



ICAR-INDIAN INSTITUTE OF FARMING SYSTEMS RESEARCH ANNUAL REPORT 2023



वार्षिक प्रतिवेदन ANNUAL REPORT 2023



भा.कृ.अनु.प. भारतीय कृषि प्रणाली अनुसंधान संस्थान
मोदीपुरम, मेरठ-250 110, (उ०प्र०) भारत
ICAR-INDIAN INSTITUTE OF FARMING SYSTEMS RESEARCH
Modipuram, Meerut-250 110, (U.P.) India



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Note: This compilation is a joint contribution of all the scientists and other staff of the institute, and their role is duly acknowledged.

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PREFACE

It is with great pleasure and pride that I present the Annual Report of ICAR - Indian Institute of Farming Systems Research (IIFSR), Modipuram, for the year 2023 which has been providing continuously 72 years of the services to progress in fostering sustainable and resilient farming systems in India. At ICAR-IIFSR, our mission is to address the multifaceted challenges faced by the agricultural sector by developing newer technologies to enhance productivity, profitability, and sustainability through three research divisions namely Integrated Farming Systems, Cropping Systems and Resource Management, Organic Agricultural Systems and one section Technology Transfer and Assessment. Apart from this, two National Schemes *i.e.*, All India Co-ordinated 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.



This year, the institute operated 25 institute funded project, 19 externally funded projects, 01 contract research project through the dedicated team of scientists, researchers, and support staff to work diligently towards this goal, achieving significant milestones that align with our vision of a sustainable agricultural future. We have also placed a strong emphasis on capacity building and knowledge dissemination through the 'Schedule Caste Sub Plan' (SCSP) by covering about 2003 households in 21 villages in 4 districts of Uttar Pradesh and Uttarakhand. Other important ICAR operated programmes like 'Farm, Innovations, Resources, Science and Technology' (Farmers FIRST) was implemented in 3 villages of Muzaffarnagar district in Uttar Pradesh. Information Technology and social media-based extension services through WhatsApp, telephone, Facebook, YouTube, Twitter was strengthened which helped to reach stakeholders across India. Our collaborations with national and international organizations have further strengthened our research and extension activities, bringing global best practices to our local context.

One of the key highlights of the year has been our innovative research in integrated farming systems (IFS). We have focused on optimizing resource use efficiency, improving soil health, and enhancing the resilience of farming systems to climate change. The AICRP on IFS research team partnering with SAUs and ICAR Institutes has developed 74 prototype IFS models that have been well-received by the farming community and stakeholders. Emphasis was also given for scaling of these models. Selected states like Kerala, Odisha and Tamil Nadu are implementing the IFS models in large scale covering about 79 districts. Under AINP-OF scheme, organic farming packages for 76 cropping systems suitable to 16 states have been developed besides identifying 104 varieties of 21 major crops and 8 integrated organic farming models. During the financial year 2022-23, institute utilized 100% of allocated grant. Revenue of Rs. 82.65 lakhs was also generated. The institute is intensively involved in research on natural farming at its 20 AINP-OF locations in generation of science led innovations, biochemical characterization of inputs, evaluation of natural farming practices in 8 major cropping systems, capacity building and technical backstopping to various stakeholders.

The institute has taken new initiatives in collaboration with the Department of Agriculture and Farmers Welfare, Government of India, as technology partner for enabling convergence of government schemes with different stakeholders. This collaboration aims to bring scientific advancements and innovations directly involving farmers for enhancing agricultural productivity and sustainability at the grassroots level. Additionally, the institute is collaborating with international organizations such as CIMMYT, IWMI, ACIAR and ICRISAT to organize new cutting-edge research programs. Through these efforts, the institute seeks to foster a holistic approach for agricultural development, leveraging both national and international expertise. As we look forward to the coming year, we remain committed to our mission of advancing sustainable farming systems through innovative research and development.



I express my heartfelt gratitude to Dr. Himanshu Pathak, 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. My appreciation is also due to Dr. Rajbir Singh, ADG (AGAF&CC), ICAR, New Delhi, Dr. A. Velmurugan, ADG (Soils & WM), ICAR, New Delhi and to other staff members of NRM division, ICAR HQ for cooperation and support. The support of the entire ICAR-IIFSR team including scientific, technical, administrative, supporting, and contractual for their unwavering dedication and hard work is duly acknowledged for taking up Institute's programme activity. I also thank our partners, stakeholders, and the farming community for their continuous support and collaboration. Lastly, I appreciate the efforts of the Editorial Committee, PME Cell, Heads of the Divisions/units/sections in compiling and timely publication of the Annual Report, 2023.

A handwritten signature in black ink, appearing to read 'Sunil Kumar', is written over a horizontal line.

(Sunil Kumar)

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कार्यकारी सारांश

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

2. बजट: 2023-24

क. संस्थागत (रु. लाख में): 2023-24

					बजट	व्यय		
	प्रावधान	व्यय	सरकारी अनुदान	परिषद के शेयर से मुख्यालय द्वारा प्रदान की गई अतिरिक्त राशि	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
संस्थान	2201.80	2201.80	2201.80	0.00	2201.80	2201.80	0.00	2201.80
संस्थान योजनाएं	4323.60	4323.02	4323.60	117.64	4441.24	4440.66	0.00	4440.66
कुल योग	6525.40	6524.82	6525.40	117.64	6643.04	6642.46	0.00	6642.46

ख. बाह्य स्रोत (रु० लाख में): 2023-24

स्रोत	बजट	व्यय
बाह्य वित्त पोषित परियोजनाएं	472.90	291.87
कुल	472.90	291.87

ग. राजस्व प्राप्ति (रु. लाख में): 2023-24

स्रोत	धनराशि
प्रक्षेत्र उत्पाद – अन्न, फल, सब्जी, मत्स्य, दूध एवं पशु विक्रय	54.99
लाइसेन्स शुल्क/जल शुल्क	6.18
ऋण एवं अग्रिम राशि पर ब्याज	1.01
टी.डी.आर. पर ब्याज	3.34
अन्य (रॉयल्टी और संस्थान शुल्क)	6.45
विविध	10.68
कुल	82.65



3. कर्मचारियों की स्थिति (31.12.2023 तक)

श्रेणी	स्वीकृत	स्थिति	रिक्त
वैज्ञानिक वर्ग			
निदेशक	01	01	00
विभागाध्यक्ष	03	03	00
परियोजना समन्वयक – ए आई सी आर पी, आई एफ एस	01	01	00
प्रधान वैज्ञानिक	00	00	+01
वरिष्ठ वैज्ञानिक	08	04	04
वैज्ञानिक	28	19	09
उप-योग	41	28	13
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	01	00
सहायक प्रशासनिक अधिकारी	02	02	00
प्रधान निजी सचिव	00	+1	+1
सहायक	08	03	05
वरिष्ठ लिपिक	03	03	00
निजी सचिव	02	02	00
व्यक्तिगत सहायक	02	01	01
कनिष्ठ लिपिक	03	02	01
उप-योग	22	15	07
सहायक कर्मचारी वर्ग			
सहायक कर्मचारी	23	23	00
कुल योग	110	79	31

परिचय

भाकृअनुप—भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) अपनी स्थापना के बाद से देश 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 72 वर्षों 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, निरन्तर उत्पादन, संसाधन प्रयोग दक्षता, खाद्य एवं पोषण सुरक्षा, रोजगार सृजन एवं जलवायु परिवर्तन का हल खोजने में महत्वपूर्ण उपाय के रूप में उभरा है।

संस्थान के संक्षिप्त विकास यात्रा का अवलोकन करें तो ज्ञात होता है कि वर्तमान आईआईएफएसआर के अनुसंधान की जड़ें भारत की स्वतंत्रता अवधि से पहले की हैं। इस दिशा में प्रयास चालीस के दशक में मैकाले इंस्टीट्यूट ऑफ साॅयल 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 सके 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 परिणाम

स्वरूप सन् 1953 में भारत—अमेरिका प्रौद्योगिकी सहयोग समझौते के अन्तर्गत “मिट्टी की उर्वरता और उर्वरक” के माध्यम से किसानों के खेतों पर सरल उर्वरक परीक्षणों की शुरुआत हुई।

विकास की उत्तरोत्तर वृद्धि के क्रम में, मॉडल एग्रोनोमिक एक्सपेरिमेंट्स अर्थात्, सावधानी पूर्वक 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” (एआईसीएईएस) 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 कृषि अनुसंधान परियोजना (एआईसीएआरपी) दो घटकों के साथ—मॉडल कृषि विज्ञान प्रयोग और सरल उर्वरक परीक्षण के रूप में स्वीकृति प्रदान कर 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 पंच वर्षीय योजना के दौरान इस केन्द्र को एक निदेशालय के रूप में उच्चिकृत 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 उच्चिकृत किया गया और इसका नाम बदल कर भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) कर दिया गया। अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना (74 केंद्र) एवं जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम (20 सहयोगी केंद्र) 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 पूर्ण करने के लिए तीन अनुसंधान प्रभाग और एक अनुभाग के अलावा एक परियोजना समन्वयन इकाई स्थापित है।

संस्थान का दृष्टिकोण, उद्देश्य एवं अधिदेश

दृष्टिकोण

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

उद्देश्य

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

अधिदेश

- 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 वर्षों के दौरान भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम निम्नलिखित तीन योजनाओं के माध्यम से क्रियाशील रहा।

भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम

वर्तमान में, संस्थान चार प्रमुख विषय वस्तुओं 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 परियोजनाएं यथा अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना एवं जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम का समन्वयन एवं पर्यवेक्षण कर रहा है।

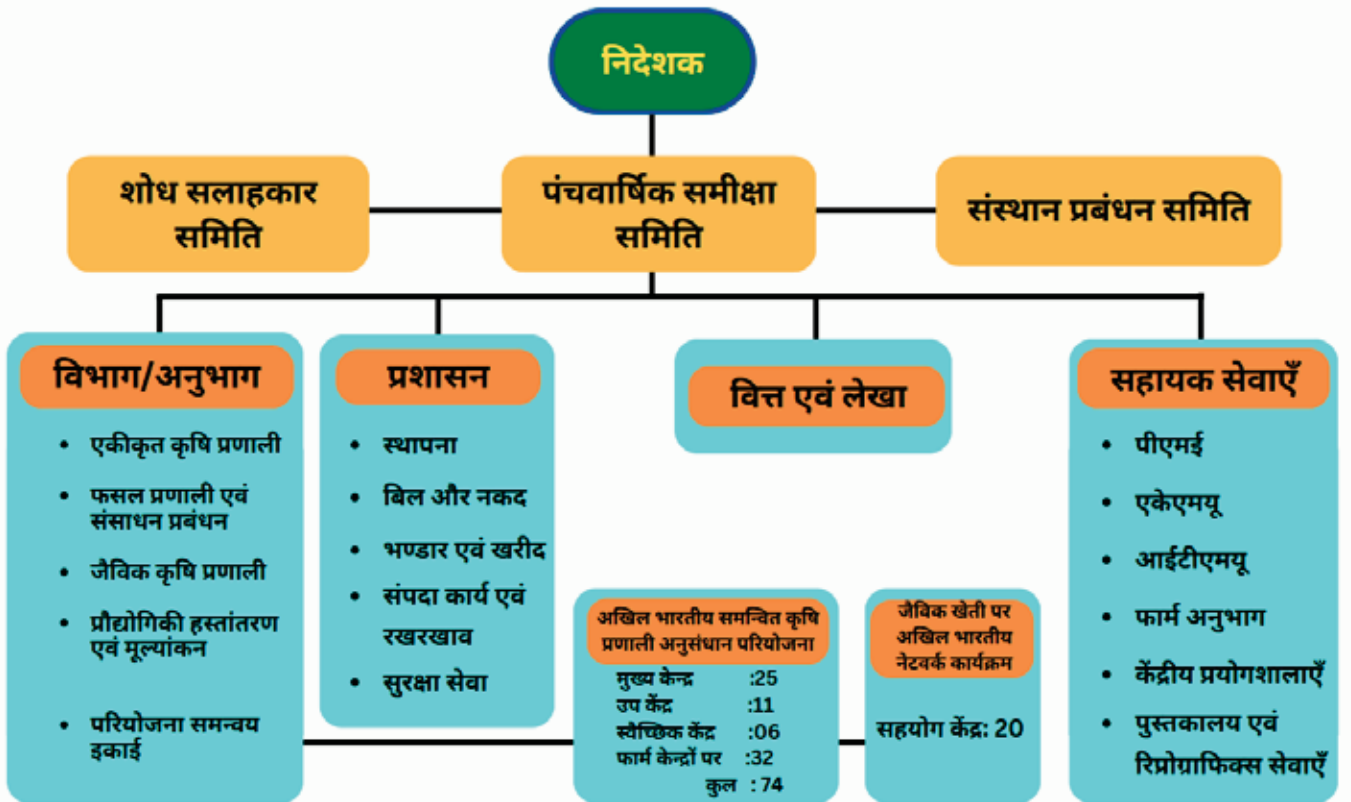
अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना

अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना, वर्ष 2010–11 से योजना के रूप में प्रारम्भ हुई। यह योजना वर्तमान में देश के विभिन्न 15 कृषि–जलवायु क्षेत्रों में स्थित 74 केंद्रों के साथ 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 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

- समेकित कृषि प्रणाली मॉडल, जिसमें फसल प्रणाली, फल उद्यान, मछली तालाब और मेढ़ वृक्षारोपण समावेशित था, 1.4 हेक्टेयर क्षेत्र में विकसित किया गया। इस मॉडल में फसल पद्धतियों, पशुपालन, बागवानी, मत्स्य पालन, मशरूम खेती और द्वितीयक कृषि सम्मिलित थी। फसल घटक कुल मॉडल क्षेत्र का 69 प्रतिशत समाहित था, जिसमें विभिन्न फसल प्रणालियाँ गन्ना-पेड़ी-गेहूँ-ढैंचा, बाजरा - चना - भिंडी, मक्का - बरसीम - उडद, ज्वार - सरसों - मूँग और संकर नेपियर + लोबिया+बरसीम सम्मिलित हैं। इन फसल प्रणालियों से कुल 122.3 टन गन्ना समतुल्य उपज (एसईवाई), रू 4,28,050 का सकल लाभ और रू 3,14,965 के शुद्ध लाभ के साथ महत्वपूर्ण योगदान प्राप्त हुआ। फल उद्यान और मछली तालाब घटक उत्पादकता और लाभप्रदता को बढ़ाने, जबकि डेयरी इकाई से अतिरिक्त आय और मृदा पोषक तत्वों के लिए गोबर प्रदान करती है। मेढ़ वृक्षारोपण ने वित्तीय योगदान में मामूली होते हुए भी, स्थान के अधिकतम उपयोग को सुनिश्चित किया। इस प्रकार कुल मिलाकर, समेकित कृषि प्रणाली में 266 टन गन्ना समतुल्य उपज (एसईवाई) का उत्पादन प्राप्त हुआ, जिसकी सकल आय रू 9,33,295 और शुद्ध आय रू 5,47,678 थी।
- पुनर्योजी कृषि वानिकी आधारित समेकित कृषि प्रणाली मॉडल के अंतर्गत 2022 के रबी सीजन में, विभिन्न वृक्ष संयोजनों को शामिल करते हुए सरसों की अंतर-फसल को भी समाहित किया गया। सबसे अधिक (1201 किग्रा/हेक्टेयर) सरसों की उपज नियंत्रण में पाई गई, उसके बाद सागौन (1153 किग्रा/हेक्टेयर), सहजन (1149 किग्रा/हेक्टेयर) का स्थान रहा, तथा सबसे कम उपज शीशम ब्लॉक (982 किग्रा/हेक्टेयर) में देखी गई। 2023 के खरीफ सीजन के दौरान, मॉडल के भीतर सहजन, सागौन और शीशम ब्लॉक के साथ-साथ मूँग, बाजरा और ज्वार की अंतर-फसल की गई। सबसे अधिक मूँग की उपज (489 किग्रा/हेक्टेयर) सागौन-मूँग के संयोजन में देखी गई, उसके बाद शीशम (374 किग्रा/हेक्टेयर), नियंत्रण (362 किग्रा/हेक्टेयर) का स्थान रहा, तथा सबसे कम उपज सहजन ब्लॉक (329 किग्रा/हेक्टेयर) में गंभीर छायांकन प्रभावों के कारण देखी गई।
- पश्चिमी उत्तर प्रदेश के अलाभकारी मवेशियों के साथ एकीकृत कृषि प्रणाली मॉडल को बनाये रखा गया। उच्चतम शुद्ध आय रुपये 98,507, लाभ: लागत 5.97 के अनुपात के साथ फसल प्रणाली मॉड्यूल में पाई गई। प्रणाली से कुल शुद्ध लाभ (श्रम लागत सहित) लाभ: लागत अनुपात 1.30 के साथ 53,905 रुपयों का था। इसके अलावा, प्रणाली से कुल शुद्ध लाभ (श्रम को छोड़कर) 91,609 रुपयों का था, जिसका लाभ: लागत अनुपात 2.03 था। चारा फसलों के संबंध में, 500 मी² क्षेत्रफल में उगाये बाजरा नेपियर हाइब्रिड ने पांच कटाई में 140.46 क्विंटल की आपूर्ति करके उच्चतम प्रणाली उत्पादकता, 280.9 टन/हेक्टेयर दी, इसके बाद जई 83.35 टन/हेक्टेयर और बरसीम 82.22 टन/हेक्टेयर का स्थान रहा।
- उत्तर प्रदेश के छोटे एवं सीमांत किसानों के लिए एक बागवानी आधारित मॉडल द्वारा रुपये 4,09,958 की सकल प्राप्ति एवं रुपये 2,35,804 की शुद्ध प्राप्ति 2.35 लाभ: लागत अनुपात के साथ हुई। यह परिवार के पाँच सदस्यों के लिए खाद्य सुरक्षा एवं आय को सुनिश्चित करता है साथ ही रुपये 339.9 से 462.0/हेक्टेयर/दिन की आय के साथ मॉडल की आर्थिक दक्षता पाँच सालों तक स्थिर रही। इस मॉडल द्वारा प्राप्त विविध उत्पादनों से लाभप्रदता, उत्पादकता एवं पोषण सुरक्षा में सुधार हुआ।
- तमिलनाडु और केरल में किये गये एकीकृत कृषि प्रणाली के प्रभावों के विश्लेषण ने दर्शाया कि एकीकृत कृषि



- प्रणाली को अपनाने वाले किसानों की खेती की लागत में गैर अपनाने वालों की तुलना में 27 प्रतिशत की कमी आयी। जबकि एकीकृत कृषि प्रणाली के कारण शुद्ध आय में 21 प्रतिशत की वृद्धि हुई। एकीकृत कृषि प्रणाली को अपनाने वाले किसानों के लिए लाभ: लागत अनुपात 3.57 रहा जबकि अन्य किसानों के लिए यह अनुपात 2.60 रहा। फसल आधारित-कृषि प्रणाली की तुलना में सब्जी आधारित-कृषि प्रणाली से पुनर्चक्रण के लिए अधिक अवशेष उत्पन्न हुए। एकीकृत कृषि प्रणाली किसानों के लिए खाद्य खपत की आहार विविधता में 6.1 प्रतिशत की वृद्धि हुई, जिसमें 13 खाद्य घटकों में से 9.1 का औसत स्कोर था। एकीकृत कृषि प्रणाली से औसतन 922 मानव दिन/वर्ष का रोजगार सृजन भी हुआ। एकीकृत कृषि प्रणाली ने गैर किसानों की तुलना में 18 प्रतिशत अधिक रोजगार सृजन किया।
- उच्च वर्षा की स्थितियों में, एकीकृत फसल प्रबंधन प्रथाओं के साथ मक्का ने अकार्बनिक उत्पादन की प्रणाली की तुलना में 8.0 प्रतिशत अधिक अनाज उत्पादित किया। अल्प वर्षा वर्ष में, एकीकृत फसल प्रबंधन उत्पादन प्रणाली अकार्बनिक प्रबंधन के साथ अनाज उपज को बनाये रखने में सक्षम पायी गयी, लेकिन जैविक उत्पादन प्रणाली के तहत आनाज उपज में काफी कमी (31.0 प्रतिशत) आई। धान के बाद जैविक उत्पादन प्रणाली के अंतर्गत उगायी गयी सरसों ने अकार्बनिक उत्पादन की प्रणाली की तुलना में 148.4 प्रतिशत अधिक अनाज उपज प्राप्त की। अल्प वर्षा वर्ष में धान के बाद सेम फली ने जैविक और एकीकृत फसल प्रबंधन उत्पादन प्रणाली के अंतर्गत अकार्बनिक उत्पादन प्रणाली की तुलना में क्रमशः 17.4 और 16.2 प्रतिशत अधिक अनाज उपज पाई गई, जबकि सामान्य और उच्च वर्षा स्थितियों में इस उत्पादन प्रणाली के अंतर्गत उपज में कोई महत्वपूर्ण वृद्धि या कमी नहीं हुई।
 - जैविक उत्पादन प्रणाली के लिए फसल सुधार के तहत, भारतीय सरसों की चार पैतृक लाइनों— एमएम 16ए 241, एमएम 16ए, एमएम 16बी 002 और एमएम 16ए 001 बीज उत्पादन और तेल की मात्रा के मामले में मौजूदा श्रेष्ठ टेस्ट प्रजाति, आरएच 749 से बेहतर पाई गई। सोयाबीन की 14 पैतृक लाइनों में से, एसएल 958, एसएल 955 और एसएल 979 अनाज उपज के मामले में जैविक उत्पादन प्रणाली के लिए सर्वश्रेष्ठ प्रदर्शन करने वाली पाई गई।
 - एआईएनपी—ओएफ परियोजना में जैविक, अजैविक और एकीकृत उत्पादन प्रणालियों के मूल्यांकन के दौरान, 100 प्रतिशत जैविक प्रबंधन के तहत, सामान्य कीमतों पर 25 प्रतिशत प्रीमियम मूल्य लगाने पर उच्चतम प्रणाली धान समतुल्य उपज (आरईवाई) पाई गई। मूल्यांकन की गई विभिन्न फसल प्रणालियों में, सबसे अधिक आरईवाई (23.8 टन/हेक्टेयर) और प्रणाली शुद्ध प्रतिफल (रु 3,57,021/हेक्टेयर) उड़द—टमाटर—सनई (हरी खाद) प्रणाली के अंतर्गत पाया गया, उसके बाद भिंडी—सब्जी मटर—ढेंचा (हरी खाद) प्रणाली का स्थान रहा। जीवाणुओं, कवकों, एक्टिनोमाइसेट्स की संख्या एवं विभिन्न मृदा एंजाइम गतिविधियों और ग्लोमैलिन क्रियाशीलता 100 प्रतिशत जैविक प्रबंधन के अंतर्गत सबसे अधिक और अजैविक प्रबंधन के अंतर्गत सबसे कम पाई गई।
 - एआईएनपी—ओएफ परियोजना में जैविक खेती के लिए प्रमुख फसलों की विभिन्न प्रजातियों के मूल्यांकन के दौरान, सब्जी मटर की सबसे अधिक फली उपज किस्म प्राची 10 के साथ पाई गई, उसके बाद पी.एस. 100 का स्थान रहा। इसी प्रकार, सबसे अधिक सकल प्रतिफल और शुद्ध प्रतिफल किस्म प्राची 10 के अंतर्गत पाया गया। बैंगन की विभिन्न किस्मों में, सबसे अधिक फल उपज पूसा हरा बैंगन के अंतर्गत पायी गई, उसके बाद काशी उत्तम का स्थान रहा।
 - चार राज्यों के लिए उपयुक्त, चार फसल प्रणालियों के लिए जैविक खेती प्रथाओं के पैकेज विकसित किये गये हैं, इसके अलावा जैविक और प्राकृतिक खेती के तहत 690 जैविक और 214 प्राकृतिक खेती किसानों का विवरण सम्मिलित किया गया है ताकि उपज अंतर की पहचान की जा सके। तमिलनाडु के लिए एक एकड़ का खेती प्रणाली मॉडल तमिलनाडु सरकार के वित्तीय समर्थन से 14 कृषि विज्ञान केन्द्रों में स्थापित किया गया है।
 - एआईएनपी—ओएफ परियोजना के तहत जैविक/एस पी एन एफ किसानों के भू-संदर्भित लक्षण वर्णन सर्वेक्षण में कुशीनगर और गोरखपुर जिलों के 30 किसानों का सर्वेक्षण किया गया। जैविक उत्पादकों के पास औसतन 0.51 हेक्टेयर भूमि थी और औसतन 0.6 पशुधन थे। लगभग 37 प्रतिशत किसान पशुधन घटक के बिना जैविक खेती कर रहे हैं और बाहर से खरीदे गए

- खाद आगतों पर निर्भर हैं। सर्वेक्षण के दौरान विपणन सुविधाओं की कमी, कम/न के बराबर प्रीमियम मूल्य, कम उत्पादकता और प्रथाओं के पैकेज में अंतर प्रमुख बाधाएं पायी गयीं।
- विभिन्न कृषि-पारिस्थितिकी के तहत प्राकृतिक खेती प्रथाओं के मूल्यांकन के दौरान, मक्का और गेहूँ में अत्यधिक खरपतवार संक्रमण ने प्राकृतिक खेती उपचारों के तहत उत्पादकता में महत्वपूर्ण कमी की। एआईएनपी-ओएफ और आईसीएम की तुलना में प्राकृतिक खेती के तहत प्रणाली उपज में क्रमशः 68.8 और 70.3 प्रतिशत की कमी हो गई। यद्यपि सबसे अधिक माइक्रोबियल संख्या और एंजाइमेटिक प्रतिक्रिया एआईएनपी-ओएफ पैकेज के तहत देखी गयी, इसके बाद संपूर्ण प्राकृतिक खेती उपचार में रही जो कि कार्बनिक व प्राकृतिक खेती के लाभकारी प्रभाव को मृदा सूक्ष्मजीव पर पड़ने वाले प्रभाव को दर्शाता है।
 - माइक्रोबियल कंसोर्टिया परियोजना के तहत 29 कवक विभेदों को सेल्यूलोलिटिक, हेमिसेल्यूलोलिटिक और लिग्नोलिटिक गतिविधियों के लिए गुणात्मक (विकास, बीजाणु जनन, हाइड्रोलिसिस) और मात्रात्मक (बाह्य कोशिकीय हाइड्रोलैटिक एंजाइम कॉकटेल का उत्पादन) रूप से जांचा गया।
 - उत्तरप्रदेश, उत्तराखंड और पंजाब राज्यों के लिए तीन आई ओ एफ एस मॉडल विकसित किये जा रहे हैं, जिनमें से उत्तराखंड के लिए एक एकड़ आई ओ एफ एस मॉडल जिसमें खाद्य और चारा प्रणाली इकाई (0.31 हे), पशुधन इकाई (0.06 हे) और मछली पालन इकाई (0.03 हे) शामिल हैं। इस मॉडल ने 46,305 रुपये की शुद्ध आय और 2.47 का लाभ: लागत अनुपात दर्ज किया। वही पंजाब में एक एकड़ आई ओ एफ एस मॉडल जिसमें खाद्य और चारा प्रणाली (0.30 हे) व पशुधन (0.10 हे) शामिल हैं ने 45,634 रुपये की शुद्ध आय और 1.85 का लाभ: लागत अनुपात प्राप्त किया।
 - दीर्घकालिक संरक्षण कृषि आधारित प्रबंधन प्रक्रियाओं का पालन करते हुए उगाये मक्का-सरसो-मूँग एवं धान-गेहूँ-मूँग फसल चक्रणों में पारंपरिक कृषि प्रक्रियाओं के मुकाबले क्रमशः 17.90 व 23.24 प्रतिशत जल की बचत हुई। मक्का-सरसो-मूँग फसल चक्र में पारंपरिक कृषि प्रक्रियाओं के मुकाबले संरक्षण कृषि प्रक्रियाओं के पालन से 31.73 प्रतिशत श्रम की बचत भी देखी गयी।
 - इसी प्रकार धान-गेहूँ-मूँग एवं गन्ना-पेडी-गेहूँ फसल चक्रणों में पारंपरिक कृषि प्रक्रियाओं के मुकाबले संरक्षण कृषि आधारित प्रबंधन प्रक्रियाओं में क्रमशः 27.53 व 23.24 प्रतिशत श्रम की बचत हुई।
 - आजकल भारत वर्ष के उत्तरी भाग में धान के अवशेषों का प्रबंधन एक प्रमुख चुनौती बना हुआ है जिसको या तो जला दिया जाता है या खेत से हटाना पड़ता है। परिक्षणों में देखा गया है कि धान के अवशेषों के प्रतिधारण, समावेश एवं अपघटन से अवशेषों के जलाने के सापेक्ष पद्धति की उत्पादकता में 5-7 प्रतिशत की वृद्धि होती है। इसके अतिरिक्त मृदा के भौतिक एवं रासायनिक गुणों में भी बड़ा सुधार देखा गया। सभी अवशेषों के उपचार परिक्षणों में जैसे कि अवशेष प्रतिधारण, अवशेष समावेश, अवशेष प्रतिधारण + पुसा डीकम्पोजर एवं अवशेष समावेश + पुसा डीकम्पोजर में क्रमशः 24.7, 40.8, 47.9 एवं 43.7 प्रतिशत अधिक जैविक कार्बन पायी गयी। अवशेष प्रतिधारण + पुसा डीकम्पोजर एवं अवशेष समावेश + पुसा डीकम्पोजर उपचारों में क्रमशः 10-14, 20-30 एवं 10 प्रतिशत अधिक उपलब्ध नत्रजन, फास्फोरस एवं पोटैश तत्व पाये गये।
 - उच्च मृदा कार्बन स्तर के अंतर्गत पौध रोपण विधि द्वारा उगाये धान के मुकाबले बीज द्वारा सीधी बुआई किये धान में ग्लोबल वार्मिंग की संभाव्यता में उर्वरकों की अनुशंसित खुराक+डाईसाइनाडाईअमाइड; जैविक एवं प्राकृतिक खेती उपचारों में क्रमशः 54.0, 32.5 व 67.1 प्रतिशत की दर से कमी देखी गयी जबकि मध्य मृदा कार्बन स्तर की दशा में कमी की दर 52.6, 31.7 व 70.8 प्रतिशत रही। उच्च मृदा कार्बन स्तर की दशा में बीज द्वारा सीधी बुआई किये धान व पौध रोपण विधि द्वारा उगाये धान के अंतर्गत मीथेन गैस का प्रवाह क्रमशः 25.6-608.1 व 20.8-840.1 मिलीग्राम/वर्ग मीटर/दिन के बीच विस्तारित रहा जबकि मध्य मृदा कार्बन स्थितियों में यह प्रवाह क्रमशः 42.5-500.5 व 38.4-620.8 मिलीग्राम/वर्ग मीटर/दिन के बीच विस्तारित रहा। उच्च मृदा कार्बन स्तर की दशा में बीज द्वारा सीधी बुआई किये धान व पौध रोपण विधि द्वारा उगाये धान के अंतर्गत नाइट्रस ऑक्साइड का प्रवाह क्रमशः 0.34-7.68 व 0.46-15.93 मिलीग्राम/वर्ग मीटर/दिन के बीच विस्तारित रहा जबकि मध्य मृदा कार्बन स्थितियों में यह प्रवाह क्रमशः 0.48-6.20 व 0.30-8.39 मिलीग्राम/वर्ग मीटर/दिन के बीच विस्तारित रहा।



- मक्का का सीईआरईएस मॉडल, जो डीएसएसएटी (कृषि प्रौद्योगिकी हस्तांतरण के लिए निर्णय समर्थन प्रणाली) के तहत अंतर्निहित हैं, मक्के की दो किस्मों जे सी 4 एवं सुजाता में पारंपरिक और संरक्षित जुताई के तहत एंथ्रेसिस और शारीरिक चरणों के लिए सिम्युलेटेड दिन खेती के देखे गये मूल्यों के 5 प्रतिशत के भीतर पाये गये। सिम्युलेटेड पत्ती क्षेत्र सूचकांक, सभी उपचारों में अवलोकन किए गये डाटा (आर एम एस सी 0.49) एवं (एन आर एम एस सी 8.11 प्रतिशत) के साथ निकटता से जुड़ा हुआ पाया गया। दानो का जड़ माध्य मूल मान (आर एम एस ई) एवं जैव भार क्रमशः 323 (एन आर एम एस सी 5.83 प्रतिशत) व 1119 (एन आर एम एस सी 9.21 प्रतिशत) कि ग्रा/ हेक्टेयर था। पारंपरिक और संरक्षित जुताई के तहत किए गये सभी परिक्षणों में बिना नत्रजन दिये उपचारों के अलावा मक्का के दानों की सिम्युलेटेड उपज सभी उपचारों में सामान्यतः मापी गयी मात्राओं से मेल खाती हुई पायी गयी। इस प्रकार इस अध्ययन में पाया गया कि मॉडल ने 6 से 10 प्रतिशत की सीमा में त्रुटि मार्जिन के साथ जैव भार एवं उपज का प्रभावी ढंग से अनुकरण किया।
- फसल विविधीकरण की पायलट परियोजना के अंतर्गत चार जिलों 464.24 हेक्टेयर क्षेत्रफल में फसल विविधीकरण लागू किया गया। कार्यक्रम के अंतर्गत 29 जिलों में 40 प्रशिक्षण कार्यक्रम आयोजित किये गये, जिनमें 790 व्यक्तियों को प्रशिक्षित किया गया, जिनमें से 77.63 प्रतिशत पुरुष और 22.37 प्रतिशत महिलाएँ थीं। प्रतिभागियों के फसल प्रणाली में विविधीकरण संबंधी ज्ञान में औसतन 37.5 प्रतिशत की वृद्धि देखी गयी। फसल विविधीकरण के प्रभाव का अध्ययन करने के लिए 17 जिलों में धान क्षेत्र मानचित्रण पूरा किया गया।
- एफएफपी कार्यक्रम के तहत यह पाया गया कि सरसों, उड़द और मूँग के साथ गन्ने की अंतर-फसल लगाने से क्रमशः 64,578 रुपये, 45,610 रुपये और 35,635 रुपये का अतिरिक्त लाभ हुआ। बेहतर गन्ना प्रबंधन से प्रति हेक्टेयर 2,09,200 रुपये का शुद्ध लाभ हुआ, जबकि बेहतर गेहूँ प्रबंधन से प्रति हेक्टेयर 90,625 रुपये का लाभ हुआ। अंतर-फसल लगाने से एकल फसल की तुलना में प्रणाली समतुल्य उपज में 24.13 प्रतिशत (सरसों), 21.66 प्रतिशत (उड़द) और 17.87 प्रतिशत (मूँग) की वृद्धि हुई। एकीकृत कृषि प्रणाली (आईएफएस) को अपनाने से फसल विविधता में वृद्धि हुई, आईएफएस के बिना 0.42 की तुलना में सिम्पसन सूचकांक 0.53 रहा। उन्नत सरसों किस्म आरएच-725 लगाने पर उपज में 10-12 क्विंटल प्रति हेक्टेयर से बढ़कर 22-28 क्विंटल प्रति हेक्टेयर वृद्धि पायी गई।
- कृषक-प्रक्षेत्र शोध योजना के अंतर्गत फसलों में पोषक तत्वों की प्रतिक्रिया और मृदा स्वास्थ्य पर प्रभाव का आकलन करने के लिए मेरठ जिले का चयन 2023-24 में किया गया। कृषि उत्पादकता के आधार पर दो ब्लॉक चुने गए। उच्च उत्पादकता रोहटा तथा कम उत्पादकता के लिए दौराला ब्लॉक का शोधकार्य के लिए चयन किया गया। प्रमुख फसल प्रणालियों में गन्ना-पेड़ी-गेहूँ और चावल-गेहूँ शामिल हैं, जिन्हें डेयरी और फसल+डेयरी+बागवानी प्रणालियों के साथ एकीकृत किया गया है। एक सर्वेक्षण में रोहटा में 6.9 लीटर/पशु और दौराला में 6 लीटर/पशु का औसत दूध उत्पादन पाया गया।
- ओएफआर कार्यक्रम के तहत, 0.91 हेक्टेयर की औसत भूमि वाले 24 परिवारों को शामिल करते हुए कृषि प्रणालियों में विविधता लाने हेतु शोधकार्य किये गये। 18 परिवारों में, फसल, डेयरी और बागवानी को एकीकृत करने से विभिन्न मॉड्यूल में बेंचमार्क आय की तुलना में प्रति परिवार शुद्ध लाभ/आय में 1,15,000 रुपये तक की वृद्धि पायी गई।
- उत्तराखंड के मध्य पर्वतीय क्षेत्र अल्मोड़ा जिले में कृषि प्रणाली लक्षण वर्णन सर्वेक्षण किया गया। फसल (खरीफ चावल+ बाजरा+ फलियां-गेहूँ / दाल/ सरसों-ग्रीष्मकालीन चावल) + पशुधन (डेयरी/बकरी पालन) ताकुला ब्लॉक की प्रमुख कृषि प्रणाली पाई गई, जिसका 96 प्रतिशत किसान पालन करते हैं। फसल (बाजरा/खरीफ चावल+फलियां-गेहूँ/दाल/सब्जियां-मक्का) + पशुधन (डेयरी/बकरी पालन/मुर्गी पालन) हवालबाग ब्लॉक की प्रमुख कृषि प्रणाली पाई गई, जिसका 94 प्रतिशत किसान पालन करते हैं।

EXECUTIVE SUMMARY

1. **Name and Address of the Institute:** ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut- 250110

2. **Budget: 2023-24**

A. **Institute Budget (₹ in Lakhs): 2023-24**

	Budget					Expenditure		
	Provision	Expenditure	Govt. Grant	Allocation internal+ additional amount provided by Hqrs out of Council shares	Total Allocation (3+4)	Exp. out of Govt. Grant	Exp. out of revenue generation	Total expenditure (6+7)
	1	2	3	4	5	6	7	8
Institute	2201.80	2201.80	2201.80	0.00	2201.80	2201.80	0.00	2201.80
Institute Scheme	4323.60	4323.02	4323.60	117.64	4441.24	4440.66	0.00	4440.66
Total	6525.40	6524.82	6525.40	117.64	6643.04	6642.46	0.00	6642.46

B. **External sources (in ₹ Lakhs): 2023-24**

Source	Budget	Total expenditure
External funded projects	472.90	291.87
Total	472.90	291.87

C. **Revenue Generated (in ₹ Lakhs): 2023-24**

Source	Amount
Field produces and sale of grain, fruits, vegetables, fish, milk and animals	54.99
License fee/ water charges	6.18
Interest on loan and advances	1.01
Interest on TDR	3.34
Others (Royalty and Inst. Charges)	6.45
Miscellaneous	10.68
Total	82.65

**3. Staff Position (as on 31.12.2023)**

Category	Sanctioned	In position	Vacant
Scientists			
Director	01	01	00
Head of Division	03	03	00
Project Coordinator-AICRP, IFS	01	01	00
Principal Scientist	00	00	+01
Senior Scientist	08	04	04
Scientist	28	19	09
Sub Total	41	28	13
Technical Staff			
Category- III (T-6, 7/8, 7/9)	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
Sr. Finance & Account Officer	01	01	00
Assistant Administrative Officer A O	02	02	00
Principal Private Secretary	00	+1	+1
Assistant	08	03	05
Upper Division Clerk	03	03	00
Private Secretary	02	02	00
Personal Assistant	02	01	01
Lower Division Clerk	03	02	01
Sub Total	22	15	07
Supporting Staff			
Supporting	23	23	00
TOTAL	110	79	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 72 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 country. 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**

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.
- Coordinate and monitor integrated farming systems research in the country.

Major Research Areas

- Farming system design and farm typology work intensified on the farmer's field (On-farm research) for appropriate designing and efficient resource utilization in IFS.
- Research on whole farm concept by the inclusion of agri-voltaic integrated farming systems.
- Development of sensor-based input management options of predominant cropping systems for sustainably enhancing use efficiencies.
- Carbon neutral farming, vertical cropping, regenerative agriculture and circular economy and waste-wealth generation.

- Capacity building and Human Resource Development for Integrated Farming Systems Research, Education and Extension.

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 and Resource Management (CSR), Organic Agriculture Systems (OAS) and Transfer of Technology and Assessment (TTA) besides a Coordination Unit (CU) to monitor and coordinate the two national level schemes viz., AICRP on Integrated Farming System (AICRP-IFS) and All India Network Project on Organic Farming (AINP-OF).

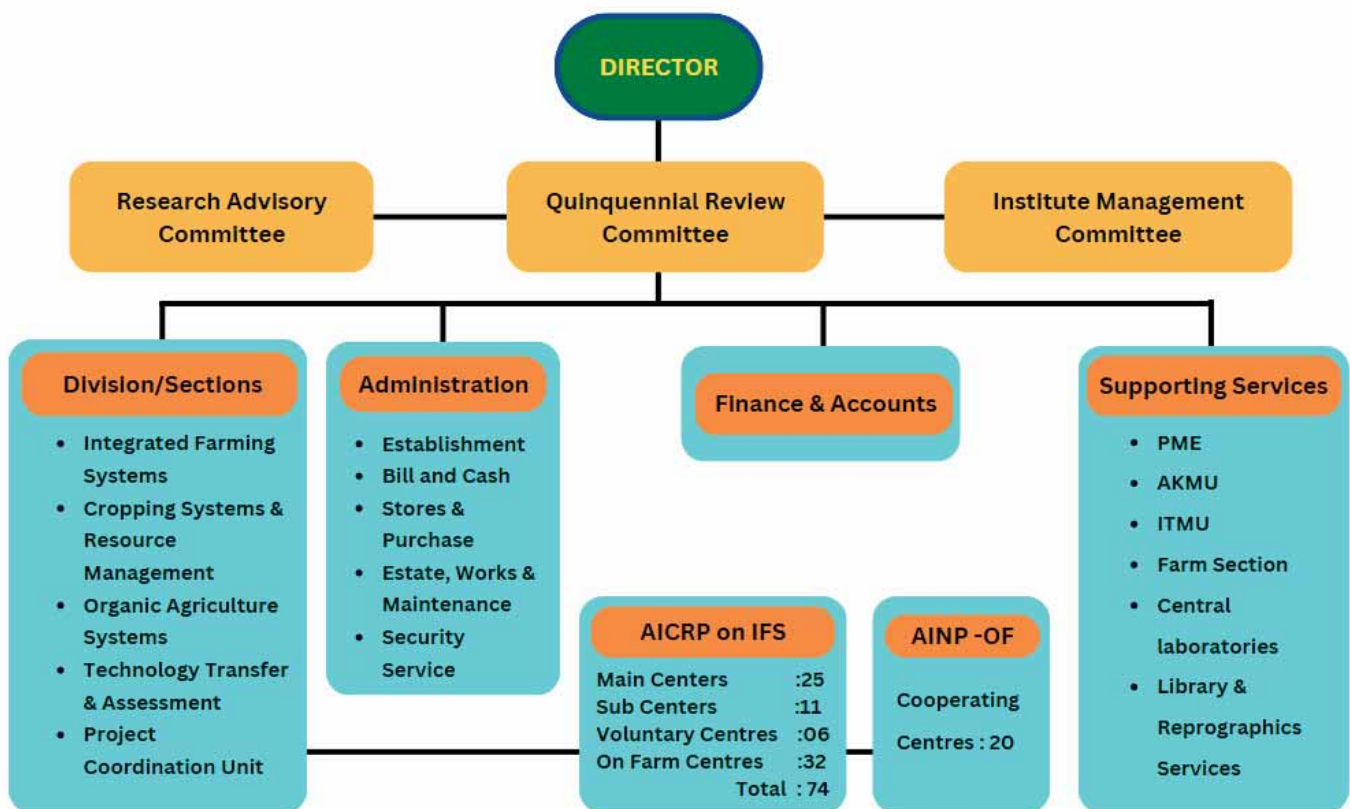
All India Coordinated Research Project on Integrated Farming Systems (AICRP-IFS)

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

- An Integrated Farming System model, comprising cropping systems, dairy, orchard, fish pond, and boundary plantation over 1.4 hectares has been developed at ICAR-IIFSR. This model included crop cultivation, dairy farming, horticulture, fishery, mushroom cultivation, and secondary agriculture. The crop component covered 69% of the total model area, with various cropping systems such as sugarcane-ratoon-wheat, rice-wheat-dhaincha, pearl millet-chickpea-okra, maize-berseem-urd bean, sorghum-mustard-moong bean, and BN hybrid+cowpea+berseem. These cropping systems contributed significantly to the IFS with a total sugarcane equivalent yield (SEY) of 122.3 t, a gross return of ₹ 4,28,050 and a net return of ₹ 3,14,965. The orchard and fish pond components enhanced the productivity and profitability, while the dairy unit provided additional income and manure for plant nutrition. The boundary plantation, though modest in financial contribution, maximized space utilization. Overall, this IFS model produced SEY of 266 t, a gross return of ₹ 9,33,295 and a net return of ₹ 5,47,678.
- Under regenerative Agroforestry based IFS model, mustard intercropping recorded highest seed yield in the control (1201 kg/ha), closely followed by teak (1153 kg/ha), moringa (1149 kg/ha) and the lowest was observed in the shisham block (982 kg/ha). During the Kharif season of 2023, highest green gram yield was noted in the teak+green gram combination (489 kg/ha), followed by shisham (374 kg/ha), control (362 kg/ha) and the least yield was in the moringa block (329 kg/ha) due to severe shading effects.
- Under uneconomic cattle-based farming system modules, cropping system module produced the maximum net revenue of ₹98,507. Overall, farming system module generated a net return of ₹53,905 with a B:C ratio of 1.30 with inclusion of labour cost while it was ₹91,609 and a B:C ratio of 2.03 without involving labour costs.
- A horticulture-based farming system model of Uttar Pradesh for small and marginal farmers yielded gross returns of ₹4,09,958 and net returns of ₹2,35,804 with a B:C Ratio of 2.35. The system ensures food security and income generation for a five-member family. Economic efficiency has been stable over five years, ranging from ₹339.6 to ₹462.0/ha/day. The model's diverse production enhances profitability, productivity, and nutritional security.
- Impact analysis of integrated farming systems from Tamil Nadu and Kerala states indicated that the cost of cultivation has reduced by 27% with IFS farmers compared to non-adopter while net return increased by 21% due to adoption of IFS. The B:C ratio for IFS farmers was 3.57 compared to others (2.60). Residue for recycling was generated more from crop-based farming system as compared to vegetable-based IFS. There was improvement in dietary diversity of food consumption for IFS farmers by 6.1% with a mean score of 9.1 out of 13 food components. IFS also created additional employment of 18% with a mean of 922 man-days per year compared to non-IFS farmers.
- Under high rainfall situation, maize with integrated crop management practices registered significantly higher grain (8.0%) over inorganic production system. In case of deficit rainfall year, integrated crop management production system was able to sustain the grain yield at par with inorganic management, but grain yield was drastically reduced under organic production system (-31.0%). Mustard after rice, cultivated under organic production systems registered significantly higher grain yield (+85.3%) over inorganic production system whereas integrated crop management gained 148.4% significantly higher grain yield over inorganic production system. Dolichos bean after rice under organic and integrated crop management production systems registered significantly higher grain yield of +17.4% and +16.2% over inorganic production system under deficit



rainfall year, whereas no significant gain or loss in the yield was recorded under this production system in normal as well as high rainfall situation.

- Under crop improvement for organic production system, four strains of Indian Mustard namely MM 16A 241, MM 16A, MM16B 002 and MM 16A 001 were found superior over existing check (RH 749) in terms of seed yield and oil content. Out of 14 parental lines/varieties of soybean tested, SL 958, SL 955 and SL 979 were found as best performers in terms of grain yield.
- Under evaluation of organic, inorganic and integrated production system in AINP-OF project, highest system REY was recorded under 100% organic management if 25% premium prices are provided over normal prices. Among the different cropping systems evaluated, highest REY (23.8 t/ha) and system net return (₹ 3,57,021/ha) was recorded under black gram-tomato-sunhemp (green manuring) system followed by okra-vegetable pea-sesbania green manuring system. The population of bacteria, fungi, actinomycetes, different soil enzyme activities and glomalin content was recorded highest under 100% organic management and lowest under inorganic/conventional practice.
- During evaluation of different varieties of major crops for organic farming in AINP-OF project, highest pod yield of vegetable pea was found with variety Prachi 10 followed by PS 100. Similarly, highest gross return and net return was found under Prachi 10. Among different tested varieties of brinjal, highest fruit yield was recorded under Pusa Hara Baigan followed by Kashi Uttam.
- Organic farming package of practices for 4 cropping systems suitable to 4 states has been developed besides the characterization of 690 organic and 214 natural farming farmers for identification of yield gaps under organic and natural farming. One acre integrated organic farming system model developed for Tamil Nadu has been established in 14 KVKs with financial support from the Government of Tamil Nadu.
- In geo-referenced characterization, survey of organic/SPNF farmers under AINP-OF project, 30 farmers of Kushinagar and Gorakhpur districts were surveyed. Organic growers were having 0.51 ha average land holding with average 0.6 number of livestock. Around 37% farmers are following organic farming without livestock component and dependent on purchased manure inputs from outside. Lack of marketing facilities, low/no premium price, lower productivity, and gap in package of practices were major constraints identified during the survey.
- During evaluation of Natural farming practices under different agro-ecology, heavy weed infestation in maize and wheat caused significant reduction in productivity under natural farming treatments. System yield was reduced by 68.8% and 70.3% under natural farming as compared to AINP-OF and ICM, respectively. The highest microbial population and enzyme activities were observed under AINP-OF package followed by complete natural farming which indicate the beneficial effect of organic/natural farming practices in improving the soil biological properties.
- Twenty nine fungal isolates were screened for cellulolytic, hemicellulolytic and lignolytic activities both qualitatively (growth, sporulation, zone of hydrolysis) and quantitatively (production of extracellular hydrolytic enzyme cocktail) under 'development and validation of microbial consortia' project.
- Three IOFS models being developed for 3 States namely Uttar Pradesh, Uttarakhand and Punjab of which one-acre IOFS for Uttarakhand comprising of 3 modules i.e. food and fodder system (0.31 ha), livestock (0.06 ha) and fish (0.03 ha) recorded net income of ₹ 46,305 with B:C ratio of 2.47 while one-acre IOFS comprising of food and fodder system (0.30 ha), livestock (0.10 ha) established in Punjab recorded net income of ₹ 45,634 with B:C ratio of 1.85.
- The long-term CA-based management practices showed that maize - mustard - green gram (M-M-GG) and rice-wheat-green gram (R-W-GG) cropping system recorded 17.90% and 16.50% water saving, respectively over the CT-based management practices. The CA practices reduced labour use by 31.73% in M-M-GG cropping system over the CT practices in this cropping system. Similarly, R-W-GG and S-R-W cropping systems under CA based practices recorded 27.53% and 23.24% less labour use over the CT practices in these cropping systems.
- Rice residue management has become a major challenge particularly in rice growing areas of North India, as the

residue (straw) is either burnt in situ or removed from the field. Results of the field experiment conducted showed that among the different in-situ residue management treatments, the rice residue retention (RR+PD) and rice residue incorporation (RI+PD) along with the spray of Pusa decomposer recorded 7.46% and 5.04% higher system productivity, respectively as compared to the rice residue burning (RB) treatment. All the residue treatments RR, RI, RR+PD, and RI+PD recorded 24.7%, 40.8%, 47.9%, and 43.7% higher SOC content in 0–5 cm soil depths over the RB treatment, respectively. Although the differences in 5–15 and 15–30 cm soil depth were not significant among the different treatments.

- The global warming potential (GWP) reduced by 54.0%, 32.5% and 67.1% in RDF+DCD, organic and NF treatments over the RDF treatment in direct seed rice under carbon strata. Similarly, the magnitude of reduction was 46.5%, 31.2% and 65.5% in these treatments in transplanted rice. In rice crop, CH₄ flux fluctuated between 25.6 and 608.1 mg m⁻² day⁻¹ under DSR and 20.8 and 840.1 mg m⁻² day⁻¹ under transplanted rice with respect to high carbon strata, while it was between 42.5 and 500.5 mg m⁻² day⁻¹ under DSR and 38.4 and 620.8 mg m⁻² day⁻¹ under transplanted rice with respect to medium carbon strata.
- CERES-Maize model, which is embedded in the DSSAT (Decision Support System for Agro-technology Transfer), simulated days to anthesis and physiological stages within 5% of observed values of maize cultivars JC4 and Sujata under conventional and conservation tillage. The simulated leaf area index (LAI) closely aligned with observed data across treatments, exhibiting an RMSE of 0.49 and nRMSE of 8.11%. The root mean square error (RMSE) for grain and biomass was 323 (nRMSE 5.83%) and 1119 kg ha⁻¹ (nRMSE 9.21%), respectively. The simulated grain yields of maize generally matched the measured values well in most of the treatments except for N₀ treatments (without nitrogen) in both CT and ZT tillage in which model slightly over-predicted the grain yield. Despite this exception, the model effectively simulated grain and biomass yields with an error margin in a range of 6 to 10 percent.
- Under pilot project on crop diversification was implemented in 464.24 ha in 4 districts. Under the programme 40 trainings were organized in 29 districts for extension officers/input dealers in which 790 personnel were trained of which 77.63% are male and 22.37% are female. On average, an increase of 37.5% in the knowledge base of the participants pertaining to diversification in cropping systems was observed. Rice area mapping was completed for 17 districts to study the impact of crop diversification.
- Under FFP programme, intercropping of sugarcane with mustard, black gram, and green gram resulted in additional returns of ₹64,578, ₹45,610 and ₹35,635, respectively. Improved sugarcane management yielded a net return of ₹2,09,200 per ha, while improved wheat management yielded ₹90,625 per ha. Intercropping increased system equivalent yields by 24.13% (mustard), 21.66% (black gram), and 17.87% (green gram) compared to sole cropping. Adoption of Integrated Farming Systems (IFS) increased crop diversity, with a Simpson Index of 0.53 compared to 0.42 without IFS. Improved mustard variety RH-725 boosted yields from 10-12 q/ha to 22-28 q/ha.
- Under OFR Programme in 2023-24, Meerut district was selected to assess nutrient response in crops and its impact on soil health. Two blocks were chosen: high-productive Rohta and low-productive Daurala. Major cropping systems included sugarcane-ratoon-wheat and rice-wheat, integrated with dairy and crop + dairy + horticulture farming systems. A survey showed average milk production of 6.9 liters/animal in Rohta and 6 liters/animal in Daurala.
- Under OFR an experiment involving 24 households with an average landholding of 0.91 ha led to diversification in farming systems. Among 18 households, integrating crop, dairy, and horticulture increased net profit income by up to ₹1,15,000 per household over the benchmark income, due to technological interventions in different modules.
- Farming systems characterization survey was performed in Almora district representing Mid Hills of Uttarakhand. Crop (kharif rice + millets+ legumes –wheat/lentil/mustard-summer rice) + livestock (dairy/goatery) was found to be the dominant farming system of Takula block, practiced by 96% of farmers. Crop (millets/kharif rice + legumes–wheat/lentil/vegetables - maize) + livestock (dairy/goat/ poultry) was the dominant farming system of Hawalbagh block, practiced by 94% of farmers.



WEATHER REPORT - 2023

For the reporting period i.e. January to December 2023, average monthly maximum temperature (°C), minimum temperature (°C), relative humidity (%) for morning and evening, bright sunshine hours (Hrs), evaporation (mm) and rainfall (mm) were analyzed (Fig. 1). The results revealed that the maximum monthly temperature (35.7 °C) was recorded in the month of June whereas it was lowest in January (18.1 °C). But the monthly average minimum temperature (°C) was recorded as the highest in the month of July (25.0 °C), however, the lowest value for the parameter was recorded for the similar month as in the case of maximum temperature. The morning relative

humidity was found in the range of 78.6% to 94.7%, whereas, evening relative humidity was found in the range of 55.2% to 63.2%. A total of 976.3 mm rainfall was measured for the period of report, and it was highest (407.8 mm) for the month of July whereas no rainy days were recorded for the month of January, February, and December. Average monthly evaporation was found to be highest for the month of June (224.1 mm) whereas it was lowest for the month of January (40.4 mm). A total of 1276.5 mm evaporation was recorded for the reporting period. Bright sunshine hours (BSSH) were found to be in the range of 2.7 hrs (January) to 8.8 hrs (February).

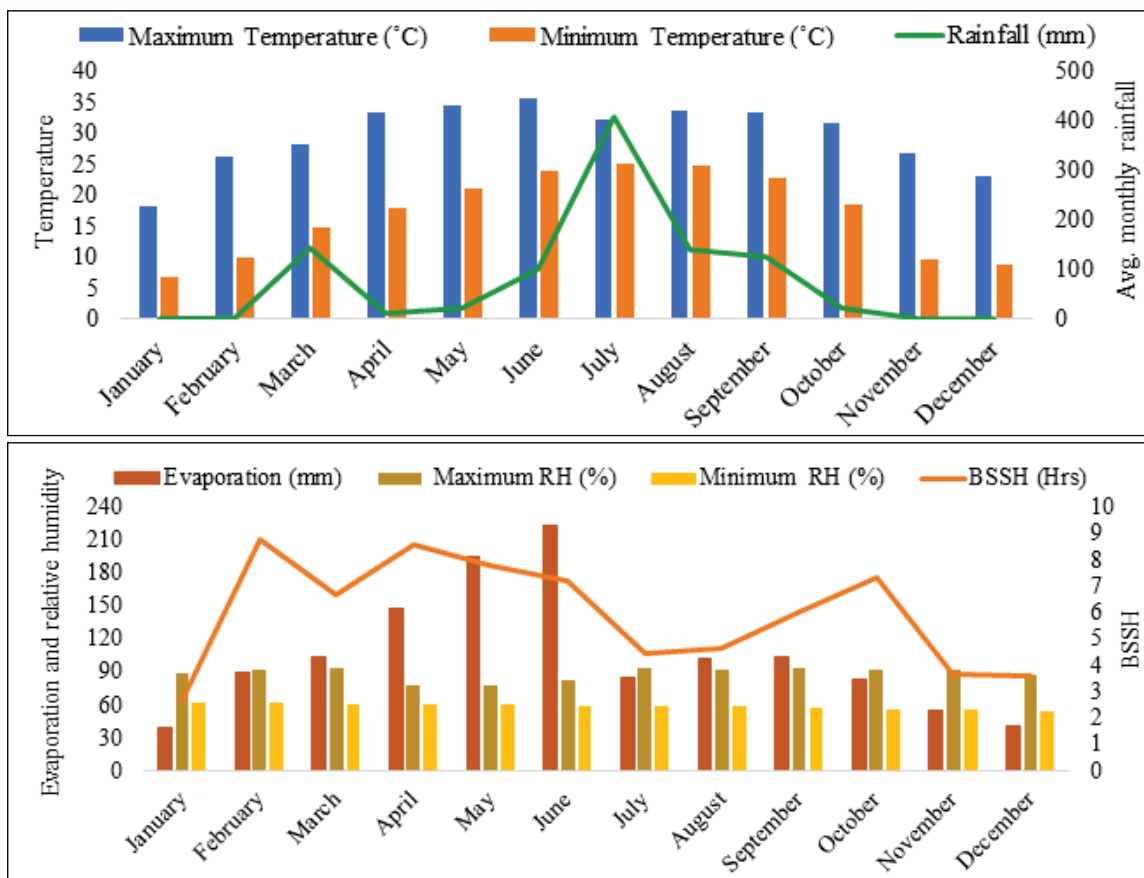


Fig. 1: Prevailing weather at ICAR-IIFSR Modipuram during January to December, 2023

RESEARCH ACOMPLISHMENTS



INTEGRATED FARMING SYSTEMS





Standardization of IFS modules and model for different farming situations of western plain zone of U.P. (Project code: NRMAIIFRSIL202305000298)

Integrated farming systems (IFS) represent a unique approach aimed at enhancing agricultural productivity, profitability, nutritional security, waste recycling, environmental protection and employment generation. It provides a holistic and sustainable solution to various challenges faced in modern agriculture. In response to the diverse agricultural needs of the Western Plain Zone of Uttar Pradesh, a tailored IFS model (1.50 ha) has been developed to address multidimensional challenges effectively. The project encompasses various modules including crop cultivation, dairy farming, horticulture, fishery, mushroom cultivation and secondary agriculture. Specifically, the crop component covered 69% of the total model area, which was 1.04 hectares out of a total of 1.50 hectares allocated for the project.

