

वार्षिक प्रतिवेदन ANNUAL REPORT 2019



भा.कृ.अनु.प. भारतीय कृषि प्रणाली अनुसंधान संस्थान
मोदीपुरम, मेरठ-250 110, भारत

ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut - 250 110, India



ANNUAL REPORT 2019

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

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PREFACE

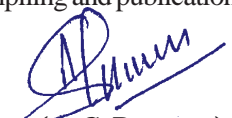
Integrated farming systems research is considered to be an effective tool to answer many questions being raised today in agriculture, viz., food and nutritional security, profitability, production sustainability, resource use efficiency, employability and climate change; with special reference to small and marginal farmers, that currently constitute about 86 percent of the country's total landholdings. Scientifically designed integrated farming systems play significant role in providing sustainable livelihood to marginal and small households as the existing farming systems do not provide sufficient round the year production and income to meet the requirement of relatively larger family size of these households. Existing farming systems productivity and profitability is hampered by increased market dependency and declining factor productivity.



Institute has undertaken various research activities under institute programmes, AICRP-IFS and AI-NPOF network with an aim to improve the productivity of existing systems and profitability. In this endeavour, AICRP on Integrated Farming Systems is operating currently with 74 centres covering all the 15 agro-climatic regions covers 25 States/UT's. Seven experiments/study namely Sustainable resource management for climate smart IFS (32 locations), Development of region-specific IFS models (9 locations), Identification of cropping systems module for different farming systems (37 locations), Evaluation of weed management practices under organic production system (8 locations) and Carbon crediting and GHG emission in IFS models (32 locations) are taken up at on-station centres. All India Network Programme on Organic Farming (AI-NPOF), is operating currently with 20 centres covering 10 agro-climatic regions and 16 states. Under the programme on Geo-referenced characterization, till now, 3629 organic and 126 natural farming farmers from 16 States have been characterized besides biochemical characterization of 5 inputs and 6 ITKs. Natural farming concoctions have been evaluated in rice-wheat system. Package of practices for 51 cropping systems have been developed till now under scientific package of practices development programme which also includes identification of 104 varieties, 3 bio-intensive complementary cropping systems, weed management package for 10 cropping systems, insect-disease management package for 12 cropping systems. Seven Integrated organic farming system models suitable to 6 States have been established.

Quantitative analytical tools and models are being applied in farming systems analysis for target-oriented productivity and profitability and science-based evidencing of farming systems. The research activities and programmes of the institute, AICRP and network works with the aim to double the real farm income through farming systems approach by 2022. Capacity building of scientists have been made by deputing them to national and international training. The Institute during the COVID 19 period disseminated the information to farmers through developed apps and through media, whatsapp as well as organized several kisan gosthies and field days on different aspects of farming systems management.

I express my gratitude to Dr. Trilochan Mohapatra, 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. S. Bhaskar, ADG (AAFCC), ICAR, New Delhi and to other staff members of NRM division for cooperation and support. The help of the Editorial Committee in compiling and publication of the report is highly appreciated.



(A S Panwar)s

कार्यकारी सारांश

- संस्थान का नाम व पता : **भाकूअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान,**
मोदीपुरम, मरेठ (उत्तर प्रदेश) 250110
- बजट रू (वर्ष 2019-20)

क. संस्थागत (रू लाख में)

प्रावधान	व्यय	सरकारी अनुदान	सरकारी आवंटन+ परिषद के शेयर से मुख्यालय द्वारा प्रदान की गई अतिरिक्त राशि	कुल अनुदान (कॉलम3+4)	कुल अनुदान से व्यय	सरकारी राजस्व से व्यय	कुल व्यय (कॉलम 6+7)
1	2	3	4	5	6	7	8
1738.26	1717.26	1738.26	.	1738.26	1717.26	.	1717.26

ख. वाह्य: स्रोत (रू. लाख में)

स्रोत	बजट	व्यय
पेंशन और अन्य सेवानिवृत्ति लाभ	111.00	111.00
निजी ऋण और अग्रिम राशि	00	00
वाह्य वित्त पोषित परियोजनाएं	76.38	41.19
कुल	187.38	152.19

ग. राजस्व प्राप्ति (वर्ष 2019-20) (रू लाख में)

स्रोत	धनराशि
प्रक्षेत्र उत्पाद	35.14
मत्स्य, दूध एवं पशु विक्रय	प्रक्षेत्र उत्पाद में शामिल
लाइसेन्स शुल्क/जल शुल्क	6.45
विविध	2.73
ऋण एवं अग्रिम राशि पर ब्याज	3.21
टी.डी.आर. पर ब्याज	19.20
अन्य (रॉयल्टी और संस्थान शुल्क)	1.47
कुल	68.20



3. कर्मचारियों की स्थिति (31.12.2019 तक)

श्रेणी	मंजूरी	स्थिति	रिक्त
निदेशक	01		
प्रधान वैज्ञानिक	07	03	04
वरिष्ठ वैज्ञानिक	12	10	02
वैज्ञानिक	19	16	03
कुल	41		
तकनीकी कर्मचारी			
श्रेणी-III (T-6,7/8,7/9)	02	0	02
श्रेणी-II (T-3, T-4 , एवं T-5)	19	16	03
3 श्रेणी-I (T-1 , एवं T-2)	03	03	0
कुल	24		
प्रशासनिक कर्मचारी			
वरिष्ठ प्रशासनिक अधिकारी	01	01	0
वित्त एवं लेखाधिकारी	01	01	0
सहायक प्रशासनिक अधिकारी	01	0	01
सहायक	04	04	0
वरिष्ठ लिपिक	02	02	0
थनजी सचिव	01	01	0
व्यक्तिगत सहायक	02	04	02
कनिष्ठ आशुलिपिक	01	02	01
कनिष्ठ लिपिक	03	02	01
कुल	16		0
सहायक कर्मचारी	11	11	0

3.1 नई नियुक्तियाँ / कार्यभारग्रहण

क्र.सं.	नाम	पदनाम	पदभार ग्रहण	कहाँ से	आख्या
1.	डा. ललित कुमार	प्रधान वैज्ञानिक	02-12-2019	आई.आई.पी.आर, कानपुर	स्थानांतरण

परिचय

भारतीय कृषि अनुसंधान परिषद (आईसीएआर) कृषि अनुसंधान और शिक्षा विभाग (डेयर), कृषि मंत्रालय, भारत सरकार के अन्तर्गत एक स्वायत्त संगठन है, जो भारतीय कृषि अनुसंधान परिषद के रूप में जाना जाता है। यह 16 जुलाई 1929 को कृषि पर रॉयल कमीशन की रिपोर्ट के अनुसरण में सोसाइटी पंजीकरण अधिनियम, 1860 के अन्तर्गत एक पंजीकृत सोसाइटी के रूप में स्थापित किया गया था। इसका मुख्यालय नई दिल्ली तथा यह पूरे देश में कृषि विज्ञान, बागवानी, मत्स्य पालन और पशु विज्ञान में अनुसंधान और शिक्षा के समन्वयन, मार्ग दर्शन और प्रबंधन के लिए कार्यरत है। देश में 101 आईसीएआर संस्थानों और 71 कृषि विश्वविद्यालयों के साथ समन्वय स्थापित कर IIFSR भारतीय किसानों की दुगनी आय एवं टिकाऊ खेती में अपना महत्वपूर्ण योगदान दे रहा है। संस्थान द्वारा विकसित तकनीकियों को देश की विभिन्न संस्थानों और विश्वविद्यालयों तथा कृषि विज्ञान केंद्रों (केवीके) के माध्यम से हस्तांतरित और परिष्कृत किया जा रहा है। आईसीएआर ने अपने अनुसंधान, शिक्षा और विस्तार गतिविधियों के जरिए भारत में हरित क्रांति और कृषि के आधुनिकीकरण के लिए अग्रणी भूमिका निभाई है। परिषद, अनुसंधान और प्रौद्योगिकी विकास के माध्यम से, देश को 1951 से 2018 तक अनाज उत्पादन में 5.6 गुना, बागवानी के उत्पादन में 10.5 गुना, मछली की मात्रा में 16.8 गुना, दुग्ध उत्पादन में 8.5 गुना और अंडे के उत्पादन में 52.9 गुना वृद्धि कर देश को राष्ट्रीय खाद्य और पोषण सुरक्षा में आत्मनिर्भर बनाया है। कृषि में उच्च शिक्षा में उत्कृष्टता को बढ़ावा देने में परिषद ने भी एक प्रमुख भूमिका निभाई है। परिषद के वैज्ञानिक अंतरराष्ट्रीय स्तर पर उनके क्षेत्रों में संघर्ष स्वीकार किए जाते हैं। देश की बढ़ती जनसंख्या के लिए पोषण सुरक्षा, घटती खेती योग्य भूमि, पानी की कमी के साथ-साथ ग्लोबल वार्मिंग आदि आईसीएआर के समक्ष बड़ी चुनौतियाँ हैं, जिनका निराकरण एकिकृत कृषि प्रणाली अपनाकर किया जा सकता है। इसी कड़ी में, भारतीय कृषि अनुसंधान परिषद (आईसीएआर) का संस्थान भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदिपुरम सत्त रूप से कार्यरत है। इस संस्थान ने देश की विभिन्न जलवायु क्षेत्रों के लिये 51 कृषि प्रणाली मॉडल विकसित किये तथा जैविक खेती में 51 फसल प्रणालियों की उत्पादन तकनीकियों के परिष्कृत कर भारत सरकार एवं राज्य सरकारों को प्रचारित एवं प्रसारित किया है।

भारतीय कृषि प्रणाली अनुसंधान संस्थान (भाकृ अनुप)

भारतीय कृषि प्रणाली अनुसंधान संस्थान ने राष्ट्रीय स्तर का दर्जा 27 नवम्बर 2014 को दिया गया तथा वर्ष 2020 में QRT की संस्तुति के आधार पर 3 सम्भाग, एक समन्वय इकाई तथा एक अनुभाग की स्वीकृति प्रदान की है।

भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान की उदय यात्रा

- 1952-53 : "कृषक के खेतों पर "सरल उर्वरक परीक्षण" योजना शुरू हुई थी।
- 1956 : आदर्श सस्य प्रयोगों को जोड़ा गया और अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना के रूप में शुरू हुई।
- 1968-89 : इस परियोजना के अन्तर्गत दो विशेष घटकों "आदर्श सस्य प्रयोग" और "सरल उर्वरक परीक्षण" को साथ-साथ जोड़कर योजना को अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना (ए.आई.सी.ए.आर.पी.) के रूप में पुनर्व्यवस्थित और स्वीकृत किया गया।
- 1989 : अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना को फसल प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना के साथ "फसल प्रणाली अनुसंधान परियोजना निदेशालय" के नाम से मोदीपुरम मेरठ में स्थापित किया गया।
- 2004-05 : इस निदेशालय के साथ 13 सह-संचालन केंद्रों के साथ नई योजना जैविक खेती पर नेटवर्क परियोजना (एनपीओएफ) को फसल प्रणाली अनुसंधान परियोजना निदेशालय से जोड़ा गया।
- 2010 : फसल प्रणाली के साथ दूसरे कृषि घटकों को जोड़कर फसल प्रणाली अनुसंधान परियोजना निदेशालय को कृषि प्रणाली अनुसंधान



परियोजना निदेशालय नामित किया गया तथा फसल प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना का नाम बदलकर कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना निदेशालय परिवर्तित किया गया।

2014 : फसल प्रणाली अनुसंधान परियोजना निदेशालय (कृ.प्र.अनु.परि.निदे.) को पूर्ण विकसित संस्थान में उन्नत (अपग्रेड) कर दिया गया और इसे "भारतीय कृषि प्रणाली अनुसंधान संस्थान" के रूप में नामित किया गया। कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना और जैविक खेती पर नेटवर्क परियोजना (एनपीओएफ) संस्थान के अभिन्न अंग के रूप में बने रहें।

संक्षिप्त इतिहास

फसल प्रणाली अनुसंधान परियोजना की उत्पत्ति डा ए. बी. स्टीवर्ट, (मैकले इंस्टीट्यूट ऑफ सॉइल रिसर्च, एबरडीन, यू.के.) के भारतयात्रा के अवसर पर 1940 के मध्य में हुई थी। उन्हे मिट्टी की उर्वरता की जांच के संबंध में स्थिति की समीक्षा करने के लिए तत्कालिक इंपीरियल कौंसिल ऑफ एग्रिकल्चरल रिसर्च द्वारा आमंत्रित किया गया था तथा उनकी समीक्षा रिपोर्ट, 1947 में प्रकाशित हुई, जिसका देश में उर्वरक प्रयोगों के तत्त्वज्ञान और अभ्यास पर सकारात्मक प्रभाव पड़ा। किसानों के खेतों पर होने वाले "सरल खाद परीक्षण" करने और चयनित केंद्रों पर "अंकुल प्रयोगों" के संचालन के महत्व को रिपोर्ट में बल दिया गया। वर्ष 1953 में मिट्टी की उर्वरता स्तर और उर्वरक प्रयोग परियोजना के माध्यम से, भारत-अमेरिकी प्रौद्योगिकी सहयोग समझौते के अर्न्तगत, किसानों के खेतों पर "उर्वरक परीक्षण" के आरम्भ को निम्नलिखित उद्देश्यों के साथ प्रोत्साहित किया गया।

- किसान के क्षेत्र की स्थितियों के अलग-अलग संयोजनों में एन.पी.के. के प्रयोग को फसल की प्रतिक्रियाओं का अध्ययन करने के लिए।
- व्यापक मिट्टी समूहों में विभिन्न उर्वरकोंकी सापेक्ष प्रतिक्रिया की जांच और विभिन्न कृषि-जलवायु क्षेत्रों के लिए इष्टतम उर्वरक संयोजन का अनुमान करना।
- देश में खाद्यन्न उत्पादन बढ़ाने के लिए विभिन्न नाइट्रोजन और फॉस्फेटिक उर्वरकों के सापेक्ष प्रदर्शन द्वारा अध्ययन करना।

- किसानों के समक्ष फसल उत्पादन में उर्वरक उपयोगिता की भूमिका का प्रदर्शन करना।

उपरोक्त बिन्दुओं पर कार्य करते हुए वर्ष 1956 में आदर्श सस्य परीक्षण अर्थात् संकुल प्रयोगों के लिये चयनित केंद्रों को भी परियोजना के अर्न्तगत लाया गया और इसे अखिल भारतीय समन्वित सस्यविज्ञान परीक्षण (एआईसीईईएस) के रूप में नामित किया गया। यह योजना विकास एवं इसके विभिन्न चरणों में प्रगति करते हुए विज्ञान और प्रौद्योगिकी के विकास में वृद्धि एवं खाद्यांत्रों की बढ़ती मांगों को पूरा करने में सफल हो सकी। कृषि सांस्कृतिक प्रथाओं, सिंचाई, पोषण, रासायनिक उर्वरक खरपतवार नियंत्रण और अन्य फसलों को सम्मिलित करके अनुसंधान क्षेत्र का विस्तार किया गया तथा मिट्टी की उर्वरता और उर्वरक उपयोग क्षमता को बढ़ाने के प्रयास अनवरत किए गए। 1968-69 में इस योजना को अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना (एआईसीआरएपी) के रूप में दो घटकों "आदर्श सस्य प्रयोग" और "सरल उर्वरक परीक्षण" के साथ स्वीकृत किया गया था।

भारत में कृषि अनुसंधान, हरित क्रांति के बाद भी पृथक फसल पर केन्द्रित रहा, लेकिन एक स्थायी विकास के लिए प्रणाली दृष्टिकोण होना चाहिए। इस धारणा ने फसल प्रणाली उन्मुख अनुसंधान आरम्भ करने के लिए प्रोत्साहन दिया और 7 वीं पंचवर्षीय योजना की अवधि में यह परियोजना निदेशालय में परिवर्तित की गई और इसे फसल प्रणाली अनुसंधान परियोजना निदेशालय के नाम के रूप में मार्च, 1989 में मुख्यालय के रूप में मोदीपुरम, मेरठ, उत्तर प्रदेश स्थापित किया गया। 11वीं पंचवर्षीय योजना के दौरान पीडीसीएसआर को 2009-10 की अवधि में कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) के रूप में पुनः नामित किया गया। वर्ष 2014 की अवधि (12वीं पंचवर्षीय योजना) में पीडीएफएसआर को पूर्ण विकसित संस्थान, भारतीय कृषि प्रणाली अनुसंधान संस्थान के रूप में उन्नत और नामित किया गया तथा एकीकृत कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी-आईएफएस) के साथ (वर्तमान 74 केंद्रों) और जैविक खेती हेतु नेटवर्क परियोजना भी (एनपीओएफ, मौजूदा 20 सह-संचालन केंद्रों) निम्नलिखित जनादेशों के साथ संस्थान का एक अभिन्न अंग बने रहे।

- एकीकृत कृषि प्रणालियों में, उत्पादकता और संसाधन उपयोग क्षमता में सुधार के लिए, उत्पादन तकनीकियों पर बुनियादी और सामरिक अनुसंधान करना।

- विभिन्न कृषि स्थितियों के लिए कुशल, आर्थिक रूप से व्यवहार्य और पर्यावरण की दृष्टि से, स्थायी एकीकृत खेती प्रणाली मॉडल विकसित करना।
- प्रणाली आधारित कृषि उत्पादन प्रौद्योगिकियों के ऑन-फार्म परीक्षण, सत्यापन और परिशोधन करना।
- एकीकृत कृषि प्रणालियों में मानव संसाधन विकास और क्षमता निर्माण करना।
- कृषि प्रणालियों के अनुसंधान और विकास के सभी पहलुओं पर उपलब्ध सूचना के एक भंडार के रूप में कार्य करना।
- देश में एकीकृत कृषि प्रणाली अनुसंधान का समन्वय और गहन अवलोकन करना।

इसकी स्थापना के बाद से संस्थान ने विभिन्न पारिस्थितिकी-शैक्षिक और संसाधन-आधार स्थितियों के लिए, कृषि उत्पादन प्रौद्योगिकियों के विकास और शोधन में महत्वपूर्ण योगदान दिया है। इन प्रौद्योगिकियों का उद्देश्य नई प्रौद्योगिकियों के माध्यम से, कुशल संसाधन उपयोग और अधिकतम लाभ प्राप्त करना है।

अनुसंधान के कुछ प्रमुख क्षेत्र निम्न हैं:

- एकीकृत कृषि प्रणाली।
- आवश्यकता –आधारित कुशल और लाभदायक फसल/कृषि प्रणालियों का विकास करना।
- विभिन्न फसल अनुक्रमों के लिए इष्टतम किस्मों का संयोजन।
- इष्टतम फसल संयोजन और अंतर फसल प्रणाली के लिए रोपण ज्यामिति का आंकलन।
- विभिन्न फसल प्रणालियों के अंतर्गत जुताई आवश्यकताओं और फसल स्थापना विधि का अवलोकन।
- विभिन्न कृषि-पारिस्थितिक क्षेत्रों एवं कृषि स्थितिया के अंतर्गत, कृषि संसाधनों का चरित्र चित्रण और बाधा विश्लेषण करना।
- कृषि/फसल प्रणालियों का विश्लेषण करना
- विभिन्न फसलों और मिट्टी की किस्मों के लिए उर्वरकों के कुशल एवं लाभप्रद स्रोत ज्ञात करना।

- विभिन्न कृषि/फसल प्रणालियों में एकीकृत पोषक प्रबंधन करना।
- फसल की उपज और मिट्टी की उर्वरता शक्ति पर, दीर्घकालिक एकीकृत पोषक प्रबंधन और रासायनिक उर्वरक का प्रभाव ज्ञात करना।
- अनाज-अनाज फसल प्रणालियों में दलहन फसलों का समावेश करना।
- संसाधन संरक्षण प्रौद्योगिकियों का विकास।
- जलवायु लचकदार कृषि की संभावनाएं देखना।
- जैविक एवं परिशुद्धि खेती का विस्तार।
- खेतों पर फसल प्रणाली प्रौद्योगिकियों का मूल्यांकन एवं शोधन परिष्करण।
- फसल/कृषि प्रणाली से संबंधित डेटाबेस प्रबंधन का भंडारण।
- कृषि प्रणाली अनुसंधान एवं प्रसार से सम्बंधित मानव संसाधन उपलब्धता का विकास करना।

भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान द्वारा निम्नलिखित तीन योजनाएं संचालित हैं:

1. **भाकृअनुप- भारतीय कृषि प्रणाली अनुसंधान संस्थान आई आई एफ एस आर मोदीपुरम, मुख्यालय** अपने चार विभागों (एकीकृत कृषि प्रणाली प्रबंधन, फसल प्रणाली और संसाधन प्रबंधन, जैविक कृषि प्रणाली, एवं प्रौद्योगिकी स्थानांतरण परिष्करण एवं मानव संसाधन विकास समन्वयक इकाई के साथ पूर्ण विकसित संस्थान के रूप में कार्यरत है।
2. **एकीकृत कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी –आईएफएस)**

इस परियोजना के अन्तर्गत ICAR एवं राज्यों के कृषि विश्वविद्यालयों के सहयोग से देश के 74 केन्द्रों पर कृषि प्रणाली मॉडल विकसित करने में अनुसंधान कार्य किया जा रहा है, इनमें से 60 मॉडल देश के 24 राज्यों के 32 केन्द्रों द्वारा तैयार किये गये हैं तथा इन पर अनुसंधान कार्य प्रगति पर है। कृषि प्रणाली मॉडल में किसानों की सहभागिता सुनिश्चित करने के लिये देश के 21 राज्यों के 32 केन्द्रों पर 63 कृषि प्रणाली मॉडलों का किसानों की सहभागिता द्वारा परिष्करण किया जा रहा है।



3. अखिल भारतीय जैविक खेती पर नेटवर्क परियोजना (एआई-एनपीओएफ)

यह परियोजना देश के 16 राज्यों में स्थित कृषि विश्वविद्यालयों/आई सी ए आर संस्थानों पर 20 केंद्रों में जैविक खेती एवं प्राकृतिक खेती तकनीकी विकास में कार्यरत है। इस परियोजना को ICAR-IIFSR द्वारा समन्वित किया जाता है। इस परियोजना के अन्तर्गत, 51 उन्नत फसल प्रणालियों की पहचान कर जैविक खेती की तकनीकी विकसित की गयी है।

प्रमुख अनुसंधान उपलब्धियाँ

- एक एकड़ एकीकृत जैविक खेती प्रणाली मॉडल के तहत खरीफ के दौरान मक्का +लोबिया चारा प्रणाली 1000 वर्ग मी. में जैविक उत्पादन प्रणाली के तहत 2 गायों के लिए 263 दिनों के लिए चारा उत्पादन का वादा करती है। प्रणाली के आर्थिक विश्लेषण से संकेत मिलता है कि पशुधन घटक के साथ जैविक खेती प्रणाली के तहत, अपनाए गए मॉड्यूल के संयोजन के आधार पर 0.78 लाख रुपये (खेत और बागवानी आधारित) से 1.23 लाख प्रति एकड़ (मसाले आधारित) की शुद्ध आय प्राप्त की जा सकती है।
- एकीकृत कृषि प्रणाली (आईएफएस) मॉडल को कीटनाशक के राष्ट्रीय उपयोग औसत के आधार पर निम्न, मध्यम और उच्च प्रणालियों में वर्गीकृत किया गया है। सक्रिय संघटक (ए.आई.) के संदर्भ में कीटनाशक का उपयोग प्रति हेक्टेयर 0.001 से 2.34 किलोग्राम ए.आई. प्रति हेक्टेयर की सीमा में भिन्न है। कर्मना केंद्र के तीन आईएफएस मॉडल कम कीटनाशक में वर्गीकृत किए गए। जबकि जोरहाट में आईएफएस मॉडल और कर्मना के केले आधारित आईएफएस मॉडल मध्यम कीटनाशक श्रेणी में पाए गए।
- संबंधित जिलों के पंजीकृत किसानों को वास्तविक समय के आधार पर विशेष जिलों की अनुमानित मौसम की स्थिति के आधार पर कृषि-सलाह के माध्यम से कुल 70 तकनीकी हस्तक्षेप दिए गए। मानसून (जुलाई से सितंबर) और पोस्ट मानसून (अक्टूबर से जून) के दौरान, बारिश के दिनों के संदर्भ में सटीकता का स्तर भविष्यवाणी के 50 प्रतिशत से अधिक पाया गया।
- जलवायु परिवर्तन के तहत टिकाऊ संसाधन प्रबंधन के तहत मूल्यांकन किए गए अन्य मॉड्यूल की तुलना में

