickles (73.5%), harvesting of horticultural crops manually (58% solely, 14% jointly), threshing manually (53.3%), carrying of fodder as head load (93.3%). Time involvement in farming system activities for male was 750 hrs annum^{-1} whereas 1052 hrs /-annum for female.

Women empowerment in Agriculture Index (WEAI) in prevailing farming system

WEAI comprises two sub-indexes, namely five domains of empowerment (5DE) and the gender parity index in empowerment within dual-adult households (GPI). Improvements in either one of these sub-indexes will increase the empowerment level in the surveyed area. The values for WEAI are based 5DE sub index alone, the fact that the GPI accounts for just 10% of the index weight leads to believe that its exclusion will not influence the results significantly.

The 5DE is used to indicate both a level of general empowerment and the specific indicators that contribute the most to disempowerment. The five domains are production, resources, income, leadership, and time. At first, a disempowerment index (M0) is calculated starting with processing the data according to the inadequacy indicators. Coding was done by allocating the number 1 if the individual lacked adequacy and 0 if the individual achieved adequacy in the specific indicator.

Table 62: Five domains of Empowerment (5DE)

Disempowered headcount % (H)	60.86%
Empowered headcount (1-H) %	39%
Average inadequacy score (A) %	47.82%
Average adequacy score (1-A) %	52.17%
Disempowerment index (M0)=HxA	0.29
5DE index (1-M0)	0.71

It was observed that only 39% of women are empowered and have adequacy in 52.17% of the 6 sub-indicators considered. On an average woman in the prevailing farming system were found disempowered in the five domains of agriculture (5DE score < 0.80).

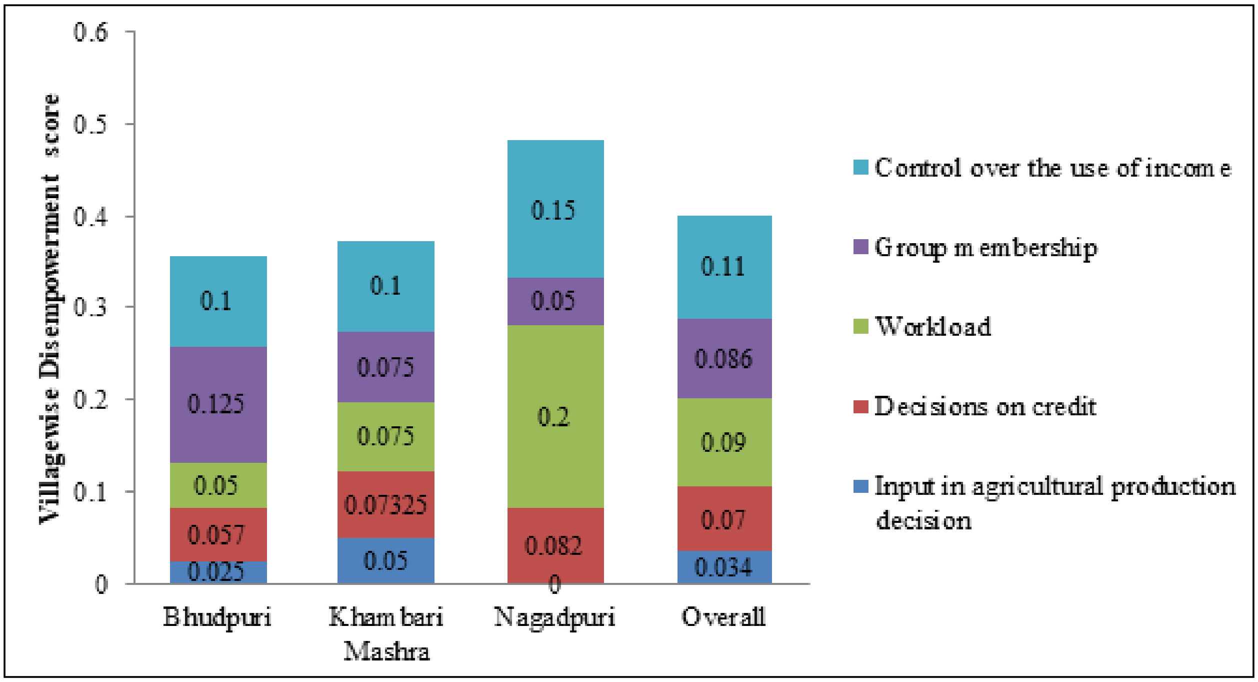


Figure 31: Village wise Disempowerment Score

By disaggregating disempowerment score it was found the main driver of women's disempowerment is the absence of control over the use of income. It accounts for 28.16% of the burden of the disempowerment across the surveyed villages, highest being in Nagadpuri (31%). This is followed by workload and group membership that accounts for 23.83 and 21.6 %

of the burden of disempowerment, respectively, across the surveyed villages. Village wise analysis shows that highest burden of workload in disempowerment score was found in Nagadpuri (41.49%) and highest burden of group membership in disempowerment score was found in Bhudpuri (35%) (Fig 31).

Project OXX6003: Co-creating sustainable water use in the Hindon sub-basin: A multiscale participatory approach (DST Funded project)

The Hindon sub-basin, part of the Gangetic Plain, suffers from water depletion and pollution due to over-extraction and emissions by agriculture and other sectors. Under this project, with relevant stakeholders in the Hindon sub-basin, the contribution of agriculture and other sectors to problems with water quantity and quality will be determined. The origins of water flows and pollutants, particularly nitrate and lead, will be traced with isotope analysis. Stakeholders and researchers will identify alternative agricultural management options to improve water use efficiency and to reduce emissions by agriculture. Using spatially explicit models for trade-off analysis, these will be evaluated and visualized at the levels of fields, farms, landscapes, and the whole sub-basin.

A vision of future development will be formulated and steps for its implementation will be identified and started. The objectives of this project are to i) assess the contribution of agricultural practices to water depletion and pollution in the Hindon basin, and ii) identification and development of agricultural pathways in participatory fashion which can reduce the pressure on the river system while remaining productive and competitive. This will require the involvement of farmers, industry, government, and other relevant stakeholders in a process of visioning, scenario development, scientific analysis, policy formulation and co-learning to guide and support implementation.

The project is structured into three work packages (WP) that will: WP1) Analyse and quantify water flows and its quality in the Hindon river basin system, WP2) Identify and assess interventions for improved agricultural water management and WP3) Vision, plan, develop and foster implementation. Under WP2 preliminary survey of the study basin revealed that sugarcane and wheat are the most widely grown crops in the region, followed by rice which are water intensive crops, and require a lot of water extraction for irrigation. In Saharanpur, Shamli, Muzaffarnagar, Baghpat, Meerut and Ghaziabad, sugarcane-sugarcane ratoon-wheat (2 year rotation) is the first predominant cropping system followed by rice-wheat system (1 year rotation) while in Gautambudh Nagar rice-wheat (1 year rotation) is the first predominant cropping system followed by fallow-wheat system.

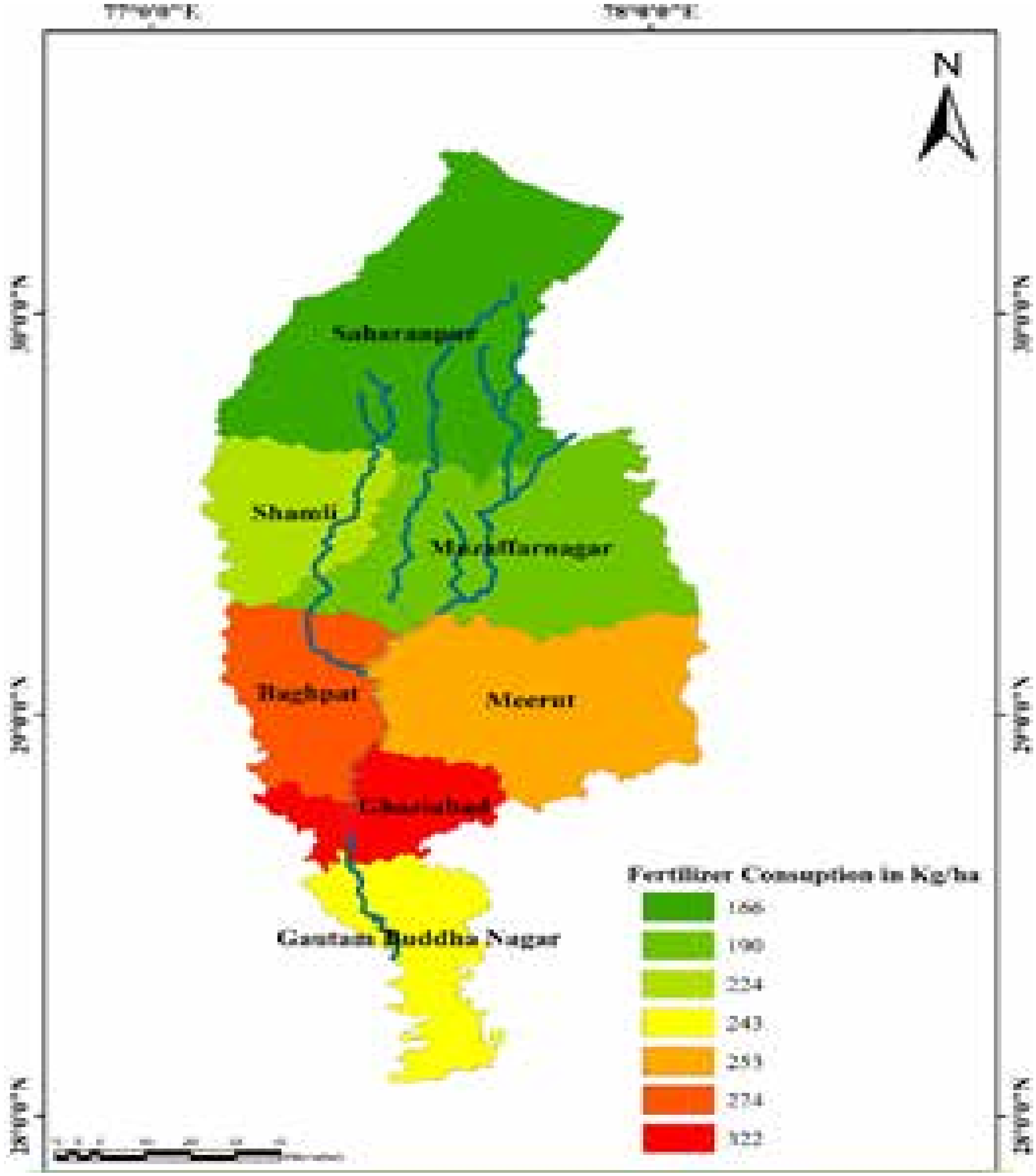


Figure 32: Fertilizer consumption (2018-19) (National average: 133.11 kg/ha; U.P. state: 170.1kg/ha

In addition, the average nitrogen usage in the Hindon basin is higher for example, 142 kg/ha nitrogen is used in the Hindon basin, and the average phosphorus usage in the Hindon basin is 39 kg/ha (Fig.32). Under WP2 100 ha area under cluster mode around Atali Rajputana village was identified for delineating the typology of farming systems existing in the region through detailed survey which is in progress. Type specific intervention will be carried out for improved agricultural management in the region through adoption/demonstration of SPAD & LCC based nitrogen application, crop diversification (new crops, intercrops and varietal diversification), micro-irrigation methods, soil moisture indicator-based scheduling of irrigation, integrated Farming System Models, Organic farming (IOFS), Natural Farming (locally prepared concoctions, mulching, crop diversity, intercropping) etc.


Plate 37: Survey of study area under DST project in progress

Project OXX6005:Agri-Drone Project (ADP by ICAR-ATARI, Kanpur)

Under ICAR pilot programme on Agri-Drone where drones are to be used for agricultural research, development and demonstration. ICAR-IIFSR, Modipuram received 2 Agricultural spray drones under Agri-Drone Project for demonstration of drone spraying technology in 500 ha area. Two nos. of drones were procured under the project and demonstration at farmer's field will be done after pilot training and obtaining RPTO license.

Project OXX6004:Preparation of detailed project report (DPR) and providing technical backstopping for establishment of model IFSs including Agro-Ecotourism at identified agricultural farms (4 farms) in Odisha(Funded by Govt. of Odisha)

ICAR- Indian Institute of Farming Systems Research, Modipuram signed MoU with Directorate of Agriculture & Food Production and Directorate of Horticulture, Govt. of Odisha for preparation of detailed project report (DPR) for transforming 4 nos. Agricultural Farms into a hub of Integrated Farming Systems activities along with a philosophy of agro-tourism concept. Through this project it is intended to showcase and demonstrate different scientific packages and practices and to develop a learning site for the farmers of the state. ICAR-IIFSR has already submitted DPR for 3 Farms namely Nayagarh, Sakhigopal and Semiliguda farm which were approved by Govt of Odisha. Remaining DPRs for one Farm at Nildunguri, Sambalpur district is in progress.

Plate 38: Proposed model Agro-tourism farm at Semiliguda, Odisha (conceptual drawings)

Sustainable livelihood improvement of underprivlaged farmers through integrated farming system approach under SCSP scheme

Project OXX6006: Acheivements of Muzzafarnagar and Meerut districts

The program was undertaken in 5 villages of 2 adjoining districts *viz*. Muzaffarnagar and Meerut. A total of 800 farm families of different categories i.e., landless, marginal, small and medium were selected. The selected farmers were exposed to Institute technologies via conducting demonstrations and providing them inputs of high yielding variety of fodder and food crops, fertilizers for balance crop nutrition, animal health components for balance nutrition and health, small agricultural implements (tools) and improved breeds of poultry birds. Detail of interventions made during this year is given below in Table 63.

Table 63: Interventions made in IFS mode at farmer's field in adopted villages

IFS module	Intervention	Details of intervention		Village	No. of farmers covered
Field crops	Demonstration of improved varieties of wheat	Wheat	DBW187 and DBW222 @15-20kg/ farmer	Kasiara Rasoolpur Khanuda Dhanju	80 40 40 64
	Demonstration of improved variety of mustard	Mustard	RH725 @ 0.5kg / farmer	Kasiara Rasoolpur Khanuda Dhanju	70 60 64 79
	Small implements to support their agricultural operations	Spray machine	One sprayer to a group of 4 farmers	Kasiara Rasoolpur Khanuda	80 30 40

Fodder crops	Demonstration of improved variety of oat	Highly nutritive Kent variety seed was distributed to interested farmers	Khanuda Dhanju	14 25
	Demonstration of improved variety of berseem	Highly nutritive BL10 variety of berseem seed were distributed to interested farmers	Kasiara Rasoolpur Khanuda Dhanju	16 11 17 25
Vegetable crops	Seed kits containing seeds of various seasonal vegetables	Rabi and Kharif seasons @ 1 seed kit to each farmer	Dhanju Iklota	65 45
Livestock	Mineral mixture, calcium suspension and Fendokit Plus Tablets	1 kg pack of mineral mixture and calcium suspension were given @1-3numbers/farmer depending up on the number of animals they have	Kasiara Rasoolpur Khanuda Dhanju Iklota	90 25 50 50 40
Poultry	One month old chicks of CARI-Nirbheak breed	A minimum of 5 to a maximum 15 chicks were distributed	Kasiara Rasoolpur Khanuda	75 45 33

Mustard variety (RH725) grown on an area of 75 hectares of 270 numbers of farmer's field revealed an incremental increase in yield to the tune of 10 to 40% as compared to farmer practice. The high yielding varieties (DBW187 and DBW222) of wheat crop sown in an area of approximately 30 hectares land of nearly 240 numbers of farmers revealed a higher yield production in range of 10-30%. To feed adequate green fodder to livestock, interested farmers were also given high yielding variety seed of oat (Kent) and berseem (BL10). The fodder crops performed well with the production of nearly 50-60 and 70-80 t/ ha green fodder, respectively in two cuts of oat and 5-6 cuts of berseem. The farmers were also advocated to use various nutrient supplements to their livestock *viz.* mineral mixtures, Ca-bottle and Fendokit Plus Tablets. After being given these inputs, Farmers had reported improvement in milk productivity up to an extent of 10-15% due to these increments. Vegetable seed kits were given to 110 numbers of farmers in two villages namely Dhanju and Iklota with the aim to promote nutritional kitchen gardening so that the farmers get good amount of fresh vegetables daily. As poultry module, 1635 number of one month old chicks (CARI-Nirbheak) was distributed among 150 numbers of lands less farmers during the month of April 2022. Health and body weight gain performance of birds were recorded after 90 days of distribution. Live body weight of 500 numbers of poultry birds was found in the range of 800g to 1500g with an average of 1100g/bird.

Project Code IXX18177: Acheivements of Laldhang cluster under Bahadrabad block, District Haridwar (Uttarakhand)

The project was initiated in the Laldhang cluster, Bahadrabad block of Haridwar district since Kharif 2020 to improve the livelihood of the farmers belonging to the Scheduled caste category. A total number of 310 farm families of Schedule Caste (SC) from Dalupuri, Rasoolpur Mithiberi and Chamariya villages of Laldhang cluster situated in the foothills of Rajaji National Park, Uttarakhand have been undertaken under the project. To identify the suitability of integrated farming system (IFS) component among the farmers of small and marginal farmers' category, the basic data related to socio-economic status of the adopted farmers were collected using the standard survey proforma. As per the survey, the selected villages are dominated by the marginal farmers' category with owning 55.6% marginal; >36.3% small farmers; >22.9% medium and large farmers. The mean cropping intensity of adopted villages was 164%. The (Fig. 33 and 34) showed the data related to comparison of effect of improved wheat varieties and introduction of poultry component on nutritional and livelihood security of the adopted farm families.

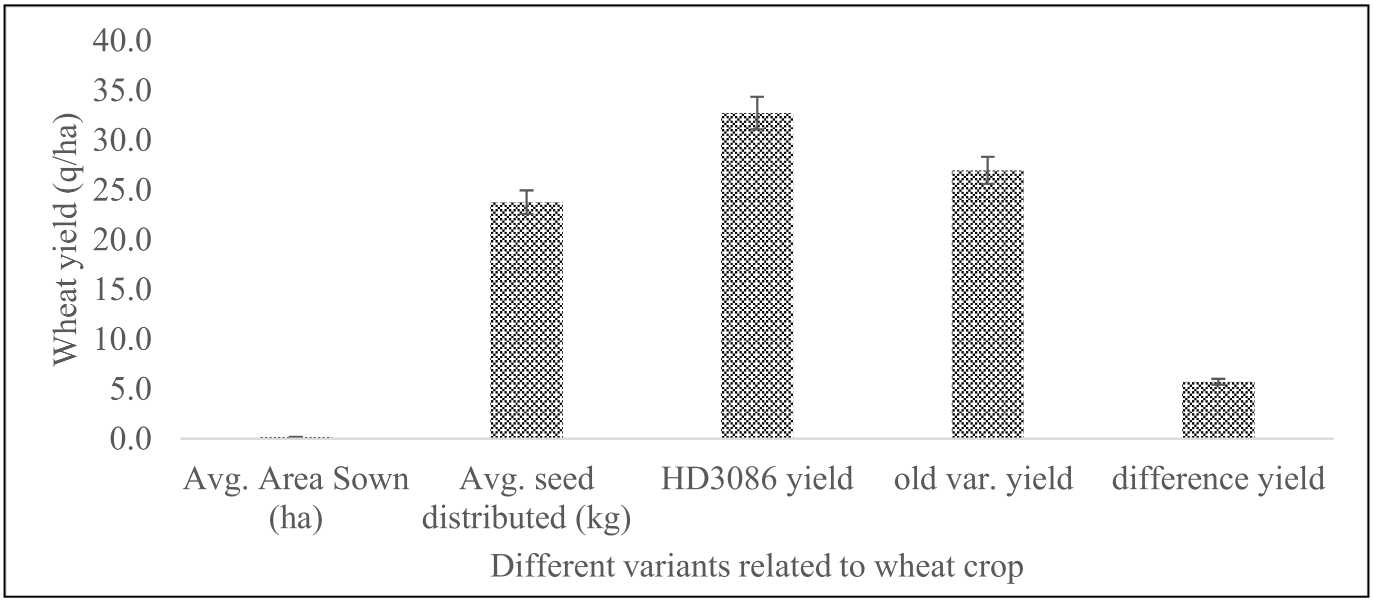


Figure 33: Comparison of farmers practices and improved wheat cultivar on yield enhancement among the adopted farm families

The data depicted in Fig. 28 shows that the average area shown by individual farmers under wheat crop was 0.20 ha in the studied area. The improved HD 3086 variety of wheat produced on an average 32.71 q ha^{-1} yield; whereas the traditional cultivar used by the farmers produced the 26.9 q ha^{-1} yield. Thus, the improved HD3086 recorded 21.6% higher yield over the traditional cultivar. Backyard Poultry is an important IFS component for nutritional security and income generation among the farmers. Data depicted in Fig. 2 shows that an average of 29 birds/

farmer were distributed among the farmers. The mortality rate was 6.5 birds per farm family. At the same time, the live birds produced on an average of 19 egg per bird which in turn produced a total of 67.67 eggs per farm family.