Cropping system

The Integrated Farming System (IFS) encompasses a variety of cropping enterprises, each contributing uniquely to the overall economic performance. The cropping systems included sugarcane-ratoon-wheat, rice-wheat-dhaincha (GM), pearl

millet–chickpea–okra, maize-berseem-urd bean, sorghum-mustard-moong bean, and BN hybrid+cowpea+berseem. Together, these systems covered an area of 1.05 hectares. The sugarcane-ratoon-wheat system, occupying 0.36 hectares, yields a substantial sugarcane equivalent yield (SEY) of 31.2 tons and provided a gross return of ₹1,09,200 with a net return of ₹76,000. The rice-wheat-dhaincha (GM) system, spread over 0.18 hectares, contributed SEY of 21.2 tons and generated a net return of ₹59,330 from a gross return of ₹74,200. The pearl millet–chickpea–okra system, also on 0.18 hectares, achieved the SEY of 25.3 tons and results in a net return of ₹63,570 from a gross return of ₹88,550. The maize-berseem-urdbean system, covering another 0.18 hectares, yielded the SEY of 17.8 tons and provided a net return of ₹45,200 from a gross return of ₹62,300. The sorghum-mustard-mungbean system, allocated 0.11 hectares, achieves SEY of 21.9 tons and resulted in a net return of ₹57,135 from a gross return of ₹76,650. Similarly, BN hybrid+cowpea+berseem system, covering 0.04 hectares, provided an SEY of 4.9 tons and resulted in a net return of ₹13,730 from a gross return of ₹17,150. In total, these cropping systems contributed significantly to the IFS with a total SEY of 122.3 tons, a gross return of ₹4,28,050 and a net return of ₹3,14,965.

Table 1: Area, production and economics of IFS model

Cropping system	Area allocation (ha)	SEY (t)	Gross return (₹)	Cost of cultivation (₹)	Net return (₹)
Sugarcane-ratoon-wheat	0.36	31.20	109200	33200	76000
Rice-wheat-dhaincha (GM)	0.18	21.20	74200	14870	59330
Pearl millet–chickpea– okra	0.18	25.30	88550	24980	63570
Maize-berseem-urd bean	0.18	17.80	62300	17100	45200
Sorghum-mustard- moong bean	0.11	21.90	76650	19515	57135
BN hybrid +cowpea+berseem	0.04	4.90	17150	3420	13730
Total Cropping System	1.05	122.30	428050	113085	314965
Dairy	0.05	36.32	127106	104714	22392
Poultry	0.01	39.79	139265	97750	41515
Orchard	0.2	43.90	153650	41000	112650
Fish pond	0.1	21.50	75249.65	25610	49639.65
Boundary plantation	200 m running length	2.85	9975	3458	6517
Total IFS	1.4	266.66	933295.65	385617.00	547678.65

Horticulture

The horticulture component, occupying 0.2 hectares orchard (guava, mango, peach, plum and pear) is a highly productive component of the Integrated Farming System. It achieved an impressive SEY of 43.9 tons, making it a significant contributor to the overall system's productivity. The gross return from the orchard is ₹ 1,53,650 with a cost of cultivation (COC) of ₹ 41,000. This resulted in a net return of ₹ 1,12,650 reflecting the orchard's high profitability and its importance within the IFS.

Dairy unit

The dairy unit is consisted of one buffalo (Murrah) and one cow (Sahiwal). A total of 1488.50 litres of milk were produced, out of which the buffalo produced 662 litres, while the cow produced 826.50 litres (Table 2). The total variable cost works out to ₹1,04,714 with share of 51.57, 20.90, 13.07, 12.55 and 1.91% on labour, concentrates, green fodder, dry fodder and medicine, respectively. Total gross return and net returns from dairy unit was found to be ₹1,27,106 and ₹ 22,392, respectively. The net return from dairy module without considering family labour cost was ₹ 76,391.

Table 2: Production and economics of dairy module under IFS model

Animal	Milk (l)	Dung (t)	Cost (₹/year)	Gross income (₹/year)	Net income (₹/year)
1 Buffalo (Murrah)	662.00	18.60	104714	127106	22392 (76391)*
1 Cow (Sahiwal)	826.50				

*Value in parenthesis is net return without family labour cost.

Poultry module

Day old chicks of CARI Nirbheek were procured from ICAR-CARI, Izatnager. A total of 102 birds maintained in the project out of which 45 males were sold before starting of laying from

females (Table 3). A total of 10,415 eggs produced with gross income of ₹ 1,04,150. The gross income from the sale of birds was ₹ 29,919. The variable cost on feed and labour etc. was ₹ 97,750 and net income from poultry module was ₹ 41,519.

Table 3: Production and economics of poultry module

Poultry bird (nos.)	Egg (nos.)	Total live weight (kg)	Poultry manure (q)	Variable Cost (₹)	Gross income (₹)	Net income (₹)
102	10,415	175.97	26.00	97,750/-	1,39,269/-*	41,519/-

*Cost of eggs @ Rs. 10/- egg

Fish Pond

The fish pond, covering an area of 0.1 hectares, is another important component of the Integrated Farming System (Table 4) produced an SEY of 21.5 tons, generating a gross return of ₹ 75,250 with a cost of cultivation of ₹ 25,360 the net return

from the fish pond resulted in ₹ 49,890. This enterprise not only diversifies the income streams within the IFS but also added a significant financial return, enhancing the overall economic stability of the system.

Table 4: Growth parameters for the cultured fish

Species	Initial size (mm)	Initial weight (g)	Present size (mm)	Present weight (g)
Catla	15	6	240	900
Rohu	70	25	270	1000
Mrigal	40	20	220	1000
Grass carp	50	30	300	1500
Amur carp	30	15	260	900



Plate 1: Harvesting of fish from IFS pond

Boundary plantation

The boundary plantation was evaluated based on its running length rather than area, contributed an SEY of 2.85 tons to the Integrated Farming System. It generated a gross return of ₹ 9,975 with a cost of cultivation of ₹ 3,458 resulting in a net return of ₹ 6,517. Although the financial contribution of the boundary plantation is relatively modest compared to other enterprises, it played an essential role in maximizing the utilization of space and resources within the IFS.

Considering the Integrated Farming System as a whole, which includes cropping systems, orchard, fish pond, dairy and boundary plantation, the total area allocation is 1.4 ha. The combined SEY across all enterprises is 266 tons. The total gross return from the IFS is ₹ 9,33,295 with a cumulative cost of cultivation of ₹ 3,85,617. This results in a substantial net return of ₹ 5,47,678 highlighting the overall economic viability and profitability of the Integrated Farming System.

Development of regenerative Agroforestry based IFS model for sustainable production and livelihood (Project code: NRMAIIFSR/SIL202005000251)

The highest mustard yield was recorded in the control (1200 kg/ha), closely followed by agroforestry block of teak (1153 kg/ha), moringa (1148 kg/ha) and the lowest yield was observed in the shisham block (982 kg/ha). During the Kharif season of 2023, intercropping of green gram, bajra, and jowar was carried out in moringa, teak and shisham blocks within the model. The

highest green gram yield was obtained in the Teak+greengram combination (489 kg/ha), followed by shisham (374 kg/ha), control (362 kg/ha), and the lowest yield was reported in the moringa block (329 kg/ha) due to severe shading effects.

In the Rabi season of 2022, mustard intercropping was implemented within the model, incorporating various tree combinations. The highest mustard yield was recorded in the control group (1200.87 kg/ha), closely followed by teak (1153 kg/ha), moringa (1148 kg/ha), and the lowest yield was observed in the shisham block (982 kg/ha). The highest green gram yield was recorded in the Teak+green gram combination (489 kg/ha), followed by shisham (374 kg/ha), control (362 kg/ha), and the lowest yield was recorded in the moringa block (329 kg/ha) due to severe shading effects.

Similarly, for bajra, the highest green fodder yield was observed in the teak+bajra combination (180 q/ha), followed by shisham (178 q/ha), moringa (157 q/ha), with the lowest yield in the control group (132 q/ha). In case of jowar, the highest green fodder yield was found in the shisham block (140 q/ha), followed by control (136 q/ha), teak (89 q/ha) and the lowest yield was recorded in the moringa block (75 q/ha). The total fodder yield from the model reached 65.73 quintals, which was further enhanced by the addition of hybrid Napier grass and fodder cactus plantations along the model's boundary. Additionally, 60 guava trees were planted to establish the horticulture module within the model.



Shisham + green gram



Moringa + green gram



Teak + green gram



Fodder cactus

Plate 2: Agroforestry based IFS model

Sustainable livelihood generation through IFS involving uneconomic cattle (Project code: NRMIIFERSIL201910000254)

The farming system model consisting of crop and dairy was continued. The highest net income was contributed by cropping system module of ₹98,507 with B:C ratio of 5.97. The overall net return (including labour cost) from the system was ₹53,905 with B:C ratio of 1.30. Moreover, the overall net return (excluding labour) from the system was ₹ 91,609 with B:C ratio of 2.03. In case of fodder crops, Bajra Napier Hybrid gave the highest

system productivity 280.9 t/ha, by supplying 140.46 q from 500 m² area in five cuts, followed by oat 83.35 t/ha and berseem 82.22 t/ha.

Dairy component: During the reporting year, the project was continued with four cows and three male grower. The calving of one cow took place and one female calf was produced. The total milk production from the cows was 1012 liters and gross income from milk was ₹50,625. Total gross income and net income from dairy unit was found to be ₹1,15,567 and ₹ (-)44,602, respectively.

Table 5: Economics of dairy module with uneconomic cattle

Animal species	Variable cost (₹)	Milk obtained (l)	FYM prepared (q)	Vermi-compost prepared (q)	Gross income (₹)	Net income (₹)
04 Cows + 03 male grower + 01 female calf	1,60,169	1,012	222	16.50	1,15,567	(-)44,602



The cow dung was converted into FYM and vermicompost. During the period, a total of 238.71 q of FYM and vermicompost were incorporated into the crop field. By incorporation of different manures, 158.07 kg nitrogen, 52.69 kg phosphorus and 151.41 kg potash were added in the soil, which is equivalent to 345.00 kg urea, 329.31 kg SSP and 252.35 kg MOP fertilizers.

Table 6: Recycling of FYM and vermicompost

Type of manure	Quantity (q)	Nutrient content (%)			Nutrients recycled (kg)		
		N	P	K	N	P	K
FYM	222.21	0.6	0.2	0.57	133.32	44.44	126.66
Vermicompost	16.50	1.50	0.50	1.50	24.75	8.25	24.75
Total	238.71	-	-	-	158.07	52.69	151.41

Crop component: All fodder crops performed very well in the system and overall, 584.7 tones fodder was harvested from 2500 m² area with a productivity level of 233.8 t/ha (Table 7). Overall, across the different fodder crops, Bajra Napier Hybrid has given the highest system productivity 280.9 t/ha by supplying 140.46 q from 500 m² area in five cuts, followed by oat 83.35 t/ha in two cuts, berseem 82.22 t/ha in four cuts, sorghum 80.25 t/ha in kharif and 71.90 t/ha in summer fodder, pearl millet with 69.95 t/ha and fodder maize 59.50 t/ha. With the exception of summer fodder maize, all other crops performed exceptionally well. During the Rabi season of 2022-23, Brassica Napus Gobhi sarson encountered germination issues, attributed to

heavy infestations of Cypurus rotunds, prompting a transition to wheat due to the field's previous perennial crop, moringa. However, subsequent trials with Brassica napus showed promising results, yielding 22.6 metric tons per hectare in the initial cut. Among the Bajra Napier hybrid varieties, BNH (CO-5) stood out for its exceptional performance both in the field as well as animal feed, with no adverse effects on animal health or performance was observed. During the period, a total of 31.30 q green fodder of moringa was fed to the cows, which provided 2.09 q of protein in total to the animals and is equivalent to 13.33 q of concentrate ration.

Table 7: Fodder yield of different crops during 2022-23

Area (m ²)	Rabi 2022 (q)		Summer 2023 (q)		Kharif 2023 (q)	
500	Berseem	41.11	Sorghum	71.90	Sorghum	80.25
500	Mustard	1.59				
1500	Wheat grain straw	8.80 9.35	*	*	Pearl millet	69.95
1000	Oat	83.35	Maize Fodder	38.20	Maize Fodder	59.50
500	Bajra Napier Hybrid (CO-5)	24.80	Bajra Napier Hybrid (root sapling)	28.10 + 27.35	Bajra Napier Hybrid (root sapling)	28.70 + 31.51

*Due to unseasonal rain, summer crop skipped.

Economics of IFS Model consisting of uneconomic cattle: The model consisting of only crop and dairy modules. The highest net income was contributed by cropping system module of ₹ 98,507 with B:C ratio of 5.97. The overall net return (including labour cost) from the system was ₹ 53,905 with B:C

ratio of 1.30. Moreover, the overall net return (excluding labour) from the system was ₹ 91,609 with B:C ratio of 2.03 (Table 8).

Table 8: Economics of one acre IFS model consisting of uneconomic cattle

Component	Total yield	Variable cost (₹)	Gross return (₹)	Net return (₹)	B:C ratio
Cropping system	8.80 q grain+1.59 q oil seed+ 584.7 q green fodder + 9.35 q straw	19,808	1,18,315	98,507	5.97
Dairy (05 cows + 03 male growers)	1012.5 l milk + 222.2 q FYM + 16.5 q vermicompost	1,60,169	1,15,567	(-)44,602	0.72
Including family labour	Total	1,79,977	2,33,882	53,905	1.30
Excluding family labour	Total	1,15,342	2,33,882	91,609	2.03

Development of fruit based integrated farming systems for western plain zones of U.P. (Project code: NRMAIFRSIL202205000255)

The objective of this project is to enhance agricultural productivity and sustainability by combining fruits, vegetables, field crops and livestock. The significant differences were observed in yield levels (REY) of intercropping modules (cereals based, vegetable based and fodder based). Among the modules, vegetable-based intercropping was most suitable

and the yields ranged between 178.3 to 186.2 q/ha which was significantly higher than cereal-based (90.3 to 98.8 q/ha) and fodder-based (126.4 to 135.6 q/ha) cropping systems. With respect to costs and returns (₹/ha) of the modules, vegetables grown under guava was found to be most suitable intercropping cropping system and recorded highest net return (₹ 1,03,316/ha) followed by under citrus (₹ 99,933/ha) and the least return observed in pomegranate (₹ 98,513/ha).

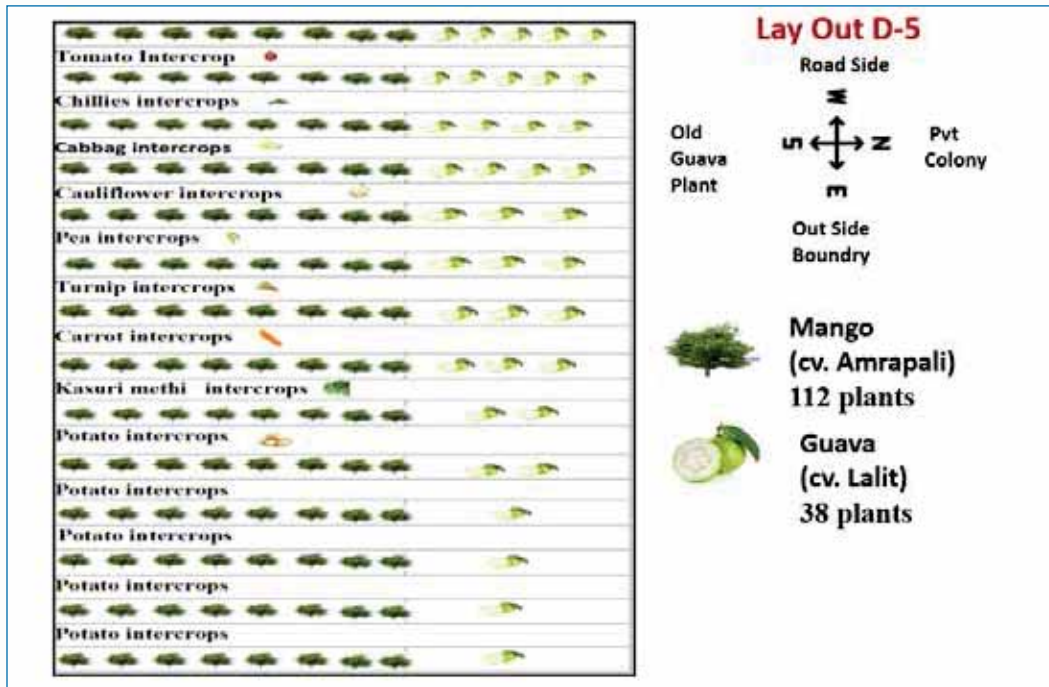
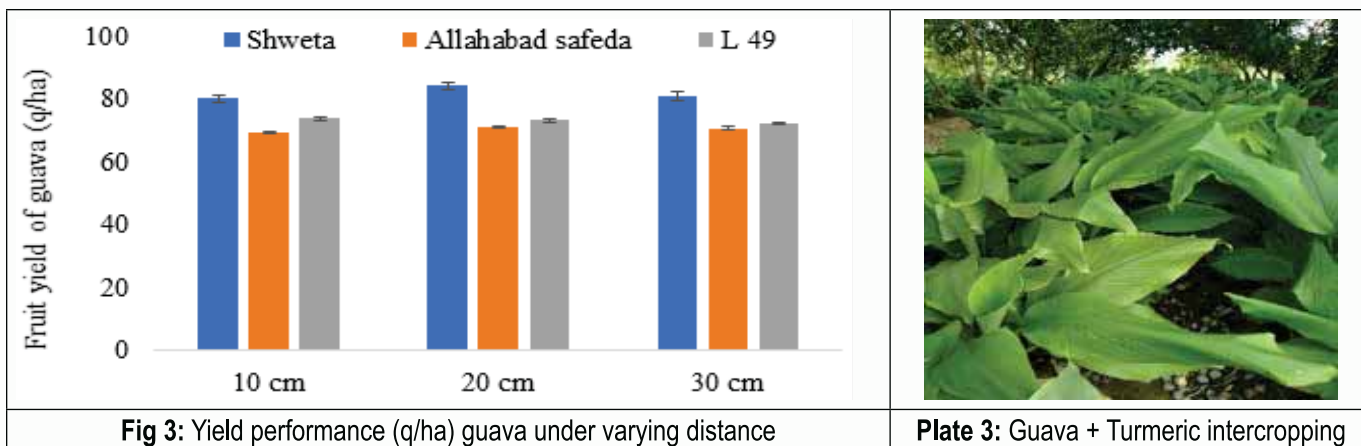


Fig. 2: Layout of the model

The performance of different turmeric varieties as an intercrop under guava plantations indicated the potential for higher yields of these three varieties (Lakadong-1, Megha turmeric -1 and Roma). Lakadong-1 recorded maximum yield (226.78 q/ha) as

an intercrop followed by Megha turmeric-1 and Roma with 214 q/ha and 212 q/ha, respectively. The result also showed that all varieties of turmeric showed better performance at a planting distance of 20 cm.



Refinement of vegetable-based farming system models for food and nutritional security of farmers of Western Uttar Pradesh. (Project code: NRMIIFSRSIL202201000262)

The development of an on-station horticulture-based farming system model for small and marginal farmers in the western plain zone of Uttar Pradesh is a comprehensive and sustainable approach in improving profitability, enhancing productivity and nutritional security of small and marginal farmers particularly of western plain zone of Uttar Pradesh. The model comprised of following modules, viz. Module 1 (M1): Fruit Orchards with intercropping of vegetables; Module 2 (M2): Vegetables; Module 3 (M3): Field crops and Module 4 (M4): Pond Dyke system with integration of poultry birds. Module 2 (Vegetables) has the highest area under cultivation at 34%, followed by

Module 1 (Fruit orchards + intercropping) at 27%, Module 3 (Crop based) at 27%, and Module 4 (Pond dyke + Poultry integration) at 7%. Economic analysis of system revealed that, the total gross returns (GR) of the model for the year 2023 has been recorded to be ₹ 4,09,958 with net returns (NR) of ₹ 2,35,804 and ₹ 1,74,154 as the cost of cultivation (COC). The B:C ratio was recorded to be 2.35 for the model. This shows an improvement in both gross and net returns compared to the previous year, along with a higher benefit-cost ratio, indicating increased profitability and efficiency in the farming model with consistent performance. The economic efficiency of the model was observed as ₹ 420.5/ha/day, which is slightly lower than the previous year's reported economic efficiency. However, over the last five years, the economic efficiency has varied between ₹ 339.6 to ₹ 462.0/ha/day indicating stable performance over years.

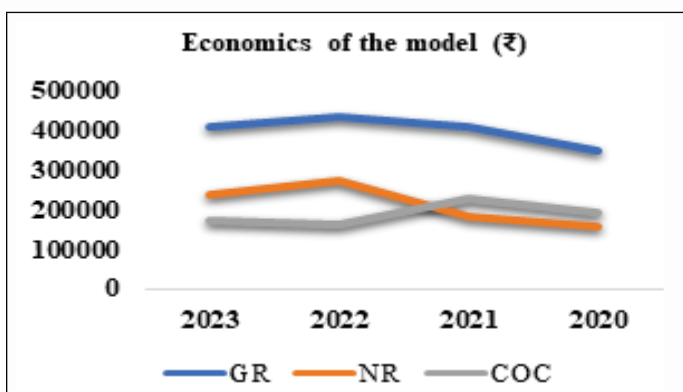


Fig. 4: Economics of model over years

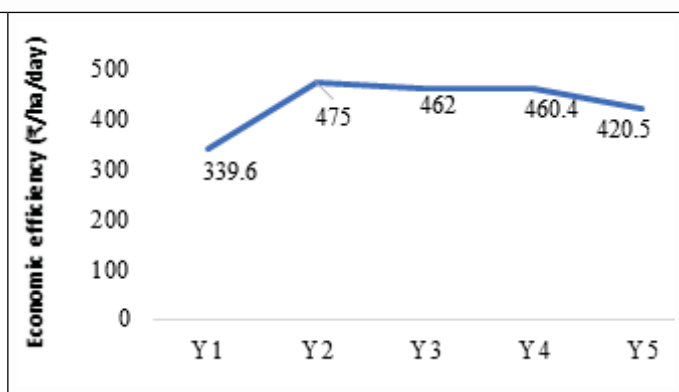


Fig. 5: Economic efficiency of model over years (2019 to 2023)

Module 1 still recorded the highest energy input (127264 MJ), likely due to the extensive cultivation practices involved in maintaining fruit orchards and intercropping of vegetables. Module 2 follows closely behind in terms of energy input. Module 4, the Pond-dyke system, continued to have the lowest

energy input (18426 MJ), indicating its efficiency in resource utilization compared to the other modules. This analysis helps in understanding the energy dynamics within the farming system model, facilitating informed decision-making for resource management and sustainability. Module 2, which

focused on vegetables, provides the highest output energy of 227431MJ, followed by Module 1 (175412 MJ). Module 4, the Pond-dyke system, provided the least output energy (20408). Additionally, Module 2 (124689 MJ) also utilized the highest net energy, while Module 4 utilized the least net energy (1982

MJ). Module 3, which focused on field crops, has the highest energy use efficiency, while Module 1 has the lowest. These efficiency values provide insights into the effectiveness of energy utilization within each module of the farming system model (Table 9).

Table 9: Energy dynamics of the model

Module	Energy input (MJ)	Energy output (MJ)	Net energy (MJ)	Energy use efficiency
M1	127264	175412	48148	1.38
M2	102742	227431	124689	2.21
M3	57702	145420	87718	2.5
M4	18426	20408	1982	1.1

The total produce harvested from the model, including cereals and millets, roots and tubers, green leafy vegetables, other vegetables, and fish and meat, amounts to 17190 kg. This abundance of produce not only meets the food demand of a 5-member family but also generates surplus that can be sold in the market for extra income. A total of 17190 kg of the produce including cereals and millets (2245 kg), roots and tubers (3579

kg), green leafy vegetables (625 kg) and 8125 kg of other vegetables and 124 kg of fish and meat have been harvested from the model. The diversity of produce indicates a well-rounded farming model that not only ensures food security but also offers opportunities for income generation through surplus sales.

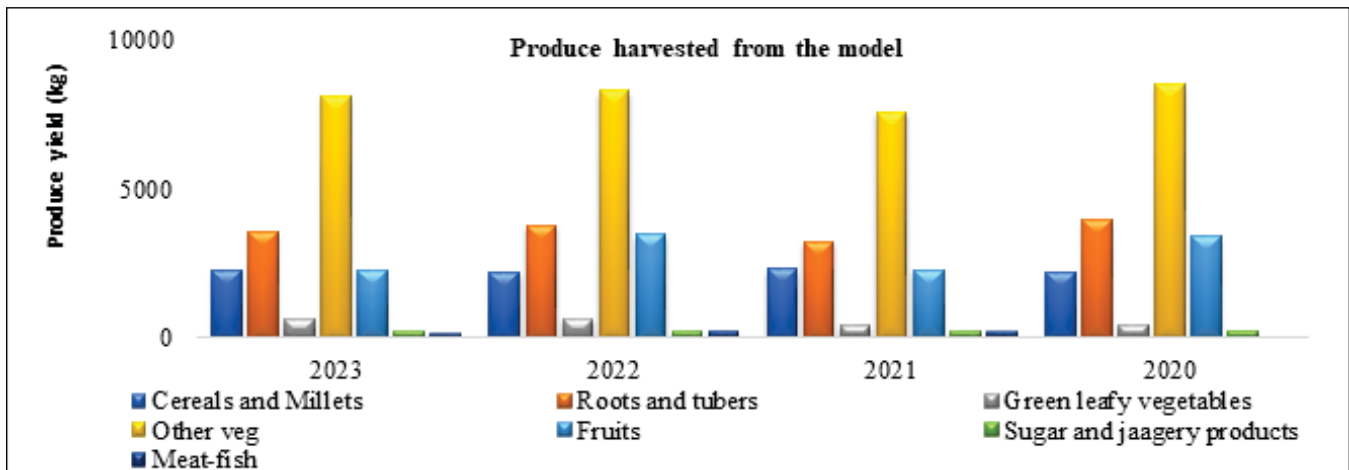


Fig. 6: Food group wise produce harvested from models

Water requirement of the modules over the years indicated that the water requirement of Module 3 (field crops-based system) had been found to be the highest (22746 m³) because this module, which focuses on cultivating field crops, requires the more water among all modules. Field crops typically have higher water needs compared to other types of crops, which explains the higher water requirement for this module. Module 1- Fruits + intercropping had 19574 m³ water requirement. Fruit

trees and vegetables also require significant water, but the overall requirement is slightly lower than that of field crops. and least water requirement has been reported for M4 – pond-dyke system (7932 m³). This is likely because the system utilizes water efficiently, recycling it within the pond-dyke system, and also benefits from natural water sources like rainwater collection in the pond (Fig. 7).

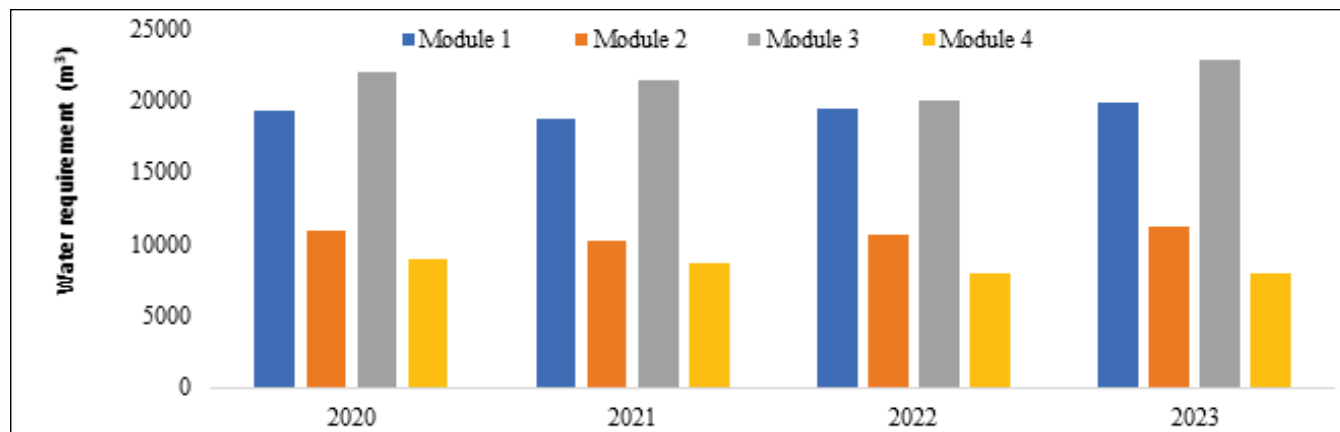


Fig. 7: Water requirement of the modules under study

The highest population of bacteria and fungi was found in the soil of fruit orchard (old) (Table 10) which may be due to the continuous leaf litter fall. The lowest bacterial and fungal population was found under pond dyke system but was comparatively higher than the previous year. A significant

improvement in the microbiological properties in the soil of pond dyke system has been observed over the years, which is probably due to the application of pond water as irrigation source.

Table 10: Microbial count of soil samples (0-15 cm depth) under different components in horticulture-based farming system model

Sample	Bacteria (CFU/mL)	Fungi (CFU/mL)
Crop component	5.8×10 ⁷	3.9×10 ⁴
Vegetable component	6.3×10 ⁷	4.2×10 ⁴
Fruit (Mango) + vegetable (intercrop) New orchard	8.7×10 ⁷	5.2×10 ⁴
Pond dyke system	9.7×10 ⁶	1.4×10 ⁴
Fruit orchard (old)	3.7×10 ⁸	7.2×10 ⁴

The activities of different enzymes involved in nutrient mineralization were found highest in the soil of fruit orchard (old) which may be due to the continuous leaf litter fall. The lowest enzyme activity was found under pond dyke system (Table

11) but was comparatively higher than the previous year. The similar trend was observed for buildup in the enzyme activities under the pond dyke system.

Table 11: Activity of different enzymes in soil (0-15 cm) under components of horticulture-based farming system model

IFS components	Dehydrogenase activity (µg TPF/g soil/h)	Phosphatase activity (µg PNP/g soil/h)	B-glucosidase activity (µg PNP/g soil/h)	Urease activity (mg urea/g soil/h)
Crop	21.57	54.05	13.62	10.23
Vegetable	22.45	59.37	14.27	11.37
Fruit (Mango) + vegetable	23.89	63.42	14.87	11.88
Pond dyke system	18.63	29.84	12.07	9.12
Fruit orchard (old)	26.12	72.15	17.11	12.35

Establishment of Ornamental and Biofloc fisheries modules for Farm livelihood improvement (Project code: NRMAIFSR SIL202205000257)

During this year carp hatchery was made operational and *Labeo rohita* breeding was undertaken. A total of 5.0 lakhs spawn was produced. Bioflock unit has been made operational and fish culture and bioflock culture has been initiated. Breeding of molly fish was undertaken and offsprings were produced. In India, especially in the northern region there is a considerable gap whereas demand is high for the ornamental fish and cultured fish. Live feed culture was also initiated. Trail breeding for production of juveniles for the Biofloc culture was also initiated and partial success was obtained. 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 for production of

quality seed to be used in pond culture (Plate 4) and Biofloc system. One set of breeding trial for *Labeo rohita* was set. Two female fish weighing 1.5 kg each were injected with Ovaprim @ 0.05 mg/kg body weight and male fishes (four numbers) were injected with 0.2 mg/kg body weight for inducing spawning in the evening (Plate 5). After overnight induction fishes spawned in the morning and fertilized eggs were transferred to the hatching unit through centrifugal action (Plate 6 a and 6 b). The breeding trial resulted in production of 7-7.5 lakhs fertilized eggs with 90% fertilization, which were incubated in the hatching pool for 48 hrs. The hatched spawn was then reared in the hatching pool with continuous circulation for three days for yolk sac absorption (Plate 7 a) and there after collected in the spawn collection chamber (Plate 7 b). Approximately, 5.0 litres of spawn were collected which was estimated to be 5.0 lakhs spawn i.e. 1 lakh spawn per litre. The spawn was then released in the small pond for rearing to the fry stage (Plate 7 c).



Plate 4: Small scale fish hatchery unit



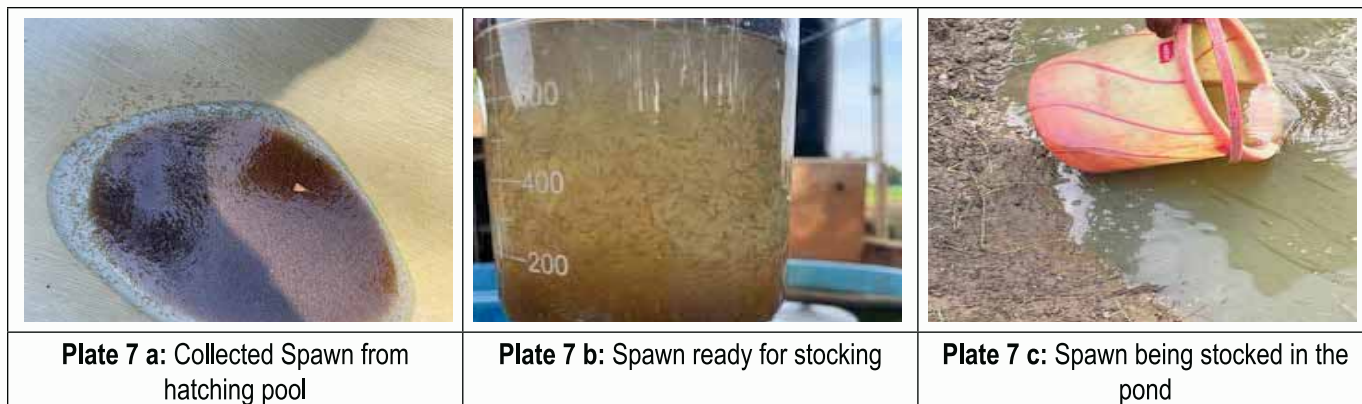
Plate 5: Injecting the brood fishes with Ovaprim



Plate 6 a: Comma shaped fertilized eggs



Plate 6 b: Hatched spawn in spawning pool



However, due to unavailability of proper nursery pond, the survival was less and recovery was low which shall be rectified in the coming season for better recovery. The aquarium fishes namely, gold fishes of different varieties, Koi carp, black and silver molly of various varieties were brought and reared in the aquariums as a backyard activity for increasing livelihood security for rural youth and farm women. The fishes

were reared and acclimatised for confined culture with filters (Plat 8). Aeration was provided into the tanks and regular water exchange/cleaning is being undertaken. Juvenile fishes are being reared for adulthood and the trial breeding shall be undertaken upon maturity to develop breeding protocols and rearing of the young ones.



Plate 8: Aquarium setup for rearing of aquarium fishes

Zooplankton was cultured in the FRP tank and was fed as natural feed to the aquarium fishes for increased growth, colour maintenance and better health as well as for easy tank maintenance. The feed was also provided to the juveniles

produced during the reporting period. Growth parameters of the different aquarium fishes were recorded and have been presented in the Table 12.

Table 12: Growth parameters of the aquarium fishes

Species	Initial size (mm)	Initial weight (g)	Present size (mm)	Present weight (g)
Gold Fish	30	25	90	70
Molly	20	10	50	20
Sword Tail	20	10	55	25
Tetra	25	10	40	25
Koi	50	30	90	100
Angel fish	30	10	40	35

Sustainable resource management for climate smart IFS under AICRP on Integrated Farming Systems (NRMAIFRSOL202104000269)

Climate smart integrated farming system model of 0.72 ha has been developed for higher productivity, profitability and resource use efficiency for the marginal farmers of Western Uttar Pradesh. Model comprises Crop (1. Biofortified rice cv. CR Dhan 310, biofortified wheat cv. WB 02 and mustard-green gram, 2. Sweet corn-garlic-vegetable cowpea and 3. Maize + soybean- ryegrass-fodder sorghum) (0.38 ha) + Multi-layer

farming (Turmeric+ green/leafy vegetables (red amaranthus-fenugreek-coriander)+ cucurbits+ papaya) (0.18 ha)+ Agri-horti (papaya + turmeric, banana + turmeic) (0.12 ha)+ Boundary plantation (karonda, guava, napier) (0.02 ha)+ Dairy (1 buffalo + 1 bow) (0.01ha)+ secondary agriculture. Out of total IFS model area, highest area (53%) is being allocated to cropping system module followed by multi-layer farming (25%) and Agri-horti module (17%). Remaining 5% area is allocated for boundary plantation, livestock unit, vermicomposting etc.



Plate 9: Different components of climate smart IFS

IFS model produced 136 t sugarcane equivalent yield from different module such as cropping system (28%), agri-horti (22%), multilayer model (11%), boundary plantation (9%), dairy (30%) and secondary agriculture. IFS model ensured the round the year income generation ranging from ₹ 5,228 to 1,35,396

with surplus production of food items. Model also produced surplus food (cereals, pulses, oilseed, vegetable, fruits and milk) and nutrition to meet out family requirement (4 no.). IFS model supplied sufficient quantity of green fodder (197%) along with dry fodder.

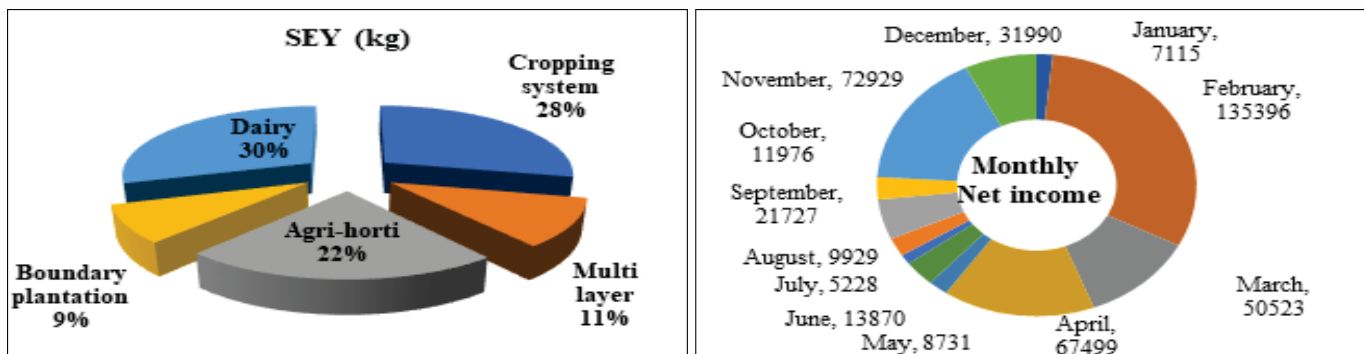


Fig. 8: Production and income from different components of IFS model

Different key performance indicator (KPIs) such as water productivity (₹ 71.7/m²), improvement in soil organic carbon (7.02%), energy input (216515 MJ) and output (490872 MJ), energy efficiency (2.27), employment (473 man-days including 168 male and 315 female), sustainable value index (0.71), sustainable yield index (0.81), Simpson’s diversity index (0.926) and pesticide use (0.06 kg a.i) were also recorded in the IFS model. Through recycling of different crop residues and manure, around 86 kg N, 30 kg P₂O₅ and 140 kg K₂O was recycled within the model. Economics of model was calculated using CACP methodology. Total cost was ₹ 2,44,596 (including family labour), gross return ₹ 4,76,138 and net return ₹ 2,73,178 with B:C ratio of 1.95. Among the different module, cropping system module (37%) contributed highest in net return of IFS model followed by Agri-horti module (30%).

Evaluation and identification of farm implements under different farming systems (Project Code: NRMIIFERSIL201805000256)

Manual harvesting/use of traditional tools leads to musculoskeletal disorders (MSD’s) that result in agony and functional impairment including damage to tendons, tendon sheaths, muscles and nerves of the hands, arms, wrists, elbows, shoulders, neck, back, knee and legs which are produced due to repetitive movements, awkward postures and force applied during work by the farm workers. Excessive muscular and work stress tends to declined fitness results in less productivity and work output.

Designing and evaluation of multipurpose horticultural crops harvesting tool: Ergonomically designed multipurpose horticultural crops harvesting tool developed by ICAR-IIFSR was evaluated amongst users in selected horticultural crops to access its ergonomic comfort (grip fatigue, strain index)

and work output (kg hr⁻¹). The tool was found very effective in terms of improved work output by ~9.0, 10 and 11 percent as compared to conventional method in case of harvesting of bitter gourd, sponge gourd and bottle gourd respectively. A significant reduction in grip fatigue by ~49, 39 and 58% in okra, bottle gourd and sponge gourd harvesting respectively. Significant reduction in strain index was observed by ~ 44.37, 56, 55, 47, 69 per cent in okra, bottle gourd, sponge gourd, bitter gourd and brinjal harvesting.



Plate 10: A women farmer using improved tool for harvesting of ridge gourd

Identification of other problems in vegetable-based farming systems: Some of the problems viz. burning sensation in thumb and index finger, pain at lower back and heat stroke pertaining to harvesting of vegetables in vegetable based large

farming systems has also been identified during picking of chilli and capsicum activity at farmer's field. After harvesting of vegetables, carrying of vegetables as head load is another area of women's drudgery in vegetable-based farming system.



Plate 11 a: Picking of chilli



Plate 11 b: Picking of capsicum

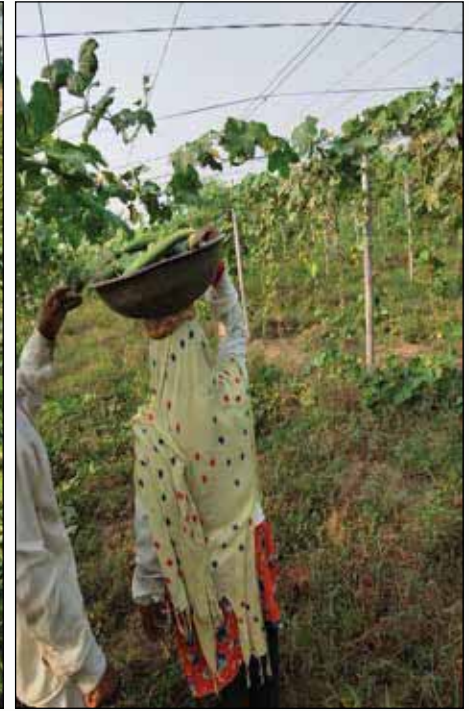


Plate 11 c: Load carrying

Identification of problems in sugarcane-based production system: Sugarcane cultivation is required huge human labour including field operations, seed cane de-trashing, sett preparation etc. (~400 man-days/ha). Sugarcane harvesting process includes de-trashing, de-topping, cutting, lifting and loading of bundles of stalks in the trolley/cart involved high energy expenditure and high risk of muscular stress pertaining to posture, load, movement activity and movement load. Out of total energy expenditure in sugarcane cultivation 25% energy used in planting which is one of the most labour intensive after sugarcane harvesting. Sett cutting is being done by using sickle and is risk prone activity (a risk of amputation of fingers are involved). Sett cutter cum bud chipper is developed by ICAR-IISR, few are also commercially available, but due to its heavy weight, farmers are not using. Keeping this point in view, ICAR-IIFSR has developed a prototype of hand operated improved portable sugarcane bud chipper (needs further refinement for better functionality, improved working efficiency). Further research, pertaining to design development and refinement of

tool/implement in farming system perspective is being planned in collaborative manner.

AICRP on Integrated Farming Systems (On-station National) (Project Code: NRMAIFSRCOL 20214000266)

Under All India Coordinated Research Project (AICRP) on Integrated Farming Systems (IFS) on station experimentation, sustainable resource management for climate smart IFS were implemented (25 main, 2 sub and 5 ICAR institute centers) starting from 2017-18 with revised objectives, across different agro-climatic zones and continued through reporting period of 2022-23. Development of region-specific IFS models at 9 sub centers and carbon crediting and GHG emission estimation and measurement in IFS models (25 main, 11 sub and 5 ICAR institute centers) during the reported period have been undertaken. Mean system production from IFS models in terms of REY was found to be 24.74 t (Fig. 9).

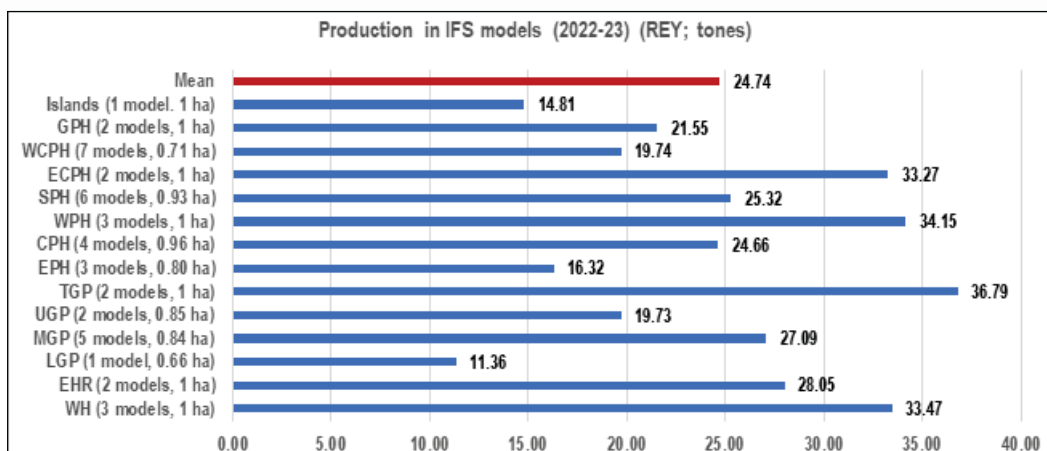


Fig. 9: System productivity (REY in tonnes) from IFS models of different agro-climatic zones

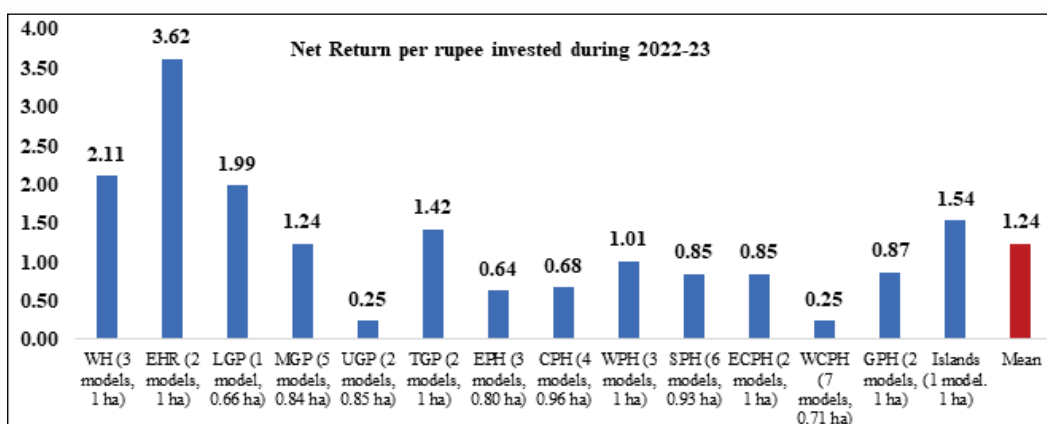


Fig. 10: Mean net return (₹) from IFS models of different agro-climatic zones

Similarly, mean net return per rupee invested from IFS models of different ACZ was found to be 1.24 while it varied from 0.25 in West Coast Plains and Hills (WCPH) and Upper Gangetic Plain (UGP) to 3.62 in Eastern Himalayan Region (EHR) (Fig. 10)

Other key performance indicators like recycling values within IFS models, improvement in soil organic carbon, employment generation (man days) and GHG emissions (estimated through empirical factors based on IPCC Tier II) were recorded for the IFS models and presented as mean of IFS models of different ACZ and presented in Figure 11-14.

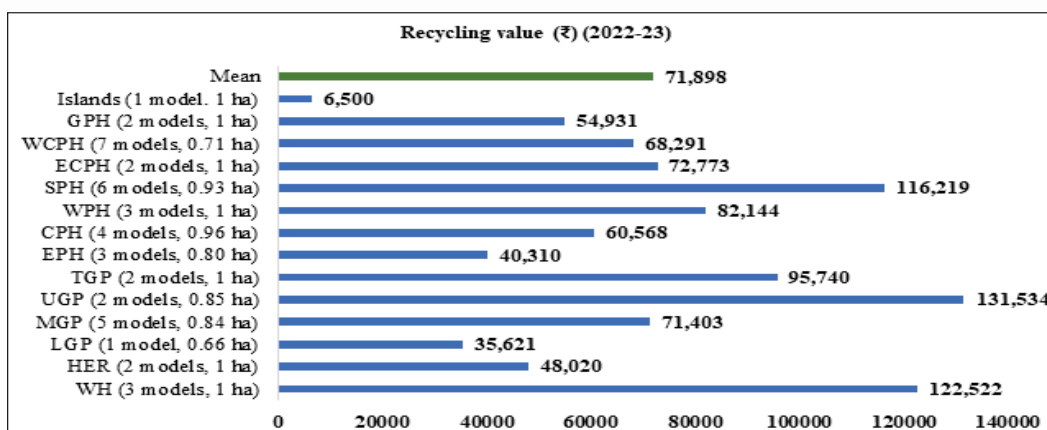


Fig. 11: Mean value of recycling (₹) in IFS models

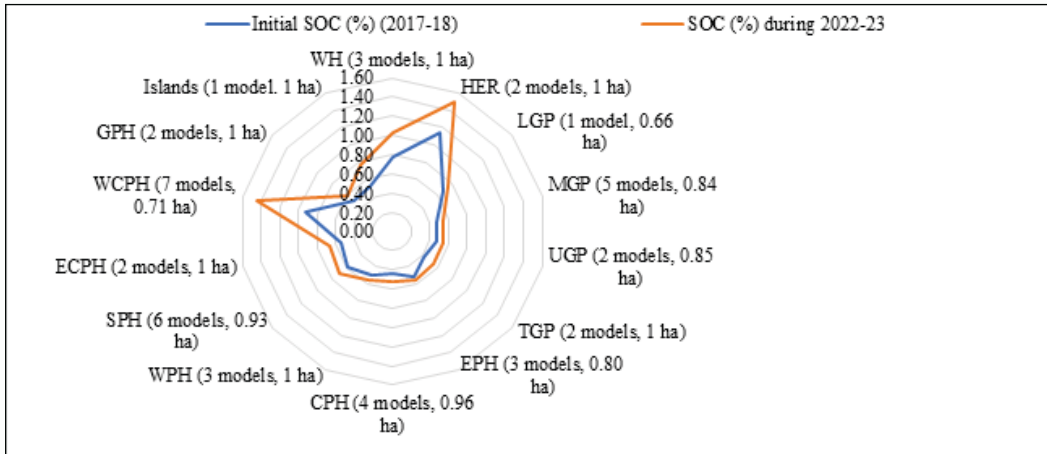


Fig. 12: Improvement in SOC (%)

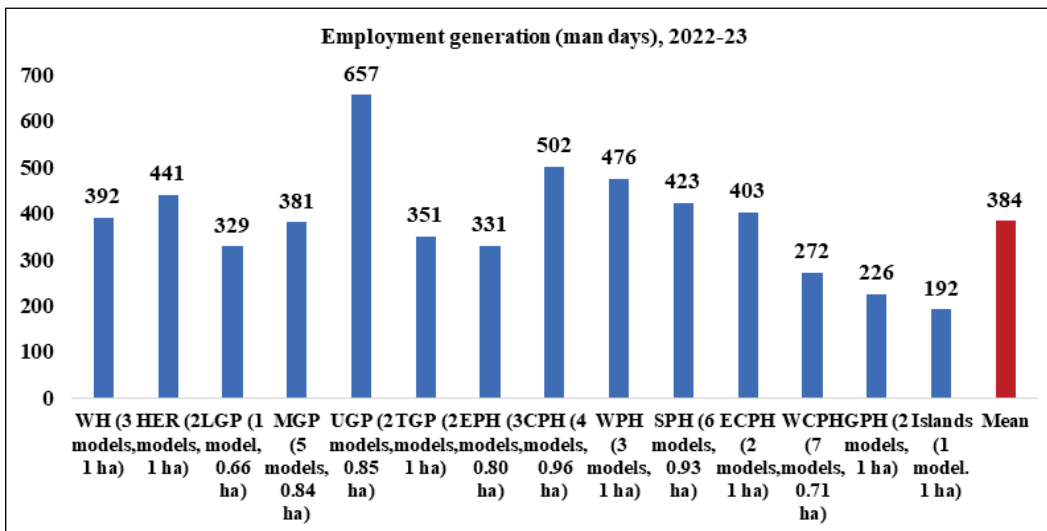


Fig. 13: Employment generation from IFS models

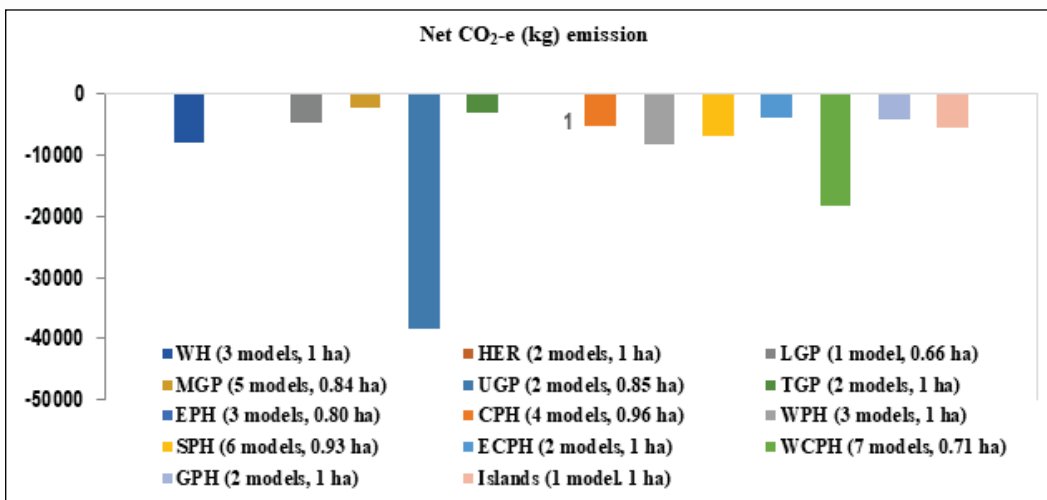


Fig. 14: Net GHG emission from IFS models

The study of climate smart IFS across agroclimatic zones ₹ 6500 in Island to ₹ 1,31,534 in IFS models of UGP (Fig. during 2022-23 depicted that recycling values varied from 11). Improvement in SOC percentage was varied between



6.2 % (EPH) to 55.9 % (WCPH) (Fig. 12). Mean employment generation varied from 192 (Island) to 657 (UGP) man days from IFS models of the ACZ (Fig. 13). In most of the IFS models of different ACZ, the net emission of GHG i.e. source and sink difference as estimated using IPCC Tier II coefficients were found to be negative (Fig. 14) suggesting environmental suitability of these IFS models.

AICRP on Integrated Farming Systems- On-farm research (National) (Project code: NRMAIFSR COL202104000268)

On-Farm crop response to plant nutrients in predominant cropping systems (OFR-1)

Increasing the nutrient use efficiency in major food production systems has always been a major concern because of the escalating costs of production of crops, especially with regard to nutrient management. ‘Researcher-designed farmer-managed trials’ were conducted during 2022-23 through farmer

participatory research covering the major food production systems in India. A total of 336 trials, 48 in rice-rice, 96 in rice-wheat, 48 in rice-mustard, 24 each in soybean-wheat, soybean-chickpea, black gram-sorghum, maize-wheat, 12 in maize-maize and groundnut-sesame were conducted. Across various NARP zones and cropping systems, the farmer’s package resulted in a lower yield compared to the recommended package owing to the lower application of N, P₂O₅, K₂O and micronutrients. On-farm system yield gap between the recommended dose of N, P₂O₅, K₂O+ micronutrients and farmer’s package were found to be higher in rice-rice, rice-wheat, maize-wheat and rice-mustard cropping systems (Fig. 15). Application of micronutrients based on soil tests resulted in additional yield in rice-rice, rice-wheat, maize-wheat, and rice-mustard systems. In all the NARP zones and systems, application of recommended N, P₂O₅, K₂O alone or N, P₂O₅, K₂O + micronutrient resulted in higher yield and use efficiency of nutrients.

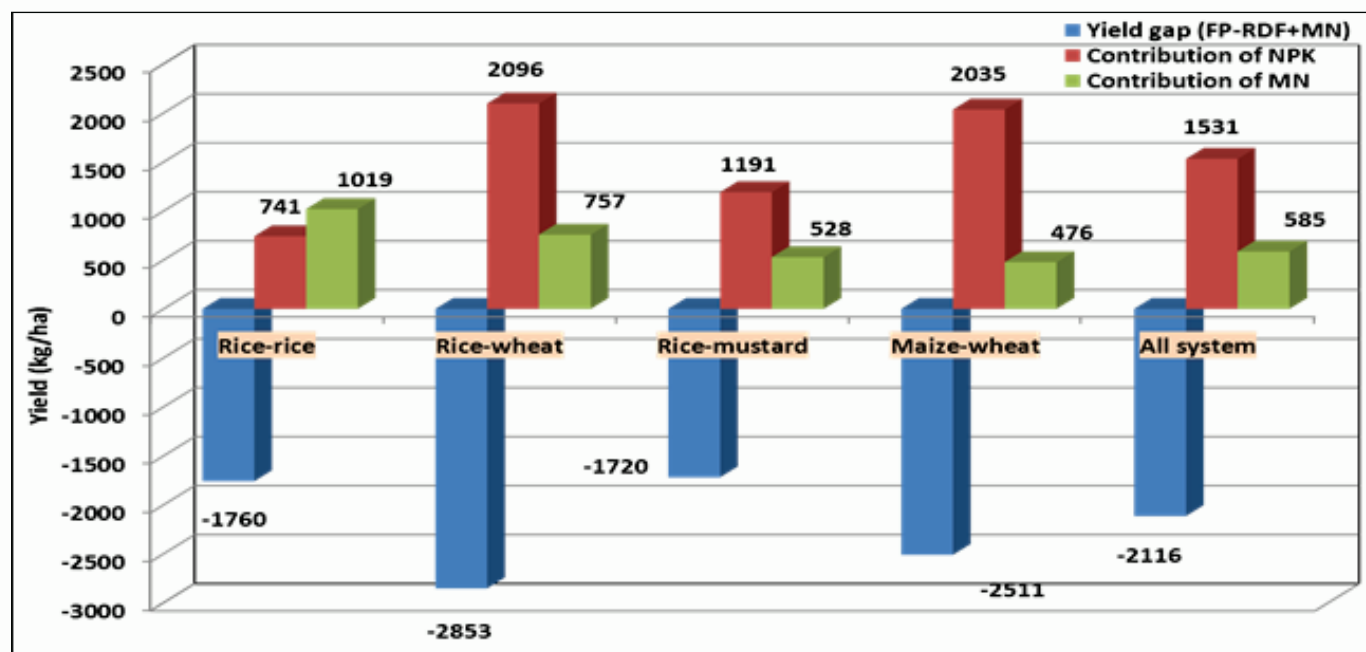


Fig. 15: Yield gap across major cropping system in India

On-farm system yield gap between recommended dose of N, P₂O₅, K₂O and farmer’s package was found to be 741, 2096, 1191 and 2035 in rice-rice, rice-wheat, rice-mustard and maize-wheat which can enhance up to 1760, 2853, 1720 and 2511 kg ha⁻¹ with the application of micronutrients. If we consider all system together then yield gap between recommended dose of N, P₂O₅, K₂O and farmer’s package was found 1531 kg

ha⁻¹, which can enhance up to 2116 kg ha⁻¹ with application of micronutrients. Agronomic efficiency of N can be enhanced to 33, 25, 29 and 19 kg from 8, 10, 9, 10 (grain yield /kg of N) in rice-rice, rice-wheat, rice-mustard and maize-wheat 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 ₹ 8.0, 5.7 and

5.8 per rupee invested on N, P₂O₅ and K₂O, respectively.

Diversification and improvement of existing farming systems under small and marginal household conditions

All OFR center till 2022-23 have been shifted to the new district and benchmark survey is completed. Benchmark survey shows that the existing number of farming system ranging from 1-6. The highest 6 farming system recorded in Bankura (West Bengal), followed by 5 in Rajsamad (Rajasthan) and Golaghat (Assam), Saharasa (Bihar), Alappuzha (Kerala), Mandala (Madhya Pradesh), Jabalpur (Madhya Pradesh), Nanded (Maharashtra) and Solapur (Maharashtra) recorded 4 farming system. It is observed that in hilly and costal area having more number of farming system but in plain area generally crop+dairy and crop+dairy+horticulture are more prevalent.

Model value chain development (MVCD) for Integrated Farming Systems

This is the new method to develop the Integrated Farming Systems in value chain mode. In this approach instead of individual farmers a group or village is targeted and intervention made on pre-production, production and post-production in value chain mode during 2022-23, its being implemented at 7 OFR center and total 2491 households covered which having 3902 ha land. Total 18 trainings were given to the farmers during 2022-23 and through intervention and imparting knowledge through training and recorded 9-27% increase in productivity. Total 27 SHG and 58 JLG created under MVCD and farmers linked with 2 FPO total 1950 farmers enrolled in Dharani and Agro millet FPO (Table 13 and Plate 12).