फसल प्रणालियों से उच्च शुद्ध आय प्राप्त किया गया था। विभिन्न फसल प्रणालियों में भिंडी-फूलगोभी-बेबीकॉर्न – लोबिया ने सबसे अधिक शुद्ध लाभ दिया। खरीफ के दौरान चारे के लिए बाजरे की खेती 0.18 हेक्टेयर बागवानी-चारागाह में 1 गाय और 1 भैंस को 161 दिनों तक हरा चारा दिया जा सकता है।

- प्रमुख घटक और क्लस्टर विश्लेषण का उपयोग करते हुए, इंडो गंगा के मैदानी इलाकों में 252 परिवारों से किए गए सर्वेक्षण का उपयोग करके टाइपोलॉजी का निर्माण किया गया है। प्रत्येक प्रकार के 39, 8, 39 और 15 प्रतिशत घरों के साथ चार प्रकार के परिवार की पहचान की गई।
- जैविक खेती के तहत 15 राज्यों के लिए खरीफ और रबी मौसम के लिए उपयुक्त विभिन्न फसलों की कुल 73 किस्मों को बढ़ावा देने की सिफारिश की गई है। तीन राज्यों मेघालय, तमिलनाडु और केरल के लिए कम बाहरी इनपुट आधारित एकीकृत जैविक खेती प्रणाली मॉडल विकसित किए गए हैं।
- फार्मडिजाइन एप्लिकेशन के परिणामों के संकेत के अनुसार वांछित उद्देश्यों को पूरा करने के लिए वैकल्पिक फसल चक्र के एकीकरण के बिना सीमांत किसानों में सुधार की सीमित गुंजाइश है, जबकि सीमांत मशीनीकृत किसान वर्तमान फसल चक्र के साथ भी उद्देश्यों के समाधान के लिए संभावित जगह है।
- चावल-परती-परती, चावल-सरसों-बोरो चावल और चावल-सरसों-जूट की पहचान पश्चिम बंगाल के मध्य जलोढ़ मैदानी क्षेत्र में प्रचलित पूर्व प्रमुख फसल प्रणालियों के रूप में की गई थी।
- पशुधन घटक के साथ जैविक खेती प्रणाली के तहत, अपनाए गए मॉड्यूल के संयोजन के आधार पर 0.78 लाख रुपये (खेत और बागवानी आधारित) से 1.23 लाख प्रति एकड़ (मसाले आधारित) की शुद्ध आय प्राप्त की जा सकती है। हालांकि, यह 0.23 लाख (कंद फसल आधारित) से 0.49 लाख (खेत फसल आधारित विविध प्रणाली) से भिन्न है, जो कि उगाई गई फसलों पर निर्भर करता है, यदि पशुधन घटक एकीकृत नहीं है।
- सभी फसलों का प्रदर्शन बाजरा नेपियर संकर के रूप में दर्ज किया गया था, जिसमें चार महीने में 92.28 टन/हेक्टेयर के साथ उच्चतम हरा चारा उपज क्षमता दिखाई गई थी, इसके बाद चार महीने में दो कटाई के

बाद ज्वार (75.16 टन/हेक्टेयर) था। पोल्ट्री के लिए 2.23 क्विंटल मक्का बीज अनाज की आपूर्ति के साथ-साथ पांच गायों को खिलाने के लिए 115 दिनों के लिए हरा चारा और 119 दिनों के लिए स्टोवर प्रदान करने में समग्र प्रणाली सक्षम थी।

- मुजफ्फरनगर ज़िले में "फार्मर फस्ट" परियोजना के तहत 800 किसानों को उन्नत दरांती वितरण किया गया। उन्नत दरांती की औसत कार्य क्षमता 405.89 घंटा/हेक्टेयर है जो पारंपरिक दरांती (499.39 घंटे/हेक्टेयर) की तुलना में काफी अधिक (पी d" .05) है।
- अमरुद और लीची में दलहन की इंटरक्रॉपिंग के साथ बाग आधारित मॉडल ने बी:सी अनुपात को 1.89 से बढ़ाकर 2.12 कर दिया।
- सीमांत, भूमिहीन किसान के पशुपालन आधारित आईएफएस की आजीविका सुरक्षा सुनिश्चित करने के लिए "फार्मर फस्ट" परियोजना के तहत सुअर पालन, बकरी और मुर्गी पालन किया गया और सुअर पालन से उनकी आय में 40 प्रतिशत की वृद्धि, मुर्गी पालन में 29 प्रतिशत की वृद्धि और 32 प्रतिशत की वृद्धि बकरी पालन के माध्यम से उनकी आय में वृद्धि देखी गई।
- मक्का (कोब)-मटर (फली)-गेहूं-लोबिया (फली) प्रणाली के तहत अधिकतम गेहूं समकक्ष उपज (16.38 टन/हेक्टेयर) दर्ज की गई, इसके बाद चावल-गेहूं-मूंग (16.30 टन/हेक्टेयर) का स्थान रहा। ये दोनों प्रणालियाँ सांख्यिकीय रूप से समान रहीं और चावल-गेहूं-ढेंचा और गन्ना- गन्ना (पेडी)-गेहूं प्रणालियों पर महत्वपूर्ण श्रेष्ठता दिखाई।
- धान-गेहूं- मूंग प्रणाली के तहत अधिकतम शुद्ध आय (1.53 लाख/हेक्टेयर) दर्ज किया गया, इसके बाद मक्का (कोब)-मटर (सब्जी)-गेहूं- लोबिया (फली) फसल प्रणाली का स्थान रहा। गन्ना- गन्ना (पेडी) -गेहूं प्रणाली द्वारा सबसे कम शुद्ध आय (रु.0.95 लाख/हेक्टेयर) दर्ज किया गया।
- संरक्षण कृषि पद्धतियों के तहत मिट्टी की सतह पर औसतन 8.63 टन/हेक्टेयर जबकि पारंपरिक प्रथाओं के तहत यह 3.06 टन/हेक्टेयर अवशेष छोड़ा जा रहा है। मिट्टी में बचे अवशेषों की अधिक मात्रा कार्बनिक कार्बन सामग्री के निर्माण और मिट्टी के घनत्व को कम करने में मदद करती है।

- सिंचाई के पानी में औसतन 10 प्रतिशत की बचत, 28 प्रतिशत श्रम की बचत, 16.8 प्रतिशत डीजल और ऊर्जा की बचत पारंपरिक प्रथाओं की तुलना में संरक्षण कृषि प्रथाओं के तहत दर्ज की गई थी। गन्ना- गन्ना (पेडी) -गेहूं और मक्का (कोब)-मटर (सब्जी)-गेहूं- लोबिया (फली) प्रणाली के तहत सिंचाई जल (19.41 प्रतिशत) और श्रम (31.7 प्रतिशत) की अधिकतम बचत दर्ज की गई।
- पांच मुख्य फसल चक्र में, धान-मक्का-सब्जी की खेती में शुद्ध आय सबसे अधिक था (रु.120344/हेक्टेयर), इसके बाद चावल-दाल-गेहूं (रु.98000/हेक्टेयर), चावल-गेहूं (रु.88950)/हेक्टेयर, मक्का-आलू-गेहूं (रु. 103380/हेक्टेयर) और दलहन-सरसों-गेहूं (रु. 101100/हेक्टेयर)। वर्ष 2019-2020 के लिए औसत कुल शुद्ध लाभ रु. 32,800 पशुधन से और फसल से रु. 4,264 मिला।
- रोपण की तारीख (अक्टूबर और फरवरी) दोनों में अपशिष्ट डीकंपोजर अनुप्रयोग में जुताई में (क्रमशः 0.05 और 0.13 प्रतिशत) और गन्ने में उपज (क्रमशः 20.42 और 31.64 प्रतिशत) (सीओ 0238) में सुधार हुआ।
- जैविक उत्पादन प्रणाली के तहत उगाई गई खरीफ फूलगोभी मौसम की वर्षा की विभिन्न स्थिति के संदर्भ में फसल मौसम की किसी भी स्थिति के तहत अजैविक उत्पादन प्रणाली पर 5.0 से 15.6 प्रतिशत अधिक उपज हासिल करने में सक्षम थी।
- एकीकृत कृषि प्रणाली मॉडल में पशु और फसल घटक आधारित अपशिष्ट से 54.33 प्रतिशत नाइट्रोजन, 47.66 प्रतिशत फॉस्फोरस और 67.47 प्रतिशत पोटेशियम और कुल मिलाकर 56.74 प्रतिशत नाइट्रोजन, फॉस्फोरस, पोटेशियम पोषक तत्वों को बचाया जा सकता है।
- विभिन्न फसल अनुक्रमों में चावल-गेहूं की फसल ने 1800 वर्ग मीटर क्षेत्र से अधिक कार्बन (1308 कार्बन डाई आक्साइड-समतुल्य (किलो) का उत्पादन किया है, इसके बाद गन्ना-पेडी-गेहूं फसल अनुक्रम (तालिका 6) है। जबकि, एकीकृत कृषि प्रणाली के अन्य घटकों में पशुधन ने वायुमंडल में अधिक ग्रीन हाउस गैसों का उत्सर्जन किया था (3378 कार्बन डाई आक्साइड-किलो में समतुल्य और उसके बाद मछली तालाब से 515 किग्रा. कार्बन डाई आक्साइड में। एकीकृत कृषि प्रणाली मॉडल का कुल कार्बन सिंक कुल कार्बन स्रोत



6638 कार्बन डाई आक्साइड—समतुल्य के मुकाबले 44028 किलोग्राम था।

- पारंपरिक जुताई (157244 मेगा जूल/हेक्टेयर) की तुलना में शून्य जुताई (170189 मेगा जूल/हेक्टेयर) में अनाज ऊर्जा उत्पादन (ईओजी) अधिक पाया गया, हालांकि, पारंपरिक जुताई (110055) में शून्य जुताई (130657) की तुलना में शुद्ध ऊर्जा अनाज उत्पादन (एनईजी) देखा गया।
- सबसे अच्छी गुणवत्ता वाला कम कैलोरी वाला कटहल जैम 50 प्रतिशत टीएसएस वाले अंतिम उत्पादों के साथ प्राप्त किया गया था, जिसमें इष्टतम बनावट स्कोर (7-8), स्वाद स्कोर (8.3) और स्वाद स्कोर (8.2) के साथ अधिकतम संवेदी स्कोर (8.1) दर्ज किया गया था।
- चावल-गेहूँ-ढैंचा (जीएम) प्रणाली में उच्च एसईवाई (153.67 टन/हेक्टेयर/वर्ष) दर्ज किया गया, इसके बाद गन्ना-पेडी-गेहूँ और मक्का-बरसीम-उर्द बीन फसल प्रणाली का स्थान रहा। गन्ना- पेडी-गेहूँ प्रणाली (3600 वर्ग मीटर क्षेत्र से 107700 रुपये) में सकल प्रतिफल सबसे अधिक पाया गया। मॉडल ने सालाना कुल 572 मानव श्रम दिवस उत्पन्न किए थे।
- 2.5 टन/हेक्टेयर सरसों की खली, 1.25 टन/हेक्टेयर सरसों की खली, गोबर की खाद और वेमी-कम्पोस्ट और अकार्बनिक प्रबंधन के तहत अनाज की उपज 5.0 टन/हेक्टेयर के आवेदन की तुलना में क्रमशः 31.8 प्रतिशत, 45.2, 60.9 और 36.4 प्रतिशत कम हो गई थी। सरसों की खली के प्रयोग से खेती की लागत में काफी वृद्धि हुई और 5.0 टन/हेक्टेयर सरसों की खली उपचार के तहत उच्चतम (1,15,174/हेक्टेयर) पाया गया। इसके अलावा, 5.0 टन/हेक्टेयर सरसों के के आवेदन के तहत उच्चतम शुद्ध आय (49,944/हेक्टेयर) पाया गया, इसके बाद अकार्बनिक प्रबंधन (45,227/हेक्टेयर) और से कम पोषक तत्व प्रबंधन के तहत गोबर की खाद और वर्मी-कम्पोस्ट आवेदन (16,773/हेक्टेयर रुपये) के तहत पाया गया।
- वैज्ञानिक जैविक खेती पैकेज और एकीकृत फसल प्रबंधन की तुलना में जेडबीएनएफ के तहत गेहूँ की उपज में

क्रमशः 44.1 प्रतिशत और 68.8 प्रतिशत की कमी आई है।

- वैज्ञानिक जैविक खेती पैकेज की तुलना में शून्य बजट खेती के तहत बासमती चावल की पैदावार पहले वर्ष के दौरान 23.4 प्रतिशत और दूसरे वर्ष के दौरान 66.2 प्रतिशत की कमी हुई।
- सरसों की खली/5 टन/हेक्टेयर के उपचार के तहत दर्ज की गई थी + बुवाई के 40 दिन बाद एक हाथ से निराई तथा चना के साथ अंतरफसल के उपचार के बाद उच्चतम बीज उपज (3592 किग्रा/हेक्टेयर) और स्टोवर उपज (11874 किग्रा/हेक्टेयर) दर्ज की गई थी।
- जैविक उत्पादन प्रणाली के तहत मक्का और सरसों की ग्यारह किस्मों का मूल्यांकन किया गया। पीएमएच 5 (9475 किग्रा/हेक्टेयर) के तहत उच्चतम अनाज उपज पाई गई, उसके बाद एच (पायनियर -3396) (9187 किग्रा/हेक्टेयर) का स्थान रहा। सरसों की किस्मों में, पूसा बोल्ड ने सबसे अधिक 2748 किग्रा/हेक्टेयर की उपज दर्ज की, उसके बाद पूसा तारक (2282 किग्रा/हेक्टेयर) का स्थान रहा।
- ग्लोमलिन की उच्चतम मात्रा (546.36 मिलीग्राम/किग्रा सूखी मिट्टी) को गेहूँ की कटाई के बाद एनपीओएफ पैकेज द्वारा प्रबंधित भूखंडों से निकाला गया था, इसके बाद एकीकृत पोषक प्रबंधन अभ्यास द्वारा प्रबंधित भूखंडों से 431.24 मिलीग्राम/किग्रा सूखी मिट्टी से निकाली गई थी। ग्लोमलिन की सबसे कम मात्रा (340.86 मिलीग्राम/किलोग्राम सूखी मिट्टी) नियंत्रण भूखंडों से निकाली गई थी।
- एनपीओएफ पैकेज के तहत डिहाइड्रोजनेज (25.24 माइक्रोग्राम टीपीएफ/ग्राम मिट्टी/हेक्टेयर) की उच्चतम गतिविधि पाई गई, इसके बाद धान की कटाई के बाद एकीकृत पोषक तत्व प्रबंधन में 20.77 माइक्रोग्राम टीपीएफ/ग्राम मिट्टी/हेक्टेयर पाया गया।

EXECUTIVE SUMMARY

- Name and address of the Institute:** ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110
- Budget (2019-20)**

1. Institute Budget (Rs. in Lakhs)

Plan					Non Plan		
Provision	Expenditure	Govt. Grant	Allocation internal+ additional amount provided by Hqrs out of Council shares	Total Allocation (col. 3+4)	Exp. out of Govt. Grant	Exp. out of revenue generation	Total expenditure (col. 6+7)
1	2	3	4	5	6	7	8
1738.26	1717.26	1738.26	-	1738.26	1717.26	-	1717.26

b) External sources (₹ in Lakhs)

Source	Budget	Expenditure
Pension and other retirement benefits	111.00	111.00
Personal loan and advances	0.00	0.00
Externally funded projects	76.38	41.19
Total	187.38	152.19

c) Revenue generated (₹ in Lakhs) during 2019-20

Source	Amount
Farm Produce	35.14
Sale of fish, milk and livestock	Included in farm produce
License fee/ water charges	6.45
Miscellaneous	2.73
Interest on loan and advances	3.21
Interest on TDR	19.20
Others (Royalty and Inst. charges)	1.47
Total	68.20



Staff position (as on 31.12.2019)

Category	Sanction	Position	Vacant
Scientific			
Director	01	01	00
Principal Scientist	07	03	04
Senior Scientist	12	10	02
Scientist	19	16	03
Total	40+1		

Category	No. of Post	Filled	Vacant
Technical Staff			
Category-III (T-6, 7/8)	02	0	02
Category-II (T-3, T-4 & T-5)	19	16	03
Category-I (T-1 & T-2)	03	03	0
Total	24		
Administrative Staff			
Sr. Administrative Officer01	01	01	0
F & A O	01	01	0
AA O	01	0	01
Assistant	04	04	0
U D C	02	02	0
P S	01	01	0
PA	02	04	02
Jr. Steno Gr.III	01	02	01
L D C	03	02	01
Total	16		
Supporting Staff			
Supporting	11	11	0

INTRODUCTION

Indian Council of Agricultural Research-at a glance

Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established on 16th July, 1929 as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. The ICAR has its headquarters at New Delhi.

The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR institutes and 71 agricultural universities spread across the country this is one of the largest national agricultural systems in the world. The developed technologies at institutes and universities are being transferred, validated and refined through more than 640 Krishi Vigyan Kendras (KVKs) of the council.

The ICAR has played a pioneering role in ushering Green Revolution and modernization of agriculture in India through its research, education and extension activities. Developments in agriculture in India through council's research and technology development enabled the country to increase the production of food grains by 5.6 times, horticultural crops by 10.5 times, fish by 16.8 times, milk by 10.4 times and eggs by 52.9 times since 1951 to 2018, thus making a visible impact on the national food and nutritional security. This has been achieved despite the limitations of decline in water table as also rainfall by >100 mm compared to 1950s, increase in minimum temperature by 1.6 degrees celsius, macro and micro nutrient starved soils and loss of around 16 ton of soil/

ha through land erosion. ICAR applied science to agriculture which ushered in the green revolution making India self-sufficient and self-reliant.

The council has also played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields. The challenge before ICAR is to ensure nutritional security to evergrowing population of the country with little potential for increase in cultivable land area, ensuing shortage of water and global warming.

Mandate of ICAR

- Plan, undertake, coordinate and promote research and technology development for sustainable agriculture
- Aid, impart and coordinate agricultural education to enable quality human resource development
- Frontline extension for technology application, adoption, knowledge management and capacity development for agri-based rural development
- Policy, cooperation and consultancy in Agricultural Research, Education and Extension.

ICAR-Indian Institute of Farming Systems Research, Modipuram is one of the institutes working under Indian Council of Agricultural Research. The Project Directorate for Farming Systems Research (PDFSR) was given the status of full-fledged institute w.e.f. 27th November, 2014 and renamed as “**Indian Institute of Farming Systems Research**” (IIFSR) with 3 divisions (Integrated Farming Systems (IFS), Cropping Systems & Resource Management (CSRM), Organic Agriculture Systems (OAS) and Transfer of Technology & Assessment section) along with AICRP on IFS and AI-NPOF being an integral part of the



institute.

Brief History

The genesis of the Cropping Systems Research Project may be traced back to the visit of Dr. A.B Stewart of Macaulay Institute of Soil Research, Aberdeen, U.K., somewhere in mid- nineteen forties. He was invited by the then 'Imperial Council of Agricultural Research' to review the status in respect of soil fertility investigations, in general, and manuring in particular, and 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, significantly influenced the philosophy and practice of fertilizer experimentation in the county. The importance of conducting simple fertilizer trials on cultivators' fields and complex experiments at selected centers was emphasized in the report which promoted the initiation of "Simple Fertilizer Trials on Cultivators Fields" in 1953 under Indo-American Technology Cooperation Agreement through Soil Fertility and Fertilizer Use Project:" with the following objectives:

- To study crop responses to NPK, when applied separately and in different combinations under the cultivator's field conditions.
- To investigate the relative response of different fertilizers in various broad soil groups and to work out the optimum fertilizer combinations for different agro-climatic regions.
- To study the relative performance of different nitrogen and phosphatic fertilizers for indigenous production.
- To demonstrate the role of fertilizer use on crop production before the farmers.

Later, in 1956, Model Agronomic Experiments, i.e., complex experiments on carefully selected centers, were also brought under the purview of the

project 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 the increasing demands. The research arena was expanded to include agronomic research encompassing cultural practices, irrigation, nutrition, chemical weed control and multiple cropping. But the emphasis continued to remain 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'.

Nevertheless, even after green revolution, agricultural research centered on only individual crops in isolation. But for a sustainable development the system approach is a must. 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 11thfive-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 System Research**" besides AICRP on IFS (in 74 centres) and NPOF (in 20 co-operating centres,) as an integral part of institute (with the following mandates:

- To undertake basic and strategic research in integrated farming systems on production technologies for improving productivity and resource use efficiencies.
- To develop efficient, economically viable and environmentally sustainable integrated farming systems models for different farming situations.

- To undertake on-farm testing, verification and refinement of system-based farm production technologies.
- To undertake human resource development and capacity building in integrated farming systems.
- To act as a repository of information on all aspects of farming systems research and development.
- To coordinate and monitor integrated farming systems research in the country.

Since its inception, the institute has made significant contributions to the development and refinement of agricultural production technologies for diverse eco-edaphic and resource-base situations. These technologies have been aimed at efficient resource utilization and yield maximization through new technologies.

Some of the major areas of research are:

- Integrated farming systems.
- Development of need-based efficient and profitable cropping/farming systems and its analysis.
- Optimum varietal combinations for various crop sequences.
- Optimum crop combinations and planting geometry for intercropping systems.
- Tillage requirements and crop establishment practices under different cropping systems.
- Agricultural resource characterization and constraint analysis under different agro-ecological regions/ farming situations.
- Efficient sources of fertilizers for different crops and soil types.
- Effect of long term INM and chemical fertilizer use on crop yields and soil fertility under different farming/cropping systems.

- Options for introducing legumes in cereal-cereal cropping systems
- Farm mechanization and crop residue management.
- Climate resilient agriculture.
- Organic and precision farming.
- On-farm evaluation and refinement of cropping systems technologies.
- Cropping/ farming systems related database management
- Human Resource Development related to Farming Systems Research

ICAR-IIFSR was operating through following three plan schemes:

ICAR-Indian Institute of Farming Systems Research, Modipuram

On-station and on-farm research under four major themes namely, integrated farming systems management, cropping systems & resource management, organic agriculture systems and transfer of technology & assessment is being carried out.

AICRP on Integrated Farming Systems (IFS)

AICRP on Integrated Farming Systems, a plan scheme initiated from 2010-11 operating currently with 74 centres (25 on-station main, 11 on-station sub, 32 on-farm and 6 ICAR institute based voluntary centres) spreading over 15 agro-climatic regions. The scheme is in operation at 34 SAU's, 1 central university and 6 ICAR institutes covering 24 states and 1 union territory across the entire country which is operational under the administrative control of Director, ICAR-IIFSR.