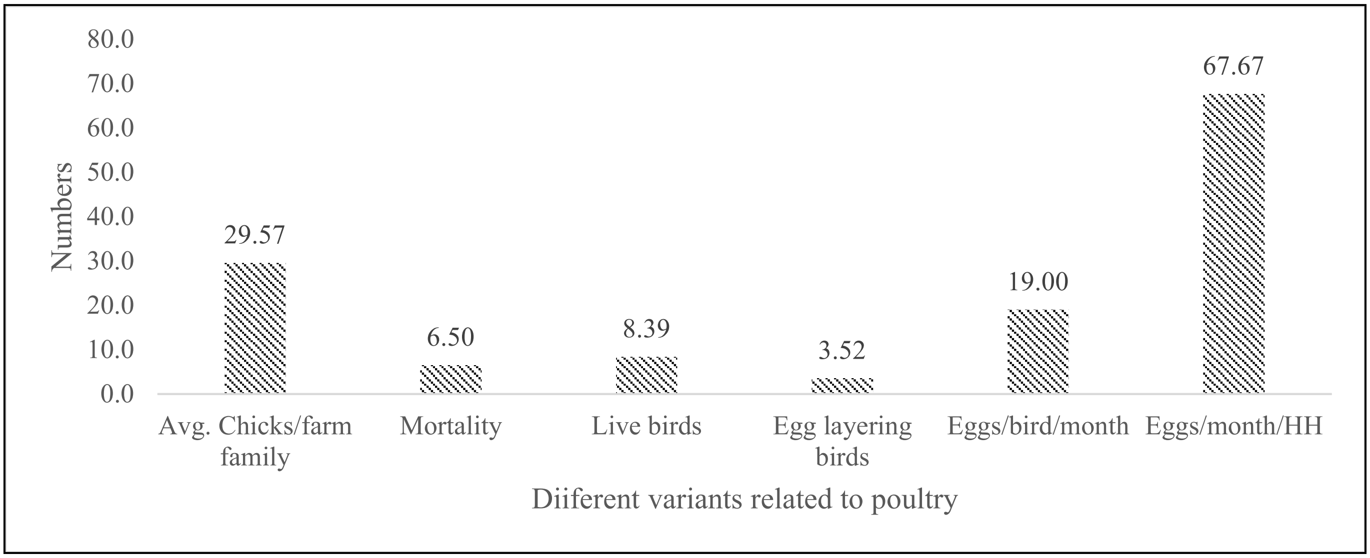


Figure 34: Introduction of commercial poultry birds among the SC farmers for nutritional and livelihood security.

Project Code: Acheivements of Kishorpur and Hastinapur villages, District Meerut

A total of 124 farmer beneficiaries were selected from 2 villages (Hastinapur-63 (under NICRA), Kishorpur-61 (under Institute project) in Meerut District. The following interventions were made as per the farming requirement/resource availability with the farmers.

Table 64. Details of interventions made in farming

IFS Modules	Interventions	Details of interventions
Field crops	Demonstration of improved rice, wheat and mustard varieties of crops	Rice: PS 5; Wheat:DBW-173; HD-2967; PBW-226 (@40.0 kg/household in Kishorepur and @50.0 kg/household in Hastinapur); Mustard: RH 749 (@1.5 kg/household)
	Integrated weed management	Herbicides e.g. Sulfosulfuron application in wheat crop
	Small implements to support their agricultural operations	Multi-functional sprayer, sickle, spade, pitthi darnti, bal kati, tasla, vermicompost bag etc.
Fodder	Demonstration of berseem and jowar	Jowar – Kanpuri
Livestock	Calcium suspension, cow mat	Calcium suspension (1 litre/household) Cow mat (1 no/household)

Based on the survey, it was found that use of improved varieties and application of recommended management practices, an increase of yield in the range of 6-14 % were noticed over existing farming, and thereby interventions increased livelihood by 4-9 %. The complete details are given in (Table 64 and Table 65).

Table 65. Details of each farming interventions, number of farmer beneficiaries, average yield and percent increase/decrease over baseline

Interventions	No of farmers	Average yield Kg/ha	Baseline Kg/ha	% increase
Rice: PS 5	60	4375	4000	9.4
Wheat: DBW-173; HD-2967; PBW-226	100	5000	4400	13.6
Mustard: RH 749	47	950	900	5.6
Livestock: calcium suspension	80	8-9 lit/day	8-9 lit/day	-
Fodder	50	Increased the number of cuts		7 %

Plate 39. Visit of Kishorpur and Hastinapur villages to assess crop/farming situation on 7th April, 2022.A WhatsApp group was created consisting of farmers from the villages and researchers i.e. IIFSR-SCSP4 for real time dissemination of measures to be taken with respect to farm operations/management decisions and agro-advisory services.

Project code: Acheivements of Bahadurpur village, District Meerut

For improvement of the existing farming systems, module wise interventions (Table 66) were made with SCSP household at project site. The results indicated notable changes and increase in overall farm productivity with the introduction of DBW 173 (late sown) along with improved package & practices (Zinc sulphate and weed control). The wheat yield increase was recorded to the tune of 42.2% by the farmers (14.8 q/ha). Livestock based interventions like BNH (CO-5), Mineral mixture (50 g/animal for 60 days), Fenbendazole tablet and Animal mat for comfort of the animal led to increase in the milk productivity. The small holdings in Western Uttar Pradesh farmers do not allocate any land for fodder crop in winter season and they are dependent on sugarcane tops to feed their animals. So this year *Brassica Napus* (GSC-7) as an intercrop in sugarcane was introduced in the experiment. *Brassica napus* being multi-cut, it can be used as fodder and thereafter left for seed to get oil also from the same crop.

Table 66: Changes made in existing IFS practiced by farmers and additional cost

Existing System				Changes made in the interventios	Cost of intervention (Rs)
Module	**Details**	**Cost (Rs)**	**Gross income (Rs)**		
Cropping systems diversification	Sugarcane	19923	50170	Trichocard, Zinck sulphate	570
	Wheat	5532	13977	Late sown wheat (DBW-173) Clodinafop propyl	650
Livestock diversification	Buffalo and Cow	55300	73775	BNH (CO-5), Mineral mixture (50 g/animal for 60 days), Fenbendazole tablet and Animal mat	2,300
Optional	-	-		Vegetable seed kit (Kharif and Rabi) and Garlic seed for kitchen gardening (Yamuna Safed – 2/G - 50)	300
		80,755	1,37,922		3,820

Enhancement of profitability of marginal households through alternative crop for western Uttar Pradesh has been given in Table 67& 68.

Table 67: Economics of low-cost IFS over base year

Parameters	Benchmark (Before intervention)	Low cost-based intervention period (years) 1st	Low cost-based intervention period (years) 2nd
Cost of cultivation (Rs/year)	80,755	84,575	84,575
Gross Return (Rs/year)	1,37,922	1,58,840	1,65,840
Net income (Rs/year)	57,167	74,265	81265
B: C ratio	1.70	1.88	1.96

Table 68: Enhanced of profitability of marginal households.

Parameters	Benchmark (Wheat)	Alternate crop (Garlic)	Additional
Cost of cultivation (Rs/ha)	34,600	89,615	55,015
Gross return (Rs/ ha)	1,32,000	36,0000	2,28,000
Net income (Rs/ ha)	97,400	2,70,385	1,72,985
B: C ratio	3.81	4.01	

Plate 40: Intervention made at scheduled caste farmers field during 2022

Project Code IXX16182: Acheivements of AICRP network

India alone has one-fourth of the small and marginal farms of the total world. Smallholding does not support farmers to live with respect in the society, and condition of a small farm holder is not better than daily paid labour. One-fifth of rural households whose principal occupation is agriculture is having income below the poverty line in the country. Raising the income of smallholders as well as marginal farmers is a big question for researchers, policymakers, and the government. It is observed that among the weaker section, maximum number of smallholders belong to the Schedule caste community, and they are impoverished to uplift their life through farming system has a lot of scope. Keeping above fact in a view following project was formulated with the following objectives:

- To study the existing productivity and profitability of crops, livestock and other components in farming system perspective and identify major constraints.
- To demonstrate the IFS modules and evaluate its impact on livelihood of the under privileged households.

This programme was executed at three level by identifying the farmers and attempted to improve the livelihood of farmers by improving in the existing farming system by providing inputs and training. Centres are provided in Table 69.

- ICAR-IIFSR, Modipuram
- AICRP on Integrated Farming Systems
- All India Network Programme on Organic Farming

Table 69: Detail of districts covered under SCSP scheme

ICAR-IIFSR, Modipuram	AICRP on IFS Centers	AINPOF Centers
Meerut (UP)	Kanker (CG)	Bajaura (HP)
	Bilaspur (HP)	Ranchi (JK)
	Jammu (Jammu and Kashmir)	Thiruvananthapuram (KA)
	Chikkaballapura (Karnataka)	Udaipur (RJ)
	Anuppur (MP)	Coimbatore (TN)
	Dausa (RJ)	
	Yethapur and Erode (TN)	
	Medak (TA)	
	Nadia (WB)	

Project IXX18169: NAIF funded ABI Centre, ICAR-IIFSR, Modipuram, Meerut

Agri Business Incubation Centre (NAIF funded) was established at ICAR-IIFSR, Modipuram, Meerut during March, 2020 In ICAR-IIFSR, ABI Centre, a total of 26 incubates were incubated and 14 incubates have already started their Agri-business with whome ICAR-IIFSR, Modipuram has signed MoUs. During the year 2022-23, organized 8 nos. of EDPs/Capacity Building Programs and 12 nos. of Agri-business awareness programmes. Three innovative process protocol were developed for value added products which have high potential for commercialization (Table 70a and 70b).

Table 70a: Total number of incubates admitted for incubation

S.No.	Name	Address	Technologies/Product (s)
1	Mr. Satender Kumar	Ladpur, Khatauli, Muzaffarnagar	Natural Vinegars Production
2	Mr. Brijveer Singh	Modipuram, Meerut	Farm Implements
3	Dr. Avnish Verma	D-503, Supertech Green Village, Bijli Bamba Hapur Bypass Road,Meerut	Year Round Mushroom Production Technologies
4	Mrs. Ritu jain	A/17, Moti Prayag Colony, Garh Road, Meerut	Year Round Mushroom Production Technologies
5	Mr. Shankar Sharma	C-551, Shastrinagar, Meerut	Year Round Mushroom Production Technologies
6	Ms. Shipra Yadav	Modipuram, Meerut	Year Round Mushroom Production Technologies
7	Mr. Rundeep Raghaw	Hapur, Uttar Pradesh	Mushroom Processing
8	Mrs. Sarla Singh	Kanker khera,Meerut	Year Round Mushroom Production Technologies
9	Mr. Iftikhar Ahmed	Kulrikhera, Shaharanpur	Organic Farming
10	Mr Vikash Soam	Kanker khera, Meerut	Bio-Pesticide Production Technologies
11	Mr Ved Pal Singh Malik	Green wood city,Meerut	Year Round Mushroom Production Technologies
12	Mr. Hemender Bal Dikshit	Begam Bridge Road, Meerut	Mushroom Processing
13	Mr. Rakesh Kumar	Sikhara, Muzaffarnagar	Vermicompost and Value added Jaggery
14	Mr. Kandarp Sirohi	Begam Bridge Road, Meerut	Year Round Mushroom Production Technologies
15	Mr. Neeraj Kumar	Binaloi, Bagpath	Year Round Mushroom Production Technologies
16	Ms. Eva Chikara	B 177, Phase-I, Pallavpuram, Meerut	Extended Shelf life of Fresh Fruits and vegetables

17	Mr. Sahil Ilahi Patel	Belagaun, Karnataka	Fruit Processing &Preservation
18.	Mr. Harpal Singh	Azampur Mulsum, Baraut, Baghpath, U.P.	Natural Vinegars Production Technologies
19.	Mr. Abdul Hamed	Bhanpur, Basti, U.P.	Natural Farming
20.	Mr. Saurabh Chaudhary	Unn, Shamli, U.P.	Fruit Processing & Preservation
21.	Mr. Rajkumar	Unn, Shamli, U.P.	Natural Vinegars Production Technologies
22.	Mr. Radheshym Meena	Adarsh Nagar, Tonk, Rajasthan	Organic Farming
23.	Mr. Ajay Kumar Verma	A-18, Anand Niketan, Meerut	Button Mushroom Production Technologies
24.	Mr. Sachin Sharma	Mavikala, Meerut	Button Mushroom Production Technologies
25.	Mrs. Deepti Kapoor	F-85, Ground Floor, Saraswati Lok, Meerut	Fruit Juice Beverages
26.	Mr. Monaj	F-85, Ground Floor, Saraswati Lok, Meerut	Fruit Juice Beverages

Table 70 b: Graduated& Startups Initiated their business

S. No.	Name	Name of Startups
1.	Mr. Rakesh Kumar	Agri Farm Buddy, FPC, Muzaffarnagar
2.	Mr. Satender Kumar	M/SAnant Gold Sirka Ladpur, Khatauli, Muzaffarnagar
3.	Mr. Brijveer Singh	Daurala Custom Hiring Centre Daurala, Muzaffarnagar
4.	Ms. Eva Chikara	Ask Fresh, Noida
5.	Dr. Avnish Verma	Moisten natural foods and environmental services (MNFES), Hapur Bypass Road,Meerut
6.	Mr. Harpal Singh	M/S Awadh gold(SIRKA), Azampur Mulsum, Baraut, Baghpath
7.	Mr Vikash Soam	Dayal Biotech (Pvt.) Ltd. Partapur, Meerut, U.P.
8.	Mrs Rekha Malik, W/O: Mr Ved Pal Singh Malik	M/S Lifecare Foundation Socity, P-42, Green Wood City, Bypass Baghpat Road, Meerut, UP-250001
9.	Mr. Sachin Sharma & Mr. Ajay Kumar Verma	Desi Mushroom HCUBE Agro Pvt. Ltd. A-18, Anand Niketan, Meerut
10.	Mrs. Deepti Kapoor & Mr. Monaj	Orgi Fru F-85, Ground Floor, Saraswati Lok, Meerut

11.	Mr. Saurabh Chaudhary & Mr. Rajkumar	Biovaid Kisan Producer Company, Unn, Shamli, UP
12.	Mr. Rundeep Raghaw	Shorya Agro Mushroom World, Hapur, Uttar Pradesh

EDPs/Capacity Building Programs Organized

- Entrepreneurship Development through Year Round Mushroom Production Technologies (1 Nos.).
- Agro Entrepreneurship Development through Processing and Value Addition (4 Nos.)
- Organic and Value Added Jaggery Production Technologies for Enhancement of income (1 Nos.)
- Organic and Natural Farming Practices (2 Nos.)

New Products/ Technologies developed under ABI Centre

1. Immune Boosting Organic Jaggery Blocks and Liquid Jaggery
2. Process Protocol for Carrot sauce
3. Standardized Process protocol for Millets Biscuits with Jaggery

Agri-business Development/Awareness Programmes Organized:

1. Organized interaction meeting with Organic Sugarcane Farmers for production of Organic Jaggery
2. Organized interaction meeting and discussion with landless farmers for Button Mushroom Production & Value Addition (02 nos.)
3. Organized interaction meeting with unemployed youth for Year Round Mushroom Production Technologies for regular income (03 nos.)
4. Organized Kisan Gosthi under "Azadi Ka Amrit Mahotsav" and also Mass Awareness for Agri-entrepreneurship (ABI) in Johdi Village of Distt., Baghpat, UP
5. Organized Mass Awareness Program for entrepreneurship development and creation of Shelf Help Group (SHG) during the programme of *Poshan Vatika* Maha Abhiyan & Tree Plantation campaign at Swami Kalyandev Kanya Inter College, Sukartal Road, Jansath, Muzaffarnagar.
6. Organized Mass Awareness Program for entrepreneurship development by creation of Shelf Help Group (SHG) in the SC unemployed women farmers of Ladpur village, Khatauli, Muzaffarnagar district.
7. Organized Agro Innovator Meet during National Conference, FSRDA on 27th January, 2023 at ICAR-IIFSR, Modipuram, Meerut.
8. Organized Mass Awareness Program on "Value addition and Processing on Agricultural Produces for Entrepreneurship development" for Final Year B.Sc. (Agriculture) students of Shri Ram College, Muzaffarnagar on 14th October 2022.
9. Organized one-day Mass Awareness Program (23/04/2022) on Natural Farming and ABI Centre of ICAR-IIFSR, Modipuram, Meerut under the aegis of 'Azadi ka Amrit Mahotsav' from 22 March to 24th April, 2022 at Bhartiya Inter College, Nangle- Mandaud, Muzaffarnagar (U.P.) and in this program 504 nos. farmers participated.

PUBLICATIONS

A. Research Papers

(i) International

1. A.L. Meena, R.N. Pandey, D. Kumar, D. Dutta, Sharma V.K. Sharma, M. Karwal , Meraj Alam Ansari, Mahaveer Nogiya, K.J. Raghavendra, P.C. Ghasal, Jairam Choudhary, R.P. Mishra, Chandra Bhanu, P.C. Jat, Sunil Kumar and A.S. Panwar. 2023. The Long-Term (13 years) Effect of Rice Based Organic Farming on Soil Sulphur Dynamics in a Typic Ustochrept Soil of Indo Gangetic Plain of India. *Journal of Soil Science and Plant Nutrition* 1-17 (NAAS rating: 9.87).

2. A.L. Meena, R.N. Pandey, D. Kumar, V.K. Sharma, M.D. Meena, M. Karwal, Debashis Dutta, L.K. Meena, Ekta Narwal, R.P. Mishra, A.S. Panwar and A. Ghosh. 2022. Impacts of long-term rice-based organic farming on fractions and forms of soil organic carbon and nitrogen in the Indo-Gangetic Plain. *Soil Research* 61(2): 159-175. (NAAS rating: 8.10).

3. A. Innazent, D. Jacob, J.S. Bindhu, Brigit Joseph, K.N. Anith, N. Ravisankar, A.K. Prusty, Venkatesh Paramesh and A.S. Panwar. 2022. Farm typology of smallholders integrated farming systems in Southern Coastal Plains of Kerala, India, *Scientific reports* 12:333, https://doi.org/10.1038 / s41598-021-04148-0. (NAAS rating: 11.00)

4. Ansari M.A., Babu S., Choudhary J., Ravisankar N. and Panwar A.S. 2022. Soil quality restoration and yield stabilization in acidic soils of northeastern Himalayas: Five years impact of green manuring and crop residue management. *Frontiers in Environmental Science*. 10:940349. Pp: 1-18. https://doi.org/10.3389/fenvs.2022.940349. (NAAS rating: 11.41)

5. Ansari, M.A., Choudhury B. U., Mandal S. Jat S.L., Meitei Ch Bungbungcha. 2022. Converting primary forests to cultivated lands: Long-term effects on the vertical distribution of soil carbon and biological activity in the foothills of Eastern Himalaya. *Journal of Environment Management*. 301: 113886. https://doi.org/10.1016/j.jenvman.2021. 113886. (NAAS rating: 14.91)

6. Ansari, M.A., Choudhury, B. U., Layek, J., Das, A., Lal, R., Mishra, V.K. 2022b. Green manuring and crop residue management: effect on soil organic carbon stock, aggregation, and system productivity in the foothills of Eastern Himalaya (India). *Soil & Tillage Research*. 218: 105318. https://doi.org/10.1016/j.still.2022.105318. (NAAS rating: 13.37)

7. Azad S. Panwar, Meraj A. Ansari, Natesan Ravisankar, Subhash Babu, Ashisa K. Prusty, Prakash C. Ghasal, Jairam Choudhary,

Mohammad Shamim, Raghuveer Singh, K. J. Raghavendra, Gautam V. Chauhan, Debashis Dutta, Majhrool H. Ansari, Amrit L. Meena, Raghavendra Singh, C. S. Aulakh, D. K. Singh and P. B. Sharma. 2022. Effect of organic farming on the restoration of soil quality, ecosystem services, and productivity in rice–wheat agro-ecosystems, *Frontiers in Environmental Science.* **10**:1918 *DOI 10.3389/fenvs.2022.972394.* (NAAS rating: 11.41)

8. Babu, S., Das, A., Singh, R., Mohapatra, K. P., Kumar, S., Rathore, S.S., Yadav, S. K., Yadav, P., Ansari, M. A., Panwar, A. S., Wani, O.A., Singh, M., Ravisankar, N., Layek, J., Chandra, P. and Singh, V. K. 2023. Designing an energy efficient, economically feasible, and environmentally robust integrated farming system model for sustainable food production in the Indian Himalayas. *Sustainable Food Technology*. 1: 126-142 http://dx.doi.org/10.1039/D2FB00016D.