Table 13: Detail of MVCD activities during 2022-23

District	Farmers involved	Area (ha)	Livestock	SHG/JLG/FPO
Vizianagaram (Andhra Pradesh)	391	154	1528	1+1
Dahod (Gujarat)	300	234	2803	-
Chikkaballapur (Karnatka)	600	1500	Cows-800; Sheep-2100; Goat-500; Poultry (local desi birds)- 5000	Nil
Palghar (Maharashtra)	300	205	1852	5 SHG
Kenduhjar (Orissa)	300	174	2580	Nil
Patiala (Punjab)	300	1485	1232	2 FIG
Salem (Tamil Nadu)	300	150	Poultry 700, Apiary 20 units Vermicompost 20 unit; Fisheries	2 SHG+ 2 JLG 1 FPO (Thiruvalluvar)



Plate 12: Different activities under taken in MVCD

Assessing the role and contribution of integrated farming systems for addressing One Health at household and landscape levels (Project code: NRMIIIFRSIL202111000275)

The project aimed to use the data sets generated at 5 centers of

AICRP on IFS fall under the different agroecosystems such as arid, semi-arid, sub-humid, humid and coastal. In the reporting period protocol for generating MDS for crops, soil, livestock and human was developed and Excel based data format has been developed. Under the Arid Agroecosystem, eight cropping



systems such under soil health, family nutrition, livestock nutrition and income enhancement crop modules have been taken. The results revealed that livestock crop module was found to be more promising with 120.6 q/ha/annum (Fig. 16).

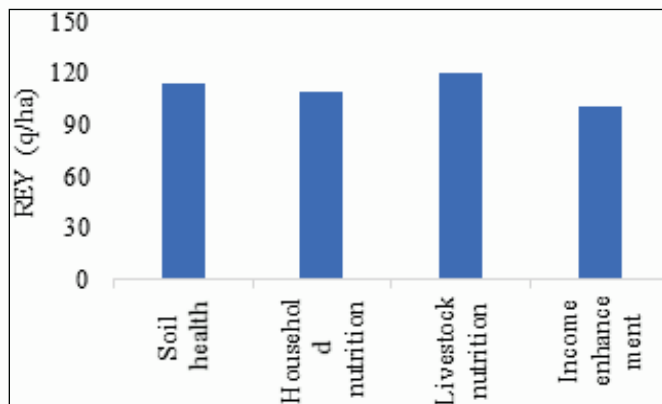


Fig. 16: System productivity under arid ecosystems in various crop modules

Soil organic carbon as an indicator of soil health was found to be highest with the value of 2.83% under Groundnut + wheat – green gram (Fig. 17).

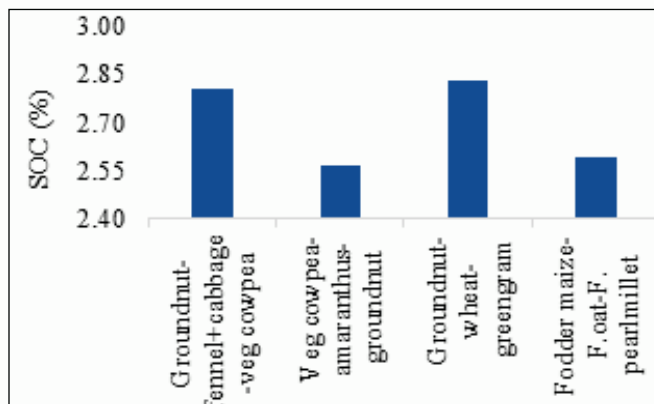


Fig. 17: Soil organic carbon (%) under arid ecosystems in various crop modules

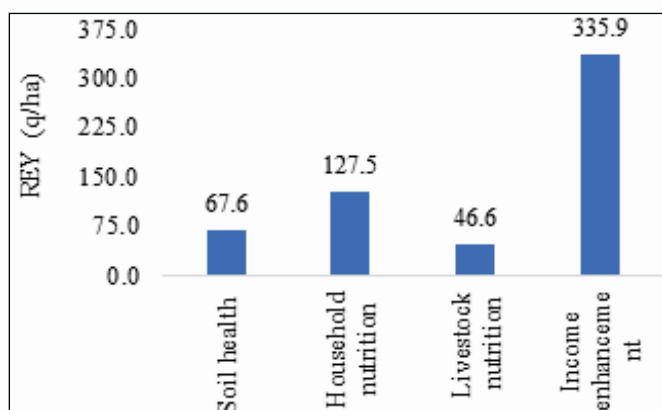


Fig. 18: System productivity under arid ecosystems in various crop modules

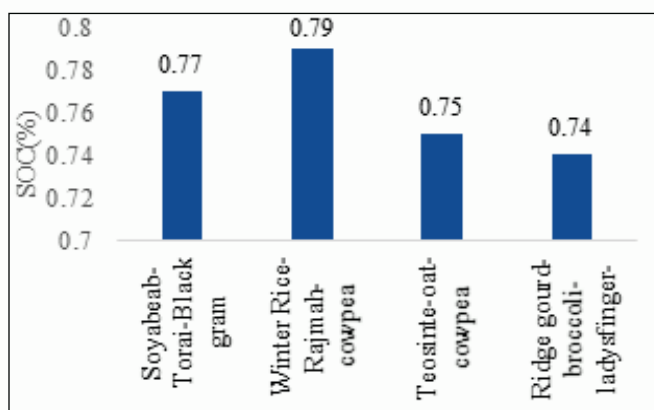


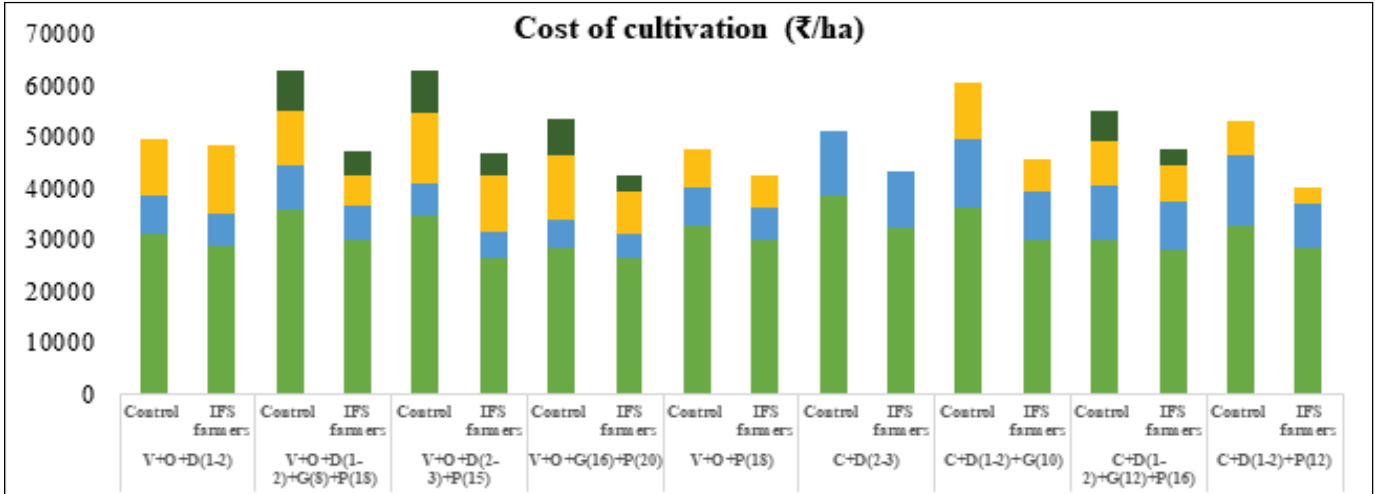
Fig. 19: Soil organic carbon (%) buildup under Humid Agro-ecosystem

Under the humid agroecosystem, out of eight cropping systems, the highest system productivity of 335.9 q/ha/annum was found from income enhancement crop module whereas it was least (46.6 q/ha/annum) registered in the case of livestock nutrition (Fig. 18). Soil organic carbon (%) buildup under humid agroecosystem was recorded in the range of 0.74 to 0.79% and it was highest with winter rice-rajmash-cowpea (Fig. 19).

Scaling and impact assessment of integrated farming system for livelihood of farmers (Project code: NRMAIIFSRCIL202109000277)

The study was undertaken to evaluate the capacity building to upscale the IFS and the impact of IFS on farmers' livelihoods in Kerala, Tamil Nadu, and Telangana. A total of 19 districts

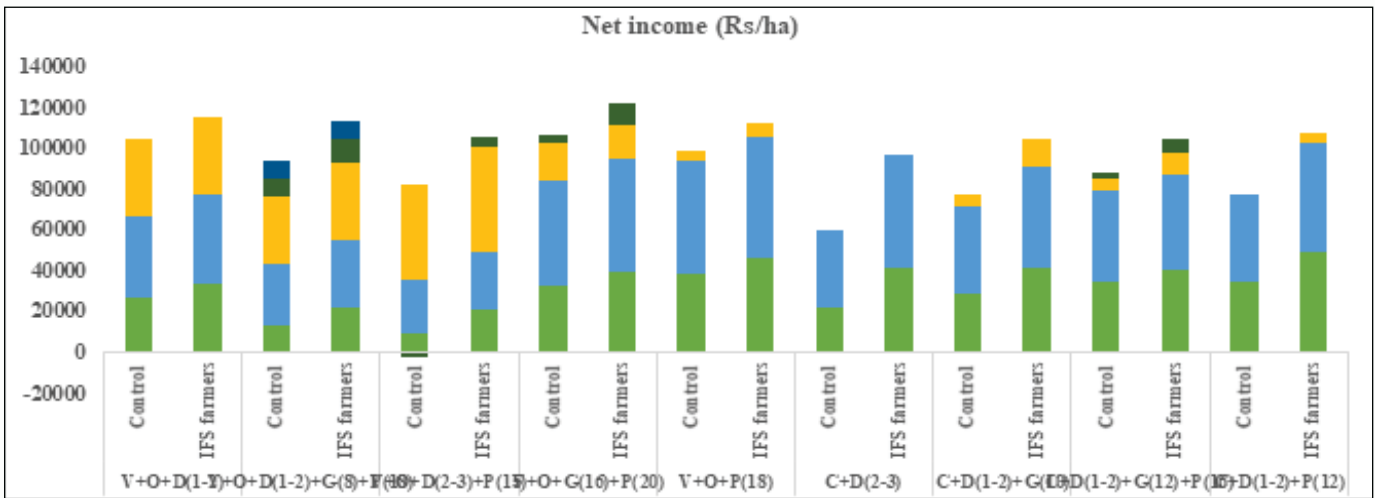
were covered from 3 states and a sample size of 1168 including counterfactuals was taken for analysis. It is clear from Fig. 20 that the cost of cultivation of the different identified farming systems combined in three states. The control group cost of cultivation was found to be higher in V + O + D (2-3) + P (15) and V + O + D (1-2) + G (8) + P (18) farming systems. The average cost of cultivation comparison of the control farmers with IFS beneficiaries indicates that in all the farming systems the cost is lesser for the later one.



* C: Crop, V: Vegetable, O: Orchards, D: Dairy, G: Goat, P: Poultry, S: Sheep: F: Fisheries

Fig. 20: Cost of cultivation of different integrated farming systems for sampled farmers

The net income of the identified IFS models explain that the net income was highest with V+O+G+P systems followed by V+O+D systems in sampled farmers (Fig. 21).



* C: Crop, V: Vegetable, O: Orchards, D: Dairy, G: Goat, P: Poultry, S: Sheep: F: Fisheries

Fig. 21: Net income of different integrated farming systems for sampled farmers

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) (Project code: NRMAIIFSRSL202203000280)

Production and Directorate of Horticulture, Govt. of Odisha and prepared Detailed Project Report (DPR) for 3 Farms namely Nayagarh, Sakhigopal (Plate 13) and Semiliguda Farm which were approved by Govt of Odisha. The project will be concluded this year with submission of DPR for Nildunguri farm.

ICAR- Indian Institute of Farming Systems Research, Modipuram signed MoU with Directorate of Agriculture & Food



Plate 13: Architectural sketch of Sakhigopal Farm by Spire Consultancy based on DPR

CROPPING SYSTEMS AND RESOURCE MANAGEMENT





Evaluation of different cropping systems for crop intensification under conservation agriculture practices (Project code: 080/CI/IFX/NRMAIFRSOL2021505000286)

To assess the impacts of location specific conservation agriculture (CA) based management practices and crop diversification on system productivity, soil sustainability, energy budgeting and energy-economic relationship a field experiment is continuing since 2015. The experiment comprises of eight cropping systems viz., rice-wheat (CP); rice-wheat (CA); rice-wheat-mung bean (CP); rice-wheat-mungbean (CA); maize-mustard-mungbean (CP); maize-mustard-mungbean (CA); sugarcane-ratoon-wheat (CP) and sugarcane+mungbean-ratoon-wheat (CA) under conservation agriculture (CA) and conventional practices (CP).

Crop productivity and profitability

Among the different cropping systems, the direct seeded rice (DSR) recorded 25.9% and 14.8% lower yields over the puddled transplanted rice (PTR), respectively, in rice wheat (R-W) and rice-wheat-mungbean (R-W-GG) cropping systems. Whereas, in same cropping systems, the zero tilled (ZT) wheat recorded 7.8% and 7.1% higher yield over the conventionally tilled (CT) wheat. Interestingly, in CA based maize-mustard-mungbean (M-M-GG) cropping system the zero tillage (ZT) maize and ZT mustard recorded 7.8% and 9.2% higher yield over the CT maize and CT mustard, respectively (Table 14). The sugarcane crop grown under reduced tillage (RT) situations yielded 6.0% lower yield over the conventionally grown sugarcane crop in sugarcane-rice-wheat and sugarcane-mungbean-rice-wheat systems.

Table 14: Crop yields and system productivity in diverse cropping systems with CA based management practices (2022-23)

Cropping systems	Tillage	Yield of different crops (t ha ⁻¹)		SP-SEY (t ha ⁻¹)		
		Kharif	Rabi	Cropping systems	CA	CP
R-W	PTR-CT	5.45	5.01	R-W	55.71	62.20
R-W	ZTDSR-ZT	4.04	5.40	R-W-GG	56.34	66.24
R-W-GG	PTR-CT-CT	5.75	5.39	M-M-GG	74.92	69.50
R-W-GG	ZTDSR-ZT-ZT	4.90	5.77	S-R-W	158.8	166.0
M-M-GG	CT-CT-CT	5.13	2.62	SEm±	1.356	0.959
M-M-GG	ZT-ZT-ZT	5.53	2.86	C.D.	4.154	2.937
S-R-W	CT-CT-CT	135.3	5.04			
S+GG-R-W	RT-ZT-ZT	127.2	5.21			

SP-SEY=System productivity in terms of sugarcane equivalent yield (t ha⁻¹); CT=Conventional tillage; ZT=Zero tillage; PTR=Puddled transplanted rice; RT=Reduced tillage

The yield attributes of sugarcane were also got influenced by the different tillage practices. As compared to RT based practices, the maximum values of millable cane (126.2), cane height (4.71 m), cane weight (1.66 kg), cane girth (23.82) and number

of internodes per cane (17.73) were found in CT practices. However, under reduced tillage practices nearly 8.43% higher sugar recovery was obtained over sugarcane grown under CT practices (Table 15).



Plate 14: (i) Mungbean in zero tilled maize-mustard-mungbean cropping system and (ii) mungbean intercropping under reduced tillage sugarcane

Table 15: Effect of tillage and crop diversification on yield attributes of sugarcane

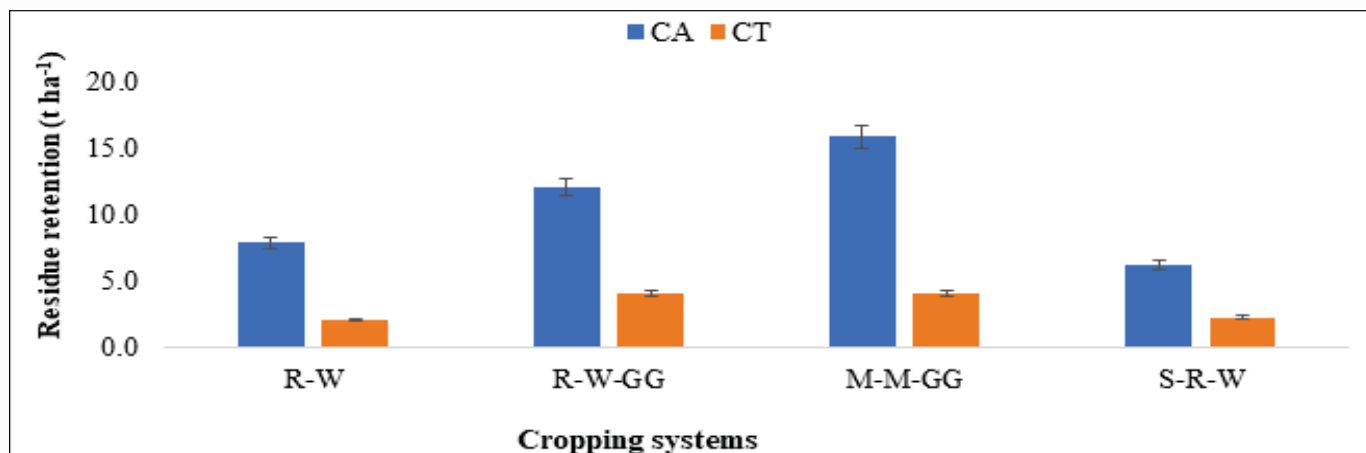
Cropping systems	Tillage	Cane height (m)	Millable cane (1000 ha ⁻¹)	Brix (%)	No. of internodes (per cane)	Girth (mm)	Single cane weight (kg)		
							Cane weight	Stalk weight	Total weight
S-R-W	CT-CT-CT	4.71	126.2	19.20	17.73	23.82	1.43	0.230	1.66
S+GG-R-W	RT-ZT-ZT	4.53	124.1	20.82	17.13	22.99	1.39	0.236	1.63

Note: CT=Conventional tillage; RT=reduced tillage; ZT=zero tillage

Residue retention and resource conservation

In the conservation agricultural (CA) based treatments, 100% residue of rice and mungbean, anchored residues of wheat (25-30%), maize (60-70%), mustard (60-70%) and sugarcane (20-30%) were retained. All the CA treatments-based cropping

systems ensured to retain significantly higher residue retention over the conventional tillage (CT) based treatments (Fig. 22). Among the CA based management practices, 15.9 t ha⁻¹ residue retention was recorded in M-M-GG cropping system followed by R-W-GG (12.23 t ha⁻¹), R-W (7.92 t ha⁻¹) and S-R-W (6.23 t ha⁻¹).



R-W = Rice-wheat; R-W-GG = Rice-wheat-greengram; M-M-GG = Maize-mustard-greengram; S-R-W = Sugarcane-ratoon-wheat; CA=Conservation agriculture; CT= Conventional tillage.

Fig. 22: Residue retention under different crop sequences



Among the different cropping systems adopted in CA and CT based management practices, nearly 18.26% irrigation water was saved in CA based sugarcane+mungbean-ratoon-wheat cropping system over the CT based treatment. CA based management practices coupled with incorporation of mungbean residue in M-M-GG and R-W-GG cropping system recorded 17.90 and 16.50% water saving over the CT based management practices in these cropping systems (Table 16).

Since CT based management practices are labour intensive therefore, adoption of CA based management practices in different cropping systems recorded 31.73% labour saving in M-M-GG cropping system over the CT practices in this cropping system. Similarly, R-W-GG and S-R-W cropping systems under CA based practices recorded 27.53 and 23.24% labour savings over the CT practices in these cropping systems (Table 16).



Plate 15: Zero tillage maize and direct seeded rice

Table 16: Resource saving in terms of irrigation water and labour by conservation agriculture practices in diverse cropping systems

Cropping systems	Irrigation (cm)			Labour (no.)		
	CP	CA	Saving (%)	CP	CA	Saving (%)
R-W	173.1	155.1	10.40	230	163	29.13
R-W-GG	153.5	128.2	16.50	178	129	27.53
M-M-GG	115.1	94.5	17.90	271	185	31.73
Sugarcane-ratoon- wheat	109.5	89.5	18.26	142	109	23.24
Average	137.8	126.5	8.18	205.3	146.5	28.62

R-W=Rice-wheat; R-W-GG=Rice-wheat-mungbean; M-M-GG=Maize-mustard-mungbean

Energy saving is another important aspect of conservation agriculture. The highest fuel saving was recorded in M-M-GG (19.76%) followed by R-W-GG (13.37%), R-W (12.50%) and

S-R-W (11.45%) cropping system in CA system over the CT practices in these cropping systems (Table 17).

Table 17: Resource saving in terms of fuel and energy by conservation agriculture practices in diverse cropping systems

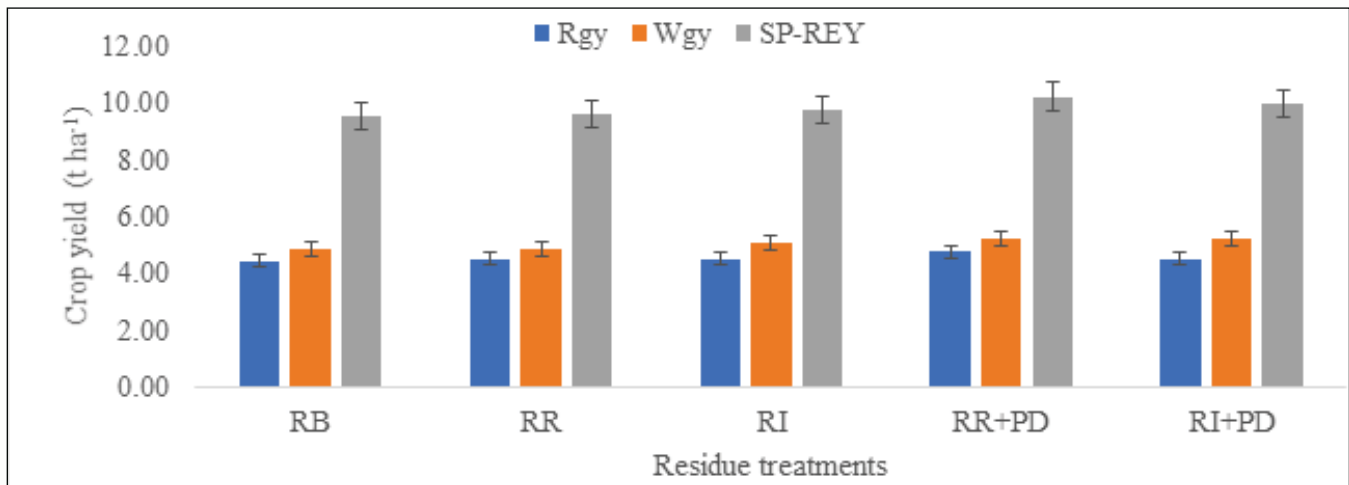
Cropping systems	Diesel (L)			Energy (KMJ)		
	CP	CA	Saving (%)	CP	CA	Saving (%)
R-W	168	147	12.50	200.2	160.9	19.60
R-W-GG	172	149	13.37	224.6	178.6	20.51
M-M-GG	167	134	19.76	204.1	156.2	23.46
Sugarcane-ratoon- wheat	192	170	11.45	137.5	133.2	3.14
Average	174.8	150.0	14.18	191.6	157.2	17.94

R-W=Rice-wheat; R-W-GG=Rice-wheat-mungbean; M-M-GG=Maize-mustard-mungbean

Effect of rice straw retention, incorporation and residue decomposition on productivity, profitability, soil health and environment under rice wheat system (Project code: 080/CI/IFX/NRMAIIFRSOL202104000287)

A field experiment is continuing since 2021 to access the effect of rice straw retention, incorporation and residue decomposition on productivity, profitability, soil health and environment under rice wheat system. The experiment comprised of 5 residue management treatments i.e. rice residue burning (RB); rice

residue retention (RR); rice residue incorporation (RI); rice residue retention + spray of Pusa Decomposer (RR+PD); and rice residue incorporation + spray of Pusa Decomposer (RI + PD). Among the in-situ residue management treatments (RR+PD and RI+PD), incorporation of rice residue along with spray of Pusa decomposer recorded 7.46 and 5.04% higher system productivity as compared to rice residue burning (RB) treatment (Fig. 23). Impact on soil physico-chemical and biological properties at harvest of wheat crop revealed in Table 18.



SP-REY=System productivity in terms of rice equivalent yield (t ha⁻¹); Rgy= Rice grain yield (t ha⁻¹); Wgy= Wheat grain yield (t ha⁻¹)

Fig. 23: Impact of in-situ residue management on crop grain yield and system productivity in terms of REY.

Table 18: Effect of in-situ crop residue management on soil physico-chemical properties

Treatments	BD (Mg m ⁻³)	WHC (%)	pH	EC (mS m ⁻¹)	SOC (g kg ⁻¹)	Avail N (mg kg ⁻¹)	Avail P (mg kg ⁻¹)	Avail K (kg ha ⁻¹)
0-5cm								
RB	1.687	31.88	7.85	340.1	4.597	118.2	20.51	110.7
RR	1.623	35.34	7.93	318.3	5.733	121.0	20.20	115.7
RI	1.616	38.91	7.85	374.1	6.471	128.1	20.41	130.3
RR+PD	1.598	42.05	7.91	306.8	6.799	138.1	24.06	122.6
RI+PD	1.584	43.92	7.95	341.0	6.607	141.0	25.21	184.2
5-15 cm								
RB	1.692	29.38	8.17	283.3	4.286	58.3	50.48	98.1
RR	1.641	32.84	8.22	255.6	4.422	75.4	51.00	100.5
RI	1.625	36.41	8.16	286.7	4.422	98.2	67.71	111.2
RR+PD	1.616	39.55	8.21	263.6	4.422	109.6	53.72	111.0



Treatments	BD (Mg m ⁻³)	WHC (%)	pH	EC (mS m ⁻¹)	SOC (g kg ⁻¹)	Avail N (mg kg ⁻¹)	Avail P (mg kg ⁻¹)	Avail K (kg ha ⁻¹)
RI+PD	1.613	41.42	8.27	274.8	4.495	112.5	38.89	130.8
15-30 cm								
RB	1.713	26.38	8.19	239.1	2.320	86.80	10.28	108.6
RR	1.676	29.84	8.19	208.8	2.184	98.20	12.47	99.0
RI	1.652	33.41	8.20	232.5	2.403	66.85	10.80	104.3
RR+PD	1.635	36.55	8.20	215.3	2.539	75.40	9.44	113.1
RI+PD	1.632	38.42	8.31	251.2	2.403	66.85	11.22	112.2

BD=Bulk density; WHC=Water holding capacity; EC=Electrical conductivity; SOC=Soil organic carbon; RB=Residue burning; RR=Residue retention; RI=Residue incorporation; PD=Pusa decomposer.

Obtained data shows that all the soil physico-chemical properties were significantly higher in the treatments RR+PD and RI+PD as compared to residue burning (RB) treatment (Table 18). In comparison to the RB treatment, all the residue treatments i.e. RR, RI, RR+PD and RI+PD recorded, respectively, 24.7, 40.8, 47.9 and 43.7% higher SOC content in samples collected from 0-5 cm soil depth. Although, among the different treatments, the differences in SOC content in samples collected from 5-15 and 15-30 cm soil depth were not significant. In-situ management of crop residue along with Pusa decomposer spray in RR+PD and RI+PD treatments recorded, respectively, 14.1 and 10.1% higher available nitrogen (N) content as compared to RR and RI treatments in 0-5 cm soil depth samples. Samples taken from 5-15 cm soil depth, similar treatments were found superior for available N content by 45.4 and 14.6% over the sole residue treatments. However, the available P content in samples taken from 0-5 cm soil depth was at par in RB, RR and RI treatments. However, the samples taken from 5-15 and 15-30 cm soil depths revealed to have 34.13 and 21.30% higher available P content respectively, in treatments of RR and RI, over the RB treatment. The available K content was found superior in RR+PD and RI+PD treatments as compared to RR and RI treatments across the soil depths. In 0-5 cm soil depth 6.0 and 41.4% higher available K content was recorded in RR+PD and

RI+PD treatments over the RR and RI treatments, respectively. Similarly, these treatments recorded 10.4 and 17.6%; 14.2 and 7.6% higher available K content in 5-15 cm and 15-30 cm soil depths over the RR and RI treatments, respectively.

Adaptation and mitigation potential through Cropping systems/farming systems approaches (NICRA) (Project code: NRMAIFRSOL20214000288)

The quantum of greenhouse gases emission from rice-wheat system under different crop establishment methods and nutrient treatments was assessed and observed that the direct seeded rice (DSR) method significantly reduced the global warming potential (GWP) as compared to transplanted rice (TPR). Among the different nutrient treatments, the GWP was reduced by 54.0, 32.5 and 67.1%, respectively, in RDF+DCD, organic and NF treatments over the RDF treatment in DSR crop establishment method under high carbon strata situations. The magnitude of reduction under TPR method was found 46.5, 31.2 and 65.5% in same treatments. Under the medium carbon strata situations, the GWP reduced respectively by 52.6, 31.7 and 70.8% in the RDF+DCD, organic and NF treatments as compared to RDF treatments of DSR method (Table 19).

Table 19: Seasonal flux of GHG from the rice under different establishment methods vs different source of nitrogen combinations in 2022-23

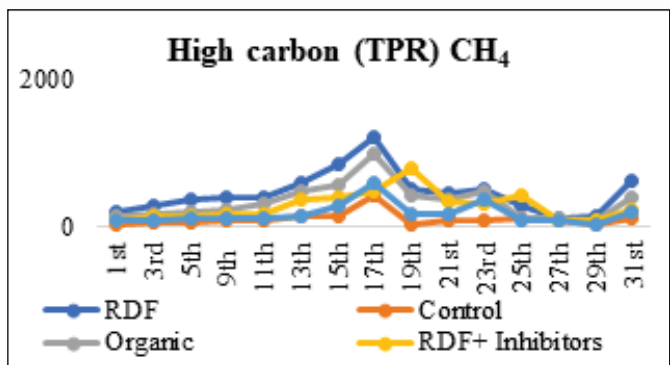
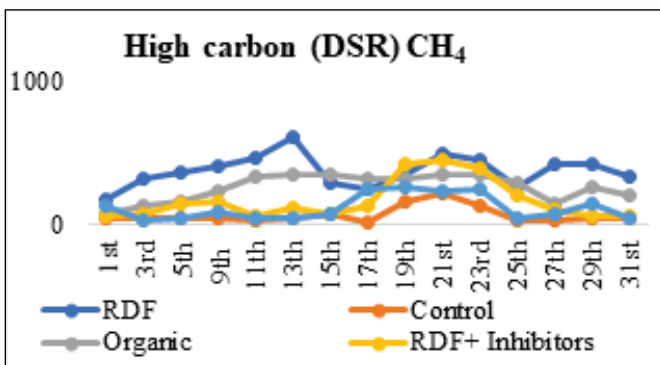
Main plot	Subplot	High carbon			Medium carbon		
		CH ₄ Emission (kg ha ⁻¹)	N ₂ O Emission (kg ha ⁻¹)	GWP (kg Co ₂ -eq/ha ⁻¹)	CH ₄ Emission (kg ha ⁻¹)	N ₂ O Emission (kg ha ⁻¹)	GWP (kg Co ₂ -eq/ha ⁻¹)
DSR	Control	3.36 ± 0.6	0.08 ± 0.02	112.2 ± 3.21	2.85 ±	0.04 ± 0.01	84.2 ± 6.53
	RDF	17.17 ± 1.72	0.17 ± 0.03	479.1 ± 29.1	13.69 ± 1.1	0.22 ± 0.04	415.2 ± 28.3
DSR	RDF+DCD	7.38 ± 0.75	0.11 ± 0.02	220.5 ± 8.1	6.56 ± 0.72	0.10 ± 0.02	196.8 ± 12.8
	Organic	11.02 ± 1.4	0.15 ± 0.03	323.6 ± 19.4	9.03 ± 1.0	0.17 ± 0.03	283.7 ± 19.5
	NF	5.26 ± 0.81	0.08 ± 0.02	157.8 ± 4.14	4.39 ± 0.68	0.04 ± 0.01	121.1 ± 9.41
TPR	Control	4.56 ± 0.72	0.02 ± 0.01	117.3 ±	3.34 ± 0.56	0.03 ± 0.01	92.0 ± 8.23
	RDF	20.69 ± 1.8	0.16 ± 0.03	559.6 ± 36.2	19.03 ± 1.6	0.18 ± 0.03	527.6 ± 32.1
	RDF+DCD	11.17 ± 1.4	0.08 ± 0.02	299.6 ± 12.1	8.42 ± 0.92	0.06 ± 0.02	225.7 ± 16.3
	Organic	14.08 ± 1.6	0.12 ± 0.03	385.2 ± 21.3	13.96 ± 1.1	0.07 ± 0.02	362.6 ± 22.8
	NF	6.89 ± 0.9	0.07 ± 0.02	192.9 ± 6.23	5.68 ± 0.81	0.06 ± 0.02	160.0 ± 11.6

DSR=Direct seeded rice; TPR=Transplanted rice; RDF= Recommended dose of fertilizers; DCD=Dicynadiamide; NF=Natural farming; CH₄= Methane; N₂O= Nitrous oxide; GWP=Global warming potential.

The temporal fluctuation (mg/m²/day) in flux of gasses like methane (CH₄) and nitrous oxide (N₂O) was measured respectively in rice and wheat during their crop cycle (Fig. 24 and 25). The data presented in fig. 24 shows that CH₄ flux fluctuated between 25.6 - 608.1 mg m⁻² day⁻¹ under DSR and 20.8-840.1 mg m⁻² day⁻¹ under transplanted rice in respect of high carbon strata, while it remained between 42.5- 500.5 mg m⁻² day⁻¹ under DSR and 38.4-620.8 mg m⁻² day⁻¹ under transplanted rice in respect of medium carbon strata. The N₂O flux fluctuated between 0.34-7.68 mg m⁻² day⁻¹ under DSR and 0.46-15.93 mg m⁻² day⁻¹ under transplanted rice in respect of

high carbon strata, while it was between 0.48-6.20 mg m⁻² day⁻¹ under DSR and 0.30-8.39 mg m⁻² day⁻¹ under transplanted rice (Fig. 25)

The water-soluble carbon (WSC) has been identified as the most soluble and reactive soil organic carbon and it was significantly higher in all the treatments over the control plots in both the crops establishment methods. However, treatment comprised of organic farming and natural farming recorded respectively 8.8 and 5.2%, 6.1 and 4.0% higher WSC content, respectively, over the recommended dose of fertilizers (RDF) treatments in DSR and TPR crop establishment methods, respectively.



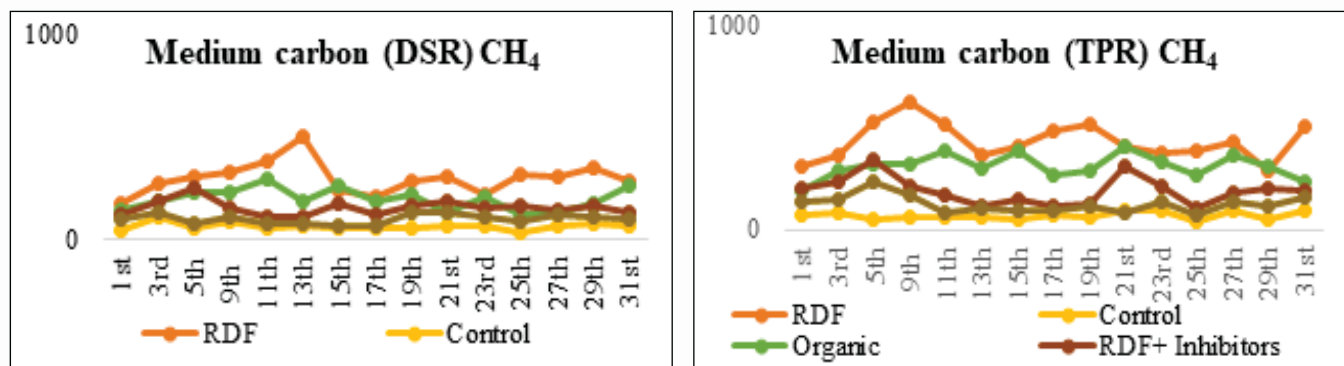


Fig. 24: Temporal variation of CH_4 (rice) flux ($\text{mg m}^{-2} \text{day}^{-1}$) under DSR and TPR establishment methods v/s source of nitrogen with respect to high and medium soil carbon strata

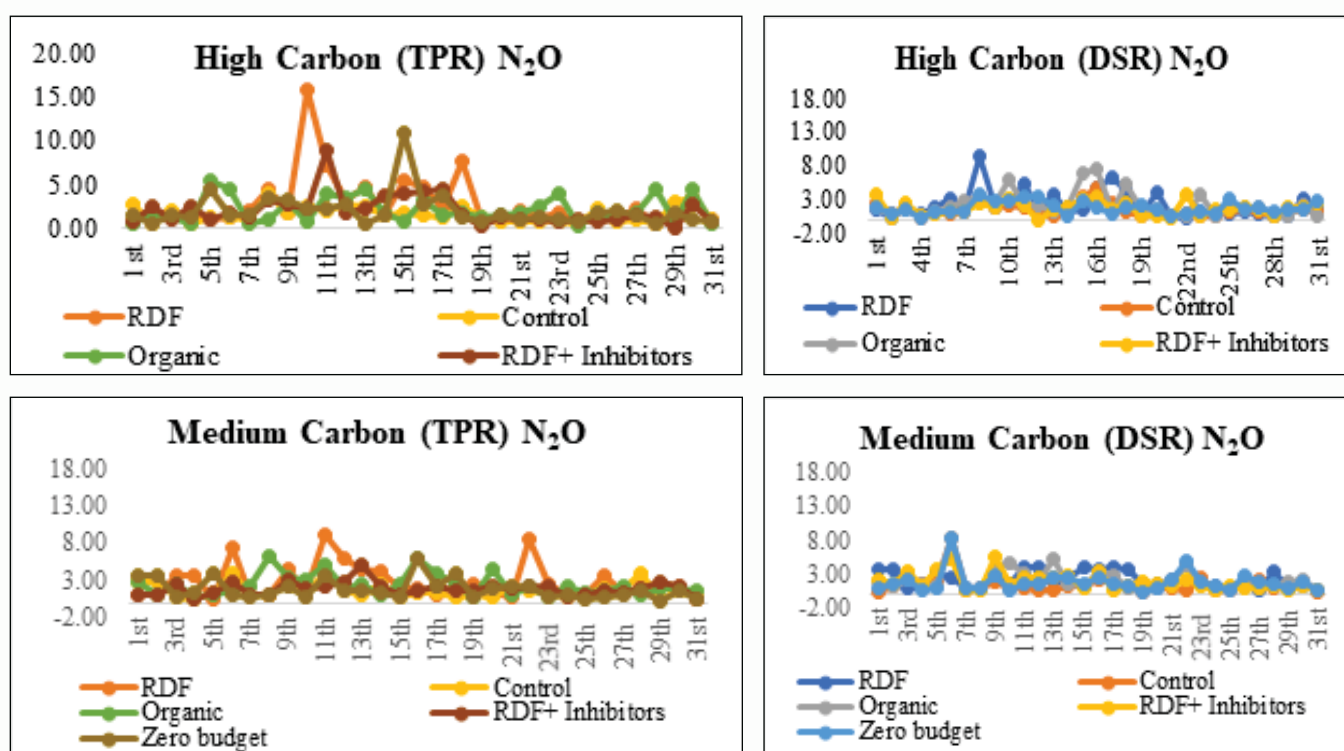


Fig. 25: Temporal variation of N_2O (wheat) flux ($\text{mg m}^{-2} \text{day}^{-1}$) under DSR and TPR establishment methods v/s source of nitrogen with respect to high and medium soil carbon strata.

Development and evaluation of novel Nano matrix intercalated formulations for enhancing nitrogen use efficiency in crops (Project code: 80/S/IPP/NRMAIFRSIL20235000301)

Nano conversion and analysis for nano properties: Two clay materials viz., Fuller's earth, (multani mitti) $[\text{Mg}_5\text{Si}_8\text{O}_{20}(\text{HO})_2(\text{OH}_2)4.4\text{H}_2\text{O}]$ belonging to chemical family, Magnesium aluminium silicate and Alabaster or chalk powder (Khadiya mitti) (CaCO_3) were taken as binder and filler,

respectively to make formulations for sustained and long-lasting release of nitrogen. The above-mentioned clay materials were successfully converted to contain more than 80% of particles to their nano-range size (50-500nm) powders by following frequent grinding and sedimentation techniques. As absorbents of nitrogen the few cellulosic materials and hydro gels were used. Approximately 500 g of nano-range materials of each clay mineral were recovered by processing nearly 1.5 kg of fine powder of respective clays. Obtained nano range materials were analyzed for their general physical observation, particle

size distribution, surface topology, sizes and shapes etc. that the most of the nano scale materials were observed fully suspended in water (Table 20). Fine powders of the prepared samples were found partially suspended and observed static in water but in contrary to

Table 20. General physical observation on samples

Sr. No.	Store number	Marked as	Particulars of samples	Observations in sample
1	M-18323	No-1	Alabaster or chalk powder (Khadiya mitti) [CaCO ₃] powder simple grinded	Partially suspended, static observed
2	M-18324	No-2	Nano-grade Alabaster made in laboratory by frequent grinding and decantation	Partially suspended, static observed
3	M-18325	No-3	Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) ₂ ·4.4H ₂ O] Simple powder made in laboratory by frequent grinding	Suspended only after sonication
4	M-18326	No-4	Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) ₂ ·4.4H ₂ O] Nano powder made in laboratory by frequent grinding and decantation	Suspended only after sonication

Mean diameters of particles of all the products were found approximately in range of 50-1500 nm as per all the distribution curves viz., Intensity weighted, Volume weighted and Number weighted Gaussian Distribution curves. The wide distribution range of the particles is given in Table 21 and also illustrated below in Fig. 26 via Gaussian distribution curves.

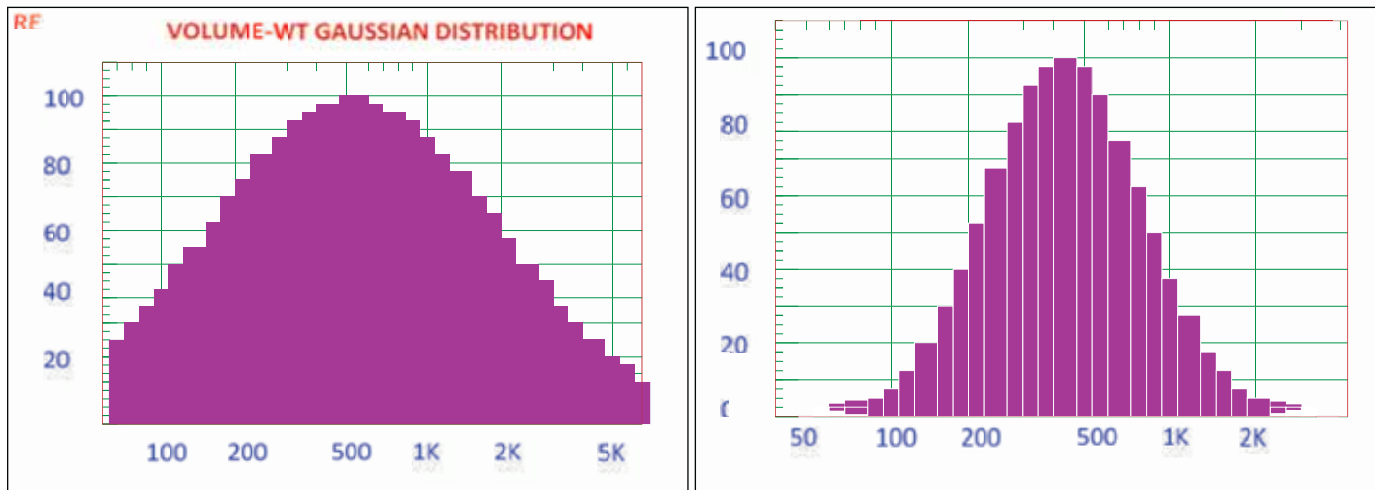


Fig. 26: Gaussian particle distribution curves of clay materials

Table 21: Complete particle size distributions of different clay materials of simple grinding powders and nano materials

Various distribution ranges	Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) ₂ ·4.4H ₂ O] Simple powder made in laboratory by frequent grinding			Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) ₂ ·4.4H ₂ O] Nano powder made in laboratory by frequent grinding and decantation		
	Intensity-Weighted Gaussian Distribution analysis	Volume-Weighted Gaussian Distribution analysis	Number-Weighted Gaussian Distribution analysis	Intensity-Weighted Gaussian Distribution analysis	Volume-Weighted Gaussian Distribution analysis	Number-Weighted Gaussian Distribution analysis
25 % of distribution	< 538.1 nm	< 605.4 nm	< 425.4 nm	< 233.2 nm	< 278.7 nm	< 64.0 nm
50 % of distribution	< 677.7 nm	< 762.5 nm	< 535.7 nm	< 355.7 nm	< 425.3 nm	< 82.8 nm
75 % of distribution	< 853.5 nm	< 960.3 nm	< 674.7 nm	< 542.8 nm	< 649.0 nm	< 114.7 nm



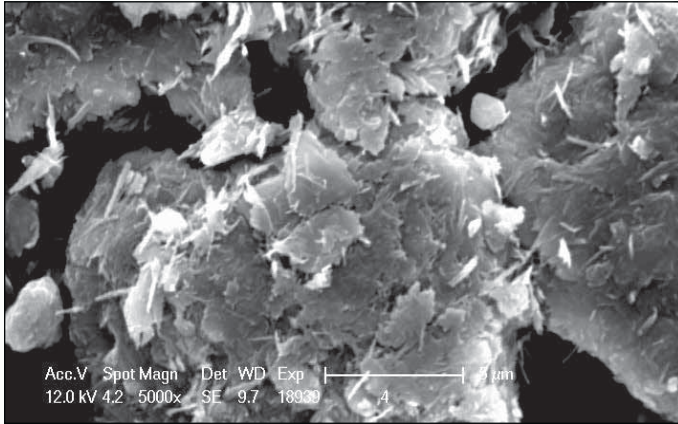
Various distribution ranges	Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) _{2,4} .4H ₂ O] Simple powder made in laboratory by frequent grinding			Fuller's earth (Multani mitti) [Mg ₅ Si ₈ O ₂₀ (HO) ₂ (OH) _{2,4} .4H ₂ O Nano powder made in laboratory by frequent grinding and decantation		
	Intensity-Weighted Gaussian Distribution analysis	Volume-Weighted Gaussian Distribution analysis	Number-Weighted Gaussian Distribution analysis	Intensity-Weighted Gaussian Distribution analysis	Volume-Weighted Gaussian Distribution analysis	Number-Weighted Gaussian Distribution analysis
90 % of distribution	< 1050.4 nm	< 1181.9 nm	< 830.4 nm	< 794.1 nm	< 949.4 nm	< 159.4 nm
99 % of distribution	< 1501.6 nm	< 1689.5 nm	< 1187.0 nm	< 1527.7 nm	< 1823.9 nm	< 291.5 nm
80 % of distribution	< 903.7 nm	< 1016.8 nm	< 714.4 nm	< 602.8 nm	< 720.7 nm	< 125.3 nm
Mean Diameter	718.9 nm	808.8 nm	568.3 nm	432.9 nm	517.9 nm	74.1 nm
Std Deviation	245.9 nm (34.2%)	276.6 nm (34.2%)	194.4 nm (34.2%)	271.5nm (62.7%)	324.7nm (62.7%)	46.5 nm (62.7%)
Coeff. of Var'n	0.342	0.342	0.342	0.627	0.627	0.627
Variance (P.I.)	0.117	0.117	0.117	0.393	0.393	0.393
Chi Squared	27.894	27.894	27.894	11.803	11.803	11.803
Z-Avg. Diff. Coeff.	6.49E-009 cm ² /s	6.49E-009 cm ² /s	6.49E-009 cm ² /s	1.08E-008 cm ² /s	1.08E-008 cm ² /s	1.08E-008 cm ² /s
Various distribution ranges	Alabaster or chalk powder (Khadiya mitti) [CaCO ₃] powder simple grinded.			Nano-grade Alabaster made in laboratory by frequent grinding and decantation (lab-based material further grinded via cryo milling)		
25 % of distribution	< 186.8 nm	< 271.5 nm	< 102.4 nm	< 813.3 nm	< 1012.0 nm	< 524.0 nm
50 % of distribution	< 371.7 nm	< 582.1 nm	< 144.5 nm	< 1114.4 nm	< 1386.7 nm	< 717.9 nm
75 % of distribution	< 799.4 nm	< 1278.9 nm	< 237.9 nm	< 1527.0 nm	< 1900.1 nm	< 983.6 nm
90 % of distribution	< 1617.3 nm	< 2511.6 nm	< 412.5 nm	< 2027.5 nm	< 2522.9 nm	< 1305.9 nm
99 % of distribution	< 4611.5 nm	< 5620.2 nm	< 1222.6 nm	< 3302.6 nm	< 4109.6 nm	< 2127.2 nm
80 % of distribution	< 970.9 nm	< 1549.2 nm	< 274.6 nm	< 1650.9 nm	< 2054.4 nm	< 1063.4 nm
Mean Diameter	670.8 nm	1233.8 nm	80.0 nm	1243.5 nm	1547.3 nm	800.9 nm
Std Deviation	854.0 nm (127.3%)	1570.6 nm (127.3%)	101.8 nm (127.3%)	580.7 nm (46.7%)	722.6 nm (46.7%)	374.0 nm (46.7%)
Coeff. of Var'n	1.273	1.273	1.273	0.467	0.467	0.467
Variance (P.I.)	1.621	1.621	1.621	0.218	0.218	0.218
Chi Squared	65.815	65.815	65.815	4.225	4.225	4.225
Z-Avg. Diff. Coeff.	6.95E-009 cm ² /s	6.95E-009 cm ² /s	6.95E-009 cm ² /s	3.75E-009 cm ² /s	3.75E-009 cm ² /s	3.75E-009 cm ² /s

Analysis for shape (Morphology): SEM (Scanning electron microscopy) and XDR techniques were adopted to observe the number of particles in a specific area under instrumental prob as well as the shape and surface characteristics of the nano clay materials. Compared to coarse particles of fine grinding

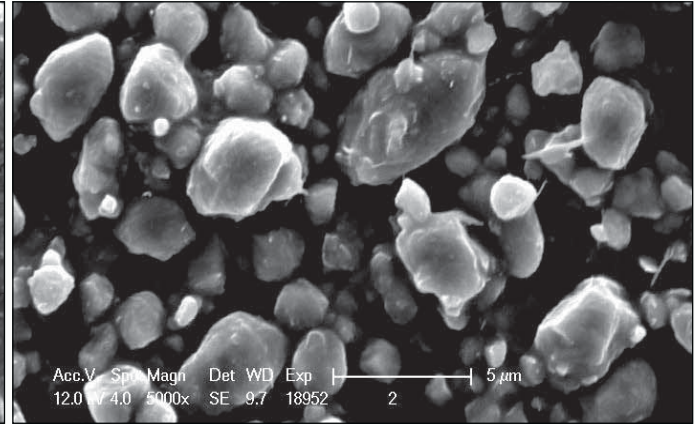
material, more number of particles were found visible in nano structures of nearly 500 nm range on a specific area of SEM image taken at different resolution levels. The Fuller's earth particles taken for this study were observed to have uneven round surface with containing hollow areas and some tendril-

like structures whereas the shape of Alabaster particles was visualized to have round tetrahedral surfaces, however, some

of the particles also visualize to have smooth oval surfaces.



Fuller's earth, (Multani mitti)



Alabaster (Khadia)

Plate 16: Surface chemistry and structure of extracted nano-particles of clay materials

Identification of composition and formulation development: Suitable ratio of different materials viz., nano-clay, alabaster fine powder, various cellulosic materials and hydro gels were identified by taking into consideration of physical barriers expected to impose on product release: kinetic parameters governed by size, shape, and polarity of penetrant and by morphology of diffusion medium. A composite matrix constituted of gel (4.6%), cellulose (2.30%), wood dust (2.76%), nano clay (6.40%), nano-alabaster (15.69), alabaster fine powder (23%) was found suitable to hold the fertilizer materials in ample quantity. The fertilizers viz, urea (21.53%), phosphoric acid (13%) and potassium chloride (10.46%) were impregnated in the composite matrix that was found able to hold N and other plant

nutrients for longer time and allow to release them constantly in the form of several fractions as per plant need by mechanisms of osmotic system and erode of cellulosic materials under the influence of moisture, enzymes and proteins. During this year, the nutrient loaded matrix shaped to 20, 18 and 10 g tablets form to release the nutrients in the close proximity of rhizosphere in case of transplanted vegetables viz., brinjal, tomato, chilli, cauliflower, cabbage, etc. Each one of 20, 18 and 10 g tablet contains 2.01, 1.035, 0.86; 2.35, 1.035, 1.24 & 1.12, 0.575, 0.07 g respectively, N, P₂O₅ and K nutrients. Presently, the tablets are under observation for their release mechanism and efficacy in crops i.e. brinjal, cabbage, broccoli and coloured cauliflower. The manufactured tablets and their release mechanism are presented in plate 17.



Plate 17: Developed tablets and release mechanism



Modeling the effect of nitrogen options under conventional and conservation tillage on growth, yield and nitrogen dynamics in maize and wheat (Project code: NRMAIIFSR/SIL202306000299)

CERES-Maize model, which is embedded in the DSSAT (Decision Support System for Agro-technology Transfer), simulated days to anthesis and physiological stages within 5% of observed values of maize cv. JC 4 and Sujata under conventional and conservation tillage. The simulated leaf area index (LAI) closely aligned with observed data across

treatments, exhibiting an RMSE of 0.49 and nRMSE of 8.11% (Fig. 27). The root mean square error (RMSE) for grain and biomass was 323 (nRMSE 5.83%) and 1119 kg ha⁻¹ (nRMSE 9.21%), respectively. The simulated grain yields of maize generally matched the measured values well in most of the treatments except for N₀ treatments (without nitrogen) in both CT and ZT tillage in which model slightly over-predicted the grain yield. Despite this exception, the model effectively simulated grain and biomass yields with an error margin in a range of 6 to 10 percent.

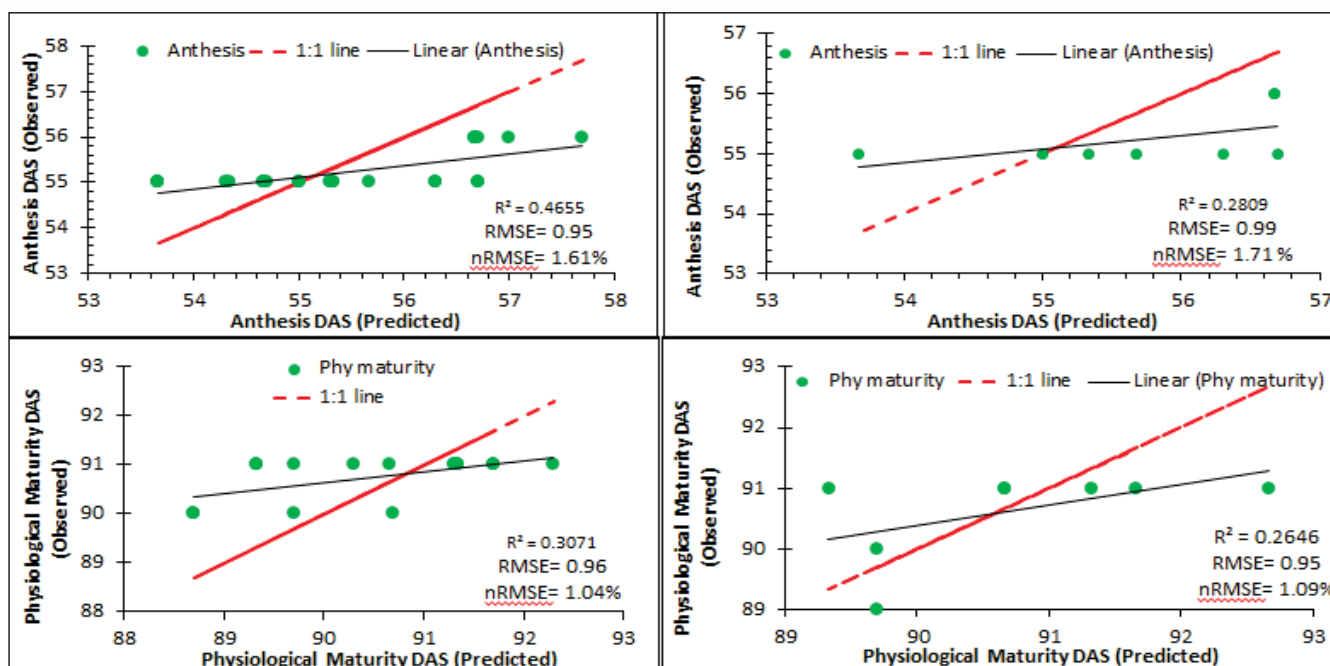


Fig. 27: Simulated and observed anthesis and physiological maturity of Maize (cv. JC 4 and Sujata)

The root mean square error (RMSE) for grain and biomass was 323 and 1119 kg ha⁻¹, respectively. The normalized RMSE (nRMSE) of the measured and simulated grain and biomass yield were 5.83% and 9.21%, respectively (Fig. 28).

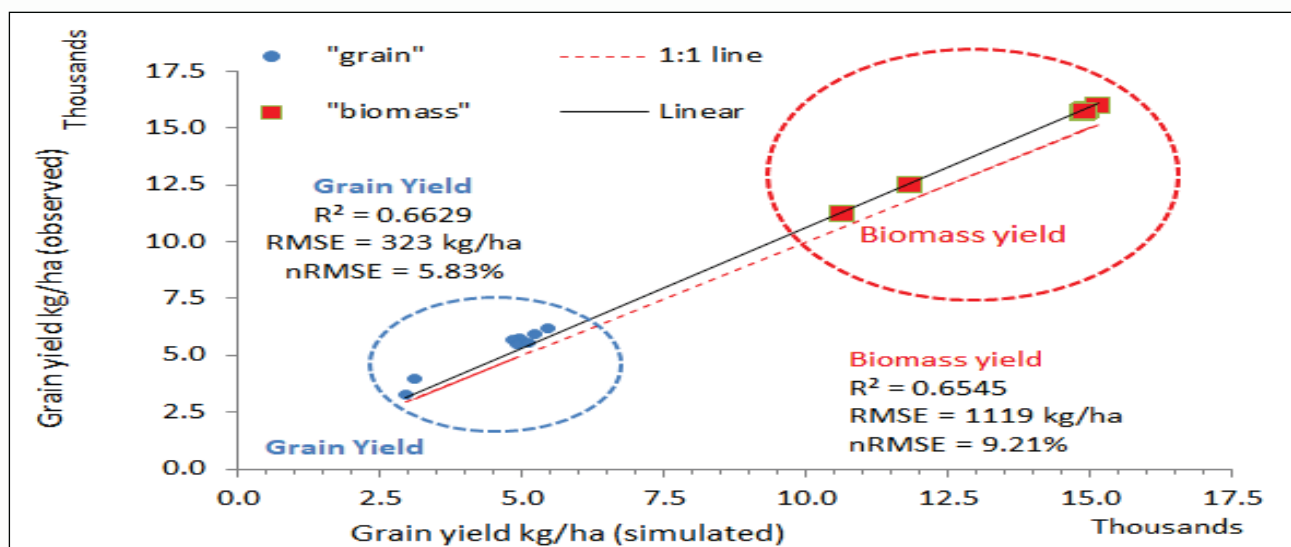


Fig. 28: Simulated and observed grain and biomass yield of Maize (Sujata)

The simulated grain yields of maize generally matched the measured values well in most of the treatments except for N₀ treatments in both CT and ZT tillage in which model slightly over-predicted the grain yield. Despite this exception, the model's performance in predicting grain and biomass yields for most treatments was accurate, highlighting its effectiveness in simulating maize crop productivity. Additionally, the model successfully simulated soil ammonical and nitrate concentrations as well as nitrogen uptake by the crop within an error margin of 4-10%, highlighting its efficacy in predicting various aspects of nitrogen dynamics.