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

All India Network Programme on Organic



Farming (AI-NPOF), a plan scheme initiated from 2004-05 operates currently with 20 co-operating centres covering 16 states to develop package of practices for organic production of crops in cropping and farming systems perspective. The scheme involves 11 State Agricultural Universities, 8 ICAR institutes/centres and 1 deemed to be/special heritage university

Salient Research Achievements

- Maize + cowpea fodder system during *kharif* in 1000 m² under one acre integrated organic farming system model promises to produce fodder for 263 days for 2 cows under organic production system. The economic analysis of the system indicates that under organic farming system with livestock component, a net income of Rs 0.78 lakhs (field and horticulture based) to 1.23 lakhs per acre (spices based) can be obtained depending upon the combination of modules adopted. However, it varied from 0.23 lakhs (tuber crop based) to 0.49 lakhs (field crop based diversified system) depending upon the crops grown, if livestock component is not integrated.
- IFS models were classified into low, medium and high pesticide using systems by using national average. Pesticide use in terms of a.i. per ha varied in the range of 0.001 to 2.34 Kg a.i. per ha). Three IFS models from Karmana centre categorised into low pesticide while IFS model at Jorhat and banana based IFS model of Karmana were found to be medium pesticide category.
- A total of 70 numbers of technological interventions were given through agro-advisories based on anticipated weather condition of the particular districts on real time basis to the registered farmers of respective districts. During Monsoon (July to September) and Post Monsoon (October to June), the accuracy level was found to be reduced up to 50% of the prediction in terms of rainy days.
- Higher net return was obtained from cropping systems compared to other modules which were evaluated under sustainable resource management under climate change. Among the various cropping systems okra-cauliflower-babycorn+cowpea gave highest net return. Cultivation of pearl millet for fodder during *kharif* in 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 161 days.
- Using principal component and cluster analysis, typology has been constructed using survey conducted from 252 farm households in Indo Gangetic plains. Four types of farms were identified with 39%, 8%, 39% and 15% households in each type.
- The results of FarmDesign application indicated that there is limited scope for improvement in Marginal farms without integration of alternative cropping patterns to meet the desired objectives while in case of marginal mechanized farms solution clouds depicted that there is potential room for manoeuvre towards objectives even with current cropping patterns.
- A total of 73 varieties of various crops suitable for *kharif and rabi* seasons for 15 States have been recommended for promotion under organic farming. Low external input based Integrated Organic Farming System models have been developed for three states namely Meghalaya, Tamil Nadu and Kerala.
- Rice-fallow-fallow, rice-mustard-boro rice and rice-mustard-jute were identified as pre-dominant cropping systems being practiced in Central Alluvial Plain zone of West Bengal.
- Performance of all crops was recorded as Bajra napier hybrid shown highest green fodder yield potential with 92.28 t/ha in four months by two cuttings followed by sorghum (75.16 t/ha) in four months by two cuttings. Overall system able to provide green fodder for 115 days and stover 119 days for feeding five cows along with supplying of 2.23 q maize seed grain for poultry.
- The average working capacity of improved sickle is 405.89 hr/ha which is significantly higher

($p < 0.05$) as compared to the traditional sickle (499.31 hr/ha), based on the improved sickle distributed to 800 farmers under Farmer's First Project in Muzaffarnagar District.

- Orchard based model with intercropping of pulses in Guava and litchi increased the B:C ratio from 1.89 to 2.12.
- For ensuring the livelihood security of marginal, landless farmer's animal husbandry based IFS involving piggery, goatary and poultry were carried out under Farmer First Project and 40% increase in their income from pig rearing, 29% increase in their income backyard poultry rearing and 32% increase in their income through addition of goat rearing were noticed.
- Maximum wheat equivalent yield (16.38 t/ha) was recorded under maize (cob)-pea (pod)-wheat- cowpea (pod) system followed by rice-wheat-green gram (16.30 t/ha). Both these systems remained at par statistically and showed significant superiority over rice-wheat-sesbania and sugarcane-ratoon-wheat systems.
- Maximum net returns (Rs. 1.53 lakhs/ha) were recorded under rice-wheat-green gram system followed by maize (cob)- pea (veg)-wheat-cowpea (pod) cropping system. Lowest net returns (Rs0.95 lakhs/ha) were recorded by sugarcane-ratoon-wheat system.
- On an average 8.63 t/ha residue is being left on the soil surface under CA practices where as it is to the tune of 3.06 t/ha under CP practices. Higher amount of residue left in the soil helps in building of organic carbon content and reducing bulk density of soil.
- An average 10% saving in irrigation water 28% saving of labor 16.8% saving of diesel and energy was recorded under CA practices as compared to conventional practices. Maximum saving of irrigation water (19.41%) and labor (31.7%) was recorded under sugarcane-ratoon-wheat and maize (cob)- pea (veg)-wheat- cowpea (pod) systems.
- The main cropping pattern was five cropping patterns, net returns was the highest in Rice-maize-vegetable cultivation (Rs.120344 ha⁻¹) followed by Rice-Pulses-Wheat (Rs. 98000 ha⁻¹), Rice-Wheat (Rs.88950 ha⁻¹), Maize-Potato-Wheat (Rs.103380 ha⁻¹) and Pulse-Mustard-Wheat (Rs.101100 ha⁻¹). Average per farm total net return were from livestock 32,800 and crops Rs. 42,64 for the year 2019–2020.
- Across both the DOP (October and February planted) waste decomposer application improved in tillering (0.05 and 0.13 % respectively) and yield (20.42 and 31.64 % respectively) in sugarcane (Co0238).
- *Kharif* cauliflower grown under organic production systems was able to registered 5.0 to 15.6% higher curd yield gain over inorganic production system under the any situation of crop season in terms of rainfall status of the seasons Bajaura, CSKHPKV, Palampur, H.P.
- Animal and crop components based waste in the IFS model can put aside 54.33% of N, 47.66% of P and 67.47% of K and overall 56.74% of NPK nutrients can be saved.
- Among the different cropping sequences rice—wheat cropping has produced more carbon (1308 CO₂-e(kg) from 1800 m² area followed by sugarcane-ratoon –wheat cropping sequence. Whereas, in the other components of the integrated farming system livestock had emission more GHG in to the atmosphere(3378 CO₂-e in Kg and thereafter from fish pond 515 CO₂-e in Kg. The total carbon sink of the IFS model was 44028 against the total carbon source 6638 CO₂-e(kg).
- Grain energy output (EO_g) was found higher in Zero tillage (170189 MJ ha⁻¹) as compared to conventional tillage (157244 MJ ha⁻¹), however, net energy grain output (NE_g) was observed in ZT (130657) than CT (110055).
- The best quality low calorie jack fruit jam was obtained with final products having 50% TSS



recorded the maximum sensory score (8.1) with optimum texture score (7.8), flavour score (8.3) and taste score (8.2).

- Rice – wheat – dhaincha (GM) system recorded higher SEY ($153.67 \text{ t ha}^{-1}/\text{yr}^{-1}$) followed by Sugarcane – ratoon – wheat and Maize – berseem – urd bean cropping system. Gross return was found maximum in Sugarcane – ratoon – wheat system (Rs.107700 from 3600 m^2 area).. The model had generated annually a total 572 man days.
- Grain yield under application of 2.5 t ha^{-1} MC, 1.25 t/ha MC, FYM & vermi-compost and inorganic management was lowered by 31.8%, 45.2%, 60.9 % and 36.4% as compared to application of 5.0 t ha^{-1} MC, respectively. Application of mustard oilcake considerably increased cost of cultivation and highest (Rs. 1,15,174 ha^{-1}) was found under 5.0 t ha^{-1} MC treatment. Moreover, highest net return (Rs. 49,944 ha^{-1}) was found under application of 5.0 t/ha MC followed by inorganic management (Rs. 45,227 ha^{-1}) and least under nutrient management through FYM and vermi-compost application (Rs. 16,773 ha^{-1}).
- Wheat yield under ZBNF was reduced by 44.1% and 68.8% as compared to scientific organic farming package and integrated crop management, respectively.
- Basmati rice yield was reduced by 23.4% during first year and 66.2% during second year under Zero budget farming as compared to scientific organic farming package.
- The highest amount of glomalin ($546.36 \pm 8.95 \text{ mg kg}^{-1}$ dry soil) was extracted from the plots managed by NPOF package after wheat harvest followed by $431.24 \pm 7.28 \text{ mg kg}^{-1}$ dry soil from the plots managed by integrated nutrient management practice. The lowest amount of glomalin ($340.86 \pm 12.51 \text{ mg kg}^{-1}$ dry soil) was extracted from control plots.
- Highest activity of dehydrogenase ($25.24 \pm 1.78 \mu\text{g TPF g}^{-1} \text{ soil h}^{-1}$) was found under NPOF package followed by $20.77 \pm 2.71 \mu\text{g TPF g}^{-1} \text{ soil h}^{-1}$ in integrated nutrient management after rice harvest.
- Among different weed mgt practices under organic farming, Highest seed yield (3592 kg ha^{-1}) and stover yield (11874 kg ha^{-1}) was of mustard recorded under treatment incorporation of mustard oilcake @ 5 t/ha + one hand weeding at 40 DAS followed by the treatment of intercropping with chickpea (1:1) (2447 kg ha^{-1}).
- Eleven maize and mustard varieties were evaluated under organic production system. Highest grain yield was found under PMH 5 (9475 kg ha^{-1}) followed by H (Pioneer-3396) (9187 kg ha^{-1}). Among the mustard varieties, Pusa Bold recorded highest yield of 2748 kg/ha followed by Pusa Tarak (2282 kg ha^{-1}).

Soil & Climate Weather-2019

During the reporting year the onset of southwest monsoon was recorded on 7th July, which was 10 days delayed onset. Total annual precipitation of 824.3 mm was received with uneven distribution. This was 10.3 % higher than the normal precipitation of 747.0 mm. Out of the total annual precipitation, Southwest monsoon contributed 73.9 %. The mean maximum temperature varied from 17.7°C in December to 39.0°C in May while the mean minimum temperature varied between 5.1°C in January to 25.0°C in August. The average relative humidity and sunshine hours were 74.2% and 6.2 hours/day, respectively. There

were 42 rainy days with rainfall more than 2.5 mm. The highest daily maximum temperature recorded was 43.5°C on 30th May and the lowest minimum temperature was 2.0°C on 1st January. The summary of the monthly meteorological data are presented in Table 1. The weekly pan evaporation reached 69.5 mm during the 19th standard meteorological week (SMW) and came down from 26th SMW onwards (Fig. 1 & 2). Highest maximum temperature of 40.3°C was recorded during the 16th SMW and lowest minimum temperature of 4.3°C was recorded during the 2nd SMW.

Table 1. The summary of the monthly meteorological data recorded at Agromet observatory

Month	Temperature (°C)		Avg. RH (%)	Sunshine hours (hr day ⁻¹)	Rainfall (mm)	Rainy days (nos.)	Pan Evaporation (mm)
	Max.	Min.					
January	20.9	5.1	74.8	4.9	65.5	2.0	53.1
February	21.5	9.6	77.8	5.0	51.4	5.0	61.3
March	27.0	12.2	71.3	8.6	10.6	1.0	129.1
April	35.8	19.4	65.7	8.7	2.4	0.0	235.9
May	39.0	21.7	55.0	9.2	9.0	2.0	349.0
June	38.8	24.9	66.5	6.9	17.3	2.0	260.5
July	33.7	24.5	82.1	3.9	301.8	11.0	113.8
August	33.2	25.0	85.6	5.4	265.8	12.0	95.5
September	33.4	24.0	82.9	7.2	24.0	2.0	91.4
October	31.2	18.3	75.8	6.6	22.9	1.0	76.4
November	27.0	12.4	72.5	4.7	10.8	2.0	63.5
December	17.7	7.3	80.1	3.0	42.8	2.0	52.0
Annual Average/Total	29.9	17.0	74.2	6.2	824.3	42.0	1581.5

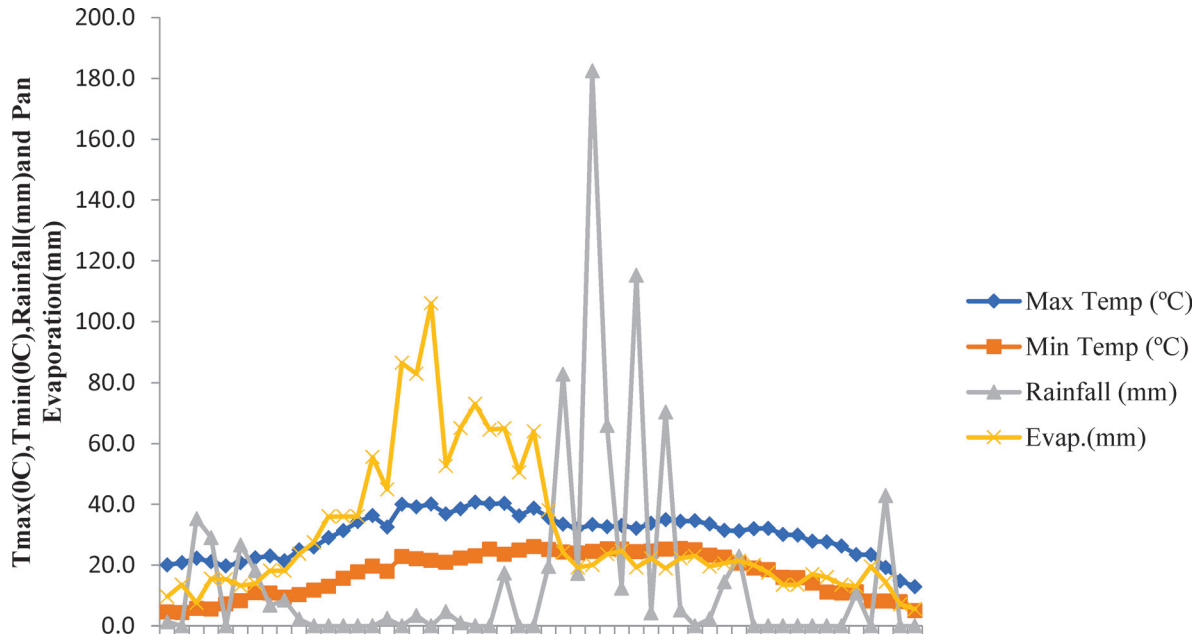


Fig. 1. Weekly Pan Evaporation, Rainfall, Maximum and Minimum temperature recorded during the year 2019

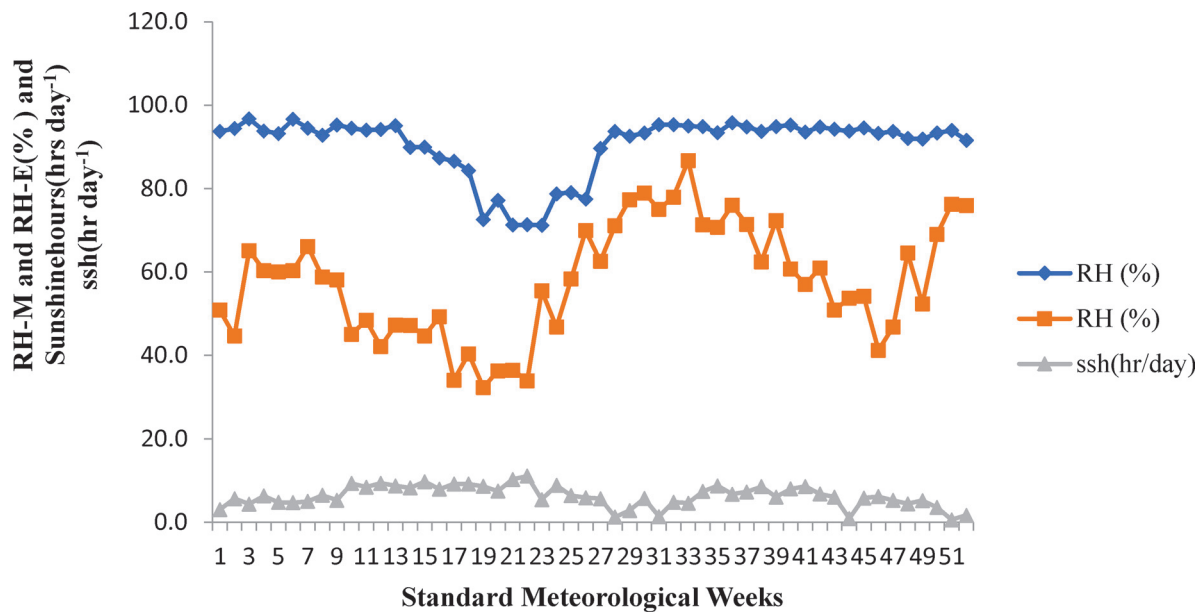


Fig. 1. Weekly RH (morning), RH (evening) and sunshine hours recorded during the year 2019

Theme I

Integrated Farming Systems

Project: Characterization of Existing Farming Systems of Uttarakhand

The study area encompasses the existing farming systems of Udham Singh Nagar District, Uttarakhand. A Survey was conducted to characterize the existing farming systems, their mechanization level and its effect on labour usage and income level, constraints and technological solutions identified in existing farming systems of Uttarakhand. The total sample comprises a random sample of 30 households i.e. (1 District x 1 block/district x 3 villages/ block x 10 households) using a stratified sampling frame. Anandpur, Kanakpur and Pratapur were the villages surveyed in a high productive block, Rudrapur (Udham Singh Nagar). Data was collected by personal interview method using pre-tested structured questionnaire through face to face interaction with the men and women farmers.

Findings of the survey revealed that the mean operational landholding was 3.41 ha ranges from 0–16.19 ha/farm household, whereas mean leased in land was 3.38 ha farm household⁻¹ ranges from 0-16.19 ha farm

household¹. The total landholding was noticed to be 6.79 ha/farm household ranges from 1-16.19 ha farm household⁻¹. Crop (paddy/sugarcane-wheat/mustard) + Livestock (Dairy/poultry) (42.85 %) followed by Crop (paddy-paddy-wheat/mustard) + vegetables (23.8%) were the predominant farming systems found in Rudrapur (Udham Singh Nagar).

Highest human labour is being used in cultivation of sugarcane crop (358.13 mandays ha⁻¹) followed by summer paddy and Kharif paddy in the existing farming systems (Table 1). This may be due to the low mechanization level and higher labour requirement in these crops. Summer paddy is labour and energy intensive crop, requires more frequent weeding and irrigation operations as compared to *Kharif* paddy. However, lowest human labour is being used in wheat crop (14.82 mandays ha⁻¹) due to high mechanization level in wheat crop (100% mechanized land preparation by using tractor and its attached implements, sowing and fertilizer application by using seed drill, spraying by using battery operated sprayers, irrigation by using electric or diesel operated engines,

Table 1. Labour use pattern in existing farming systems of Udham Singh Nagar (USN).

Labour use (mandays ha ⁻¹)	Mechanical	Human
Summer rice	3.8	176.15
Paddy	3.6	124.14
Wheat	4.60	14.82
Sugarcane	5.80	358.13
Mustard	4.07	14.81
Maize	6.09	39.81
Pea (prior to harvesting)	3.66	29.72
Potato	7.8	29.78



Table 2. Mechanization effect on labour usage and income in farming systems of USN.

Operation	Manual		Mechanized		
	Labour use (mandays ha ⁻¹)	Expenditure (Rs ha ⁻¹)	Labour use (mandays ha ⁻¹)	Expenditure (Rs ha ⁻¹)	%Saving (Rs)
Potato Planting	44.5	13,350	4.0	3705	72.24
Potato Harvesting	45.6	13,680	4.5	4940	63.88

harvesting cum threshing by using combine harvestors, reapers and threshers).

As mentioned in Table 2, 72.24% planting expenditure could be saved by mechanized potato planting. Similarly, 63.88% harvesting expenditure could be saved by using mechanized potato harvesting.

The highest value of output was noticed in sugarcane (Rs 312922 ha⁻¹) followed by summer paddy (Rs 124371 ha⁻¹). Similarly the highest manual cost of operation was also noticed in sugarcane (Rs 69164 ha⁻¹) followed by summer paddy (Rs 52849 ha⁻¹). Interestingly, the highest percentage of manual cost of operation was noticed to be in summer paddy (42.49 %) followed by kharif paddy (38.22%) and is responsible of highest total cost of operation (45.75 %) and (42.70%) respectively for summer paddy and Kharif paddy crops. Therefore, the study depicts there is an urgent need either to diversify the system or to reduce the operational costs through improving the mechanization for these crops. The major constraint perceived by the farmers of existing farming systems is less rate of paddy and wheat given to the farmers due to non-maintenance of required moisture content and poor storage facilities (85.71 %) followed by no rate of rice stalk due to livestock problem which forces farmers to burn paddy fields (76.19%) and scarcity of farm labour (47.61%). Less productivity due to stone crusher was also notified by 28.57 % farmers. Around 200 quintal year⁻¹ farmer⁻¹ of paddy straw which is being burnt in fields could be used as (biogas, water geezers, non-woven mulches etc.) for the benefit of farming community.

Project: Development of Sustainable IFS Model for Western Plain Zone of Uttar Pradesh

The work on IFS model in Western Uttar Pradesh is continued since 2004-05. Based upon the outcomes, the existing model was refined with deletion of uneconomical component and with addition of some components. During 2016-17, climate resiliency works also taken in to account to enhance the farming sustainability.

A 1.50 ha IFS models was evaluated and developed for the small and marginal land holding farmers of Western Uttar Pradesh, wherein only farming (sugarcane-ratoon-wheat) + dairy (2 to 3 buffaloes/cows) system is practiced by around 84% of the total farm families. Sustainable IFS model was developed on 1.5 hectare of land under assured irrigation supply. IFS model comprises of Crop and cropping systems (1.04ha), Dairy component (2 buffaloes+1cow), Horticulture (0.22ha), Fisheries (0.01ha), Poultry (10 birds), Kitchen garden (20 m²), Vermicompost unit (0.001 ha), Mushroom cultivation (0.01ha) and boundary plantation (0.004ha) (Fig. 1). The productivity of the whole system goes up to 133.37 ton/annum, where yield of every crop was multiply with its prevailing market prices and that was compared with sugarcane market price to bring equivalent yield (ton/annum) (Table 3).Whereas, the highest gross and net returns were fetched from Sugarcane+ Cowpea (2:1)-Ratoon-Wheat cropping sequence (Rs.113329 and 78729/annum with B:C ratio 3.27 from 3600m² area).

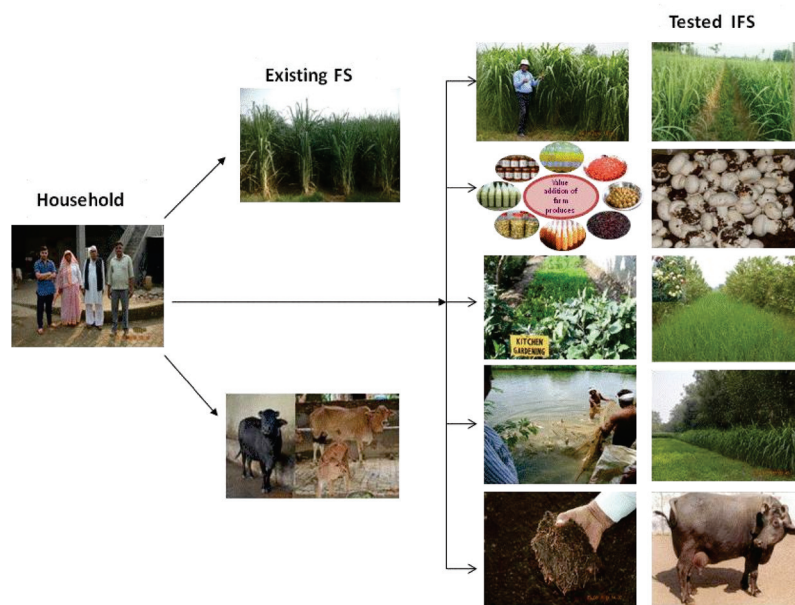


Fig.1. Profitable IFS model for small farm household in western plain zone of Uttar Pradesh

Table 3. Productivity and economics of various cropping sequences in IFS Model

Crop and cropping sequences	Land allocation (m ²)	SEY* (ton year ⁻¹)	Cost of cultivation (Rs./year ⁻¹)	Gross return (Rs. annum ⁻¹)	Net return (Rs. year ⁻¹)	B:C ratio
Sugarcane + cowpea (2:1) - Ratoon- Wheat	3600(36.5%)	45.51	34600	113329	78729	3.27
Rice-Wheat - Dhaincha (GM)	1800(17.3%)	26.12	28900	78470	59570	2.71
Pigeon pea + Maize (1:2) - Chickpea -Okra/Urd bean	1800(17.3%)	26.35	30340	86234	65894	2.84
Maize- Berseem- Urd bean	1800(17.3%)	21.65	20600	54005	38405	2.62
Sorghum (F) - Mustard Moong bean	1100(10.5%)	10.82	8500	23070	14570	2.71
Round the year fodder production (Napier+ Cowpea /Napier+ Berseem +Subabool)	400(3.8%)	2.92	4850	12400	7550	2.55
SEm±		0.92				
CDat 5%		2.86				
Total	10400(100%)	133.37	127790	367508	264718	2.78

*SEY: Sugarcane equivalent yield (ton annum⁻¹)



Nutrient Budgeting: A total of 56.74% of NPK requirement of the crops and fruit plants (Fig. 2) would be full filled within the system.