9. Chaudhary Ved Prakash, Ram Chandra, Derrick Mario Denis, Tinku Casper D'Silva, Adya Isha 2022. Agri-biomass-based bio-energy supply model: An inclusive sustainable and circular economy approach for a self-resilient rural India *Biofuels, Bioproducts and Biorefining,* 1-13. DOI: 10.1002/bbb.2373. (NAAS rating 11.24).

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11. D Dutta, A L Meena, A Kumar, N Subash, R P Mishra, P C Ghasal, Jairam Choudhary, Chandra Bhanu, Raghavendra K J , Chethan Kumar G, Ankur Kumar, Vaibhav Kumar, R B Tewari and Panwar, A.S. 2022. Influence of Different Nutrient Management Practices and Cropping Systems on Organic Carbon Pools in Typic Ustochrept Soil of Indo-Gangetic Plains in India. *Journal of Soil Science and Plant Nutrition* 22(2): 1403-1421 (NAAS rating: 9.87).

12. Dutta, A., Bhattacharyya, Ranjan, Chaudhary, V.P., Sharma, C., Nath, C.P., Kumar, S.N. and Parmar, B. 2022. Impact of long-term residue burning versus retention on soil organic carbon sequestration under a rice-wheat cropping system. *Soil and Tillage Research Soil Tillage Research* 221, 105421, 1-8. (NAAS rating 13.37).

13. L R Meena, N Subash, Anjali, D Kumar and Nirmal.2022. Integrated Farming System Models Development for Small and Marginal Households for Sustainable Production and Livelihood Improvement in India: An Overview. *Medicon Agriculture & Environmental Sciences* **3**(1): 05-18 (NAAS rating: 7.14).

14. Neeraj Kumari, Suraj Prakash, Manoj Kumar , Radha , Baohong Zhang, Vijay Sheri, Nadeem Rais, Deepak Chandran , Abhijit Dey, Tanmay Sarkar , Sangram Dhumal , Sunil Kumar , Dipendra Kumar Mahato , Marthandan Vishvanathan , Pran Mohankumar , Mirian Pateiro and José M Lorenzo .2022. Seed Waste from Custard Apple (Annona squamosa L.): A Comprehensive Insight on Bioactive Compounds, Health Promoting Activity and Safety Profile. *Processes*. Article No. Processes 10(10): 2119 (NAAS rating: 8.85).

15. Poonam Kashyap, Ashisa K. Prusty, Azad S. Panwar, Venkatesh Paramesh, Ravisankar Natesan, M. Shamim, Nisha Verma, Phool Chand Jat and Mahendra Pal Singh. 2022. Achieving Food and Livelihood Security and Enhancing Profitability through an Integrated Farming System Approach: A Case Study from Western Plains of Uttar Pradesh, India. *Sustainability*. 14**,** 6653. https://doi.org/10.3390/su14116653. (NAAS rating: 9.89)

16. Prusty, A.K., Ravisankar, N., Panwar, A.S., Jat, M.L., Tetarwal, J.P., López-Ridaura, S., Adelhart Toorop, R., Akker, J.V.D., Kaur, J., Ghasal, P.C., Groot, J.C.J., Barba-Escoto, L., Kashyap, P., Ansari, M.A., Shamim, M. 2022. Redesigning of Farming Systems Using a Multi-Criterion Assessment Tool for Sustainable Intensification and Nutritional Security in Northwestern India. *Sustainability*. 14, 3892. https://doi.org/10.3390/su14073892. (NAAS rating: 9.89).

17. Rakesh Kumar Verma, Yashbir Singh Shivay, Radha Prasanna, Prakash Chand Ghasal, Chiter Mal Parihar, Mukesh Choudhary, Raghavendra Madar. 2022. Bio-energy auditing, system productivity, energy efficiencies and economics of different direct-seeded basmati rice-based cropping systems and nutrient management options. *CABI Agriculture and Bioscience,* 3(1): 1-14.

18. Ravisankar, N., Ansari, M.A, Shamim, M., Prusty, A.K., Singh, R., Panwar, A.S., Dutta, D., Bhaskar, S., Bindhu, J.S., Sanjay, M.T., Kaur, J., Varghese, C., Dash, S., Bhowmik, A., Bal., S.K. (2022). Sustainable livelihood security of small farmers improved through resilient farming systems in the Semi-Arid Region of India. *Land Degradation & Development***.** *33*(15), 2830-2842. https://doi.org/10.1002/ldr.4358. (NAAS rating: 10.38)

19. Shibasis Mukherjee, Suchana Sen, Md. Nasim Ali, Rupak Goswami, Argha Chakraborty, Krishnendu Ray, Rantim Bhattacharjee, Bhubaneswar Pradhan, N. Ravisankar, Gautam Chatterjee.2022. Microbiological properties of *Beejamrit*, an ancient Indian traditional knowledge, uncover a dynamic plant beneicial microbial network, *World Journal of Microbiology and Biotechnology*, 38 (111): 1-12 (NAAS rating: 10.25)

20. Venkatesh Paramesh, Parveen Kumar, Mohammad Shamim, Natesan Ravisankar, Vadivel Arunachalam, Arun Jyoti Nath, Trivesh Mayekar, Raghuveer Singh, Ashisa K. Prusty, Racharla Solomon Rajkumar, Azad Singh Panwar, Viswanatha K. Reddy, Malay Pramanik, Anup Das, Kallakeri Kannappa Manohara, Subhash Babu and Poonam Kashyap.2022. Integrated Farming Systems as an Adaptation Strategy to Climate Change: Case Studies from Diverse Agro-Climatic Zones of India, *Sustainability,* 14**,** 11629. https://doi.org/10.3390/ su141811629. (NAAS rating: 9.89)

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22. Gupta, G., Dhar, S., Kumar, A., Choudhary, A. K., Dass, A., Sharma, V. K, Kumar Kamlesh. & Rajawat, M. V. S. (2022). Microbes-mediated integrated nutrient management for improved rhizo-modulation, pigeonpea productivity, and soil bio-fertility in a semi-arid agro-ecology. *Frontiers in Microbiology*, 13.

(ii) National

1. Akoijam, R., Ningombam, A., Beemrote, A., Shashank, P.R., Ansari, M.A. 2022. Detection of fall armyworm *Spodoptera frugiperda* (J.E. Smith) and its biology under Manipur conditions. *Journal of Entomological Research.* 46 (1): 195-198. https:// doi.10.5958/ 0974-4576.2022.00035.4. (NAAS rating: 5.89)

2. Chandra Bhanu, N. Ravisankar, P.C. Ghasal, Jairam Choudhary, Raghuveer Singh, K.J. Raghavendra, A.L. Meena, L.K. Meena, D. Dutta, R.P. Mishra, N. Balasubramani, A. Sadalaxmi and A.S. Panwar. 2022. Knowledge based assessment of trained certified farm advisors (CFA) on Organic Farming, *Indian Journal of Agricultural Sciences***. 92 (1):** 85-89. (NAAS rating: 6.37)

3. Choudhury, B.U., Nengzouzam, G., Ansari, M.A., Islam, A. 2022. Causes and consequences of soil erosion in northeastern Himalaya, India. *Current Science*, 122(7): 772-789. https://doi.10.18520/cs/v122/ i7/772-789. (NAAS rating: 7.17)

4. Ghasal, P.C., R.P. Mishra, Jairam Choudhary, Debashis Dutta, Chandra Bhanu, A.L. Meena, Kamlesh Kumar, Ankur Kumar, N. Ravisankar and A.S. Panwar.2022. Performance of cultural and mechanical practices on weed-control efficiency, productivity and economics of Indian mustard (*Brassica juncea)* under organic production, *Indian Journal of Agronomy.* 67 (1): 67-72. (NAAS rating: 5.55)

5. Giridhar, B. J., K. J. Raghavendra, Dharam Raj Singh, and Philip Kuriachen. 2022. Agricultural Vulnerability to Climate Change: A Case Study of Kerala. *Journal of Community Mobilization and Sustainable Development*. 17(1): 29-34. (NAAS rating: 5.67)

6. Jat, N.K., M. Shamim, Sudhir Kumar, N. Ravisankar, R.S. Yadav, Subhash Babu and A.S. Panwar.2022. Agrometeorological evaluation of mustard (*Brassica juncea*) under organic production in North Western Indo-Gangetic Plains, *Indian Journal of Agricultural Sciences.* 92 (3):339-343. (NAAS rating: 6.37)

7. A K. Verma, P. P. Singh, D. Singh, P. L. Saroj and Major Singh Performance evaluation and scope of onion improvement under hot arid conditions *Indian. Hortic. 79*(2), June 2022: 202-207.

8. Kumar Devendra, L.R. Meena, Nirmal, Lalit K. Meena, Raghvendra, K.J., Arpan Bhowmic (2022). Assessment of genetic divergence and correlation analysis of sugarcane clones (*Saccharum* spp.L.) in North-Western Plain Zone of Uttar Pradesh. *Medicon Agriculture & Environmental Sciences.* 3.1: 29-38 (IF 1.147)

9. L R Meena, S A Kochewad, A K Prusty, Chandra Bhanu, Sanjeev Kumar, A L Meena, Lalit Krishan Meena, K J Raghavendra, Devendra Kumar, N Subash and S P Singh .2022. Sustainable integrated farming system model for small farm holders of Uttar Pradesh. *Indian Journal of Agricultural Sciences* 92(9):1080-1085(NAAS rating 6.6).

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12. Meena L.R., N. Subhash, Anjali, Kumar Devendra and Nirmal (2022). Integrated Farming System models development for small and marginal households for sustainable production and livelihood improvement: An overview. *Medicon Agriculture & Environmental Sciences.* 3.1:05-18 (IF 1.147)

13. Raghavendra K J, L R Meena, A L Meena, D Dutta, D Kumar and A S Panwar 2022.

Understanding farm diversity through typology for technological interventions in western plain zone of Uttar Pradesh, India. *Indian Journal of Extension Education* 58(1): 125-129 (NAAS rating 5.95).

14. Sunila Kumari, Poonam Kashyap and N. Ravisankar.2022. Challenges and Opportunities in promoting sustainable organic farming in India through policy and technical interventions at FPO level-A case study from Haryana, *Journal of Agricultural Extension Management*. 23 (1): 115-121.

15. Tamreihao K., Devi AK, Langamba P, Singh HS, Kshetri P, Rajiv C., Singh TS, Langhu T, Sharma SK, Ansari M.A. and Roy SK. 2022. Phytostimulating Potential of Endophytic Bacteria from Ethnomedicinal Plants of North-East Indian Himalayan Region. *Journal of Pure and Applied Microbiology. 16*(2), 747-762. https://doi.org/10.22207/JPAM. 16.2.05. (NAAS rating: 5.05)

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17. Meena, H. S., Devi, K. S., Kumar, Kamlesh., & Kumar, V. (2022). Growth, productivity and nutrient uptake in clusterbean varieties at varied crop geometry in semi-arid region of Andhra Pradesh. *The Pharma Innovation Journal* SP-11(7): 1887-1890.

B. Other Publications

(i) Books

1. Deepak Kumar, N. Ravisankar and Anupama Panghal.2022. Transforming Organic Agri-Produce into Processed Food Products: Post-COVID-19 Challenges and Opportunities, Apple Academic Press, Florida, USA (ISBN: 9781774911921), p.466

2. Kumar A., Dash, S. Sarkar, S.K., Harun, M., Ravisankar, N., Panwar, A.S. and Chaudhary, V. K. (2021). *Brochure on AICRP on Integrated Farming Systems On-Station Research: Online Data Entry and Analysis*. ICAR-IASRI Publication.

3. प्रगतिशील खेती अर्द्धवार्षिक हिन्दी पत्रिका जनवरी एवं जुलाई अंक 2202 ISSN: 2583-2204 (online)

4. N. Ravisankar, P.C. Ghasal, Amit Kumar and A.S. Panwar. 2022. Organic Farming: Status, Scope and Opportunities. In: A text book on recent advances in agronomy (Eds. Kumar et al.). Kalyani Publishers, NOIDA, Uttar Pradesh. Pp: 7.1-7.35.

(ii) Book chapters

1. Ansari, M.A., Shamurailatpam, D., Bhuvaneswari, S., Sharma, S.K., Roy, S.S., Ansari, M.H. 2022. Rice bean. (In) Production technology of underexploited

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(iii) Bulletins

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Strategies for Profitable Pig Farming. Agriculture and food e-Newsletter.

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45. Kamlesh Kumar, Adarsh Kumar, Preety Dagar, B. Raghavendra Goud, Rahul Katiyar (2022). Crop Diversification: Potential Strategy to Achieve the Sustainable Developmental Goals (SDGs) in Agriculture. Agriculture and food e-Newsletter.

(vii) Leaflets

1. Chandra Bhanu, P.C. Ghasal, N. Ravisankar, Jairam Choudhary, D. Dutta, A.L. Meena, R.P. Mishra, Raghavendra K.J. and Raghuveer Singh .2022.. Beejamrit and Ghanjeevamrit: Preparation and Application Techniques. Published by ICAR-IIFSR, Modipuram – 250 110.

2. Chandra Bhanu, P.C. Ghasal, N. Ravisankar, Jairam Choudhary, D. Dutta, A.L. Meena, R.P. Mishra, Raghavendra K.J. and Raghuveer Singh .2022. Jeevamrit: Preparation and application techniques. Published by ICAR-IIFSR, Modipuram – 250 110.

3. Chandra Bhanu, P.C. Ghasal, N. Ravisankar, Jairam Choudhary, D. Dutta, A.L. Meena, R.P. Mishra, Raghavendra K.J. and Raghuveer Singh .2022. Dashparani Extract: Preparation and application techniques. Published by ICAR-IIFSR, Modipuram – 250 110.

(viii) Patent

1. Minakshi Karwal, Ashok Jangra, Pratibha Kumari and Amrit Lal Meena (2022). "Biodegradable Lawn Waste Management System"Controller General of Patents, Designs & Trade Marks. Application No.202211003527 A. Publication Date: 04/02/2022

SEMINARS/SYMPOSIA/WORKSHOP/MEETINGS ATTENDED

Title of training/seminar/ symposia/ workshop/Meeting	Period	Venue	Name of participant
Meeting on Bioenergy potential from crop residues with RSC, Hyderabad, ICAR-CRIDA and ICAR-CAFRI	31.01.2022	Virtual	N. Ravisankar
Workshop on National disaster management plan for Nodal Officers of Ministry/Departments of Government of India	02.03.2022	New Delhi	N. Ravisankar
Meeting on GOBARDHAN and Zero Budget Natural Farming (ZBNF) by Department of Drinking Water and Sanitation, Ministry of Jal Shakthi, Government of India	14.03.2022	Virtual	N. Ravisankar
XXVII meeting of the Regional Committee No. I organised by ICAR-CPRI, Shimla	22.04.2022	Virtual	M. Shamim
Natural Farming Technical and implementation aspects	02.05.2022	DA&FW, New Delhi	N. Ravisankar
Mid-term Review Meeting of the ICAR Regional Committee, Zone-VI	20.05.2022	Virtual	M. Shamim
Biennial National conference-2022 on Natural Farming for sustainable agriculture	31.05-02.06. 2022	Solan, Himanchal Pradesh	N. Ravisankar A. K. Prusty M. A. Ansari
Brainstorming workshop on Organic Farming	10.06.2022	ICAR-NAARM, Hyderabad	N. Ravisankar
RCM Recommendation-Modification of crop calendar with reference to climate change	08.07.2022	Virtual	M. Shamim
Interaction meets state govt. officials, Odisha Govt. for MATF	21-27.07. 2022	Bhubaneswar, Odisha	N. Ravisankar A.K. Prusty M. Shamim. M. A. Ansari Raghavendra KJ

Foreign Aided Projects (NRM) Review meeting	23.07. 2022	IIWM Bhubaneswar, Odisha	N. Ravisankar A.K. Prusty M. A. Ansari
26th meeting of Regional Committee-IV	24.08.2022	Virtual	M. Shamim
State Stakeholder Workshop, TEEB, UNEP	20.09. 2022	ICAR-IIFSR, Modipuram	N. Ravisankar A.K. Prusty Poonam Kashyap M. Shamim. M. A. Ansari Raghuveer Singh Raghavendra KJ
Discussion meet with SAARC officials	22.09.2022	ICAR-IIFSR, Modipuram	N. Ravisanakr A. K. Prusty M. Shamim
Consultation meeting for out scaling of natural farming through KVK	27.09. 2022	New Delhi	N. Ravisankar M.A. Ansari
Brainstorming session to discuss the researchable issues in organic and natural farming	07.10. 2022	TNAU, Tamil Nadu (virtual)	N. Ravisankar M.A.Ansari
5th Global meet on science and technology (GMST-2021) for minimizing innovation cost and time: to make a long story short	8-9.10. 2022	Meerut (virtual), U.P.	A.K. Prusty M. Shamin, M. A. Ansari Raghuveer Singh
Harmonizing Land Use for Emerging Challenges and Opportunities in the island and coastal region	12-13.10. 2022	ICAR-CIARI, Port Blair	M. A. Ansari
XXVI Meeting of ICAR Regional Committee-II	14.10.2022	Virtual	M. Shamim
National Crop Plan Meeting	01.11.2022	ICAR-IIWM, Bhubaneswar	A. K. Prusty
XXVI Meeting of ICAR Regional Committee IV	07.11.2022	Virtual	M. Shamim
National Stakeholder Workshop, TEEB, UNEP	9-10.11. 2022	New Delhi	N. Ravisankar A.K.Prusty M. Shamim M.A.Ansari

Annual Action Plan Workshop on Natural Farming	23-24.11. 2022	ICAR-ATARI, Guwahati	M. A. Ansari
Mid-term Review Meeting of ICAR Regional Committee for Zone VIII,	30.11.2022	Virtual	M. Shamim
Annual Group Meeting (XVII) of the All-India Network Programme on Organic Farming (AI-NPOF)	28-30.12. 2022	Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI), Narendrapur, W.B.	N. Ravisankar A.K. Prusty M. Shamim. M. A. Ansari Raghuveer Singh Raghavendra KJ
5th Global Meet on Science & Technology (GMST-2021), Hi Tech Horticultural Society, Meerut and Prerna Foundation, Meerut Uttar Pradesh	08-09.10.2022	SVP University of Agriculture and Technology Meerut (UP)	Poonam Kashyap
Discussion meet on participatory research on climate smart agriculture and interaction with SAARC officials	22.09.2022	ICAR-IIFSR, Modipuram	Poonam Kashyap A. K. Prusty
DST-NOW Hindon Kick off workshop project NWO-DST 'Cleaning the ganga and Agri-water' programme	13.09.2022	ICAR-IIFSR, Modipuram	Poonam Kashyap
International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals"(AAFS2022)	22-24 .08. 2022	UAS Bangalore	Poonam Kashyap
International Conference on "Harnessing Indian Agriculture for Domestic and Global Prosperity	22-23 .07.2022	NASC, New Delhi	P. C. Jat
One-day symposium (Hybrid mode) on "Soils: Where Food Begins	30.11. 2022	ICAR-Indian Agricultural Research Institute, New Delhi	A. L. Meena