Evaluation of Poly4 application on productivity, quality, soil sustainability of Basmati Rice–Potato Cropping system at Modipuram centre (Project code: NRMAIFSRCL202005000295)

The application of Poly4 has influenced various growth, yield attributes, and overall productivity of both basmati rice and potato under organic management, as detailed in Table 22 and 23. Specifically, for basmati rice, the number of tillers increased by 1.15% to 7.85% across different Poly4 treatments compared to the treatment with 100% recommended dose of nutrients (RDN) applied through organic sources. Similarly, there was

a significant increase in grains per panicle ranging from 0.5% to 13.6% in various Poly4 treatments compared to the 100% RDN applied treatment. The highest recorded grain yield of basmati rice (4250 kg/ha) was achieved under the treatment of 100% RDN through organic sources in combination with 100% recommended dose of K (RDK) through Poly4. This was followed closely by the treatment with 100% RDN through organic sources and 75% RDK through Poly4. In the case of potato, the number of tubers per plant, tuber weight, and tuber diameter, all showed improvements with the application of Poly4 across different treatments. Tuber yield was increased of 2.3% to 6.7% due to Poly4 application in various treatments compared to the 100% RDN through organic sources treatment. The highest tuber yield (167.7 q/ha) was observed under the treatment with 100% RDN through organic sources combined with 100% RDK through Poly4 followed by the treatment with 100% RDN through organic sources and 75% RDK through Poly4. The enhancements in various growth and yield parameters in both basmati rice and potato under different Poly4 treatments can be attributed to the improved availability of potassium (K) and other secondary nutrients for the crops.



Plate 18: Basmati rice under Poly 4 experimentation



Plate 19: Potato crop under Poly 4 experimentation

Table 22: Performance of basmati rice as influenced by Poly4 application under organic production system

Treatment	Tiller/m row length (No.)	Grains/panicle (No.)	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
Control	42.8	34.9	21.5	2532	4278
100% RDN through organic source	52.2	55.8	31.1	3656	6326
100% RDN (Organic) + 100% RDK through poly4	56.3	63.4	34.0	4250	7306



Treatment	Tiller/m row length (No.)	Grains/panicle (No.)	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
100% RDN (Organic) + 75% RDK through poly4	54.8	58.8	31.9	4084	6792
100% RDN (Organic) + 50% RDK through poly4	52.8	57.3	30.8	3894	6580
75% RDN (Organic) + 100% RDK through poly4	51.6	56.1	33.8	3767	6668
75% RDN (Organic) + 75% RDK through poly4	51.1	54.0	28.8	3530	6247
75% RDN (Organic) + 50% RDK through poly4	51.3	53.6	29.5	3625	6018
50% RDN (Organic) + 100% RDK through poly4	47.7	49.4	32.8	3363	6115
50% RDN (Organic) + 75% RDK through poly4	46.3	46.2	29.4	3308	5833
SEm±	0.93	0.89	1.33	75.8	124.8
LSD(P=0.05)	2.77	2.67	3.98	227.0	373.6

Table 23: Performance of Potato as influenced by Poly4 application under organic production system

Treatment	No of tubers/plant	Tuber diameter (mm)	Tuber weight (g)	Tuber yield (q/ha)
Control	9.2	37.7	42.5	123.0
100% RDN through organic source	12.3	47.8	55.5	157.2
100% RDN (Organic) + 100% RDK through poly4	13.5	51.3	59.3	167.7
100% RDN (Organic) + 75% RDK through poly4	12.5	49.6	56.9	165.0
100% RDN (Organic) + 50% RDK through poly4	12.0	48.4	56.7	160.8
75% RDN (Organic) + 100% RDK through poly4	13.1	48.7	56.6	160.9
75% RDN (Organic) + 75% RDK through poly4	11.9	47.2	53.2	154.8
75% RDN (Organic) + 50% RDK through poly4	11.5	46.9	52.1	142.5
50% RDN (Organic) + 100% RDK through poly4	12.9	44.8	48.9	131.6
50% RDN (Organic) + 75% RDK through poly4	11.2	43.3	48.0	129.2
SEm±	0.12	0.56	0.94	1.84
LSD(P=0.05)	0.358	1.69	2.81	5.52

Development of an intelligent model for predicting mango yields using Artificial Neural Networks (ANN) (Project code: NRMAIFSRIL202008000285)

IT (Information Technology), especially Mobile Technology using Artificial Intelligence can help an average Indian farmer to get information regarding forecasting and to predict the weather, crop production, etc., in a timely and precise manner. In this project, efforts are being made to develop a mobile application that will assist mango crop growers as well as researchers

exhaustively in the selection of Mango variety, planting schedule, disease, pest, weed, weather information, yield forecast (based on the ANN model), soil testing labs, and prevailing Govt schemes related to mango farming and contacts to ICAR-IIFSR Kisan Helpline, etc. The application is being developed by using the Android Studio platform, Java language, XML, and SQLite database. The neural network (Back-propagation algorithm) is being used to create a feature of yield prediction network that can contain three layers of neurons: an input layer, a hidden layer (which is optional), and an output layer.

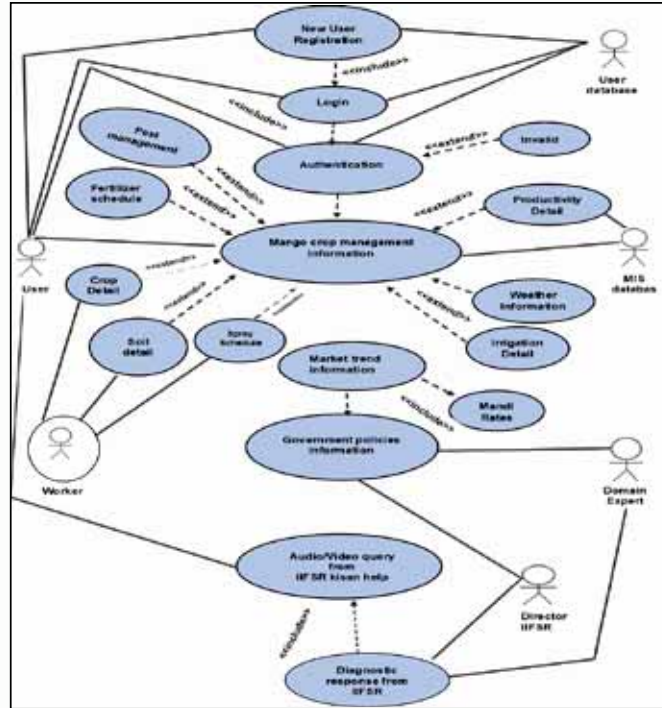


Fig. 29: Snap shot of developed Farm Mango Mobile App

A multi-facet Android mobile app has been developed in-house. This is an application of emerging smart farming technology tools in agriculture. This mAgriculture application is intended to assist farmers with system management / crop management in horticulture crops.

It features detailed information about ICAR-IIFSR, streamlined user registration processes and pricing data from state/district bazars (Mandis). Additionally, it offers links to pertinent websites of agricultural agencies and a direct connection to the ICAR-IIFSR Kisan Helpline for convenient support.

Comprehensive resources on mango varieties, optimal planting schedules, disease, and pest identification/management, weed control strategies and weather information complement the app's offerings. Notably, efforts are being made to integrate a predictive yield forecast component in this app, likely powered by ANN, machine learning or statistical models. Data regarding soil testing laboratories and relevant government schemes further empower users. To ensure accessibility for its target audience, the majority of this information is presented in the Hindi language.



Plate 20: Use case diagram of ICAR-IIFSR Farm Mango Mobile App.



Identification of climate resilient production system for different ecology (Project code: NRMIIIFRSIL202005000274)

Using the data of 12 years of field experimentation on growing 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' E 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

with 2906.0 mm annual rainfall which is received normally in 84 rainy days.

The evaluation of production systems in terms of grain yield of kharif rice was performed using the long-term rainfall data (1985 to 2016). To find out the climatic normal, 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 $\pm 20.0\%$ 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 24).

Table 24: Rainfall status of the crop seasons over the years (2004-2016)

Year	Crop Seasonal rainfall	% 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 grain yield was calculated. Climate resilient production systems were identified by working out % gain (+/-) in yield over inorganic management during normal, high and deficit rainfall years. However, under high rainfall situation, maize with integrated crop management practices registered significantly higher grain (8.0%) over inorganic production

system. Organic production system could not register any significant yield gain over inorganic production system. In case of deficit rainfall year, integrated crop management production system was able to sustain the grain yield at par with inorganic management, but grain yield was drastically reduced under organic production system (-31.0%) (Fig. 30)

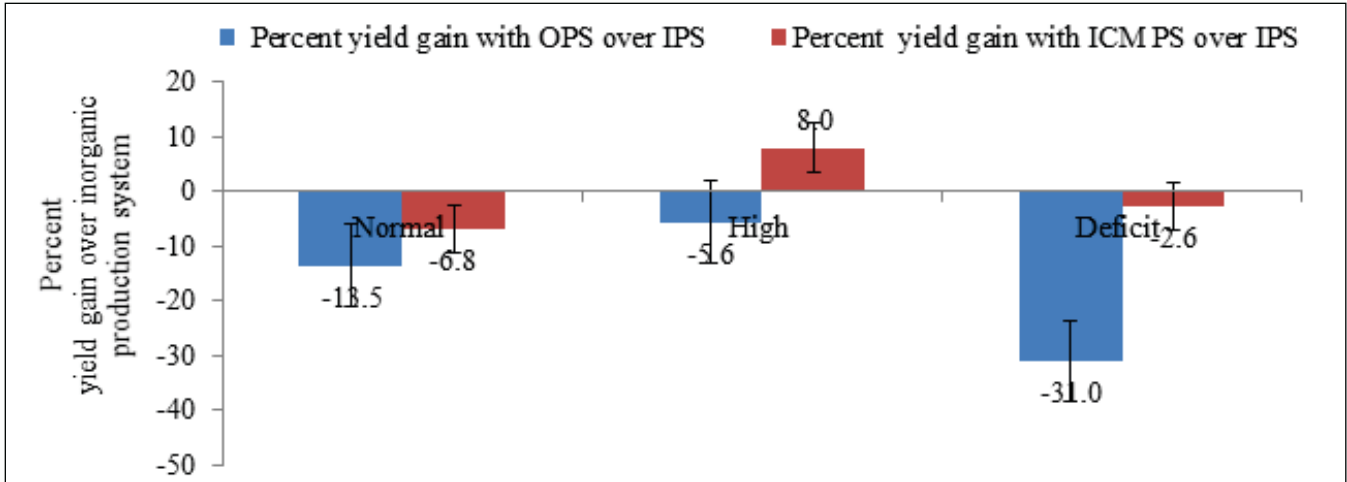


Fig. 30: Comparative study of percent yield gain with organic production system (OPS) and integrated crop management production systems (ICM PS) over inorganic production system for grain yield of maize at Karjat, Maharashtra

Study on effect of rainfall situations during crop season on the grain yield of maize in a particular production system revealed no significant effect of annual rainfall amount under organic production system. Under deficit rainfall condition, integrated crop management production system yielded higher grain yield (3754 kg/ha) compared to higher and normal rainfall year. However, the yield under higher rainfall year in integrated crop management production system was at par with the yield

registered under normal rainfall year. Inorganic production system registered grain yield (3854 kg/ha) of maize under deficit rainfall year which was significantly higher over yield under high and normal rainfall year in the same production management. Organic production system was found to be ineffective in giving significant difference in the yield of maize under normal, deficit and high rainfall year (Fig. 31).

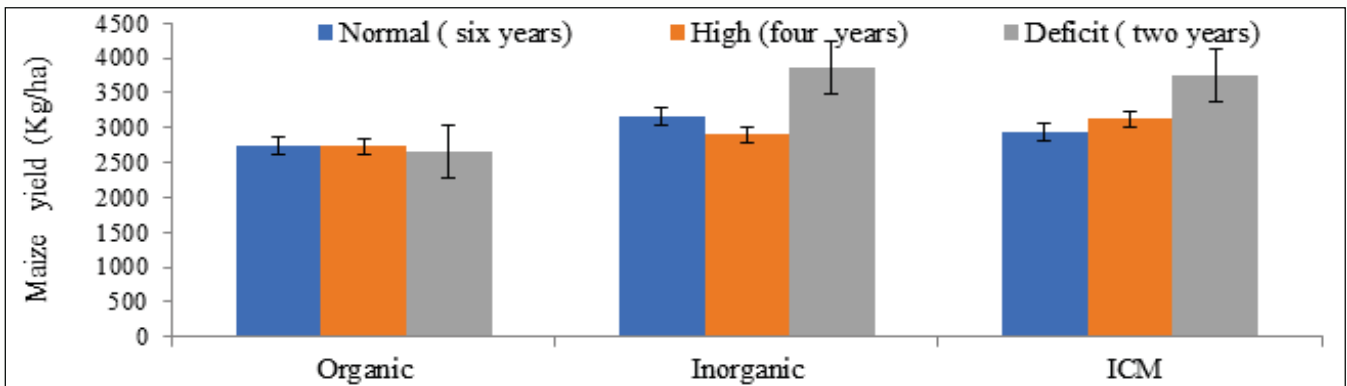


Fig. 31: Effect of rainfall situations during crop season on the grain yield of maize in a particular production system at Karjat, Maharashtra

Mustard after rice cultivated under organic production systems registered significantly higher grain yield (+85.3%) over inorganic production system whereas integrated crop management gained 148.4% significantly higher grain yield

over inorganic production system. Under the situation of deficit and high rainfall year, none of the organic and integrated crop management production system registered any significant gain over inorganic production system (Fig. 32).

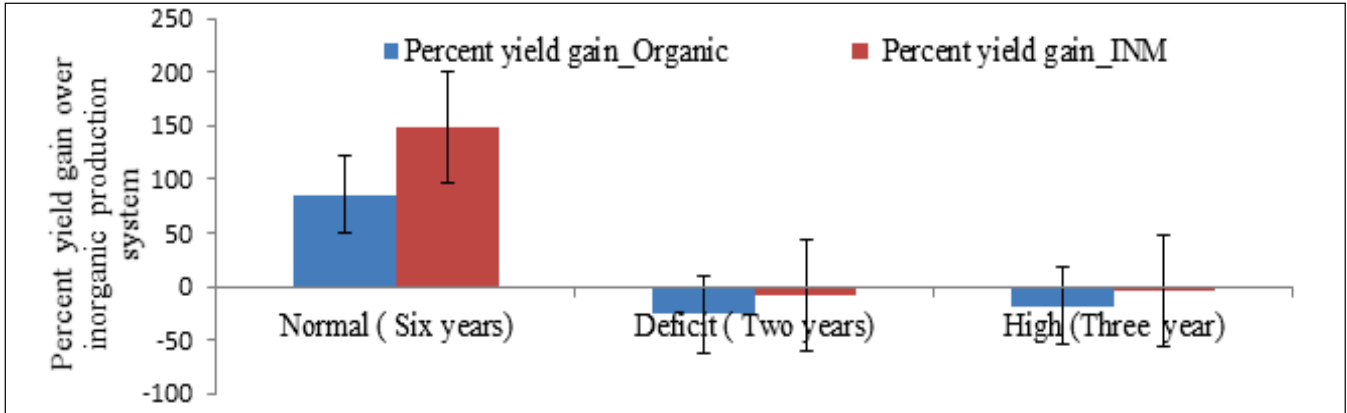


Fig. 32: Comparative study of percent yield gain with organic production system (OPS) and integrated crop management production systems (ICM PS) over inorganic production system for grain yield of mustard at Karjat, Maharashtra

Study on effect of rainfall situations during crop season on the grain yield of mustard in a particular production system revealed significant effect of annual rainfall amount on organic (1563 kg/

ha) and integrated crop management production system (2096 kg/ha). However, on inorganic production system, no significant effect on grain yield was recorded (Fig. 33).

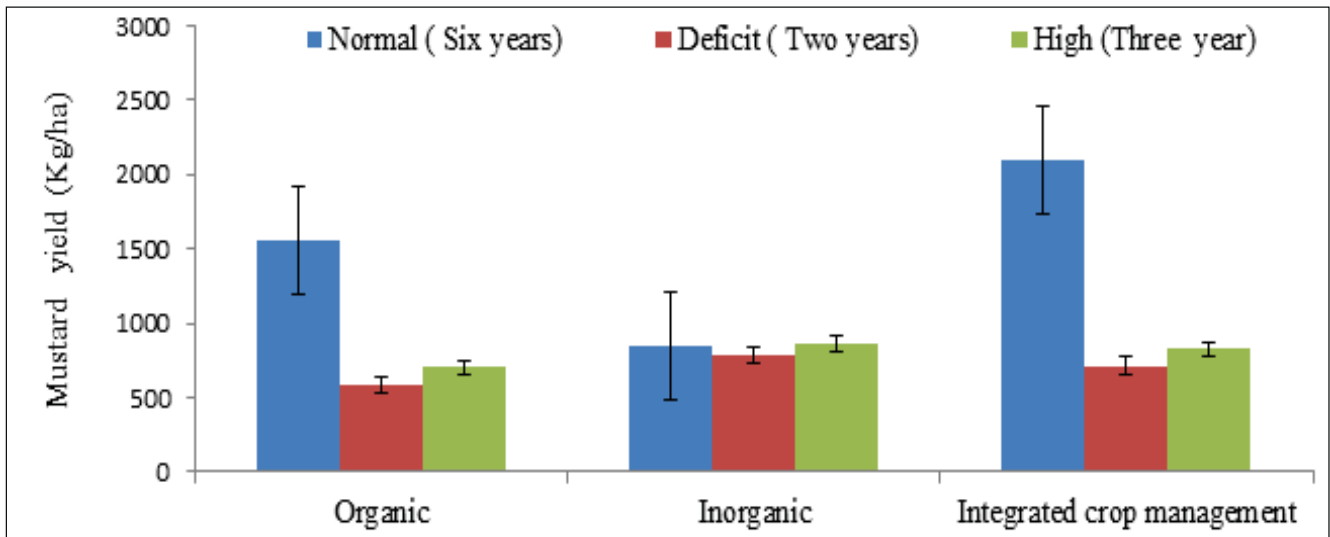


Fig. 33: Effect of rainfall situations during crop season on the grain yield of mustard in a particular production system at Karjat, Maharashtra.

Dolichos bean after rice cultivated under organic and integrated crop management production systems registered significantly higher grain yield of 17.4% and 16.2% over inorganic production system under deficit rainfall year, whereas no

significant difference in the yield was recorded between these two production systems. No significant gain or loss in the yield was recorded under this production system in normal as well as high rainfall situation (Fig. 34).

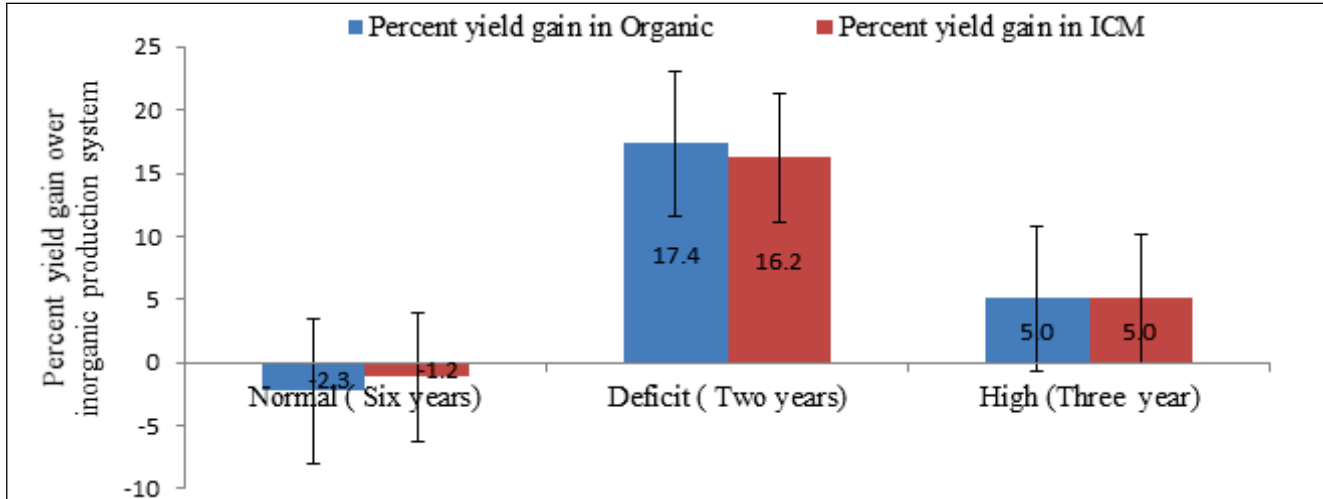


Fig. 34: Comparative study of percent yield gain with organic production system (OPS) and integrated crop management production systems (ICM PS) over inorganic production system for Dolichos bean at Karjat, Maharashtra

Study on effect of rainfall situations during crop season on the grain yield of Dolichos bean in a particular production system revealed significant effect of annual rainfall amount on inorganic (3426 kg/ha) in deficit rainfall year. However, no significant effect on yield was recorded under inorganic production system during

high and deficit rainfall year. Under the scenarios of organic and integrated crop management practices, no significant yield variations were recorded due to different rainfall scenarios. (Fig. 35).

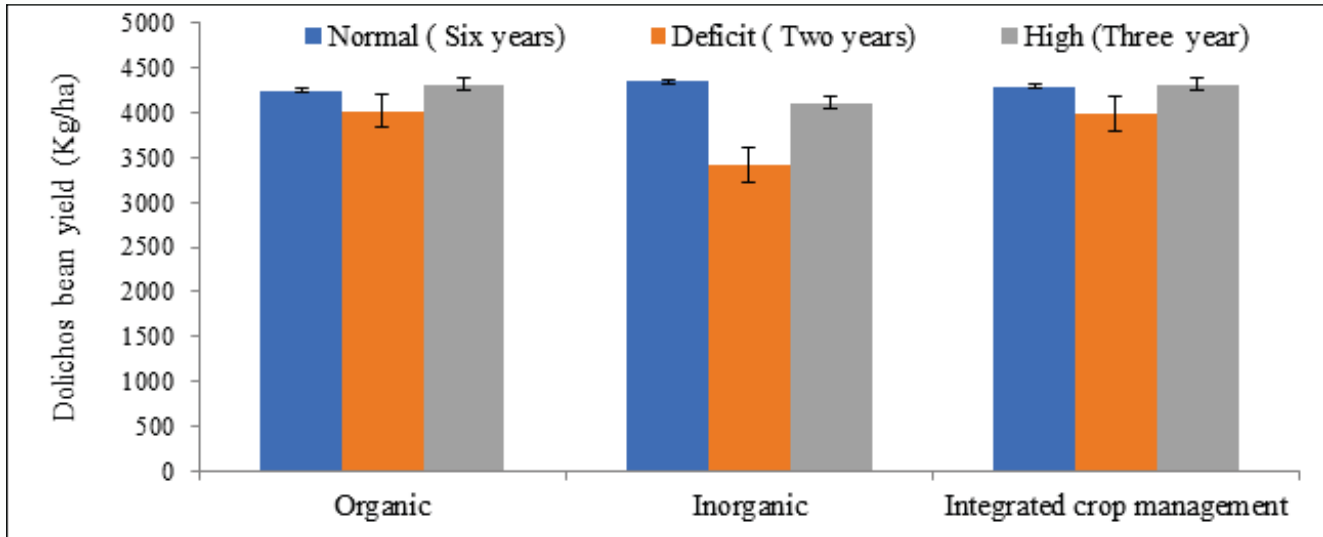


Fig. 35: Effect of rainfall situations during crop season on the grain yield of Dolichos bean in a particular production system at Karjat, Maharashtra.

Updating of cropping system atlas of India and preparation of futuristic crop plan for 2030 (Project code: NRMAIIFSRCIL201910000273)

Cropping system Atlas developed by Yadav and Rao in 2001 working in PDFSR, presently ICAR-IIFSR. At that time, it has

been estimated that more than 250 double cropping systems, 30 major cropping systems were spread throughout the country. In the last two decades lot of changes have occurred due to government policies, depletion in natural resources, research activities, extension activities, extensions of land improvement programme, increases in purchasing power and food habits.



This has shown impact on cropping systems being adopted by the farmers over the years. Apart from this now government emphasizes crop diversification at large scale. This necessitates to know the present status of cropping system being followed by the farmers in different farming scenario of the country. Such changes are required to be captured using suitable scientific methods. Therefore, the project entitled “Updating of Cropping System Atlas of India and Preparation of Futuristic Crop Plan for 2030, 2040, and 2050” was formulated with the following objectives:

- i. To update the cropping system Atlas as per current scenario
- ii. To identify the changes in cropping systems between 2000-01 to 2019-2020
- iii. 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

Primary data was collected with the help of 74 centres of AICRP on Integrated Farming Systems and through Krishi Vigyan Kendras (KVKs) while the secondary data was obtained through the Area, Production and Yield (APY) statistics site of the Department of Agriculture and Farmers Welfare. The following procedure was adopted for collecting the data:

- The AICRP-IFS network centres and KVKs were requested to collect information on area under each crop during kharif, rabi and summer seasons. Thereafter, a sample survey was undertaken. For this purpose, 36 farmers, representatives of the region from the selected districts were interviewed on a simple questionnaire developed for this purpose. From this exercise, the data on total cultivated area of each

farmer, area devoted to different crops during kharif and then partitioning the area of each kharif crops to different rabi crops were done for planning of future agriculture.

- The total area cultivated by 36 farmers who were interviewed during survey and the area under different crop rotations were pooled. These figures were extrapolated to district level in the region to calculate area under different crop rotations in the districts.
- A master database was developed for each state on different cropping systems (First major, Second major and Third major cropping systems in order of area coverage). The secondary data collected by Department of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India, were utilized to verify the area under different crops. Based on this database, and the verification, the total area occupied by individual cropping systems in the country has been calculated for all the systems.
- First and Second major cropping systems (in terms of area coverage) maps of the country and of each state were developed using GIS. Cropping system maps for each agro-climatic zone and agroecological regions were also created. It is clarified that maps are not to the scale and represent cropping systems only.

The Cropping System Atlas was updated successfully and it has been published (Fig. 36) the Futuristic crop plan (Agroclimatic zone crop plan, Agroecological region crop plan, State and District crop plan) were prepared for 14 crops viz. rice, wheat, maize, sorghum, pearl millet, pigeon pea, chickpea, mustard groundnut, soybean, cotton, sugarcane, potato and onion. Futuristic crop plan map has also developed for all the season crops grown viz Kharif, Autum, Rabi and Summer.

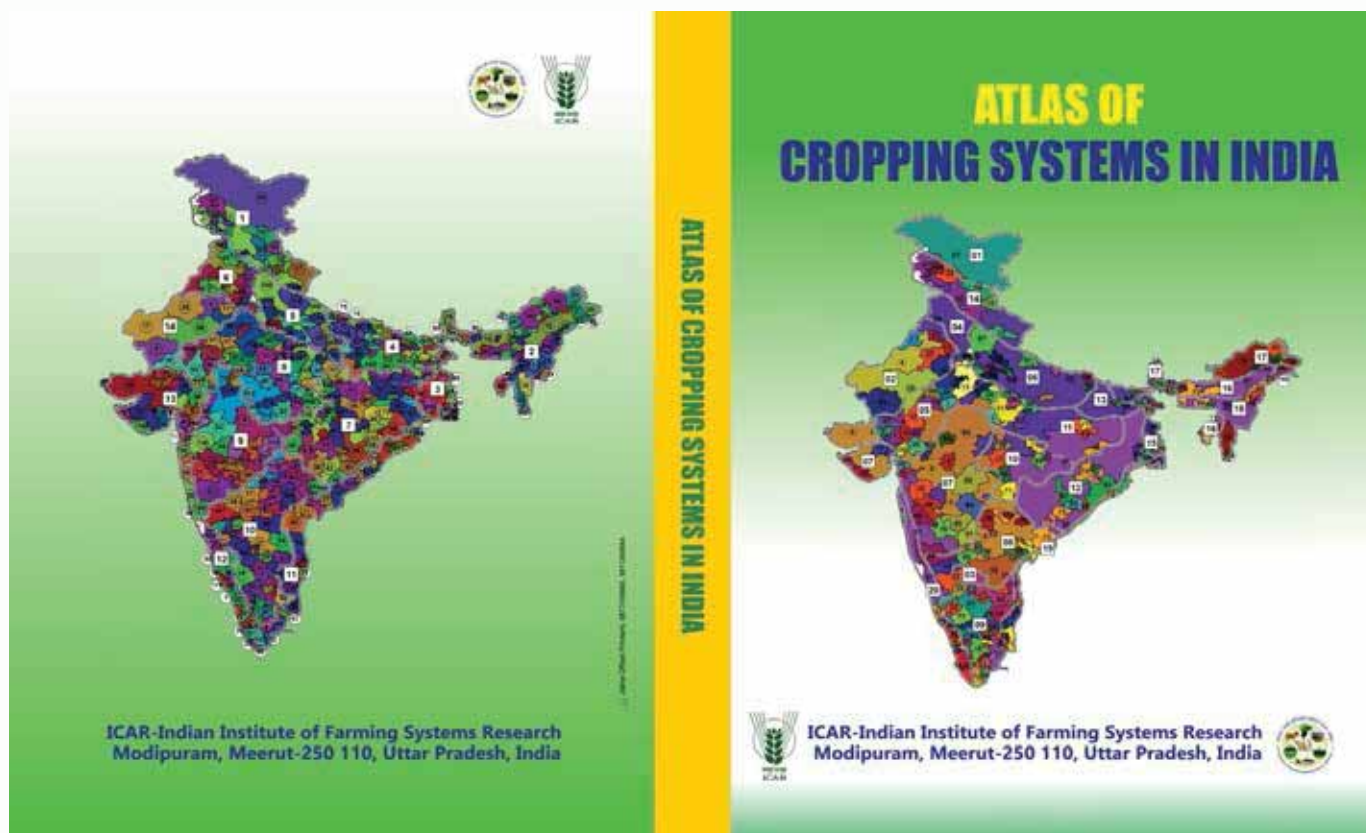


Fig. 36: Cropping System Atlas- Published

From the analysis, following conclusions are drawn:

- 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). The rice-fallow system mainly exists in the states of Chhattisgarh, Assam, West Bengal, Maharashtra, Orissa, Jharkhand, Bihar, Karnataka, Madhya Pradesh, Andhra Pradesh, Gujarat and Tamil Nadu.
- Number of cropping system currently practiced in the country is found to be 155 and during the last 2 decades by replacing of other crops by rice, wheat and sugarcane particularly in North and central India. This clearly indicates this has reduced the diversity in these regions.
- Rice-wheat area increased by 54% (5.31 m ha) compared to reported area in 2000-01 (9.87 m ha) The major state contributing for the increased area are Uttar Pradesh and Uttarakhand (2.27 m ha), Punjab (1.24 m ha), Madhya Pradesh (0.96 m ha) Haryana (0.67 m ha) and Bihar (0.42 m ha). It was observed that the increase is contributed by all the previous rice-wheat growing states and highest increase in area was observed in Madhya Pradesh (163%) followed by Haryana (77%), Punjab (71%), Uttar Pradesh & Uttarakhand (55%) and Bihar (28%).
- Area under rice-rice and rice-fallow decreased significantly in South India and Gujarat. These systems were replaced with other low water requiring crops such as cotton, pigeon pea, groundnut, maize etc.
- Area under cotton-fallow increased by 6.26 m ha in last two decades which is 246% higher than previous area and the major state contributing for increase are Maharashtra (3.66 m ha), Telangana (1.67 m ha), Gujarat (1.66 m ha), Andhra Pradesh (0.53 m ha) and Karnataka (0.40 m ha).
- Rice-based cropping systems were predominant in the nine zones namely Western Himalaya, Eastern Himalaya, Lower Gangetic Plains, Middle Gangetic Plains, Upper Gangetic Plains, Trans Gangetic Plains, Eastern Plateau & Hills, East Coast Plains & Hills and Western Plains & Ghat. The cotton-based systems are dominated in Western Plateau & Hills, Southern Plateau and Hill and Gujarat Plains & Hills. The groundnut-based systems were predominant in the Gujarat Plains & Hills. The soybean-based system have



been the principal systems in Central Plateau & Hills and Western Plateau & Hills while pearl millet-fallow, cluster bean-fallow and kharif pulses-fallow systems were leading in the Western Dry Zone. The maize-based systems were dominant in the Western Himalaya and Southern Plateau and Hills.

- In last two decade across the different agro-climatic zones highest changes recorded in Western Himalaya (maize to rice dominance), Southern Plateau and Hill region (rice to cotton and maize dominance) and Central Plateau & Hills Zone (diversified to soybean-based system). Area under rice-wheat system increased significantly in Middle, Upper and Trans Gangetic Plains while sugarcane-ratoon-wheat increased in Upper Gangetic Plains.

Pilot Project for Crop Diversification (Project code: NRMAIFSR/SOL20234000278)

Crop plan analysis was undertaken to identify the suitable areas of crops by using the relative yield index, relative spread index, sustainable yield index and soil-climate suitability index and accordingly potential areas for 14 major crops was identified. In order to diversify the rice and rice-based cropping systems in the pre-dominant areas, the pilot project for crop diversification is being implemented in 75 districts under AICRP on Integrated Farming Systems with the involvement of other institutions such as ICAR-NBSSLUP, Nagpur; ICAR-ATARI, Guwahati and also ICAR-IIAB, Ranchi with a target to create 100 ha area under diversification. During the year, 15 districts were identified for diversification. These were Udhampur (Jammu), Shimla (Himachal Pradesh), Udaipur (Rajasthan), Sabarkantha and Panchmahal (Gujarat), Betul (Madhya Pradesh), Ahmednagar and Ratnagiri (Maharashtra), Khammam, Vishakhapatnam and Kadapa (Andhra Pradesh), Erode and Tiruppur (Tamil Nadu), Medinipur West (West Bengal) and Balangir (Odisha). A benchmark survey tool was developed having information on farmer's socio-economic indices such as consumption pattern, total expenditure, net return, cropping pattern, etc. The project has 5 aspects, namely, (i) Implementation of rice crop diversification, (ii) Training of Extension Officers (EOs), (iii) Training of farmers, (iv) District-wise rice crop spatial distribution and mapping and (v) Decision Support System Development.

Implementation of diversification: Field implementation of crop diversification has been initiated in 4 districts, namely, Ahmednagar, Jhagam, Balangir and Khammam, respectively.

Chickpea, green pea + mustard, groundnut + green gram, groundnut, soybean + pigeon pea, and maize + black gram + green gram was grown by diversifying the rice-based cropping systems. An area of 464.24 ha has been covered under the same. For effective utilization of water resources, measures such as drip and sprinkler irrigation were adopted, while, sowing technologies such as flatbed, broad bed & furrow (BBF), etc. were also included. Further, moisture conservation practices such as ridges and furrows were also integrated. With regards to the benchmark survey(s), a total of 566 farmers were covered from 10 districts.

Training of Extension Officers: Training of extension officers is an important aspect of the project as it is critical to effectively disseminate knowledge and support farmers in crop diversification. A total of 40 trainings in 29 districts were conducted in which 790 personnel were trained of which 77.63% are male and 22.37% are female. Of the attendees, 685 (90.51%) were extension officers, while 75 (9.49%) were dealers. The impact of training was assessed by conducting the pre and post MCQ type of examination. The average pre-training score of the participants was 5.84 (± 0.29), while the post-training score was 8.03 (± 0.27). On an average, increase of 37.5% in the knowledge base of the participants pertaining to diversification in cropping systems was observed.

Training of farmers: Farmer's training is another essential aspect of the project as they are the actual custodians of the field which the project aims to diversify. Key benefits of farmers training include risk management, soil health, pest & disease control, market opportunities, nutritional diversity, and environmental sustainability in the sect of crop diversification. A total of 32 trainings were conducted in 29 districts in which a total of 1021 farmers attended the training out of which 91.87% were male, while, 8.13% were female.

District-wise rice crop spatial distribution and mapping: Crop cover mapping plays a crucial role in improving informed decision-making and policy formulation in agricultural and environmental management. This commends towards estimation & monitoring of rice cover acreages along with their spatial distribution in the target districts an important feature of the project. Mapping operations are executed via Remote Sensing (RS) and digital image processing. Microwave remote sensing specifically the Synthetic Aperture Radar data of Sentinel-1 SAR imagery (which can penetrate through the cloud cover) was used in the Google Earth Engine (via Java

scripts) for analysis. Subsequent maps were developed in ESRI ArcMap. As of now rice cover mapping of 17 districts has been completed. The area under paddy cover was then compared with the acreages as mentioned in Agriculture and Production Statistics (APS), Ministry of Agriculture & Farmer Welfare,

Government of India (available from: aps.dac.gov.in). The percent change (either increase or decrease) for the 17 districts is mentioned in Table 25. Additionally, the Ground Truthing (GT) of the developed maps is under process.

Table 25: Rice cover indices following GEE estimates and APS data for the 17 aspirational districts

S. No	District	State	Estimated rice cover-GEE (sq. km)	Rice cover-APS (sq. km)	Difference (%)	Probable Plantation date	Year (APS data)	Cropping season	
1	Erode	Tamil Nadu	213.54	271.92	-21.47	01 to 15 Dec	2020-21	Rabi	
2	Balangir	Odisha	1407.62	1213.5	+15.99	01 to 15 Jan	2019-20	Rabi	
3	Kadapa	AP	344.92	326.47	+5.65	16 to 30 Jun	2018-19	Kharif	
4	Visakhapatnam	AP	836.93	999	-16.22	01 to 15 Jul	2018-19	Kharif	
5	Medinipur	WB	4254.42	3699.26	+15.01	15 Dec to 15 Jan	2019-20	Rabi	
6	Panchmahal	Gujarat	647.99	555.72	+16.6	16 to 30 Jun	2019-20	Kharif	
7	Khammam	AP	1289.04	921.96	+39.81	01 to 30 Jun	2019-20	Kharif	
			900.15	820.93	+9.65	16 to 30 Jan	2019-20	Rabi	
8	Udhampur	J&K	123.47	297.43	-17.78	16 to 30 Jun	2019-20	Kharif	
			121.07			01 to 15 Jul			
9	Ratnagiri	Maharashtra	440.63	753.97	+11.84	16 to 30 Jun	2019-20	Kharif	
			402.63			01 to 15 Jul			
10	Betul	MP	54.48	282.09	+9.15	16 to 30 Jun	2018-19	Kharif	
11	Ahmednagar	Maharashtra	178.03	173.1	+2.72	16 to 30 Jun	2019-20	Kharif	
12	Upper Siang	Arunachal Pradesh	76.47	67.54	+13.22	16 to 30 Jun	2019-20	Kharif	
13	West Siang		59.39	62.5	-4.98	16 to 30 Jun	2019-20	Kharif	
14	Upper Subansiri		46.57	43.56	+6.91	16 to 30 Jun	2019-20	Kharif	
15	East Kameng		62.45	63.93	-2.32	16 to 30 Jun	2019-20	Kharif	
16	West Kameng		11.45	9.64	+18.78	16 to 30 Jun	2019-20	Kharif	
17	Kurung Kumey			5.92	6.39	-2.32	16 to 30 Jun	2019-20	Kharif

Atlas of Climate Adaptation in South Asian Agriculture (ACASA) (Project code: NRMAIFRSOP 202312000306)

Identified the key hazards include i.e. frost, floods/waterlogging, hailstorm, high humidity (pests & diseases), extreme rainfall, low temperature (lower than optimal to record the key risks that may arise include yield losses, economic losses, crop failure, pest & disease infestation, soil degradation and crop damage in South Asia. It has been observed from the collected data from the few studies that hazards occur like frost damage the crop nearly 30±7.1% in timely sown varieties, while extended up to 80% (late sown varieties) crop damage at vegetative stage.

Unseasonal heavy rains/hailstorm also recorded 43.6±18.3% yield reduction at harvesting stage. Some adaptation approaches like crop diversification and intercropping enhanced nearly 59.7±34 % production efficiency over sole cropping. Similarly, various adaptation approaches like heat/biotic stress/drought resistance/tolerance; resource efficient/responsive genotypes; alteration in sowing time, mulching/residues management, planting techniques (RAF), conservation agriculture-based cropping systems, integrated water management; irrigation scheduling; micro irrigation, integrated nutrient management, balanced fertilization, green manuring and organic nutrient management also mitigates the natural hazards.

ORGANIC AGRICULTURE SYSTEMS



**Crop improvement for organic production system (Phase – II) (Project code: NRMAIFRSIL 201805000290)**

The Institute initiated breeding programme on development of mustard varieties for organic production systems since 2015. Over a period of seven years, a total of 15 new strains have been developed from different parentages under organic environment (Table 26). Out of them 09 newly developed organic strains

(tapped up from F_8 progeny) were tested in station trial during 2022-23 crop season against RH 749 (standard check) under organic environment. Out of them, four strains namely MM 16A 241(I J 31×EC 597313), MM 16A 082 (I J 31×EC 597313), MM16B 002 (MJA 38×MJR 9) and MM 16A 001 (I J 31×EC 597313) were found superior over RH 749 check in terms of seed yield and other attributes (Table. 27). All the nine organic strains have also been inducted in AI-NPOF for multi-location trials at eight different locations in 2023-24 rabi season.

Table 26: Homozygous strains isolated from F_8 individual plant progenies across the crosses

SI. No.	Strains developed and isolated from F_8	Parentage
1.	M M 16A 001	IJ 31 × EC 597313
2.	M M 16A 081	IJ 31 × EC 597313
3.	M M 16A 082	IJ 31 × EC 597313
4.	M M 16A 083	IJ 31 × EC 597313
5.	M M 16A 241	IJ 31× EC 597313
6.	M M 16A 242	IJ 31 × EC 597313
7.	M M 16B 001	MJA 38 × MJR 9
8.	M M 16B 002	MJA 38 × MJR 9
9.	MM 17A 008	MJA 25 × MJR 3

Table 27: Average performance of newly developed organic strains in station trial against RH 749

SI. No.	Organic strains	Days to physiological maturity	Plant height (cm)	Harvest index (%)	Biological yield (q/ha)	Seed yield (q/ha)
1	MM16A 001	135.66	217.73	25.275	109.15	27.57
2	MM16A 081	135.66	185.33	29.448	91.57	26.22
3	MM16A 082	135.66	210.66	28.881	100.64	29.06
4	MM16A 083	134.33	195.8	27.580	83.80	23.16
5	MM16A 241	135.66	217.53	23.509	127.65	29.83
6	MM17A 008	136.66	239.73	22.273	118.77	23.96
7	MM16A 242	135.66	208.33	25.967	92.17	26.43
8	MM16B 001	135	223.53	28.494	96.57	27.52
9	MM16B 002	136.33	205.66	28.193	98.05	27.61
10	RH 749	137	224.66	27.437	96.20	26.38
	C.D. (P = 0.05)	2.216	21.901	3.261	4.25	2.13
	CV%	0.879	7.946	7.924	9.26	8.69

Nine parental lines of soybean from PAU, Ludhiana and five lines from G.B. Pant Agricultural and Technology University, Pantnagar were procured to identify their yield potential under organic environment. The purpose of this exercise was to resort to hybridization among themselves for creating new genetic variability in F_2 population for initiating further organic breeding program in soybean. Parental lines namely, SL 958, SL 955

and SL 979 were found highest seed yielder among SL group. However, in PS pool the PS 1347 and PS 25 out yielded under organic environment (Table 28). The mean performance of the parental lines in these two groups will help in formulating crossing programme among them to produce transgressive segregants in F_2 population to breed organic soybean varieties.

Table 28: Mean Performance of parental lines of soybean under organic environment

Sl. No.	Parental lines	Physiological maturity(days)	Biological yield (q/ha)	Seed yield (q/ha)	Harvest index (%)
1	SL525	145	55.93	10.04	17.95
2	SL688	144	66.28	17.96	27.09
3	SL744	143	99.30	20.50	20.64
4	SL955	144	149.26	29.62	19.84
5	SL958	144	152.21	30.48	20.02
6	SL979	143	140.15	26.91	19.20
7	SL1028	143	108.23	20.07	18.54
8	SL1074	144	110.85	17.77	16.03
9	SL1104	145	99.77	17.69	17.73
10	PS23	121	89.60	16.58	18.50
11	PS24	121	75.52	9.30	12.31
12	PS21	123	87.76	17.74	20.21
13	PS25	123	88.95	18.32	20.59
14	PS1347	122	83.25	18.35	22.04

Development and validation of microbial consortia for crop residue recycling under organic farming system (Project code: NRMIIIFRSIL201805000293)

During the period under report, total 29 fungal isolates have been obtained from different sources using different fungal culture media and PDA for further purification and maintaining the cultures in slants. All the isolates were screened for cellulolytic, hemicellulolytic and lignolytic activities both qualitatively (growth, sporulation, zone of hydrolysis) and quantitatively (production of extracellular hydrolytic enzyme cocktail). Based

on the growth, sporulation ability, production of extracellular hydrolytic enzyme cocktail under solid state fermentation with paddy straw, five best isolates were selected for further study. In situ decomposition study in Nylon bags containing 10 g chopped paddy straw inoculated with selected individual isolates have shown significant reduction in the dry biomass of paddy straw, ranging from 47% (control) to 72% (Isolate 8) after 40 days incubation. Dual culture inoculation of cultures to check their compatibility in consortium have been checked and found all the cultures are growing in presence of other cultures.



Plate 21: Isolate 8 with fastest growth, sporulation and decomposition activity among the selected isolates



All India Network Programme on Organic Farming (AINP-OF), Modipuram center (Project code: NRMAIIFRSOL200405000294)

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

Crop management practices significantly affected the performance of different cropping systems. The yield of black rice was recorded highest under 100% organic management. However, yield of finger millet, black gram, barley, tomato and vegetable pea was recorded highest 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. Among the different cropping system, highest

REY (23.8 t/ha) was recorded under black gram-tomato-sunhemp green manuring system followed by okra-vegetable pea-sesbania green manuring system (Table 29). Similarly, system net return (₹ 3,57,021/ha) was also recorded highest under black gram-tomato-sunhemp green manuring system and 100% organic management (Table 30). Crop management practices significantly affected the biological properties of soil under different cropping systems. The population of bacteria (on nutrient agar, Kings B agar, Jensen agar, CRYEMA), fungi (on Rose Bengal agar and Trichoderma selective medium), actinomycetes, different soil enzyme activities and glomalin content was recorded highest under 100% organic management and lowest under inorganic/conventional practice in all four cropping systems (Fig. 37).

Table 29: 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	6916 (5533)	7423 (5948)	14247 (11397)	23790 (18990)
50% organic+ NF inputs	5656 (4525)	6367 (5102)	12524 (10019)	19256 (15371)
50% organic + 50% inorganic	4609	6408	11240	21172
25% organic + 25% inorganic + NF inputs	4266	4438	9405	16162
100% inorganic	4762	6912	11575	21685
State Rec.	4438	7043	11338	22753

* Value in parenthesis is system REY (kg/ha) without premium price

Table 30: Net return under different cropping systems with different crop management

Treatments	Black rice – lentil – vegetable cowpea	Finger millet – barley-sesbania rostrata GM	Okra – vegetable pea – Sesbania aculeata GM	Black gram – tomato – sunhemp GM
100% Organic	64203 (35987)	62934 (44334)	191580 (144954)	357021 (270593)
50% Organic + NF inputs	37343 (14265)	41919 (27605)	158985 (119388)	270664 (202928)
50% Organic + 50% Inorganic	24563	53762	141896	318728
25% Organic + 25% Inorganic + NF inputs	13273	7894	101189	215721
100% Inorganic	32263	85604	165716	349714
State Rec.	25649	81695	150972	360141

* Value in parenthesis is net return (₹/ha) without premium price

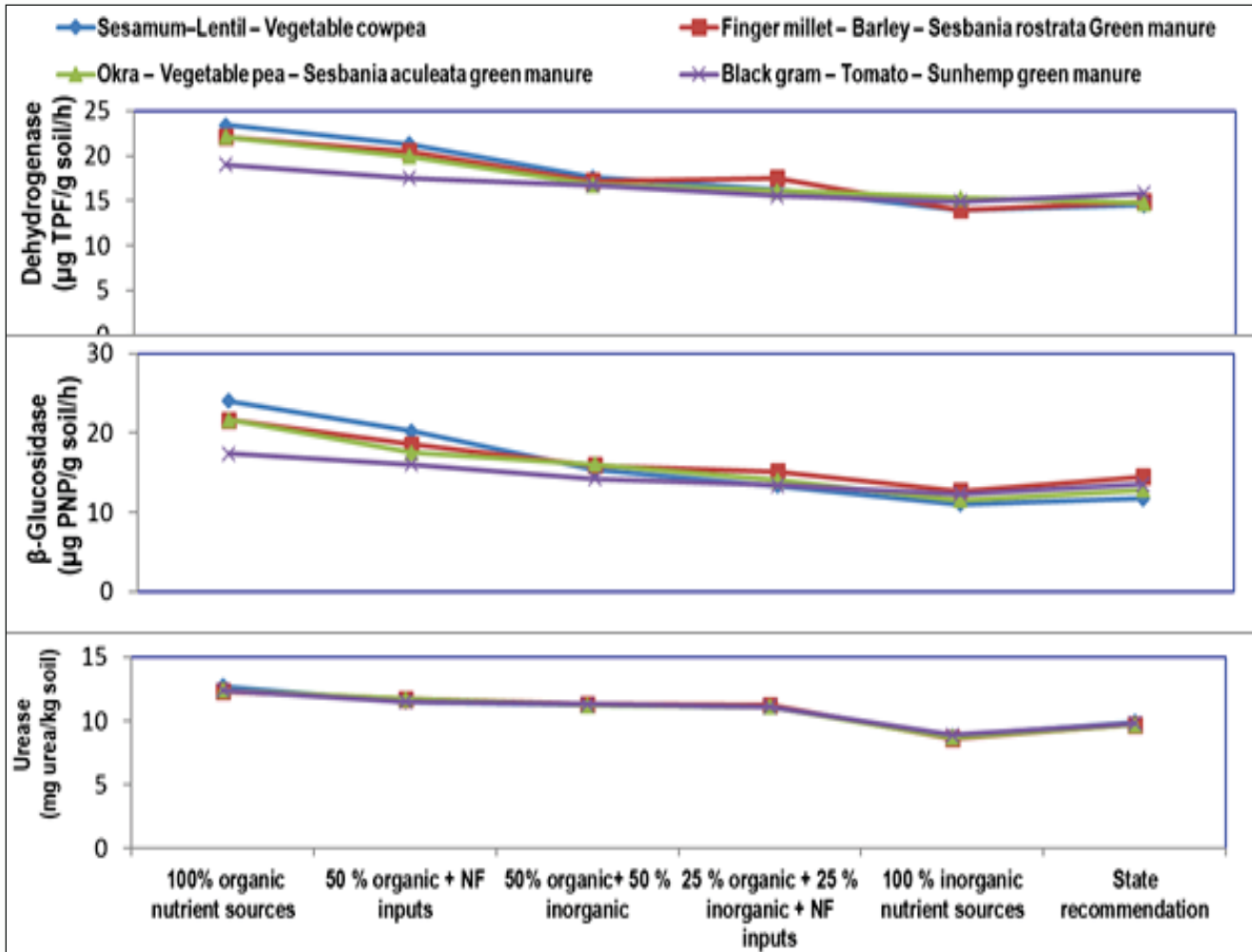


Fig. 37: Soil enzyme activities under different production systems

Experiment 2: Evaluation of different varieties of major crops for organic farming

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 under Prachi 10 followed by PS 100. Similarly, highest gross return and net return was found under Prachi 10. Similarly, among different varieties of brinjal, highest fruit yield was recorded under Pusa Hara Baigan followed by Kashi Uttam variety. Incidence of fruit and shoot borer, blight and phyllody significantly varied among different brinjal varieties. Fruit and shoot borer infestation was highest in Navkiran variety.

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

Geo-reference characterization survey of 30 farmers of Kushinagar and Gorakhpur was conducted (Plate 22). Organic grower was having 0.51 ha average land holding with average holding of 0.6 livestock. Around 37% farmers are following organic farming without livestock component and dependent on purchased manure inputs from the market. Rice (Kala Namak Kiran) and wheat was the major crops of cultivation. There was 22.2% yield gap in wheat at farmers field as compared to the on-station experimental fields. 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 22: Geo-referenced survey of organic and natural farmers

Experiment 4: Evaluation of Natural Farming Practices in different agroecology

Under natural farming experiment, 05 different management practices including control, scientific organic package, complete natural farming and integrated crop management were evaluated under maize + cowpea – wheat + chickpea system. System productivity in terms of REY was recorded highest under

integrated crop management followed by AI-NPOF package and least under complete natural farming (Fig. 38). Due to heavy weed infestation, maize and wheat productivity was greatly affected under natural farming treatments. Better gross and net return was found under integrated crop management followed by scientific organic package with premium prices. Cost of cultivation under complete natural farming was reduced by 38.1% as compared to AI-NPOF package.

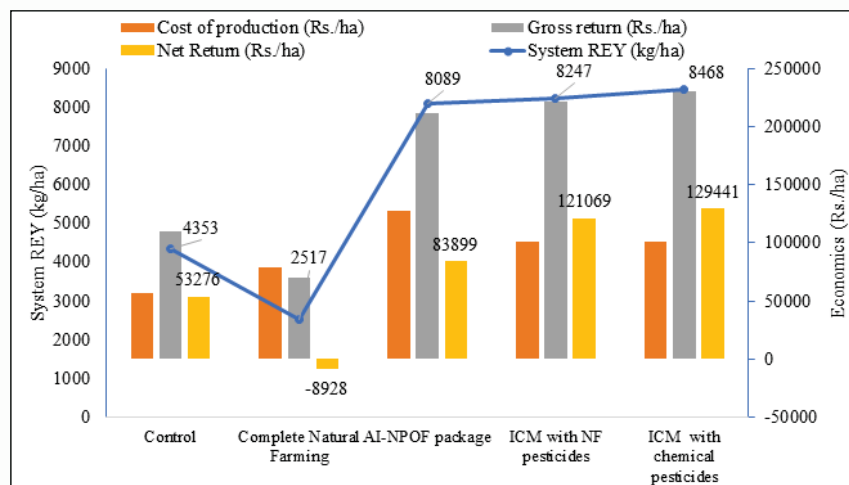


Fig. 38: Productivity and profitability of maize + fodder cowpea –wheat + chickpea system under natural farming

The microbial activity is crucial under all type of management practices to ensure the constant availability of nutrients through different biological processes. The nutrient management practices significantly affected the microbial population and different enzyme activities (Table 31, 32 and Fig. 39). The

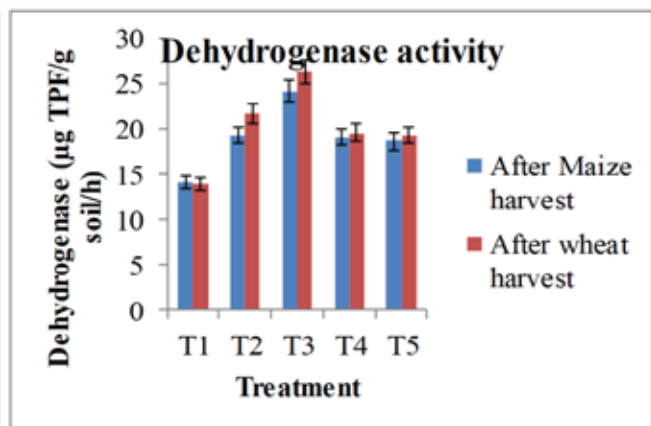
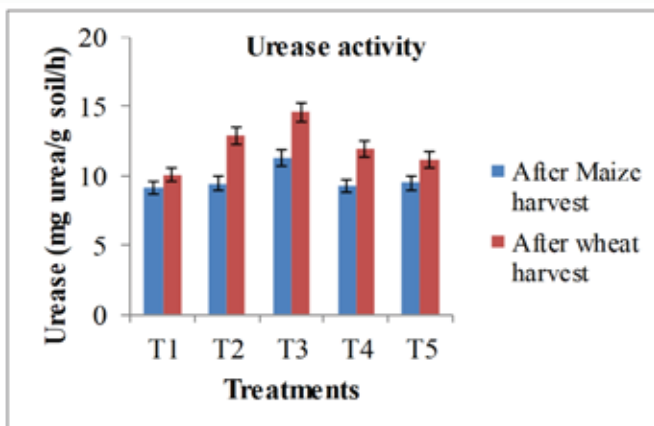
highest microbial population and enzyme activities (after wheat harvest 2023) were found under NPOF package followed by complete natural farming which indicate the beneficial effect of organic/natural farming practices in improving the soil biological properties.

Table 31: Effect of different nutrient management practices on the population of different microbes after wheat harvest (2023)

Treatments	CFU/g dry soil						
	Bacteria on NA ($\times 10^6$)	Fungi ($\times 10^3$)	Rhizobium ($\times 10^2$)	Free living NFB ($\times 10^2$)	Fungi THM ($\times 10^3$)	Bacteria on Kings B ($\times 10^4$)	Actinomycetes ($\times 10^4$)
Control	14 \pm 0.32	30 \pm 3.16	98 \pm 6.83	99 \pm 3.57	24 \pm 2.65	133 \pm 12.59	30 \pm 3.42
Complete Natural Farming	19 \pm 1.06	50 \pm 4.23	128 \pm 9.52	159 \pm 12.16	30 \pm 1.21	176 \pm 12.01	41 \pm 3.03
AINP-OF package	23 \pm 1.17	72 \pm 6.87	175 \pm 12.69	187 \pm 9.87	36 \pm 3.64	221 \pm 15.32	49 \pm 2.86
ICM with NF pesticide	17 \pm 2.15	44 \pm 3.64	116 \pm 10.09	162 \pm 14.75	29 \pm 2.87	170 \pm 9.62	39 \pm 3.64
ICM with chemical pesticide	18 \pm 0.87	45 \pm 2.17	125 \pm 14.64	160 \pm 13.64	29 \pm 1.63	174 \pm 14.35	37 \pm 3.12

Table 32. Effect of different nutrient management practices on glomalin content in soil

Treatments	Easily extractable glomalin (mg/kg dry soil)		Total glomalin (mg/kg dry soil)	
	After maize harvest	After wheat harvest	After maize harvest	After wheat harvest
Control	182.3 \pm 7.31*	178.1 \pm 9.53	327.6 \pm 12.45	358.8 \pm 18.45
Complete Natural Farming	205.7 \pm 9.81	212.7 \pm 13.71	392.6 \pm 18.16	496.7 \pm 23.17
AINP-OF package	226.4 \pm 6.37	231.4 \pm 15.12	407.7 \pm 12.16	518.7 \pm 26.22
ICM with NF pesticide	197.91 \pm 10.30	203.5 \pm 10.07	381.8 \pm 20.67	466.5 \pm 20.14
ICM with chemical pesticide	192.3 \pm 11.79	204.0 \pm 8.16	373.2 \pm 9.67	443.6 \pm 23.89



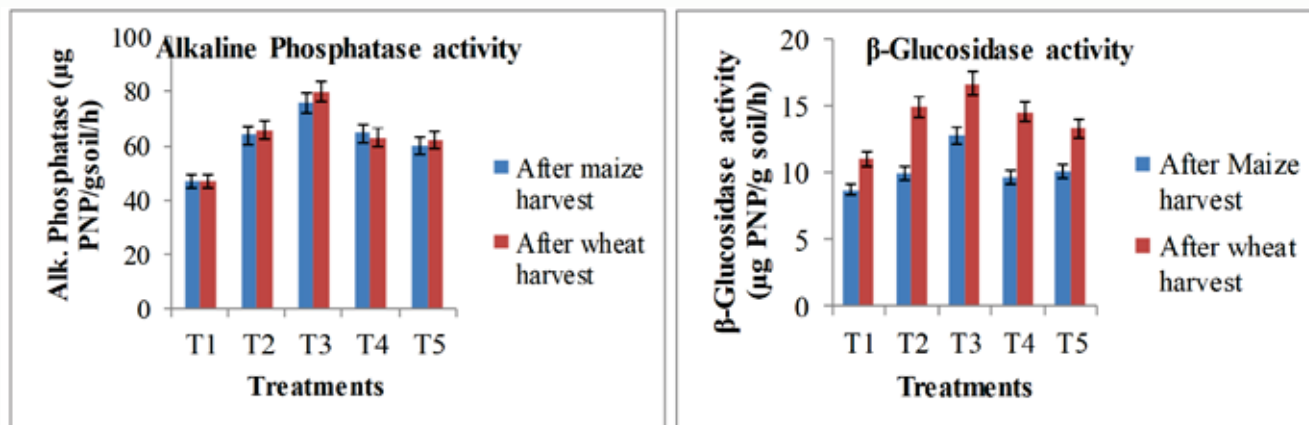


Fig. 39: Comparative activities of different enzymes under different treatments in maize + cowpea- wheat + chickpea cropping system

Development of pest and disease management package for important vegetables under organic production system (Project Code: NRMAIFRSIL202305000304)

The project was initiated in kharif 2023 to develop a complete package of pest and disease management for organic cultivation of important vegetables i.e. chilli, muskmelon, cucumber, fenugreek, okra and cowpea for western plain zone of Uttar Pradesh. These packages of pest/disease management could be directly utilized by the organic farmers of the region. Moreover, the findings of this project could serve as a model for developing same kind of POP for other vegetables in other parts of the country. The treatment consisted of three cropping systems i.e. chilli-fenugreek, muskmelon-okra- fenugreek and cucumber-cowpea- fenugreek and three pest and disease management packages i.e. organic, integrated and inorganic with three replications in factorial complete randomized block design. Sorghum crop was grown in the experimental area to neutralize the fertility gradient and raising of nursery in protrays

under low-poly-tunnel are under progress. The data will be presented in the next year after execution of complete set of treatments.