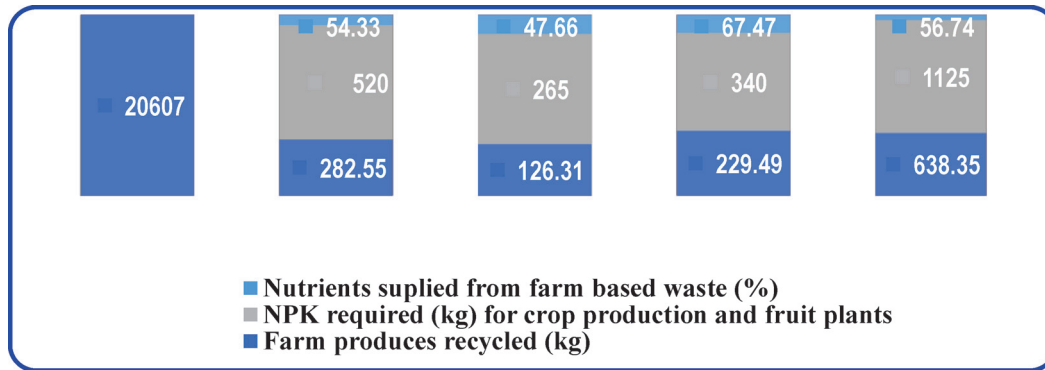


Fig 2. Nutrients available and requirement for different crops in IFS Model.

When, we look towards nutrients supply through various farm based by-products viz. crop residues, farm yard manure, tree leaves, weeds, mushroom spent and green manure crop (Dhaincha), out of these dhaincha crop grown for green manure after the rice and wheat crops, which had more nutrients content (1.04:0.64:1.45% NPK on dry weight basis) (Table 4). This means that crop residues, tree leaves,

farmyard manure, mushroom compost (spent), vermicompost and green manure had produced 1125 kg of NPK/annum from the 20607kg farm based by-products. Thus, nutrient balance sheet showed that animal and crop components based waste in the IFS model can put aside 54.33% of N, 47.66% of P and 67.47% of K and overall 56.74% of NPK nutrients can be saved (Table 5).

Table 4. Nutrients content in dry matter of different crops under various cropping sequences.

Cropping sequences	Kharif			Rabi			Summer		
	N content (%)	P content (%)	K content (%)	N content (%)	P content (%)	K content (%)	N content (%)	P content (%)	K content (%)
Sugarcane+Cowpea(2:1) -Ratoon- Wheat	0.924	0.484	1.421	0.916	0.554	1.401	0.980	0.458	1.358
Rice-Wheat- Dhaincha	0.948	0.392	1.303	0.944	0.482	1.258	1.048	0.647	1.455
Pigeon pea + Maize(2:1) – Chickpea –Okra	1.108	0.479	1.245	0.932	0.435	1.188	1.296	0.390	01.597
Maize- Berseem-Urd bean	0.920	0.358	1.462	1.344	0.754	1.463	1.372	0.346	1.641
Sorghum(F) - Mustard -Moong bean	1.088	0.855	1.407	1.037	0.317	1.279	1.349	0.381	1.738
Napier+Cowpea/Napier+ Berseem	1.052	0.331	1.059	1.02	0.413	1.099	1.069	0.656	1.028

Table 5. Nutrient supply in IFS Model through the recycling of farm based by products.

Source of nutrients and per cent nutrient content (N:P:K) on dry weight basis	Available quantity of farm produce in (kg)	Approx. N (kg)	Approx. P (kg)	Approx. K (kg)	Total NPK produced in IFS (kg)
Sugarcane dry leaves (0.4:0.19:1.29)	730	4.48	2.15	12.85	19.48
Mustard straw (0.42:0.08:0.88)	630	3.05	1.25	6.15	10.45
Chickpea straw (1.19:0.06:1.25)	3397	32.41	1.45	35.41	69.27
Moong bean straw (1.12:0.27:1.00)	590	6.17	1.06	6.26	13.49
Urd bean straw (0.85:0.18:0.53)	590	5.89	0.45	2.34	8.68
Pigeon pea leaves (1.28:0.37:1.62)	755	10.01	3.06	13.12	26.19
Dhaincha (3.50:0.60:1.20)	1260	38.02	6.41	14.58	59.01
Paddy straw (0.36:0.08:0.71)	1480	4.59	0.87	6.74	12.2
Tree leaves(1.20: 0.58: 0.42)	160	1.9	1.8	0.80	4.5
FYM (0.6:0.4:0.5)	4450	36.50	18.20	22.45	77.15
Vermicompost (2.1:1.5:1.4)	5500	115.0	82.0	77.61	274.61
Poultry manure (1.1:0.8:0.5)	265	3.04	2.181	1.35	6.571
Fish pond(1000m ²), nutrient supply through water and silt	-	4.4	2.04	5.4	11.84
	-	9.09	0.58	22.34	32.01
Spent mushroom compost (0.8:0.3:0.3)(0.8:0.3:0.3)	800	8.0	2.81	2.09	12.9
Total	20607	282.55	126.311	229.49	638.351
Nutrient requirement for crops and fruit plants in IFS Model	-	520 (54.33%)	265 (47.66%)	340 (67.47%)	1125 (56.74%)

Dairy component (2 buffaloes and 1 cow): High milk producing breeds of buffalo (Murrah) and cow (Gir) were kept in dairy unit and animals were fed with green fodder (30kg day⁻¹), dry fodder (6kg day⁻¹) and concentrate ration (2kg day⁻¹) for maintenance of body weight and 1 kg for every 2.5 litre of milk production. Apart from feed stuffs, mineral mixture (MM) and common salt was also fed to animals for good health and higher production. Further, data revealed that

small farm conditions a unit of 3 milch animals can be handled easily from crop component of IFS model. The milk production from all three animals was 4534 liters annum⁻¹. The gross and net returns from diary component were obtained of Rs.204030 and 114530 with B: C ratio 2.28. Besides, milk production from the animals, FYM and vermicompost were also produced (8997 kg and 3600 kg). The total NPK turnover was 638.4 kg annum⁻¹ from farm based wastes

and dairy unit byproducts. This all can be saved money as equivalent of Rs.22548 year¹.

Horticulture component (0.22 ha): Under horticulture module, guava, mango, pear, peach, and karonda plants are grown. The fruit production from 35 guava plants was 3950 kg, from 5 mango plants (250kg), 10 pear plants (560 kg), 2 peach plants (50 kg) and 40 plants of karonda produced (160kg) having total gross and net return Rs. 117500 and 79900, respectively.

Fish component (0.01ha): Composite fish culture of mix fish species including rohu, katla, mrigal, common carp, silver carps and grass carp with stocking density of 10000 fingerlings per hectare in ratio of 20:20:20:10:20:10 was continued in IFS pond (0.1 ha) during the reporting period. The pond was fertilized by the excreta released from animal shed (dairy wash). Periodic fertilization with NPK mixture to maintain the natural fertility of fish pond for optimum plankton production was followed. Fishes were fed with floating pelleted diets having 26% protein content @ 5% of their body weight. Periodic random samplings of fishes were carried out for adjusting the feed demand. A total of 230 kg of fishes were harvested from the 0.1 ha pond area. The lower

yield in the current year was due to renovation of fish pond under which the pond was being dried up for dyke repairing and estimation of NPK content of pond silt which will be recycled into field crops for agriculture-aquaculture integration and periodic rejuvenation of fish pond for maintaining optimum water depth. A gross return of Rs. 33000 was realized from sale of 330 kg of fish harvested beside employment generation of 45 days. The net profit from the module was recorded at Rs.21550. The important water quality parameter like dissolved oxygen, pH were measured periodically and were found to be within optimum range for carp culture. The size of the harvested fishes ranged from 0.75kg to 1.4 kg.

Mushroom Component: By utilizing 50% capacity of the crop room, 120 kg yield of mushrooms (80 kg button and 40 kg oyster mushroom) was harvested with additional yield of 500 kg of high quality organic manure (from button mushroom spent compost and 500 kg of animal feed (from spent straws of oyster and milky mushroom). From this module about Rs. 6800 was earned as net return. Mushrooms spent substrate was recycled in sugarcane crop (1200 kg) and some good quality mushroom spent was also used as animal feed (200kg) from the mushroom unit (Table 6).

Table 6. Yield and economics of mushrooms module in IFS Model.

Mushroom species	Production (kg)	Cost of production (kg)	Gross income (kg)	Net income (kg)
Button mushroom	75	1875	6000	4120
Oyster mushroom	42	840	2520	1680
Milky mushroom	20	500	1200	700
		Total	9720	6505



Plate 1. Different components in IFS Model

Poultry Component: Poultry birds were reared on farm based by-products and wastes, which are generally not utilized by farm household. So that rearing cost of birds can be reduced. From poultry component of IFS model, 10 birds of CARI Nirbheek breed were kept in the bamboo hut nearby fish pond. Through selling of eggs and litter (poultry manure), the gross and net returns were obtained of Rs.10075 and Rs.7850, respectively. The poultry manure (litter) is having high value of nutrient content than other farm wastes.

Kitchen gardening: The size of kitchen garden is depends upon the land availability and number of persons in a family. However, for the 5 members of a family, round the year supply of vegetables was worked out, in which vegetable crops for all three seasons were preferred as per the liking of family members and maintains supply of production throughout the year. During *Kharif* season pumpkin,

cucumbers, okra and Spanish were grown efficiently. Whereas, in *Rabi* and *Summer* seasons vegetables like peas, broccoli, cauliflower, carrot, tomato, onion, radish and brinjal were grown for regular supply of different kinds of vegetables for nutritional security. The vegetables grown on 0.002 ha of land were sufficient for regular supply of a family. The production of vegetables in kitchen garden was 338.2 kg annum⁻¹, whereas, the gross and net returns were Rs.7665 and 440 annum⁻¹, respectively.

Boundary plantation: Boundary plantation was done across the all field boundaries with fruit trees like Aonla (*Phyllanthus emblica*), Jackfruit (*Articarpus hetrophyllus*), Bael (*Aegle marmelos*), Karonda (*Carisa carendis*) and Citrus spp. Kagji Nimboo in 2004-05. Now the age of fruit trees is 16 years and they produce fruit 380 kg annum⁻¹. The gross and net returns from selling of fruits were Rs. 8900 and Rs. 5350.

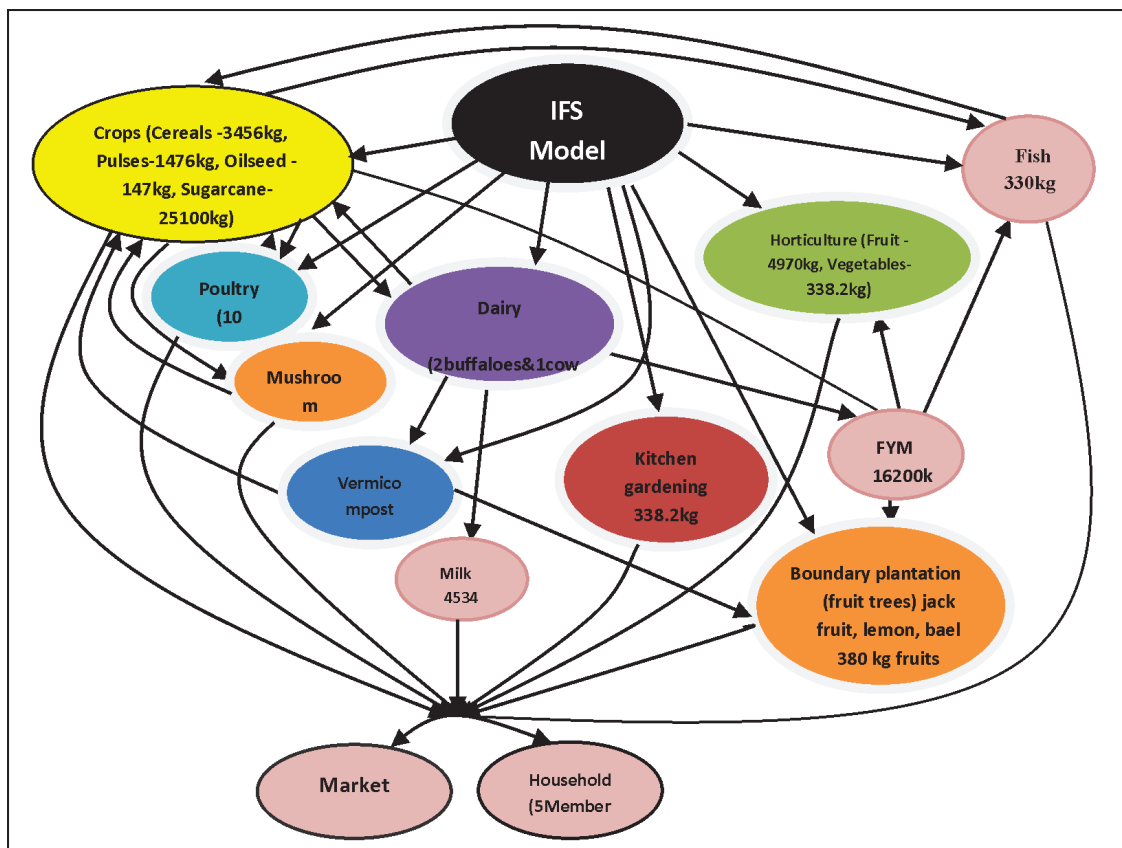


Plate 2. Resource flow model of Integrated Farming System under assured irrigation (1.5 ha)



GHG Emission and Estimation in IFS model:

Among the different cropping sequences rice-wheat cropping has produced more carbon (1308 CO₂-e(kg) from 1800m² area followed by sugarcane-ratoon-wheat cropping sequence (Table 7). Whereas, in the other components of the integrated farming system livestock had emission more GHG in to the atmosphere (3378 CO₂-e in Kg and thereafter from fish pond 515 CO₂-e in Kg. The total carbon sink of the IFS model was 44028 against the total carbon source 6638 CO₂-e(kg). Higher carbon sink due to fruit trees and boundary plantation, the GHG emission is negative, so more intensification of crops or enterprises can be done (Table 7). ©

Project: Evaluation and Identification of Farm Implements under Different Farming Systems

The identification of existing tools (Table 8) and improved farm machineries are being suggested for enhancing the mechanization level in different farming systems. It has been observed that indigenous farm tools are being used by the framers in existing framing system which can be replaced for improved ergonomically designed tools so that working efficiency can be improved.

Table 7. Net GHG emission in IFS Model (CO₂-e in Kg).

Carbon Sources	Enterprises	CO ₂ -e(kg)	
CS1	Cropping System		
	Sugarcane-Ratoon -wheat	641	
	CS2	Rice-wheat	1308
	CS3	Maize-Chickpea-Okra	232
	CS4	Maize-Berseem-Urdbean	203
	CS5	Sorghum-Mustard-Moong bean	126
CS6	Napier	33	
	Horticultural-Vegetable crops	189	
	Livestock (Cattle and buffalo)	3378	
	Kitchen garden	13	
	Pond	515	
Carbon Sink	Agro-Forestry- SINK	1140	
	Total Biomass/compost added - SINK	42888	
	Total SOURCE	6638	
	Total SINK	44028	
	GHG-IFS	-37390	

Table 8. Identifications of machineries under different framing system.

S. N.	Operations	Traditional method	Improved method/ implements
A. Sugarcane machineries			
1.	Land preparation	Cultivator, Harrow & Rotavator (Farmers have)	Deep ploughing + harrowing followed by Rotavator
2.	Sowing/Planting	Tractor operated furrower followed by manually dropping of sets in furrow	Sugarcane cutter planter Trench planter Paired row planter Sugarcane raised bed multi crop planter
3.	Intercultural implement	In sugarcane crop intercultural implements are urgently required, so that Labour intensive work may be reduced. Animal drawn 3/5-tyne cultivators for inter culture operation. Implements required for efficient intercultural operation sugarcane	Self-propelled power weeder (BCS) Tractor operated 3-row rotary weeder. Tractor operated weeder (Desmesh made power weeder) Small tractor operated weeder or other machineries (<20hp)
4.	Plant protection Implement ⁻¹	Knap neck sprayer Battery operated sprayer (farmers have)	Power sprayers (wide swath spray boom) Tractor operated aero blast sprayers
5.	Earthing	Furrow for earthing operation (spacing required-90 cm & height of sugarcane is not more than 40 cm)	
6.	Harvesting & De-trashing of Sugarcane	Manually by traditionally hand tools	IISR tractor front mounted sugarcane windrower whole stalk harvester IISR sugarcane de-trasher
7.	Loading & transport	Animal Cart Tractor trolley	Big cart with facility of loading & unloading
8.	Ratoon management	Manually	IISR developed RMD (ratoon management device) Five operation at a time: Stubble shaving Deep ploughing Application of inorganic/organic fertilizers/manure Earthing
B. Other crop machineries			
1.	Wheat, mustard, maize, urd, moong etc. Sowing/planting	Broad casting	Zero till ferti- drill Multi crop planter
2.	Harvesting	Manually	Self-propped reaper binder Tractor operated reaper Small combine
3.	Threshing	Locally design thresher used	Multi crop thresher
C. Machinery for dairy			
1.	Chaff cutter	Manually operated chaff cutter Electric motor fitted with manually operated chaff cutter	Power operated chaff cutter with safety device
2.	Milking machine	Manually milking	Power operated milking machine



Plate 3. Evaluation of intercultural operation 3- row manual weeder

Evaluation of small farm machineries

Manual weeder: The 3-tine manual weeder (Plate 3) was introduced for the intercultural operation of the row cropped. It provides several advantages such as work without bending, more coverage of area with less time & efficiency, better work, less labour requirement etc.

Brush cutter for rice harvesting: The brush cutter performance was evaluated at the farm of IIFSR for rice harvesting. The field capacity and fuel consumption during harvesting operation were

recorded to compare the performance of manual harvesting. The operational view of the cutter is shown in (Plate 4). At 2.8 km h⁻¹ forward speed of the operator, brush cutter take 22 h to harvest 1.0 ha area. Working capacity of brush cutter was found to be 70 & 75 % higher than improved and traditional local sickle (Table 9). The energy expenditure for brush cutter was found to be 9.37 ± 0.30 KJmin⁻¹ (Table 10) which is high as compared to sickles (4 to 5 KJ min⁻¹). The cost of operation for one hectare was Rs. 2340.4/- in case of crop cutter and Rs. 3750/- for manual operation.

Table 9. Performance evaluation of different harvesting tools for rice crop.

Parameter	Brush cutter	Sickle	
		Improved	Traditional
Time of harvest (h ha ⁻¹)	22	75	91
Labour require (man-h) ha ⁻¹	48	149	181
Labour requirement (labour day ⁻¹)	6	19	23
Field capacity (ha h ⁻¹)	0.045	0.013	0.011
Fuel consumption (l ha ⁻¹)	12.39	-	-

Table 10. Physiological workload in wheat harvesting through brush cutter.

S. No.	Physiological variables	Wheat harvesting (Brush cutter)
1	Working Heart rate (beats min ⁻¹)	115.66 ± 3.17
2.	Energy Expenditure (KJmin ⁻¹)	9.37 ± 0.30
3.	Δ HR (beats min ⁻¹)	39 ± 2.08
4.	Type of workload	Moderately heavy
5.	Body part discomfort score	14 ± 0.57



Plate 4. Sectional view of the brush cutter and field operation of the brush cutter



Plate 5. Evaluation okra harvesting by ring cutter

Ring cutter (improved knife) used for okra harvesting: The cutting vegetables or flowers with thorny stems lead to cuts, injuries, rashes and scratches on the fingers of farm women. Ring cutter was used as an intervention to harvest the okra vegetables (Plate 5). In traditional method, they pluck vegetables with bare hands which inflict pain on the fingers, especially with okra; they have cuts scratches and itching on the fingers. Working efficiency of ring cutter was 7.69 kg per hour with no damage, whereas, working efficiency of traditional plucking was 7.20 kg per hour with 8% damage in okra. Ring cutter improves the work performance, reduce labour cost.

Sugarcane set cutter cum bud chipper: New technology for sugarcane planting is to use single bud of sugarcane stem instead of a set of sugarcane having 2-3 buds. The seed cutter machines can efficiently conserve time and labor and cost as it chips more buds in less time. Therefore, ICAR-IISR, Lucknow developed bud chipper (Plate 6) is being evaluated at the farm experiments. The bud chipping can be done in both sitting and bending posture. The ergonomic analysis was done in both postures (Table 11) . The germination percentage of seedling in IISR bud chipper (93%) was higher than traditional bud chipping method (80%) (Plate7).

Table 11. Ergonomic and performance evaluation of sugarcane bud chipping using different tools/ techniques.

Sugarcane bud chipping	Traditional tool	Improved bud chipper	
		bending posture	sitting posture
BPDS	17.0 ± 0.0	15.66±0.57	9.33± 0.57
Strain Index	60.8 ± 0.0	11.23 ± 1.96	2.76 ± 0.40
Output (Buds) minute ⁻¹	15.66 ± 0.57	15.33±1.15	14.0 ±0.0
Efforts minute ⁻¹	15.66 ± 0.57	15.33±1.15	28.0 ±0.0



Plate 6. Sugarcane bud chipping in bending and sitting posture through bud chopper and germination of seedling of sugarcane after buds from bud chopper



Plate 7. Sugarcane bud chipping in bending and sitting posture through bud chopper.

Project: Sustainable livelihood generation through IFS involving uneconomic cattle

The major objective of the project is to develop profitable farming system model involving of uneconomic cattle with supplementary modules of goat and poultry. For this purpose, initially 5 uneconomic cattle, 21 goats and 500 poultry were

maintained in a total of 1 acre land. Out of this 1 acre land, 640 sqm was allocated for animal housing and remaining for fodder production. The animals were provided optimum feeding and management. The female were treated to make them fertile. The dung of the animals would be converted into vermicompost, where as urine will be distilled to prepare ark (Distilled urine). In 2019 (*kharif*), performance of sorghum, bajra napier hybrid, quality protein maize

Table 12. The observed values of girth and body length and estimated body weight of the animals at the time of procurement and after two months at the Institute.