NICRA Theme (NRM) Technical Review Workshop	21-22.07.2022.	NASC Complex, New Delhi	N. Subash Debashis Dutta
NICRA Theme (Modelling) Technical Review Workshop	13-15 .09. 2022	ICAR-CSSRI, Karnal	N. Subash
TROPMET 2022 -Advances in Weather and Climate Prediction and Climate Change Projection over South Asia: Applications in Water and Agriculture Sectors	29 .11. to 02 .12. 2022	IISER Bhopal, Madhya Pradesh	N. Subash
First International Conference-ICRA2022 Reimagining Rainfed Agro-ecosystems: Challenges & Opportunities	22-24 .12. 2022	ICAR-CRIDA, Hyderabad, Telangana, India	N. Subash
NICRA-LCA PROJECT CONSULTATION Workshop	07.10.2022	MSSRF, Chennai	N. Subash Debashis Dutta
AMW-2021 Annual Monsoon E-Workshop (AMW 2021) and National E-Symposium on "Changing climate and extreme events: impacts, mitigation & Role of oceans	21- 23.02. 2022	IITM, Pune and Indian Meteorological Society-Pune Chapter	N. Subash
Participated in Generic Online Training in Cyber Security for Central Govt Ministries/Departments,	25.02.2021	Ministry of Electronics & Information Technology (MeitY), Govt. of India (Virtual)	Vipin Kumar Choudhary
Completed successfully 12 Weeks online training and certification course on cyber security (DIAT certified Information Assurance participation) , from	28.02.2021 to 31.05.21 (12 weeks)	DRDO (Défense Institute of Advance Technology) (Virtual)	Vipin Kumar Choudhary

Completed successfully training in Advances in web and mobile app development,	02.08.2022 to 06.08.2022	ICAR-NAARM, Hyderabad (Virtual)	Vipin Kumar Choudhary
Seminar on *Prakrtik Kheti evam swachchh Pariyavarn*	26.04.2022	ICAR-IIFSR, Modipuram	R. P. Mishra, Devendra Kumar, Debashis Dutta, Chandra Bhanu, P.C. Ghasal, Jairam Choudhary
Orientation workshop of KVKs on Chemical free natural farming in the present context: Challenges and prospects	10-11.10.2022	DDRI, Chitrakoot	Chandra Bhanu, P.C. Ghasal
Biennial Workshop of AICRP-IFS	18-21.01.2023	MPKV, Rahuri	Debashis Dutta, Chandra Bhanu, P.C. Ghasal
International Conference on Harnessing Indian Agriculture for Domestic and Global Prosperity	22-23.02.2022	NAS Complex, New Delhi	P.C. Ghasal
Brainstorming Session on organic farming practices for cold arid Ladakh region	24-26.07. 2022	DIHAR, Leh	P.C. Ghasal
Annual Co-operators' conference	17-18.10.2022	ICAR-CRIDA, Hyderabad	R. P. Mishra P.C. Ghasal
Attended the National workshop Awareness on Intellectual Property Rights (IPRs) and its management	17.01.2023	ICAR IIFSR	P.P. Singh
XXXVI Indian Poultry Science Association Conference and National Symposium on "Recent Advances in Sustainable Poultry Production for Livelihood and Nutritional Security.	4-6.11.2022	UPPDDU Veterinary University and Cattle Research Institute, Mathura	Suresh Malik

1st International Symposium on "Cereals for Food Security and Climate Resilience " held online during January 18-20, 2022.	18-20.01.2022.	SAWBAR, Karnal, Haryana, India (Virtual)	Kamlesh Kumar
Virtual participation in ISPEC 9th international conference on Agriculture, Animal science and Rural Development (March 19-20, 2022), Burdur, Turkey	19-20.03. 2022	ISPEC, Turkey (Virtual)	Kamlesh Kumar
National Workshop on Hydroponic Cultivation.	28-29.03.2022	College of Horticulture and Forestry, Jhalawar (Raj.) Under NAHEP-IG, ICAR, New Delhi (Virtual)	Kamlesh Kumar
National Conference·on "Maize for Resource Sustainability, Industrial Growth and Farmers' Prosperity" Udaipur)	23-25.02.2022	MPUAT, Udaipur (Hybrid mode)	Kamlesh Kumar
Regional Conference on “Conservation agriculture in maize-wheat based systems systems for sustainability” sustainability” in the regional conference April 29-30, 2022 Lucknow, Uttar Pradesh	29-30.04.2022	NEEDEF and ICAR-IISR (Hybridmode)	Kamlesh Kumar
International Conference on Advances in Agriculture and Food Systems towards sustainable development goals (AAFS 2022)	22-24 August 2022.	UAS Begaluru (Virtual mode)	Nisha Verma
20th International Conference on Humanizing work and work Environment	24-26 November 2022	Dept of Sports Science, Punjabi University, Patiala.	Nisha Verma

INVITED LECTURES DELIVERED IN NATIONAL/INTERNATIONAL SEMINAR, WORKSHOPS, SYMPOSIA, WEBINAR / MEETINGS

Name of the Seminar/Symposia/ Webinar/ Workshop	Organized by	Venue	Title of lecture	Date of lecture	Resource Person
Regional thematic workshop on crop diversification in South India	Govt. of Tamil Nadu & TNAU, Coimbatore	Virtual	Successful IFS models for doubling of farmers income	11.01.2022	N. Ravisankar
Different Forms of organic agriculture	ICAR-IIFSR, Modipuram	Virtual	-	14.2.2022	M A Ansari
Workshop on Natural Farming	SKNAU, Jobner	Jobner	Natural farming: Concepts and Practices	07.03.2022	N. Ravisankar
Azadi Ka Amrut Mahotsav-Special lecture	ICAR-VPKAS, Almora	Virtual	Status and Prospects of Organic and Natural Farming	24.04.2022	N. Ravisankar
National workshop on Natural Farming for Sustainable Agriculture and Environment	ICAR-IISS, Bhopal	Virtual	Natural Farming in India: An Overview	24.04.2022	N. Ravisankar
Awareness Campaign on Organic and Natural Farming	NCONF, Ghaziabad	Virtual	Organic Farm Designing, Cropping system planning, biodiversity and conversion of conventional land to organic	26.04.2022	N. Ravisankar
Webinar on "Promotion of Natural Farming" (Azadi Ka Amrit Mahotsav)	NCONF, Ghaziabad	Virtual	Integrated Farming Systems for Natural Farming	26.05.2022	N. Ravisankar

Orientation workshop of KVKs on Chemical free natural farming in the present context: Challenges and prospects	DDRI, Chitrakoot	Physical	Concepts of organic and Natural Farming for Chemical Free agriculture	10-11.10. 2022	Chandra Bhanu, P.C. Ghasal
XII Biennial National KVK Conference-2022: Sustainable Agricultural Production System	ICAR and Dr YSPUHF, Solan	YSPUHF, Solan	Natural Farming for Sustainable Agriculture	01.06.2022	N. Ravisankar
Brainstorming workshop on Organic Farming in India	ICAR-NAARM, Hyderabad	Hyderabad	Critical interventions and gaps (Research and Development) in Organic Agriculture	10.06.2022	N. Ravisankar
National Seminar on Sustainable Food Production Systems for Self-Reliant and Climate Resilient Agriculture	UAS, Dharwad	Virtual	Organic and Natural Farming for Resilient and Sustainable Food Production	16.06.2022	N. Ravisankar
National Seminar on Natural Farming	ICAR-IISWCR-RS, Ooty	Virtual	Natural Farming Practices and Research Approach	22.07.2022	N. Ravisankar
International conference on "Harnessing Indian Agriculture for Indigenous and Global Prosperity"	NASC, New Dehli	NASC, New Dehli	Bhartiya Agro-Economic Research Center (BAERC)& Bhartiya Kisan Sangh	22-23.07.2022	Raghuveer Singh

Webinar on Wise management of Resources for Sustainable development	ANRCM, Lucknow	Virtual	Role of integrated farming systems in resource management and food sustainability	16.08.2022	N. Ravisankar
Organic farming for sustainable agriculture	AMU, Aligarh	Virtual	-	22.08.2022	M A Ansari
Short course on "Resource management, socio-economic development and environmental sustainability through climate-resilient Integrated Farming Systems"	AAU, Jorhat	Virtual	Scope and importance of Integrated Farming Systems(IFS) in NE India	30.08.2022	N. Ravisankar
DST-ICRISAT Consultative National Workshop	ICRISAT, Hyderabad	ICRISAT, Hyderabad	Evidence from on-farm and on-station research on regenerative agriculture	15.09.2022	N. Ravisankar
International conference on 5th Global Meet on Science and Technology for minimizing innovation cost and time	Keral Verma Subharti College of Scince, Subharti University, Meerut	Virtual	-	8-9.10.2022	M. A .Ansari Raghuveer Singh
Organic and natural farming: in restoration of ecosystem services	ICAR-CIARI, Port Blair	ICAR-CIARI, Port Blair	-	13.10.2022	M. A. Ansari

International Training Workshop on Farming Systems Design towards zero hunger and zero carbon	ICRISAT, Hyderabad	ICRISAT, Hyderabad	PAN India Farming System Typologies	08.11.2022	N. Ravisankar
International Training Workshop on Farming Systems Design towards zero hunger and zero carbon	ICRISAT, Hyderabad	ICRISAT, Hyderabad	Farming System Typologies	07-12.11.20 22	A. A. K, Prusty
Natural farming	ICAR-ATARI, Guwahati	ATARI, Guwahati	-	23.11.2022	M. A. Ansari
Soil and water management in organic and natural farming	NCONF, Ghaziabad	NCONF, Ghaziabad	Training programme on organic and natural farming	26.12.2022	M. A. Ansari
Horticulture based IFS in India	ICAR-IIFSR	MPKV Rahuri (Virtual)	Horticulture based IFS in India	11.01.2022	Poonam Kashyap
Agricultural System Modelling for Natural Resource Management	IIFSR, Modipuram, Meerut	ICAR-NAARM, Hyderabad on 19th September, 2022	Agricultural System Modelling for Natural Resource Management	19-24.09.2022.	N. Subash
ICAR sponsored 21 days' Winter School on Climate Smart Agriculture for Sustainable Production	IIFSR, Modipuram, Meerut	Dr. Rajendra Prasad Central Agricultural University Pusa, Samastipur - 848-125, Bihar, India on 16th April	Climate Smart Technologies through Advanced Tools	28.03 to 17.04.2022	N. Subash

Integration of agro-forestry in organic farming and benefits.	IIFSR, Modipuram, Meerut	IIFSR, Modipuram, Meerut	Certified Farm Advisor (CFA) on Organic Farming: Module-II, ICAR IIFSR Modipuram	10.12.2022	Nirmal
Agroforestry Based Farming System- A Potential tool for Climate Risk Mitigation	IIFSR, Modipuram, Meerut	IIFSR, Modipuram, Meerut	"Promotion of Agroforestry as Climate Risk Mitigation" CFA MANAGE during 25-26 May 2022	25.05.2022	Nirmal
Livestock handling and operations, farm records and its maintenance.	ICAR-IIFSR, Modipuram	ICAR-IIFSR, Modipuram	Livestock handling and operations	26.02.2022	Suresh Malik

LECTURES DELIVERED IN TRAININGS /PG STUDENTS

Name of Programme	Venue	Title of lecture	Date of lecture	Resource person
Three week national online certificate course on "Integrated Farming System for Sustainable Agriculture"	Virtual (MPKV, Rahuri)	Sustainable Agriculture and Farming Systems	03.01.2022	N. Ravisankar
Three week national online certificate course on "Integrated Farming System for Sustainable Agriculture"	MPKV Rahuri (Virtual)	Farm Design Application for Redesigning IFS Models	11.01.2022	A. K. Prusty
Three week national online certificate course on "Integrated Farming System for Sustainable Agriculture"	MPKV Rahuri (Virtual)	Synthesis of Alternate Integrated Farming System for Different Farm Situations	11.01.2022	A. K. Prusty
Three week national online certificate course on "Integrated Farming System for Sustainable Agriculture"	Virtual (MPKV, Rahuri)	Farming Systems Research: Methodology and evaluation	07.01.2022	N. Ravisankar

Regional thematic workshop on crop diversification in India	Virtual (TNAU, Coimbatore)	Successful IFS models for doubling of farmers income	11.01.2022	N. Ravisankar
Three week national online certificate course on "Integrated Farming System for Sustainable Agriculture"	MPKV, Rahuri. (Virtual)	Impact assessment on IFS: methods used and results	13.01.2022	Raghavendra K.J.
National Girl Child day	Virtual (ICAR-IIFSR)	Agricultural Education and Career opportunities	24.01.2022	N. Ravisankar
Winter school on Advances in Agricultural Extension Research	Virtual (NDRI, Karnal)	Concept, way forward and challenges for promotion of natural farming	31.01.2022	N. Ravisankar
Organic Farming training under NAHEP, Akola	Virtual (Dr PDKV, Akola)	Organic Farming: A new way for rural entrepreneurs to develop sustainable business	31.01.2022	N. Ravisankar
CFA on Organic Farming	ICAR-IIFSR, Modipuram	Orientation to Institute facilities and activities	07.02.2022	M. Shamim
IFS in creation of sustainable livelihoods for small and marginal farmers	Virtual (Extension Education Institute, Hyderabad)	IFS models for different farming situations (rainfed, ID and irrigated conditions)	15.02.2022	N. Ravisankar
IFS in creation of sustainable livelihoods for small and marginal farmers	Virtual (Extension Education Institute, Hyderabad)	IFS: The livelihood approach in Indian Context, Models in IFS: An overview	15.02.2022	N. Ravisankar
Winter school on Conservation agriculture for efficient resource use and climate-resilient farming	Virtual (IARI, New Delhi)	Conservation agriculture intervention in IFS for improving resource use and farmers income	18.02.2022	N. Ravisankar

CFA on Organic Farming	Virtual (ICAR-IIFSR)	Government schemes and policies for development of organic farming	20.02.2022	Raghavendra K.J.
Recent Advances in Organic Farming Research	Virtual (NAARM, Hyderabad)	Organic Farming in India: Status and Research Strategies	26.02.2022	N. Ravisankar
Short course on Ecosystem service analysis in diversified coconut and arecanut gardens	Virtual (CCARI, Goa)	Coconut/Arecanut based IFS for livelihood security	28.02.2022	N. Ravisankar
Trainers Training on Natural and Organic Farming	Virtual (SVPUAT, Modipuram)	Concepts and Practices of Natural and Organic Farming	03.03.2022	N. Ravisankar
Trainers Training on Natural Farming	EEI, Hyderabad	Natural Farming: An Overview	19.04.2022 (Virtual)	N. Ravisankar
Trainers Training on Integrated Farming Systems	EEI, Hyderabad	Crop based solutions for sustainable food systems	27.04.2022 (Virtual)	N. Ravisankar
CFA on Organic farming	ICAR-IIFSR, Modipuram	IFS model visit	02-07.05.2022	A. K. Prusty
Good Practices in Organic Agriculture	SAMETI, Pudukottai, Tamil Nadu	Integrated Farming System: A pathway to Organic Agriculture	12.05.2022 (Virtual)	N. Ravisankar
Training on “New Analytical Methods in Soil Research” for ICFRE Scientists	ICAR-CAFRI, Jhansi	Natural Farming Components and Processes	16.09.2022 (Virtual)	N. Ravisankar
Online training program on “Ensuring Soil Health in Scenario of Climate Change”	ICAR-CAFRI, Jhansi	Ensuring Soil Health in Scenario of Climate Change	20.10.2022 (Virtual)	N. Ravisankar
CFA on Organic farming	ICAR-IIFSR, Modipuram	Pre-monsoon dry sowing (PMDS)/ Muti-variate cropping (MVC) for organic/ natural Farming	18.12.2022	M. A. Ansari

CFA on Organic Farming training for the first batch 2022-23	ICAR-IIFSR, Modipuram	Orientation to Institute facilities and activities	06.12.2022	M. Shamim
CFA on Organic farming	ICAR-IIFSR, Modipuram	IFS model visit	10.12.2022	A K Prusty
CFA on Organic Farming training for the first batch 2022-23	ICAR-IIFSR, Modipuram	Government schemes and policies for development of organic farming	10.12.2022	Raghavendra KJ
CFA on Organic Farming training for the first batch 2022-23	ICAR-IIFSR, Modipuram	Identification of green manures and its utilization in organic production system	16.12.2022	Raghuveer Singh
CFA on Organic Farming training for the first batch 2022-23	Sajag Organic International, Keena Road, Meerut	Visit to vermi compost commercial unit with training participants	18.12.2022	Raghavendra KJ
CFA on Organic Farming training for the first batch 2022-23	Patanjali Yogpeeth/PBRI, Haridwar	Visit to herbal garden, Goshala (biogas and different composting units), processing and packaging unit at Patanjali Yogpeeth Haridwar	17.12.2022	Raghuveer Singh
Namai gange scheme	Asifafad, Kila Prakshit garh	Organic farming for farmers of Namai gange	19.12.2022	Raghuveer Singh
Certificate Course on Organic and Natural Farming	NCONF, Ghaziabad	Integrated Farming Systems in Organic and Natural Farming	23.12.2022	N. Ravisankar
HRD training programme	SVPUAT, Meerut	Assessment approaches for studying the drudgery, energy and nutrition requirements for implementation of sustainable interventions	05.03.2022	Nisha Verma

Preparation of students for national level competitions	Dept of Apparel and Textile Science, PAU, Ludhiana	Research Methodology in Agricultural and Allied Sciences	11.04.2022	Nisha Verma
World Breast feeding Week during 1-7 August 2022	Dr Rammanohar Lohia Avadh University, Ayodhya (Virtual Mode)	Benefits of breast feeding for mother and child	05-08.2022	Nisha Verma
Certified Farm Advisor (CFA) on Organic Farming wef 06-20 December, 2022	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Quality aspects of organic crop produce	08-12-2022	Nisha Verma
Product diversification by formulating/ registering Self help groups in Krishak/ Mahila Krishak Goshthi	MudhKareempur village, Block Khatauli	Technological interventions in Rabi crops/animal health/product diversification through gender transformative approaches (GTA's)	21-11-2022	Nisha Verma
Certified Farm Advisor (CFA) on Organic Farming	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Organic farming packages of practices for vegetables and fruits	19 February 2022	Poonam Kashyap
Certified Farm Advisor (CFA) on Organic Farming	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Nursery Production and management of fruits and vegetable crops	24 Feb, 2022	Poonam Kashyap
Certified Farm Advisor (CFA) on Organic Farming	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Horticulture based farming system models for food and nutritional security (T &P)	10 Dec, 2022	Poonam Kashyap
Certified Farm Advisor (CFA) on Organic Farming organized	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Organic farming packages of practices for vegetables and fruits	24 Feb, 2022	Poonam Kashyap

Certified Farm Advisor (CFA) on Organic Farming	Organized by ICAR-IIFSR and sponsored by MANAGE, Hyderabad	Horticulture and Agroforestry based farming system model	26 May, 22	Poonam Kashyap
Three week certificate course on IFS for sustainable agriculture during January 3 to 23, 2022 organised by CAAST and CSAWM, MPKV Rahuri	MPKV Rahuri (Virtual)	Horticulture based IFS in India	11 January 2022	Poonam Kashyap

TRAININGS ATTENDED

Title of training	Venue	Period	Name of participants
Geospatial Analysis using QGIS & R	NAARM, Hyderabad (virtual)	14-19.02.2022	M. A.Ansari
Data Visualization using R	Virtual by NAARM	9-11.03. 2022	A. K. Prusty
Interactive Trainings on the E-Flows Assessment (under the ageis of NMCG, CWC and India - EU Water Partnership Action - Phase 2) https://elearning.nwapune.in/course/view.php?id=48	Virtual	5-7.04. 2022	A. K. Prusty
"Analytical techniques for Impact Evaluation Methods"	Bhanaras Hundu Universilty, Varanasi, Sponsored by IFPRI, NewDelhi	25-30.04.2022	Raghavendra KJ
International Training Workshop on Farming Systems Design Towards Zero Hunger and Zero carbon	ICRISAT Patancheru, Hyderabad, Telangana – 502324, India	07-12.11.2022	Raghuveer Singh
Concepts and mechanisms of soil carbon sequestration and stabilization for soil health improvement and climate change mitigation	ICAR-IISS, Bhopal	02-11 .03. 2022	Dr.A.LMeena
International training workshop on Farming Systems Design Toward Zero Hunger and zero carbon	ICRISAT, Patancheru, Hyderabad	8-12 .11.2022	P.C. Ghasal
Descriptive Data Analysis Using MS-EXCEL & SPSS Software	Virtual (BHU)	6-10.06.2022	P.C. Ghasal
Recent development in Agroforestry dimensions for managing salt affected ecologies	ICAR CSSRI Karnal (Online mode)	22.02 to 03.03.2022	Nirmal
Simulation modelling and climate change research	IARI New Delhi	17.11.-7.12.2022	Nirmal