All India Network Programme on Organic Farming (National) (Project code: NRMAIFSCOL 202104000265)

All India Network Programme on Organic Farming (AI-NPOF), a plan scheme initiated from 2004-05 operates currently with 20 centers 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 into 4 programmes namely characterization of organic practices and inputs adopted by organic growers, development of scientific package of practices for organic production, organic farming systems assessment and farming systems and capacity building including policy support to central and state Agencies. Programme wise salient progress made during the 2022-23 under the scheme is given in Table 33 and 34.

Table 33: Characterization of organic inputs and practices

Output parameter	Up to 2021-22	2022-23
Geo-tagged characterization of farmers	4192 organic farmers in 16 States; 318 natural farming farmers in 11 States	690 organic farmers in 16 states; 214 natural farming farmers in 10 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	5 (Beejamrit, Jeevamrit, Ghanjeevamrit, Brahmastra, Neemaster, Sashagavya with dry and live azolla)
Documentation and validation of Organic ITKs	18 (nutrient, pest management practices for rice, maize, blackgram, soybean and vegetables)	4 (nutrient and pest management practices in maize, green gram, soybean, cotton and vegetables)

During the year, 690 organic and 214 natural farming farmers analysed over the years. Yield gap under organic and natural farming from 16 States have been characterized and yield gap between farming is given in Fig. 40 and 41. farmers and scientific organic farming packages of major crops

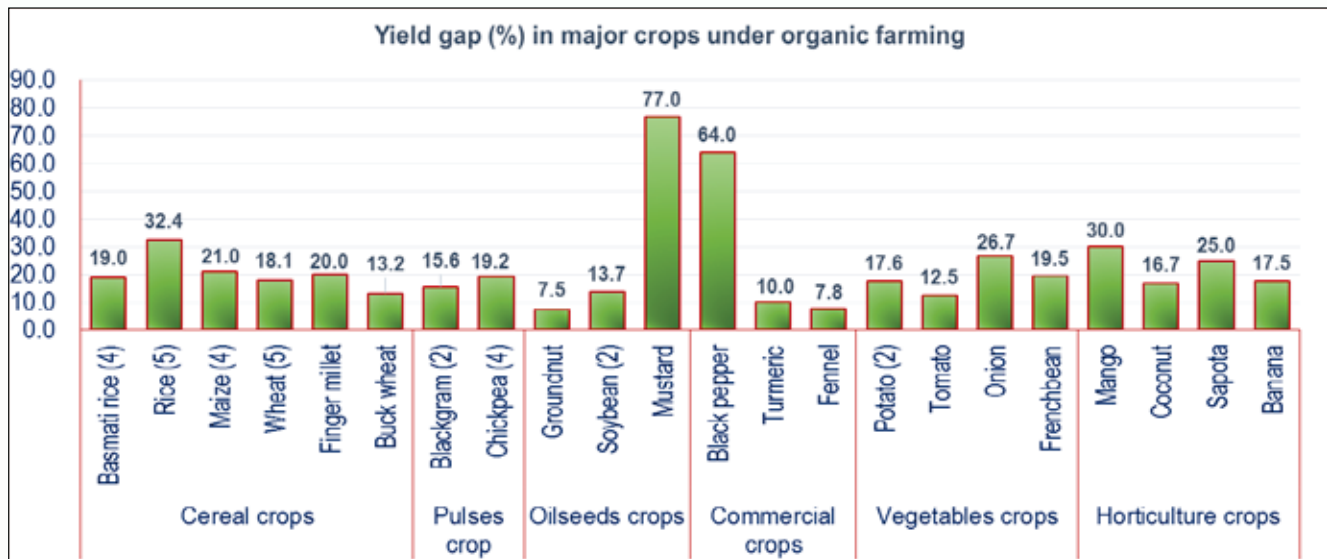


Fig. 40: Yield gap under organic farming

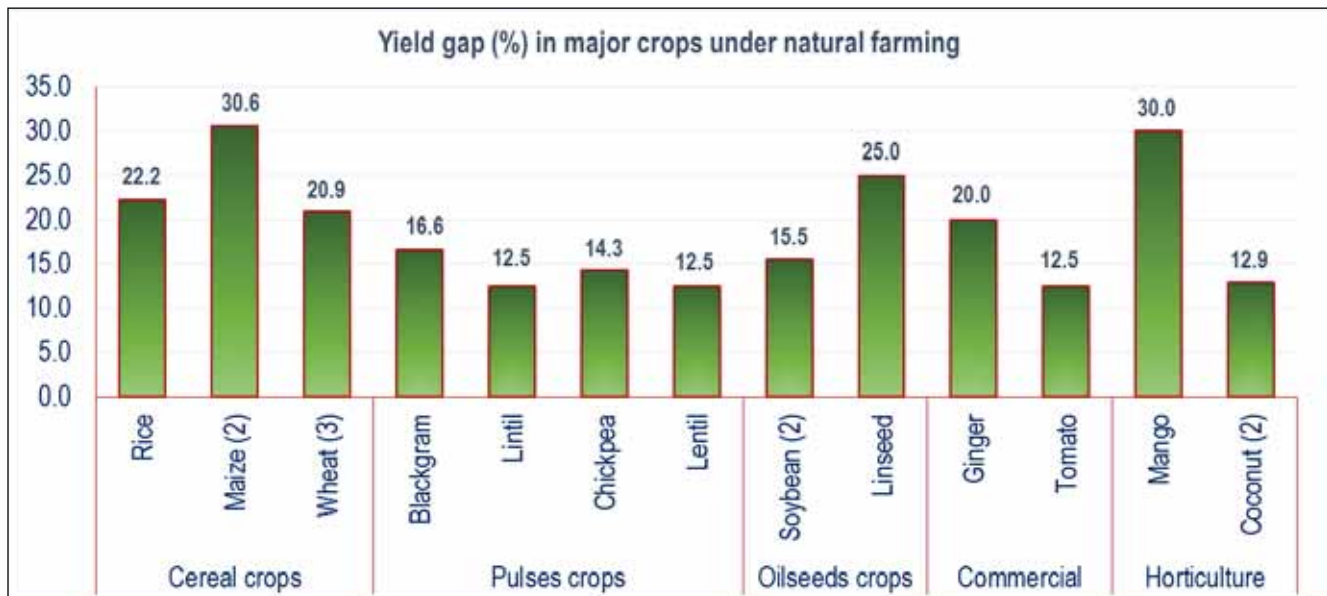


Fig. 41: Yield gap under natural farming

Table 34: Development of scientific package of practices for organic production

Output parameter	Up to 2021-22	2022-23
Scientific package of practices for organic crop production in systems perspective	PoPs for 68 cropping systems for 16 states (44 cropping systems from 2014-2021)	PoPs for 4 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	409 varieties evaluated for 23 crops, 74 identified for 18 cropping systems (Traditional, HYV, Specialty purpose)



Output parameter	Up to 2021-22	2022-23
Weed management packages for selected crops and systems	13 cropping systems for 13 states	-
Insect-disease management package	7 cropping systems for 4 states (insect management); 3 cropping systems for 3 states (disease management)	Insect management: 6 crops in 3 states Disease management: 9 crops in 3 states
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	6 cropping systems in 6 states (92 farmers)	7 cropping systems in 7 states (77 farmers)

Organic farming packages developed: During the year organic farming packages for 4 cropping systems have been developed. State-wise details of packages developed are given in Table 35 and other indicators are presented in Table 36 and 37.

Table 35: Organic farming packages developed in different states

State	Cropping system / Practice	System yield
Kerala	Cassava-vegetable cowpea	21.53 t/ha (Cassava Tuber equivalent yield)
Rajasthan	Fennel + cabbage-cowpea + maize	2121 kg/ha (Fennel equivalent yield)
Sikkim	Maize-black gram-toria	9.28 t/ha (Maize equivalent yield)
West Bengal	Rice-vegetable pea-sesame	9.96 t/ha (Rice equivalent yield)

Table 36: Organic farming systems assessment

Output parameter	Up to 2021-22	2022-23
One acre Integrated Organic Farming Systems established	8 for 7 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 0.42 (Gujarat) to 3.27 lakhs /acre during 2022-23
Major Advantage	Quality and timely availability of organic inputs ensured	Improved recycling and reduced market input cost

Table 37: Capacity building including policy support to Central and State agencies

Output parameter	Up to 2021-22	2022-23
Model value chain development	13 villages in 5 districts of 5 states covering 275 farmers	16 villages in 5 districts of 5 states covering 285 farmers Turmeric-Parapara colony Hill vegetables, tea. Coffee-Ooty FPO; Scented rice-Aarug FPO

Output parameter	Up to 2021-22	2022-23
Certified Farm Advisor (s) on Organic Farming	183 from 23 states	63 from 14 states
Technologies shared with State Agencies/Stakeholders	PoPs (62 cropping systems) with 16 states IOFS models with 3 states	13 in Rajasthan, Kerala and Tamil Nadu KVKs, PKVY, RKVY, Farmers
Input to Parliament questions	159	43
Mass Awareness Campaign/Trainings	2 (11763 participants)	Trainings: 28 Participants: 862
Registered groups	1 (Manar Vanadesa Organic Farmers group), 2 regional councils, 5 PGS groups	1 regional council in Karnataka by CFA, 1 PGS group in Punjab

During the year, a one-acre Integrated Organic Farming System model developed for Tamil Nadu was established in 14 KVKs of Tamil Nadu with financial support of Rs 35 lakhs from the State Government. Details are given Table 38.

Table 38: IOFS models established at KVKs of Tamil Nadu

KVKs (14 no's)	IOFS model (one acre at each location)
Aruppukottai	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Agroforestry, Bee keeping, Farm Pond, Mushroom
Madurai	Crop, Fodder, Livestock, Bee hives, Compost production unit, Boundary plantation, Pest repellent cafeteria
Needamangalam	Crop, Fodder, Livestock, Farm Pond with Composite fish culture, Boundary plantation, Compost production unit, Agroforestry, Apiary, Mushroom
Salem	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping
Vellore	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Agroforestry, Mushroom, Fish Pond
Dharmapuri	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Agroforestry, Mushroom, Fish Pond
Ramnad	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Agroforestry, Fish Pond
Thirupathisaram	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Agroforestry, Fish Pond
Tiruvallur	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Fish Pond, Mushroom
Vamban	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Azolla Production unit
Villupuram	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping, Agroforestry
Tiruchirappalli	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Agroforestry
Vriddhchalam	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Farm Pond, Compost production unit, Bee keeping, Agroforestry
Tiruppur	Crop, Fodder, Livestock, Pest repellent cafeteria, Boundary plantation, Compost production unit, Bee keeping



Development of Integrated Organic Farming System (IOFS) model for Uttar Pradesh, Uttarakhand and Punjab (Project code: NRMAIFSRCOL201611000270)

In the first phase (2016 to 2023) of the project on “Development of Integrated Organic Farming System model (IOFS) for different regions of India”, 8 IOFS models suitable for 7 States namely Chhattisgarh, Gujarat, Kerala, Meghalaya, Rajasthan, Sikkim and Tamil Nadu have been developed and popularized among the stakeholders through KVKs and SCSP/STC components of All India Network Programme on Organic Farming besides documentation by Government of India and highlighted in the

United Nations Climate Change Conference. IOFS model development for Western Plain zone of Uttar Pradesh was initiated but only crop modules such as food system, fodder system and kitchen garden were evaluated without integration of livestock during the first phase. Similarly in Punjab and Uttarakhand states also demand for organic farming products are increasing and technologies to reduce the external inputs and ensure timely availability of quality inputs. In view of this, second phase of the project was initiated to develop integrated organic farming system models for Uttar Pradesh, Uttarakhand and Punjab. The details of the IOFS models being developed are given in Table 39. State-wise progress is described below.

Table 39: Location and components of IOFS models

Sl. No	ACZ	NARP	Location	Area (ha)	Components
1.	Upper Gangetic Plains	Western Plain zone (UP-1)	Modipuram (UP)	1.0	Food system + fodder system + Fruit garden + Kitchen garden + livestock cum bio-input unit including dairy and pest repellent plants + boundary plantation
2.	Upper Gangetic Plains	Bhabar and Tarai zone (UK-2)	Pantnagar (UK)	0.40	Food system + fodder system + dairy + fish+ pest repellent plants
3	Trans Gangetic plains	Central Plain zone (PB-3)	Ludhiana (PB)	0.40	Food system + fodder system + dairy + pest repellent plants

Uttar Pradesh

One hectare integrated organic farming system model comprising of 5 modules such as food system (0.40 ha), fodder system (0.15 ha), fruit garden (0.26 ha), kitchen garden (0.06 ha) and livestock cum bio-input unit (including dairy; 1 cow and 1 buffalo and pest repellent plants) (0.13 ha) with lemon as boundary plantation was established during the year for evaluation. Performance of different modules during kharif 2023 are given below.

Food system: Food system comprised of 5 cropping systems namely rice (coarse grain)-chickpea-sesbania (0.06 ha), basmati rice-mustard-green gram (0.06 ha), basmati rice-wheat-

sesbania (0.06 ha), maize (grain)-wheat-green gram (0.06 ha) and sugarcane-ratoon-wheat (0.16 ha). Three varieties of basmati rice namely PB-1509, PB-1847 and PB-1886 and coarse grain (PB-1718) were evaluated out of which PB-1886 recorded grain yield of 4220 kg/ha.

Fodder system: Fodder system comprised of 3 cropping systems namely sorghum + cowpea-oat (0.05 ha), maize + cowpea-berseem (0.05 ha) and perennial fodder (bajra napier hybrid) (0.05 ha). Besides these systems, bajra napier hybrid fodder was grown in all the bunds of fruit and kitchen garden. Sorghum + cowpea and maize + cowpea during kharif 2023 recorded yield of 2575 kg from 0.05 ha (51.5 t/ha) and 2325 kg in 0.05 ha (46.5 t/ha) respectively.



Plate 23: Fruits + vegetables under organic management in fruits garden

Fruit garden: Fruit Garden intercropped with vegetables were established in 2600 m². Mango (10 numbers), Peach (12 numbers), Pear (12 numbers), Guava (35 numbers), Litchi (6 numbers) and Pomegranate (5 numbers) were planted during the year.

Kitchen garden: A total of 14 vegetables were grown in 1800 m² (600 m² in kitchen garden and 1200 m² in fruit garden) under organic management. A total of 1173.45 kg of vegetables were harvested throughout the year for meeting the nutrition.

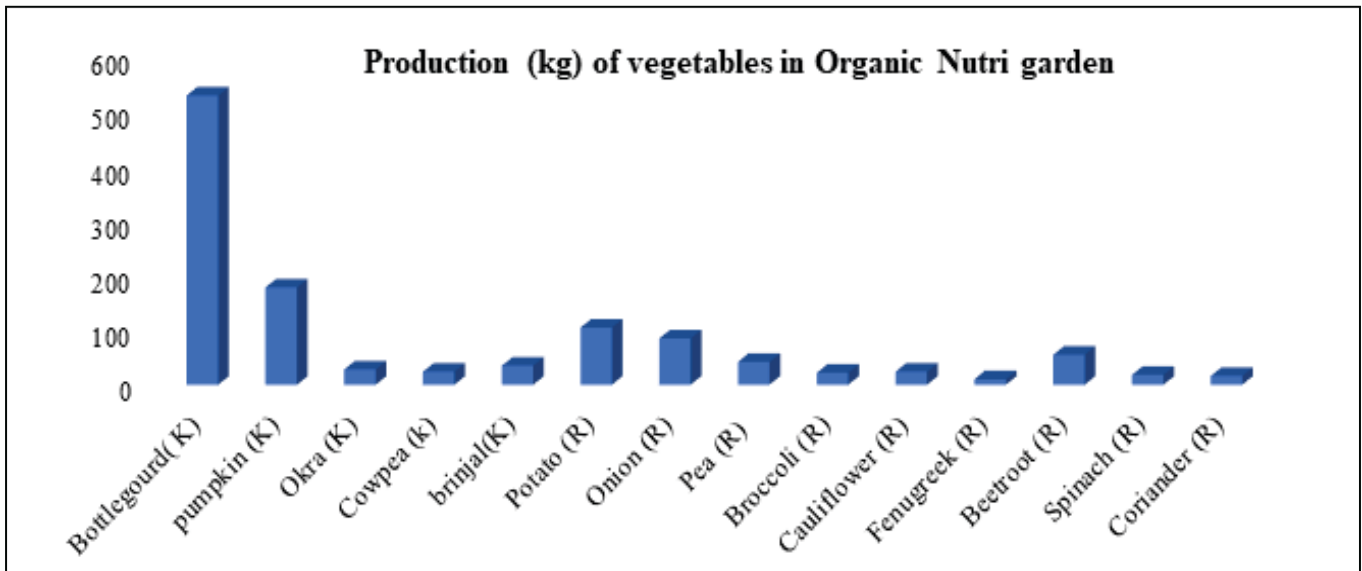


Fig. 42: Production of vegetables in kitchen garden



Plate 24: Vegetables in kitchen garden

Livestock cum bio-input unit (includes dairy and pest-repellent plants): One cow and one buffalo were integrated during the year in the model. Cow (Gir) gave the milk yield of 1112.25 litres during the lactation period of April to October 2023 under organic management with a gross return of ₹ 44,490. Cow dung and urine produced from the unit were utilized for preparing the vermicompost and natural farming concoctions and used in the IOFS mode. About 55.6 quintals of farmyard manure and 20 quintals of vermicompost were produced internally from the dung of the dairy unit and recycled in the model. To develop bio-based pesticides for the control of insects, diseases and nematodes nearly 35 numbers of different categories of medicinal plants belonging to different plant families were transplanted in a Livestock cum bio-input production unit. A literature survey of these plants reveals that some of the plant species contain a wide array of chemicals those not only reported to possess insecticidal and insect-repellent activities but some of them also contain compounds having fungicidal and nematocidal activities. Therefore, the

highly bioactive plant species were chosen and processed for the recovery of bioactive fractions of enriched chemical constituents. By following fractional crystallization and column chromatographic techniques, the bio-active fractions of *Calotropis procera*, *Azadirachta indica*, yellow oleander, *Nerium oleander*, *Tecoma stans*, *Murraya paniculata* have been isolated in three to four fractions of different polarity range i.e. soluble in solvents having eluotropic values between 2.5-5.5. Procedures for the development of suitable pesticidal formulations such as Emulsifiable concentrate (EC), microencapsulated EC and granular formulations were also identified and standardized. A pesticide development program for control of insect, fungal diseases and nematodes in organically cultivated crops is in progress. Bio-inputs such as dashparni extract (800 litres), chilli-garlic-extract (CGE) (20 litres), panchgavya (100 litres), fermented buttermilk (40 litres), neemastra (100 litres), beejamrit (75 litres) and brahmastra (40 litres), recycling of biomass of 45 quintals through NADEP composting were also made in the model.



Plate 25: Biocidal fractions of distinct polarity of various plant species

Multipurpose tree system for family nutrition, health and biodiversity maintenance under IOFS:
Table 40: Details of multi-purpose tree under IOFS

S. No.	Name of Fruit Plant	No. of plants/ age (years)	Purpose
1	Mango (<i>Mangifera indica</i>)	3/3	Family nutrition, Dashparni preparation, pollinator's attractant
2	Guava (<i>Psidium guajava</i>)	2/3	Family nutrition, Dashparni preparation, pollinator's attractant
3	Lime (<i>Citrus aurantifolia</i>)	1/3	Family nutrition, Dashparni preparation, pollinator's attractant
4	Lemon (<i>Citrus limon</i>)	1/3	Family nutrition, Dashparni preparation, pollinator's attractant
5	Beal (<i>Aegle marmelos</i>)	1/3	Family nutrition, Dashparni preparation, medicinal
6	Aonla (<i>Embllica officinalis</i>)	2/3	Family nutrition, medicinal, pollinator's attractant
7	Sapota (<i>Manilkara japota</i>)	1/3	Family nutrition
8	Jack fruit (<i>Artocarpus heterophyllus</i>)	1/3	Family nutrition
9	Mulberry (<i>Morus alba</i>)	1/3	Family nutrition, pollinator's attractant
10	Ber (<i>Ziziphus mauritiana</i>)	1/3	Family nutrition, pollinator's attractant, nectar source to natural enemies
11	Imli (<i>Tamarindus indica</i>)	1/3	Family nutrition, pollinator's attractant, nectar source to natural enemies
12	Harad (<i>Terminalia chebula</i>)	1/3	Medicinal (Trifala powder)
13	Badeda (<i>Terminalia bellirica</i>)	1/3	Medicinal (Trifala powder)
14	Moringa (<i>Moringa oleifera</i>)	2/3	Family nutrition, medicinal, ex situ green manuring, pollinator's attractant
15	Jamun (<i>Eugenia jambolana</i>)	1/3	Family nutrition, medicinal, pollinator's attractant

Boundary Plantation: Lemon is planted as a boundary plantation in the model.

Uttarakhand

One acre integrated organic farming system model comprising 3 modules such as food and fodder system (0.31 ha), livestock (0.06 ha) and fish (0.03 ha) is being established for evaluation.

The performance of different modules is given in Table 41. The food system recorded a net income of ₹ 46,305 with a B:C ratio of 2.47 (Table 42).

Table 41: Yield of different crops under IOFS- 01 Acre Model (Uttarakhand)

Crop	Area (m ²)	Yield (kg)	Sale Price (₹/kg)	Crop	Area (m ²)	Yield (kg)	Sale Price (₹/kg)
	Kharif				Rabi		
Rice (Type-3)	750	210	35.3	Wheat (Sarvati)	750	290	28.0
Rice (Tilak Chandan)	750	309	35.3	Black Wheat	750	210.0	28.0
Rice (PB-1509)	750	250	35.3	Vegetable Pea	750	195.0	25.0
Crop	Winter			Crop	Summer		



Crop	Area (m ²)	Yield (kg)	Sale Price (₹/kg)	Crop	Area (m ²)	Yield (kg)	Sale Price (₹/kg)
Onion	750	250.0	20.0	Lady Finger	750	192	20
Knotted Cabbage		90.0	10.0	Tinda		92	30
Capsicum		25.0	40.0	Cucumber		128	20
Purple cabbage		47.0	20.0	Ridged Gourd		97	20
Cabbage		154.0	10.0	Squash		65	20
Tomato		174.0	25.0	Bitter Gourd		53	50
Cauli flower		90.0	23.0				
Chilli		65.0	50.0				
Broccoli		60.0	30.0				

Table 42: Economics of Food system under IOFS- 01 Acre Model (Uttarakhand)

Crops	Cost of Cultivation (₹)	Net returns (₹)	B:C ratio
Rice (Type-3)	3717	3698	1.99
Rice (Tilak Chandan)	3717	7190	2.93
Rice (PB-1509)	3717	5108	2.37
Wheat (Sarbat)	2231	5888	3.64
Black wheat	2231	3648	2.64
Vegetable Pea	2223	2652	2.19
Winter vegetables	10055	10795	2.10
Summer vegetables	7724	7326	1.90
Total system	35615	46305	2.47



Plate 26: Vegetables in IOFS (Uttarakhand)

Punjab

One acre integrated organic farming system model comprising 3 modules such as food and fodder system (0.30 ha), livestock (0.10 ha) is being established for evaluation. The performance of different modules is given below. The food and livestock system recorded a net income of ₹ 45,634 with a B: C ratio

of 1.85. Greenhouse emission was lower in turmeric followed by maize-gobhi sarson. Basmati rice-wheat system recorded higher emissions. Significant improvement in bacteria, fungi, and actinomycetes populations was observed in all the cropping systems evaluated under the organic farming system (Table 43 and 44).

Table 43: Performance of cropping systems under IOFS (Punjab)

Cropping system	Area (m ²)	Yield (kg)			GHG emission (kg CO ₂)
		Kharif	Rabi	Summer	
Greengram-wheat-greengram	500	27	210	32	49.7
Maize-gobhi sarson	500	275	123	-	29.5
Basmati rice-wheat	500	116	182	-	66.2
Maize-berseem (fodder)	500	1662	4880	-	35.8
Sugarcane	500	-	-	-	38.2
Turmeric	500	1100	-	-	28.6

Table 44: Microbial population (CFU/g soil) under different cropping systems under IOFS (Punjab)

Cropping systems	Bacteria (10 ⁻⁷)		Fungi (10 ⁻³)		Actinomycetes (10 ⁻⁴)	
	Initial	After first cycle	Initial	After first cycle	Initial	After first cycle
Kharif moong- wheat-Summer moong	34.1	42.5	11.8	16.4	33.4	39.6
Maize- gobhi sarson	34.4	40.7	10.2	14.5	33.5	38.7
Basmati rice- wheat	32.7	37.2	10.8	14.9	33.8	37.3
Maize-berseem (fodder)	33.6	39.8	11.5	15.5	34.0	37.8
Sugarcane	34.7	-	11.0	-	33.5	-
Turmeric	31.8	37.2	10.8	13.8	32.9	36.7

Table 45: Economics of IOFS (Punjab)

Economics	Components		Total
	Crops	Dairy	
Gross returns (₹)	60925	37806	98731
Cost of cultivation/inputs (₹)	25078	28019	53097
Net returns (₹)	35847	9787	45634
B:C	2.43	1.35	1.85



Plate 27: Crop + dairy integrated organic farming system at Ludhiana (Punjab)

Estimation and valuation of ecosystem services from organic and natural farming systems in different Agro-ecology (Project code: NRMIIFSRSIL202104000276)

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 (CM1), Complete Natural farming package (CM2), AI-NPOF package (CM3), Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic Sources) (CM4) 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) (CM4). In maize + cowpea (fodder) - wheat + chickpea, AI-NPOF

treatment gave on an average 71.4% higher produced capital in kharif season and 28.3% higher in rabi season as compared to control treatment. Similarly, AINPOF package gave 79.1% and 29.4% higher produced capital was recorded over NF in Kharif and Rabi season, respectively. During 2021-22, intercropping only was incorporated in CM2 treatment. In cotton + green gram -rabi sorghum + chickpea system, 26.9 to 52.6% and 65.1 to 171.2% reduction in produced capital was observed in NF and control treatment as compared to AI-NPOF package. In, soybean + maize for grain -vegetable pea + green coriander observed that the AINPOF package gave 26.3% (in main crop) and 11.2% in intercrop of kharif season as compared to the NF. Similarly, under AINP-OF package, in Rabi season the produced capital was recorded higher 23.1 to 43.1% in main and intercrop as compared to NF. The higher valuation of maize + cowpea (fodder) - wheat + chickpea was recorded under AINPF (87% over control and 83.4% over NF) package. Similarly, in cotton + green gram -rabi sorghum +chickpea cropping systems it was varied from 6.8% in NF to 65.6% over control.





Plate 28: Wheat + chickpea grown under control, NF, AI-NPOF and ICM treatment at Pantnagar

The Economics of Ecosystems and Biodiversity: Agriculture and Food initiative in Uttar Pradesh, India (Project code: NRMAIIFRSOL202110000282)

The project under TEEB-Agri Food in India was focused on agricultural practices and ecosystem services with the aim to assess the agricultural schemes on Organic Farming (OF) and Agroforestry (AgF) practices in the five districts of Uttar Pradesh namely Meerut, Aligarh, Bulandsahar, Mirzapur and Hamirpur. Under natural capital, total C sequestration in current year (2020) was 9.04, 12.4, 9.4 55.4 and 10.2 million metric ton in Meerut, Bulandsahar, Aligarh, Mirzapur and Hamirpur district. With BaU policy all district showed decline in C sequestration ranging from (-)0.1 to (-)9.7 % under RCP 4.5 and (-)0.43% to (-)15.5

% under RCP 8.5, except Aligarh district by the end of 2030. By the end of 2050, C sequestration under BaU ranged from 6.3% to (-)14.5% under RCP 4.5 and 6.1% to (-)44.6% under RCP 8.5. However, under pessimistic policy, C sequestration is declined by (-)0.7% to (-)10.1% under RCP 4.5 and (-)0.8% to (-)28.3% under RCP 8.5 by 2030 across respective districts. This trend of decline in C sequestration further extended up to (-)0.62% to (-)15.2% under RCP 4.5; and (-)1.05% to (-)45.4 % under RCP 8.5 by 2050. On the other hand, if it would be a pessimistic land use policy, 'C' sequestration is predicted substantial increase from 2030 to 2050 for all district under RCP 4.5 as well as RCP 8.5 as compared to BaU and Pessimistic policy and CC scenarios (Fig. 43).

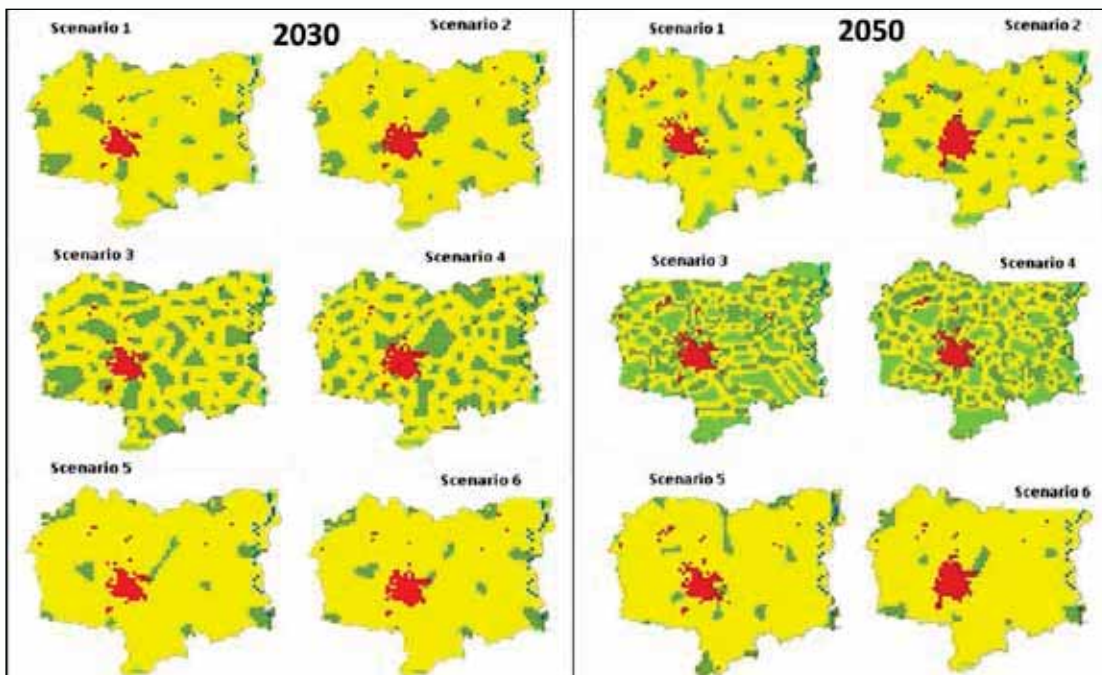


Fig. 43: Carbon sequestration under various climatic scenario of Meerut



Similarly, under Natural Capital, in the form of water and sediment yield was modelled using Soil and Water Assessment Tool (SWAT) and evaluated under predefined land use policy and CC scenario considering monetary value of ₹ 18.43/cum (0.223 USD/cum) for water. Considering the value of ₹ 60/cum (0.726 USD/cum) for sediment (CWC, 2012), economic value of sediment loss in base year (2020) is estimated to be 0.0005, 0.0009, 0.001 and 0.005 billion US\$ annually for Meerut, Bulandshahr, Aligarh and Mirzapur districts, respectively. Similarly, estimations in regard to produced capital were also contemplated for the aforementioned period and policies. Produced capital was assessed in terms of yield for all concerned scenarios.

The social capital is estimated in terms of the Sustainable Livelihood Security Index (SLSI), which is the summation of three indices, namely, Ecological Security Index (ESI), Economic Efficiency Index (EEI), and Social Equity Index (SEI), following both, organic and inorganic, landscapes. The SLSI

was higher under organic farming as compared to inorganic farming.

The participation of women in decision-making in different activities shows that about 43 and 21% women were involved in decision-making in field activities like selection of crop to be sown and labour being hired under organic farming as compared to conventional farming (21 and 20%, respectively). In the case of marketing and storage activities, more women participate in decision-making under conventional practices (91%) as compared to organic farming (26%).

Higher Agro-diversity index (ADI) values typically correspond to a more diverse system with greater resilience and CC impacts and market fluctuations. Under the OF the ADI value for Meerut, Bulandshahr, Aligarh, Mirzapur, and Hamirpur, are 57.21 (± 7.00), 53.33 (± 5.79), 51.50 (± 6.64), 57.74 (± 4.42), and 51.35 (± 4.78), while, for the conventional farming system the obtained values are 50.86 (± 6.31), 43.13 (± 5.16), 41.95 (± 5.38), 47.27 (± 4.65), and 43.21 (± 3.67), respectively (Fig. 44).

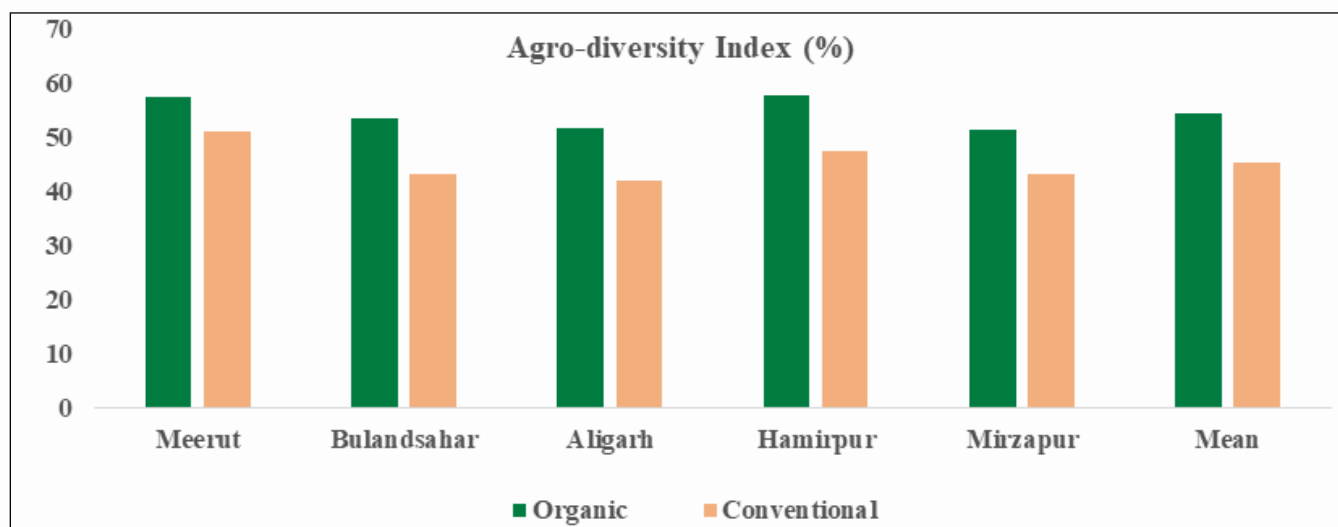


Fig. 44: Agro-diversity index of various districts under organic and conventional farming

TECHNOLOGY TRANSFER AND ASSESSMENT





AICRP- IFS OFR, Modipuram Centre (Project code: NRMAIFRSOP202004000259)

OFR 1: On-Farm evaluation of different management practices in pre-dominant cropping systems

Under OFR, Modipuram centre, the new location in district Meerut was selected in 2023-24 with two objectives (i) to assess the response of nutrients in major crops and cropping systems in different agroclimatic zones/ecosystems and (ii) to estimate the impact of nutrients application on soil health status. In

this programme two blocks were selected i.e. high productive (Rohta) and low productive (Daurala) with sugarcane, wheat, rice and sorghum crops. The first prominent cropping system was sugarcane-ratoon-wheat (occupying major area) while second major cropping system was dominated with rice-wheat cropping systems. All these crops were integrated with dairy as first and crop + dairy + horticulture as second pre dominant farming systems. In preliminary survey, average milk production 6.9 liters/animal was recorded in high productive block and 6 liters/animal was recorded in low productive block.



Plate 29: Field visit in Samoli-Salempur (Daurala block) village, District Meerut of OFR-1 by Director and scientists of ICAR-IIFSR

While, during 2022-23, four blocks were selected i.e. high productive (Chaprauli) and low productive (Binauli) in Baghpat district. In case of high productive block Lum, Kakaripur and Ramala and Idrishpur, Adampur and Kanad villages from Binauli block were selected. Total 10 farmers were selected for OFR experiment from each village. In this experiment, two cropping systems i.e. sugarcane-ratoon-wheat system and rice-wheat were selected with 6 nutrient management practices and compared with farmer's practice. The highest system equivalent yield in terms of sugarcane (1332.84 q/ha), cost of cultivation (₹ 1,79,605) and system net returns (₹ 3,53,523) were recorded in sugarcane-ratoon-wheat system with the recommended dose of NPK fertilizers (180:60:120) along with $ZnSO_4 + FeSO_4$ @ 25 kg/ha. In rice-wheat cropping system, highest system equivalent yield was recorded in terms of wheat (111.33 q/ha), with cost of cultivation (₹ 83,088) and system net returns (₹ 1,81,820) with the recommended dose of

NPK fertilizers (120:60:60) along with $ZnSO_4 + Boron$ @ 25 kg/ha. Application of balanced nutrition in sugarcane-ratoon-wheat and rice-wheat systems produced highest benefit: cost (B:C) ratio i.e. 2.97 and 3.19, respectively as compared to farmers' practices. Under this programme three capacity building and awareness programmes were organized involving 88 farmers and trained 71 farmers with scientific package of practices on integrated farming systems.

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

Experiment was conducted at 24 households with average land holding of 0.91 ha. Diversification of the existing farming systems of the 18 households led to improve net profit income up to ₹ 1,15,000 per household in crop + dairy + horticulture over the bench mark income due to technological interventions in different modules (Plate 30).



Plate 30: On farm participatory research on crop + dairy integrated farming systems

Ensuring food and nutritional security through integrated farming systems in Western Plain Zone of Uttar Pradesh (Farmer FIRST) (Project code: NRMAIFRSOL201606000261)

During the reported period, impact assessment of first phase under farmer FIRST project was done for Satheri and Bhangla village. The details are presented below in Table 46.

Table 46: Technological assemblage: Crop based technological Interventions

Crop modules		Varieties / Interventions	No. of farmers	Yield (q ha ⁻¹)	Cost of cultivation (₹ ha ⁻¹)	Yield improvement over FP (%)	Gross returns (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Sugarcane intercrops	Mustard	RH 725	35	15.75 (11.50*)	20472	36.96	85050	64578
	Black gram	PU-30	18	8.75	11265	-	56875	45610
	Green gram	Virat	9	6.70	11265	-	46900	35635
Sugarcane crop		IPNM, IWM, Legume intercropping	73	900 (750*)	105800	20	315000	209200
Wheat sole crop		DBW-187, DBW-222, DBW-173	69	52.00 (45*)	38575	15.55	129200	90625

*FP yield, selling price of black gram ` 6500/q, green gram ` 7000/q, wheat ` 2100/q and sugarcane ` 350/q

Intercropping in sugarcane with mustard, black gram and green gram resulted in mean additional return of ₹ 64,578, ₹ 45,610 and ₹ 35,635, respectively. Improved sugarcane crop management practice provided mean net return of ₹ 2,09,200 per ha while improved management of wheat provided mean

net return of ₹ 90,625 per ha. Intercropping of mustard, black gram and green gram resulted into higher system equivalent yield of 24.13%, 21.66% and 17.87% as compared to sole crop (Table 47).

Table 47: Sugarcane equivalent yield (SEY) in different intercropping systems

	SEY (q/ha)	No. of farmers	Increase in system yield (%)
Sole Sugarcane	750	31	-
Sugarcane + Mustard	931	33	24.13
Sugarcane + Black gram	912.5	18	21.66
Sugarcane + Green Gram	884	09	17.87



The data on, change in crop area and crop diversification (Simpson Index) were also recorded. Adoption of IFS with multitude of crop options resulted in higher crop diversity measured through Simpson index which was 0.53 as compared to adoption of IFS i.e. 0.42. (Table 48). Adoption of improved

varietal intervention in Mustard revealed that, RH-725 performed very well at farmer's field. Earlier farmers didn't grow black mustard due to poor yield ranging from 10-12 q/ha but now they are growing improved varieties of mustard with higher yields up to the tune of 22-28 q/ha.

Table 48: Impact of cropping systems diversification

	Before	After	Simpson index of diversification
Gross cropped area (ha)	1.35	1.46	Before - 0.42 After - 0.53
Mustard area (ha)	0.08	0.17	
Black gram (ha)	0	0.15	
Green gram (ha)	0.08	0.16	
Sugar cane (ha)	0.92	0.94	
Wheat (ha)	0.27	0.28	
(n=120)			

Interventions under livestock module, resulted in improvement in milk yield to the tune of 1.13 liters in case of cow and 1.18 liters in buffalo as compared to farmer practices (Table 49). In

poultry, the farmers gained the additional income of ₹14,160 from improved rearing of backyard poultry.

Table 49: Improvement in livestock due to technological intervention

Animal	No. of adopters	Milk yield Litre/animal/day (FP)	Milk yield Litre/animal/day (IP)	Gross income/year (FP)	Gross income/year (IP)
Cow	55	6.69	7.82	59950	76662
Buffalo	49	7.07	8.25	75240	89885
Poultry	10 (2 male)	260 (Egg from two hens)	1440 (Egg)	3120	17280

Under horticultural module, management of orchard module with nutrient management through FYM along with nutritional kitchen gardening kit (diverse nutritionally rich vegetables and green leafy vegetables) were included as technological intervention for enhancing household nutritional security. For animal health maintenance and improving their performance

in terms of milk yield, mineral mixture supplementation was implemented in households having milch animals. Fish based farming system model has been established with technical input under project to farmer at Meerapur Dalpat village which will be further strengthened in coming years.



Plate 31: Horticultural interventions in the adopted villages

For capacity building and awareness creation Kisan Gosthi and Field Day were organized in the study cluster including Mahila Krishak Gosthi for gender mainstreaming. Scientist-Farmer interaction programme was organized on 11th March,

2023 under Farmer FIRST Programme. Farmer visits were also made on the eve of 34th Foundation Day of IIFSR on 1st April, 2023 and on the eve of Shree Anna programme celebration on 21st September, 2023 (Plate 32 to 34).



Plate 32: Visit of Dr. Sunil Kumar, Director, ICAR-IIFSR at on-farm demonstration sites under Farmer FIRST at Mubarikpur village (Khatauli Block), District Muzaffarnagar



Plate 33: Celebration of Shree Anna Divas on 21st September 2023 under Farmer FIRST programme at ICAR-IIFSR, Research Farm



Plate 34: Kisan Gosthi and Farmer – Scientist interaction on 11th March 2023 under Farmer FIRST Project at Mubarikpur village (Khatauli Block), District Muzaffarnagar

Characterization of existing farming systems of Uttarakhand (Project code: NRMAIFSRSL 201810000263)

The study area encompasses the existing farming systems of Mid hills of Uttarakhand. A Survey was conducted to characterize the existing farming systems, income pattern (farm and off farm), mechanization and income level, constraints and technological solutions identified in existing farming systems of Mid hills of Uttarakhand. The total sample comprised a random sample of 60 households i.e. (1 District x 2 block/ district x 6 villages/ block x 10 households) using a stratified sampling frame. Bachuradi,

Balleigh and Lodh villages of Takula block, (high productive) located at 29°77'88 N to 29°79'99 N and 79°60'41 E to 79°68'08 E, whereas Dhamas, Canalbunga and Mahatgaon villages of Hawalbagh block (low productive), located at 29°59.26' N to 29°64.93' and 79°57'68 E to 79°68'08 E of Almora district of Mid hill region of Uttarakhand (1000-1500 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. Socio-economic status of the farmers of the study area was as follow (Table 50).

Table 50: Socio Economic status of farmers in existing farming systems

Variables	Farm size (ha farm household ⁻¹)	
	Takula Block	Hawalbagh Block
Operational landholding	0.12 (0-0.5)	0.18 (0-1.0)
Leased in	0.075 (0-0.60)	0.074 (0-0.50)
Total	0.19 (0.02-0.6)	0.23 (0.05-1.0)
Uncultivated landholding	0.057 (0.02-0.20)	0.059 (0.02-0.24)
Farm fragments	5.06 (2-12)	4.89 (2-12)
Off farm enterprises	93%	80%
Family Size	4.43 (1-7)	4.65 (1-7)
FFHD's	23%	13%

*FFD's = Female Headed Households

Data presented in Table 50 reveals that in Takula block (high productive) of Almora District, mean operational landholding was found to be 0.12 ha having ranges from 0-0.5 ha farm household⁻¹, whereas mean leased in land was found to be 0.075 ha farm household⁻¹ ranging from 0-0.60 ha farm household⁻¹. The total landholding was noticed to be 0.19 ha farm household⁻¹ ranging from 0.02-0.6 ha farm household⁻¹. However, 0.057 ha area was found to uncultivated ranges from 0.02-0.20 ha. The mean farm fragments were 5.06 ranges from 2-12. The farm households are having 93 per cent off farm enterprises ranging from 1-3 off farm enterprises household⁻¹. Around 23% farm households were female headed. The mean family size was 4.43 ranges from 1-7 family size farm household⁻¹. Similarly, in Hawalbagh block (low productive) of Almora District, mean operational landholding was found to be 0.18 ha ranges from 0-1.0 ha farm household⁻¹, whereas mean leased in land was found to be 0.074 ha farm household⁻¹ ranges from 0-0.50 ha farm household⁻¹. The total landholding was noticed to be 0.23 farm household⁻¹ ranges from 0.05-1.0 ha farm household⁻¹. However, 0.059 ha area was found to uncultivated ranges from 0.02-0.24 ha. The mean farm fragments were 4.89 ranges from 2-12. The farm households are having 83 per cent off farm enterprises ranging from 1-3 off farm enterprises household⁻¹. The mean family size was 4.65 ranges from 1-7 family size farm

household⁻¹. Around 13% farm households are female headed. The uncultivated area is being used for grass collection purpose in order to feed their milch animals in both the blocks.

Around 93 per cent households are having off farm enterprises in Takula (high productive) block out of which around 53.3 per cent found to have private job 26.6 % are earning through farm/construction labourers whereas 20 per cent households are earning through govt. pensions (widow/desertion/old age/ex-army man/disability) etc. along with labourers/private job or with both the occupations. However, in Hawalbagh block around each of 80 per cent households are having off farm enterprises in Hawalbagh (low productive) block out of which around 45.8 percent found to have private job 25% are farm/construction labourers, 12.5 per cent households are earning through govt. pensions, 8.3% percent are earning through business whereas 8.4 per cent are earning through private job along with govt. pension.

The less availability of machineries due to terrain farming system shows that the mechanization level is low in mid hills of Uttarakhand. However, around 30 per cent farmers (3.3 % owned and 26.6% rented) found to be using power tillers for land preparation purpose. Majority of the farmers (70%) are still using indigenous plough along with bull energy for the land preparation (Fig. 45).

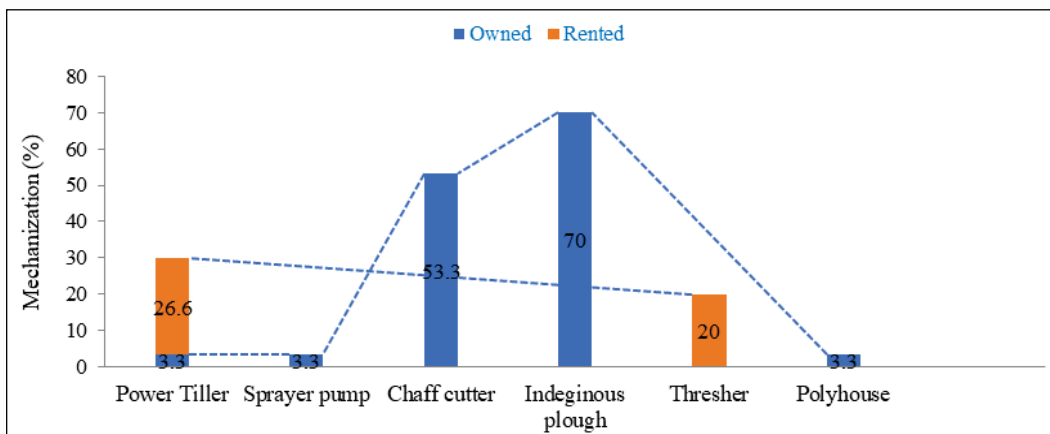


Fig. 45: Mechanization level in existing farming systems

Likewise, 20% of farmers are using threshers for wheat/finger millet threshing which was developed and demonstrated by ICAR-VPKAS, Almora in mid hills. Only 3.3% of farmers, who are practicing horticulture-based farming are using spray pump and polyhouse. Manually operated chaff cutter is being used by

53.3% of farmers

Farming system characterization of the study area is presented in Fig. 46 and 47. Crop (kharif rice + millets+ legumes –wheat/lentil/mustard-summer rice) + Livestock (dairy/goatery) was found to be the dominant farming system of Takula block,



practiced by 96% of farmers whereas, Crop (millets/kharif rice +legumes –wheat/lentil/vegetables-maize) + Livestock (dairy/goatery/poultry) was the dominant farming system of Hawalbagh block, practiced by 94% of farmers, whereas only 4% farmers of Takula block and 6% farmers of Hawalbagh block are practicing horticulture based farming system as protected mode in surveyed population. The mean productivity of all the field crops is insignificant (40-60% lower than national average) except kharif rice. Finger millet (~1057 kg ha⁻¹), barnyard millet

(~685 kg ha⁻¹), summer rice (~1220 kg ha⁻¹), black soyabean (~925 kg ha⁻¹), white soyabean (921 kg ha⁻¹), horse gram (661 kg ha⁻¹), maize (1258 kg ha⁻¹), blackgram (927 kg ha⁻¹), kharif rice (2791 kg ha⁻¹), wheat (959 kg ha⁻¹), lentil (362 kg ha⁻¹), mustard (462 kg ha⁻¹). The major reason for low productivity is wild animal menace and rainfed farming situation which are also the prominent constraint of the region. Different activities performed by farm women in hills is presented in Plate 35 while view of horticultural interventions can be seen in Plate 36.

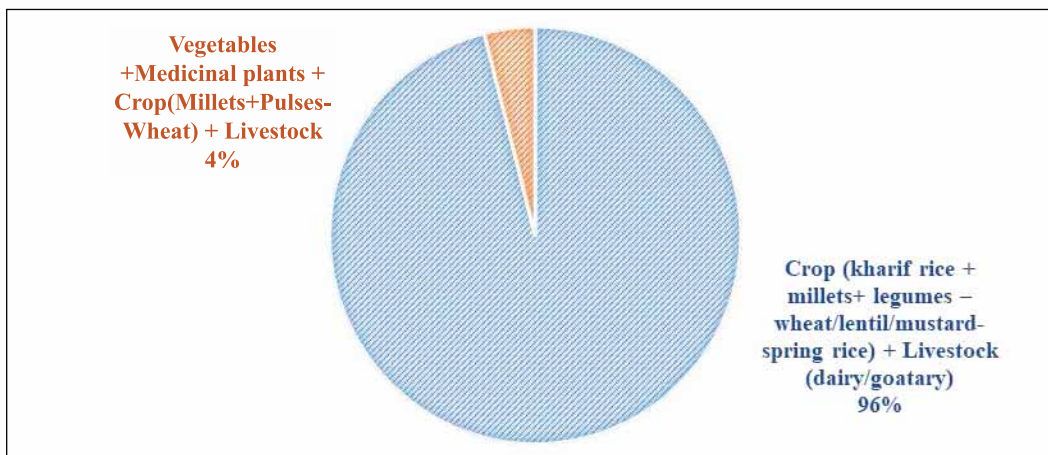


Fig. 46: Farming systems of Takula Block, District Almora

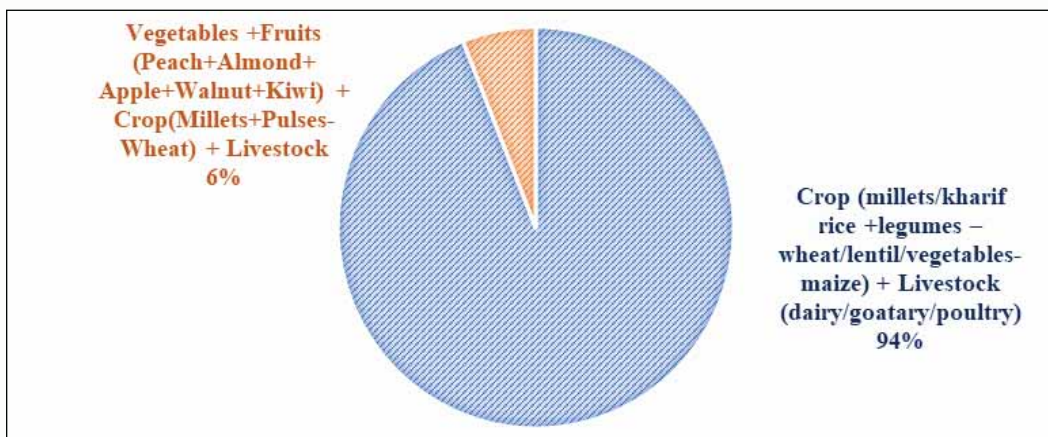


Fig. 47: Farming systems of Hawalbagh Block, District Almora



Plate 35: Women farmer of mid hills performing (a) Weeding in maize (b) Carrying fodder for livestock feeding



Plate 36: Horticultural based farming system in mid hills (a) Protected cultivation (b) Soil and moisture conservation through mulching

Status of Agriculture in Jammu and Shimla Division of Western Himalayan Region (Project code: NRMAPDFRSIL201801000160)

A survey of Shimla District Himachal Pradesh was conducted to characterize the status of various farming systems and their impacts on the livelihoods of farmers (Plate 37). Nearly 27.5, 11.3 and 21.3% of farmers were found following the organic agriculture, respectively in Rohru, Chidgaon and Jubble blocks while the rest are inorganic grower. In whole district on an average, 28% percent follow organic cultivation rest are inorganic grower. The productivity of rice was recorded 15.5 q/ha for organic cultivators while for inorganic cultivators it was 21.9 q/ha. On an average 2.3 animal including cow, goat,

poultry were reared by each sample household. Inorganic producers utilized inorganic fertilizers to the tune of nearly 40 kg/ha. While FYM, compost and vermicompost were the major organic materials for organic growers. The products mainly based on cow dung. Agriculture, agriculture+ animal husbandry, agriculture+ horticulture, agriculture+ animal husbandry+ horticulture are the major and minor farming systems of this region. Cereal based and livestock-based farming system were followed predominantly by 72% of farmers. Apple, peach, pear and plum are the major fruit crops however barley, millets, maize and wheat are the major cereal crops in the entire districts. Pulses and certain vegetable crops also exist in few patches.



Plate 37: Interaction with farmers at Shimla District

Consortium for scaling-up climate smart agriculture in South Asia (Project code: NRMIAIFRSOL 202212000283)

Under this project, Kharkiya, Matila, Gairoli, Deolikhan, Champakhali and Khunt villages of Almora districts were selected for the demonstration of organic and natural farming in finger millet +soybean cropping system and Agri-livestock-vegetable-allied enterprises based integrated farming system.

Altogether, 60 farmers were selected for demonstration in 53 ha area. The improved organic farming practice increased 12.30% system yield over farmer practice (Fig. 48) with enhancement of 28.5% net returns and 5% benefit cost ratio. Similarly, adoption of the improved IFS model (Agri-livestock-vegetable-allied enterprises) increased the system productivity, net returns and B:C ratio by 6.7%, 17% and 3.5%, respectively over existing farmer practice. In total 185 farmers were benefited with capacity building (Plate 38) and awareness programme.

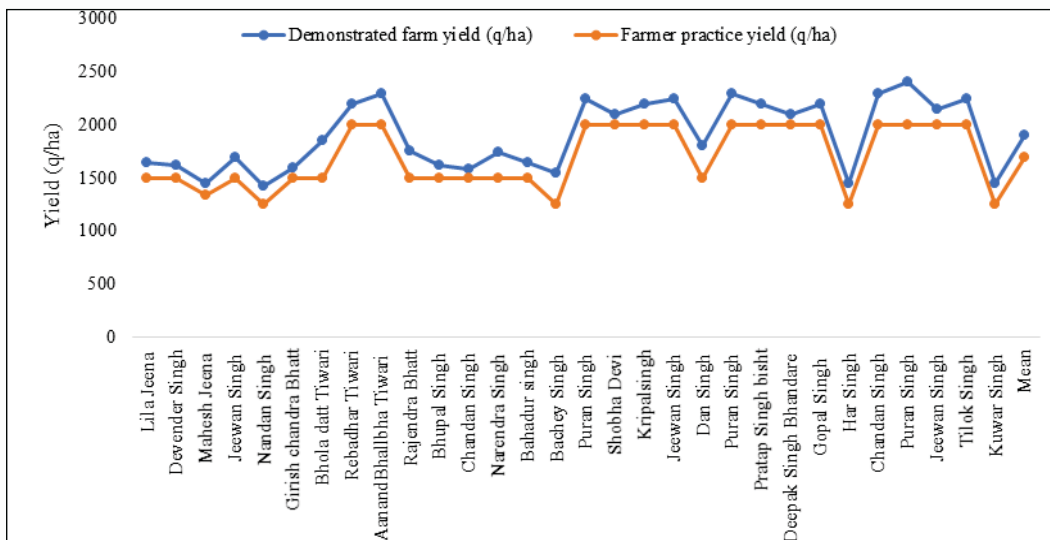


Fig. 48: The comparative yield in finger millet + soybean (FEY) under demonstrated farm and farmers field

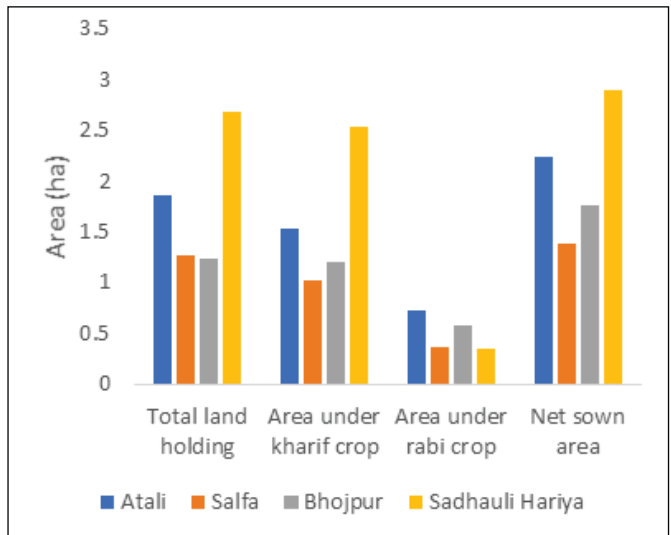
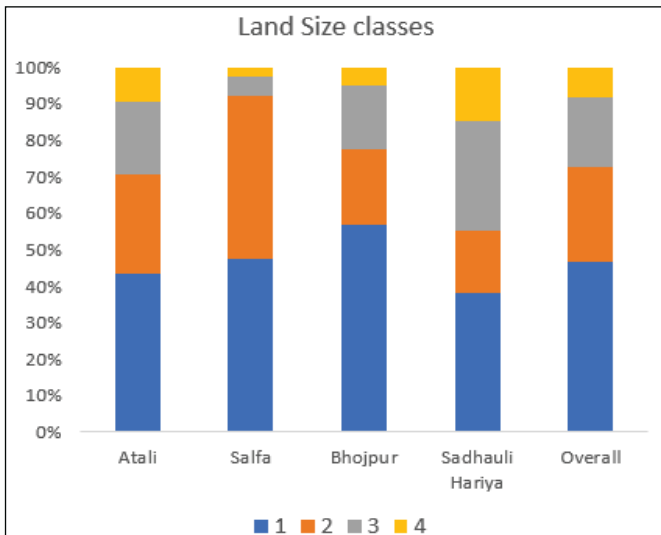


Plate 38: Organized capacity building programme on organic and natural farming, Almora

Co-creating sustainable water use in the Hindon sub-basin: A multiscale participatory approach (Project code: NRMAIFRSOL202204000279)

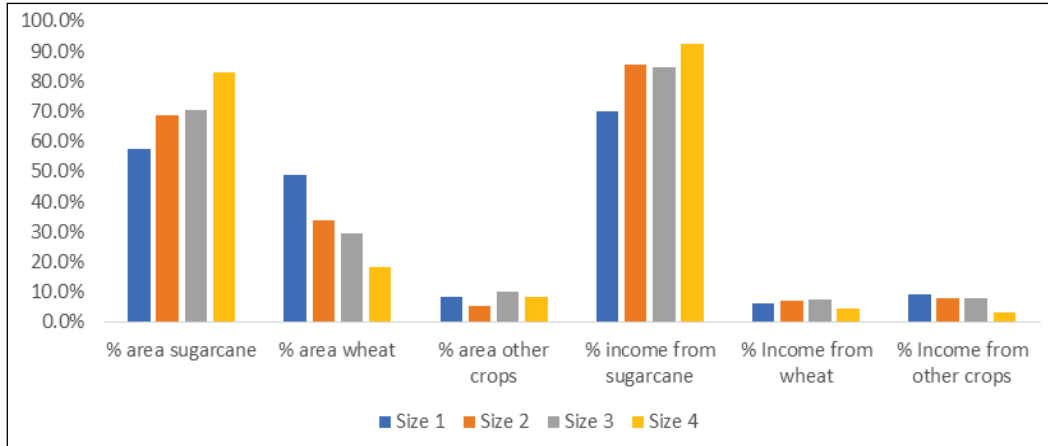
During the reported period survey at 4 locations of Hindon Basin was carried out by ICAR-IIFSR along with consortia partners including PSI, Dehradun. Survey of 85 households (Atali), 38 households (Salfa, Shamli), 59 households (Bhojpur, Saharanpur) and 47 households (Sadhauli Hariya in Saharanpur) was completed for enumerating the typology of the farming systems of the region. Further, survey of Kannauni (Meerut), Bhanera Khemchand (Saharanpur) and Maleera (Muzaffaranagar) is being conducted by PSI, Dehradun.