Animal No.	Initial Values			Values after two months		
	Girth (inches)	Length (inches)	Body weight (kg.)	Girth (inches)	Length (inches)	Body weight (kg.)
380636	63.00	52.00	312.71	62.00	52.00	302.86
663474	63.00	55.00	330.75	64.00	55.00	341.33
677665	62.00	49.00	285.38	63.00	50.00	300.68
677461	61.00	54.00	304.44	62.00	54.00	314.51
663598	61.50	58.00	332.38	62.00	58.00	337.81
Mean =	62.10	53.60	313.13	62.60	53.81	319.44
S.E.	0.39	1.50	8.72	0.39	1.35	8.55

(QPM) and annual moringa was evaluated in a system mode. Intercropping in sugarcane with (gram, potato, garlic and faba bean) was started from autumn (October 2019) and crop diversification was initiated in sugarcane through intercrop on bund. The performance of different fodder, Stover and grain providing crops was evaluated, to provide a sustainable integrated farming system (IFS) model in future by involving uneconomic livestock.

The unit of uneconomic cattle was established by the procurement of 5 nondescript/local cows from the Gaushala, Partapur of Nagar Nigam, Meerut on 19th Nov., 2019. The condition of animals was very poor. The animals started feeding straw 4.0 kg., green fodder 12.0-15.0 kg and concentrate 1.50 kg. per day per animal. The mean values of girth and body lengths are presented in Table 12. During the period, the girth of animal improved significantly, however the improvement in the body length was non-significant. One cow calve male calf on 7th January, 2020.

The poultry birds at the age of 12 weeks of the Chabrown variety were procured on 30 August, 2019 from Central Poultry Development Organisation, Chandigarh for the initiation of poultry component of the project. The birds reared in deep litter system at the poultry unit of the Institute. The daily feed consumption after 20 weeks was 120 g. bird⁻¹ day⁻¹. The age at first egg was observed 151 days and age at sexual maturity was 167.73±0.50 days. The mean body weights at 20 weeks of age were 1.566±0.064,

0.987±0.044 and 1.228±0.052 kg, respectively, for male, female and overall mean. The total egg production upto 34 weeks of age was 6543 eggs and the gross income from the sale of eggs was Rs. 49,782.00. The gross income from the sale of live birds was Rs. 1,370.00. The total gross income from eggs and meat was Rs. 51,152.

All fodder crops performed very well in the system and overall 10332 kg fodder harvested from 1850 m² area with the productivity level of 55.56 t/ha (Table 13). The fodder is sufficient for 115 days to maintain five cow at the rate of 15 kg green fodder day⁻¹ cow⁻¹. Overall across the different fodder crops Bajra Napier Hybrid given highest system productivity 92.28 t ha⁻¹ by supplying 2307 kg from 250 m² area in two cuts followed by sorghum with 75.16 t ha⁻¹ supplied 7516 kg from 250 m² area in two cuts. Performance of moringa was not very good as it contributed to reduce overall system productivity. *Moringa oleifera* Lam. is sensitive to water logging and winter. Annual moringa (PKM-1) was seeded on 23rd August, 2019 using 1.6 kg seed in 500 m² area at 30×30 cm spacing. There is severe loss occurred due to continuous rain during 2019 along with too much cold. To protect it from water logging it was planted on ridge but due to continuous rain heavy losses occur in Moringa with 45% plant survival at its first cut in November. Further Moringa growth checked after the first cut and there are 6.62% well established plant losses due to cold.



Table 13. Performance of fodder crops in the system module.

Date of introduction	Name of Crop	Variety	Area (m ²)	First cut	Second cut	Total harvest	Fodder availability	System productivity (days*)
30/06/2019	Sorghum (broadcasting)	Jumbo gold	1000	3433 kg	4083 kg	7516 kg	84	75.16 t/ha
05/07/2019	Bajra Napier Hybrid (root sapling)	Co-3	250	1130 kg	1177 kg	2307 kg	26	92.28 t/ha
22/08/2019	Bajra Napier Hybrid(stem cutting)	Co-3	100	481 kg	-	481kg	5	48.10 t/ha
23/08/2019	Annual Moringa* (line sowing on ride)	PKM-1	500	28 kg	-	28 kg	-	0.56 t/ha
Gross harvest			1850	5072 kg	5260 kg	103.32 q	115	55.56 t/ha

*15 kg green fodder/ day /animals; total 5 cow maintained.

Table 14. Performance of grain crops in the system module.

Date of introduction	Name of Crop	Variety	Area (m ²)	Grain yield	Stover yield	Stover availability (days*)	System productivity
08/07/2019	Maize (line sowing on ride)	HQPM-1	1000	223 kg	395 kg	10	22.3 q ha ⁻¹ (grain yield) 39.52 q ha ⁻¹ (stover yield)
24/08/2019	Sorghum (line sowing)	Safed sudan	1000	-	4372 kg	109	4372 q ha ⁻¹
Gross harvest		2000	223 kg	4767	119		

*8 kg dry Stover day⁻¹ animals⁻¹; total 5 cow maintained

Performance of HQPM-1 variety of maize was observed very well with 223 kg grain and 395 kg Stover yield (Table 18). Grain yield not received in proportion of Stover yield due to heavy loss caused by wild animal mainly Indian palm squirrel (*Funambulus palmarum*) and Indian porcupine (*Hystrix indica*). This is the main reason for poor

adoption by farmers though it is a remunerative crop. Sorghum performance was quite well as it gave 4372 kg Stover yield from 1000 m² area within 70 days with a yield potential of 43.72 t ha⁻¹ Stover yield and 55.02 t ha⁻¹ in green stage. Fodder is sufficient for 119 days to maintain five cows at the rate of 8 kg Stover day⁻¹ cow⁻¹.

Project: Refinement of vegetable Based Farming Systems model for Food and Nutritional Security of Farmers of Western Uttar Pradesh

The project aims to provide alternative farming based upon the horticulture systems to maximize production, returns and nutritional security. A 1.5 ha horticulture based farming system model comprising of Primary Component viz., fruit with vegetable intercropping (0.4ha), Vegetable (0.5 ha), the secondary component i.e. food crop based system (Rice-wheat and Sugarcane- sugarcane ratoon- wheat in 0.4 ha), the complimentary component fish based pond-dyke system (0.10 ha) and supplementary component i.e poultry birds and composting unit (800 m²) is under evaluation at Siwaya farm of the institute. Establishment and evaluation of all the modules except poultry unit on pond-dyke system is in progress from Jan 2018.

The performance of fruits grown viz., mango (Amrapalli and Dashehri), Guava (L-49, Allahabad Safeda and Lalit) and Citrus (Kinnow) were tested in 0.4 ha area. The physico-chemical properties of the fruits harvested in the developed model is presented in Table 15.

A total of 15 vegetables were evaluated in the system during the year in an area of 0.5 ha throughout the year. The nutritional requirement of a five member farm family was worked out from the model and it was reported that this model was able to meet out the total nutritional requirement for cereals, roots and tubers, green leafy vegetables, other vegetables, fruits, sugar and jaggery products throughout the year as presented in Table 16. A surplus of each category of the produce harvested from the model can be sold in meeting out the other social requirements of the farm family.

Table 15. Physico-Chemical properties of the fruits harvested from the developed Model.

Fruit	Variety	Avg yield kg tree ⁻¹	Total Yield	Price kg ⁻¹	Avg fr wtg fr ⁻¹)	TSS (°Brix)	Time of flowering
Mango	Amrapalli	39.2	310	40	238.09	22	20 Feb
	Dashehri	48.5	325	40	174.02	12.5	27 Feb
Guava	A. Safeda	74.0	260	30	180.50	11.8	24 Feb and 18 June
	L-49	82.5	225	30	177.62	13.01	26 Feb and 20 June
	Lalit	30	240	30	178.50	12.5	24 Feb and 21 June
Citrus	Kinnow	30	311	30	172.0	12.0	27 Feb

Economics of the developed Horticulture based farming system model : The model provided gross returns of Rs 360830/- with. The total cost of cultivation was Rs. 103635/-. The component wise details are given in Table 17. The primary component of the provided the highest benefit : cost ratio (3.53) followed by the secondary component (2.38) thus it

can be inferred from the table 17 that the horticulture based farming systems can provide diversification in the income and crops to the farmers of western Uttar Pradesh and suitable strategies needs to be undertaken for promotion of horticulture based farming systems as they are more sustainable and environment loving systems.



Table 16. Nutritional yield vis-a-vis annual requirement of 5 members (3 adult male + 2 adult Female) family considering heavy work as per ICMR.

Food Group	Requirement of 3 adult male day ⁻¹ kg	Requirement of 2 adult female day ⁻¹ kg	Total requirement of 5 member family day ⁻¹ kg	Annual Requirement kg	Yield kg	Deficit/surplus kg
Cereals & Millets	1.8	0.96	2.76	1007.4	2060	1053
Roots and Tubers	0.6	0.4	1	365	2552	2187
Green Leafy Vegetables	0.3	0.2	0.5	182.5	335	153
Other Vegetables	0.6	0.4	1	365	7487	6932
Fruits	0.3	0.2	0.5	182.5	1671	1489
Sugar & Jaggery products*	0.165	0.09	0.255	93.075	200	107

* Considering 10% yield of jaggery from sugarcane i.e. 100kg sugarcane producing 10 kg of jaggery.

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

Table 17. Economics of 1.5 ha horticulture based farming system model developed at Siwaya Farm.

Components	Area ha.	Details	GR	COC	NR	B:C Ratio
Orchards (With Inter crops)	0.4	1. Mango (Amrapalli) + intercrops (Onion-Okra-Pea) 2. Mango(Dashehri) + intercrops (turmeric) 3. Guava + intercrop (Turmeric) 4. Kinnow + intercrops (Pea- Beans- Radish-Cauliflower)	119900	26439	93461	3.53
Vegetables	0.5	1. Brinjal-Potato-Beans 2. Onion-Bottlegourd-Cauliflower 3. Okra-Potato-Brinjal 4. Radish-Beans-Pumpkin-Fengreek 5. Cariander-Bottlegourd-Lobia-Carrot	109670	36351	73319	2.02
Field Crops	0.4	1. Rice-Wheat-GM 2. Sugarcane-S. Ratoon-Wheat	111600	33000	78600	2.38
Fish pond dyke-vegetable system	0.1	Fish + Dyke (Radish-bottlegourd-broccoli)	19660	7845	11815	1.51
Poultry (20		Layers	-	-	-	-
	1.5	Grand Total	360830	103635	257195	2.48

Molecular identification and characterization of citrus (Kinnow) grown under the developed model:

Citrus greening bacterium, *Candidatus Liberibacter asiaticus* associated with decline of citrus were undertaken in collaboration with college of biotechnology, SVPUAT, Modipuram, Meerut. This study is based on the detection of bacteria associated with citrus trees from different parts of Western Uttar Pradesh. Citrus trees showing symptoms were collected from different places (60 Samples) and DNA was extracted from Midribs of infected leaves by using CTAB and Sodium Sulphite method. PCR products were resolved by Gel Electrophoresis where ~500bp for Las and ~1160bp OI1 amplicon size were observed. A comparative data-based study was done between two sets of primer. Where, primer Las606/LSS gave 45 positive samples out of 60 samples, whereas primer OI1/OI2c gave 2 positive samples out of 60 samples. The primer Las606(~500bp) amplified products of 16S rDNA gene were ligated into pTZ57R/T vector with size of 2.8kb and recombinant

plasmids were transformed into DH5 α cells of *E.coli* followed by the screening of recombinant (white) colonies. To confirm the presence of inserts, Colony PCR was performed where, results showed that white colonies were positive and gave amplification of ~500bp as shown in Table 18 and Fig 3(a) & 3(b). Further confirmation was done by isolating Plasmid by Alkaline Lysis Method. Isolated plasmid was then subjected to Restriction Digestion for pTZ57R/T using *EcoRI* and *HindIII* as restriction enzymes. The positive cloned products were sent for sequencing. All sequences obtained from 16S rDNA from citrus were submitted to GenBank, NCBI and further accession numbers were provided to those by GenBank. In-silico analysis was performed using Multiple Sequence Alignment and phylogenetic tree construction which showed 99% homology with *Ca. L. asiaticus* MH368774 (China), KY990822 (Italy), JF819898 (Brazil) (Las606/LSS) and 99% Homology with *Ca. L. asiaticus* JQ867437 (Mexico), AB555706 (Japan), DQ157273 (China).

Table 18. Result of PCR amplification using specific primer sets.

S.N.	Primer set	Primer Sequence (5'-3')	Tm(°C)	Expected size	Observed size
1.	Las606	GGAGAGGTGAGTGGAATTCCGA	50.00	500bp	~500bp
2.	LSS	ACCCAACATCTAGGTAAAAACC	50.00		
3.	OI1	GCGCGTATGCAATACGAGCGGCA	60.00	1160bp	~1160bp
4.	OI2c	GCCTCGCGACTTCGCAACCCAT	60.00		

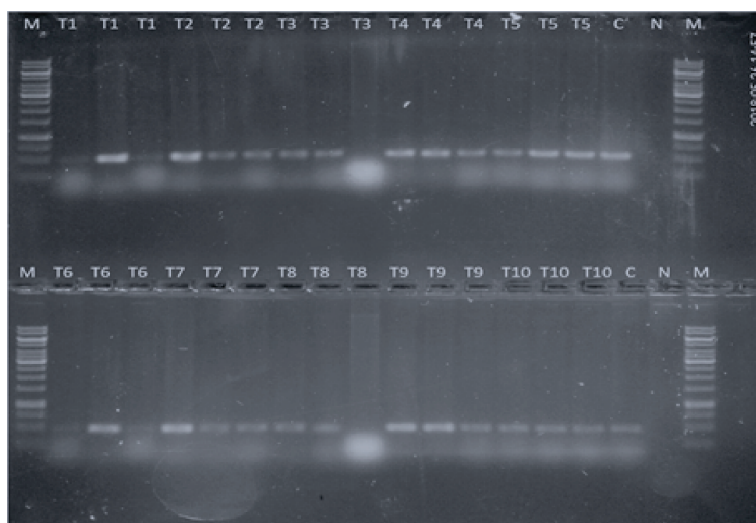


Fig. 3(a) Electrophoresis on 0.8% gel of DNA amplified with primer Las606/LSS. From left to right: M- Marker 1kb; extract from citrus infected with 16S rDNA (Lane 1-10); C- Positive control; N- Negative control.

The result revealed that the Huanglongbing disease is infecting the citrus production in district Meerut and belongs to *Candidatus Liberibacter asiaticus*. Prevalence of disease leads to heavy loss in the production and quality of citrus fruits which results in a huge economic loss to the farmer. HLB is causing a serious threat in manufacture of juices, jam, pickles etc. In this study PCR based detection with

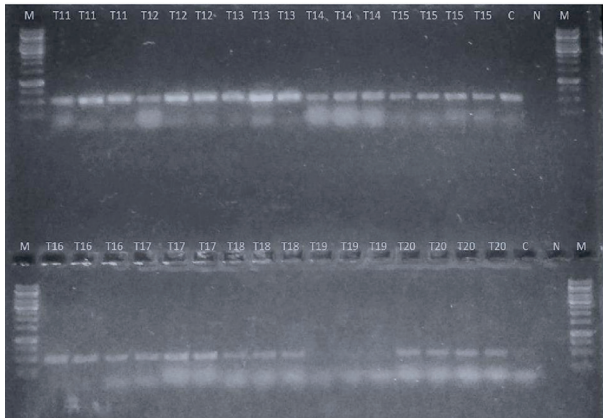


Fig. 3(b) Electrophoresis on 0.8% gel of DNA amplified with primer Las606/LSS. From left to right: M-Marker 1kb; extract from citrus infected with 16S rDNA (Lane 11-20); C- Positive control; N- Negative control.

primer Las606/LSS could be a great foundation for the preparation of disease free planting material as primer Las606/LSS shown to be highly potent than OI1/OI2c. Further studies must be carried out to eliminate the infection in citrus trees, identification of resistance loci for greening bacterium, management of vector *Diaphorina citri* for the management of the disease.



Plate 8. Collection of citrus greening infested leaf samples of Kinnow plants from horticulture based farming system model at Siwaya farm.

Project : Sustainable resource management for climate smart IFS (AICRP On-station, Modipuram Cente

Out of total IFS model area, highest area (53%) is being allocated to cropping system module followed by Horti-pasture (25%) and Agri-horti module (17%). Remaining 5% area is allocated for boundary plantation, livestock unit, vermicomposting etc.

Cropping system module (0.38 ha): Three cropping systems (CS) namely basmati rice-wheat + mustard/gram-green manure, *Sesbania* (seed)-chickpea-green gram and okra-cauliflower-babycorn + cowpea was planned under the module to meet the household demand of food, feed and to generate income for the family under changing climate, respectively. The results indicate that CS1 produced 308 kg basmati rice, 500 kg wheat, 37 kg mustard and 13 kg chickpea. The straw of rice was recycled

as mulch in cauliflower under okra-cauliflower-baby corn + cowpea system. Straw of wheat was fed to animals as dry straw. Green manuring with dhaincha was done before planting of basmati rice. Vegetable based system (CS2) produced 875 kg okra, 1625 kg cauliflower, 1114 kg baby corn and 335 kg vegetable cowpea during the reporting year. Stalks of okra, cauliflower, and cowpea were incorporated in-situ to increase soil fertility. Moreover, Stover of baby corn was fed to animals as green fodder. From CS3, 198 kg chickpea and 69 kg greengram was produced. Total 2874 kg of rice equivalent yield was recorded from cropping systems module. Total cost of cultivation, gross return and net return of cropping system module was Rs. 32684, Rs. 100595 and Rs. 69389, respectively. Among three tested cropping system, okra-cauliflower-babycorn + cowpea cropping system was found highest profitable followed by basmati rice-wheat + mustard/chickpea.

Horti-Pasture Module (0.18 ha): Three fodder crops namely sorghum, pearl millet and maize were evaluated during *kharif* 2018 in strips (300 m² each) of kinnow plantation. Kinnow recorded 849 kg of fruits from 0.18 ha (27416 kg/ha). Among fodder crops, pearl millet recorded higher fodder production (809 kg from 300 m²) followed by sorghum (486 kg from 300 m²) and maize (385 kg from 300 m²). It can be inferred that with the cultivation of pearl millet for fodder during *kharif* in 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 161 days (Table 19).

During the *rabi* season, fodder crops viz. mustard, berseem, lucerne, oat and rye (makhan) grass were grown under inter-row space of kinnow. Highest fodder yield was found in berseem followed by oat and ryegrass. It can be inferred that cultivation of berseem for fodder during *rabi* in 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 150 days. Total cost of cultivation of horti-pasture module was Rs. 7560/ha with net returns of Rs, 19,410/ha (Table 19).

Table 19. Performance of different fodder crops under Kinnow plantation.

Component	Yield(kg)	Yield under 1800 m ² (kg)	Fodder sufficient for number days*
Kinnow	-	652	-
<i>Kharif fodder</i>			(56 days)
Maize	385	2310	77
Sorghum	486	2916	97
Pearl millet	809	4854	161
<i>Rabi fodder</i>			(102 days)
Berseem	751	4506	150
Lucerne	582	3492	117
Ryegrass	670	4020	134
Oat	689	4134	137
Mustard	362	2172	72

* 30 kg green fodder/ day for 2 animals

Table 19. Economics of Horti-pasture module (0.18 ha).

Component	Cost(Rs)	Gross Returns(Rs)	Net Returns(Rs)
Kinnow	4245	19560	15315
<i>Kharif fodder</i>			
Maize	388	385	-
Sorghum	374	486	112
Pearl millet	337	809	472
<i>Rabi fodder</i>			
Berseem	523	1502	979
Lucerne	513	1164	651
Ryegrass	448	2010	1562
Oat	423	689	266
Mustard	309	362	53
Total	7,560	26,967	19,410

*Kinnow price: Rs. 30 kg⁻¹ Legume Fodder price: Rs. 2 kg⁻¹ Other Fodder price: Rs. 1 kg⁻¹

Dairy module (1B +1C): The dairy unit is having one buffalo (murrah) and one desi cow. A total of 3563 litre of milk was produced out of which buffalo produced 1991 litres while and cow produced 1572 litres. Total cost works out to Rs. 129225 with share of 56, 26, 10 and 8% on labour, concentrates, straw and green fodder, respectively. Total gross return and net returns from dairy unit was found to be Rs. 179089

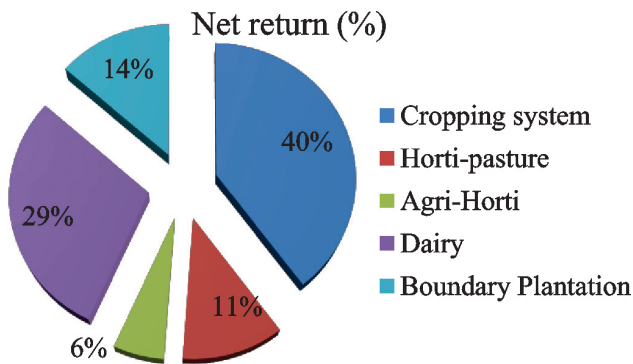


Fig. 4. Percentage share of different modules of IFS model in net return.

and Rs. 49864 respectively. Average daily dung production from dairy unit was found to be 44 kg which is equi 12.4 t/year.

Economics of IFS model: Among the different modules of IFS model, highest cost of cultivation, gross return was found under dairy module (Table 20). However, net return was found highest under cropping systems module. Benefit to cost ratio was found highest under boundary plantation due to low variable cost. With respect to net return cropping system contributed 40% followed by dairy module (29%) (Fig. 4).

Household Food Requirement: IFS model is producing sufficient amount of cereals, pulses, milk, vegetables and fruits to fulfill the household food requirement (Table 21). From this model after meeting family requirement sufficient marketable surplus is also available and by selling of these marketable surplus Rs. 2,66,889 can be generated as gross income.

Table 20. Cost of cultivation, returns and B:C ratio of IFS model.

Module	Variable Cost Rs.	Gross return Rs.	Net return Rs.	B:C ratio
Cropping system	32684	100595	69389	3.08
Horti-pasture	7560	26967	19410	3.57
Agri-Horti	3200	12780	9580	3.99
Dairy	129225	179089	49864	1.39
Boundary Plantation	3300	26440	23140	8.01
Total (All modules)	1,75,969	3,45,871	1,71,383	1.97

Table 21. Production of different components for household food requirement in IFS model.

Commodity	Net Production (kg/year)	Requirement (kg/year/family)*	Marketable Surplus (kg/year)	Gross income from marketable surplus (Rs.)
Cereals	808	584	224	4480
Pulses	280	116	164	7544
Edible oil	12.21	44	-	-
Milk	3563	438	3125	140625
Vegetables	4588	292	4296	85920
Fruits	1562	146	1416	28320
Total	-	-	-	2,66,889

Energy budgeting of cropping system module:

Highest energy input was reported under vegetable based cropping system followed by cereal based cropping system and least under legume based cropping systems. However, energy use efficiency was reported highest under legume based cropping system followed by cereal based cropping system and lowest under vegetable based cropping system. Overall energy use efficiency of cropping system module was found 6.21 (Table 22).

Recycling of waste: To build up fertility of soil residues of different crops were incorporated/added in the IFS model. During the reporting year total 10159 kg of crop residues and farm wastes were recycled within the system (Table 21). Through incorporation these farm wastes 76.87 kg N, 20.22 kg P₂O₅ and 72.07 kg K was added in the soil which is equivalent to 167 kg urea, 126 kg SSP and 120 kg MOP fertilizer.

Table 22. Energetics of cropping system module in IFS model.