Virtual Karyashala cum High-End International Workshop on Integrating Innovations with Cost-effectiveness for Competing Electromagnetic Energy Assisted Food Processing and Packaging Technologies	NIT, Rourkela, Odisha-769008	22-26.08. 2022	Amit Nath
Attended the training program on "Science Administration and Research Management"	ASCI, Hyderabad	05-16.09.2022	Amit Nath
Attended the AAHAR International Food and Hospitality Fair 2022 at Pragati Maidan, New Delhi	APEDA and India Trade Promotion Organization (ITPO), New Delhi	28.04.2022	Amit Nath
Training programme for HRD Nodal officers of ICAR	ICAR-NAARM, Hyderabad	21-23.02.2022	Suresh Malik
Role of Farmer Producer Organizations (FPO's) in Linking farmers to market.	College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh (Virtual mode)	02-03-2022 to 05-03-2022	Nisha Verma
Online training course on "Ergonomics and Safety in Agricultural Operations to Enhance Farmer's Productivity and well being	ICAR-IARI, New Delhi	16-18 November, 2022	Nisha Verma

TRAINING/WORKSHOP/SCHOOLS/MEETINGS ORGANIZED

Title of Training/ workshop/schools organized	Venue	Period	Number of participants	Name of Organizers
Three week national online certificate course on “Integrated Farming System for Sustainable Agriculture” jointly by CAAST under NAHEP, MPKV, Rahuri and ICAR-IIFSR	Virtual	3-23.01.2022	40	N. Ravisankar M.A. Ansari
Certified Farm Advisor (CFA) on Organic Farming (Module-II: Virtual for 9 days) sponsored by National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Telangana	Virtual	15-24.02.2022	63	N. Ravisankar C. Bhanu Poonam Kashyap A.K.Prusty M. Shamim M.A. Ansari P.C. Ghasal A.L.Meena Jairam Choudhary Raghuveer Singh Raghavendra KJ
Trainers Training on Natural and Organic Farming for KVKs of SVPUAT, Meerut Modipuram	Virtual & Physical at ICAR-IIFSR, Modipuram	Virtual 2-3.03.2022; Physical 22-23.03.2022	84	N. Ravisankar C. Bhanu M.A. Ansari Raghuveer Singh P.C. Ghasal Raghavendra KJ

"New technologies and developments in oilseeds" for extension officiers/ workers/input dealers sponsored by NFSM (Oilseeds & Oilpalm) (4 trainings in 3 States)	Umaria, Dungarpur, Kota and Dahod	January to March 2022	80	N. Ravisankar
"Crop diversification and remunerative cropping system involving oilseeds" for farmers sponsored by NFSM (Oilseeds & Oilpalm) (5 trainings in 5 States)	Modipuram, Kalahandi, Medak, Vizianagaram, Palghar	January to March 2022	100	N. Ravisankar
Foundation Day of ICAR-IIFSR	ICAR-IIFSR, Modipuram	01.04.2022	400	N. Ravisankar A.K.Prusty M.Shamim M.A.Ansari Raghuveer Singh Raghavendra KJ
Certified Farm Advisor (CFA) on Organic Farming: Module-II (Physical)	ICAR-IIFSR, Modipuram	2-7.05.2022	28	N. Ravisankar Chandra Bhanu Poonam Kashyap A.K. Prusty M. Shamim M.A. Ansari Raghuveer Singh A L Meena Jairam Choudhary PC Ghasal Raghavendra KJ

Certified Farm Advisor (CFA) on Organic Farming: Module-II (Physical)	ICAR-IIFSR, Modipuram	23-28.05.2022	19	N. Ravisankar Chandra Bhanu Poonam Kashyap A.K.Prusty M.Shamim M.A.Ansari Raghuveer Singh Jairam Choudhary Raghavendra KJ
8th International Yoga Day, 2022	ICAR-IIFSR, Modipuram	21.06.2022	40	Chandra Bhanu Raghavendra KJ
Har Ghar Tiranga Awarness" on the occasion of 75 years of independence under SC-SP programme	Bhadurpur village, Meerut, Uttar Pradesh	13.08.2022	150	Raghuveer Singh
International Training Workshop on Farming Systems Design Towards Zero Hunger and Zero carbon as Resource person	ICRISAT, Hyderabad	8-12.11. 2022	20	A.K. Prusty
Organized *Kisan Gosti* at village Jamalullapur	Kathouli, Muzaffarnagar	21.11.2022	150	Raghuveer Singh Raghavendra KJ

Interstate Exposure Visit of Farmers for IFS from Siva Ganga district of Tamil Nadu.	ICAR-IIFSR, Modipuram. Meerut	29-30.11.2022	22	N Ravisankar Raghavendra KJ, A K Prusty M. Shamim. M. A. Ansari. Raghuveer Singh
Certified Farm Advisor (CFA) on Organic Farming: Module-III	ICAR-IIFSR, Modipuram, Meerut	06-20.12.2022	35	N. Ravisankar C. Bhanu Poonam Kashyap M.Shamim M.A.Ansari Raghuveer Singh P.C. Ghasal A.L. Meena Jairam Choudhary Raghavendra KJ
Interstate Exposure Visit of Farmers for IFS from Tiruvannamalai district of Tamil Nadu.	ICAR-IIFSR, Modipuram, Meerut	7-8.12.2023	22	N. Ravisankar Raghavendra KJ. A.K. Prusty M. Shamim. M. A. Ansari. Raghuveer Singh
Interstate Exposure Visit of Farmers for IFS from Udagai, Nilgiris district of Tamil Nadu.	CAR-IIFSR, Modipuram. Meerut	21-22.12.2022	22	Raghavendra KJ. A. K. Prusty M. Shamim M.A .Ansari. Raghuveer Singh

Interstate Exposure Visit of Farmers for IFS from Tirunelveli district of Tamil Nadu.	CAR-IIFSR, Modipuram. Meerut	22-23.12.2022	20	Raghavendra KJ, A K Prusty M. Shamim M. A. Ansari. Raghuveer Singh
Kisan Diwas Organised under the Sawchata Pankhawada	Bhadurpur village, Meerut, Uttar Pradesh	23.12.2022	150	Raghuveer Singh Raghavendra KJ
Annual Group Meeting (XVII) of the All-India Network Programme on Organic Farming (AI-NPOF)	RKMVERI Narendrapur, W.B.	28-30.12. 2022	50	N. Ravisankar A.K.Prusty M.Shamim M.A.Ansari Raghuveer Singh Raghavendra KJ
Biennial workshop of AICRP on integrated farming systems	MPKV, Rahuri, Maharashtra	18-21.01.2023	300	N. Ravisankar A.K.Prusty M.Shamim M.A.Ansari Raghuveer Singh Raghavendra KJ
Agricultural System Modelling for Natural Resource Management	ICAR-NAARM, Hyderabad	19.09.2022	19-24th September, 2022.	N. Subash
ICAR sponsored 21 days' Winter School on Climate Smart Agriculture for Sustainable Production	Climate Smart Technologies through Advanced Tools	28.03-17.04.2022	20	N. Subash

Organized the National Campaign on farm mechanization	Khanuda and Dhanju villages	28.4.2022	200	V. P. Choudhary, Lalit Kumar, Peyush Punia Suresh malik L.R. Meena
Capacity and skill upgradation programme for Technicall staffs on 'Farm Management'	ICAR IIFSR, Modipuram	22-28.02. 2023	13/30	Nirmal
National Conference on Agro-Ecology Based Agri-Food Transformation System	ICAR IIFSR, Modipuram	27-28.01.2023	700	Nirmal
Organized Agro Innovator Meet during National Conference, FSRDA	ICAR IIFSR, Modipuram	27.01. 2023	700	Amit Nath
Organized Mass Awareness Program on "Value addition and Processing on Agricultural Produces for Entrepreneurship development" for Final Year B.Sc. (Agriculture) students	Shri Ram College, Muzaffarnagar	14.10. 2022	50	Amit Nath
Organized one-day Mass Awareness Program (23/04/2022) on Natural Farming and ABI Centre of ICAR-IIFSR	Bhartiya Inter College, Nangle-Mandaud, Muzaffarnagar (U.P.)	23.04.2022	504	Amit Nath Chandra Bhanu A L Meena

Attended organized a kisan goshti as a member of the committee on "Special national swachhta campaign and food & nutritional security through IFS model of Agriculture	ICAR IIFSR Modipuram	15th December2022 to 30th December 2023.	50	P.P. Singh
Improvement in the working efficiency of Skill Supporting Staff	ICAR-IIFSR, Modipuram	22-26.02.2022	14	Suresh Malik,
Poultry chicks and other input distribution for demonstration.	Khanauda village (Meerut)	23.04.22	80	Suresh Malik Peyush Punia Lalit Kumar
Poultry chicks and other input distribution for demonstration.	Kasiara and Rasoolpur village (M. Nager)	26.04.22	200	Lalit Kumar Suresh Malik Peyush Punia
Kisan Gosthi, Swachata programme & input (wheat) distribution for demonstration.	Kasiara and Rasoolpur village (M. Nager)	13.12.22	100	Lalit Kumar. Suresh Malik Peyush Punia,

RADIO/TELEVISIONS TALK / SOCIAL MEDIA

Topic	Broadcasted/ telecasted in	Date	Name of speaker
Expert regarding Integrated farming system in farmers programme	DD-Kisan	08.06.2022	Raghuveer Singh
Integrated Farming	Hello Kisan programme of DD Kisan	17.10.2022	A.L.Meena
Soil Testing for Higher Crop Production	Hello Kisan programme of DD Kisan	17.10.2022	A.L. Meena

OTHER PROGRAMMES ORGANIZED

Webcasting of PM Kisan Samman Nidhi fund Release programme

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut organized the webcasting programme for release of PM Kisan Samman Nidhi by Hon. Prime Minister Shri Narendra Modi on 01 January, 2022. A total of 177 farmers and officials participated in the programme.

Programmes organized under *Azadi Ka Amrit Mahotsav*

Virtual Lecture on "How to increase resistance power against Coronavirus"

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut celebrated '***Azadi ka Amrit*** *Mahotsav*'since August, 2021. A virtual lecture was organized under this programme on the topic 'How to increase resistance power against Coronavirus' was held on 22 January, 2022 through virtual mode. Scientists, technical, administrative and other categories of staff from ICAR-IIFSR participated in this virtual lecture. Dr. Sambhu Dutt Dheeman, Ex. Professor, CCS Haryana Agriculture University, Hissar, Haryana was the main speaker of the programme. Dr. Dheeman elaborated about importance, use, recipe and preparation protocol of Amritprash using Aonla, dry fruits and other immunity boosting spices.

'Farmer's Fair' organized at village: Meerapur Dalpat, Distt. Muzaffarnagar

ICAR-IIFSR organized a 'Farmer's Fair' under the aegis of 'Azadi ka Amrit Mahotsav' on 25 May, 2022. The main aim of the farmer's fair was to promote Natural Farming practices among the farming communities with slogan "Prakritik Kheti-Khushhaal Kisan" The participants included 11 VIPs and 2500 farmers of Western Plain Zone of Uttar Pradesh.

"Har Ghar Tiranga" flagship programme

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut organized a campaign on "Har Ghar Tiranga" under the aegis of 'Azadi ka Amrit Mahotsav' from 11-15 August, 2022.


रैली निकालकर दिया हर घर तिरंगा लगाने का संदेश

धूमधाम से निकाली तिरंगा रैली

ग्रीन इंडिया मिशन का दिया संदेश

Annadata Devo Bhava flagship programme

Institute celebrated 'Annadata Devo Bhava' programme under the aegis of 'Azadi ka Amrit Mahotsav' from 22nd March to 24th April,

2022. The various activities organized under this included farmers' training programme on Natural farming and Organic Farming on 22-23 March, 2022 to KVK staff of SVPUAT, Meerut, 33rd Foundation Day, ICAR-IIFSR on 1st April, 2022 (hybrid mode) and Kisan Gosthi on Natural Farming on 23-24 April, 2022 at Nangle- Mandaud, Muzaffarnagar. A total of 923 participants took part in these events.

Celebration of 33rd Foundation Day of Institute

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut celebrated its 33rd Foundation Day on April 01, 2022. The institute, established on the same date in 1989, dedicated the event to honoring farmers through the "Annadata Devo Bhavah" programme. Dr. Sieglinde Snapp, the Director of Sustainable Agri Food System at the International Maize and Wheat Improvement Center (CIMMYT) Mexico, graced the occasion as the chief guest.

The event was organized in a hybrid mode, The participates included Dr. Azad Singh Panwar (Director, ICAR-IIFSR), Dr. Manoj Kumar (In-charge Director, ICAR-CPRI), Dr. M. L. Jat (Principal Scientist, CIMMYT-Mexico), Dr. Santiago (Senior researcher), and scientists from ICAR-IIFSR were present. Additionally, scientists from AICRP-IFS, AI-NPOF, and NRM divisions of ICAR New Delhi participated virtually. The topic of discussion on Foundation Day revolved around the "Sustainability of Agri-Food System in South Asia." Dr. Sieglinde Snapp, the Chief Guest, delivered an insightful talk on the subject.

Organization of a six-day training program on Certified Farm Advisor in Organic Farming

The institute, in collaboration with the National Academy of Agricultural Extension Management (MANAGE), Hyderabad, organized a six-day training program on Certified Farm Advisor in Organic Farming. The program took place from May 02 to May 07, 2022. A total of 28 trainees from four states participated in the program. Throughout the training program, various sessions were conducted focusing on the four pillars of organic farming: national standards, organic certification, technical packages and market networks. The progress of the trainees was thoroughly explained and discussed. The objective of the training program was to equip the trainees/officers with the necessary knowledge and skills to implement organic farming projects with farmers in their respective states. After completing one year of training, the trainees will be awarded the certificate of Certified Farm advisor. This certification will enable them to effectively implement organic farming schemes initiated by the state or central government.

International Day of Yoga and Yog Shivir Saptaah

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut organized International Day of Yoga (in Hybrid mode) and Yog Shivir Saptaah from 14-21 June, 2022. The programme was celebrated under the aegis of 'Azadi ka Amrit Mahotsav'. A total of 459 participants took part in various events.

Fit India Freedom Run 3.0 organized on the 153rd birth anniversary of Mahatma Gandhi

On October 2, 2022, the institute organized the Fit India Freedom Run 3.0 to commemorate the 153rd birth anniversary of Mahatma Gandhi, the Father of the Nation. The program began with the inaugural address by Dr. Peyush Punia, Principal Scientist and Nodal Officer, who paid tribute to Mahatma Gandhi and recalled his ideals. Following this, all the scientists, officers, and employees present at the institute paid homage to Mahatma Gandhi. The Fit India Freedom Run 3.0 commenced with the slogan "75 years of independence, fitness is unmatched." Around 35 officers and employees of the institute participated in the fitness run, starting from the institute campus and extending to the research area. The program emphasized the significance of physical exercise for physical, mental, and spiritual well-being.

Parthenium Awareness Week

Institute organized “Parthenium Awareness Week” during 16-22 August,2022 with an objective to create the awareness among the rural masses about the menace and lethal effects of this invasive weed (Congress grass). The total number of 120 participants including scientists, other staff and students of the institute participated in the programme. The programme was takenup under adopted outreach villages involving school children. The scientific and technical aspects of ethics weed eradication was also attempted through organizing seminars and awareness discussions.

Vigilance Awareness Week

Vigilance Awareness Week on the theme of "Corruption Free India for a Developed Nation" was organized during 31 October to 06 November 2022 through video conferencing with various events such as administering the pledge by Dr A.S. Panwar, Director, ICAR-IIFSR. Lecture on vigilance by Dr. Peyush Punia, vigilance officer, IIFSR, Meerut was organized on 02 November 2022 for the benefit of the staff and for creating awareness regarding the vigilance matters and procedures.

Webcasting of PM Kisan Samman Sammelan 2022 and Agri Start-up Conclave at ICAR-IIFSR

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut organized the webcasting programme of "PM Kisan Samman Sammelan 2022 and Agri Start-up Conclave" and also a "*Kisan Gosthi* under SCSP Scheme" at ICAR-IIFSR, Modipuram, Meerut on 17 October, 2022. The participants included 113 dignitaries and 472 farmers.

Recycling program of crop residues and household waste was organised under cleanliness drive

The Indian Institute of Farming Systems Research, Modipuram, Meerut, organized the Cleanliness Fortnight from December 16 to December 31, 2022. Under this drive, trainees of Certified Farm Advisor were trained for recycling of crop and domestic waste using organic concoctions on December 19, 2022. The program witnessed the participation of 35 trainees from 6 states across the country. Trainees were educated about the importance of recycling farm and household waste. They were provided with practical demonstrations on the technology of composting, showcasing how to convert farm produce and kitchen waste into compost. The program aimed to promote sustainable waste management practices in organic farming. The program received a positive response, with approximately 40 individuals, including the trainees, registering their participation. The initiative aimed to create awareness about cleanliness, waste management, and sustainable practices in agriculture.