During the reporting period, characterization of land classes, cropping systems information, livestock information and income related information was collected using the surveyed information in collaboration with WUR, The Netherlands. Classification of land size classes at different sites is presented in Fig. 49, which revealed majority of the farmers belonging to small and marginal category of farmers. Analysis of cropping system information revealed that, other than Bhojpur, sugarcane is the predominant crop in the Hindon Basin surveyed while mostly small holder farms, though Sadholi Hariya has a few extremely large farms. Cropping area during kharif and rabi for the survey locations are presented in Fig. 50.



1 – less than 1 ha; 2 – 1-2 ha; 3 – 2-4 ha; 4 – 4-10 ha; 5- larger than 10 ha (combined with 4 since only 2 farms)

Fig. 49: Land holding and cropping area of the selected villages



1 – less than 1 ha; 2 – 1-2 ha; 3 – 2-4 ha; 4 – 4-10 ha; 5- larger than 10 ha (combined with 4 since only 2 farms)

Fig. 50: Percentage area under different crops among different land classes and their income contribution

Further, percentage area in different major crops across different land classes were studied and presented in Fig. 51 which gave information about the importance of the main crops. Study of income sources across surveyed locations revealed, Bhojpur has high % of income from daily wages. Sadholi Hariya has higher average income and Bhojpur and Sadholi Hariya

has higher average income from livestock. It was observed that, smaller farms supplement farm income with daily wage labour larger farms has higher average livestock income but becomes a smaller % of total income (Fig. 51 and 52). Almost all households have at least some livestock – mostly cows followed by buffalos.

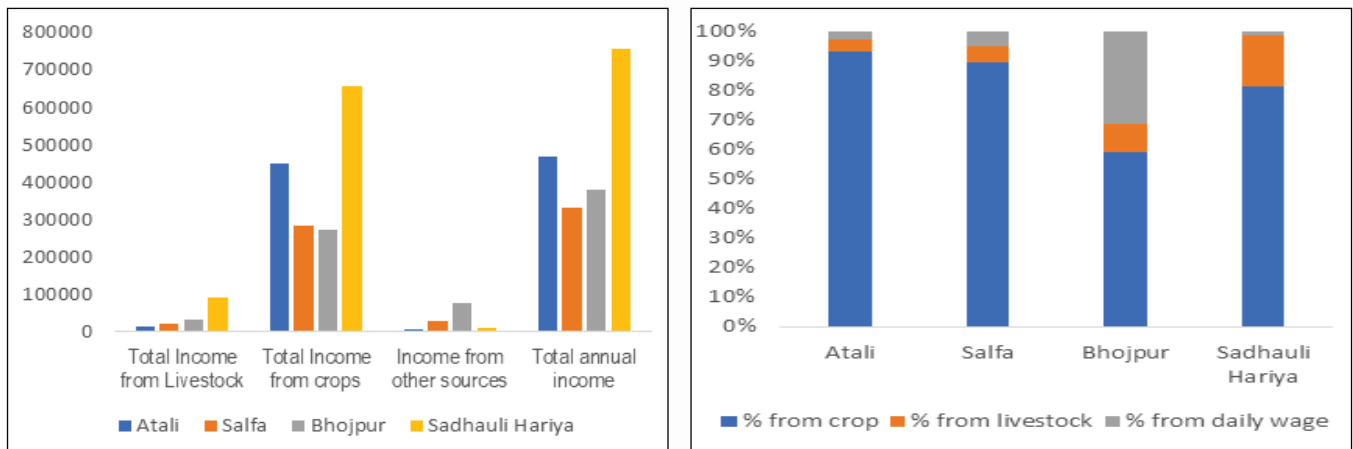


Fig. 51: Sources of Income in the study cluster of Hindon Basin across different locations

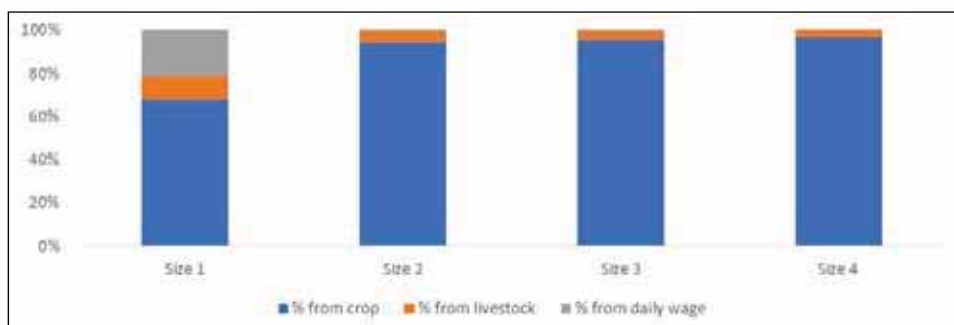


Fig. 52: Land class wise sources of income

During the reporting period series of district-level stakeholder meetings (4 nos.) were held during 18th to 31st July, 2023 in the Hindon basin. In this series of workshop, ICAR-IIFSR organized a stakeholder consultation meeting on 28th July, 2023 (Plate 39)

to identify and build connections with the relevant stakeholder and explore the roles, responsibilities and priorities of various stakeholders.



Plate 39: View of stakeholder meeting organized under DST project on 28th July 2023 at ICAR-IIFSR

Collection of soil and water data are being done regularly for their qualitative study (Plate 40). During the period farmers were provided with improved fodder (Bajra Napier Hybrid) for higher

green fodder yield to meet demand of animals while groundnut was introduced in the village. Further, implementation of different farming systems interventions are in progress.



Plate 40: Water sample collection from the Hindon river

Agri-Drone Project (Project code: NRMAIIFSR SOL202208000281)

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. During the period demonstration was conducted at Atali village as well as at IISFR farm (Plate 41).



Plate 41: Drone demonstration at Atali and ICAR-IIFSR and application of drone for spraying

Improvement of existing farming systems of underprivileged households through SCSP-AICRP/Network and AINPOF (Project code: NRMAIIFRSRIL202005000274)

More than 80% of the world, as well as Indian farmers, fall under the small and marginal (less than 2 ha) category. India alone has one-fourth of the small and marginal farms in the world.

Small holding does not support farmers to live with respect in 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 have 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.

Table 51: Detail of districts covered under scheme

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

Aiming to enhance existing farming systems of underprivileged households, targeted interventions were implemented module-wise at SCSP households (Table 51). These interventions resulted into significant changes, fostering an overall increase in farm productivity. The incorporation of DBW-173 (late sown) with an improved package of practices in the 2022-23 agricultural year resulted in a remarkable 54.4% increase in wheat yield. Farmers observed a substantial improvement of 19.01 q/ha in wheat yield compared to the base year. In case of mustard cultivation, farmers expressed high satisfaction with the performance of RH-725 (25-28 q/ha vs 10-12 q/ha with local variety). Livestock feeding management was improved

with the introduction of BNH (cv. CO-5) and Brassica napus (cv. GSC-7) in sugarcane as intercrop during winters, through supplementation of regular supply of green fodder. In the third year, the interventions which demonstrated success in farmers' fields during the previous two years were continued. This targeted approach resulted in a significant reduction in the cost of interventions, with only ₹ 1520 being spent on critical inputs in 2022-23 (Table 52). Despite this modest investment, the overall Benefit-Cost (B:C) ratio enhanced to 2.02 (Table 53). Farmers experienced an additional income of ₹ 34,588 due to interventions on critical inputs during the same period.

Table 52: Changes made in existing IFS practiced by farmers and additional cost

Existing System				Changes made	Cost of intervention (₹) 2022-23
Module	details	Cost (₹)	Gross income (₹)		
Cropping systems diversification	Sugarcane	19923	50170	Late sown wheat (DBW-173)	800
	Wheat	5532	13977	Mustard Seed	120
Livestock diversification	Buffalo and cow	55300	73775	BNH (CO-5) and Gobhi sarso	2,300
Optional	-	-		Vegetable seed kit (Kharif and Rabi) Garlic seed for kitchen gardening (Yamuna Safed-2/G-50)	300
		80,755	1,37,922		1,520

Table 53: Economics of low-cost IFS over base year

Parameters	Benchmark (Before intervention)	Low cost-based intervention period (years)	Low cost-based intervention period (years)	Low cost-based intervention period (years)
		1 st	2 nd	3 rd
Cost of cultivation (₹/year)	80,755	84,575	84,575	90,350*
Gross return (₹/year)	1,37,922	1,58,840	1,65,840	1,82,105
Net income (₹/year)	57,167	74,265	81,265	85,542
B: C ratio	1.70	1.88	1.96	2.02

*Increase in cost of cultivation was taken 10% of base year in the third year



Plate 42: Intervention made at SC farmers field during 2022-2023

On-farm participatory research for improvement of existing farming systems of under privileged households through Schedule Caste Sub-plan (SCSP) in Bahadradab block, District Haridwar (Uttarakhand) (Project code: 080/S/IPP/NRMAIFRSIL202104000288)

villages of Laldhang cluster situated in the foothills of Rajaji National Park, Uttarakhand have been adopted. The farmers were surveyed for their socio-economic status. As per the survey, the selected villages were dominated by the marginal farmers' category owning 55.6% marginal; >36.3% small farmers; >22.9% medium and large farmers. The mean level of cropping intensity of adopted villages is 164%.

A total of 310 numbers of farm families of Scheduled Caste (SC) category from Dalupuri, Rasoolpur Mithiberi and Chamariya

Table 54. Category of farmers as per land holdings at selected village

Particulars	Landless farmers	Marginal farmers (<1 ha)	Small farmers (1-2 ha)	Medium and large farmers (>2 ha)	Overall
Farmers (No.)	76	88	22	14	200
Percent (%)	38	44	11	7	100
Average family size (Nos.)	5.07	4.50	5.09	5.43	5.0
Average age (Years)	42.7	44.7	49.9	49.6	46.7
Education (number of years of schooling)	5.3	6.7	8.8	9.7	7.6
Farming experience	-	32.0	35.3	33.0	33.4
Non-farm income					
Wage days	148	175	148	160	157.8
Wage rate	185	252	311	395	285.8
Non-farm income (Rs.)	49051	70633	88773	246789	113812
Mean land holding (ha)					
Owned land	-	0.306	0.871	1.637	0.938
Leased-in land	-	0.116	0.511	1.458	0.695
Leased-out land	-	-	-	0.964	0.964
Operational holding	-	0.423	1.383	3.095	1.634

Particulars	Landless farmers	Marginal farmers (<1 ha)	Small farmers (1-2 ha)	Medium and large farmers (>2 ha)	Overall
Possession of Kisan Credit Cards (KCC %)	-	70.6	76.7	79.5	75.6
Membership in organizations					
Gram Panchayat (%)	30.2	31.3	22.1	22.5	26.53
Co-operative society (%)	12.3	40.5	38.7	38.3	32.45
Marketing society (%)	5.1	34.3	44.2	41.8	31.35
SHG's (%)	66.3	55.6	36.3	22.9	45.28
Adoption of micro-irrigation (%)	-	-	5.6	11.4	8.50
Adoption of crop insurance (%)	-	-	9.8	17.9	13.85
Cropping intensity (%)	-	157.9	162.7	171.3	164.0

The data depicted in Fig. 53 shows that the average area shown by individual farmers under wheat crop was 0.20 ha. The improved HD 3086 variety of wheat produced on an average of 32.71 q ha⁻¹ yield; whereas the traditional cultivar used by the farmers produced only 26.9 q ha⁻¹ yield. Thus, the improved HD3086 variety 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. In the project study area, 29 birds /farmer were distributed to each farm family that produced on an average of 19 egg per bird which in turn produced a total of 67.67 eggs per farm family (Fig 54).

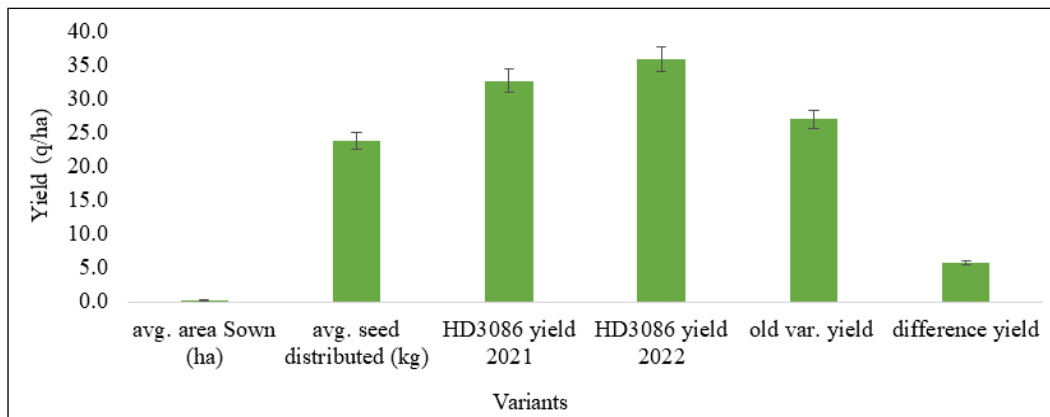


Fig. 53: Performance of high yielding variety of wheat at selected farmer's field

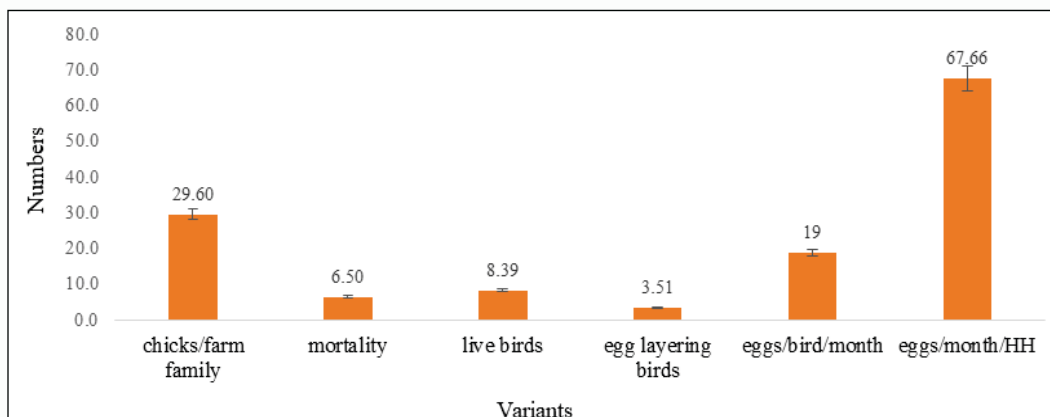


Fig. 54: Performance of poultry bird intervention in terms of nutritional and livelihood



Plate 43: A view of poultry and vermicompost intervention

Sustainable livelihood improvement of SC farmers through integrated farming system approach (Meerut and Muzaffarnagar districts)

During this year, the SCSP Program was implemented in four villages viz., Dhanju, Khanuda, Kasiara and Rasoolpur of Meerut and Muzaffarnagar districts. The selected SC category farmers belonged to either the marginal or sub marginal farmers category (land holdings 0.3-0.6 ha/farm family) and having their annual income by 40-50%, 30-40% and 10-30% from farm field, livestock and off farm activities, respectively. For bringing out some of the improvement in their economic, social and livelihood situations, the farmers were provided innovative

agricultural techniques of various farming system modules. Around 339 number of land holder farmers were given seeds of high yielding varieties of wheat and mustard as crop module and nearly 60 number of farmers were provided seeds of improved variety of berseem and oat for fodder supply. Approximately 350 number of landless farmers were covered to support in terms of balance nutrition on animal health and productivity. Details of interventions made are given in Table 55. To educate farmers' certain animal Health Camps and Kisan Gosthis on Rabi season crop modules of farming systems were also organized in the adopted villages.

Table 55: detail of interventions implemented, demonstrations conducted and beneficiaries covered

IFS Module	Demonstrations	Detail of interventions/ quantity to each farmer	Village	No. of farmers covered
Field crop	Improved variety of wheat	DBW-187 and DBW-222 @ 15-20 kg	Kasiara	54
	Improved variety of mustard	RH-725 @ 400-500 g	Rasoolpur	43
			Khanuda	45
			Dhanju	97
Fodder crops	Improved variety of oat	Highly nutritive Kent variety seed	Kasiara	16
			Dhanju	10
	Improved variety of berseem	Highly nutritive BL-10 variety seed	Kasiara	25
			Dhanju	12
Livestock	Mineral mixture, Ca-suspension and Fendokit Plus tablets	1 kg pack of Mineral mixture and Ca-suspension were given @1-3 numbers/ farmer depending on the number of animals	Kasiara	90
			Rasoolpur	25
	Animal mattresses	17 numbers @1/farmer	Dhanju	250
			Dhanju	17

Performance of demonstrations: During this year, mustard variety i.e. RH-725 demonstrations were laid out in an area of approximately 80 ha belonging to >300 farmers of all the four villages. Depending on farmer to farmer performance, an incremental increase in yield ranging from a minimum of 10% to

a maximum of 30% was recorded as compared to the previous year's performance. The monetary benefit to the farmers by a higher value of nearly 20-25% was achieved. The comparative performance of intervention given to 25 numbers of farmers is represented graphically in Fig. 55.

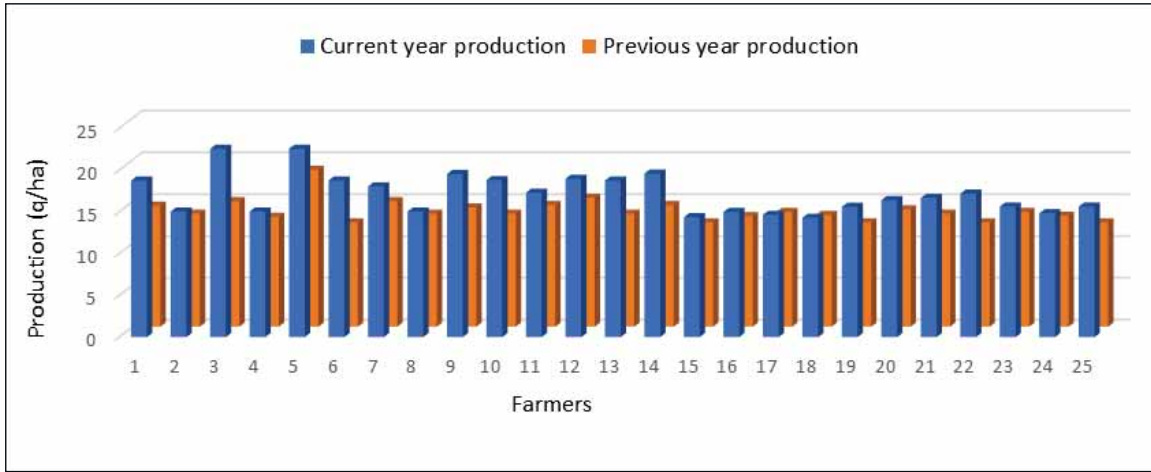


Fig. 55: Performance of mustard demonstration with different farmer’s in SCSP adopted villages

In case of wheat, the seed of high yielding varieties (DBWL-187 and DBWL 222) of wheat were provided to 339 numbers of farmers of the same villages that was sown to a total area of approximately 40 ha. Farmers not only reported a vigour plant growth with having broad and lush green leaf canopy as compared to other varieties of wheat sown in same area by other farmers but also realized a higher yield advantage to the tune of 10-30%. Performance of wheat in different villages is

graphically represented below in Fig 56. The fodder crop also performed well at farmer’s field and found to produce nearly 50-60 and 70-80 t ha⁻¹ green fodder yields, respectively in two cuts of oat and 5-6 cuts of berseem. Various nutrient supplements viz., mineral mixtures, Ca-bottle (balance nutrition) and Fendokit Plus Tablets also proven beneficial in maintaining animal health as well as increase in milk productivity by a margin of 5-10%.

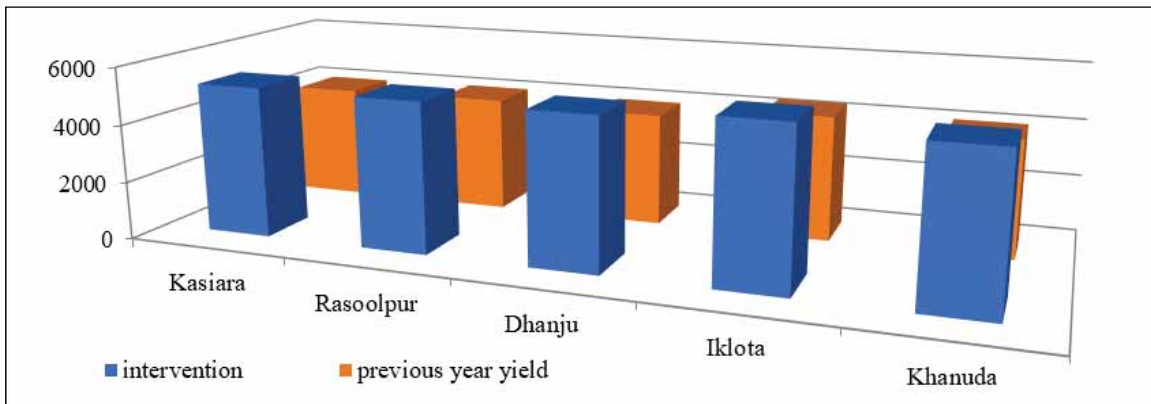


Fig. 56: Performance of wheat at farmers field in selected SCSP villages

National Agriculture Innovation Fund (NAIF): ABI IIFSR (Component II)

ABI: IIFSR

The ABI: IIFSR centre organized various activities benefiting numerous participants including entrepreneur farmers, women self-help groups and students. During the year, a total of 26 entrepreneurs and incubators were admitted for incubation and 12 of them successfully graduated. Additionally, 12 entrepreneurs or startups initiated their businesses. Under

incubation, six new products were developed. The centre also organized ten Entrepreneur Development Programmes (EDPs) and six agri-business development awareness programmes. These activities generated revenue of ₹ 1.8 lakhs.

Entrepreneur Development Programme (EDPs) organized

1. Entrepreneurship development through year-round mushroom production an exposure visits cum hands on training for mushroom farmers/entrepreneurs under ABI Project on 3rd March, 2023 at Regional Mushroom



- Research Centre (RMRC/HAIC), Murthal, Haryana with 8 incubates and 35 other participants (Plate 44).
- 2. Entrepreneur/ FPOs interaction programme during ICAR Institute Industry Interaction meet of NRM Division at New Delhi on 17th July, 2023 with 5 incubates (Plate 45).
- 3. Entrepreneur Development Programme on value addition of millets on 10th October, 2023 (Plate 46).
- 4. EDP on demonstration of technologies developed under ABI project of ICAR-IIFSR on Kisan Diwas, 23rd December, 2023, Johri village, Baghpat (Plate 47).



Plate 44: EDP on mushroom farming 3rd March, 2023



Plate 45: Entrepreneur/ FPO interaction meet 17th July, 2023



Plate 46: EDP on value addition of millets on 10th October, 2023 at ICAR-IIFSR



Plate 47: Demonstration of technologies 23rd Dec., 2024 at Johri village, Baghpat

Other activities

MoU signed between four agri-startups (1. Agi Farm buddy, 2. Anant Gold Sirka, 3. Deshi Mushroom Agro. Pvt. Ltd. and 4. Orgifruit Meerut) and ABI IIFSR for technological backstopping of the startups and promoting agribusiness in the region on 3rd May 2023.



Plate 48: MoU signing with four emerging Agri-startups and ICAR-IIFSR on 3rd May 2023



NEW PRODUCTS/TECHNOLOGIES DEVELOPED UNDER INCUBATION



Plate 49: Banana Jam



Plate 50: Organic jiggery and Shakkar



Plate 51: Banana Sauce



Plate 52: Immune Boosting Carrot Sauce



Plate 53: Millet Cookies



Plate 54: Aonla pickle and murabba



PUBLICATIONS

Research Papers

i) International

- Ansari M A, Ravisankar N, Ansari M H, Babu S, Layek J, Panwar A S. 2023. Integrating conservation agriculture with intensive crop diversification in the maize-based organic system: Impact on sustaining food and nutritional security. *Frontiers in Nutrition*, 10:1137247. doi: 10.3389/fnut.2023.1137247 (NAAS Rating: 11.00).
- Babu S, Singh Raghavendra, Avasthe R K, Rathore S S, Kumar S, Das A, Layek J, Sharma V, Wani O A, Singh V K. 2023. Conservation tillage and diversified cropping enhance system productivity and eco-efficiency and reduce greenhouse gas intensity in organic farming. *Frontiers in Sustainable Food Systems*, 7:1114617. doi: 10.3389/fsufs.2023.1114617 (NAAS Rating: 10.70).
- Babu S, Singh Raghavendra, Avasthe R, Kumar S, Rathore S S, Singh V K, Ansari M A, Valente D, Petrosillo I. 2023. Soil carbon dynamics under organic farming: Impact of tillage and cropping diversity. *Ecological Indicators*, 147:109940. <https://doi.org/10.1016/j.ecolind.2023.109940>. (NAAS Rating: 12.90).
- Babu S, Singh Raghavendra, Kumar S, Rathore S S, Yadav D, Yadav S K, Yadav V, Ansari M A, Das A, Rajanna G A, Wali O A. 2023. Biochar implications in cleaner agricultural production and environmental sustainability. *Environmental Science: Advances*, 115(1): 1–7. (Impact factor: 3.50).
- Bhat S, Kumar D, Paramesh V, Kumar P, Ravisankar N, Kumar S, Kashyap P, Arunachalam V. 2023. Enhancing farm profitability and sustainability through integrated farming systems: A case study of coastal Karnataka, India. *Farming System*, 1(100052): 1-11.
- Chaudhary M, Kumar S, Dixit A K, Singh T, Kantwa S R. 2023. Inclusion of Egyptian clover improves the value of sorghum-based cropping systems. *Crop and Pasture Science*, 74: 1307-1317. (Impact Factor: 1.9)
- Choudhary P, Prasad M, Choudhary M, Kumar A, Kumar S, Srinivasan R and Mahawer S K. 2023. Exploring invasive weed Biochar as soil amendment: A study on fodder oats productivity and soil biological properties. *Environmental Research* 216: 114527. (NAAS Rating: 14.43)
- Jitendra K, Kalita H, Rekhung W, Rajesh A Alone, Thejangulie Angami, Doni Jini, Badapmain Makdoh, Letngam Touthang, Nirmal Khatri, A P Singh, Nishant K Sinha, Dhiraj Kumar and R S Chaudhary. 2023. Dynamics of soil organic carbon of Jhum agriculture land use system in the heterogeneous hill of Arunachal Pradesh, India. *Scientific Reports*, 13:12156. (NAAS Rating: 11.00)
- Kumar A, Behera U, Dhar S, Shukla L, Singh Raghavendra, Babu S, Kumar A. 2023. Conservation tillage and microbially mediated integrated phosphorus management enhance productivity, profitability, and energy use efficiency of maize. *Journal of Agricultural Science*, 1-44. doi:10.1017/S0021859623000266 (NAAS Rating: 8.00)
- Kumar S, Dixit A K, Prasad M, Rai S K, Mahanta S K, Singh S, Radotra S and Ghosh P K. 2023. Effects of grazing intensity and pasture type on soil organic carbon stock in the semiarid tropics of India. *Tropical Grasslands Forrajes Tropicales*, 11(1): 41-51. (NAAS Rating: 6.76)
- Kumar S, Kumar T K, Prasad M, Singh, J B, Choudhary M, Dixit A K and Ghosh P K. 2023. Alley cropping system in degraded land of central India: Evaluation of crop

- performance, economic benefit and soil nutrients availability. *International Journal of Plant Production*, 17(1): 8193. (NAAS Rating: 8.61)
- Kumar S, Meena A L, Punia P, Raghvendra K J, Choudhary V K, Kumar C G, Meena L K, Kumar L, Mishra R P, Khajuria V, Udit, Kundu M and Chandra M S. 2023. Methodology of identification and characterization for sustainable development of small and marginal farmers in Jammu. *Agricultural Mechanization in Asia (AMA ISSN 00845841)*, 54(7): 14357-14367. (NAAS Rating: 6.29)
- Layek J, Das A, Ansari M A, Mishra V K, Rangappa K, Ravisankar N, Patra S, Baiswar P, Ramesh T, Hazarika S, Panwar A S, Devi S, Ansari M H and Paramanik B. 2023. An integrated organic farming system: innovations for farm diversification, sustainability, and livelihood improvement of hill farmers, *Frontiers in Sustainable Food Systems*, 7: 1-20. <https://doi.org/10.3389/fsufs.2023.1151113> (NAAS Rating: 10.70).
- Layek J, Rangappa K, Das A, Ansari M A, Choudhary S, Rajbonshi N, Patra S, Kumar A, Mishra V K, Ravisankar N, Kumar S, Hazarika S, Dutta S K, Babu S, Tahasildar M and Shettigar N. 2023. Evaluation of millets for physio-chemical and root morphological traits suitable for resilient farming and nutritional security in Eastern Himalayas, *Frontiers in Nutrition*, 10:1198023: 1-17. (NAAS Rating: 11.00)
- Layek, J, Das A, Mishra V K, Lal R, Krishnappa R, Hazarika S, Mohapatra K P, Ansari M A, Pramanick B, Kumar M, Ramkrushna G I, Saha S, Babu S and Tahashildar M. 2023. Improved agronomic practices and high yielding rice varieties maintain soil health and enhance yield and energy use efficiency under shifting cultivation landscapes of eastern Himalayas. *Land Degradation & Development*. 1–17. <https://doi.org/10.1002/ldr.4807> (NAAS Rating: 10.70)
- Meena A L, Pandey R N, Kumar D, Dutta D, Sharma V K, Karwal M, Ansari M A, Nogiya M, Raghvendra K J, Ghasal P C, Choudhary J, Mishra R P, Chandra Bhanu, Jat P C, Kumar S, Panwar A S. 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*, 23: 651-667. (NAAS Rating: 9.61)
- Meena M D, Dotaniya M L, Meena B L, Rai P K, Antil R S, Meena H S, Meena L K, Dotaniya C K, Meena V S, Ghosh A, Meena K N, Singh A K, Meena V D, Moharana P C, Meena S K, Srinivasarao Ch, Meena A L, Chatterjee S, Meena D K, Prajapat M, Meena R B. 2023. Municipal solid waste: Opportunities, challenges and management policies in India: A review. *Waste Management Bulletin*, 1: 4-18. (NAAS Rating: 14.10)
- Mourya K K, Purakayastha T J, Ahmed N, Kumar S, Trivedi A, Husain K, Ravisankar N. 2023. Assessment of carbon pools and stocks in an Inceptisol under long-term manuring and fertilization in rice-wheat cropping system: Comparison of different methods, *Communications in Soil Science*, 10: 1-14. (NAAS Rating: 7.80)
- Mukherjee S, Basak A, Chakraborty A, Goswami R, Ray K, Ali M N, Santra S, Hazra A K, Tripathi S, Banerjee H, Layek J, Panwar A S, Ravisankar N, Ansari M A, Chatterjee G. 2023. Revisiting the oldest manure of India, Kunapajala: Assessment of its animal waste recycling potential as a source of bio stimulant, *Frontiers in Sustainable Food Systems*, 6: 1073010. <https://doi.org/10.3389/fsufs.2022.1073010> (NAAS Rating: 10.70).
- Ola S K, Singh S K, Prasad M, Chaudhary M, Srinivasan R, Kumar, Plasaniya D R, Kumar S. 2023. POLY4 positively improves the growth, fodder yield and quality of oat (*Avena sativa* L.) in semi-arid tropics of central India. *International Journal of Plant & Soil Science*, 35: 355-364. (NAAS rating: 5.07)
- Palsaniya D R, Kumar P, Das M M, Kumar S, Rai S K, Chaudhary M, Kumar S, Sahay C S, Ahmad A, Tirumala K K, Chand K. 2023. Rain water harvesting, agroforestry and goat based intensification for livelihood resilience in drought prone rainfed smallholder farming system: a case for semiarid tropics. *Agroforestry Systems*, 97: 14051419. (NAAS rating: 8.42)



- Palsaniya D R, Triumala K K, Chaudhary M, Chaudhary M, Prasad M, Kumar S. 2023. Tillage practices and mulching affect system productivity, profitability and energy use in Sesbania alley based food fodder systems under rainfed agroecosystems of semiarid tropics. *Field Crops Research*, 302: 1-9. (NAAS rating: 12.15)
- Rai A K, Das S K, Basak N, Dixit A K, Rai S K, Singh J B, Kumar S, Tirumala K K, Chandra P and Sundha P. 2023. Cganges in soil microbial biomass and organic C pools improve the sustainability of perennial grass and legume system under organic nutrient management. *Frontiers in Microbiology*, 14. (NAAS rating: 12.06)
- Singh Raghavendra, Kumar A, Babu S, Avasthe R K, Das A, Rathore SS, Kumar S, Singh C, Sharma V, Bhupenanchandra I. 2023. Development of organic nutrients management system for profitable and soil- supportive French bean (*Phaseolus vulgaris* L.) farming in North Eastern Himalayas, India. *Frontiers in Sustainable Food Systems*, 7:1115521. doi: 10.3389/fsufs.2023.1115521 (NAAS Rating: 10.70).
- Subash N, Dutta D, Ghasal P C, Punia P, Mandal V P, Brahmadut and Chaudhary V P. 2023. Relevance of climatological information on spatial and temporal variability of Indian summer monsoon rainfall (ISMR) in recent El Nino years and its impact on four important kharif crops over India. *Climate Services*, 30: 100370. (NAAS Rating: 9.20).
- Subash N, Dutta D, Ghasal P C, Ravisankar N, Chaudhary V P, Kumar S, Meena L R, Singh O, Mandal V P, Singh S, Kumari S and Brahmdukt. 2023. A composite index to assess the climate-carbon-yield-sustainability of cereal based cropping system. *International Journal of Plant Production*. <https://doi.org/10.1007/s42106-023-00268-x>. (NAAS Rating: 8.61).
- Suresh V R, Naskar M, Brahmane M P, Prusty A K, Panda D, Behera B K, Sajina A M, Sahu S K, Meena D K, Lal K K. 2023. Morphometric differentiation of *Labeo catla* (Hamilton 1822) (Cyprinidae) in rivers: Possible adaptation to hydrology. *Zoology and Ecology*, 33(1):63–76. <https://doi.org/10.35513/21658005.2023.1.8>
- Wani O A, Sharma V, Kumar S S, Babu S, Sharma K R, Rathore S S, Marwah S, Ganai N A, Darf S R, Yeasin M, Singh Raghavendra, Tomar J. 2023. Climate plays a dominant role over land management in governing soil carbon dynamics in North Western Himalayas. *Journal of Environment Management* <https://doi.org/10.1016/j.jenvman.2023.117740>. (NAAS Rating: 14.70).
- ii) **National**
- Aulakh C S, Ravisankar N, Sidhu A S and Sharma S. 2023. Crop productivity and soil health under organic farming: a review, *Indian Journal of Agronomy* 68 (XXII Biennial National Symposium Special issue): S16-S28. (NAAS Rating: 5.21)
- Avasthe R, Devi SH, Bhupenanchandra I, Kumar A, Chongtham S, Babu S, Singh R, Das A, Gudade B, Bora S. 2023. Agro-tactics for reducing carbon footprint in agricultural production systems: A review. *Indian Journal of Agronomy*, 68(2):115-125. (NAAS Rating: 5.21)
- Chaudhary S, Lal M, Sagar S, Sharma S, Meena A L and Kumar M. 2023. Variation in oxalic acid production, mycelial compatibility and pathogenicity amongst isolates of *Sclerotinia sclerotiorum* causing white mold disease. *Vegetos*. <https://doi.org/10.1007/s42535-023-006764>. (NAAS Rating: 5.68)
- Choudhary V K. 2023. Applications of emerging smart technologies in farming systems: A review. *Global Journal of Computer Science and Technology*, 23 (G1): 49–64.
- Doley S, Kaur S, Nirmal and Pandey N K. 2023. Edible and dye yielding plants used by Galo tribe of Lepa Rada, Arunachal Pradesh. *Indian Forester*, 149(5): 591-594. (NAAS 5.10)
- Gudade B, Babu S, Aage A, Bora S, Deka T, Singh N, Kumar A, Singh Raghavendra, Dhanapal K, Remashree, A. 2023. Incidence of hailstorms damage and strategies to minimize its effects on large cardamom (*Amomum subulatum* Roxburgh) plantations in Sikkim, North East India. *Mausam*, 74(4): 929-934. (NAAS Rating: 6.60)

- Jyoti Rani, Nirmal, Ramgopal and Meena Bakshi. 2023. Potentiality of plant production in different genotypes of *Dendrocalamus strictus* via ex vitro and in vitro approaches. *Indian Journal of Agroforestry*, 25(1): 55-60. (NAAS Rating: 5.19).
- Kumar A, Avasthe R, Singh R, Babu S, Das S K, Ravisankar N, Panwar A S, Qureshi A, Laha R, Mishra V K, Bhupenchandra I and Prasad S K. 2023. Productivity and profitability of maize (*Zea mays*) cultivars under organic management condition in mid-hills of Sikkim, *Indian Journal of Agronomy*, 68: 26-29. (NAAS Rating: 5.21).
- Kumar A, Harun M, Dash S, Kumar S S, Yadav S K, Choudhary V K, Kumar D. 2022. Integrated nutrient management in different cereal based cropping sequences: A statistical perspective. *Bhartiya Krishi Anusandhan Patrika*, 37: 316-319.
- Kumar D, Meena L R, Nirmal, Meena L K, Meena A L, Raghvendra K J and Bhowmik A. 2023. Analysis of genetic diversity and correlation in sugarcane (*Saccharum spp.*) clone in North Western zone of Uttar Pradesh. *Journal of Sugarcane Research* 12: 63-74. (NAAS Rating: 4.54).
- Kumar K, Parihar C M, Nayak H S, Godara S, Avinash G, Patra K, Sena D R, Reddy K S, Das T K, Jat S L and Gathala M K. 2023. Enhancing maize yield in a conservation agriculture-based maize-wheat system through efficient nitrogen management. *Indian Journal of Agricultural Sciences*, 93(4): 420-424. (NAAS rating: 6.37)
- Kumar L, Sondhia S, Nath C P, Kumar N, Choudhary D and Tomar S. 2023. Dissipation kinetics and residues of pendimethalin in soil, straw and grain of rainy season green gram. *Indian Journal of Weed Science*, 55(3): 294-300. (NAAS Rating: 5.85)
- Kumar M, Singh Raghavendra, Avasthe R K, Babu S, Pathak PK, Singh J K. 2023. Economic and sustainable appraisal of organic growers through no-till garden pea (*Pisum sativum L.*) under rice-fallow. *Indian Journal of Agricultural Sciences* 93(2): 195-99. (NAAS Rating: 6.37)
- Kumar S, Meena A L, Kumar C G, Meena L K, Kumar L, Punia P, Meena L R, Nirmal, Kumar A, Gupta A, Khajuria V, Raghavendra K J, Choudhary J and Ghasal P C. 2024. Characterization and impact of organic vis-à-vis conventional farming systems in Jammu District. *Journal of Eco-friendly Agriculture*, 19(1): 32-35. (NAAS Rating: 5.36)
- Kumar S, Meena A L, Punia P, Raghvendra K J, Choudhary V K, Chethan Kumar G, Meena L K, Kumar L, Mishra R P, Khajuria V, Udita, Kundu M, Mandapelli Sharath Chandra. 2023. Methodology of identification and characterization for sustainable development of small and marginal farmers in Jammu. *Agricultural Mechanization in Asia*, 54 (7): 14357-14368.
- Kumar S, Ravisankar N, Verma N, Nirmal, Chaudhary J, Singh R, Punia P, Bhanu C, Ansari M A, Prusty A K, Shamim M and K J Raghavendra. 2023. Agri-food system transformation through integrated farming systems approach. *Indian Journal of Agronomy*, 68: S98-S109. (NAAS Rating: 5.21)
- Malik S, Sarkar B, Kumar S and Punia P. 2023. Comparative evaluation of production performance of different crosses generated for backyard poultry farming. *Indian Journal of Poultry Science*, 58: 51-55. (NAAS Rating: 5.85)
- Meena A K, Pandey A K, Meena L R, Meena A L and Mourya C. 2023. Phenotypic characterization of plant growth promoting microbial isolates from rice rhizosphere and phyllosphere. *International Journal of Plant & Soil Science*, 35(18): 270-274. (NAAS Rating: 5.07).
- Meena L R, Meena S L, Kumar L, Subash N P and Ram T. 2023. Evaluation of food and fodder-based cropping systems for sustaining productivity, resource use efficiency and profitability in western zone of Uttar Pradesh. *Indian Journal of Agronomy*, 68(4): 398-403. (NAAS Rating: 5.55)
- Meena L R. 2023. Soil organic carbon: A tool of soil fertility and productivity. *Medicon Agriculture and Environmental Science*, 5 (2): 1-3.
- Raghavendra K J, Kumar S, Kar A, Kumar P, Singh R, Arya P and Kumar T K. 2023. Awareness and determinants



of farmers participation in e-marketing of agricultural commodities in India. *Indian Journal of Extension Education*, 59(4): 161-164. (NAAS Rating: 4.48).

Ramamurthy V, Kumar A, Ravisankar N and Patil N G. 2023. Potential crop zone planning approach for climate smart agriculture: a way forward, *Indian Journal of Agronomy* 68 (XXII Biennial National Symposium Special issue): S139- S147. (NAAS Rating: 5.21)

Ravisankar N, Singh D K, Parmar D K, Singh A B, Thankamani C K, Ansari M A, Jat P C, Kashyap Poonam, Shamim M, Prusty A K, Singh R, K J Raghavendra, Layak J, Malik S, Kumar L, Bhanu C and Kumar S. 2023. Nutrient management in organic farming through cropping and farming systems approach in India, *Indian Journal of fertilizers*, 19:1166-1174. (NAAS Rating: 5.29)

Sharma S K, Ravisankar N, Jain R K and Sarangi S K. 2023. Natural Farming: Current status, research and case studies, *Indian Journal of Agronomy* 68 (XXII Biennial National Symposium Special issue): S1-S15. (NAAS Rating: 5.21)

Singh A K, Singh P P, Mishra D S, Gangadhara K and Rane J. 2024. Impact of temperature aberration in fruit crops. *A Review Current Horticulture* 12(1): 3-12.

Singh P P, Kumar L, Nirmal, Punia P and Kumar S. 2023. Advances on production and post-production technologies of turmeric (*Curcuma longa* L.): A review, *Frontiers in Crop Improvement*. 11 (VI): 2728-2734. (NAAS Rating: 4.20)

Other publications

Abstracts/extended summaries

Ansari M A, Ravisankar N, Shamim M, Prusty A K, Singh R, Raghavendra K J, Rani M, Yadav P, Pandey K, Vikal M, Kashyap Poonam and Panwar A S. 2023. Scope and potential of agroforestry for ecosystem services In *Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems* held during 27-28 January, 2023 at ICAR-IIFSR pp: 337-338.

Choudhary J, Ghasal P C, Mishra R P, Ravisankar N, Narwal E, Meena A L, Bhanu C, Dutta D, Panwar A S

and Tewari R B. 2023. Effect of organic, inorganic and natural farming practices on soil microbial properties. Importance of micronutrients for soil and crop sustainability. In *Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems* held during 27-28 January, 2023 at ICAR-IIFSR pp: 212.

Ghasal P C, Kumar A, Choudhary J, Dutta D, Bhanu C, Meena A L, Kumar L and Mishra R P. 2023. Mustard oilcake: an effective nutrient management sources for organic cultivation of mustard in Upper Gangetic Plain. *Proceedings of International Conference on Innovation to Transform Drylands* held during 21-23 February, 2023 at ICRISAT, Hyderabad pp: 163.

Ghasal P C, Kumar A, Choudhary J, Dutta D, Bhanu C, Meena A L, Kumar K, Mishra R P and Singh R. 2023. Mustard Oilcake Integration for Organic Nutrient Management in Wheat under Upper Gangetic Plain Zone. *Proceedings of XXII Biennial National Symposium of Indian Society of Agronomy* held during 22–24 November, 2023 at ICAR-CCARI, Ela, Goa.

Ghasal P C, Ravisankar N, Dutta D, Malik S, Kashyap P, Nath A, Prusty AK and Shamim M. 2023. Climate smart integrated farming system model for marginal farmers of western plain zone of Uttar Pradesh. In *Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems* held during 27-28 January, 2023 at ICAR-IIFSR pp: 230-231.

Jat P C, Ansari M A, Kashyap P, Meena A L, Raghavendra K J, Singh R, Ghasal P C, Choudhary J and Kumar S. 2023. Nutrient responses and application effects in major cropping systems of Western Plain Zone of Uttar Pradesh: AICRP-OFR Study. *Proceedings of XXII Biennial National Symposium of Indian Society of Agronomy* held during 22–24 November, 2023 at ICAR-CCARI, Ela, Goa.

Jat P C, Kashyap P, Punia P, Kumar S and Panwar A S. 2023. On-farm evaluation of farming system modules for profitability and livelihood improvement of different farmers' categories of the Western Plain Zone of

- Uttar Pradesh and Uttarakhand. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 260.
- Kumar S, Meena A L, Subash N, Punia P, Nirmal, Choudhary J, Ghasal P C and Raghavendra K J. 2023. Assessment of livelihood activities of rural farmers in Jammu region. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR.
- Malik S, Singh R, Punia P, Chaudhary V K, Kumar D, Meena L R, Nirmal Kumar, Lalit and Kumar Sunil. 2023. Development of sustainable integrated farming system model using uneconomic cattle. In: proceeding of 2nd International Conference on prospects and challenges of environment and biological sciences in food production system for livelihood security of farmers held during 18-20 September, 2023 at ICAR-CIARI, Port Blaire.
- Meena A L, Chaudhary M, Singh R, Kumar S, Jat P C, Ghasal P C, Choudhary J, Meena L R, Kumar K, Meena A K, Rai A K and Kumar S. 2023. Assessment of in-situ residue management on carbon mineralization and soil physico-chemical properties in rice-wheat system. Proceedings of Agricultural Science Congress and ASC Expo. held during 10-13 October, 2023 at ICAR-CMFRI, Kochin, Kerala.
- Meena A L, Dutta D, Meena L R, Subash N, Kumar L, Jat P C, Choudhary J, Ghasal P C, Kumar S, Bhanu C, Biswas A K and Meena A K. 2023. Evaluation of different cropping sequences for crop intensification under conservation agriculture practices. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 203.
- Meena A L, Tevatia M, Singh R, Meena A K, Jat P C, Meena L R, Choudhary J, Ghasal P C, Mishra R P, Kumar K and Kumar S. 2023. Effect of tillage, crop establishment and diversification on soil physico-chemical properties and extracellular enzymes of semi-arid Northwest India. Proceedings of XXII National Symposium on Climate Smart Agronomy for resilient production systems and livelihood security held during 22-24 November, 2023 at ICAR-CCARI, Goa.
- Mhaskar N V, Bhagat S B, Bodake P S, Khandetod Y P and Ravisankar N. 2023. Management of greenhouse gas emissions through integrated farming systems, XXII Biennial National Symposium of Indian Society of Agronomy, held during 22-24 November, 2023 at ICAR-CCARI, Goa, pp. 338-339.
- Mishra R P, Ghasal P C, Choudhary J, Dutta D, Bhanu C, Ravisankar N and Kumar A. 2023. Performance of integrated, organic and natural farming in Basmati rice-wheat system in western plain zone of Uttar Pradesh. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 203.
- Mishra R P, Ghasal P C, Dutta D, Ravisankar N, Kumar S and Rathi S. 2023. Polyhalite (POLY4) as a multifaceted nutrient source for organic production of basmati rice-potato system. Proceedings of Research Co-operators' Conference on Ensuring nutritional and environmental sustainability using multinutrient mineral fertilizers held during 11-13 December, 2023 at NASC Complex, ICAR, New Delhi.
- Nath A, Ghasal P C, Kashyap Poonam, Shamim M, Prusty A K, Dutta D, Malik S, Ravisankar N, Mishra R P, Punia P, Singh S P and Panwar A S. 2023. Value addition in banana: A scope for enhancement of income in integrated farming systems. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 271.
- Nath CP, Narendra Kumar, Hazra KK, Dutta A, Singh Raghavendra, Praharaj CS, Singh SS and Hashim M. 2023. Conservation agriculture and efficient weed management in rice-chickpea cropping system for intensification of rice fallows. In: Abstracts: International Conference on, "Pulses: Smart Crops for Agricultural Sustainability and Nutritional Security", Feb. 10-12, 2023 at NASC, New Delhi. Pp. 288



- Prusty A K, Ravisankar N, Shamim M, Ansari M A, Singh R, Raghavendra K J, Dutta D and Kumar S. 2023. Integrated farming systems as a tool for sustainable agriculture in Gangetic plains of India, XXII Biennial National Symposium of Indian Society of Agronomy, held during 22-24 November, 2023 at ICAR-CCARI, Goa, pp. 267-268.
- Prusty A K., Ravisankar N, Shamim M, Ansari M A, Singh R, Raghavendra K J, Kashyap P and Noopur K. 2023. Climate smart integrated farming system for different agro-ecologies. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 278.
- Raghavendra K J, Jacob D, Rajendran T, Ravisankar N, Prusty A K, Ansari M A, Punia P, Nirmal, Kumar S, John J, Shamim M, Singh R, Meena A L. 2023. Impact of integrated farming systems on farmers income and dietary diversity in India: A case study. Proceedings of Agricultural Science Congress and ASC Expo. held during 10-13 October, 2023 at ICAR-CMFRI, Kochin, Kerala.
- Rai A K, Shahi U P, Dutta D, Mishra R P and Meena A L. 2023. Importance of micronutrients for soil and crop sustainability. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 242.
- Ravisankar N, Singh R, Ramamurthy V, Ramarao C A, Raju B M K, Shamim M, Ansari M A, Raghavendra K J, Subash N, Prusty A K and Kumar S. 2023. Eco-region-based crop planning for diversification and natural resource. In Proceedings of XXII Biennial National Symposium of Indian Society of Agronomy held during 22-24 November, 2023 at ICAR-CCARI, Ela, Goa pp:400-401
- Shamim M, Ravisankar N, Kashyap P, Kumar S, Prusty A K, Ansari M A, Raghavendra K J, Singh R, Painkrai A and Kumar S. 2023. Weather based technological interventions in integrated farming system for reducing cost of cultivation and climate risk. NAAS XVI Agricultural Science Congress held during 10-13 October, 2023 at Kochi, pp: 161.
- Shamim M, Ravisankar N, Panwar A S, Prusty A K, Ansari M A, Singh R, Raghavendra K J, Kashyap Poonam and Painkrai A. 2023. Suitable cropping systems for climate resilient farming system for various purposes of households in India. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR pp: 336-337.
- Shamim M, Ravisankar N, Prusty A K, Ansari M A, Singh R, Raghavendra K J, Dutta D and Kumar S. 2023. Climate resilient integrated farming systems for humid and sub-humid Himalayan region of India, XXII Biennial National Symposium of Indian Society of Agronomy held during 22-24 November, 2023 at Goa, pp: 244-245.
- Singh P P, Mishra R P, Punia P, Singh R, Kumar N and Kumar S. 2023. Enhancing the productivity of turmeric and Guava through Intercropping. (Full Paper) Indian society of Agronomy, New Delhi. XXII Biennial National Symposium of Indian Society of Agronomy held during 22-24 November, 2023 at Goa.
- Singh P P, Nath Amit, Nirmal, Punia P. 2023. Scope of Horticulture based Integrated Farming Systems for Livelihood security. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR.
- Singh R, Ravisankar N, Panwar A S, Ansari M A, Shamim M, Prusty A K, Kumar S and Raghavendra K J. 2023. Diversification and improvement of existing farming systems under small and marginal household conditions. In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR, pp: 338.
- Singh Raghavendra, Nath CP, Kumar N, Praharaj CS, Dutta A, Hazra KK, Singh B. 2023. Effect of organic practices on productivity and profitability of pulse-based system in comparison to the inorganic management.

Abstracts: International Conference on, "Pulses: Smart Crops for Agricultural Sustainability and Nutritional Security", Feb. 10-12, 2023 at NASC, New Delhi. pp. 449

Singh Raghavendra, Praharaj C S, Kumar N, Nath C P, Dutta A, Shakya R P, Babu S. 2023. Effect of conservation tillage and precision irrigation scheduling on productivity and resource use efficiency in fieldpea. In: Souvenir of National Symposium on "Climate Smart Agronomy for Resilient Production Systems and Livelihood Security" 22- 24 November, 2023 held at ICAR-Central Coastal Agricultural Research Institute, Goa, pp:184-185

Singh Raghavendra, Praharaj CS, Narendra Kumar, Nath CP and Dutta A. 2023. Conservation tillage integrated with sprinkler-based irrigation scheduling could enhance productivity and farm income in fieldpea under resource constraints. In: Abstracts: International Conference on, "Pulses: Smart Crops for Agricultural Sustainability and Nutritional Security", Feb. 10-12, 2023 at NASC, New Delhi. pp: 287

Tetarwal J P, Bijarnia A, Prusty A K, Ravisankar N and Panwar A S. 2023. Income and nutritional security through integrated farming systems In Proceedings of National Conference on Agro-ecology based Agri-Food Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR, pp: 28-29.

Verma N, Chaudhary V P, Malik S, Bhanu C, Verma A, Kumar A, Kumar D, Ravisankar N and Prusty A K. 2023. Augmenting nutritional and livelihood security of Buxa tribes through implementing the apt Integrated Farming Systems. International Conference on Prospects and challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS 2023) held during 18-20 September, 2023 at Port Blair.

Verma N, Panwar A S, Kashyap Poonam, Prusty A K, Shamim M, Ravisankar N and Jat P C. 2023. Strategies to achieve overall food security and nutrition through reducing inequalities In Proceedings of National Conference on Agro-ecology based Agri-Food

Transformation Systems held during 27-28 January, 2023 at ICAR-IIFSR, pp: 294.

Popular Articles

Chauhan G V, Yadav Poonam, Ravisankar N, Kumar V, Ansari M A and Singh G. 2023. Increase sugarcane production by organic methods, *Krishak Bharathi*, 18(3): 45-46.

Meena L R, Subash N, Kumar D, Meena S R and Meena A K. 2023. Alternate cropping system: A tool to enhance income. *Indian Farming* 73(07): 36-40.

Prusty A K, Yadav P and Kashyap P. 2023. *Antidesma bunius*- A potential medicinal fruit plant of high therapeutic value. *Grain. Nov.*, 2023, pp: 12-20.

कमलेश कुमार, प्रकाश चंद घासल, अमृत लाल मीना, जयराम चौधरी, सिमरदीप कौर, निर्मल एवं राजेंद्र प्रसाद मिश्र. 2023. जलवायु स्मार्ट कृषि में हरी खाद का महत्व। खेती, पृष्ठ संख्या 45-48.

दिनेश यादव, संग्राम चव्हाण, गीतांजलि मेहरा, विजय काकड़े, वनिता सालुंखे एवं निर्मल. 2023. शहरी वन: मानव स्वास्थ्य और पर्यावरण सुरक्षा के लिए एक प्रकृति-आधारित समाधान। प्रगतिशील खेती, जुलाई 2023.

देवेन्द्र कुमार, निर्मल, लक्ष्मण राम मीना, सुरेश मलिक, ललित कृष्णा मीना. 2023. सरसो उत्पादन में वृद्धि एवं आर्थिक लाभ। प्रगतिशील खेती, पृष्ठ संख्या 48-53.

निशा वर्मा, अमित नाथ, पूनम कश्यप, आशीष कुमार, मोहम्मद शमीम, पी. सी. जाट, सुनील कुमार. 2023. सह उद्यमिता में आत्मनिर्भरता की ओर देवाजंलि महिला का एक सफल उदाहरण। लीफलेट, पृष्ठ संख्या 1.

निशा वर्मा, वेद प्रकाश चौधरी, चन्द्रभानु, सुरेश मलिक, अल्का वर्मा, अमित कुमार, एन रविशंकर एवं आजाद सिंह पंवार. 2023. एकीकृत कृषि प्रणाली के माध्यम से आदिवासी किसानों की आजीविका एवं पोषण सुरक्षा. गेहूँ एवं जौ स्वर्णिमा. भाकृअनुप-भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल, पृष्ठ संख्या 15-20.

निशा वर्मा, पूनम कश्यप, आशीष कुमार पृष्टि, पी सी जाट, मोहम्मद शमीम, सुनील कुमार, पंवार ए एस एवं सुनील कुमार. 2023. पोषण सुरक्षा एवं खाद्य सन्तुलन हेतु समेकित कृषि प्रणालियों का प्रभाव: एक सफल प्रयास. कृषि प्रणाली आलोक 7रू 43.47



- निशा वर्मा, विपिन कुमार चौधरी एवं सुनील कुमार. 2023. बागवानी फसलों में तुड़ाई सम्बंधित मानव जोखिम व श्रम काम करने हेतु बहुउद्देशीय उपकरण। प्रगतिशील खेती, पृष्ठ संख्या 28–33.
- पुष्पेन्द्र प्रताप सिंह, अमित नाथ एवं निर्मल. 2023. गाजर की वैज्ञानिक खेती, फल-फूल, मार्च-अप्रैल, 2023, पृष्ठ संख्या 12–13.
- प्रकाश चंद्र घासल, चंद्र भानु, जयराम चौधरी, कमलेश कुमार, अमृत लाल मीणा, टी पी स्वर्णम, विजय पुनिया एवं सुनील कुमार. 2023. जैविक खेती का महत्व व प्रमाणीकरण। खेती, पृष्ठ संख्या 49–51.
- प्रकाश चंद्र घासल, राजेंद्र प्रसाद मिश्र, जयराम चौधरी, रहस बिहारी तिवारी, निर्मल और अंकुर कुमार. 2023. जैविक खेती रीति एवं नीति। प्रगतिशील खेती (जनवरी 2023), पृष्ठ संख्या 20–27.
- मेराज आलम अंसारी, एन रविशंकर, महिमा दीक्षित, एच. एम अंसारी, मोहम्मद शमीम, राधवेन्द्र सिंह एवं सुनील कुमार. 2023. जैविक खेती और मृदा स्वास्थ्य सुधार में इसकी संभावनाएँ। कृषि प्रणाली आलोक, पृष्ठ संख्या 65–67
- विपिन कुमार, सुनील कुमार, लक्ष्मण राम मीणा, पीयूष पुनिया, निर्मल, जयराम चौधरी, एवं प्रकाश चंद्र घासल. 2023. भारतीय भाषाओं के लिए संगणक प्रौद्योगिकी यूनिकोड। लीफलेट, पृष्ठ संख्या 1–2.
- सुनील कुमार, लक्ष्मण राम मीणा, निर्मल, प्रकाश चंद्र घासल, अमृत लाल मीणा, जयराम चौधरी एवं पीयूष पुनिया. 2023. सफल कृषि प्रसार वार्ता का अयोजन। लीफलेट, पृष्ठ संख्या 1–2.
- सुनील कुमार, लक्ष्मण राम मीणा, पीयूष पुनिया, निर्मल, विपिन कुमार एवं सुनील कुमार. 2023. सांख्यिकीय डेटा विश्लेषण उपकरण: साफ्टवेयर फसल उत्पादकता के लिए संभावनाएँ। लीफलेट, पृष्ठ संख्या 1–4.
- सुनील कुमार, लक्ष्मण राम मीणा, पीयूष पुनिया, निर्मल, विपिन कुमार एवं सुनील कुमार. 2023. कृषक सशक्तिकरण में सूचना संचार क्रांति का महत्व। लीफलेट, पृष्ठ संख्या 1–2.
- सुनील कुमार, लक्ष्मण राम मीणा, पीयूष पुनिया, निर्मल, विपिन कुमार एवं सुनील कुमार. 2023. किसान अपनी उत्पादन लागत कैसे कम करें। लीफलेट, पृष्ठ संख्या 1–2.
- सुनील कुमार एवं निशा वर्मा. 2023. भारतीय कृषि में ड्रोन का उपयोग। प्रगतिशील खेती, पृष्ठ संख्या 4–9.
- सुनील कुमार, विपिन कुमार, पीयूष पुनिया, लक्ष्मण राम मीणा, अमृत लाल मीणा, जयराम चौधरी, प्रकाश चंद्र घासल. 2023. सांख्यिकीय साफ्टवेयर एवं वेब पोर्टल द्वारा कृषि में किसानों की आय में आमदनी। लीफलेट, पृष्ठ संख्या 1–4.