Cropping system	Energy Input (MJ)	Energy Output (MJ)	Net Energy (MJ)	Energy use efficiency
Basmati rice-wheat + mustard/chickpea-GM (0.125 ha)				
Basmati rice	2007	15742	13735	7.84
Wheat + Mustard/ chickpea	1765	18805	17040	10.65
Okra-Cauliflower-Baby corn + Cowpea (0.125 ha)				
Okra	1997	4897	2900	2.45
Cauliflower	1945	5090	3145	2.62
Baby corn + Cowpea	1648	10559	8911	6.40
Dhaincha-Chickpea-Green gram (0.125 ha)				
Dhaincha	393	1625	1232	4.14
Chickpea	592	6848	6256	11.57
Green gram	583	4360	3778	7.48
Total CS module	10930	67926	56996	6.21

Table 23. Recycling of crop residue and farm wastes in IFS model.

Waste/Residue	Quantity(kg)	Nutrient content(%)			Nutrients added(kg)		
		N	P	K	N	P	K
Rice straw	896	0.87	0.06	1.18	7.80	0.54	10.57
Dhaincha	202	3.53	0.19	1.68	7.13	0.38	3.40
Cowpea	140	2.51	0.41	0.88	3.51	0.57	1.23
Okra	274	0.62	0.15	1.31	1.70	0.41	3.59
Cauliflower	379	1.32	0.21	1.24	5.00	0.80	4.70
Green gram	268	3.78	1.01	1.11	10.13	2.71	2.98
FYM	8000	0.52	0.18	0.57	41.60	14.40	45.60
Total	10159	—	—	—	76.87	20.22	72.07

Saving of fertilizers: Urea: 167 kg; SSP: 126 kg; MOP: 120 kg



Secondary Agriculture (Value addition): Protocol for production of karonda squash was evaluated during reporting period. The fully ripen fruits collected and washed with clean water. Karonda fruits were blanched in boiling water for 5 min. and made into pulp with the help of laboratory pulper/mixture grinder. Smooth pulps without seeds and skins were obtained by passing through 20mm ISI sieves. Recorded pulps initial TSS of (4.1%) and pulp yield of 75.1%. Sugar syrup of 70% was prepared and mixed with the fresh pulp followed by addition of colour, essence and preservatives (sodium benzoate @ 300 ppm) as per five different treatments. The final products was packed in PET bottles, labelled and stored in dark and cool place for at least three days before use. The final products were analyzed for TSS,

titratable acidity and organoleptic score. Among different treatments, the karonda squash treated with colour and essence with 50°Brix had recorded the maximum sensory score (8.1) with attractive colour, flavour and taste. Economic analysis of value addition to karonda indicates that additional income of Rs 0.22 lakhs can be obtained from boundary plantation by making karonda squash. The increase in net income due to value addition was found to be 2.47 times when 50 % of produces are made as karonda squash and 50 % sold as fresh fruits. If 100 % of produces are subjected to value addition in the form of karonda squash, the net income increases by 3.6 times over net income obtained by selling fresh karonda (Table 24).

Table 24. Economics of karonda squash preparation.

Inputs	Qty. for 10 L squash	Cost Rs Unit ⁻¹	Amount Rs 10 L ⁻¹ squash	Amount (Rs) for production as 50% karonda squash	Amount (Rs) for 100% production as karonda squash Cost
Karonda	5 kg	40 /kg	200	4120	8240
Sugar	7 kg	40/kg	280	2884	5768
Additives (colour, essence, KMS)	-	2/litres	20	412	824
Cost of fuel and labour	-	5/litres	50	1030	2060
Packaging and labelling	-	5/litres	50	1030	2060
Total cost	-	-	600	9476	18952
Income					
Final product	-	litres	10	206	412
Gross income by sale raw karonda	-	40/kg	200	8240	8240
Gross income by sale of karonda squash	-	100/litre	1000	20600 +4120 =24720	41200
Cost of cultivation	-	10/kg	50	2060	2060
Cost of value addition	-	-	600	9476	18952
Net income by sale of raw kinnow mandarin	-	-	150	6180	
Net income by sale of karonda squash	-	-	400	15244	22248
No. of times of improvement in net income due to value addition	-	-	-	2.47	3.60

Project: Influence of pesticides application in IFS on fisheries and quantification of GHGs emission

To understand the potential impacts of different pesticides/chemicals applied in IFS models and significance of pesticide residues a project was initiated in collaboration with AICRP-IFS centres having fisheries/aquaculture modules to delineate the pesticide usage in the IFS models. Pesticide/chemical usage in terms of active ingredients were quantified using a proforma generated keeping in mind the requirement to capture information related to different module of IFS systems. Based on the usage of active ingredient of pesticide/chemicals per unit area, the IFS models were classified into low, medium and high pesticide using systems as compared to national average. Database of pesticide usage and

quantification of active ingredients in 11 IFS models viz. Karmana (4 models), Jorhat, Bhubaneswar, Kalyani, Modipuram, Ludhiana, Hisar, Rajendra Nagar were analysed during the preceding year. Results revealed pesticide use in terms of a.i. per ha varied in the range of 0.001 to 2.34 Kg a.i. ha⁻¹. IFS models were categorized into low (less than 0.2 Kg a.i. ha⁻¹), Medium (between 0.2 to 0.4 Kg a.i. ha⁻¹) and High (above 0.4 Kg a.i. ha⁻¹). Three IFS models from Karmana centre categorised into low pesticide using IFS (Fig. 5), while IFS model at Jorhat and banana based IFS model of Karmana were found medium pesticide consuming models (Fig.6). However, the IFS models of Bhubaneswar, Kalyani, Modipuram, Ludhiana, Hisar, Rajendra Nagar were found high pesticide using IFS models, highest being used in Rajendra Nagar (Fig. 7)

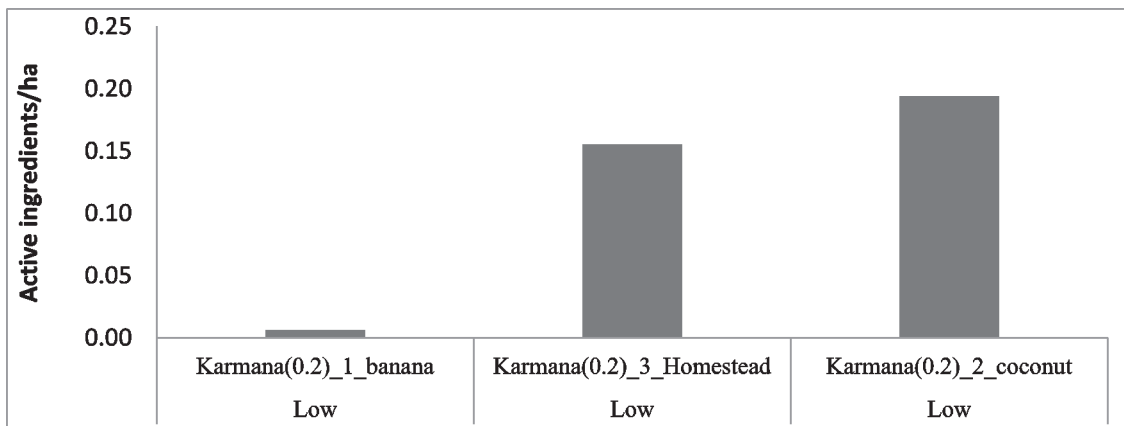


Fig 5. Low Pesticide Use IFS Models.

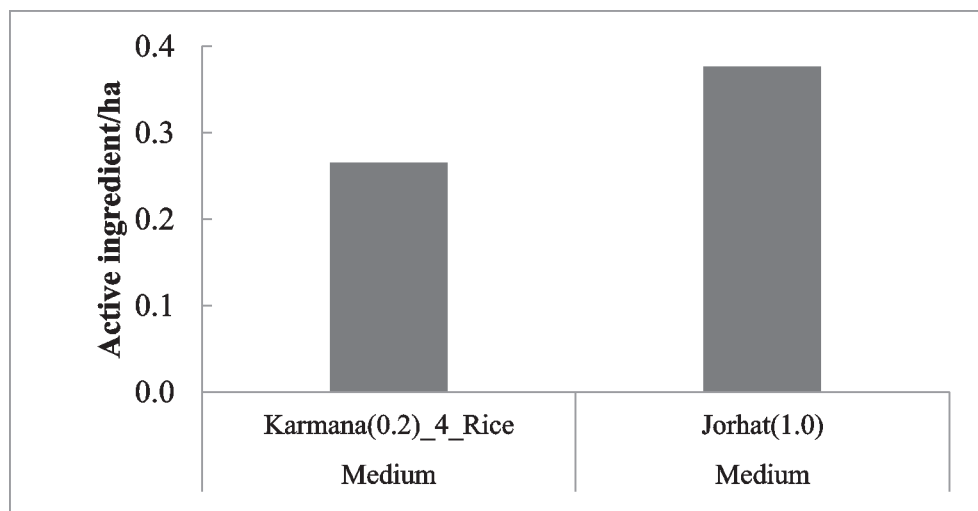


Fig 6. Medium pesticide Use IFS Models

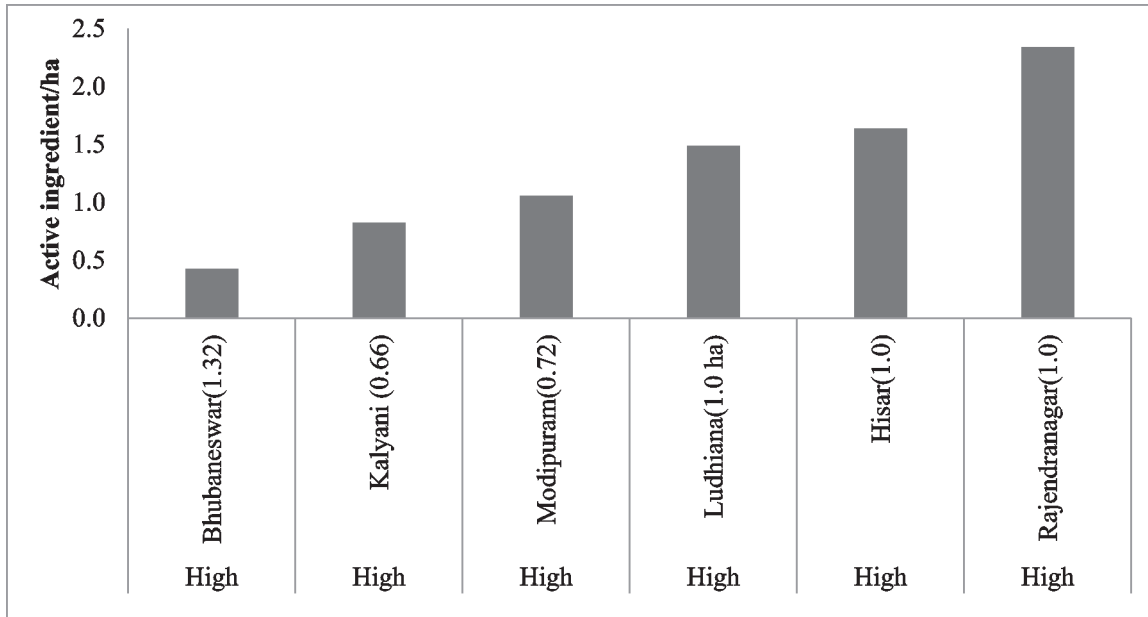


Fig 7. High Pesticide Use IFS Models

Further analysis of contribution of different chemicals/pesticides contributing to the overall usage of chemicals in the Rajendra Nagar IFS model falling under Southern Plateau and Hills revealed maximum contribution by Carbendazium (26%) followed by Acephate (19%) (Fig. 8).

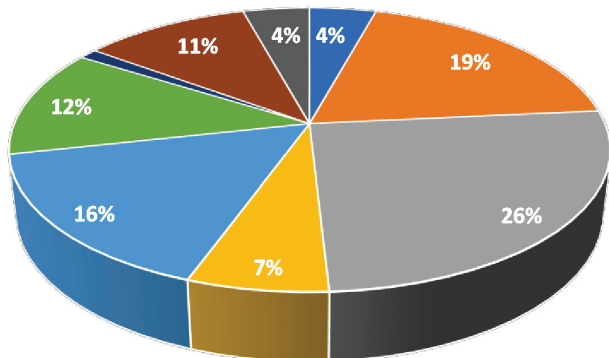


Fig. 8. Percentage contribution of different chemicals/pesticides at IFS model of Rajendra Nagar

Analysis of fish sample, sediment, water completed for 4 IFS models of Karmana for organochlorines, organophosphorous and synthetic pyrethroids & herbicides which revealed most of the samples showed no presence of pesticides (below quantifiable level) except one fish sample in coconut

based IFS which contained Quinalphos @0.05 ppm which could be due to aerial drift of the chemical from neighbouring field.

Project : Carbon crediting and Greenhouse gases emission in integrated farming system models under AICRP on Integrated Farming Systems

Using the tool IIFSR-AICRP-IFS-IFS-GHG estimator (developed by ICAR-IIFSR following the emission coefficient of IPCC, 2007), estimated the emission from 27 IFS models out of 45 IFS models developed. 23 IFS models offers scope for more intensification as net emission is negative. (Fig 9a & 9b). In general the livestock component contributed more than 60-70% % GHG emission followed by cropping system 20-30 %. The source-sink relationship of net GHG in terms of CO₂-e(kg) is concerned the agro-forestry , compost and biomass incorporation in the IFS model for maximum carbon sink. In many IFS Model, the net negative carbon emission indicate the inclusion of high value cash crop or other economically viable enterprises for making the IFS model more profitable.

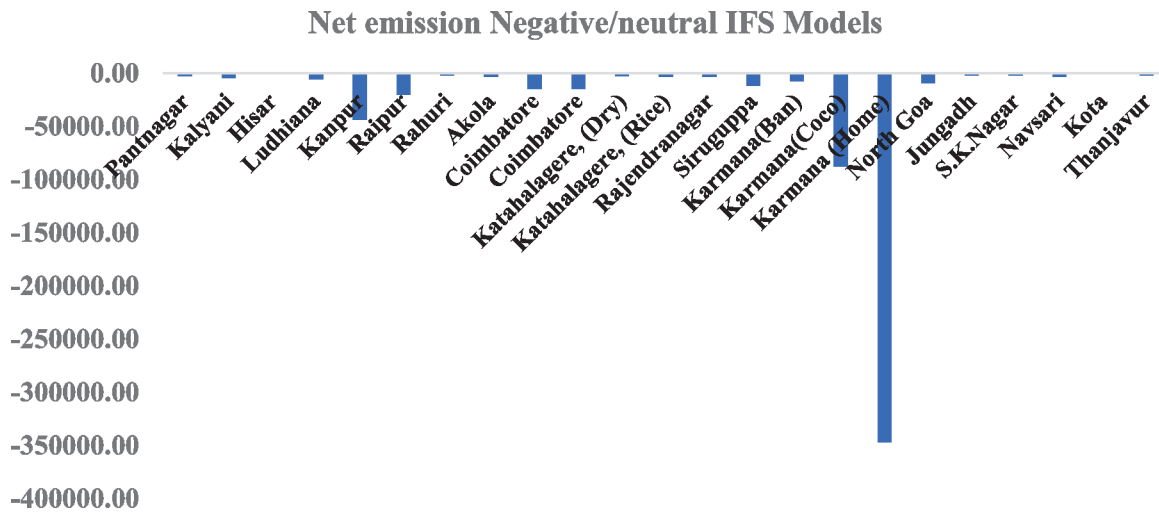


Fig 9(a). Net GHG emission (kgCO₂ eq.) from IFS models at different locations

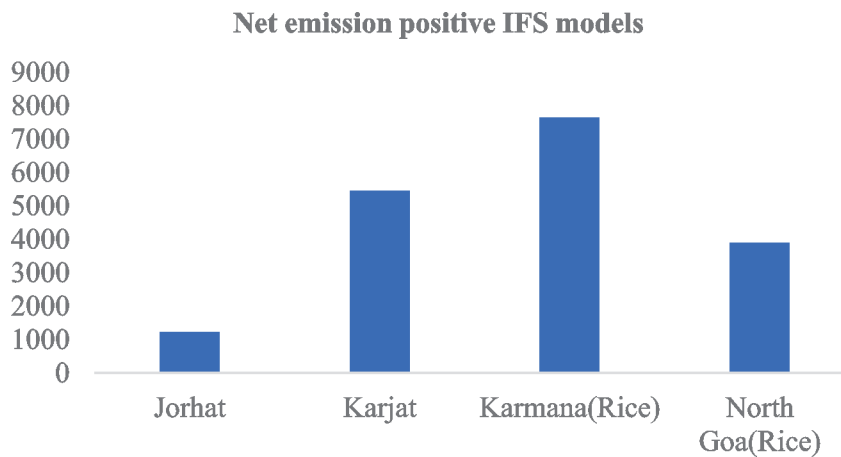


Fig 9(b). Net GHG emission (kgCO₂ eq.) from IFS models at different locations

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

This project was initiated to identify the features of neural networks in order to obtain predictions of mango yield per hectare in western plain zone of India, which will enable end users (agricultural and other inter-ested parties) to make predictions of mango yield per hectare based on input parameters. The neural network (Back-propagation) algorithm will be used to create a network that can contain three layers of neurons: an input layer, a hidden layer (which is optional), and an output layer (Fig 10).

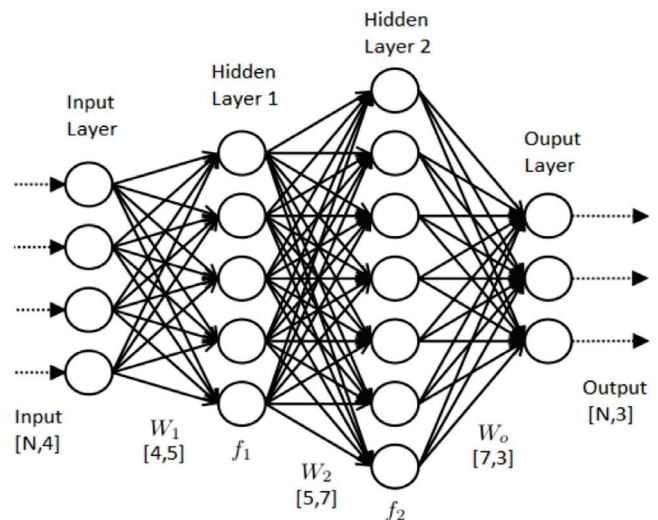


Fig10. ANN methodological framework



Theme II

Organic Agriculture Systems

Project: Status of Organic Agriculture in Western Himalayan Region

A base line survey was undertaken to know the existing farming practices of the farmers of Jammu area of Sambha District. Survey covered involving 120 farmers from 06 villages and data pertaining to input output details and other socio-economic characteristics of farm households were collected. Random sampling technique has been used for collecting the data. The result of the baseline survey showed that out of 120 average farm size for marginal, small, medium and large were 0.14 ha, 0.57 ha, 1.37 ha and 3.44 ha, respectively. Again, average family

size for landless, marginal, small, medium and large were 6.3, 4.9, 5.6, 6.5 and 4 numbers, respectively.

Among the six farming systems, the highest number of farms were under Crop+Livestock+Poultry+Agro forestry (C-L-P-A), followed by Crop+Livestock+Poultry (C-L-P) system Crop+Livestock+homestead (C-L-H), Crop +Vegetables (C-V), Crops + Horticulture (C-H) and Vegetable+Vegetable+Vegetable (V-V-V). On the other hand, average farm size was the highest under Crop+Livestock+Poultry+Agro forestry (C-L-P-A) system and lowest under Crop+Poultry systems (Table 1). About 73 percent of lands were used under high yielding variety crop whereas only 27 percent land

Table 1. Major farming systems of the sample farmers of Sambha district, 2019

Major Farming Systems	Number of households	Share (%)
Crop +Livestock+Poultry (C-L-P)	13	10.83
Crop+ Livestock +Poultry+Agro forestry (C-L-P-A)	67	55.83
Crop+Livestock+homestead (C-L-H)	16	13.33
Crop+Vegetables (C-V)	9	7.50
Crops+Horticulture (C-H)	8	6.67
Vegetable+Vegetable+Vegetable (V-V-V)	7	5.83
Total	120	100.00

Table 2. Cost of cultivation (COC) and return of major existing cropping systems at Sambha district during 2019-2020

Cropping System	Total COC (Rs. ha. ⁻¹)	Gross Return (Rs. ha. ⁻¹)	Net Return (Rs. ha. ⁻¹)	BCR
Rice-Wheat	112550	201500	88950	1.7903
Maize-Potato-Wheat	132120	235500	103380	1.7825
Rice-Pulses-wheat	121500	219500	98000	1.8066
Rice- Maize-Vegetable	135256	255600	120344	1.8897
Pulse-Mustard-Wheat	98100	199200	101100	2.0306

use under local variety. There were 5 major cropping patterns followed by the farmers (Table 2). Net return was observed highest in Rice-maize-vegetable cultivation (Rs.120344 ha⁻¹) followed by Rice-Pulses-Wheat (Rs. 98000 ha⁻¹), Rice-Wheat (Rs.88950 ha⁻¹), Maize-Potato-Wheat (Rs.103380 ha⁻¹) and Pulse-Mustard-Wheat (Rs.101100 ha⁻¹). Income was categorized by crop, livestock, poultry, homestead, agro forestry, off-farm and non-farm system. In case of marginal farm and semi medium farm, non-farm income was higher compared to on-farm income. Contrary, in case of small, medium and large farmers, on-farm income was higher compared to non-farm income. Farming constraints that were identified include lack of knowledge about new crop variety and technology was the main problems of the farmers followed by high price of inputs, lack of knowledge for quality seeds/fingerlings/duck links, lack of credit facility, lack of knowledge about homestead vegetables production, lack of knowledge about vaccination, de worming, feed of livestock and poultry, insect/pests/weeds and lack of money for buying inputs.

Poverty situation of the sample households: The food security index for integrated farm households was 1.1. The value of this index for food secure households was 1.4 for integrated farming, whereas for food insecure households, it was 0.9 respectively. The integrated farm households in the study areas could be regarded as food secure given the fact that 89.0 percent integrated farms of the sample households were able to meet the required calorie intake of 2,122 kcal capita⁻¹ day⁻¹ while 11.0 percent as food insecure households, respectively .

Constraint facing index (CFI): The computed CFI of the 12 constraints ranged from 208 to 240 for integrated farming. Majority of the farmers mentioned that low price of outputs, non-availability and high price of HYV seed and scarcity of concentrate feed and fodder are the serious problems in the study areas

and the computed value of CFI was 240, 231 and 227 for integrated farming. The extent of high price of fertilizers and pesticides and non-availability and high price of irrigation are also more remarkable problems for the integrated farming. Due to lack of education and training facilities, farmers were using traditional method of cultivation and getting lower yield. The high price of irrigation was another problem of cultivating different crops. This problem arises mainly due to high price of electricity. Non-farm employment opportunity has been created to a large extent and labourers in the study areas migrated from agriculture farming to non-farm activities for higher income. Therefore, the scarcity of labour along with their higher wage rate is found to a large extent in to integrated farming in different cropping seasons that ultimately hamper the whole process of cultivation. To prevent certain diseases and to run livestock and poultry production smoothly, farmers required medicine and vaccine timely.

Project: Crop improvement for organic production system

This project was started to screen out different crop varieties for organic production system. Nine early maturing varieties of sugarcane were evaluated under organic condition. The CoPk 05191 variety of sugarcane recorded highest cane yield (108.57 t ha⁻¹) followed by CoLk 013201 (103.17 t ha⁻¹) and CoSe 03234 (101.64 t ha⁻¹), respectively. While, the green top yield was highest for CoLk 013201 variety (27.72t ha⁻¹) followed by CoSe 03234 and CoPk 05191 varieties. (Table 3). However, brix per cent was recorded highest in case of Co0118 (20.33) variety thereafter in Co 0238 (19.48). The variety like CoPk 05191 stood first place in the number of millable canes (126.58 thousand ha⁻¹), which is the most important part in cane yield productivity. Thus, varieties like CoPk 05191, CoLk 013201 and CoSe 03234 can be grown suitably under organic conditions of Western Uttar Pradesh.