Evaluation and seed production of improved varieties at Main and Siwava Farm, ICAR-IIFSR, Modipuram

Crop	Area covered	Variety	Revenue generation (Rs)	Nodal Scientists
Wheat	15.0 ha	DBW-187	13.38 lakh	P. C. Jat Raghuveer Singh
Rice	18.0 ha	Rice	17.75 lakh	P. C. Jat Raghuveer Singh

Visit and interaction programmes organized for farmers

S. No.	Programme/ Event	Venue	Date	Number of Participants	Resource persons
1	Scientist-Farmer Interaction (Farmer First Programme)	Village: Rukanpur, Mubarikpur and Tigai District: Muzzafarnagar	17th and 18th Jan, 2022	84	P. C. Jat A. K. Prusty Poonam Kashyap Nisha Verma

2	Exposure visits of 50 farmers of Muzzafaranagar organised by KVK Chittora, Muzzafarnagar-2	ICAR-IIFSR, Modipuram	08th March, 2022	50	P. C. Jat Poonam Kashyap Raghuveer Singh P. C. Ghasal A. L. Meena
3	Scientist-farmers'interaction during "Annadata Devo Bhava" programme	Jangethi, Bahadurpur and Idrishpur	22th-24th April, 2022	93	P. C. Jat A. L. Meena P.C. Ghasal Chandra Bhanu R. P. Mishra D. Dutta Ponam Kashyap
4	Kisan Mela cum Gosthi on Natural Farming and Exhibition (ICAR-IIFSR under the aegis of Azadi ka Amrit Mahotsav.)	Village: Meerapur Dalpat , Dist.: Muzzafarnagar	25th May, 2022	2800	P. C. Jat R.P. Mishra Chandra Bhanu Poonam Kashyap P.C. Ghasal A. L. Meena Jairam Chaudhary
5	Swachata Karykram (Siwaya Farm of ICAR-IIFSR)	ICAR-IIFSR, Modipuram	25th December, 2022	40	P. C Jat Poonam Kashyap Nisha Verma
6	Kisan Divas Samaroh on the occasion of Birthday of former Prime Minister Choudhary Charan Singh	Bahadurpur Dist.: Baghpat	23th December, 2022	74	P. C. Jat Raghuveer Singh Raghvendra K J A. L. Meena
7	National campaign on "Efficient and Balanced use of Fertilizers (including nano-fertilizers)"	Sathedi, Jangethi, Dist: Muzaffarnagar	22th- 23th June, 2022	120	P.C. Jat Poonam Kashyap Nisha Verma A. L. Meena D. Dutta
8	Training programme on Organic Farming and improved IFS Technologies and Exposure visit of Farm Women of NGO	ICAR-IIFSR, Modipuram	11th -13th November, 2022	32	P. C. Jat Dr Poonam Kashyap A. L. Meena

9	Fasal Kranti-Kisan Mela (Fasal Kranti)	Janta Vedic College, Bara-rut	02nd November, 2022.	5000	P. C. Jat Poonam Kashyap Nisha Verma A. L. Meena
10	Programme on Improved IFS Technologies and Exposure visit under ATMA-SSEPERS Programme (20 Farmers)	ICAR-IIFSR, Modipuram	03rd -4th November, 2022	32	P. C. Jat Poonam Kashyap A. L. Meena
11	Visit for 25 farmers and officials of NABARD-Manjari Foundation, Rajasthan.	ICAR-IIFSR ,Modipuram	13th -16th November, 2022	25	P. C. Jat Poonam Kashyap A. L. Meena
13	All India Farmers' Fair and agro-Industrial Exhibition	SVPUAT Meerut	18th Oct to 20th Oct, 2022.	NF	P. C. Jat A. K. Prusty Poonam Kashyap Nisha Verma P.C. Ghasal A. L. Meena Raghvendra K J
14	Kisan Gosthi under Farmer FIRST programme	Rukanpur, Mubarikpur and Tigai villages of Muzafarnagar	13th December, 2022	89	P. C. Jat A. K. Prusty Poonam Kashyap Nisha Verma
15	Swachata Programme under Farmer FIRST programme	Rukanpur, Mubarikpur and Tigai villages of Muzafarnagar	18th and 19th December, 2022	84	P. C. Jat A. K. Prusty Poonam Kashyap Nisha Verma
16	Kisan Gosthi	Kashyara and Rasoolpur villages	18th October, 2022	100	Lalit Kumar L.R.Meena Sunil Kumar Nirmal
17	National Girl Child Day	ICAR-IIFSR, Modipuram	24th January, 2022	42	P.C. Ghasal Poonam Kashyap Nisha Verma
18	Kisan Gosthi on Natural Farming	Nangle Mandor Muzzafar Nagar	23rd April 2022	38	P.C. Ghasal R.P. Misha N. Ravisankar Raghuveer Singh

19	National Campaign on farm mechanization	Khanuda and Dhanju village (Meerut)	28th April, 2022	90	Lalit Kumar Suresh Malik Peyush Punia Sunil Kumar Raghvendra K.J. Nirmal
20	Mahila Krishak Gosthi	Madhkare-empur and Tabeta, Dist.: Muzaffarnagar	21 November 2022 and 7 November 2022	150	Nisha Verma Raghuveer Singh Raghvendra K.J. P. C. Jat A. K. Prusty Poonam Kashyap

AWARDS/HONOURS/RECOGNITIONS

AWARDS/HONOURS

Sr. No.	Name of Award	Name of the society / Organisation/events giving honour	Name(s) of awardee scientist
1	Best Oral Presentation (Second)	Role of integration of pisciculture in agri-food systems" A. K. Prusty, N. Ravisankar, Poonam Kashyap, M. Shamim et al. 5th Global Meet on Science and Technology for minimizing Innovation Cost and Time, 8-9 October 2022 held at SV Subharati University, Meerut.	A. K. Prusty, N. Ravisankar, Poonam Kashyap, M. Shamim
2	Best Oral Presentation award (First)	Upscaling livelihood of small farmers through integration of horticultural crops in farming systems" 2nd Indian Horticulture Summit 2022 held at Navsari Agricultural University, Gujarat during 27-29 April, 2022.	Poonam Kashyap, N. Ravisankar, A. S. Panwar, P.C. Ghasal, Amit Nath, S. Malik, A. K. Prusty, M. Shamim, D. Dutta and M. A. Ansari
3	Best oral presentation award (Second)	Hi-Tech Horticultural Society during 5th Global Meet on Science and Technology for minimizing innovation cost and time: To make long story short during 8-9 October 2022 at Swami Vivekanand Subharti University, Meerut.	M. Shamim, N. Ravisankar, A.K.Prusty. P.Kashyap. M.A.Ansari. Raghuveer Singh, Raghavendra KJ.

4	Young Scientist Award	Indian Association of Hill Farming (IAHF), ICAR- RC for NEH Region, Umiam, Meghalaya on November, 2022	Dr. M.A.Ansari
5	Best oral presentation award (First)	Climate, carbon, yield and sustainability for identification of resilient management options under cereal based cropping system: during the ICRA-2022 First International Conference: Reimagining Rainfed Agro-ecosystems: Challenges and Opportunities) held at ICAR-CRIDA, Hyderabad during 22-24th December, 2022.	N. Subash, D. Dutta, P. Ghasal, Omkar Singh and Brahmdutt
6	Best oral presentation award (First)	Effect of nitrification inhibitors on productivity and nitrogen use efficiency of maize (*Zea mays* L.)' in the national conference by MTAIFeb 23-.25,2022 MPUAT Udaipur.	Kamlesh Kumar, C M Parihar, S L Jat and Simardeep Kaur
7	Best oral presentation award (Second)	ICAR-IIFSR during Hindi Pakhwara 14-28 September, 2022	Dr. P.C. Ghasal
8	Outstanding Horticultural Women Scientist Award	Society for Horticultural Research and Development in 2nd Indian Horticulture summit 2022 held at Navsari Agricultural University, Gujarat during 27-29 April, 2022	Dr. Poonam Kashyap
9	Best oral presentation award (First)	2nd Indian Horticulture Summit -2022, Society of Horticultural Research and Development at NAU, Navsari, Gujarat during 27-29 April 2022.	Dr. P.C. Ghasal
10	Best oral presentation award (First)	First international conference (ICRA-2022) organized by ICAR-CRIDA, Hyderabad during 22-24 December 2022	Dr. P.C. Ghasal

11	Hindi poster presentation (Second)	On the occasion of Hindi pakhwada organised on 27-9-2022 at ICAR-IIFSR.	Dr. P.C. ghasal, D. Dutta, Suresh Malik, Amit Nath, A K Prusty, Poonam Kashyap, M. Shamim, Sunil Kumar and A S Panwar
12	Reviewer Excellence Award	Legume Research (ARCC journals), Karnal, Haryana (2023)	Dr. L.R. Meena
13	Reviewer Excellence Award	Agricultural Science Digest (ARCC journals), Karnal, Haryana.(2022)	Dr. L.R. Meena
14	Excellence in Reviewing	International Journal of Environment & Climate Change:	Dr. L.R. Meena

RECOGNITIONS

January, 2022

- Dr N. Ravisankar served as Member, Selection Committee for selection of YP-1 for ICAR-Central Research Institute on Cattle, Meerut (Attended the selection committee meeting on 29 January 2022).
- Dr Poonam Kashyap organised National Girl Child Day on 24th January, 2022 as Coordinator of the programme at ICAR-IIFSR, Modipuram, Meerut.
- Dr Poonam Kashyap evaluated MSc thesis and conducted Viva Voice of Mr Harsimran Kamboj for thesis entitled " Studies on In-Vitro regeneration and Mutagen sensitivity of Jamun Cv.Konkan Bhadoli from dept. of Fruit Science PAU Ludhiana vide office order No ACAD T-5/AU-2022/Exam II/255 M/403 on Jan 6, 2022.

February, 2022

- Dr. A.L. Meena delivered an invited lecture on "Nutrient Management for Sustainable Organic Farming" in Oline State Level Training Programme organized by Organic Farming Research and Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani – 431 402 on 22-02-2022.
- Dr Poonam Kashyap coordinated the review meeting on Natural Farming Experiment under AINPOF organised by ICAR-IIFSR on 5 February, 2022

March, 2022

- Dr N. Ravisankar served as Member; Committee constituted by Government of India to draw standards for certification system for Natural Farming Products (F.No. 10-4/2022-Org.Fmg dated 25 March 2022
- Dr N. Ravisankar served as External Expert for selection of Faculty at Vellore Institute of Technology, Vellore, Tamil Nadu on 12 March 2022.
- Dr. A.L. Meena delivered an invited lecture on "Role of Phosphorus in Sustainable Agriculture" in a National Seminar on "Practical Implications of Phosphorus Management Strategies for Sustainable Agriculture" organized by Bihar Agriculture University, Sabour during 28-29 March, 2022.
- Dr R P Mishra, Dr PC Jat, Poonam Kashyap, Dr M Shamim and Dr Nisha Verma organised International Women's day on 8th March 2022 at ICAR –IIFSR as a coordinators of the programme.
- Dr Poonam Kashyap Coordinated Trainer's Training Programme on Natural and Organic Farming on 2 and 3 March, 2022 at ICAR-IIFSR

April, 2022

- Dr N. Ravisankar served as Member, Committee constituted by Government of India to evaluate the training and publicity material on Natural Farming prepared by MANAGE, Hyderabad (F.No. 9-35/2021-Org.Fmg (FTS 106455) dated 12 April 2022.

- Dr. A.L. Meena delivered an invited lecture on "Technical Agricultural solutions for Sustainable Agriculture" organized by KIET Group of Institutions, Delhi-NCR, Ghaziabad under Unnat Bharat Abhiyan on 30 April, 2022.

May, 2022

- Dr N. Ravisankar served as Member, Assessment committee for promotion under CAS of ARS Scientists of ICAR-Central Tobacco Research Institute, Rajahmundry (F.No. Pers.7-30/2014-AU dated 9 March 2022 (Attended the CAS meeting on 17 May 2022)
- Dr N. Ravisankar served as Observer for Administrative Officer and Finance and Accounts Officer Examination-2021 conducted by Agricultural Scientists Recruitment Board, New Delhi on 10 May 2022.
- Dr N. Ravisankar served as Member Secretary, Sub-Thematic Group-I on Diversification of Crops constituted by the Government of India on Crop diversification and achieving self-sufficiency in Oilseeds and Pulses (1-3/2021-CU-II dated 9 May 2022).

June, 2022

- Dr. A.L. Meena attended the stakeholders meeting of Micronutrient Action Policy Support "A web-tool to estimate micronutrient deficiencies and explore pathways to improve nutrition" jointly organized by The University of Nottingham, LUANAR and Birtish Geological Survey on 14 June, 2022.
- Dr. M. Shamim involved in preparation and submission of a policy paper "Enhancing production, profitability and nutritional security through Integrated Farming Systems and Natural Farming in Uttar Pradesh" presented before APC, Govt of Uttar Pradesh, 18th June, 2022.

July, 2022

- Dr. M. Shamim involved in preparation and submission of reply to question on "Inputs to be provided for the Rajya Sabha Question D.No. U212 regarding "Support for weaker communities in Karnataka"- answered on 21.07.2022".
- Dr N. Ravisankar served as Member, Advisory Committee for promotion of Natural Farming constituted by Government of India (F.No. 9-29/2022-Org.Fmg (FTS 114126) dated 3 August 2022.

August, 2022

- Dr. Raghuveer Singh and Dr. Raghavendra KJ received an Appreciation certificate by Director, IIFSR for outstanding contributions in research, extension and institute building in various capacities on 15 August, 2022
- Dr. Poonam Kashyap evaluated MSc thesis and conducted Viva Voice of Mr Imran Ali for thesis entitled " Studies on canopy Management on yield and quality in Pear (Pyrus communis L) under Western U.P. Condition from dept. of Fruit Science SVPUAT, Modipuram on August 2, 2022.
- Dr. Poonam Kashyap organised 3 days celebration programme under the aegis of

Azadi ka Amrit Mahotsav on the occasion of 75th Independence day during 13-15 August 22 in and oof the campus as the member of the committee.

September, 2022

- Dr. A.L. Meena delivered an invited lecture on “Soil Health and Agriculture: National and International Scenario” in two days workshop on "Soil Conservation, Drought, Floods and Sustainable Agriculture in the Indo-Gangetic Plains" jointly organized by Indian Institute of Technology, Patna and Bhartiya Kisan Sangh during 22-23 September 2022.
- Dr. Raghuveer Singh and Dr. Raghavendra KJ was nominated to Coordinate the team of Doordarshan Kisan (Delhi) to cover the institute under the Shrestha sansthaan series telecast on 25th September, 2022.
- Dr. A.L. Meena delivered an invited lecture on “Soil Enzyme Assay” in five days of training on “Soil testing lab-an innovative business” during 19-23 September 2022 by the Department of Soil Science and Agriculture Chemistry, College of Agriculture, Junagadh Agricultural University.
- Dr Nisha Verma acted as member, hall arrangement committee for coordination and arrangement for the visit of Hon’ble Secretary (DARE) and DG (ICAR) during 9-10 September 2022.

October, 2022

- Dr. A.L. Meena, Dr. Poonam Kashyap, Dr. Nisha Verma and Dr. P.C. Jat participated in "All India Farmer’s Fair and Agro-Industrial Exhibition” at Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram during 18-20 October, 2022 and secure second best stall award among the ICAR Institutes.

Others

- Dr N. Ravisankar served during the year, as Member of Institute Management Committee (IMC) for
  - ICAR-NRC on Orchids, Gangtok
  - ICAR-Research Complex for Eastern Region, Patna,
  - ICAR-Central Arid Zone Research Institute, Jodhpur,
  - ICAR-Central Soil Salinity Research Institute, Karnal.
  - ICAR-National Rice Research Institute, Cuttack
- Dr N. Ravisankar served as Member of the Individual Technical Expert Group (ITEG) of the Department of Biotechnology for the thematic area “Scientific research on prime products from indigenous cows for agricultural applications”
- Dr. A.K. Prusty invited as an expert member for UPPSC selection.
- Dr. Raghuveer Singh nominated to Coordinating Frontline Demonstrations (FLDs) in cropping systems involving Oilseeds (2020-21). Total 30 FLDs on oilseeds conducted covering Dausa (Rajasthan), Vizianagaram (AP) OFR centre.

- Dr. Lalit Kumar Acted as Member Secretary of RAC for the year 2020-21 and 2021-2022.
- Dr Peyush Punia served during the year, as Member of Institute Management Committee (IMC) for ICAR-NBFGR, Lucknow.
- Dr Poonam Kashyap evaluated Ph. D. Thesis on Physiological and anatomical alterations in wilting of guava (Psidium guajava) trees and its amelioration using ethylene inhibitor submitted by Dept of Fruit Science PAU Ludhiana No ACAD T-1/AU-2022/Exam II (1)/code No 1550-D/15118 on 10 Nov, 2022.
- Dr. Poonam Kashyap coordinated the visit of Dr S. K. Choudhary, DDG (NRM) along with Deputy Secretary NRM on 30 Nov, 2022 as the chairman Hall Mangement committee.
- Dr Nisha Verma reviewed a research paper entitled "Carbon footprints of rice-wheat cultivation across farm size categories: Evidence from Punjab in India" for Journal of Cereal Research.
- Dr Nisha Verma acted as Member, Global Forum on Food Security and Nutrition, FAO, United Nations.
- Dr Nisha Verma acted as Co-Editor, for the Hindi Magazine Pragatisheel Kheti. ISSN No: 2583-2204.
- Dr Nisha Verma acted as reviewer for the Journal of Cereal Research.

PRESS AND MEDIA

कृषि प्रणाली अनुसंधान में मनाया 33वां स्थापना दिवस

मोदीपुरम: भारतीय कृषि प्रणाली अनुसंधान संस्थान में संस्थान के 33वें स्थापना दिवस का आयोजन किया गया। कार्यक्रम में संस्थानिक खेलकूद प्रतियोगिता के साथ कार्यक्रम शुरू हुआ। स्थापना दिवस के अवसर पर दक्षिणी एशिया में कृषि खाद्य प्रणाली के टिकाऊपन विषय पर मुख्य अतिथि डा. सिंगलिडे निदेशक सस्टेनेबल एग्री फूड सिस्टम अंतर्राष्ट्रीय मक्का एवं गेहूं अनुसंधान संस्थान ने व्याख्यान दिया। कृषि प्रणाली संस्थान के निदेशक डा. आजाद सिंह पंवार ने संस्थान के साधारण से उर्वरक प्रयोगों से प्रारंभ होकर एक प्रतिष्ठित राष्ट्रीय संस्थान के रूप में स्थापित होने की गौरव गाथा पर विस्तृत व्याख्यान दिया। समारोह के मुख्य अतिथि डा. आरके मित्तल कुलपति कृषि विवि रहे। कृषि प्रणाली संस्थान एवं कृषि विवि के मध्य कृषि शिक्षा शोध एवं प्रसार के ऊपर आपसी सहयोग को बढ़ावा देने के लिए समझौता ज्ञापन पर हस्ताक्षर किए गए। इससे दोनों संस्थानों को एक-दूसरे का लाभ मिलेगा। समापन के दौरान विभिन्न खेल एवं सांस्कृतिक कार्यक्रम के विजयी प्रतिभागियों को अध्यक्ष एवं मुख्य अतिथि द्वारा पुरस्कार देकर सम्मानित किया गया। वालीबॉल प्रतियोगिता में केंद्रीय गोपशु अनुसंधान संस्थान की टीम दूसरे स्थान पर रही। रस्साकसी प्रतियोगिता में कृषि प्रणाली संस्थान मेरठ की टीम प्रथम एवं केंद्रीय गोपशु अनुसंधान स्थान मेरठ की टीम दूसरे स्थान पर रही। कार्यक्रम का समन्वयन डा. एन रविशंकर प्रधान वैज्ञानिक ने किया। कार्यक्रम का संचलन डा. पूनम कश्यप ने किया। इस दौरान डा. पीयूष पूनिया, डा. एलआर मीणा, डा. आरपी मिश्रा, डा. सीपी जाट आदि मौजूद रहे।

फसल प्रणाली अनुसंधान में कृषक भागीदारी कार्यक्रम का आयोजन

मोदीपुरम: भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम व इंटरनेशनल नेचुरोपैथी आर्गेनाइजेशन के संयुक्त तत्वावधान में आजादी का अमृत महोत्सव के अंतर्गत अन्नदाता देवो भव: व कृषक भागीदारी कार्यक्रम का आयोजन किया गया। कार्यक्रम का मुख्य विषय प्राकृतिक खेती एवं स्वच्छ पर्यावरण, कृषि प्रणाली के विविधीकरण रहा। कार्यक्रम का शुभारंभ कार्यक्रम अध्यक्ष व संस्थान के निदेशक डा. आजाद सिंह पंवार ने किया। कार्यक्रम में मुख्य अतिथि सरदार वल्लभ भाई पटेल कृषि विवि के अधिष्ठाता छात्र कल्याण डा. अनिल सिरोही रहे। कार्यक्रम में निदेशक डा. आजाद सिंह पंवार ने कहा कि स्वच्छ पर्यावरण के लिए प्राकृतिक एवं जैविक खेती को जरूरी बताया। उन्होंने बताया कि देश में जैविक एवं प्राकृतिक खेती को बढ़ावा देने के लिए कृषि प्रणाली संस्थान देशभर में स्थित अपने 20 केंद्रों के माध्यम से अलग-अलग क्षेत्रों के लिए समेकित जैविक खेती मॉडल विकसित कर रहा है। मुख्य अतिथि डा. अनिल सिरोही ने कहा कि प्राकृतिक खेती एवं स्वच्छ पर्यावरण एक दूसरे के पूरक हैं, स्वच्छ पर्यावरण को बनाए रखने के लिए सभी को जैविक एवं प्राकृतिक खेती की ओर जाना पड़ेगा। जितेंद्र सिंह, सोहनलाल ने खेती में प्राकृतिक नुस्खों व कृषि शोध में किसानों की भागीदारी के ऊपर अपने-अपने विचार रखे। डा. शंभू दत्त धीमान ने स्वच्छ पर्यावरण के लिए इंडोर ऑक्सीजन उत्पादन के ऊपर अपना व्याख्यान दिया। साथ ही साथ उन्होंने प्रकृति एवं मानव पथ विषय पर लिखित एक पुस्तक का विमोचन डा. आजाद सिंह पंवार व डा. अनिल सिरोही के साथ किया। कवि सुरेश यादव हरियाणवी ने अपनी कविताएं प्रस्तुत कीं। कुमारी लावण्या ने बनाई गई वीडियो फिल्म इंपोर्टिंग करना जानेंद्र को कार्यक्रम के दौरान दिखाया। कार्यक्रम का संचालन डा. चंद्रभानु ने किया। इस मौके पर डा. मनोज शर्मा, डा. आरपी मिश्र, प्रीति बंसल, डा. जयराम चौधरी, डा. एन रवि शंकर, डा. प्रकाश चंद घासल, डा. एके पृष्टि, डा. अमित नाथ, रश्मि मिश्र आदि मौजूद रहे।