Bulletin/ manual

Ravisankar N, Prusty A K, Kashyap Poonam, Shamim M, Ansari M A, Singh R, Raghavendra K J and Kumar S. 2023. Training Manual on Agroecology and Integrated Farming Systems, ICAR-Indian Institute of Farming Systems Research, Modipuram pp: 1-117.

Shamim M, Ravisankar N, Raghavendra K J, Prusty A K, Ansari M A, Singh R, Kashyap Poonam and Kumar S. 2023. Agroclimatic Zone Specific Integrated & Organic Farming Systems with Contingency Plans and Natural Farming Prospects for Uttar Pradesh, ICAR-Indian Institute of Farming Systems Research, Modipuram pp: 47.

Book/Souvenir of Conference

Babu S, Das A, Rathore SS, Singh Raghavendra and Dhar S. 2023. Frontiers in Agronomy for Sustainable Agriculture. Published by The Indian Society of Agronomy, Division of Agronomy, ICAR-IARI, New Delhi 110012 (India). ISBN: 978-81-967051-9-0 (392 pages).

Bhanu C, Ghasal P C, Ravisankar N, Choudhary J, Dutta D, Meena A L, Mishra R P and Kumar S. 2023. Organic Farming: A Grower's Handbook, Series 1: Concepts and Use of Inputs, pp: 1-125. ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110.

Chaudhary V P, Sundar J, Verma N, Nirmal, Bohra P, Singh P K, Kumar V, Kumari S, Katiyar H O and Prasad G. 2023. (Eds.) Prospects and challenges of environment and biological sciences in food production system for livelihood security of farmers (ICFPLS–2023), pp: 1-237. September 18-20, 2023, Port Blair, Andaman & Nicobar Islands, India. ISBN: 978-81-966536-1-3.



- Kumar D, Ravisankar N and Panghal A. (Eds.). 2023. Transforming organic agri-produce in to processed food products: Post Covid 19 challenges and opportunities (Edited), Apple Academic Press, Canada, p.472
- Ravisankar N, Prusty A K, Dutta D, Kashyap P, Meena A L, Shamim M, Mishra R P, Jat P C, Singh R, Ghasal P C, Choudhary J, Raghavendra K J and Rathi S. 2023. Extended Summary and Abstracts book of National Conference on Agro-Ecology Based Agri-Food Transformation Systems, pp: 344. 27-28 January 2023, Modipuram. ISBN No. 9789391872212.
- Singh R, Ravisankar N, Ramamurthy V, Ansari M A, Raghavendra, K J, Shamim M, Panwar A S, Prusty A K, Bhaskar S, Subash N, Kumar S, Singh R and Rani M (Eds.). 2023. Atlas of Cropping Systems in India (Updated version). ICAR-Indian Institute of Farming Systems Research, Modipuram, pp: 320.
- Book chapter**
- Ansari M A, Panwar A S, Shamim M, Ansari M H, Kohima N and Ravisankar N. 2023. Strategies for enhancing pulses productivity in NE India. (In) Sustainable hill agriculture (Eds. Noopur K., Panwar A S and Ansari M A). Biotech books publisher, Ansari Road, New Delhi-110002, India. ISBN: 978-81-7622-538-0.
- Ansari M A, Panwar A S, Shamim M, Roy S S, Ansari M H, Kohima N and Ravisankar N. 2023. Organic based entrepreneurship development in North east. (In) Sustainable hill agriculture (Eds. Noopur K., Panwar AS and Ansari MA). Biotech books publisher, Ansari Road, New Delhi-110002, India. ISBN: 978-81-7622-538-0.
- Chaudhary V P, Sundar J, Verma N, Nirmal, Bohra P, Singh P K, Kumar Vijay, Kumari Sweeti, Katiyar Hari Om & Prasad G. 2023. In Prospects and challenges of environment and biological sciences in food production system for livelihood security of farmers (ICFPLS-2023) pp: 1-23, September 18-20, 2023, Port Blair, Andaman & Nicobar Islands, India., Pragati International Scientific Research Foundation (PISRF), Meerut. ISBN 788196653613.
- Kharia S K, Malav L C, Jangir A, Kumar S, Tiwari G, Choudhary J and Saripa A. 2023. Biofuels and land use/land cover change nexus pp: 49-67. Elsevier.
- Narwal E, Choudhary J, Jat N K, Meena A L, Ghasal P C, Dutta D, Mishra R P, Saritha M, Meena L K, Bhanu C, Singh R, Chethan K G, Panwar A S and Choudhary M. 2023. Plant Growth-Promoting Microbes: Key Players in Organic Agriculture, pp: 139-160. Mawar et al. (Eds). Springer Nature Singapore.
- Narwal E, Choudhary J, Jat N K, Meena AL, Ghasal P C, Dutta D, Saritha M, Meena L K, Bhanu C, Singh R, Kumar G C, Panwar AS, Choudhary M. 2023. Plant growth-promoting microbes: Key players in organic agriculture plant growth promoting microorganisms of arid region. [doi:10.1007/978-981-19-4124-5_7](https://doi.org/10.1007/978-981-19-4124-5_7).
- Panwar A S, Ravisankar N, Ansari M A, Prusty A K and Kohima N. 2023. Cropping system for production enhancement. (In) Sustainable hill agriculture (Eds. Noopur K., Panwar AS and Ansari MA), Biotech books publisher, Ansari Road, New Delhi-110002, India. ISBN: 978-81-7622-538-0. pp: 441-452.
- Prusty A K, Ravisankar N, Kumar S, Shamim M, Kashyap P, Ansari M A, Singh R and Raghavendra K J. 2023. Achieving food and livelihood security and enhancing profitability through Integrated Farming systems approach: Case studies. In: Agripreneurship through farming system: a viable techno-economical approach for women empowerment, pp: 21-28 (Eds.) Tauja S, Veenita Kumari, Lipi Das, Neetish Kumar and Mridula Devi. pp.130, ICAR-CIWA, Bhubaneswar. ISBN No. 978-81-944268-4-4.
- Ravisankar N and Kumar S. 2023. Agroecosystem specific integrated farming systems for sustainable livelihood of smallholder farms, Souvenir Article, XXII Biennial National Symposium (November 22-24): 15-22.
- Ravisankar N and Panwar A S. 2023. Organic farming issues and strategies for improved production In organic crop production management: focus on India with global implications (Editor: Singh D P, Prakash H G, Swapna M and Solomon S), Apple Academic Press, Canada pp:79-94.



Ravisankar N. 2023. IFS for achieving the SDGs in Training Manual on IFS for Sustainable Agriculture, JAU, Junagadh pp: 43-52.

Shamim M, Ravisankar N, Raghavendra K J, Prusty A K, Ansari M A, Singh R and Kumar S. 2023. One Health: An emerging concept in natural farming: present status and future prospects, Coimbatore, India

Singh Raghuvver. 2023. Package and practices of crops in natural farming, In An emerging concept in natural farming: present status and future prospects, Coimbatore, India

Singh, Raghavendra, Avasthe, R.K., Babu, S. 2023. Organic Farming: Issues and Challenges in India. In: Organic crop production management focus on India, with Global Implications. (Eds) Singh, D.P., Prakash, H.G., Swapna, M, Solomon, S. Apple Academic Press. ISBN 9781774910580

Verma N, Chaudhary V P, Jat P C, Prusty A K, Kashyap P, Verma A, Malik S, Bhanu C, Kumar A, Kumar D, Ravisankar N and Kumar S. 2023. Assessment

approaches for studying the drudgery, energy and nutrition requirements for implementation of sustainable interventions: Multidisciplinary Portrait of Agriculture Concepts and Practices (Eds) Parvender Sheoran, Pragya Bhadauria, S S Bhadauria, R A Shah, pp: 294-304. ISBN: 978-93-91995-10-2.

Policy paper

Ramesh Naik, M, Hudedamani U, Gopinath K A, Ramanjaneyulu A V, Ravisankar N, Srinivas T, Ansari M A, Singh V K, Venkateshwarlu G and Ch. Srinivasa Rao. 2023. Organic Farming in India: Production Constraints and Policy Recommendations. ICAR-NAARM Policy Paper 2023/1, pp: 30.

Folders/ Leaflets/ Ready Reckoners

Bhanu C, Ghasal P C, Ravisankar N, Chaudhary J, Dutta D, Meena A L and Mishra R P. 2023. Production technology for organic wheat in India. ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut- 250 110 (U.P.).

SEMINARS/SYMPOSIA/WORKSHOPS/MEETINGS ATTENDED

Title of training/seminar/ symposia/ workshop/ Meeting	Period	Venue	Name of participant
National Conference on Plant Parasitic Nematodes	16-18 January, 2023	Hotel Lila Bhartiya, Bangaluru, Bayer Crop Science	Dr. Chandra Bhanu
One day Awareness programme on Intellectual Property Rights (IPRs)	17 January, 2023	ITMU, ICAR-IIFSR, Modipuram	Dr. Sunil Kumar
Biennial Workshop of AICRP-IFS	18-21 January, 2023	MPKV, Rahuri	Dr. N. Ravisankar Dr. A. K. Prusty Dr. M. Shamim Dr. M. A. Ansari Dr. Raghuvveer Singh Dr. Raghavendra K.J. Dr. Chandra Bhanu Dr. P.C. Ghasal Dr. Nisha Verma
National Conference on Agro-ecology based Agri-Food Transformation System	27-28 January, 2023	ICAR-IIFSR, Modipuram	Dr. N. Ravisankar Dr. R. P. Mishra Dr. P. C. Jat Dr. Chandra Bhanu Dr. Poonam Kashyap Dr. A.K. Prusty Dr. M. Shamim Dr. M.A. Ansari. Dr. Raghuvveer Singh Dr. P. C. Ghasal Dr. Raghavendra K.J. Dr. Jairam Choudhary Dr. Nisha Verma
International training workshop on Quantitative Systems Analysis for the Sustainable Intensification of Mixed Farming Systems	15-17 February, 2023	CIMMYT, Nepal	Dr N. Ravisankar Dr. A.K. Prusty
International Conference on Innovations to Transform Drylands	21-23 February, 2023	ICRISAT, Hyderabad	Dr. P.C. Ghasal
Workshop/Consultation on Invigorating Organic Farming for Sustainable Food Systems and Atmanirbhar Bharat (organized by NITI Aayog and Department of fertilizers)	6 March, 2023	NITI Aayog, New Delhi	Dr. Sunil Kumar Dr N. Ravisankar
International Millet (Shree Anna) Conference	18 March, 2023	NASC, New Delhi,	Dr. Sunil Kumar Dr. P. C. Jat Dr. Chandra Bhanu
G20 MACP Meet	17-20 April, 2023	New Delhi	Dr. Sunil Kumar



Title of training/seminar/ symposia/ workshop/ Meeting	Period	Venue	Name of participant
G20 Meeting (MACP)	18-19 April, 2023	Varanasi	Dr. Sunil Kumar Dr. A.K. Prusty
National Agricultural Scientist Conclave	1-2 May, 2023	GBPUAT, Pantnagar	Dr. Raghuvveer Singh Dr P C Ghasal Dr A L Meena Dr Jairam Chaudhary
National Campaign on Soil Health Management	22-23 May, 2023	ICAR-Indian Institute of Soil Science, Bhopal	Dr. Sunil Kumar
Mainstreaming Agrobiodiversity-An integrated approach to reduce climate vulnerability, improve nutrition, livelihoods, and ecosystem services	23 May, 2023	MPUAT, Udaipur	Dr. Amrit Lal Meena
Additive intercropping in wide-row crops Inception meeting	24-27 May, 2023	Lataguri, West Bengal	Dr. Sunil Kumar Dr. Poonam Kashyap Dr. Raghuvveer Singh Dr. Raghavendra KJ
22 nd Foundation Day & Brain Storming Session on "Micro biome engineering for nature-friendly agriculture-Challenges and prospects"	01 June, 2023	ICAR-NBAIM Mau (Online)	Dr. Sunil Kumar
Global Organic Expo 2023 and Millets Conference	3-4 June, 2023	India Expo Centre and Mart, Greater Noida (U.P.)	Dr. Devendra Kumar Dr. Chandra Bhanu Dr. P. C. Ghasal
XXXIII AGM of AICRN on Potential Crops	7 June, 2023	UAS, Bengaluru	Dr P C Jat
Webinar on "Navigating Cyber security Challenges in the Era of Digital Transformation"	20 July, 2023	Online	Dr. Sunil Kumar
Stakeholder Workshop at TEEB	31 July, 2023	IISR, Lucknow	Dr. Sunil Kumar
Regional Advisory Group Meeting of NABARD on Farms, Farmers and Rural Areas	31 July, 2023	NABARD, Regional Office, Patna (Virtual)	Dr N. Ravisankar
State Stakeholder Workshop of "TEEB AgriFood Initiative in Uttar Pradesh" on 1 August, 2023	1 August, 2023	ICAR-IISR, Lucknow	Dr. Sunil Kumar Dr N. Ravisankar Dr. Raghavendra Singh Dr. P. P. Singh Dr. M. Shamim Dr. M. A. Ansari Dr. A. L. Meena Dr. P. C. Ghasal Dr. Jairam Choudhary
30 th Annual Group Meeting of AICRP on Rapeseed and Mustard	3-4 August, 2023	SKUAST, Jammu	Dr N. Ravisankar Dr. Devendra Kumar
First Expert Group Committee Meeting on the PM-DeVINE project on "Promotion of Scientific Organic Agriculture in North east India" organized by NECTAR, DST, Government of India.	10 August, 2023	IIT New Delhi	Dr. M. A. Ansari

Title of training/seminar/ symposia/ workshop/ Meeting	Period	Venue	Name of participant
Foreign Aided Projects running in NRM Institutes meeting	12 August, 2023	CSSRI, Karnal	Dr. Sunil Kumar Dr. M. A. Ansari
13 th meeting of Agricultural Systems and Management Sectional Committee, FAD, Vimarsha (Blue room), Bureau of Indian Standards, HQ, New Delhi (Virtual)	18 August, 2023	New Delhi (Virtual)	Dr. M. A. Ansari Dr. Jairam Choudhary
National workshop of the ICAR-BISA collaborative project "Atlas on Climate Adaptation in South Asian Agriculture (ACASA)"	21-22 August, 2023	ICAR-CRIDA, Hyderabad	Dr. Raghavendra Singh Dr. M. A. Ansari
Review meeting of committee on Agrivoltics	22 August, 2023	Virtual	Dr N. Ravisankar
Expert Committee Meeting of Tribal Sub Plan Scheme for presentation of shortlisted project proposal received under the Programme "Accelerated Development of Particularly Vulnerable Tribal Groups" by SEED Division, DST, New Delhi	22 August, 2023	Assam Downtown University, Guwahati	Dr Nisha Verma
National Seminar on Abiotic Stress Management for Sustainable Millet-based Production Systems	22-23 August, 2023	ICAR-NIASM, Baramati (Pune)	Dr. Sunil Kumar Dr P.C. Jat
G20 Spouse Event	07-09 September, 2023	NASC, New Delhi	Dr. Sunil Kumar
International Conference on Prospects and challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS 2023) organized by PISRF Trust, Meerut and ASA, Portblair	18-20 September, 2023.	ICAR-CIARI, Portblair	Dr. Sunil Kumar Dr. Nisha Verma Dr. Nirmal
Online IRC meeting of ICAR-ATARI, Kanpur	22 September, 2023	Virtual	Dr N. Ravisankar
Two days' workshop on "Stakeholder dialogue on enhancing fertilizer use efficiency for sustainable soil health"	28-29 September 2023	TAAS and ICAR at NAAS complex	Dr. Raghavendra Singh Dr. Lalit Kumar
XVI Agricultural Science Congress, NAAS	09-13 October, 2023	Kochi	Dr. Sunil Kumar Dr. N. Ravisankar Dr. M. Shamim Dr. Raghavendra KJ
Project Steering committee meeting of TEEB-UNEP	10 October, 2023	Virtual	Dr. Sunil Kumar Dr N. Ravisankar Dr. M. A. Ansari
Agroecology India Partners Meeting	17 October, 2023	Jaypee Siddarth Hotel, New Delhi	Dr. M. Shamim
14 th meeting of Agricultural Systems and Management Sectional Committee, FAD, Vimarsha (Blue room), Bureau of Indian Standards, HQ, New Delhi (Virtual)	6 November, 2023	New Delhi (Virtual)	Dr. M. A. Ansari Dr. Jairam Choudhary
Progress review (2022-23) and Action Plan (2024) meeting of Farmer FIRST project	7 November, 2023	ICAR-IIPR, Kanpur	Dr Nisha Verma



Title of training/seminar/ symposia/ workshop/ Meeting	Period	Venue	Name of participant
TEEB AgriFood Global Symposia 2023	7-9 November, 2023	UNCC, Bangkok, Thailand	Dr. Sunil Kumar Dr N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M.A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra KJ
IXth AGM of AICRN on Potential Crops	9 November, 2023	Agricultural University, Jodhpur	Dr. P.C. Jat
TEEB AgriFood National Symposium	16-17 November, 2023	Dr Ambedkar International Centre, New Delhi	Dr. Sunil Kumar Dr N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M.A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra K.J.
XXII Biennial National Symposium of Indian Society of Agronomy	22-24 November, 2023	ICAR-CCARI, Goa	Dr. Sunil Kumar Dr N. Ravisankar Dr. R. P. Mishra Dr. Raghavendra Singh Dr. P. P. Singh Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari Dr. A. L. Meena Dr. P. C. Ghasal Dr. Jairam Choudhary
Agroecology Initiative project	25 November, 2023	Mandla, MP	Dr. M. Shamim
National review meeting of Farmer FIRST project	27-30 November, 2023	CSKHPKV Palampur	Dr. P C Jat Dr. Raghuvveer Singh
Soil and Water: A source of life (one day workshop)	3 December, 2023	Krishi Vigyan Kendra, Sitapur	Dr. Amrit Lal Meena
Research Co-operators' Conference on Ensuring nutritional and environmental sustainability using multi nutrient mineral fertilizers	11-13 December, 2023	NAAS, NASC Complex, ICAR, New Delhi	Dr. Sunil Kumar Dr. R. P. Mishra Dr. Raghavendra Singh Dr. P.C. Ghasal
ACASA (Atlas of Climate Adaptation in South Asian Agriculture) Annual Project Review and Planning Meeting	12-14 December, 2023	Kathmandu, Nepal	Dr. M. A. Ansari

TRAININGS ATTENDED

Name of training	Institute	Duration	Scientist name
Data Visualization using R (Online mode)	ICAR-NAARM, Hyderabad	1-8 March, 2023	Dr. P.C. Ghasal
Training on Agro-Ecology and Integrated Farming Systems sponsored by NBSC, Lucknow	ICAR-IIFSR, Modipuram	10-12 April, 2023	Dr. Sunil Kumar Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra KJ
Technology trends and the revolution in mobile	BVICAM, New Delhi	23 April, 2023	Dr. Sunil Kumar
Monetising the carbon credit on farmlands for benefitting Indian Farmers	ICAR-CAFRI and MANAGE, Hyderabad	17-19 May, 2023	Dr Poonam Kashyap
MANAGE Training Programme on “Value Chain based Agricultural Extension by FPOs and Agri-Startups”	MANAGE, Hyderabad (Online)	12-16 June, 2023	Dr. Sunil Kumar
Discussion on Implementation of Pilot Project for Crop Diversification	Virtual	24 July, 2023	Dr. Sunil Kumar Dr. N. Ravisankar
SAARC Regional Training on Climate Smart Agriculture in South Asia: Technologies, Policies and Digital Innovation	IRRI South Asia Regional Centre (ISARC), Varanasi	25-28 July, 2023	Dr. M. A. Ansari Dr. A. L. Meena Dr. P.C. Ghasal
Stakeholder consultation meeting under DST project on Hindon river water utilization	ICAR-IIFSR, Modipuram	28 July, 2023	Dr. Sunil Kumar Dr. N. Ravisankar Dr. Raghavendra Singh Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra K.J.
Stakeholder workshop on Draft results of TEEB AgriFood Initiative in Uttar Pradesh	ICAR-IISR, Lucknow	1 August, 2023	Dr. Sunil Kumar Dr. N. Ravisankar Dr. Raghavendra Singh Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra K.J.



Name of training	Institute	Duration	Scientist name
Whole Farm Bio-economic modelling and Integrative Sustainability Assessment Tool	ICRISAT, Hyderabad	11-15 September, 2023	N. Ravisankar Dr. M. Shamim Dr. Raghuvveer Singh Dr. Raghavendra K.J. Dr. P. C. Ghasal
J-Gate@CeRA	CSK HPKV, Palampur	17 October, 2023	Dr. Sunil Kumar
Advance course on Conservation Agriculture for Asia and North Africa (16 days training)	CIMMYT, BISA and ICAR	09-24 December, 2023	Dr. Amrit Lal Meena
Farm Design for component optimization using multi objective tools	Virtual	20 December, 2023	Dr. A. K. Prusty

TRAININGS/WORKSHOPS/SCHOOLS/MEETINGS ORGANIZED

Title of Training/ workshop/ schools organized	Venue	Period	Number of participants	Name of Organizers
VII (XXXV of project) Biennial workshop (2022) of AICRP on Integrated Farming Systems	MPKV, Rahuri	18-21 January, 2023	150	Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghveer Singh Dr. Raghavendra KJ
National Conference on Agro-Ecology-based Agri-Food Transformation Systems	ICAR-IIFSR, Modipuram	27-28 January, 2023	-	Dr. N. Ravisankar Dr. R. P. Mishra Dr. Chandra Bhanu Dr. Poonam Kashyap Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari
Certified Farm Advisor (CFA) on Organic Farming (Module-II) sponsored by National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Telangana	ICAR-IIFSR, Modipuram	7-21 February, 2023	28	Dr. Sunil Kumar Dr. N. Ravisankar Dr Chandra Bhanu Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghveer Singh Dr. P.C. Ghasal Dr. Jairam Choudhary Dr. Raghavendra KJ
Capacity building and skill up gradation programme from technical staffs on farm management	ICAR-IIFSR, Modipuram	22-28 February, 2023	20	Dr. Sunil Kumar Dr. Suresh Malik Dr Sunil Kumar Dr. P.C. Ghasal Dr. Kamlesh
Global Science for Global Wellbeing	ICAR-IIFSR, Modipuram	28 February, 2023	156	Dr. Debashis Dutta Dr. Chandra Bhanu
Exposure Visit cum Hands on Training for Mushroom Farmers/ Entrepreneurs under ABI Project/ICAR-ABI, Modipuram, Meerut	Regional Mushroom Research Centre (RMRC), MHU, Murthal, Haryana	03 March, 2023	43	Dr. Amit Nath Dr. Chandra Bhanu
एक दिवसीय हिंदी कार्यशाला	ICAR-IIFSR, Modipuram	17 March, 2023	110	Dr Chandra Bhanu



Title of Training/ workshop/ schools organized	Venue	Period	Number of participants	Name of Organizers
World Water Day-2023	ICAR-IIFSR, Modipuram	22 March, 2023	115	Dr. Debashis Dutta Dr Chandra Bhanu Dr. P.C. Ghasal
Training on Agro-Ecology and Integrated Farming Systems sponsored by NBSC, Lucknow	ICAR-IIFSR, Modipuram	10-12 April, 2023	29	Dr. Sunil Kumar Dr. N. Ravisankar Dr. A.K. Prusty Dr. Poonam Kashyap Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra KJ
एक दिवसीय हिंदी कार्यशाला	ICAR-IIFSR, Modipuram	13 June, 2023	107	Dr Chandra Bhanu
International Day of Yoga under 'Azadi ka Amrit Mahotsav' Kutumbkam"	ICAR-IIFSR, Modipuram	21 June, 2023	143	Dr. Chandra Bhanu Dr. A. L. Meena
ICAR-IIFSR Incubate/ Entrepreneurs Visit during ICAR-Industry meet on 17 July, 2023	NASC Complex, Delhi	17 July, 2023	06	Dr. Chandra Bhanu
Discussion on Implementation of Pilot Project for Crop Diversification	Virtual	24 July, 2023	24	Dr. Sunil Kumar Dr. N. Ravisankar
Stakeholder consultation meeting under DST project on Hindon river water utilization	ICAR-IIFSR, Modipuram	28 July, 2023	50	Dr. Sunil Kumar Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra KJ Dr Poonam Kashyap
Stakeholder workshop on Draft results of TEEB AgriFood Initiative in Uttar Pradesh	ICAR-IISR, Lucknow	1 August, 2023	100	Dr. Sunil Kumar Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M. A. Ansari. Dr. Raghuvveer Singh Dr. Raghavendra KJ
"Har Ghar Tiranga" campaign under under 'Azadi ka Amrit Mahotsav'	ICAR-IIFSR, Modipuram	13-15 August, 2023	1377	Dr. Chandra Bhanu
Seminar on Effect of Congress Grass (Parthenium) on food production and human health during Parthenium Awareness Week, 16-22 August, 2023	ICAR-IIFSR, Modipuram	22 August, 2023	86	Dr. Chandra Bhanu Dr. P.C. Ghasal
Whole Farm Bio-economic modelling and Integrative Sustainability Assessment Tool	ICRISAT, Hyderabad	11-15 September, 2023	25	Dr. Sunil Kumar Dr. N. Ravisankar
हिंदी पखवाड़ा	ICAR-IIFSR, Modipuram	14-28 September, 2023	245	Dr. Chandra Bhanu

Title of Training/ workshop/ schools organized	Venue	Period	Number of participants	Name of Organizers
International Conference on Prospects and challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS 2023) organized by PISRF Trust, Meerut and ASA, Portblair	ICAR-CIARI, Portblair	18-20 September, 2023.	250	Dr. V P Chaudhary Dr. Nisha Verma Dr. Nirmal
One day Farmers-Scientists interaction (Farmers FIRST and OFR Scheme)	ICAR-IIFSR, Modipuram, Meerut	21 September, 2023	63	Dr. P C Jat, Dr. Poonam Kashyap Dr. AK Prusty Dr. Raghuvver Singh Dr. Amrit Lal Meena
Gandhi Jayanti	ICAR-IIFSR, Modipuram	02 October, 2023	102	Dr. Chandra Bhanu
Training programme on Value addition of Millets to 5 SHG's of Famer FIRST project under ABI Scheme	ICAR-IIFSR, Modipuram	10 October 2023	15	Dr. R P Mishra Dr. P C Jat Dr. Nisha Verma, Dr. Poonam Kashyap Dr. Nirmal Dr. Sunil Kumar
Vigilance Awareness Week	ICAR-IIFSR, Modipuram, Meerut	31 October to 6 November 2023	80	Dr. Peyush Punia Dr. Chandra Bhanu, Dr. Sunil Kumar, Dr. Jairam Choudhary Dr. Nirmal
World Soil Day "Soil and Water: A Source of Life"	ICAR-IIFSR, Modipuram, Meerut	05 December, 2023	110	Dr. Amrit Lal Meena Dr. P C Ghasal Dr. Jairam Choudhary Dr. Raghavendra Singh
Swacchta hi Sewa programme	Village Tabita	17 December, 2022	70	Dr Sunil Kumar Dr Nisha Verma Dr Raghuvver Singh
एक दिवसीय हिंदी कार्यशाला	ICAR-IIFSR, Modipuram	19 December, 2023	112	Dr. Chandra Bhanu
Farm Design for component optimization using multi objective tools	Virtual	20 December, 2023	-	Dr. A. K. Prusty

**RADIO/TELEVISION TALK / SOCIAL MEDIA**

Topic	Broadcasted/telecasted	Date	Name of speaker
Live Question and Answer Programme on IFS, Organic and Natural Farming	All India Radio-Kodai FM (Kodai-kanal, Tamil Nadu)	19 April, 2023	Dr. N. Ravisankar
IIFSR-Kisano ki Sewa Mein	DD Kisan; Vigyan aur Kisan	02 June, 2023	Dr. Sunil Kumar
Importance of integrated farming system in clean environment	DD Kisan	05 June, 2023	Dr. P.C. Ghasal
TV Talk on "Integrated Farming System" for Hello Kisan Programme Live Broadcasting on 09.06.2023 at 06-7.0PM.	CPC Doordarshan, Asian Village Complex, New Delhi – 110 049.	09 June, 2023	Dr. Chandra Bhanu
Expert regarding impact of pollution on field crops	News 18 Television network	24 November, 2023	Dr. Raghuveer Singh
Round the year fodder production for Western Uttar Pradesh	News 18 Television network	24 November, 2023	Dr. Raghuveer Singh

NEW RESEARCH INITIATIVES

Pilot Project on Crop Diversification (PPCD): Pilot project on crop diversification has been implemented in 75 districts of the 18 states with main objectives to diversify the rice crops with suitable and potential alternative crops like pulses, oilseed and vegetables to enhance the sustainability and resiliency of the cropping systems. This project is operated by the ICAR-IIFSR, Modipuram in collaboration with 19 SAUs AICRP-IFS centers and 4 ICAR institutes viz., ICAR-NBSS-LUP, Bangalore (RC), ICAR-ATARI, Guwahati, ICAR-IIAB, Ranchi and ICAR RC for ER, Patna.

Atlas on Climate Adaptation in South Asian Agriculture (ACASA): The project is implemented by the BISA CIMMYT in collaboration with ICAR, New Delhi (lead by ICAR-CRIDA, Hyderabad with partnering institutions ICAR-IARI, New Delhi, ICAR-NDRI, Karnal, ICAR-CIBA, Chennai, ICAR-IIFSR, Modipuram, ICAR-NRRI, Cuttack, ICAR-NIASM, Baramati), BARC, Bangladesh, NARC, Nepal and NRMC, Sri Lanka.

Consortium for Scaling-up Climate Smart Agriculture in South Asia (C-SUCSeS): This project is implemented in collaboration with ICAR-CRIDA, Hyderabad (Lead institute) funded by SAC, IFAD and SDF. This is implemented in Assam, Punjab, Andhra Pradesh and Uttarakhand to accelerate the identification and scaling-up of viable CSA interventions through national policies/ programs and setting-up effective and efficient mechanism for knowledge sharing, policy dialogue, and cooperation among SAARC countries.

Carbon Credit and Framework for Voluntary Carbon Market: New initiative started in collaboration and funding with Ministry of Agriculture and Farmers Welfare, Govt. of India to develop the Framework for Voluntary Carbon Market (VCM) in Agriculture Sector to encourage small and medium farmers to avail the benefits of carbon credits. The framework follows the rationale that the carbon market will not only benefit the farmers but also accelerate the adoption of environment-friendly agricultural practices.

Additive Intercropping in Wide Row Crops for Resilient Crop Production in Bangladesh, Bhutan and India: The project is

initiated for sustainably intensifying smallholder farmers' wide-row crop production to improve productivity, food, nutrition & income security and climate change resilience through wide-row, additive intercropping in sugarcane. The project anchored by CIMMYT and funded by ACIAR comprises on-station and on-farm experiment in sugarcane along with detailed characterization of initial, mid-term and final, knowledge, attitude and perspective (KAP) towards intercropping in sugarcane for production, family nutrition and women empowerment.

Nano Matrix Intercalated Formulations: A research programme has been initiated to enhance nitrogen use efficiency by minimizing the losses of nitrogen nano-material based formulation of urea fertilizer. The fine powders of two clay materials viz., Fuller's earth (multani mitti) and Alabaster or chalk powder (Khadiya mitti) are to be converted to nano range of materials of 50-500 nm range. The nano materials were utilized to make a matrix to hold greater quantity of plant nutrients and release them in close proximity of root zone in small quantity for longer period of time.

Research on Extension Methodologies: This project has been initiated to characterize the existing extension methods in order to identify their suitability for effective dissemination of integrated farming system interventions. Evaluation of new/emerging extension methods will also be validated for promotion of IFS.

Project on Transformational Agroecology across Food, Land and Water Systems: A foreign funded project has been conceived for implementation in Narayanganj block of Mandla district of Madhya Pradesh in collaboration with IWMI, New Delhi and JNKVV, Jabalpur OFR centre at Mandla. The project was started in November 2023 with the objectives 1) Identification of household level technology gaps and resource constraints for establishing IFS, IOFS, and NFS models to improve livelihoods and achieve economic and environmental benefits in water, soil, and ecology and 2) Refinement of existing farming systems through farmers participation for better farm productivity through reducing negative yield contributing factors for further scaling up the achievements at the landscape level also.



NEW INFRASTRUCTURE CREATED



International Standard Referral Laboratory for Organic Farming



VIP Guest House



Technology Park

OTHER PROGRAMMES ORGANIZED

National Conference on "Agro-ecology Based Agro-Food Conversion System



A two-day National Conference on "Agroecology Based Agro-Food Conversion System" was organized in the Institute during 27-28 January, 2023 under the joint aegis of ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut and Farming Systems Research and Development Association (FSRDA), Meerut in collaboration with international agencies like CIMMYT and ICRISAT. The chief guest of the program was Padmashree Dr. Arvind Kumar, former Vice Chancellor, RLBCAU, Jhansi. Honorable MP Meerut, Shri Rajendra Agarwal, presided over the program. In his address, the chief guest said that, as a result of the policies of the government, research achievements of scientists and hard work of farmers, today our country has risen from self-sufficient in terms of many food products and has come into the category of exporter.

Honorable M.P. of Meerut said that, today our country has gone beyond self-sufficiency in terms of food grain production and to increase the income of farmers, emphasis will have to be laid on processing of food items and connecting farmers directly to the market. More than 250 agricultural scientists, researchers, and students etc. from various agricultural institutes of the country participated in this two-day national conference. The programme was graced by eminent scientists viz., Dr. B.S. Dwivedi, Dr. M S Chauhan, Dr. A.K. Singh, Dr. R.L. Yadav, Dr. S.K. Sharma, Dr. S Madhu, Dr. Gyanendra Singh, Dr. Rajveer Singh, Dr. V.K. Singh, Dr. M.L. Jat, and farmer representatives. The dignitaries like Dr. P.S. Pandey, Dr. B. Gangwar, Dr. V.P. Chahal, Dr. S.K. Sharma, Dr. P.S. Virathal etc. put forward their views to establish high standards of integrated farming system and organic farming system research.

Certified Farm Advisors on Organic Farming (Module II) Training



ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut in collaboration with National Institute of Agricultural Extension Management (MANAGE), Hyderabad organized a fifteen days training course on "Certified Farm Advisors on Organic Farming (Module II)" from 07-21 February, 2023. Twenty eight participants from five different states Tamil Nadu, Andhra Pradesh, M.P., U.P. and Manipur participated in this certificate course.

Training program on "Capacity building and Skill development on Farm Management"



A seven-day training program on capacity building and Skill development on Farm Management was organized at the institute during 22-28 February, 2023. Dr. Sunil Kumar, Director of the Institute was the chief guest of the inaugural program. Dr. Omkar Singh, Principal, Gochar Mahavidyalaya, Rampur Maniharan, was the special guest in the program. He has praised this training program organized with the aim of increasing the working efficiency of the farm managers of various research centers of the Indian Council of Agricultural Research. Program Director Dr. Suresh Kumar Malik gave detailed information about the subject matter of this training program. In this training program, 13 trainees from 5 states of the country were trained on various aspects of resource use efficiency and farm productivity enhancement. During the inaugural ceremony itself, a Memorandum of Understanding was signed by the heads of both the institutes with the objective of enhancing mutual cooperation on various aspects of agricultural education, research and extension between ICAR-IIFSR and Gochar Mahavidyalaya, Rampur Maniharan.

National Science Day



National Science Day was organized in the Institute on 28th February, 2023. The theme of National Science Day was focused on "Global Science for Global Welfare". The program was inaugurated by the Chief Guest Professor Amar P. Garg, Vice Chancellor, Shobhit University Meerut. The Director of the Institute, Dr. Sunil Kumar presided over the program. The Chief Guest delivered the keynote address on the topic "Sustainable Environmental Technology for Sustainable Development" and told that to make the development of human civilization sustainable, we have to focus on the main four pillars, use of renewable energy sources, conservation of biodiversity, recycling of waste materials and population control. Program Chairman and Director ICAR-IIFSR Dr. Sunil Kumar welcomed all the dignitaries and participants and stated that today with the help of science and technology, we are succeeding to a great extent in dealing with many global challenges in agriculture. Dr. A.K. Rai, Principal Scientist, ICAR-Central Soil Salinity Research Institute, Karnal also expressed his views. During the program, a poster display competition was organized for the research students of the Agricultural University on the topic of "Green Technology for Sustainable Agriculture" in which the research students of the Agricultural University participated enthusiastically. After the program, the winning participants of the poster display were also honored by the guests with certificates.



Exposure Visit cum Hands on Training for Mushroom Farmers/Entrepreneurs

An Exposure Visit cum Hands on Training was organized under ABI Project on 3rd March, 2023 for Mushroom Farmers/Entrepreneurs working in collaboration with ICAR-IIFSR. The visit of entrepreneurs was organized at Regional Mushroom Research Centre (RMRC), Murthal, Haryana. During forenoon session, experts from RMRC demonstrated the commercial Spawn Production technologies, compost production unit,

seasonal and controlled mushroom production technologies of Button Mushroom, production technologies of specialty mushroom etc. followed by lectures on Cultivation of Oyster and Milky Mushroom.

International Women's Day



The Institute organized an awareness program under the Scheduled Caste Sub Plan in Iklota village of Meerut district on 6th March, 2023. Inaugurating the program, the Principal Scientist of the Institute, Dr. Peyush Punia said that today the contribution of women in agriculture and all other fields of life is increasing rapidly and they are moving forward in every field of life shoulder to shoulder with men. Scientist Amrit Lal Meena said that India is an agricultural country and the contribution of women in agricultural work is much more than that of men. Dr. O. K. Tomar gave information about the techniques developed by the Institute to reduce the hard labor works of women in the agricultural system. More than 60 women, including the Gram Pradhan representative of Iklota village, participated in the program.

Celebration of World Water Day- 2023



ICAR-Indian Institute of Farming Systems Research (IIFSR)

celebrated World Water Day on 22nd March, 2023 with a series of activities emphasizing the critical importance of water conservation and sustainable water management. The program was graced by Dr. Alok Kumar Sikka, Indian Representative of the International Water Management Institute, as the chief guest through virtual mode. He shared innovative water-saving techniques and the efficient use of water resources in agriculture. The program included interactive sessions, demonstrations, and workshops aimed at educating farmers and stakeholders about rainwater harvesting, drip irrigation, and other best practices for water management. The celebration underscored IIFSR's commitment to promoting sustainable water use in farming systems to ensure food security and environmental sustainability.

Institute Celebrated its 34th Foundation Day on 01 April, 2023



ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut celebrated its 34th Foundation Day on 1st April, 2023. The programme was celebrated in Hybrid mode (physically



and virtually both) in which, all the employees of ICAR-IIFSR, PIs and Co-PIs from different AICRP-IFS, AINP-OF Centres; Director/representatives from different NRM Institutes and representatives from ICAR-CPRIC, Modipuram, ICAR-CIRC, Meerut, SVPUA&T, Meerut; farmers, FPOs, SHGs, and agripreneurs took part during different events. The programme was inaugurated by the chief guest of the function Hon. Dr. Panjab Singh, Chancellor, RLBCAU, Jhansi and Ex. Secretary DARE and DG, ICAR. In his foundation day lecture, he congratulated the employees of the institute and emphasized that, ICAR-IIFSR is the only institute in the country which integrates all the technologies given by NARS institutes in the form of integrated farming system (IFS)/ integrated organic farming system (IOFS), models with aim of solving food, nutrition and livelihood security of farmers. Dr. S.K. Chaudhary, the Chairman of the function and DDG (NRM) at ICAR, New Delhi, delivered a virtual address to the gathering. Dr. K. K. Singh, the Vice-Chancellor of SVPUA&T, Meerut, and Dr. Amar P. Garg, the Vice-Chancellor of Shobhit University, Meerut, were the guests of honor at the event. They also praised ICAR-IIFSR's efforts in serving the farming community for their food, nutritional, and livelihood security. Dr. Rajbir Singh, the Guest of Honor and ADG (AAFCC) at ICAR, New Delhi, in his speech, stated that agriculture's challenges in the next 25 years would differ from those of today. He urged scientists to develop futuristic farming system models to address these upcoming challenges. Special invitees and ex Directors ICAR-IIFSR, Dr. R. L. Yadav, Dr. S. K. Sharma and Dr B. Gangwar appreciated the research achievements of the institute and suggested future road map.

Celebration of World Environment Day



World Environment Day was celebrated at ICAR-IIFSR, Modipuram Meerut on 5th June, 2023 with a theme centered around "Defeating Plastic Pollution." During the event Dr. Sunil Kumar, Director, ICAR-IIFSR highlighted the persistent environmental issues caused by plastic pollution and emphasized the importance of reducing the use of non-

degradable plastics. This initiative showcased ICAR-IIFSR's dedication to fostering environmental sustainability.

International Yoga Day 2023



ICAR-IIFSR organized the International Day of Yoga (IDY-2023) on 21st June, 2023, as part of the 'Azadi ka Amrit Mahotsav' initiative, themed "Yoga for Vasudhaiva Kutumbakam". The event saw enthusiastic participation from scientists, technical experts, and administrative staff and family members of ICAR-IIFSR staff. Dr. Nisha Lohia, a yoga teacher, led sessions to introduce yoga practices to all participants. Additionally, Yoga experts Dr. Manoj Kumar Rana and Shri Lakshya Rana provided training to everyone in attendance.

Har Ghar Tiranga campaign

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 13-15 August, 2023. Under this campaign, various activities like motivation of citizens to use "Har Ghar Tiranga" Hashtag, Selfie, banner etc. through various social media group and digital platforms; Tiranga Vitran Samaroh; Tiranga Yatra, Flag Hoisting, sports and cultural programmes were organized.





Celebration of the birth anniversary of Mahatma Gandhi and Bharat Ratna Shri Lal Bahadur Shastri

Gandhi Jayanti was organized on 2nd October 2023 at the Institute. Director of the Institute, Dr. Sunil Kumar inaugurated the program by garlanding the Father of the Nation Mahatma Gandhi and former Prime Minister Shri Lal Bahadur Shastri. Thereafter, all the scientists, officers and employees of the institute paid tribute to these two great personalities. The Director in his address said that the Father of the Nation Mahatma Gandhi got our country freedom from the British rule by following the path of truth and non-violence. Father of the Nation Mahatma Gandhi had a balanced view on all aspects of life along with unique struggle, humanism, kindness, self-respect, women's respect, self-reliance, which is known as Gandhism and today Gandhism is flourishing as a different idea all over the world. During the program, a painting competition was also organized for children on the topic "Mahatma Gandhi Ji's views on cleanliness". The winning participants were also honored by the Director by giving them prizes. After the Gandhi Jayanti program, a 'Swachhta Abhiyan' was organized in which all the scientists, officers and employees of the institute including the director cleaned the roads inside the institute campus.

Vigilance Awareness Week



Vigilance Awareness Week on the theme of "Say No to Corruption; Commit to the Nation" was organized from October 30 to November 05, 2023, featuring various events. The week commenced with a pledge administered by Dr. Sunil Kumar, Director of ICAR-IIFSR, followed by lectures delivered by all Heads of the Divisions. Dr. Peyush Punia, the Vigilance Officer, also presented a detailed session. Additionally, awareness sessions were conducted for government school students by the Vigilance Officer on 4th November, 2023 reaching out to over 500 students and 10 teachers to inform them about the importance of "Vigilance Awareness Week".

Celebration of World Soil Day

ICAR-IIFSR celebrated World Soil Day on 5th December, 2023, with a strong emphasis on the vital role of soil health in sustainable agriculture. The Chief Guest, Shri Amit Agrawal, MLA of Meerut Cantt, and special guest Shri Sunil Bharala, MLC, attended the event. The event featured informative presentations by leading scientists and experts, highlighting innovative soil management practices and their impact on crop productivity and environmental sustainability. Demonstrations and workshops were conducted to educate farmers and stakeholders on soil testing, nutrient management, and the adoption of conservation agriculture techniques. More than 70 farmers from seven villages actively participated, enriching the program with their insights and experiences.



Swachhta Campaign of ICAR-IIFSR

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut celebrated Swachhta Pakhwada from 16 to 31 December, 2023. The series of programs began with a pledge taken by all staff members. The activities included cleanliness drives focused on cleaning offices, corridors, and premises to improve the overall quality of life in rural areas by promoting cleanliness, hygiene, and eliminating open defecation. The initiative also involved reviewing the process

of maintaining housekeeping services with high cleanliness standards and weeding out/disposal of old records, furniture, and junk materials. The swachhta campaign also conducted in villages adopted by ICAR-IIFSR for its outreach programmes.



Visit and interaction programmes organized for farmers

Name of events	Title of Training	Venue	Duration	No. of participants	Name of Organizer
Interaction meeting	Organized Farmer Scientist interaction on IFS	ICAR-IIFSR, Modipuram	27 January, 2023	-	Dr. P.C. Jat
Kisan Gosthi	Kisan Gosthi on Natural Farming	SVPUAT, Modipuram	15 February, 2023	-	Dr. P.C. Ghasal
Gau Krishi Krishak Sammelan	Exhibition of technologies on IFS, Natural and Organic Farming	Hastinapur, Meerut	17-18 February, 2023	500	Dr. P.C. Jat Dr. Poonam Kashyap Dr. Nisha Verma
National Conference	Demonstration of IFS technologies through exhibition	ICAR-IIFSR, Modipuram	27-28 February, 2023	-	Dr. P.C. Jat, Dr. Nisha Verma
Pusa Krishi Vigyan Mela	Demonstration of IFS technologies through exhibition	ICAR-IARI, New Delhi	2-4 March, 2023	-	Dr. P.C. Ghasal Dr. Poonam Kashyap
Mahilaa Sashaktikaran hetu Hunar se Rozgaar Programme	Display of IFS and drudgery reduction technologies with special reference to farm women.	SVPUAT, Meerut	19 March, 2023	500	Dr. P.C. Jat, Dr. Poonam Kashyap, Dr. Nisha Verma

Name of events	Title of Training	Venue	Duration	No. of participants	Name of Organizer
Kisan Gosthi	Crop diversification and field demonstration of oilseeds	Atali, Muzaffarnagar	27 March, 2023	150	Dr. Raghuvveer Singh Dr. Raghavendra K.J.
Virat Kisan Mela	Virat Kisan Mela	SVPUAT, Modipuram	27-29 March, 2023	500	Dr. Nisha Verma Dr. Nirmal Dr. P.C. Ghasal, Dr. Yogender Singh
Pashu Mahotsav Pradarshini evam Kisan Prashikshan Mela	Demonstration of IFS Technologies through exhibition	Numaish Ground, Muzaffarnagar	6-7 April, 2023	6000	Dr. P.C. Jat Dr. Chandra Bhanu Dr. Poonam Kashyap Dr. Nisha Verma Dr. P.C. Ghasal
Interaction meeting	Farmer Scientist interaction on organic farming	Kushawali, Muzaffarnagar	15 April, 2023	-	Dr. P.C. Jat
World Environment day	Display of IFS, Organic & Natural Farming technologies on World Environment Day organized by DoAFW	NASC complex, New Delhi	5 June, 2023	800	Dr. P.C. Jat, Dr Nisha Verma Dr. O.K. Tomar
ICAR Foundation and Technology Day	Display of improved IFS, Organic and Natural Farming practices	NASC complex New Delhi	15-18 July, 2023	-	Dr. P.C. Jat Dr. Poonam Kashyap
Kisan Gosthi	Kisan Gosthi on Kharif crops	Tiggai and Mubarikpur villages, Muzaffarnagar	14 August, 2023	-	Dr. P.C. Jat
Parthenium Awareness Week	Awareness and management of Parthenium weed	ICAR-IIFSR, Modipuram	16-22 August, 2023	110	Dr. Chandra Bhanu Dr. P.C. Ghasal
G20 Leaders' Summit Spouse Programme	Display of improved IFS, Organic and Natural farming at C. Subramaniam Convention Centre	NASC Complex and Millets Demonstration Mela Ground in Pusa, IARI, New Delhi	08-09 September, 2023	-	Dr. Sunil Kumar Dr. P.C. Jat Dr. Poonam Kashyap Dr. Nisha Verma
Interaction meeting	Farmer-Scientist Interaction and exposure visit of framers on improved PoP of Millets cultivation	ICAR-IIFSR, Modipuram	21 September, 2023	-	Dr. P.C. Jat Dr. Poonam Kashyap
Farmers Field Day	Demonstration of FLD on oil seeds	Atali, Muzaffarnagar	16 October, 2023	-	Dr. Raghuvveer Singh Dr. Raghavendra K.J.



Name of events	Title of Training	Venue	Duration	No. of participants	Name of Organizer
All India Farmer's Fair and Agro-Industrial Exhibition	Demonstration of IFS, Organic and Natural Farming, agribusiness technologies	SVPUAT, Meerut	17-19 October,2023	800	Dr. P.C. Jat Dr. Nisha Verma Dr. O.K. Tomar Dr. Yogender Singh
Kisan Gosthi cum sanitation drive programme	Sanitation, sustainable agriculture and balanced nutrition: A basis of healthy life	Dudhli village, Muzaffarnagar	18 December, 2023	80	Dr. P.C. Jat Dr. Poonam Kashyap Dr. Nisha Verma
Kisan Diwas	Exhibition of technologies developed under ABI project of ICAR-IIFSR	Johri Village, Baghpat	23 December, 2023	350	Dr. R.P. Mishra Dr. Nisha Verma Dr. Nirmal
Interaction meeting	Farmer- Scientist interaction on Integrated Farming System on OFR and field visit	Samuali -Salempur, Daurala, Meerut	28 December, 2023	-	Dr. P.C. Jat Dr. Poonam Kashyap



One day training on crop diversification and remunerative cropping systems involving oilseeds (Mustard) and demonstration of drone at farmer's field



Kisan Gosthi and Har Ghar Tiranga programme at Mubarikpur village (Khatauli block), District Muzaffarnagar on 14th August, 2023

TECHNOLOGIES/METHODOLOGIES RECOGNIZED BY ICAR, NEW DELHI

Name of technology	Category	Technology Code	Name of Recipients
Integrated Farming System Models for different regions of India	Technology	ICAR-NRM-IIFSR-Technology-2023-001	N Ravisankar, A S Panwar, A K Prusty, M Shamim, M A Ansari, Raghuvveer Singh, Raghavendra K J, Anil Kumar (IASRI), Sunil Kumar, S Bhaskar and Rajbir Singh
Methodology for Sustainable Livelihood Security Analysis in Integrated Farming System Technology Certificate	Methodology	ICAR-NRM-IIFSR-Methodology-2023-042	N Ravisankar, M A Ansari, M Shamim, A K Prusty, Raghuvveer Singh, A S Panwar, Debashish Dutta, Cini Varghese, Sukanta Das and Arpan Bhowmik
Climate Smart IFS Model for marginal farm households of Western Uttar Pradesh	Model Development	ICAR-NRM-IIFSR-Model-2023-043	N Ravisankar, P C Ghasal, Debashish Dutta, Suresh Malik, Amit Nath, A K Prusty, Poonam Kashyap and M Shamim
Package of Practices for Organic Production of 64 cropping systems	Technology	ICAR-NRM-IIFSR-Technology-2023-044	N Ravisankar, A S Panwar, M. Shamim, Raghuvveer Singh, A K Prusty, M A Ansari, Raghavendra KJ, Poonam Kashyap, Rajbir Singh and All the Scientists of on-station centers of AINP-OF
Intensification of Autumn Sugarcane with Mustard through paired row trench planting	Technology	ICAR-NRM-IIFSR-Technology-2023-045	Devendra Kumar, Suresh Malik, L R Meena, R P Mishra, P C Jat, Poonam Kashyap, Nisha Verma, A K Prusty, Sunil Kumar, M Shamim, M P Singh and A S Panwar
Integrated Farming System Model for small farmers of Upper Gangetic Plains	Technology	ICAR-NRM-IIFSR-Model-2023-046	LR Meena, Suresh Malik, Amit Nath, Devendra, Kumar, Chandra Bhanu Dushyant Mishra, A K Prusty, A L Meena, Peyush Punia and Raghavendra KJ
Orchard and vegetable based (including pond dyke system) farming system for small farmer of Upper Gangetic Plains	Technology	ICAR-NRM-IIFSR-Technology-2023-047	Poonam Kashyap, A K Prusty, P C Jat, A L Meena, Sunil Kumar, Lalit Kumar and M P Singh
Wide row inter-cropping of garlic and onion in sugarcane -ratoon system	Technology	ICAR-NRM-IIFSR-Technology-2023-048	P C Jat, Poonam Kashyap, Peyush Punia, Sunil Kumar A L Meena, P C Ghasal and Jairam Choudhary



<p>ICAR-NRM-IFSR Technology-2023-042</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. N. Ravivaradar (Lead Developer)</p> <p>Associate Developers Dr. A.S. Panwar, Dr. A.K. Prusty, Dr. M. Sharma, Dr. M.A. Ansari Dr. Raghuvir Singh, Dr. Raghendra K.J., Dr. Anil Kumar (IASIR) Dr. Sunil Kumar, Dr. S. Bhaskar, Dr. Rajiv Singh</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Integrated Farming System Models for different regions of India (Technology/Package of Technology)</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>	<p>ICAR-NRM-IFSR Technology-2023-043</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. N. Ravivaradar (Lead Developer)</p> <p>Associate Developers Dr. A.S. Panwar, Dr. M. Sharma, Dr. Raghuvir Singh, Dr. A.K. Prusty Dr. Manoj Anand, Dr. Raghendra K.J., Dr. Praveen Kachap Dr. Rajiv Singh and all the scientists of an various centres of IASIR of</p> <p>ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Package of practices for organic production of 64 Cropping systems</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>	<p>ICAR-NRM-IFSR Technology-2023-044</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. N. Ravivaradar (Lead Developer)</p> <p>Associate Developers Dr. Manoj Anand, Dr. M. Sharma, Dr. A.K. Prusty Dr. Raghuvir Singh, Dr. A.S. Panwar, Dr. Debashree Dutta Dr. Chiranjeev, Dr. Sukanta Das, Dr. Arjun Bhattacharya</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Methodology for sustainable livelihood security analysis in integrated farming systems</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>
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<p>ICAR-NRM-IFSR Technology-2023-045</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. N. Ravivaradar (Lead Developer)</p> <p>Associate Developers Dr. P. C. Ghosal, Dr. Debashree Dutta Dr. Suresh Malik, Dr. Anil Nath, Dr. A.K. Prusty Dr. Manoj Kashyap, Dr. M. Sharma</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Climate smart IFIS model for marginal farm households of Western Uttar Pradesh</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>	<p>ICAR-NRM-IFSR Technology-2023-046</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. D. Kumar (Lead Developer)</p> <p>Associate Developers Dr. Suresh Malik, Dr. L. B. Meena, Dr. P.P. Mishra Dr. P. C. Jat, Dr. Praveen Kachap, Dr. Nisha Verma, Dr. A.K. Prusty Dr. Suresh Kumar, Dr. M. Sharma, Dr. M.P. Singh, Dr. A.S. Panwar</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Intensification of Autumn Sugarcane with Mustard through paired row trench planting</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>	<p>ICAR-NRM-IFSR Technology-2023-047</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. L. B. Meena (Lead Developer)</p> <p>Associate Developers Dr. Suresh Malik, Dr. Anil Nath, Dr. Debashree Kumar Dr. Chandan Kumar, Dr. Suresh Malik, Dr. A.K. Prusty Dr. L. B. Meena, Dr. Piyush Punia, Dr. Raghendra K.J.</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Integrated farming system modal for small farmers of Upper Gangetic Plains</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>
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<p>ICAR-NRM-IFSR Technology-2023-048</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. PC Jat (Lead Developer)</p> <p>Associate Developers Dr. Poonam Kashyap, Dr. Piyush Punia, Dr. Sunil Kumar Dr. A. L. Meena, Dr. P. C. Ghosal, Dr. Jairam Choudhary</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Wide row inter-cropping of garlic and onion in sugarcane-ratoon system</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>	<p>ICAR-NRM-IFSR Technology-2023-047</p> <p>INDIAN COUNCIL OF AGRICULTURAL RESEARCH</p> <p>Certified that Dr. Poonam Kashyap (Lead Developer)</p> <p>Associate Developers Dr. A.K. Prusty, Dr. P.C. Jat, Dr. D. Dutta Dr. Jairam Choudhary, Dr. A. L. Meena, Dr. Sunil Kumar Dr. Lalit Kumar, Dr. M. P. Singh</p> <p>of ICAR-Indian Institute of Farming Systems Research (IIFSR) Modipuram, Meerut</p> <p>has developed the technology Orchard and vegetable-based integrated farming system for small farmers of Upper Gangetic Plains</p> <p>16th July, 2023 New Delhi</p> <p><i>(Rajiv Singh)</i> Assistant Director General (IASIR)</p> <p><i>(S.K. Chaudhari)</i> Deputy Director General (NRM)</p>
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AWARDS AND HONOURS

Name of Recipient	Name of Award/ Honours	Year of award	Awarding Organization and event venue
National			
Dr. M. A. Ansari	The Mosaic Foundation Young Scientist Award (in the area of plant nutrition category)	2022	The Mosaic Foundation Pvt. Ltd. on 10 th April, 2023. (Cash prize 1.50 Lakhs)
Recognized Society			
Dr. Sunil Kumar	ISA Gold Medal	2022	Indian Society of Agronomy, New Delhi received in XXII National Symposium during 22–24 November, 2023 at ICAR-CCARI, Ela, Goa
Dr. R P Mishra	ISA- Fellow	2022	Indian Society of Agronomy, New Delhi received in XXII National Symposium during 22–24 November, 2023 at ICAR-CCARI, Ela, Goa
Dr. Raghavendra Singh	IAHF-Fellow	2018	Indian Association of Hill Farming, Umiam, Meghalaya and received in National Conference of IAHF on “Rebooting the hill farming for future sustainability and livelihood” during 8-9 June, 2023.
Dr. M A Ansari	ISA-Associateship	2022	Indian Society of Agronomy, New Delhi received in XXII National Symposium during 22–24 November 2023 at ICAR-CCARI, Ela, Goa
Dr. M A Ansari	IAHF Young Scientist Award	2022	Indian Association of Hill Farming, Umiam, Meghalaya and received in National Conference of IAHF on “Rebooting the hill farming for future sustainability and livelihood” during 8-9 June, 2023.
Dr. M A Ansari	Associate Editor	2023	The Indian Society of Agronomy, New Delhi
Dr. M A Ansari	Associate Editor	2023	Indian Journal of Soil Conservation, Indian Association of Soil & Water Conservationists, Dehradun
Dr. Nirmal	Young Scientist Award	2023	Pragati International Scientific Research foundation, Meerut, India
Institutional			
Dr. P C Ghasal	ICAR-IIFSR Best Young Scientist Award	2022-23	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
Dr Vipin Kumar, CTO, Project Coordination Unit	Best Technical Staff Award	2023	ICAR-IIFSR, Modipuram received at 34 th Foundation Day



Name of Recipient	Name of Award/ Honours	Year of award	Awarding Organization and event venue
Project Coordination Unit all scientists and staff of PCU	Best Research Division/ Section Award	2023	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
R P Mishra, D Dutta, Chandra Bhanu, P C Ghasal and Jairam Choudhary	ICAR-IIFSR Best Research Team Award for outstanding team research in the field of organic farming	2022-23	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
Dr. Raghuvveer Singh and Dr. Raghavendra KJ	Appreciation certificate for outstanding contribution in research, extension and institute building in various capacities	2023	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
A S Panwar and team consisting of M P Singh, P C Jat, Poonam Kashyap, A K Prusty, M Shamim, Nisha Verma, D Kumar, Sunil Kumar, Raghuvveer Singh and Raghavendra KJ	ICAR-IIFSR Team Award for Extension/Outreach Programme (Farmer First)	2023	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
N Ravisankar, M A Ansari, M Shamim, A K Prusty, R Singh, A S Panwar, D Dutta, S Bhaskar, J S Bindhu, M T Sanjay, J Kaur, C Varghese, S Dash, A Bhowmik and S K Bal	Best Research Paper Award (Sustainable livelihood security of small farmers improved through resilient farming systems in the Semi-arid region of India, Land degradation and development 33: 2830-2842, (2022)	2023	ICAR-IIFSR, Modipuram received at 34 th Foundation Day
Best presentation/poster award in national symposia/seminar/conferences			
Dr. A K Prusty	Best Poster Presentation Award (Paper: Integrated Farming Systems as a tool for sustainable agriculture in Gangetic plains of India)	2023	Indian Society of Agronomy, received in XXII Biennial National Symposium of Indian Society of Agronomy held during 22–24 November, 2023 at Goa
Kohima Noopur, N Ravisankar, M A Ansari, M Shamim, A K Prusty, N P Thakur, A K Gupta, Vijay Khajuria, Anil Kumar and Purushottam Kumar	Best Oral Presentation Award (Paper: Integrated farming systems of foot hills of Jammu for sustaining production and productivity-An exploratory study)	2023	Society for Extension Education, received in International Extension Education Congress-2023 held during 18-20 December, 2023.
Dr. P C Ghasal	Best Lead Paper Award (Theme: Agro-ecology based diversification in crops and horticulture)	2023	FSRDA, Modipuram
Jairam Choudhary, P C Ghasal, D Dutta, Chandra Bhanu, A L Meena, Lalit Kumar, Kamlesh Kumar, Raghuvveer Singh	Best Poster Award in Theme I	2023	Indian Society of Agronomy, received in XXII Biennial National Symposium of Indian Society of Agronomy held during 22–24 November, 2023 at Goa

Name of Recipient	Name of Award/ Honours	Year of award	Awarding Organization and event venue
Dr. P C Ghasal	Best Oral Presentation Award (In technical session Organic Farming and Natural Farming)	2023	Indian Society of Agronomy, received in XXII Biennial National Symposium of Indian Society of Agronomy held during 22–24 November, 2023 at Goa
Dr. Pushendra Pratap Singh	SHRD Award for the year 2022	2022	3 rd Indian horticultural Summit-com-International Conference in Rajasthan Agricultural Research Institute, Durgapur
Nirmal, R P Mishra, Peyush Punia, Suresh Malik, Pushendra Pratap Singh, Kamlesh Kumar, Raghavendra KJ and Sunil Kumar	Best Oral Presentation Award	2023	2 nd International Conference PISRF, 18-20 September, 2023 at ICAR-CIARI, Port Blair, Andaman & Nicobar Islands, India.