Table 3. Comparative performance of early maturing varieties of sugarcane under organic conditions

Variety	NMC'000'/ha	Single cane weight (kg)	Brix % (300 days)	Cane yield (t ha ⁻¹)	Green leaves top yield (t ha ⁻¹)
Co 0238	82.23	1.06	19.48	78.54	15.70
CoSe 03234	121.04	1.07	18.51	101.64	26.48
UP 05125	94.24	0.93	19.24	66.23	17.39
Cos 03251	117.81	0.92	18.75	97.78	23.86
Co 098014	86.39	0.77	18.28	72.68	10.39
Co 0118	96.09	1.05	20.33	82.38	21.86
CoLK 011201	86.85	0.76	18.25	69.30	17.86
CoLk 013201	124.27	0.84	18.97	103.17	27.72
CoPk 05191	126.58	0.92	18.59	108.57	23.70
C.D.	21.19	0.16	NS	19.67	5.86
C.V.	8.21	9.64	2.29	11.37	12.89

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

Nutrient management using mustard oil cake in basmati rice-mustard-okra cropping system:

An experiment was conducted to assess the effect of mustard oilcake application on growth, productivity

and economics of basmati rice (cv. PB 1509) during *kharif* 2019 (Plate 1). The treatments include *i.* 5.0 t ha⁻¹ mustard oilcake (MC), *ii.* 2.5 t ha⁻¹MC, *iii.* 1.25 t ha⁻¹MC, *iv.* Nutrient management through FYM and vermi-compost and *v.* Inorganic nutrient management. Experiment was laid out in randomized complete block design with three replications. Standard package and practices were followed for the cultivation of basmati rice.

Table 4. Effect of mustard oil cake application on productivity and profitability of basmati rice

Treatments	Grain kg ha ⁻¹	Biological yield(kg ha ⁻¹)	Cost of cultivation yield Rs ha ⁻¹	Gross return* Rs ha ⁻¹	Net Return Rs ha ⁻¹	B:C ratio
5.0 t/ha MC (kharif) + 5.0 t/ha MC (rabi)	4658	15655	115174	165118	49944	1.43
2.5 t/ha MC (kharif) + FYM & VC (rabi)	3177	11800	77506	114043	36537	1.47
1.25 t/ha MC (kharif) + FYM	2551	9874	64240	92061	27821	1.43
FYM & VC (kharif) + 5.0 t/ha MC (rabi)	1821	7961	50074	66847	16773	1.33
Inorganic	2964	12288	41168	86395	45227	2.10

Selling price of basmati rice was Rs. 2600 quintal⁻¹

* 25% perimum price was used for organic treatments

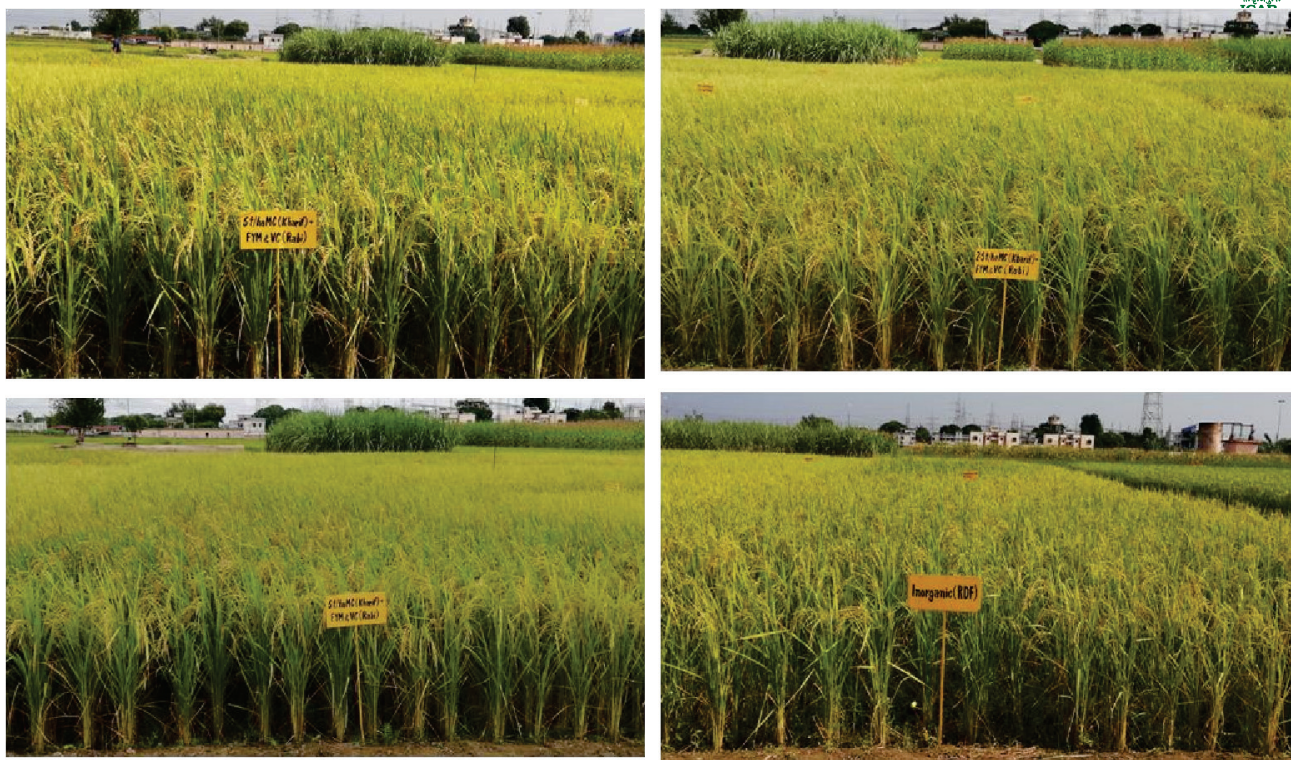


Plate 1 Experimental view of basmati rice field

Growth, yield parameters and yield of basmati rice were significantly affected under different treatments (Table 4). Grain yield (4658 kg ha^{-1}) and straw yield (10997 kg ha^{-1}) were found higher under application of 5.0 t/ha MC followed by 2.5 t/ha MC . Grain yield under application of $2.5 \text{ t ha}^{-1} \text{ MC}$, $1.25 \text{ t ha}^{-1} \text{ MC}$, FYM & vermi-compost and inorganic management was lowered by 31.8%, 45.2%, 60.9% and 36.4% as compared to application of $5.0 \text{ t ha}^{-1} \text{ MC}$, respectively. Application of mustard oilcake considerably increased cost of cultivation and was highest (Rs. 1,15,174 ha^{-1}) under $5.0 \text{ t ha}^{-1} \text{ MC}$ treatment. Moreover, highest net return (Rs. 49,944 ha^{-1}) was found under application of 5.0 t/ha MC followed by inorganic management (Rs. 45,227 ha^{-1}) and least under nutrient management through FYM and vermi-compost application (Rs. 16,773 ha^{-1}). This study indicates that concentrated organic manures can be integral part of nutrient management under organic farming to meet out crop nutrient demand and to achieve better productivity and profitability.

Performance of Sugarcane: Sugarcane plants raised with bud chip method were transplanted in the main field. Different nutrient management treatments

significantly affected the growth and survival rate of transplanted plants. Sugarcane + sesbania cultivation significantly reduced the survival rate and growth of the sugarcane (Table 5). Plant height at different stage and cane height at 120 DAP was found highest under application 100% RDN through MC, FYM and vermicompost w/o sesbania intercropping. Similarly, number of tillers / plants were also reduced significantly with sesbania intercropping. SPAD meter reading at 45 DA was found higher under application 100% RDN through MC, FYM and vermicompost w/o sesbania intercropping followed by 75% RDN through MC, FYM and vermicompost w/o sesbania intercropping.

Performance of Basmati rice: Among different organic nutrient management treatments, highest plant height and number of tillers in basmati rice was found in 100% RDN through MC, FYM and VC with sesbania green manuring treatment followed by 75% RDN through MC, FYM and VC with sesbania green manuring (Table 6). Similarly, SPAD meter reading, Green seeker readings, grain yield and straw yields were also found highest under 100% RDN through MC, FYM and VC with sesbania green manuring.



Table 5. Survival rate and plant height of sugarcane crop under different nutrient management

Treatment	Survival rate (%) (45 DAP)	Plant height (cm)				Cane height (cm) 120 DAP
		45 DAP	60 DAP	90 DAP	120 DAP	
100% RDN with CR (T1)	95	91.4	127.8	189.1	250.4	115.0
75% RDN with CR (T2)	91	87.2	117.6	182.4	244.3	107.8
100% RDN w/o CR (T3)	99	113.7	148.4	222.8	283.5	131.2
75% RDN w/o CR (T4)	98	112.3	144.7	220.5	281.1	126.8
50% RDN in kharif+ 100% RDN in rabi with CR (T6)	94	92.9	124.1	197.1	257.7	109.4
Inorganic	99	109.4	140.5	214.9	270.4	121.5
CD (P=0.05)	3.22	11.65	21.65	24.21	19.71	5.94

Table 6. Growth and yield of basmati rice as affected by different treatments

Treatment	Plant height (cm)		No. of tillers m.r.l ⁻¹		SPAD meter reading at 60 DAT	Green seeker reading at 60 DAT	Grain yield (kg ha ⁻¹)	Straw Yield (kg ha ⁻¹)
	60 DAT	At harvest	60 DAT	At harvest				
100% RDN with CR	86.0	84.9	54.0	48.4	31.4	0.74	3122	5236
75% RDN with CR	80.7	80.9	49.5	44.7	30.4	0.72	2880	4598
100% RDN w/o CR	78.4	80.4	48.8	43.9	30.3	0.69	2411	4112
75% RDN w/o CR	77.1	78.1	45.0	37.7	28.8	0.66	2091	3767
50% RDN in kharif+ 100% RDN in rabi with CR	78.2	78.5	46.8	39.9	29.9	0.71	2332	4200
Inorganic	89.0	96.0	58.4	52.4	37.1	0.82	3960	6797

Performance of maize: Among the different organic nutrient management treatments, highest plant height, SPAD meter reading, Green seeker reading and cob yield was found under application of 100% RDN through MC, FYM and VC with incorporation of

green gram residue. Incorporation of green gram crop residue before sowing of maize crop increased the productivity by 39% over no incorporation (Table 7).

Table 7. Growth and productivity of maize under different nutrient management

Treatment	Plant height (cm)		SPAD meter reading		Green seeker reading		Cob yield (kg ha ⁻¹)
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	
100% RDN with CR (T1)	80.1	218.1	36.1	38.1	0.73	0.89	5249
75% RDN with CR (T2)	74.3	216.6	32.3	36.1	0.69	0.88	4612
100% RDN w/o CR (T3)	69.7	204.2	32.6	36.5	0.68	0.88	3780
75% RDN w/o CR (T4)	67.1	199.1	31.9	33.5	0.64	0.86	3308
50% RDN in kharif+ 100% RDN in rabi with CR (T6)	71.6	204.7	32.8	35.0	0.70	0.87	3962
Inorganic	81.5	222.1	36.9	39.9	0.71	0.90	7448
CV (%)	7.12	2.66	5.26	2.33	3.14	1.30	
SEm±	3.05	3.24	1.03	0.49	0.013	0.007	
CD (P=0.05)	9.72	10.33	3.27	1.57	0.040	0.021	

**Plate 2.** Isolation of different active microorganisms for crop residue decompositions

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

Development and validation of microbial consortia for crop residue decomposition is very important for inclusion in Integrated Farming Systems. It is essentially required for improving soil, human and animal health and as well as farm income towards the climate resilient agriculture. During the year, a total of 25 fungal isolates (Plate 2) have been isolated from different samples taken from mustard oil cake, compost pit, decaying bark, rhizosphere of pipal tree, vermicompost, sugar mill effluent and fungal growth observed on fruit peels. Further study on characterization of isolated microbial strains is under progress.

Project: All India Network Programme on Organic Farming (AI-NPOF), Modipuram Centre

Impact of organic, conventional and integrated management practices on crop productivity and soil health: This experiment is continued since 2004 as a part of on-going Network Project on Organic Farming (NPOF) under four different cropping systems i.e. basmati rice-durum wheat-green manuring (CS₁), Maize (cob)-potato-okra+green manuring (CS₂), coarse rice-barley-green gram (CS₃) and maize (sweet corn)-mustard-green manuring (CS₄) with six different nutrient management practices viz. T1-100% organic, T2- 75% organic + 25% innovative practices (introduced in 2013), T3-50% organic+50% Inorganic, T4-75% inorganic + 25

organic (introduced in 2013), T5- 100% inorganic and T6-State recommendation. Soil samples from 4 different depths at 15 cm intervals i.e. 0-15, 15-30, 30-45 and 45-60 cm were collected after completion of 12 cropping cycles under organic management practices. These soils samples were analyzed for various soil physico-chemical properties and carbon pools. The results indicated that the cropping systems and organic nutrient management practices showed significant effect on different organic carbon pools. The total soil organic carbon (TSOC) and Walkley Black Carbon (WBC) showed highest build-up in 100% organically managed treatment over the others across the soils depths (0-60 cm) in all the cropping systems. Concurrently the magnitude of increase for TSOC and WBC among the different cropping systems was 33.8% in 100% organic treatment as compared to 100% inorganic treatment in CS₁, 32.6% and 27.9% in CS₂, 46.2% and 30.0% in CS₃ and 21.4% and 32.8% in CS₄ (Table 8). The various carbon

fractions of different oxidizability were grouped into four fractions i.e. very labile (C_{VL}), labile (C_L), less labile (C_{LL}) and non-labile (C_{NL}) were also performed. In all the treatments under all the cropping systems comparatively the higher proportion of all the soil oxidizable carbon fractions were found in organically managed treatments over the farmer's practices.

On an average, the relative preponderance of the organic carbon fractions extracted under different degree of oxidizability was: C_{NL}>C_L>C_{VL}>C_{LL} in all the four cropping systems (Table 8). The labile fractions and recalcitrant fractions constituted about ~40.4 and 62% of the total SOC. The magnitude of SOC distribution across the soil depths (0-60 cm) varied significantly in cropping systems and CS₁ (Basmati rice-wheat sesbania green manure) recorded highest carbon sequestration over the others. Soil enzyme activity is a sensitive indicator of alteration

Table 8 . Effect of different nutrient management practices and cropping systems on different carbon pools across the soil depths (0-60 cm)

Carbon Pools (%)	CS ₁			CS ₂			CS ₃			CS ₄		
	T ₁	T ₃	T ₅	T ₁	T ₃	T ₅	T ₁	T ₃	T ₅	T ₁	T ₃	T ₅
C _{VL}	0.843	0.760	0.666	0.753	0.753	0.679	0.722	0.693	0.584	0.698	0.599	0.561
C _L	0.460	0.499	0.429	0.542	0.542	0.497	0.578	0.490	0.482	0.597	0.508	0.481
C _{LL}	0.788	0.643	0.625	0.825	0.805	0.576	0.816	0.767	0.673	0.846	0.838	0.719
C _{NL}	1.124	0.930	0.690	1.048	0.977	0.652	1.026	0.885	0.614	0.988	0.856	0.596
WBC	2.092	1.902	1.720	2.120	2.101	1.752	2.116	1.951	1.739	2.142	1.946	1.761
TOC	3.216	2.832	2.409	3.168	3.078	2.404	3.142	2.836	2.352	3.130	2.802	2.357

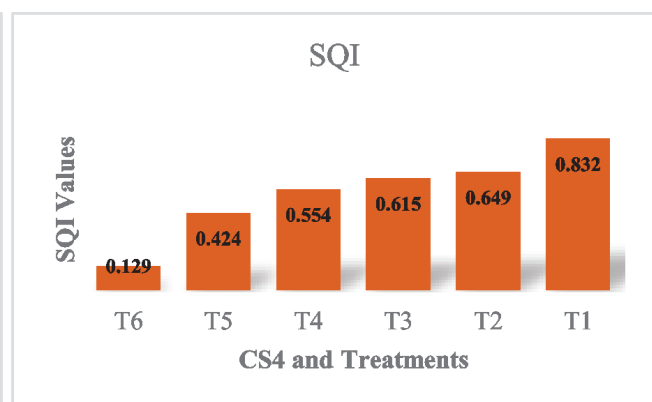
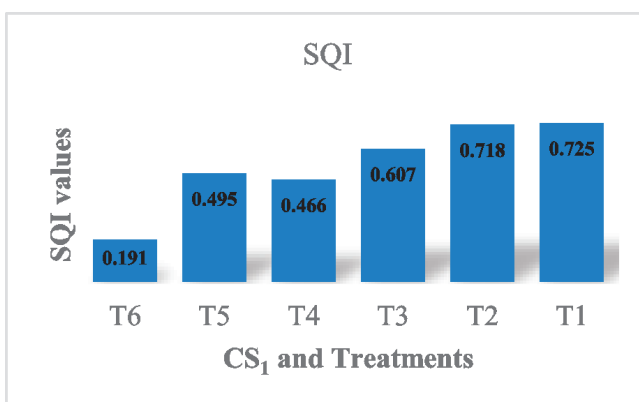


Fig. 1: Soil quality indices as affected by different cropping systems and nutrient management practices

in soil quality by management practices. Acid and alkaline phosphomonoesterases studied showed higher activity in organic and chemical nutrient management practices whereas under integrated application of both organic and inorganic nutrient sources, the activity of these enzymes was low. The reason behind such enhanced activities under organic nutrition may be attributed to higher microbial activity in case of acid phosphatases.

Soil quality indices using specific chemical, physical and biological soil properties over defined time frame were also developed and the impact of different quality parameters on soil quality and crop performance were recorded. Results of the study revealed soil quality indices (SQI) ranged from 0.19 (farmers practice) to 0.725 (100% organic) and 0.129 (farmers practice) to 0.832 (100% organic) in CS₁ and CS₄, respectively.

Incorporation of organic manures in 100% organically managed treatments had a significant effect on SQI in all the four cropping systems (Fig.1). In the present study from the view point of soil quality indices the trend was: CS₁>CS₂>CS₄>CS₃. This showed that these key indicators have a considerable

role to play in influencing various soil functions and in turn the functional goals.

Microbial enzyme activities: Different nutrient management practices significantly affected the microbial activities in the soil. The highest microbial biomass was found under the 100% organically managed plots. The addition of organic inputs to the soil favored the microbial activities into the soil as dehydrogenase, phosphatase, urease and α -glucosidase activities were found highest in 100% organically managed plots. Maximum population of bacteria, fungi and actinomycetes was observed in 100% organically managed plants. A continuous decrease in the population was observed with increasing percentage of inorganic inputs.

Evaluation of zero budget farming in basmati rice –wheat cropping system: A study was initiated in year 2017 to study the effect of zero budget farming on productivity and economics of basmati rice. Yield of basmati rice was reduced by 23.4% during first year and 66.2% during second year under Zero budget farming as compared to scientific organic farming package (Table 9). However, yield gap between Scientific organic farming package and Integrated

Table 9. Effect of different nutrient management packages on yield attributes of basmati rice cultivation

Treatments	Grain yield (kg ha ⁻¹)		% changeover NPOF		% changeover ICM		COC (Rs. ha ⁻¹)	Gross Return (Rs. ha ⁻¹)	Net Return (Rs. ha ⁻¹)
	2018	2019	2018	2019	2018	2019			
Control	2303	732	-25.8	-70.5	-39.6	-73.6	37,830	27291	-10539
NPOF package	3104	2481	-	-	-18.6	-10.5	57,330	89248	31918
ZBNF-G	2377	838	-23.4	-66.2	-37.7	-69.8	42,765	30865	-11900
ZBNF-GC	2452	869	-21.0	-65.0	-35.7	-68.7	42,765	31927	-10839
ZBNF-IG	2601	1230	-16.2	-50.4	-31.8	-55.6	43,165	45308	2143
ICM	3813	2772	22.8	11.7	-	-	49,286	81940	32654
CV (%)	6.52	8.46							
SEm±	90.47	62.90							
CD (P=0.05)	275.2	191.3							

*Selling price of Basmati rice Rs. 2600/qt

**25% premium price for organic basmati rice

crop management was reduced from 18.6% during first year to 10.5% during second year. Better net return was found under scientific organic farming package with premium prices.

Performance of scientific organic farming package, zero budget natural farming (ZBNF) and integrated crop management practices were evaluated

in wheat (Plate 3). Highest grain yield and profit was recorded under integrated crop management followed by scientific organic farming package. Yield under ZBNF was reduced by 44.1% and 68.8% as compared to scientific organic farming package and integrated crop management, respectively (Table 10).



Plate 3. Visit of Dr. Panjab Singh (Former DG, ICAR) at ZBNF experiment

Table 10. Productivity and profitability of Wheat under Zero budget natural farming

Treatment	Grain yield (kg/ha)		Yield changes over NPOF (%)		Yield changes over ICM (%)		COC (Rs. ha ⁻¹)	Gross return (Rs. ha ⁻¹)	Net return (Rs. ha ⁻¹)
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19			
Control	2193	1283	-12.7	-45.3	-59.4	-69.5	24400	40120	15720
NPOF	2513	2347	-	-	-53.5	-44.2	43900	69684	25784
ZBNF-G	2662	1313	5.9	-44.1	-50.8	-68.8	29335	40781	11446
ZBNF-GC	2456	1411	-2.3	-39.9	-54.6	-66.4	29335	42118	12783
ZBNF-IG	2760	1557	9.8	-33.7	-49.0	-63.0	29735	46024	16289
ICM	5408	4205	115.2	79.2	-	-	35856	107271	71415
CV (%)	8.29	13.4							
SEm±	124	135.7							
CD (P=0.05)	377	412.7							

*Selling price of Wheat Rs. 1840/qt

**25% premium price for organic wheat

The highest amount of glomalin ($546.36 \pm 9.0 \text{ mg kg}^{-1}$ dry soil) was extracted from the plots managed by NPOF package after the wheat harvest (2019) followed by integrated nutrient management practice ($431.2 \pm 7.3 \text{ mg kg}^{-1}$ dry soil). The lowest amount of glomalin ($340.9 \pm 12.5 \text{ mg kg}^{-1}$ dry soil) was extracted from control plots. Different microbial enzymes namely phosphatase, glucosidase, urease etc plays significant role in nutrient recycling into the soil. In this study, highest activity of dehydrogenase, phosphatase, α -glucosidase and urease activities were found under NPOF package followed by the integrated nutrient management.

Evaluation of weed management practices in Maize-mustard system under organic farming:

Field experiment was carried out during Rabi 2017-18 and 2018-19 to evaluate the effect of different weed management practices on weed density, productivity and profitability of mustard under organic farming. Eight different weed management treatments were followed i.e. T1. Two hand weeding at 25 and 50 days after sowing (DAS), T2. One mechanical weeding at 25 days after sowing+ One Hand weeding at 50 DAS, T3. Intercropping with Chickpea (1:1), T4. Stale seed

bed + reduced spacing ($30 \times 10 \text{ cm}$) + mulching with maize straw + one Hand weeding at 40 DAS, T5. Mulching with water hyacinth @ 4 t ha^{-1} dwb + one hand pulling at 40 DAS, T6. Incorporation of mustard oilcake @ 5 t ha^{-1} + one hand weeding at 40 DAS, T7. Soil solarization with 25 microns polythene mulch during summer + one hand weeding at 40 DAS, T8. Mulching with Eucalyptus leaves @ 5 t/ha dwb + one hand weeding at 40 DAS.