जंगेठी व बटजेवरा में योग शुरू

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में मंगलवार को जंगेठी और बटजेवरा गांव में योग शिविर सप्ताह का शुभारंभ किया गया। मानवता के लिए योग विषय पर चित्रकला प्रतियोगिता का आयोजन किया गया, कार्यक्रम का शुभारंभ ग्राम प्रधान स्वेता ने किया।

डॉ. जयराम चौधरी, डॉ. निर्मल की देखरेख में आयोजित चित्रकला प्रतियोगिता में विजेताओं को ग्राम प्रधान व वैज्ञानिकों ने पुरस्कार देकर सम्मानित किया। कार्यक्रम में डॉ. ओके तोमर, शिवकुमार आदि का सहयोग रहा। कार्यक्रम अधिकारी एवं प्रधान वैज्ञानिक डॉ. चंद्रभानु ने बताया कि 21 जून को योग दिवस का आयोजन किया जाएगा। संवाद

बीडीएस में योग करते लोग। संवाद

योग को करें दिनचर्या में शामिल

मेरठ। जागृति विहार स्थित बीडीएस गुरुकुल ऑफ एजुकेशन में योग शिविर का शुभारंभ चेयरमैन धर्मेंद्र शर्मा ने किया। शिविर में छात्रों और शिक्षकों ने मर्कटासन, बटरफ्लाई, नौकासन, अनुलोम-विलोम, कपालभाति, प्राणायाम व ध्यान किया। प्रधानाचार्य डॉ. अजय कुमार शर्मा, डॉ. रेखा शर्मा,अन्य ने भाग लिया। संवाद

आजीविका सुरक्षा की धुरी है कृषि प्रणाली

आईएफएसआर में आयोजित बैठक में जानकारी देते अतिथि। संवाद

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में बृहस्पतिवार को दक्षिण एशियाई क्षेत्रीय सहयोग संगठन (सार्क) के कृषि केंद्र की बैठक हुई। बैठक का उद्देश्य सार्क के छह प्रतिनिधि देशों में जलवायु स्मार्ट कृषि को बढ़ावा देने पर केंद्रित रहा। अध्यक्षता संस्थान के निदेशक डॉ. आजाद सिंह पंवार ने की। सार्क प्रतिनिधि किंजेंग गिल्सेन और डॉ. प्रीसन जार्ज विशिष्ट अतिथि रहे। डॉ. आजाद सिंह पंवार ने कहा कि भारत एवं अन्य सार्क देशों समेकित कृषि प्रणाली खाद्य एवं आजीविका सुरक्षा की धुरी है। संचालन डॉ. पुनम कश्यप ने किया। इस दौरान डॉ. एम शमीम, डॉ. एन रविशंकर आदि मौजूद रहे। संवाद

प्राकृतिक एवं जैविक खेती आवश्यक

मोदीपुरम, संवाददाता। आजादी का अमृत महोत्सव के अंतर्गत, अन्नदाता देवो भवः तथा कृषक भागीदारी पर कार्यक्रम आयोजित किया गया। कार्यक्रम भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम और इंटरनेशनल नेचुरोपैथी आर्गेनाइजेशन मेरठ-एनसीआर के तत्वावधान में हुआ। मुख्य विषय प्राकृतिक खेती एवं स्वच्छ पर्यावरण तथा कृषि प्रणाली के विविधीकरण पर केंद्रित रहा।

शुभारंभ कार्यक्रम अध्यक्ष एवं संस्थान के निदेशक डॉ. आजाद सिंह पंवार ने किया। मुख्य अतिथि डॉ. अनिल सिरोही, अधिष्ठाता छात्र कल्याण सरदार पटेल कृषि विश्वविद्यालय रहे। उन्होंने स्वच्छ पर्यावरण, प्राकृतिक एवं जैविक खेती को जरूरी बताया।

देश में जैविक एवं प्राकृतिक खेती को बढ़ावा देने के लिए कृषि प्रणाली संस्थान देशभर में स्थित अपने 20 केंद्रों के माध्यम से समेकित जैविक खेती मॉडल विकसित कर रहा है। स्वच्छ पर्यावरण को बनाए रखने के लिए सभी को जैविक एवं प्राकृतिक खेती की ओर जाना पड़ेगा। जितेंद्र सिंह, सोहनलाल जोहड़ी, डॉ. शंभू दत्त धीमान, डॉ. एन रवि शंकर, डॉ. प्रकाश चंद घासल, डॉ. एके पृष्टि ने विचार रखे। डॉ. अमित नाथ ने एलोवेरा से बने जूस एवं जैविक खेती पर चित्रकारी एवं प्रदर्शनी लगाई।

भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में मंचासीन अतिथि।

जैविक खेती से होगा कृषि दशा में सुधार

भारतीय कृषि प्रणाली अनुसंधान संस्थान में कार्यशाला का आयोजन

संवाद न्यूज एजेंसी

भारतीय कृषि प्रणाली अनुसंधान संस्थान में हुई कार्यशाला में मौजूद वैज्ञानिक और अधिकारी।

64 से अधिक कृषि मॉडल बनाए : पंवार

मोदीपुरम, संवाददाता। भारतीय कृषि प्रणाली अनुसंधान संस्थान में दो दिवसीय नवीं शोध सलाहकार समिति की दूसरी बैठक हुई, जिसकी अध्यक्षता कृषि वैज्ञानिक डॉ. एसएस मायर ने की।

उन्होंने बताया कि किसानों की खाद्य आर्जीविका एवं सुरक्षा मजबूत करने के लिए कृषि प्रणाली संस्थान विकसित कृषि प्रणाली मॉडल बना रहा है। संस्थान निदेशक डॉ.आजाद सिंह पंवार ने बताया कि संस्थान में अब तक 64 से अधिक कृषि प्रणाली मॉडल विकसित किए हैं, जिनकी 26 राज्य व केंद्र शासित प्रदेशों में किसानों के क्षेत्र पर टेस्टिंग की जा चुकी है।

इस मौके पर डॉ. पीयूष पूनिया, डॉ. एलआर मीणा, डॉ.एन रविशंकर, डॉ. आरपी मिश्र, डॉ.पीसी जाट ने रिपोर्ट प्रस्तुत की।

कृषि खाद्य पहल परियोजना पर कार्यशाला आयोजित

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान में मंगलवार को पारिस्थितिकी तंत्र एवं जैव विविधता को लेकर अंतरराष्ट्रीय कार्यशाला का आयोजन हुआ। अध्यक्षता भारतीय कृषि अनुसंधान परिषद के सहायक महानिदेशक डॉ यश भास्कर ने की। संस्थान निदेशक डॉ आजाद सिंह पंवार ने बताया कि कृषि एवं अन्य संबंधित व्यवसाय जैसे समेकित कृषि प्रणाली, जैविक कृषि प्रणाली व कृषि वानिकी आम जनमानस को सीधे आर्थिक लाभ पहुंचाने के साथ कई सारी पारिस्थितिकी सेवाएं भी देते हैं। इन्हीं पारिस्थितिकी सेवाओं के ऊपर संस्थान के वैज्ञानिकों एवं संयुक्त

किसान वैज्ञानिक आधार पर करें खेती : पंवार

संवाद न्यूज एजेंसी

मुजफ्फरनगर। अन्नदाता देवो भवः कार्यक्रम में किसानों से खेती की नई तकनीक अपनाने पर बल दिया गया। मुख्य अतिथि एवं कृषि प्रणाली संस्थान मोदीपुरम के निदेशक डा. आजाद सिंह पंवार ने कहा कि कहा कि खानपान में आज हम दुनिया में अपनी अलग पहचान बनाने में सफल रहे हैं। किसानों के अथक प्रयासों और कृषि में हुए अनुसंधानों का ही परिणाम है कि किसान आर्थिक प्रगति की ओर बढ़ रहा है। नंगला मंदौड़ स्थित भारतीय इंटर कॉलेज के प्रांगण में प्राकृतिक खेती पर किसान गोष्ठी का आयोजन किया। 10 गांवों के 450 किसानों ने भाग लिया।

डा. आजाद सिंह पंवार ने कहा कि हमारा देश कृषि के क्षेत्र में आत्मनिर्भर बन गया है। तकनीकी सत्र के दौरान जिले के उपनिदेशक कृषि डॉ राजेंद्र कुमार, गन्ना शोध संस्थान के संयुक्त निदेशक डॉ वीरेंद्र सिंह, जिला गन्ना अधिकारी डॉ आरडी द्विवेदी, मंसूरपुर चीनी मिल के जनरल मैनेजर केन बलधारी सिंह ने गन्ने की प्रजातियों व उत्पादन तकनीकों के बारे में बताया।

मेरठ | रविवार, 29 मई 2022 5

जैविक खेती पर छह दिवसीय प्रशिक्षण का समापन

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में राष्ट्रीय कृषि विस्तार प्रबंध अकादमी (मैनेज) हैदराबाद के सहयोग से जैविक खेती में प्रमाणिक प्रबंध सलाहकार विषय पर छह दिवसीय प्रशिक्षण का शनिवार को समापन हुआ। कार्यक्रम में 11 राज्यों के 19 प्रतिभागी शामिल हुए। इफको से एरिया मैनेजर विजय पाल जैविक खेती की मौजूदा समय की बड़ी जरूरत बताया। संस्थान के निदेशक एवं कार्यक्रम अध्यक्ष डॉ. आजाद सिंह पंवार ने कहा कि खेती की लागत घटाने के लिए जैविक एवं प्राकृतिक कृषि आवश्यक है। डॉ. एन रविशंकर, निदेशक डॉ. चंद्रभानु ने जैविक खेती से जुड़ी तकनीकों की जानकारी दी। प्रतिभागियों को नई दिल्ली में आयोजित तीसरी ग्लोबल आर्गेनिक एक्सपो का भ्रमण कराया गया। संवाद

कृषि प्रणाली संस्थान द्वारा अन्नदाता देवो भवः कार्यक्रम का आयोजन

DISTINGUISHED VISITORS

Visit of Hon. Secretary DARE and DG-ICAR, Dr. Himanshu Pathak

Hon. Secretary, DARE and DG, ICAR Dr. Himanshu Pathak visited ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut on 09-10 September, 2022. He interacted with Scientists and other staff of ICAR-IIFSR and discussed on key researchable issues in the area of integrated farming systems and organic/ natural farming. He stressed upon in-depth research on role of various microbial communities in regulating nutrient availability/mineralization of crops. He has also suggested the scientist to be more focused on taking maximum scientific observations from the existing experiments. He also stressed his concern on developing higher level of knowledge and understanding for in-depth research to solve the problems. Traditional knowledge should also be focused along with new research initiatives. Increasing the resource use efficiency; new ideas of research; searching for new outputs and products to solve the problems, Inter-institutional collaborative research, one-scientist-one product etc. were some of the main talking points during the interaction meeting.

Visit of Hon. Secretary DARE and DG-ICAR, Dr. Himanshu Pathak at ICAR-IIFSR, Modipuram, Meerut during 09-10 September, 2022

Hon. Secretary DARE and DG-ICAR, Dr. Himanshu Pathak field visit at ICAR-IIFSR, Modipuram

Visit of Hon. Secretary DARE and DG-ICAR, Dr. Himanshu Pathak visiting stall of FPO developed products at ICAR-IIFSR, Modipuram

Deputy Director General (NRM), Dr. S.K. Chaudhari visited institute

On November 30, 2022, Dr. S.K. Choudhary, (DDG-NRM), visited the institute. During his visit, he took part in the foundation stone-laying ceremony and Bhoomi Pujan for a new storehouse and barn at the institute. In his address, he expressed appreciation for the research work conducted by the institute's scientists and emphasized on the new research challenges presented by the evolving national and international scenarios. The DDG also stressed on the importance of diversification in integrated farming systems and the need for district-specific crop and farming systems that useful to rainfed agricultural areas. He advised the researchers to focus their efforts on finding nature-friendly solutions and encouraged them to get additional funds through national and international research projects. Dr. A. Velmurugan, the ADG of the Indian Council of Agricultural Research in New Delhi, was a special guest at the program and gave valuable guidance to the scientists.

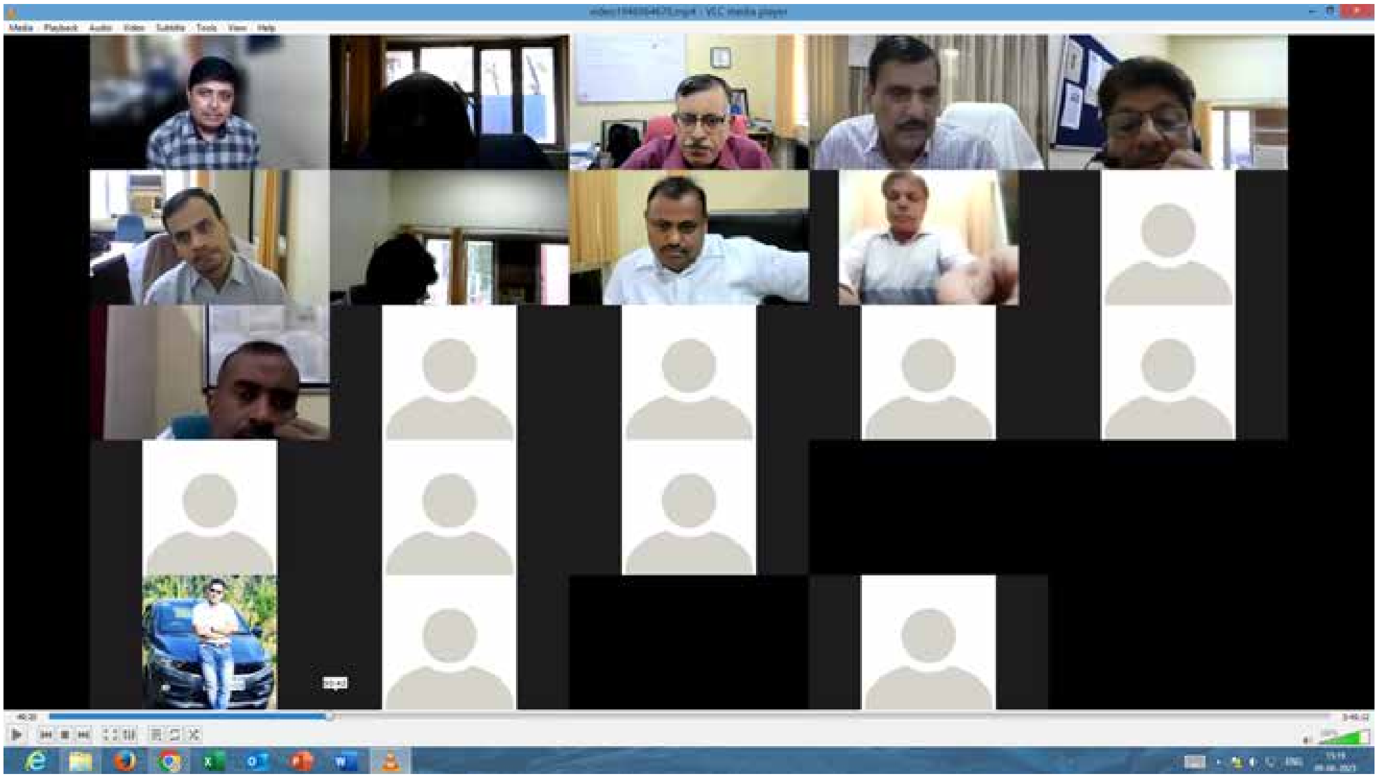
Interaction of Dr. S.K. Choudhary, (DDG-NRM) with staff of at ICAR-IIFSR, Modipuram

Dr. S.K. Choudhari, (DDG-NRM) laying the foundation stone of Farm Godown at ICAR-IIFSR, Modipuram

RESEARCH COORDINATION AND MANAGEMENT

34th Institute Research Committee Meeting

The 34th meeting of Institute Research Committee (IRC) meeting of ICAR-IIFSR, Modipuram, Meerut was held on 19,21,26,28 and 30th March 2022 to review the progress of on-going research projects, the follow up of action of 33nd IRC meeting and technical programmes of new research proposals through video conferencing. The meeting was chaired by Dr A. S. Panwar, Director, ICAR-IIFSR. All the scientist attended and participated in the meeting. Dr A. S. Panwar, Director and Chairman, 34th IRC welcomed all the member scientists and suggested that the current projects should aim towards achieving better results keeping of the constraints faced by farmers and find solutions under the prevailing conditions under COVID 19 for the benefit of farmers. All the Division Heads made the presentation of the achievements of their projects being undertaken in the division followed by the PIs of the respective projects division wise and presented the progress of on-going research projects with the technical programme and achievements for the work undertaken under different institutional projects. The major action points/ recommendations of house were discussed and incorporated in the ongoing projects.



Research Advisory committee meeting

The second meeting of the 9th Research Advisory Committee of ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, was held during 6th&7th June, 2022 at ICAR-IIFSR Modipuram, Meerut. In the meeting Hon'ble RAC members, Head of Divisions & all scientist of the institute were present. Dr. A.S. Panwar, Director ICAR-IIFSR delivered the welcome address and briefed the Committee about the research programmes, achievements and activities undertaken at the institute during the year 2021-2022. Hon`ble Chairman RAC, Dr. S.S. Magar in his opening remarks applauded the efforts of scientists and highlighted the significance of ICAR-IIFSR for its unique role in achieving food and nutritional security, livelihood improvement as well as the income security of the farming community of the country. Other Hon`ble RAC members Dr. P.K. Mahapatra, Dr. A.K. Yadav, Dr. S.K. Dhyani and Dr. K.K. Vas also appreciated the achievements of the institute during last one year for developing several IFS models especially for small and marginal farming community of the country. They gave their valuable suggestions for further improvement in Institute research. Two ex-officio members Shri Heera Singh and Dr. Momraj Gujar also attended the meeting. Hon`ble chairman and the RAC members critically reviewed the experiments at Main Farm and the Siwaya Farm and gave their valuable suggestions for further improvement of the experiments and overall visibility of the farm area.