Dr. Sunil Kumar received ISA-Gold Medal



Dr. N. Ravisankar received Technology Certificate



Dr. R. P. Mishra received ISA Fellow



Dr. M. A. Ansari received ISA Associate Fellow



Dr. M.A. Ansari received Mosaic Young Scientist Award



RECOGNITIONS

- Dr. Sunil Kumar, Member, Institute Management Committee (IMC), ICAR-DWR, Jabalpur.
- Dr. Sunil Kumar, Chaired Technical session during NG of AICRPPFC BAIF, Pune.
- Dr. N. Ravisankar, Chairman, National Initiative on Farming Systems Technology Demonstrations (KVK)- Coordination Committee.
- Dr. N. Ravisankar, Member, Institute Management Committee (IMC) for ICAR-Research Complex for Eastern Region, Patna, ICAR-Central Arid Zone Research Institute, Jodhpur, ICAR-Central Soil Salinity Research Institute, Karnal and ICAR-National Rice Research Institute, Cuttack.
- Dr. N. Ravisankar, Member, Advisory Committee for promotion of Natural Farming constituted by Government of India.
- Dr. N. Ravisankar, Member Subject Matter Expert for Crop Production for AICRP on Rapeseed and Mustard.
- Dr. N. Ravisankar, Member of the committee constituted for restructuring of the developed syllabus for UG degree in Natural Farming.
- Dr. N. Ravisankar, Member of Knowledge Platform committee of MSTC (Jaivik Kheti Portal) constituted by Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi.
- Dr. N. Ravisankar Co-Chairmen, Technical Session on Strengthening On-Farm Participatory Rainfed IFS Research and TAR in 28th Working Group Meeting of AICRP-Dryland Agriculture.
- Dr. Raghavendra Singh, Member Secretary, QRT 2023-2028 of ICAR-IIFSR, AICRP-IFS and AI-NPOF.
- Dr. Raghavendra Singh, Member, Board of Studies (BOS) of Udai Pratap Autonomous College, Varanasi.
- Dr. Raghavendra Singh, Member, Assessment Committee on Technical Personal of ICAR-CRIDA, Hyderabad.
- Dr. Raghavendra Singh, Member, CACP Meeting Pulses and Oilseeds on Price Policy for Kharif Crops, Marketing Season 2023-24 on January 27, 2023 at Krishi Bhawan, New Delhi.
- Dr. M. A. Ansari and Dr. Jairam Choudhary, Member of the Agricultural Systems and Management Sectional Committee, BIS, New Delhi.

MONITORING AND VISITS

Monitoring of AICRP-IFS/AINP-OF Centers

University/Institute	Centre	Date	Monitored by
BHU, Varanasi	Varanasi	24 March, 2023	Dr. M. A. Ansari Dr. Raghavendra K.J.
ANDUA&T, Kumarganj, Ayodhya	Kumarganj, Ayodhya	25 March, 2023	Dr. M. A. Ansari Dr. Raghavendra K.J.
SKUAST Jammu and Srinagar	Jammu & Sriangar	8-11 June, 2023	Dr. Sunil Kumar Dr. Raghveer Singh
CSKHPKV Palampur	Palampur	14-16 June, 2023	Dr. Sunil Kumar Dr. Raghveer Singh
SKUAST-Jammu	Jammu	3-5 August, 2023	Dr. N Ravisankar
PJTSAU, Hyderabad	Hyderabad	24 August, 2023	Dr. Raghavendra Singh Dr. M. A. Ansari
CSAUA&T, Kanpur	Kanpur	16 September, 2023	Dr. M. A. Ansari
PJTSAU, Hyderabad	Rajendranagar, Rudrur/ Ranga Reddy	16-17 September, 2023	Dr. N. Ravisankar Dr. A. K. Prusty Dr. M. Shamim Dr. Raghveer Singh Dr. Raghavendra K.J.
Poly4 in ICAR-CRIDA, Hyderabad	Hyderabad	23-24 September, 2023	Dr. R. P. Mishra
Wardha OFR and Akola	Wardha OFR and Akola	29-30 September, 2023	Dr. R. P. Mishra
ICAR-CCARI, Goa	Goa	23 November, 2023	Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim Dr. M.A. Ansari
JNKVV, Jabalpur	Jabalpur and Mandla	25-26 November, 2023	Dr M Shamim
JNKVV, Jabalpur	Jabalpur	13 December, 2023	Dr. N. Ravisankar Dr. A. K. Prusty

Foreign Visit/International Conference/Workshop/Training Attended

- M. A. Ansari, A.L. Meena and P. C. Ghasal attended SAARC regional training on “Climate Smart Agriculture in South Asia: Technologies, Policies and Digital Innovation” during 25-28 July, 2023 at ISARC, Varanasi.
- M. Shamim, P.C. Ghasal, Raghveer Singh, Kamlesh Kumar and Raghavendra KJ attended training on “Whole Farm Bio-Economic Modelling and Integrative Sustainability Assessment Tool” during 11-15 September, 2023 at ICRISAT, Hyderabad.
- Sunil Kumar, N. Ravisankar, A. K. Prusty, M. Shamim, M. A. Ansari, Raghveer Singh, Raghavendra KJ and Meenu Rani attended the TEEB Agri-Food Global Symposium, Bangkok, Thailand during 7-9 November, 2023.



- M. A. Ansari attended ACASA Annual Project Review and Planning Meeting during 12-14 December, 2023 at Kathmandu, Nepal.
- A.L. Meena, attended 12th Advance Course on Conservation Agriculture for Asia and North Africa during 9-24 December, 2023 jointly organized by CIMMYT, BISA and ICAR, New Delhi.



State Stakeholder Workshop on UNEP-TEEB organized on 1st August, 2023, Lucknow



TEEB Agri Food Global Symposium attended by ICAR-IIFSR Scientist at Bangkok, Thailand during 7-9 November, 2023



National Symposium on TEEB Agri-Food during 16-17 November, 2023 at New Delhi

MOUs SIGNED

- **ICAR-IIFSR signed MoUs with the following organizations during 2023**

1. Galgotias University, Greater Noida, Uttar Pradesh
2. U.P. Council of Agricultural Research (UPCAR), Lucknow
3. Agribusiness Incubation (ABI) incubate (8 Nos.)
4. Licence agreement with Scissor Manufactory Unit, Meerut

Under the Agribusiness Incubation Project, the Institute signed a Memorandum of Understanding between the Institute and Agri-preneurs with the objective of promoting self-employment through agricultural commercialization in the region. During the program, MoUs were signed by the Institute for the purpose of technical exchange between agribusinesses trained in various fields of agribusiness. The program was inaugurated

by the Director of the Institute, Dr. Sunil Kumar. In his address, the Director said that commercializing various techniques of agricultural systems, promoting self-employment in agriculture, creation of agri startups in the field of agriculture, taking the commercial activities of agriculture further by forming self-help groups and FPOs are the priorities of today and we will have to work actively on these points, so that the people of the village can get options for self-employment and increasing income in the village itself. Dr. Amit Nath, PI of Agribusiness Incubation Project, introduced everyone to the objectives of Agri Business Incubation Center run by Indian Council of Agricultural Research, New Delhi and also gave detailed information about the technical assistance provided by the institute to the agricultural businessmen of the region. The companies that signed the MoU included Agri-Farm Badi Producer Company Limited, Muzaffarnagar; Anant Gold Sirka, Muzaffarnagar; Desi Mushroom Agro Private Limited, Meerut and Orgi Fru, Meerut.



MoU between ICAR-IIFSR and ABI incubates

IIFSR IN PRESS AND MEDIA

गन्ना कम, कोल्हू संचालकों की नहीं निकल रही लागत

मोहित कुमार

मोदीपुरम/मेरठ। गन्ने की पैदावार में इस बार पश्चिमी उत्तर प्रदेश में बड़ी गिरावट देखने को मिल रही है। चीनी मिलें भले ही पूरी क्षमता के साथ चालू हो चुकी हैं, लेकिन गन्ना पर्याप्त मात्रा में नहीं पहुंच पा रहा है। केशर व कोल्हू संचालकों को लागत निकालना मुश्किल हो रहा है।

यह तथ्य कृषि वैज्ञानिकों द्वारा पश्चिमी उत्तर प्रदेश के विभिन्न जिलों में किए गए सर्वे में सामने आया है।

सर्वे के अनुसार मेरठ समेत आसपास के जिलों में इस वर्ष गन्ने की पैदावार में पांच से 20 प्रतिशत तक की गिरावट देखने की मिली है। इसकी वजह से काफी संख्या में कोल्हू संचालित नहीं हो पाए हैं। हालात यह

सर्वे में मेरठ समेत आसपास के जिलों में गन्ने की उपज में पांच से 20 प्रतिशत तक कम मिली

है कि जो केशर व कोल्हू चल रहे हैं, वहां आधे या इससे भी कम मात्रा में गन्ना पहुंच रहा है। गन्ने की पैदावार में गिरावट का मुख्य कारण बारिश बताया जा रहा है।

इसके अलावा साल के शुरुआत में फरवरी से लेकर मई के दौरान पावरिल्ला कोट, मई से लेकर सितंबर के दौरान पोखा बोंडिंग बीमारी और चोटी वेभक कोट के आक्रमण के कारण भी पैदा गन्ने की उपज में गिरावट दर्ज की गई है। गन्ना केशर व कोल्हूओं पर ज्यादातर गन्ना खादर क्षेत्र से आता है। खादर क्षेत्र में इस बार बारिश काफी हुई जिससे काफी फसल नष्ट हो गई।



गन्ने में नगी पोखा बोंडिंग बीमारी। संवाद

मकाना रोड पर इचौली में चार केशर संचालित हैं। केशर संचालक जयशेद ने बताया कि पिछले वर्ष एक दिन में 600 से 800 क्विंटल गन्ना आता था, लेकिन इस बार 250 से 300 क्विंटल गन्ना ही आ रहा है। पिछले दो दिनों में एक बुग्गी गन्ना ही क्रशर पर आया। एक बुग्गी में 25 से 30 क्विंटल तक गन्ना आता है। जयशेद ने बताया कि क्रशर पर आने वाले गन्ने के बदले वह 330 से 340 रुपये प्रति क्विंटल नकद दे रहे हैं। गन्ने की कमी के चलते इस साल खरदौनी गांव में चार कोल्हू संचालित नहीं हो पाए। (संवाद)

अच्छी प्रजातियों का गन्ना लगाएं

85 प्रशिक्षण से अधिक भू-भाग में गन्ने की को-0238 प्रजाति बीमारियों से रोगग्रहित हो गई है। अच्छी प्रजातियों का गन्ना लगाएं। - डॉ. चंद्रभानु, प्रधान वैज्ञानिक, भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम



पिछले साल के मुकाबले इस साल वर्तमान मह तक अधिक पैदाई हुई है। पिछले साल जहाँ 2.25 करोड़ क्विंटल गन्ने की पैदाई दिसंबर तक हुई थी, वहीं इस बार दिसंबर मह तक 2.30 करोड़ क्विंटल गन्ने की पैदाई हो चुका है। किसानों को मुनाफा भी हो रहा है। - दुष्यंत कुमार, जिला गन्ना अधिकारी

को-118 प्रजाति को देना होगा बढ़ावा

पांच से छह प्रजातियों को फसल लगानी चाहिए। कोसा 13295 और को-118 प्रजातियों में कोट और बीमारियों का प्रकोप कम पाया जा रहा है। - डॉ. सुनील कुमार, निदेशक, भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम



मोटे अनाज के उत्पाद तैयार करना सिखाया



कार्यक्रम में डॉ. सुनील कुमार व प्रशिक्षु महिलाएं। संवाद

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में स्वयं सहायता समूहों की महिलाओं के लिए मोटे अनाजों के मूल संवर्धन पर प्रशिक्षण कार्यक्रम का आयोजन किया गया। इसमें मोटे अनाज से विभिन्न उत्पाद बनाने के तरीके बताए गए। कार्यक्रम का शुभारंभ संस्थान के निदेशक एवं मुख्य अतिथि डॉ. सुनील कुमार ने किया। डॉ. सुनील ने बताया कि ऐसे प्रशिक्षण से महिलाओं को उनकी आर्थिक एवं सामाजिक स्थिति को मजबूत बनाया जा सकता है। मुख्य प्रशिक्षक डॉ. सुरेश चंद्र प्रो. सरदार बल्लभ भाई पटेल कृषि एवं प्रौद्योगिकी विधि में प्रशिक्षु महिलाओं को मोटे अनाजों से विभिन्न उत्पाद बनाने के बारे में बताया। मुख्य समन्वयक डॉ. आरपी मिश्रा रहे। संचालन डॉ. पूनम चक्रवर्त ने किया। इस मौके पर डॉ. निशा वर्मा, डॉ. सुनील कुमार, डॉ. विमल आदि मौजूद रहे। संवाद

विजेताओं को प्रमाणपत्र देकर किया सम्मानित



विजेताओं को पुरस्कृत करते अतिथि। संवाद

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान में 14 सितंबर से चल रहे हिंदी पखवाड़े का बुधवार को समापन किया गया। इस दौरान विभिन्न प्रतियोगिताएं आयोजित हुईं। प्रतियोगिता में विजेताओं को पुरस्कार व प्रमाणपत्र देकर सम्मानित किया गया। संस्थान के निदेशक डॉ. सुनील कुमार ने बताया कि राजभाषा हिंदी विश्व में तीसरी सबसे अधिक बोली जाने वाली भाषा है, इसी भाषा में देश के सभी लोगों को एक सूत्र में पिरोने की क्षमता निहित है। इस दौरान निबंध लेखन, आसु-भाषण, प्रारूप, टिप्पण लेखन, सामान्य ज्ञान, प्रश्नोत्तरी व वर्ष के दौरान सर्वाधिक हिंदी कार्य प्रमुख रहे। प्रतियोगिता में विजेताओं को प्रमाणपत्र देकर सम्मानित किया गया। इस दौरान रहस्य विहारी तिवारी, डॉ. चंद्रभानु, डॉ. राधेवंद सिंह, डॉ. अमृतलाल मीणा, डॉ. आरपी मिश्रा, डॉ. टीपी. स्वर्णम, अशोक शर्मा, दीप शिखा आदि मौजूद रहे। संवाद

मेरठ, 11 फरवरी, 2023 **दैनिक जागरण 7**

एग्री ड्रोन से फसल पर दवा छिड़काव का प्रदर्शन

मोदीपुरम : भारतीय कृषि प्रणाली अनुसंधान संस्थान-मोदीपुरम में शुक्रवार को भारत सरकार की एग्री ड्रोन परियोजना के अंतर्गत दो कृषि ड्रोन (एग्री बोट) का प्रदर्शन किया गया। कृषि विज्ञानियों के अलावा

क्षेत्र के किसान भी प्रदर्शन में मौजूद थे। संस्थान के निदेशक डा. सुनील कुमार ने बताया कि वर्तमान दौर में फसलों की उपज एवं गुणवत्ता बढ़ाने और लागत घटाने के लिए तकनीकी के प्रयोग की जरूरत है।

समय पर कराएं मिट्टी की जांच, आय बढ़ाएं

संवाद नृपज एजेंसी

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में विषय मृदा विज्ञान का आयोजित किया गया। इस वर्ष कार्यक्रम की थीम मृदा एवं जल जीवन का खोज रहा। कार्यक्रम में लगभग 20 किसानों के साथ संस्थान के अधिकारी, कर्मचारी मौजूद रहे।

संस्थान के सहायक निदेशक विभाग के निदेशक डॉ. अरविंद सिंह ने प्रथम मृदा एवं जल जांच कक्षा उद्घाटन किया था। कार्यक्रम के अन्तर्गत किसानों को मृदा विज्ञान के अनेक पहलुओं पर जानकारी दी गई।

भारतीय कृषि प्रणाली अनुसंधान संस्थान में हुए कार्यक्रम में शामिल अतिथि। संवाद

विषय मृदा विज्ञान पर जागरूकता रैली निकाली

मोदीपुरम। संवाद संस्थान में मृदा विज्ञान विभाग के अधिकारियों ने मृदा विज्ञान विभाग एवं किसानों को जागरूक करने के लिए 'मृदा विज्ञान दिवस' का आयोजन किया। इस दिन किसान मृदा विज्ञान पर जांच करवाए जा रहा है। इस दिन किसानों को मृदा विज्ञान पर जांच करवाया गया। इस दिन किसानों को मृदा विज्ञान पर जांच करवाया गया।

आलू की फसल में उर्वरक, जल का सतुलन जरूरी

केंद्रीय अनुसंधान संस्थान में आयोजित कार्यक्रम में शामिल अतिथि व अन्य। संवाद

मोदीपुरम। केंद्रीय अनुसंधान संस्थान में आयोजित कार्यक्रम में शामिल अतिथि व अन्य। संवाद

समझौते पर हस्ताक्षर किए

मोदीपुरम। एग्री बिजनेस इनक्यूबेशन के तहत बुधवार को भारतीय कृषि प्रणाली अनुसंधान संस्थान और कृषि उद्यमियों के बीच समझौता हस्ताक्षर किए गए। इसका उद्देश्य कृषि प्रणाली की विभिन्न तकनीकों को व्यवसायिक रूप देना, कृषि में स्वरोजगार को बढ़ावा देना और एग्री स्टार्टअप का सुजन करना मुख्य रूप से शामिल है। इसमें क्षेत्र के चार एग्री स्टार्टअप और उनके प्रतिनिधियों ने भाग लिया। कार्यक्रम का शुभारंभ संस्थान के निदेशक डॉ. सुनील कुमार ने किया। उन्होंने बताया कि इस पहल से गांव के लोगों को गांव में ही रोजगार और आय के अवसर उपलब्ध होंगे। परिचयनाम अधिकारी व प्रधान वैज्ञानिक डॉ. अमित नाथ ने कृषि व्यवसायियों को दी जाने वाली तकनीकी सहायता के बारे में बताया। विभिन्न विभागों के अध्यक्ष, वैज्ञानिक एवं अधिकारी मौजूद रहे। हस्ताक्षर करने वालीं में मुख्यप्रकरण और मेरठ से जुड़ी कंपनियों के प्रतिनिधि भी शामिल रहे। संवाद

को स्वच्छता का कार्यक्रम ने कविताओं आयोजन का

स्वच्छता का कार्यक्रम ने कविताओं आयोजन का

केंद्रीय आलू अनुसंधान संस्थान मोदीपुरम में स्वच्छता की शपथ लेते वैज्ञानिक व अन्य। संवाद

पल्लवपुरम में सड़क पर चलाया सफाई अभियान

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में स्वच्छता जागरूकता कार्यक्रम का आयोजन किया गया। कार्यक्रम में वैज्ञानिकों, अधिकारियों व कर्मचारियों के साथ पल्लवपुरम कस्बेवासी के लोगों ने सड़क-चाड़कर हिस्सा लिया। इसके साथ ही पल्लवपुरम में सड़क पर सफाई अभियान चलाया गया। मुख्य अतिथि एमएलसी धर्मेन्द्र भारद्वाज ने कहा कि जन-जन को भागीदारी में स्वच्छता मिशन सफल होगा। प्रधान वैज्ञानिक डॉ. एन रविशंकर ने अतिथियों व प्रतिभागियों का स्वागत किया। कार्यक्रम में भारतीय किसान मोर्चा के क्षेत्रीय कोषाध्यक्ष अजय भारद्वाज, रिचा सिंह, जयवीर सिंह, संदीप पांडे, पिंटू, सदाशम, डॉ. पुष्पेंद्र प्रताप सिंह, डॉ. चंद्रभानु, डॉ. सचिन सिंह, डॉ. टीवी स्वर्णम आदि मौजूद रहे। संवाद

ग : प्रतीक मेहरवाल पदक देकर मेधावी

तीन दिवसीय प्रशिक्षण कार्यक्रम का शुभारंभ

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में सोमवार को नेशनल बैंक स्टार्टअप कॉलेज (एनबीएससी) के सहयोग से तीन दिवसीय प्रशिक्षण कार्यक्रम का सोमवार को शुभारंभ किया गया। कृषि परिस्थितिकी व समेकित कृषि प्रणाली विषय पर यह प्रशिक्षण आयोजित किया जा रहा है। कार्यक्रम में देश के 22 राज्यों के 27 बैंक अधिकारी भाग ले रहे हैं। कार्यक्रम निदेशक डॉ. एन रविशंकर, पंकज कुमार त्रिपाठी, चंदिवर इसाकीमुथु ने भी विचार रखे। संचालन डॉ. पूनम कश्यप ने किया। संवाद

पोषण सुरक्षा के मामले में नहीं कर पा रहे प्रगति : डॉ. अरविंद

मोदीपुरम। देश कई सारे खाद्य उत्पादों के मामले में आत्मनिर्भर से ऊपर उठकर निर्यातक की श्रेणी में आ गया है। लेकिन, आज भी पोषण सुरक्षा के मामले में हम प्रगति नहीं कर पा रहे हैं। आने वाले कुछ वर्षों में जनसंख्या चोच से आगे निकल जाएगी। ऐसी परिस्थितियों में खाद्य पोषण एवं पर्यावरण सुरक्षा सुनिश्चित करने के लिए एक ऊंचे दर्जे के समेकित कृषि प्रणाली शोध संबंधित नीतियों के क्रियान्वयन की आवश्यकता है।

शुक्रवार को भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में आयोजित दो दिवसीय राष्ट्रीय सम्मेलन में पद्मश्री डॉ. अरविंद कुमार, पूर्व कुलपति, रानी लक्ष्मी बाई केंद्रीय कृषि

जैविक खेती व शोध कार्यों पर होगा विचार

निदेशक डॉ. आजाद सिंह पवार ने बताया कि राष्ट्रीय सम्मेलन में कृषि प्रणाली, जैविक खेती, उल्कष्ट शोध कार्यों पर वैज्ञानिकों, किसानों से विचार विमर्श होगा। 300 वैज्ञानिक व 500 से अधिक किसान प्रतिभाग करेंगे। किसानों की आय दोगुना करने व फसल उत्पादन बढ़ाने की लेकर वैज्ञानिक जानकारी देंगे।

विश्वविद्यालय शांसी ने अपने विचार व्यक्त किए।

मुख्य अतिथि पद्मश्री डॉ. अरविंद कुमार और सांसद राजेंद्र अग्रवाल ने कार्यक्रम का शुभारंभ किया। संवाद

पानी का दुरुपयोग कम कर जल की कर सकते हैं बचत

मोदीपुरम। भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम में बुधवार को अंतरराष्ट्रीय जल दिवस गोष्ठी आयोजित की गई। कार्यक्रम का शुभारंभ अंतरराष्ट्रीय जल प्रबंधन संस्थान इंडिया रिप्रेजेंटेटिव व मुख्य अतिथि डॉ. आलोक कुमार सिक्का ने किया। निदेशक डॉ. सुनील कुमार ने कहा कि पानी का दुरुपयोग कम कर हम जल को बचत कर सकते हैं। संचालन डॉ. चंद्रभानु ने किया। कार्यक्रम में डॉ. देवाशीष दास, डॉ. पीयूष पुनिया, डॉ. लक्ष्मण राम मोणा, डॉ. रवि शंकर आदि मौजूद रहे। संवाद



DISTINGUISHED VISITORS



Dr. Panjab Singh, Ex. Secretary DARE and DG, ICAR visited ICAR-IIFSR on 1st April, 2023



Sh. Amit Agrawal, Hon. MLA, Meerut Cantt visited ICAR-IIFSR on 5th December, 2023

RESEARCH COORDINATION AND MANAGEMENT

9th Research Advisory Committee Meeting

The third meeting of the 9th Research Advisory Committee (RAC) meeting of the ICAR-Indian Institute of Farming Systems Research (ICAR-IIFSR) was held on April 14-15, 2023, at ICAR-IIFSR, Modipuram, Meerut. Dr. Sunil Kumar, Director of ICAR-IIFSR, presented a brief overview of the research programs, achievements, and activities undertaken at the institute during the year 2022-2023. The Hon'ble Chairman of RAC, Dr. S.S. Magar, in his opening remarks, applauded the efforts of the scientists and highlighted the institute's significant role in achieving food and nutritional security, livelihood improvement, and income security for the farming community in the country. He emphasized the need for the institute to focus on developing sustainable Integrated Farming Systems (IFS) models that provide regular income throughout the year. Other esteemed RAC members, Dr. P.K. Mahapatra, Dr. A.K. Yadav, Dr. S.K. Dhyani, Dr. K.K. Vas and Dr. Rajbir Singh appreciated the institute's achievements over the past

year, particularly in developing several IFS models for small and marginal farming communities. They provided valuable suggestions for further improvement in the institute's research. Two ex-officio members, Shri Heera Singh and Dr. Momraj Gujar, also attended the meeting. They expressed concerns about the use of chemicals and the low income of farmers due to various challenges but were satisfied with the availability of different IFS models developed for different regions and the package of practices (PoPs) for organic production. The Hon'ble Chairman and the RAC members critically reviewed the experiments at the Main and Siwaya Research Farm, offering valuable suggestions for the improvement of the experiments and the overall visibility of the farm area. The committee also visited a Farmer Producer Organization (FPO) in Kushawali village, Muzaffarnagar District, where they interacted with a group of farmers' on various aspects of IFS, organic farming, post-harvest handling, marketing, and entrepreneurship.



RAC Meeting at ICAR-IIFSR, Modipuram on 14-15 April, 2023



Research Farm visit at ICAR-IIFSR on 15th April, 2023



Showing GHGs emission measurement procedure to RAC members



Visit at Farmer Producer Organization (FPO) in Kushawali village, Muzaffarnagar



35th Institute Research Committee Meeting

The 35th meeting of the Institute Research Committee (IRC) of ICAR-IIFSR, Modipuram, Meerut was held from June 19 to 26, 2023, to review the progress of ongoing research projects, follow up on the actions of the 34th IRC meeting, and discuss technical programmes for new research proposals. The meeting was chaired by Dr. Sunil Kumar, Director, ICAR-IIFSR. All the Heads/In-Charges and scientists attended and participated in the meeting. Dr. Sunil Kumar, Director and Chairman of the 35th IRC, welcomed all the scientists and emphasized the need to thoroughly discuss the ongoing programmes. He

requested valuable inputs to improve the ongoing research programmes and encouraged constructive suggestions for these programmes. He also stressed the importance of finalizing new research project proposals in alignment with the institute's mandate, vision, and the recommendations of the QRT and RAC. All the Division/Unit/Section Heads/In-Charges presented the achievements of their projects. This was followed by presentations from the Principal Investigators (PIs) of the respective projects, which was focused on the progress of ongoing research projects, technical programmes, and achievements under different institutional and external projects.



35th Institute Research Committee Meeting during 19-26 June, 2023

The midterm Institute research Committee (IRC) meeting of ICAR-IIFSR, Modipuram, Meerut was held on 21-22 December, 2023 to review the progress and follow up action of 35th IRC meeting. The meeting was chaired by Dr Sunil Kumar, Director, ICAR-IIFSR. All the heads/ in charges and scientists attended and participated in the meeting. Member secretary IRC welcomed the Director and all the members of IRC and gave brief background of the meeting. The PIs of the 38 projects (including institutional and externally funded) presented the progress as per the recommendations of the 35th IRC meeting. Newly joined HDs/PC also presented the vision to take up research priorities in their division domain area. The discussion led to some innovative and researchable action points, which will form the basis of research programme projects to develop

the divisions as a seat of knowledge and learning site at national level.

36th Institute Management Committee Meeting December 01, 2023

The 36th Institute Management Committee Meeting of ICAR-IIFSR, Modipuram, was held on December 01, 2023, to review management-related activities of the institute. The meeting was chaired by Dr. Sunil Kumar, Director, ICAR-IIFSR, along with other IMC members. All Heads/In-Charges and scientists attended and participated in the meeting. Furthermore, the IMC members visited the facilities of the Institute and expressed their satisfaction with the research infrastructure.



Institute Management Committee visit at Research Farm and GC laboratory

QRT Meeting of ICAR-IIFSR, Modipuram, AICRP-IFS and AINP-OF for 2018-2023

The first meeting of the QRT (2018-2023) for the ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, AICRP on Integrated Farming Systems, and Network Project on Organic Farming for the period of January 2018 to December 2023 was held on December 08-09, 2023, at ICAR-IIFSR Modipuram, Meerut. The meeting was attended by the Chairman, Prof. Arvind Kumar, Former VC, RLBCAU, Jhansi, and the members: Dr. V.S. Thakur, Former VC, YSPUHAF, Solan; Dr. A.K. Singh, Former VC, BAU, Sabour; Dr. Kusumakar Sharma, Former ADG, HRD, ICAR; Dr. Vandana Dwivedi, Former Add. Commissioner, INM Division, DA and

FW, MoA and FW, GoI, New Delhi; Dr. Sunil Kumar, Director, ICAR-IIFSR, Modipuram; Dr. Raghavendra Singh, Member Secretary, QRT; Dr. N. Ravishankar, Project Coordinator, AICRP-IFS; Dr. R.P. Mishra, Head, IFS Division, ICAR-IIFSR; Dr. T.P. Swarnam, Head, Organic Agriculture System Division; and all the scientists of the ICAR-IIFSR Modipuram, Meerut. Dr. Sunil Kumar, Director of ICAR-IIFSR, presented a brief overview of the research programs, achievements, and activities undertaken by the institute during the years 2018-2023, followed by the presentations of the Project Coordinator and Heads of the Divisions. The Chairman and members of the QRT provided their suggestions and expressed satisfaction with the progress of the institute during the review period.



1st QRT Meeting on 8th December, 2023 at ICAR-IIFSR, Modipuram



QRT Chairman and Members visit at farmer's field at Kushawali and Mubarikpur villages of Muzaffarnagar



PROJECT INFORMATION

(A) Institute Funded Projects

Name of Projects and code	Duration of project	PI/Co-PI/Associates
Standardization of IFS modules and model for different farming situations of western plain zone of U.P NRMAIIFRSIL202305000298	2023-28	Dr. R P Mishra (PI) Dr. Peyush Punia Dr. Suresh Malik Dr. Lalit Kumar Dr. P. P. Singh Dr. Chandra Bhanu Dr. A.K. Prushty Dr. Sunil Kumar Dr. Nirmal Dr. Kamlesh Kumar
Development of regenerative Agro-forestry based IFS Model for Sustainable production and livelihood. NRMAIIFRSIL202005000251	2020-2025	Dr. Nirmal (PI) Dr. Sunil Kumar Dr. Suresh Malik Dr. Kamlesh Kumar Dr. Raghavendra KJ
Sustainable livelihood generation through IFS involving uneconomic cattle. NRMAIIFRSIL201910000254	Nov. 2019 – Oct. 2024	Dr. Suresh Malik (PI) Dr Raghuvveer Singh Dr S.K. Dabas Dr A.S. Sirohi Dr H.L. Singh
Development of fruit crop based integrated farming system for western plain zone of U.P. NRMAIIFRSIL202205000255	2022-2025	Dr. Pushpendra P. Singh (PI) Dr. Suresh Malik Dr. Chandra Bhanu Dr. Amrit Lal Meena Dr. Nirmal Dr. Raghavendra K.J.
Establishment of ornamental and biofloc fisheries modules for farm livelihood improvement. NRMAIIFRSIL202205000257	July 2022-June 2025	Dr. Peyush Punia (PI) Dr. Lalit Kumar Dr Sunil Kumar Dr. Jairam Choudhary
Modelling the effect of nitrogen options under conventional and conservation tillage on growth, yield and nitrogen dynamics in maize and wheat. NRMAIIFRSIL202306000299	Jun 2023-May 2027	Dr. Kamlesh Kumar (PI) Dr. Amrit Lal Meena Dr. Prakash Ghasal Dr. Nirmal

Name of Projects and code	Duration of project	PI/Co-PI/Associates
Development of Integrated Organic Farming System model for Uttar Pradesh, Uttarakhand and Punjab (NRMAIIFSRCOL201611000270)	April 2023-March 2026	Dr. N Ravisankar (PI) Dr. P. C. Jat Dr. Poonam Kashyap Dr. Meraj Alam Ansari Dr. Suresh Malik Dr. Lalit Kumar Dr. Chandra Bhanu Dr. Jairam Chaudhary
Identification of climate resilient production system for different ecology (NRMAIIFRSIL202104000267)	Nov. 2016 - Nov.2023	Dr M. Shamim (PI) Dr. N. Ravisankar PIs of AINPOF centers of Bhopal, Raipur, Dharwad, Modipuram, Coimbatore, Dapoli, Sabour, Palampur, Umiam, Pantnagar, Calicut, Ludhiana, and Jabalpur
Assessing the role and contribution of Integrated Farming Systems for addressing One Health at household and landscape levels (NRMAIIFRSIL202111000275)	Nov. 2021-Oct. 2026	Dr. M. Shamim (PI) Dr. N. Ravisankar Dr. M A Ansari Dr. A K Prusty Dr. Peyush Punia
Updating of cropping system atlas of India and preparation of futuristic crop plan for 2030 (NRMAIIFSRCIL201910000273)	Oct. 2019- Dec. 2024	Dr. Raghveer Singh (PI) Dr. M. Shamim Dr. N. Ravisankar Dr. V. Ramamurthy Dr. C. A. Rama Rao Dr. B. M. K. Raju
Improvement of existing farming systems of underprivileged households through SCSP (NRMAIIFRSIL202005000274)	May 2020- June 2023	Dr. Raghveer Singh (PI) Dr. N. Ravisankar Dr. A. K. Purusty Dr. M. Shamim Dr. Raghavendra. K.J. Dr. M. A. Ansari
Estimation and valuation of ecosystem services from organic and natural farming systems in different Agro-ecology (NRMAIIFRSIL202104000276)	April 2021- March 2025	Dr. Meraj Alam Ansari (PI) Dr. N. Ravisankar Dr. M. Shamim Dr. Jairam Choudhury Dr. P.C. Ghasal Dr. Raghavendra KJ CCPI of AINP-OF centres (Modipuram, Ludhiana, Pant Nagar, Coimbatore, Dharwad, Gangtok, Bajaura and Almora)



Name of Projects and code	Duration of project	PI/Co-PI/Associates
Scaling and Impact Assessment of Integrated Farming System for Livelihood of Farmers. (NRMAIFSRCIL202109000277)	Sept. 2021-Aug. 2024	Dr. Raghavendra. K.J. (PI) Dr. A.K. Prusty Dr. M. A. Ansari Dr. Nirmal Dr. Peyush Punia Dr. Rajendran Dr. Jacob John Dr. Alibaba
Refinement of Vegetable Based Farming System Models for Food and Nutritional Security of Farmers of Western Uttar Pradesh (NRMAIFRSIL202201000262)	Jan. 2022-Dec. 2027	Dr. Poonam Kashyap (PI) Dr. A. K. Prusty Dr. Jayram Choudhary Dr. Amrit Lal Meena Dr. M. A. Ansari
Characterization of Existing Farming Systems of Uttarakhand (NRMAIFRSIL201810000263)	2018-2023	Dr. Nisha Verma (PI) Mr. Vipin Kumar Chaudhary Dr. Raghavendra KJ Dr. Nirmal
Crop improvement for organic production system (NRMAIFRSIL201805000290)	2023-2028	Dr. Devendra Kumar (PI) Dr. T. P. Swarnam Dr. L. R. Meena, Dr. K.H. Singh (ICAR-DRMR) Dr. B.S. Gill (PS)
Nutrient Management in different cropping systems under organic production systems (NRMAIFRSIL201905000292)	2023-2028	Dr. P.C. Ghasal (PI) Dr. Chandra Bhanu Dr. D. Dutta Dr. Lalit Kumar Dr. AL Meena Dr. Jairam Choudhary
Development of pest and disease management package for vegetables for organic production system (NRMAIFRSIL202305000304)	2023-2026	Dr. Chandra Bhanu (PI) Dr. A. L. Meena Dr. P. C. Ghasal Dr. Jairam Choudhary
Development and validation of microbial consortia for crop residue recycling under organic farming system (NRMAIFRSIL201805000293)	2018-2024	Dr. Jairam Chaudhary (PI) Dr. T. P. Swarnam Dr. Chandra Bhanu Dr. A.L. Meena Dr. P. C. Ghasal
Effect of rice straw retention, incorporation and residue decomposition on productivity, profitability, soil health and environment under rice wheat system (NRMAIFRSOL202104000287)	April 2021- May 2025	Dr. A. L. Meena (PI) Dr. L.R. Meena Dr. P.C. Jat Dr. Jairam Choudhary Dr. Lalit Kumar Dr. N Subhash
On-farm Participatory Research for improvement of existing farming systems of under privileged households through Schedule Caste Sub-plan (SCSP) in Bahadrabad block, District Haridwar, Uttarakhand (NRMAIFRSIL202104000288)	April 2021-March 2024	Dr. A. L. Meena (PI) Dr. R.P. Mishra Dr. Chandra Bhanu Dr. P.C. Ghasal Dr. Jayram Choudhary

Name of Projects and code	Duration of project	PI/Co-PI/Associates
Status of Agriculture in Jammu and Shimla Division of Western Himalayan Region (NRMAPDFRSIL201801000160)	Aug. 2024- July 2027	Dr. Sunil Kumar (PI) Dr. A. L. Meena Dr. L.R. Meena Dr. Nirmal
Development and evaluation of novel Nano matrix intercalated formulations for enhancing nitrogen use efficiency in crops (NRMAIFRSIL20235000301)	July 2023-June 2028	Dr. Lalit Kumar (PI) Dr. A.L. Meena Dr. Peyush Punia Dr. R.P. Mishra Dr. P. P. Singh Mr. V.K. Choudhary
Development of an Intelligent Model for Predicting Mango Yields using Artificial Neural Networks (NRMAIFSRIL202008000285)	Aug. 2020-Dec. 2024	Mr. V.K. Choudhary (PI) Dr. P. P. Singh
Evaluation and Identification of Farm Implements under Different Farming Systems (NRMAIFRSIL201805000256)	2018-2025	Dr. Nisha Verma (PI) Dr. V. P. Choudhary (Earlier PI)

(B) Externally funded projects

Name of Projects and code	Duration of project	Budget & Funding Agency	PI/Co-PI/Associates
Sustainable resource management for climate smart IFS under AICRP on Integrated Farming Systems (NRMAIFRSOL202104000269)	April, 2017-March, 2026	Rs. 28.20 Lakhs/year, ICAR-IIFSR, Modipuram	Dr. R P Mishra (PI) Dr. N. Ravisankar Dr. P.C. Ghasal Dr. Suresh Malik Dr. A.K. Prusty Dr. Poonam Kashyap Dr. M. Shamim
AICRP on Integrated Farming Systems (On-station National) (NRMAIFSRCOL20214000266)	April, 2021- April, 2026	Plan Scheme of ICAR, New Delhi	Dr. A. K. Prusty (PI) Dr. M. Shamim Dr. M. A. Ansari Dr. Raghuvveer Singh Dr. Raghvendra K.J.
AICRP on Integrated Farming Systems- On farm research (National) (NRMAIFSRCOL202104000268)	April, 2021 – March, 2026	Plan Scheme of ICAR, New Delhi	Dr N. Ravisankar (PC) Dr. Raghuvveer Singh (PI) Dr. Raghavendra. K.J Dr. M. A. Ansari Dr. Sunil Kumar
All India Network Programme on Organic Farming (National) (NRMAIFSRCOL202104000265)	April, 2021 – March, 2026	Plan Scheme of ICAR, New Delhi	Dr. N. Ravisankar (PI) Dr. M. Shamim Dr. Raghuvveer Singh Dr. Meraj Alam Ansari Dr. Raghavendra K.J.



Name of Projects and code	Duration of project	Budget & Funding Agency	PI/Co-PI/Associates
Pilot Project for Crop Diversification (NRMAIFRSOL20234000278)	April, 2023 – March, 2028	DAF&W, Govt. of India	Dr. Sunil Kumar (Nodal Officer) Dr. N. Ravisankar (PI) Dr. Meraj Alam Ansari Dr. Raghuvveer Singh Dr. Raghavendra K.J. Dr. M. Shamim Dr. A.K. Prusty Dr. Poonam Kashyap Dr. Nisha Verma
Co-creating sustainable water use in the Hindon sub-basin: A multiscale participatory approach (NRMAIFRSOL202204000279)	April, 2022 – April, 2027	Rs. 78.58 Lakhs, DST, Govt. of India	Dr. A. K. Prusty (PI) Dr. N. Ravisankar (PI till Jan., 2023) Dr. M. Shamim Dr. Raghuvveer Singh Dr. Raghavendra K.J. Dr. M. A. Ansari Dr. Poonam Kashyap Consortia Lead: IISER, Kolkata (India), Consortia Partners: IIT, Roorkee, PSI, Dehradun, Dutch partners: WUR, The Netherlands, Utrecht University, The Netherlands
Agri-Drone Demonstration (NRMAIFRSOL202208000281)	August, 2022 – March, 2023	Rs. 35.50 Lakhs, ATARI, Kanpur	Dr N Ravisankar (Coordinator) Dr. A. K. Prusty (Nodal officer) Dr. Raghuvveer Singh Dr. M. Shamim Dr. Poonam Kashyap Dr. Raghvendra K.J.
Preparation of detailed project report (DPR) and providing technical backstopping for establishment of model IFs including Agro-Ecotourism at identified agricultural farms (4 farms) in Odisha (NRMAIFRSCL202203000280)	Oct., 2021- Sept., 2023	Rs. 44.40 Lakhs, Ministry of Agriculture, Govt. of Odisha	Dr. A. K. Prusty (PI) Dr. N. Ravisankar Dr. Raghavendra K.J. Dr. M.A. Ansari Dr. Raghuvveer Singh Dr. M. Shamim Dr. A.S. Panwar
AICRP on Integrated Farming Systems (On-Farm), Modipuram Centre (NRMAIFRSOP202004000259)	April, 2021-April, 2026	Plan Scheme of ICAR, New Delhi	Dr. P. C. Jat (PI) Dr. Meraj Alam Ansari Dr. Poonam Kashyap Dr. Amrit Lal Meena Dr. Sumit Mahajan

Name of Projects and code	Duration of project	Budget & Funding Agency	PI/Co-PI/Associates
Ensuring Food and Nutritional Security through Integrated Farming Systems in Western Plain Zone of Uttar Pradesh (Farmer FIRST) (NRMAIIFRSOL201606000261)	2022-2027	ATARI, Kanpur	Dr P. C. Jat (PI) Dr. Poonam Kashyap Dr. A K Prusty Dr. M. Shamim Dr. Nisha Verma Dr. Sunil Kumar Dr. Raghuvveer Singh Dr. Raghvendra K.J.
All India- Network Programme on Organic Farming, Modipuram Centre (NRMAIIFRSOL200405000294)	2004-Contd.	Rs. 10.60 Lakhs, ICAR, New Delhi	Dr. T P Swarnam (PI) Dr. Chandra Bhanu Dr. P.C. Ghasal Dr. Jairam Choudhary Dr. A. L. Meena
Impact assessment of certified Farm Advisors (CFA) Interventions on Organic and Natural Farming (NRMAIIFRSOL202205000297)	2023-2024	Rs. 5.54 Lakhs, MANAGE, Hyderabad	Dr. Chandra Bhanu (PI) Dr. P.C. Ghasal Dr. N. Ravisankar Dr. Raghvendra K.J.
Adaptation and mitigation potential through Cropping systems/ farming systems approaches (NMRMAIIFRSOL202104000289)	April, 2021- May, 2025	Rs. 21.995 Lakhs, NICRA	Dr. Raghvendra Singh (PI) Dr. M. Shamim Dr. A. L. Meena Dr. P.C. Ghasal
Evaluation of different cropping systems for crop intensification under conservation agriculture practices (NRMAIIFRSOL201505000286)	July, 2015 – Dec, 2026	Rs. 23.21 Lakhs, CRP on CA	Dr. A. L. Meena (PI) Dr. P.C. Jat Dr. L.R. Meena, Dr. Sunil Kumar Dr. Jairam Choudhary
Evaluation of Poly 4 application on productivity, quality and soil sustainability of basmati rice-potato under organic farming system. (NRMAIIFRSCL202005000295)	Oct., 2020- Dec., 2022	Rs. 40.00 Lakhs, Sirius Minerals India Pvt. Ltd. New Delhi	Dr. R.P. Mishra (PI) Dr. P.C. Ghasal Dr. Sunil Kumar Dr. N. Ravisankar
NAIF funded ABI Centre, ICAR-IIFSR, Modipuram, Meerut (NRMAIIFRSOP202005000253)	March, 2020- Sept., 2022	Rs. 11.09 Lakhs/year, IPTM Unit, ICAR, New Delhi	Dr. R P Mishra (PI) Dr. P. P. Singh, Dr. Nirmal Dr. Chandra Bhanu Dr. Nisha Dr. Sunil Kumar

**(C) Foreign aided projects**

Name of Projects and code	Duration of project	Funding Agency	PI/Co-PI/Associates
The Economics of Ecosystems and Biodiversity: Agriculture and Food initiative in Uttar Pradesh, India (NRMAIIFRSOL202110000282)	Oct. 2021- Oct. 2023	TEEB-UNEP	Dr. Sunil Kumar (Nodal Officer) Dr. M. A. Ansari (PI) Dr. N. Ravisankar Dr. M. Shamim, Dr. A. K. Prusty Dr. Raghuvveer Singh Dr. Raghavendra K.J.
Consortium for Scaling-up Climate Smart Agriculture in South Asia (NRMAIIFRSOL202212000283)	Dec. 2022 -Dec. 2024	SAC, IFAD, SDF	Dr. M. A. Ansari (PI) Dr. M. Shamim
Atlas of Climate Adaptation in South Asian Agriculture (ACASA) (NRMAIIFRSOP202312000306)	Nov. 2023 -Dec. 2025	BISA-CIMMYT (Bill & Milinda Gates Foundation)	Dr. M. A. Ansari (PI)
Transformational agroecology across food, land and water systems (NRMAIIFSRCOL202301000308)	Nov. 2023 -Dec. 2024	IWMI	Dr. Sunil Kumar (Nodal Officer) Dr. M. Shamim (PI) Dr. N. Ravisankar Dr. M. A. Ansari Dr. A. K. Prusty Dr. Raghuvveer Singh Dr. Raghavendra K.J.
Additive Intercropping in wide row crops for resilient crop production in Bangladesh, Bhutan and India (NRMAIIFRSOP202308000305)	2023-2028	CIMMYT, Mexico	Dr. Sunil Kumar (Nodal Officer) Dr. P. C. Ghasal (PI) Dr. Raghuvveer Singh Dr Poonam Kashyap Dr. Raghvendra K.J.

PERSONNEL

Scientific Staff

S. No.	Name of the employees	Designation
1.	Dr. Sunil Kumar	Director (w.e.f. 01.02.2023)
2.	Dr. A. S. Panwar	Director (up to 31.01.2023)
Integrated Farming Systems Division		
3.	Dr. Rajendra Prasad Mishra	Head & Principal Scientist (Agronomy)
4.	Dr. Peyush Punia	Principal Scientist (Fisheries Resource Management)
5.	Dr. Suresh Malik	Principal Scientist (Poultry Science)
6.	Dr. Pushendra Pratap Singh	Principal Scientist (Vegetable Science)
7.	Dr. Nirmal	Scientist (Agroforestry)
8.	Dr. Kamlesh Kumar	Scientist (Agronomy)
Cropping Systems and Resource Management Division		
9.	Dr. Raghavendra Singh	Head & Principal Scientist (Agronomy)
10.	Dr. Laxman Ram Meena	Principal Scientist (Agronomy)
11.	Dr. Lalit Kumar	Principal Scientist (Agricultural Chemicals)
12.	Dr. Sunil Kumar	Senior Scientist (Computer Applications & Agricultural Statistics)
13.	Dr. Amrit Lal Meena	Scientist (Soil Science)
14.	Dr. Mohd. Arif	Scientist (Agronomy)
15.	Sh. Vipin Kumar Choudhary	Scientist (Computer Applications & Information Technology)
Organic Agriculture Systems Division		
16.	Dr. T.P. Swarnam	Head & Principal Scientist (Soil Science)
17.	Dr. Devendra Kumar	Principal Scientist (Plant Breeding & Genetics)
18.	Dr. Chandra Bhunu	Principal Scientist (Plant Pathology)
19.	Dr. Prakash Chand Ghasal	Scientist (Agronomy)
20.	Dr. Jairam Choudhary	Scientist (Agricultural Microbiology)
Technology Transfer and Assessment Section		
21.	Dr. Phool Chand Jat	In-charge & Principal Scientist (Agronomy)
22.	Dr. Poonam Kashyap	Principal Scientist (Fruit Science)
23.	Dr. Nisha Verma	Scientist (Home Science)
Project Coordination Unit		
24.	Dr. N. Ravisankar	Project Coordinator, IFS & Principal Scientist (Agronomy)
25.	Dr. Ashish Kumar Prusty	Principal Scientist (Aquaculture)



S. No.	Name of the employees	Designation
26.	Dr. Mohammad Shamim	Senior Scientist (Agricultural Meteorology)
27.	Dr. Meraj Alam Ansari	Senior Scientist (Agronomy)
28.	Dr. Raghuvveer Singh	Scientist (Agronomy)
29.	Dr. Raghavendra K J	Scientist (Agricultural Economics)

Technical Staff

S. No.	Name of the employees	Designation
1.	Dr. Om Kumar Tomar	Chief Technical Officer
2.	Sh. R B Tewari	Chief Technical Officer
3.	Sh. Dhanajay Tripathi	Chief Technical Officer
4.	Dr. Yogendra Singh	Chief Technical Officer
5.	Dr. Vipin Kumar	Chief Technical Officer
6.	Dr. S.P. Singh	Chief Technical Officer
7.	Sh. Krishan Kumar	ACTO
8.	Sh. Satish Kumar Duhoon	STO
9.	Smt. Deepsikha	STO
10.	Smt. Anju Verma	STA
11.	Sh. Uma Shankar	Driver (T-5)
12.	Sh. Ashok Kumar	Driver (T-5)
13.	Sh. Raj Kumar Meena	Driver (T 2-3)

Administrative & Accounts Staff

S. No.	Name of the employees	Designation
1.	Sh. Ashok Kumar Sharma	Senior Administrative Officer
2.	Sh. D.S. Verma	Senior Finance & Accounts Officer
3.	Sh. Surya Kant	Principal Private Secretary
4.	Smt. Jai Lata Sharma	Private Secretary
5.	Smt. Alka Jain	Assistant Administrative Officer
6.	Sh. S.K. Gupta	Assistant Administrative Officer
7.	Smt. Sheela Devi	Assistant
8.	Sh. S.K. Bansal	Private Secretary
9.	Sh. Rajesh Kumar	Personal Assistant
10.	Sh. Ravi Kant Sharma	Assistant
11.	Sh. Rai Bahadur	UDC
12.	Sh. Prem Singh	Assistant
13.	Sh. Rajendra Kumar	UDC
14.	Sh. Parmanand	UDC
15.	Sh. Prasant Panwar	UDC

S. No.	Name of the employees	Designation
16.	Sh. Rakesh Tyagi	LDC
17.	Sh. Prem Kumar	LDC

Skilled Supporting Staff

S. No.	Name of the employees	Designation
1.	Sh. Ashok Kumar	Skilled Supporting Staff
2.	Sh. Vijay Shankar Pandey	Skilled Supporting Staff
3.	Sh. Kamal Singh	Skilled Supporting Staff
4.	Sh. Naresh Kumar Chauhan	Skilled Supporting Staff
5.	Sh. Narender Pal Singh	Skilled Supporting Staff
6.	Sh. Ram Gopal	Skilled Supporting Staff
7.	Sh. Rakesh Kumar	Skilled Supporting Staff
8.	Sh. Yogendra Kumar Tyagi	Skilled Supporting Staff
9.	Sh. Sunil Kumar Sharma	Skilled Supporting Staff
10.	Sh. Devendra Kumar	Skilled Supporting Staff
11.	Sh. Subodh Kumar Tyagi	Skilled Supporting Staff
12.	Sh. Subhash Chand Sharma	Skilled Supporting Staff
13.	Sh. Brijash Sharma	Skilled Supporting Staff
14.	Sh. Kripa Shankar Tewari	Skilled Supporting Staff
15.	Sh. Anand Singh	Skilled Supporting Staff
16.	Sh. Harsh Nath Singh	Skilled Supporting Staff
17.	Sh. Prem Shankar	Skilled Supporting Staff
18.	Sh. Mahaveer Singh	Skilled Supporting Staff
19.	Sh. Ayodhya Prasad Dubey	Skilled Supporting Staff
20.	Sh. Kirpa Shankar Pandey	Skilled Supporting Staff
21.	Siddh Kumar Yadav	Skilled Supporting Staff
22.	Sh. Sada Ram	Skilled Supporting Staff
23.	Gagendra Singh	Skilled Supporting Staff

New Joining

S. No.	Name	Designation	Date of Joining	From	Transfer/ Joining
1.	Dr. Sunil Kumar	Director	01.02.2023	ICAR-IGFRI, Jhansi	New joining
2.	Dr. N. Ravisankar	Project Coordinator, AICRP-IFS	15.06.2023 (Forenoon)	ICAR-IIFSR, Modipuram	New joining
3.	Dr. R.P. Mishra	Head, Integrated Farming System Division	15.06.2023 (Afternoon)	ICAR-IIFSR, Modipuram	New joining
4.	Dr. Raghavendra Singh	Head, Cropping System & Resource Management Division	13.07.2023	ICAR-IIPR, Kanpur	New joining



S. No.	Name	Designation	Date of Joining	From	Transfer/ Joining
5.	Dr. T.P. Swarnam	Head, Organic Agriculture System Division	28.07.2023	ICAR-CARI, Port Blair	New joining
6.	Dr. Mohd. Arif	Scientist (Agronomy)	27.12.2023	ICAR-CIRG, Makhdoom	Transfer

Promotions

S. No.	Name	Designation	Date of promotion	Pay band level
1.	Dr. Ashish Kumar Prusty	Principal Scientist (Aquaculture)	07.01.2023	PB-4 (Level 14)
2.	Dr. Poonam Kashyap	Principal Scientist (Fruit Science)	07.01.2023	PB-4 (Level 14)
3.	Dr. M.A. Ansari	Senior Scientist (Agronomy)	27.04.2023	PB-4 (Level 13a)
4.	Dr. Raghuvveer Singh	Senior Scientist (Agronomy)	01.01.2023	PB-3 (Level 12)
5.	Dr. Kamlesh Kumar	Scientist (SS) (Agronomy)	05.07.2022	PB-3 (Level 11)
6.	Shri Suryakant	Private Secretary	31.10.2023	Principal Private Secretary (Level 11)
7.	Smt Jailata Sharma	Personal Assistant	10.11.2023	Private Secretary (Level 8)
8.	Shri Satish Kumar Bansal	Personal Assistant	13.11.2023	Private Secretary (Level 8)
9.	Shri Rajesh Kumar	Stenographer	28.12.2023	Personal Assistant (Level 7)

Promoted / Transferred

S. No.	Name	Designation	Promoted /Transferred to	Date
1.	Dr. N. Subhash	Principal Scientist (Agricultural Meteorology)	Head, Division of Agricultural Physics, ICAR-IARI, New Delhi	09.05.2023
2.	Dr. D. Dutta	Principal Scientist (Soil Science)	Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi	19.06.2023
3.	Dr. V.P. Chaudhary	Principal Scientist (Farm Machinery & Power)	Head, Agricultural Mechanization Division, ICAR-CIAE, Bhopal	21.06.2023
4.	Dr. Amit Nath	Principal Scientist (Food Technology)	Head, Regional Station, ICAR-CIPHET, Abohar	12.07.2023

Superannuation

S. No.	Name	Designation	Date of superannuation
1.	Dr. A.S. Panwar	Director, ICAR-IIFSR	31.01.2023
2.	Sh. Rai Bahadur	Private Secretary	31.10.2023

INSTITUTE COMMITTEES

INSTITUTE MANAGEMENT COMMITTEE (2023)

1.	Dr. Sunil Kumar	Director, ICAR-IIFSR, Modipuram	Chairman
2.	Director (Agriculture)	Government of Uttar Pradesh	Member
3.	Director (Agriculture)	Government of Uttarakhand	Member
4.	Director (Research)	SVPUAT, Modipuram, Meerut	Member
5.	Sh. Mithlesh Kumar	Village Bharveelya, Nagar Panchayat- Bankatee, Distt. – Basti (UP)	Non-official Member
6.	Sh. Narendra Singh	Village Didvadee, Tehsil and Halka-Israna, Distt. Panipat (Haryana)	Non-official Member
7.	Dr. Shiv Dhar Singh (Pr. Scientist)	Division of Agronomy, ICAR-IARI, New Delhi	Member
8.	Dr. S. K. Das (Pr. Scientist)	Division of Riverine and Estuarine Fisheries, ICAR-CIFRI, Barrackpore	Member
9.	Dr. Sanjib Kumar Behra (Pr. Scientist)	ICAR-IISS, Bhopal	Member
10.	Dr. Rajbir Singh, ADG (AAF&CC)	ICAR, New Delhi	Member
11.	Finance & Account Officer	ICAR-CSSRI, Karnal	Member
12.	Sr. AO/AO	ICAR-IIFSR, Modipuram	Member Secretary

RESEARCH ADVISORY COMMITTEE (2023)

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

**QUINQUENNIAL REVIEW TEAM (QRT -2023)**

1.	Dr. Arvind Kumar	Former Vice Chancellor, Rani Laxmi Bai Central Agricultural University, Jhansi, UP	Chairman
2.	Dr. V. S. Thakur	Former Vice Chancellor, Y S Parmar University of Horticulture & Forestry, Solan, HP	Member
3.	Dr. A.K. Singh	Former Vice Chancellor, Bihar Agricultural University, Sabour, Bhagalpur, Bihar	Member
4.	Dr. Kusumakar Sharma	Former Assistant Director General (Human Resource Development), ICAR, New Delhi	Member
5.	Dr. (Mrs.) Vandana Dwivedi	Former, Additional Commissioner, INM Division, Ministry of Agriculture and Farmers Welfare, Gol, New Delhi	Member
6.	Dr. N. P. Singh	Member, Commission for Agriculture Costs and Prices, Ministry of Agriculture and Farmers Welfare, Gol, New Delhi	Member
7.	Dr. Raghavendra Singh	Head, Cropping Systems and Resource Management Division, ICAR-IIFSR, Modipuram, Meerut, UP	Member Secretary



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