Chairman and members during deliberations with scientist and during field visit at ICAR-IIFSR, Modipuram

RESEARCH PROJECTS

S.No.	Project Title Name	Project Code	PI & CO-PI‘s
1	Development of protocol for value added Products from organic sugarcane	IXX14928	**Dr. Amit Nath** Dr. D. Kumar, Dr.R.P. Mishra
2	Evaluation and identification of farm implements under different farming systems	IXX14951	**Dr. V.P. Chaudhary** Dr.NishaVerma, Dr.Dushyant Mishra, Dr. L.R. Meena

3	Exploratory study on establishment of ornamental and biofloc fisheries modules for farm livelihood and improvement	IXX17339	**Dr. Peyush Punia** Dr. A.K. Pursty Dr Sunil kumar Dr Jairam Chaudhary
4	Sustainable livelihood generation through IFS involving uneconomic cattle	IXX18655	**Dr. S Malik** Dr Raghuveer Singh Dr L. K. Meena Dr Lalit Kumar Dr S.K. Dhoop Singh Dr A.S. Sirohi Dr H.L. Singh (External members)
5	Development of fruit crop based integrated farming system for western plain zone of U.P.	IXX19733	**Dr. P. P. Singh** Dr. L. R. Meena Dr. S. Malik Dr. Amit Nath Mr. Raghavendra K J
6	Development of a regenerative Agro forestry based IFS Model for Sustainable production and livelihood.	IXX16524	**Dr.Nirmal** Dr. Sunil Kumar Dr. D. Dutta Dr. Raghvendra KJ Dr. Kamlesh Soni
7	Study on energy dynamic pattern and environmental impact of solar operated deep borewell pump irrigation under PMKSY-HKKP-GW projects and resulting socio-economic upliftment of small and marginal farmers in Uttarakhand"	OXX6260	**Dr. V.P. Chaudhary** Dr. D. K. Singh
8	Status of organic agriculture in Jammu division of Western Himalayan regions	IXX19584	**Dr. Sunil kumar** Dr. A.L. Meena, Dr. L.R. Meena, Dr Nirmal
9	Development of sustainable IFS Model for Western Plain Zone of Uttar Pradesh.	IXX18250	**Dr. L.R. meena** Dr. S. Malik, Dr. Amit Nath, Dr. D. Kumar, Dr. C. Bhanu, Dr. Peyush Punia Dr. A.L. Meena

10	Sustainable livelihood improvement of SC farmers through integrated farming system approach	OXX6006	**Dr. Lalit Kumar** Dr. Peyush Punia Dr. Suresh Malik Dr. Nisha Verma Dr. Poonam Kashyap Dr. P. C. Jat Dr. Sunil Kumar
11	On farm participatory Research in farming systems perspective under schedule caste sub_plan (SCSP) in laldhang ciuster under bahadrabad block district haridwar (Uttarakhand)	IXX18177	**Dr. A. L. Meena** Dr. R.P Mishra Dr. D. dutta Dr. C Bhanu Dr. P.C. Ghasal Dr. Jairam Chaudhary
12	Effect of rice straw retention, incorporation and residue decomposition on productivity, profifitability, soil health and environment under RW System	IXX18176	**Dr. A.L. Meena** Dr. L.R. Meena Dr. N. Subhash Dr. Lalit Kumar Dr. P. C. Jat Dr. Jairam Choudhary
13	Development of an intelligent model for predicting mango yields using Artificial neural networks	IXX17340	**Dr. V. K. Chaudhary** Dr. P. P. Singh
14	Adaption and mitigation potential through cropping systems/IFS Model (NICRA)	IXX18168	**Dr. N. Subash** Dr. D. Dutta Dr. P. C. Ghasal
15	Evaluation of different cropping sequences for crop intensification Under CA practices (Consortium Research platform on conservation Agriculture) CRP On CA	IXX18251	**Dr. A. L. Meena** Dr. L.R. Meena Dr. P.C. Jat Dr. Sunil Kumar Dr. Jairam Chaudhary
16	Crop improvement for organic production system	IXX18385	**Dr. Devendra Kumar** Dr. L.R. Meena, Dr. Raghvendra KJ Dr. K.H. Singh (DRMR Bharatpur)

17	Nutrient Management in different cropping systems under organic production systems	IXX14937	**Dr. P.C. Ghasal** Dr. D. Dutta, Dr.C. bhanu Dr. Amit Kumar Dr. Jairam Chaudhary
18	Development of pest and disease management package for organic farming system	IXX14913	**Dr. Chandra Bhanu** Dr.Jairam Chaudhary, Dr. A.L. Meena
19	Development and validation of microbial consortia for crop residue recycling under organic farming system	IXX18175	**Dr. Jairam Chaudhary**, Dr. D. Dutta
20	Testing of different products of BTN in cabbage at ICAR-IIFSR Modipuram		**Dr. P.C. Ghasal** Dr. Chandra Bhanu Dr. Raghuveer singh Dr. R.P. Mishra Dr. A.S. Panwar
21	Evaluation of Poly 4 application on productivity, quality and soil sustainability of basmati rice-potato under organic farming system	OXX6806	**Dr. R. P. Mishra** Dr. D. Dutta Dr. P.C. Ghasal Dr. N. Navisankar
22	All India- Network Programme on Organic Farming, Modipuram Centre	OXX02390	**Dr. R. P. Mishra** Dr. D. Dutta Dr. PC Ghasal Dr. Jairam Chaudhary
23	Developing Precision nutrient management protocols for rice-wheat and rice-maize systems in Indo-Gangetic plains (NASF)	OXX6807	**Dr. R. P. Mishra**
24	Impact assessmenat of certified Farm Advisors (CFA) Interventions on Organic and Natural Farming		**Dr. Chandra Bhanu** Dr. P.C. Ghasal Dr. N. Navisankar Dr. Raghvendra KJ
25	Refinement of vegetable Based Farming System Models for Food and Nutritional Security	IXX14065	**Dr. Poonam kashyap** Dr. A.K. Prusty, Dr. Sunil Kumar, Dr.Jairam Chaudhary, Dr. D. Dutta Dr. Lalit Kumar

26	Characterization of existing farming systems in Uttarakhand.	IXX14203	**Dr. Nisha Verma** Dr. V.P. Chaudhary, Dr.Vipin Kumar Chaudhary, Dr. Amit Nath.
27	On- farm evaluation of farming system modules for profitability and livelihood improvement of different farmers categories of western plain zone of Uttar Pradesh and Uttrakhand.	IXX14064	**Dr. P.C. Jat** Dr. P. Kashyap, Dr.Peyush Punia, Dr. Sunil Kumar
29	Cluster based on farm participatory research in farming systems perspective under tribal sub plan in Uttrakhand (TSP)	OXX04208	**Dr. Nisha Verma** Dr. V.P. Chaudhary Dr. S. Malik Dr. Amit Nath Dr Chandra Bhanu Dr Alka Verma (Pant Nagar) Dr Dinesh Kumar (Pant Nagar)
30	Ensuring food and Nutritional Security through Untegrated Farming System in western Plain Zone of Uttar Pradesh (Farmer First) (Phase-I) upto March 2022	IXX19734	**Dr. A. S. Panwar** Dr. P. C. Jat Dr. D. Kumar Dr. A K Prusty Dr. Poonam Kashayp Dr. M. Shamim Dr. Nisha Verma Dr. Sunil Kumar **Phase- II (Since April 2023)** **Dr. P. C. Jat** Dr. Poonam Kashayp Dr. A K Prusty Dr. M. Shamim Dr. Nisha Verma Dr Sunil Kumar Dr. Raghuveer Singh Dr. Raghevndra KJ
31	Dispatch of seed for conducting Faba been Advance varietal trials –II	IXX18678	**Dr. P. C. Jat** Dr. Raghuveer singh Dr. A. L. Meena
32	All India Coordinated Research Project-IFS On Farm Research, OFR Modipuram Centre	IXX18677	**Dr. P. C. Jat** Dr. M. A. Ansari

33	Development of IOFS model for different regions of India	IXX13033	**Dr N. Ravisankar** Dr. M.A. Ansari, Dr. P.C. Jat, Dr. Suresh Malik, Dr. Poonam Kashyap, Dr. Lalit kumar, Dr. Chandra Bhanu CCPI from AINP-OF centres
34	Identification of climate resilient production system for different ecology	IXX13036	**Dr. M. Shamim** CC-PI from AINP-OF centres
35	Influence of pesticide application in IFS model on fisheries modules and measurement of GHG emission from aquaculture ponds	OXX5170	**Dr. A. K. Prusty** Dr. Peyush Punia, Dr. Debashis Dutta CC-PIs from AICRP-IFS-on-station centres
36	Updating of cropping system atlas of India and preparation of futuristic crop plan for 2030,2040 and 2050	IXX16181	**Dr. Raghuveer Singh** Dr. N. Subash, Dr. N. Ravisankar, Dr V. Ramamurthy (NBSSLUP), Dr. C.A. Rama Rao Dr. B.M.K. Raju (CRIDA)
37	Improvement of Existing Farming Systems of Under-Privileged Households through SCSP component	IXX16182	**Dr. Raghuveer Singh** Dr. M. Shamim, Dr.. A.K. Prusty, Dr. N. Ravisankar, Dr M. A. Ansari Dr. Raghavendra KJ
38	Assessing the role and contribution of integrated farming system for addressing one health at household and landscape level	IXX15140	**Dr. M. Shamim** Dr. N. Ravisankar Dr. M. A. Ansari Dr. A. K. Prusty Dr PeyushPunia
39	Estimation and valuation of ecosystem services from organic and natural farming systems in different Agro-ecology (Institute-AICRP -IFS linked)	IXX17318	**Dr. M. A. Ansari** Dr. N. Ravisankar, Dr. M. Shamim Dr. Jairam Chaudhury, Dr. Raghavendra KJ CC-PI from AINP-OF centres

40	Scaling and impact assessment of integrated farming system for livelihood of farmers	IXX18170	**Dr. Raghavendra KJ** Dr. A.K. Prusty, Dr. M. A. Ansari, Dr. Nirmal Dr. Peyush Punia CC-PI: Dr. Rajendran, Dr Jacob John Dr Alibaba (AICRP-IFS)
41	All India Network Programme on Organic Farming	IXX06458	**Dr. N. Ravisankar** Dr. M. Shamim, Dr. Raghuveer Singh, Dr. M. A. Ansari Dr. Raghavendra, KJ
42	AICRP on Integrated Farming Systems a. On-Station	IXX18172	**Dr. A.K. Prusty** Dr. M. Shamim, Dr. Debashis Dutta, Dr. N. Ravisankar Dr. Raghuveer Singh
43	b. On-Farm	IXX19503	**Dr. Raghuveer Singh** Dr. N. Ravisankar, Dr. M. A. Ansari, Dr Raghavendra KJ Dr Sunil Kumar
44	Sustainable Resource Management for Climate Smart Integrated Farming Systems (AICRP-IFS, On-station, Modipuramcentre)	OXX04146	**Dr. N. Ravisankar** Dr. P.C. Ghasal, Dr. Debashis Dutta, Dr. Suresh Malik, Dr. Amit Nath, Dr. A.K. Prusty, Dr. Poonam Kashyap Dr M. Shamim
45	The Economics of Ecosystems and biodiversity (TEEB) for agriculture and food initiative in Uttar Pradesh, India	OXX5580	**Dr. M.A. Ansari** Dr. N. Ravisankar Dr. M. Shamim, Dr. A.K. Prusty, Dr. Raghuveer Singh, Dr. Raghavndra, KJ

46	Co-Creating Sustainable Agri-Water Use in the Hindon sub-basin-A Multi Scale Participatory approach	OXX6003	**Dr. A.K. Prusty** Dr N. Ravisankar Dr. M. Shamim, Dr. Raghavendra, KJ Dr. M.A. Ansari, Dr. Raghuveer Singh, Dr. Poonam Kashyap
47	Preparation of Detailed Project Report (DPR) for 4Nos of Model Agro-Tourism Farm(Consultancy)	OXX6004	**Dr. A.K. Prusty** Dr. N. Ravisankar, Dr. Raghavendra, KJ, Dr. M. A. Ansari, Dr. Raghuveer Singh, Dr. M. Shamim, Dr. A.S. Panwar
48	Agridrone demonstration	OXX6005	**Dr A.K. Prusty** Dr. N. Ravisankar Dr. M. Shamim, Dr. Raghuveer Singh, Dr. Poonam Kashyap, Dr. Raghavendra, KJ
49	Pilot Project on Crop diversification	OXX5582	**Dr N. Ravisankar** Dr. M. A. Ansari, Dr. Raghuveer Singh, Dr. Raghavendra, KJ, Dr. M. Shamim, Dr. A. K. Prusty Dr. Poonam Kashyap, Dr. Nisha Verma
50	Consortium for Scaling up Climate Smart Agriculture in South Asia (C-SUCSeS)	OXX6002	**Dr. M. A. Ansari** Dr M. Shamim CC-PI from GBPUAT, Pantnagar
51	Agri Business Incubation Centre (ICAR-NAIF funded) at ICAR-IIFSR, Modipuram	OXX18169	**Dr. Amit Nath** Dr. R.P. Mishra Dr. D. Dutta Dr. Sunil Kumar
52	Weather based on-farm technological interventions in farming systems perspective for improving livelihood of farm households	IXX13035	Dr. M Shamim Dr. Poonam Kashyap Dr. Sunil Kumar

PERSONNEL

Scientific Staff

S.No.	Name of the employees	Designation
1	Dr. Sunil Kumar	Director (wef. 01.02.2023)
2	Dr. A.S. Panwar	Director (upto 31.01.2023)
3	Dr. Peyush Punia	Principal Scientist
4	Dr. Laxman Ram Meena	Principal Scientist
5	Dr. N. Ravisankar	Principal Scientist
6	Dr. Rajendra Prasad Mishra	Principal Scientist
7	Dr. Amit Nath	Principal Scientist
8	Dr. Chandra Bhunu	Principal Scientist
9	Dr. Debashis Dutta	Principal Scientist
10	Dr. Devendra Kumar	Principal Scientist
11	Dr. Lalit Kumar	Principal Scientist
12	Dr. N. Subash	Principal Scientist
13	Dr. Phool Chand Jat	Principal Scientist
14	Dr. Pushpendra Pratap Singh	Principal Scientist
15	Dr. Suresh Malik	Principal Scientist
16	Dr. V. P. Chaudhary	Principal Scientist
17	Dr. Poonam Kashyap	Sr. Scientist
18	Dr. Ashisa Kumar Prusty	Sr. Scientist
19	Dr. Mohammad Shamim	Sr. Scientist
20	Dr. Meraj Alam Ansari	Sr. Scientist
21	Dr. Sunil Kumar	Sr. Scientist
22	Dr. Prakash Chand Ghasal	Scientist
23	Mr. Raghavendra KJ	Scientist
24	Dr. Raghuveer Singh	Scientist

25	Dr. Vipin Kumar Choudhary	Scientist
26	Dr. Amrit Lal Meena	Scientist
27	Dr. Jairam Choudhary	Scientist
28	Dr. Kamlesh Kumar	Scientist
29	Dr. Nisha Verma	Scientist
30	Dr. Nirmal	Scientist

Technical Staff

S.No.	Name of the employees	Designation
31	Sh. Rash Behari Tewari	Chief Technical Officer
32	Sh. Dhanjay Tripathi	Chief Technical Officer
33	Dr. Om Kumar Tomar	Chief Technical Officer
34	Dr. Yogendra Singh	Chief Technical Officer
35	Dr. Vipin Kumar	Chief Technical Officer
36	Dr. S.P. Singh	Chief Technical Officer
37	Sh. Krishan Kumar	ACTO
38	Sh. Satish Kumar Duhoon,	STO
39	Smt. Deepsikhha	STO
40	Sh. Uma Shankar	Driver(T-5)
41	Sh. Ashok Kumar	Driver (T-5)
42	Smt. Anju Verma	STA
43	Sh. Raj Kumar Meena,	Driver (T 2-3)

Administrative Staff

S. No	Name of the employees	Designation
44	Sh. Ashok Kumar Sharma	SAO
45	Sh. D.S. Verma	F&AO
46	Sh. Surya Kant	PS

47	Sh. Rai Bahadur	PS
48	Smt. JaiLata Sharma	PA
49	Smt. Alka Jain	AAO
50	Sh. S.K. Gupta	AAO
51	Smt. Sheela Devi	Assistant
52	Sh. S.K. Bansal	P.A.
53	Sh. Rajesh Kumar	Stenographer
54	Sh. Ravi Kant Sharma	Assistant
55	Sh. Prem Singh	Assistant
56	Sh. Rajendra Kumar	UDC
57	Sh. Parmandand	UDC
58	Sh. Prasant Panwar	UDC
59	Sh. Prem Kumar	LDC
60	Sh. Rakesh Kumar	LDC

Skilled Supporting Staff

S. No	Name of the employees	Designation
61	Sh. Ashok Kumar	SSS
62	Sh. Vijay Shankar Pandey	SSS
63	Sh. Kamal Singh	SSS
64	Sh. Naresh Kumar Chauhan	SSS
65	Sh. Narender Pal Singh	SSS
66	Sh. Ram Gopal	SSS
67	Sh. Rakesh Kumar	SSS
68	Sh. Yogendra Kumar Tyagi	SSS
69	Sh. Sunil Kumar Sharma,	SSS
70	Sh. Devendra Kumar	SSS

71	Sh. Subodh Kumar Tyagi	SSS
72	Sh. Subhash Chand Sharma	SSS
73	Sh. Brijash Sharma	SSS
74	Sh. Kripa Shankar Tewari	SSS
75	Sh. Anand Singh	SSS
76	Sh. Harsh Nath Singh	SSS
77	Sh. Prem Shankar	SSS
78	Sh. Mahaveer Singh	SSS
79	Sh. Ayodhya Prasad Dubey	SSS
80	Sh. Kirpa Shankar Pandey	SSS
81	Sh. Siddh Kumar Yadav	SSS
82	Sh. Sada Ram	SSS
83	Sh. Gagendra Singh	SSS

INSTITUE MANAGEMENT AND RESEARCH ADVISORY COMMITTEES

New Joining

S. No	Name	Designation	Date of Joining	From	Transfer/Joining
1.	Sh. Ashok Kumar Sharma	SAO	25.04.2022	IISR, Lucknow	Transfer
2.	Smt. Deepshika	CTO	25.09.2022	--	New Joining

Promotions

S. No	Name	Designation	Date of promotion	Pay band Level
1.	Dr. Ashish Kumar Prusty	Sr. Scientist	07.01.2020	PB-4 (Revised Pay level-13A)
2.	Dr. Poonam Kashyap	Sr. Scientist	07.01.2020	PB-4 (Revised Pay level-13A)
3.	Dr. M Shamim	Sr. Scientist	23.06.2021	PB-4 (Revised Pay level-13A)
4.	Dr. Sunil Kumar	Scientist	06.11.2020	PB-3 (Revised Pay level-12) and re- designated as Senior Scientist.
5.	Dr. P C Ghasal	Scientist	01.07.2019	PB-3 (Revised Pay level-11)
6.	Dr. Jairam Choudhary	Scientist	05.01.2021	PB-3 (Revised Pay level-11)
7.	Dr. A L Meena	Scientist	19.01.2019	PB-3 (Revised Pay level-11)
8.	Dr. Amit Kumar	Scientist	01.01.2020	PB-3 (Revised Pay level-11)

Retirement

1	Dr. D K Singh	Principal Scientist	18.11.2022	VRS
2	Sh. D K Panday	Chief technical Officer	31.01.2022	Retirement

INSTITUE MANAGEMENT COMMITTEE (2022)

1	Dr. A. S.Panwar	Director, ICAR-IIFSR, Modipuram	Chairman
2	Director (Agriculture)	Government of Uttar Pradesh, Lucknow	Member
3	Director (Agriculture)	Government of Uttarakhand, Dehradun	Member
4	Director (Research)	SVPUAT, Modipuram, Meerut	Member

5	Shri Heera Singh	4-Deep Nagar, Manas Nagar, Mohali Road, Mathura	Member
6	Dr. Momraj Gurjar	Brilliant Scholar Public School in front of Katai Mill, Bijnor Road, Amroha	Member
7	Dr. N Ravisankar	Principal Scientist, ICAR-IIFSR, Modipuram	Member
8	Dr. A.K. Handa	Principal Scientist, ICAR-CAFRI, Jhansi	Member
9	Dr. Ramesh Kumar Kaul	Principal Scientist, ICAR-CAZRI, Jodhpur	Member
10	Dr. Rajendra Hegde	Head, ICAR-NBSSLUP, Regional Center, Bengaluru	Member
11	Dr. S. Bhaskar	ADG (AAFCC), ICAR-New Delhi	Member
12	Finance and Accounts Officer	ICAR-Central Soil Salanity Research Institute, Karnal	Member
13	Shri Ashok Kumar	Senior Adminstrative Officer, ICAR-IIFSR, Modipuram	Member Secretary

RESEARCH ADVISORY COMMITTEE (2022)

1	Dr. S. S. Magar	Former Vice Chancellor, BSKKV, Dhapoli, Maharastra	Chairman
2	Dr. P. K. Mahapatra	Ex-Dean, PUA&T, Bhubneshwar	Member
3	Dr. A. K. Yadav	Ex-Director, Nation Center on Organic Farming, CGO Complex-II, Kamla Nehru Nagar, Ghaziabad	Member
4	Dr. S.P.S. Alhawat	Ex-Director, ICAR-CIARI, Port Blair and ICAR-IVRI, Bareilly	Member
5	Dr. S. K. Dhyani	Ex-Director, ICAR-CAFRI, Jhansi	Member
6	Dr. S. Bhaskar	ADG (AAFCC), ICAR, Krishi Anusandhan Bahawan-II, New Delhi	Member
7	Dr. A. S. Panwar	Diretcor, ICAR-IIFSR, Modipuram	Member
8	Shri. Heera Singh	4-Deep Nagar, Manas Nagar, Mohali Road, Mathura	Member
9	Dr. Momrak Gurjar	Brilliant Scholar Public School in front of Katai Mill, Bijnor Road, Amroha	Member
	Dr. Lalit Kumar	Principal Scientist, ICAR-IIFSR, Modipuram	Member ?? Sec

2022

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