Among the different treatments, lowest weed density at 20 (96 m^{-2}) and 45 DAS (150 m^{-2}) was found under Soil solarization with 25μ polythene mulch during summer + one hand weeding at 40 DAS. *Cyperus rotundus* was most abundant weed species during experimentation. Highest seed yield of mustard (3592 kg ha^{-1}) and stover yield (11874 kg ha^{-1}) was recorded under treatment application of mustard oilcake @ 5 t/ha + one hand weeding at 40 DAS and it was followed by the treatment intercropping with chickpea (1:1) (2447 kg ha^{-1}) (Fig. 2). Application of mustard seed meal might have contributed in better crop nutrition over weed and led to better yield attributes and yield (Plate 4).

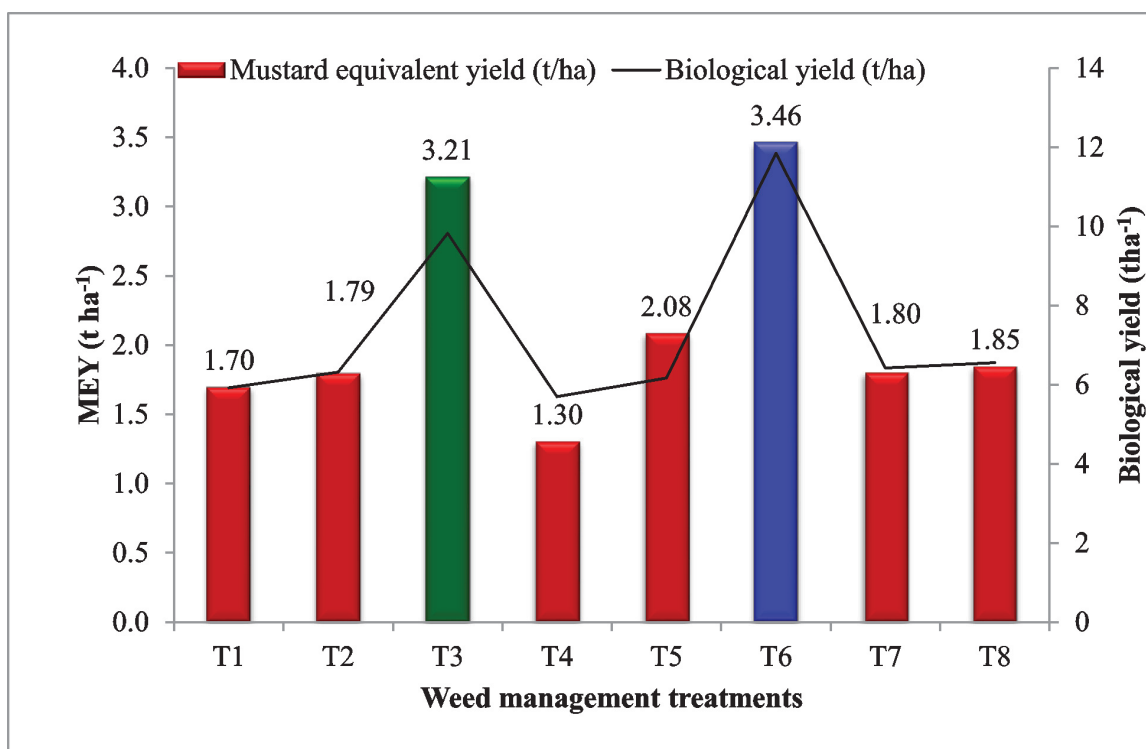


Fig. 2. Productivity of mustard under different weed management practices



Plate 4. Performance of Mustard under different weed management practices

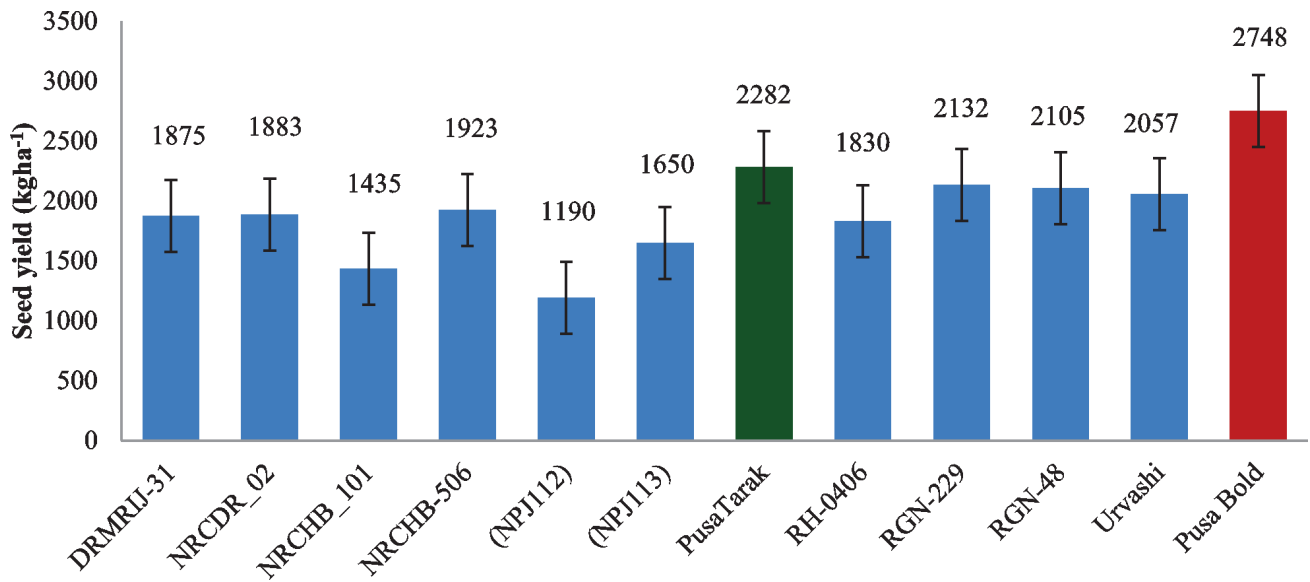


Fig.3. Performance of Mustard varieties under organic farming

Evaluation of different varieties of major crops for organic farming: Performance of different varieties of maize and mustard under organic production was evaluated. Among the different varieties of maize, highest seed yield was found under PMH 5 followed by H (Pioneer-3396). Similarly highest gross return and net return was found under PMH 5 (Fig.3). Among the different varieties of

mustard, growth, yield attributes, yield and profitability was found highest in Pusa bold followed Pusa tarak variety under organic management. Therefore these varieties can be recommended for cultivation under organic farming in Upper Indo-Gangetic Plains.

Project: Development of Integrated Organic Farming System (IOFS) models for different regions of India (Institute-AI-NPOF linked)

The project aims to utilize the concept of low external input based sustainable agriculture for reducing the input costs as well as improving the quality of inputs applied in the organic farming. As an Inter-Institutional project involving 7 centres of All India Network Programme on Organic Farming and at Institute headquarters, the integrated organic farming system models are being established to study the rate of reducing external market inputs by various means. The performance of the different modules evaluated at Modipuram location is given below.

Integrated Organic Farming System (IOFS) model for Western Plain Zone of U.P.

One acre IOFS model comprising of 5 modules such as food systems (basmati rice-durum wheat-sesbania in 0.15 ha, basmati rice-mustard-green gram in 0.05 ha), fodder systems (sorghum + cowpea-maize+cowpea-oat in 0.05 ha and maize + cowpea-sorghum + cowpea-berseem in 0.05 ha), kitchen system in 0.040 ha, pest repellent system in 0.024 ha and dairy including bio-input production system (1 buffalo and 1 cow in 0.05 ha) is being studied. Establishment and evaluation of all the modules except dairy is in progress from 2017.

Table 11. Performance of basmati rice in basmati rice-durum wheat-sesbania cropping system

Year & Variety	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Gross return (Rs ha ⁻¹)	Net returns (Rs ha ⁻¹)	B: C ratio	NRPRI*
2017(PB 1)	2653	3233	59533	14283	0.3	1.3
2018(PB 1121)	3000	3480	66960	28560	0.7	1.7
2019PB 1718	3255	4155	108038	63698	1.4	2.4
2019PB 1728	3048	3965	101353	57013	1.3	2.3
2019PB 1637	3104	3976	103060	60320	1.4	2.4

*NRPRI = Net returns per rupee invested

For year 2019 sale price of basmati rice is taken as Rs. 30 kg⁻¹ of grain

Table 12. Performance of different crops in Basmati rice-mustard-mung bean cropping system

Year & variety	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Gross return (Rs ha ⁻¹)	Net returns (Rs ha ⁻¹)	B: C ratio (NR)	Return Per Rupee Invested
2017(PB 1)	2480	3500	56600	11350	0.3	1.3
2018 (PB 1509)	2800	3420	62840	24440	0.6	1.6
2019 (PB 1509)	2970	3805	98613	59913	1.5	2.5
2017-18 (RH 749)	2000	7140	110710	90430	4.5	5.5
2018-19 (RH 749)	2600	7520	138820	119540	6.2	7.2
2018 (Pant Mung 5)	800	1000	60000	39220	1.9	2.9
2019(Pant Mung 5)	886	1049	83555	61825	2.8	3.8

*NRPRI = Net returns per rupee invested

For year 2019 sale price of basmati rice is taken as Rs. 30 kg⁻¹ of grain

For mustard and mung MSP for year 2018-19 (along 20-25% premium price) is taken



Plate 5: Mung bean crop variety Pant Mung

Food Systems: In the IOFS model, basmati rice-wheat-sesbania cropping system was practiced in 0.15 ha area of the land. The performance of different crops of the system is given in the Table 11. During the year 2019, three new basmati rice varieties namely PB 1718, PB 1728 and PB 1637 were grown in the IOFS model. Among the three cultivated varieties, PB 1718 has recorded maximum grain yield (32.50q ha^{-1}) and straw yield (41.60 ha^{-1}) followed by PB 1637. During the year 2018-19, durum wheat variety MPO JW 1215 was grown in the durum wheat-sesbania cropping system. In the third year of study, durum wheat has recorded grain and straw yield of 411 kg and 497 kg respectively out of the allotted land area of 0.15 ha.

Basmati rice-mustard-mung cropping system was practiced in 0.05 ha area of land. The performance of different crops of the system is given in the Table 12. During the year 2019 basmati rice variety (PB-1509) was grown in basmati rice-mustard-mung cropping system. It has recorded grain and straw yield of 149 and 190 kg out of 0.05 ha of allotted land area. It also recorded net returns of Rs 59913/ha, B: C ratio of 1.5 and return per rupee invested of 2.5 during the study period.

Similarly the mustard crop sown after the harvest of basmati rice recorded grain and stover yield of 130 and 376 kg respectively from the allotted land area of



Sesbania green manure crop

0.05 ha (Table 12). The mung bean crop has recorded grain yield of 40 kg out of 0.05 ha land area (Plate 5). It has also recorded straw yield of 886 kg /0.05 ha of the allotted land area. The total net return of Rs 61825 ha^{-1} , B: C ratio of 2.8 and return per rupee invested of 3.8 were realized with mung bean crop.

Fodder Systems: During *Kharif* 2019, Sorghum+ cow pea system recorded 3625 kg from 500 m^2 area which can supply green fodder for 120 days for 2 cows under organic production system. The maize + cow pea recorded 3950 kg/ha from 500 m^2 which can meet the green fodder requirement of 2 cows for 131 days. Therefore, by growing maize + cowpea fodder system in 1000 m^2 during *kharif*, and making it as silage can supply the fodder for 263 days for 2 cows under organic production system.

Kitchen garden system: A total of 14 vegetables were evaluated in the nutritional kitchen system during the year in an area of 500 m^2 which has resulted in production of 335 kg of vegetables under organic management (Plate 6). This can meet the requirement of 5 member family of other vegetables category for 159 days, roots and tuber crops for 120 days and requirement of leafy vegetables for 56 days alone (Table 13). Kitchen gardens can help in improving the nutritional security by providing essential micro nutrients and macro nutrients in the diet.

Table 13. Vegetables evaluated in nutritional kitchen garden

Category **	Name of vegetables	Area (m ²)	Yield (kg)	Daily requirement (vegetables) for 5 member family (Heavy work)**	No. of days Vegetables requirement can be met for 5 member family
Other Vegetables	Bottle gourd (<i>K</i>)	70	38	0.02kg of other vegetables per person per day (1.0 kg for 5 person/ day)	38
	Brinjal (<i>K</i>)	70	22		22
	Chiili (<i>K</i>)	70	7		7
	Okra (<i>K</i>)	70	16		16
	Cow pea (<i>K</i>)	70	21		21
	Pea (<i>R</i>)	70	7		7
	Broccoli (<i>R</i>)	70	25		25
	Cauliflower (<i>R</i>)	70	23		23
Total			159		159
Roots and Tuber crops	Radish (<i>R</i>)	70	35	0.02kg of Roots and Tuber crops per person per day (1.0 kg for 5 person/ day)	35
	Beetroot (<i>R</i>)	70	22		22
	Carrot (<i>R</i>)	70	18		18
	Potato (<i>R</i>)	70	45*		45
Total			120		120
Leafy vegetables	Spinach (<i>R</i>)	70	38	0.01 kg of Leafy vegetables per person day ⁻¹ (0.5 kg for 5 person day ⁻¹)	38
	Fenugreek (<i>R</i>)	70	18		18
Total			56		56
Grand Total (Kitchen system)		335			

* Estimated yield, *K*- Kharif,*R*- Rabi

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



Plate 6. Performance of vegetables under Kitchen garden system



Pest repellent system: Establishment of pest repellent system in 0.026 ha is in process. *Ipomoea carnea* (besharam) and *Ricinus communis* (castor) were established on bunds. *Datura metal* and *Calotropis gigantea* (aak, Madar) were established in beds and used for preparation of dashparni extract for pest management under organic production system.

Development of Integrated Organic Farming System (IOFS) model for other regions through AI-NPOF: Seven IOFS models are under evaluation in 6 states namely Gujarat, Kerala, Meghalaya, Rajasthan, Tamil

Nadu and Uttarakhand. Among the 7 models, at 4 locations namely SK Nagar, Thiruvananthapuram, Udaipur and Almora, dairy component is yet to be integrated. The economic analysis of the system indicates that under organic farming system with livestock component, a net income of Rs 0.78 lakhs (field and horticulture based) to 1.23 lakhs acre⁻¹ (spices based) (Table14) can be obtained depending upon the combination of modules adopted. Further, the performance of the system where in livestock component is not integrated, it varied from 0.23 lakhs (tuber crop based) to 0.49 lakhs (field crop based diversified system) depending upon the crops grown.

Table 14. Economic performance of IOFS model at different locations

Components	Area ha.	Gross returns Rs.	Total Cost Rs.	Net returns Rs.
Gujarat (SK Nagar)*	0.40	1,05,765	56812	48,953
Field crop based system (Groundnut-wheat-green gram; Fodder bajra-fodder maize+oat-fodderbajra; boundary plantation), 3 livestock; vermicompost				
Kerala (Calicut & Thiruvananthapuram)				
Calicut: Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost, 4 cows)				
Thiruvananthapuram*: Cassava + vegetable cowpea, Taro, Maie, Napier grass	0.24	66,705	43,700	23,005
Meghalaya (Umiam)				
Field & horticulture based system (Cereals + pulses + vegetables + fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost	0.43	1,35,785	56,835	78,950
Rajasthan (Udaipur)*				
Field crop based system (Sweet corn + blackgram-wheat; Fodder maize + cowpea-berseem-sesbania; tomato-cowpea; guava, compost unit of NADEP, vermicompost, enriched compost, vermiwash, BD 500, BD 501 & earthworm multiplication)	0.45	91,055	41,406	49,649
Tamil Nadu (Coimbatore)				
Field crop based system (Green manure-okra-maize; greenmanure-cotton-red gram, fodder, pest repellent cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow, 1 heifer & 1bull calf + vermicompost + boundary plantations (<i>Gliricidia, coconut</i>))	0.40	3,52,509	2,47,585	1,04,924
Uttarakhand (Almora)*				
Vegetable based system (Field crops, vegetables, fruits, fodder)	0.43	51,581	26,661	24,920

*Dairy component not yet integrated

Theme III

Cropping Systems and Resource Management

Project: Evaluation of different cropping sequences for crop intensification under CA practices (CRP on CA)

This experiment continues since 2015 under the umbrella of Consortium Research Platform on Conservation Agriculture (CRP on CA). A field experiment of total number of eight cropping sequences i.e. rice-wheat-sesbania (CA); rice-wheat-green gram (CA); maize (cob)-mustard-green gram (CA); sugarcane-ratoon-wheat (CP); sugarcane+green gram-ratoon-wheat (CA) are grown under both conservation (CA) and conventional agriculture practices (CP). The experiment is laid out in randomized block design with three replications. Various soil and crop parameters analyzed in the experiment are as follows:

Maximum wheat equivalent yield (WEY) of 16.38 t ha⁻¹ was recorded under maize (cob)-pea (pod)-

wheat-cowpea (pod) system followed by rice-wheat-green gram (16.30 t ha⁻¹). Both these systems remained at par statistically and showed significant superiority over rice-wheat-sesbania and sugarcane-ratoon-wheat systems. Maximum net returns (Rs. 1.53 lakhs ha⁻¹) were recorded under rice-wheat-green gram system followed by maize (cob)-pea (veg)-wheat-cowpea (pod) cropping system (Table 1). Lowest net returns (Rs 0.95 lakhs/ha) were recorded by sugarcane-ratoon-wheat system because of considering only the plant crop of sugarcane for returns purposes.

Residue retention in CA & CP practices showed on an average 8.63 t ha⁻¹ residue is being left on the soil surface under CA practices where as it is to the tune of 3.06 t/ha under CP practices (Table 2). Higher amount of residue left in the soil helps in building of organic carbon content and reducing bulk density of soil.

Table 1: WEY & net returns ratio as influenced by CA and CP practices under different cropping systems

Cropping System	WEY (t ha ⁻¹)			Gross Returns (Rs.) (lakhs ha ⁻¹)			Net Returns (Rs.) (lakhs ha ⁻¹)		
	CA	CP	Av.	CA	CP	Av	CA	CP	Av
Rice- wheat- green gram	15.35	17.24	16.30	2.75	3.13	2.94	1.48	1.59	1.53
Rice- wheat- sesbania	12.06	12.58	12.32	2.19	2.34	2.27	1.08	0.99	1.04
Maize (cob)- pea (veg)-wheat-cowpea (pod)	16.57	16.18	16.38	3.05	2.98	3.01	1.44	1.00	1.22
Sugarcane-ratoon- wheat	11.09	12.10	11.59	2.04	2.23	2.13	0.91	1.00	0.95
Average	13.77	14.53	14.15	2.51	2.67	2.59	1.23	1.14	1.19
SEm +- Factor(A)	0.355	0.061	0.061						
Factor(B)	0.501	0.086	0.086						
Factor(A X B)	0.709	0.122	0.122						
CD (0.05P) Factor(B)*	1.54	0.264	0.264						



Effect of CA practices on organic carbon and bulk density of soil showed that 7.14 % higher organic carbon content was noted under CA practices as compared to initial value of organic carbon (0.42%) likewise reduction in bulk density to the tune of 3.84% was recorded under CA conditions as compared to initial value of bulk density (1.62 g cc⁻¹) (Table 3).

Resource savings under CA practices observed as indicated in the table below on an average 10% saving

in irrigation water 28% saving of labor 16.8% saving of diesel and energy was recorded under CA practices as compared to conventional practices. Maximum saving of irrigation water (19.41%) and labor (31.7%) was recorded under sugarcane-ratoon-wheat and maize (cob)- pea (veg)-wheat-cowpea (pod) systems (Table 4).

Table 2: Residue retention in CA & CP practices

Tillage	CS ₁	CS ₂	CS ₃	CS ₄
CA	7.2	11.5	14.5	1.34
CP	1.4	6.4	3.9	1.52

CS₁- Rice- wheat- green gram ; CS₂-Rice- wheat- sesbania;CS₃-Maize (cob)- pea (veg)-wheat-cowpea;CS₄- Sugarcane-ratoon- wheat

Table 3: Effect of CA practices on organic carbon and bulk density of soil

Cropping System	Bulk Density (g cc ⁻¹)			OC (%)		
	CA	CP	Av.	CA	CP	Av.
Rice- wheat- green gram	1.55	1.56	1.56	0.44	0.42	0.43
Rice- wheat- sesbania	1.56	1.63	1.59	0.45	0.42	0.43
Maize (cob)- pea (veg)-wheat- cowpea (pod)	1.56	1.60	1.58	0.44	0.43	0.44
Sugarcane-ratoon- wheat	1.56	1.58	1.57	0.45	0.42	0.44
Average	1.56	1.59		0.45	0.42	

Table 4: Resource savings under CA under different cropping systems

Cropping System	Irrigation (cm)			Labour (no.)			Diesel (ltr)			Energy (KmJ)		
	CP	CA	Saving (%)	CP	CA	Saving (%)	CP	CA	Saving (%)	CP	CA	Saving (%)
Rice- wheat- green gram	151	150	0.7	229	162	29.3	549	440	19.9	197	158	19.9
Rice- wheat- sesbania	172	170	1.2	177	127	28.2	617	489	20.7	221	175	20.8
Maize (cob)- pea (veg)-wheat- cowpea (pod)	112	91.0	18.8	268	183	31.7	558	427	23.5	200	153	23.5
Sugarcane-ratoon- wheat	103	83.0	19.4	138	106	23.2	373	361	3.2	134	129	3.2
Average	134	123	10.0	203	144	28.1	524	429	16.8	188	154	16.8

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

A field experiment was laid out in 2018-19 at ICAR-IIFSR, Modipuram research farm under irrigated conditions to assess the quantum of greenhouse gases emission from rice-wheat system in different soil organic carbon strata (Medium and High) under different establishment methods and different sources of nitrogen. The experiment was laid out in a split plot design with three replications. The gas samples for measurement of greenhouse gases (N_2O and CH_4) were collected using the close chamber method of GHG measurement. Three objectives were identified for IIFSR viz., Study of carbon sequestration in different cropping systems in the on- going long-term experiments of AICRP-IFS/NPOF, Study of GHG emissions in rice-wheat and other prevalent

cropping systems and modeling studies with farming systems and relating it to GCMs to assess the adaptation potential of IFS to climate change. During the year 2019, the following tasks completed:

GHG measurement under rice-wheat cropping system in different strata of soil organic carbon showed that the field experiment was started in 2017-18 at Modipuram under irrigated conditions to assess the quantum of greenhouse gases emission from rice-wheat system under different organic strata (Medium and High) under different establishment methods (puddled transplanted rice and direct seeded rice in rice; zero tillage and conventional tillage in wheat) and different source of nitrogen (control, neem coated urea, vermin compost and Application of DMPP/DCD nitrification inhibitor). The GWP reduced in direct seeded rice by 16.9 % compared to transplanted rice under high carbon soil strata, while it reduced by 14.9 % under medium carbon soil strata (Table 5).

Table 5: Seasonal flux of GHG from the rice field under different establishment methods Vs different source of nitrogen combinations

Establishment method/Carbon strata	Treatments	Methane Emission (Kg ha ⁻¹)	N ₂ O Emission (Kg ha ⁻¹)	GWP (Kg CO ₂ ha ⁻¹)
High Carbon				
Direct	Control (no fertilizer)	24.56	0.54	730.56
	Application of Neem coated urea	29.45	0.69	829.6
	Application of DCDA nitrification inhibitor	30.54	0.59	824.57
	Organic N management (through vermicompost)	35.56	0.6	940.34
Transplanted	Control (no fertilizer)	25.67	0.49	710.34
	Application of Neem coated urea	36.56	0.66	964.34
	Application of DCDA nitrification inhibitor	35.96	0.64	955.67
	Organic N management (through vermicompost)	40.45	0.59	1011.34
Medium Carbon				
Direct	Control (no fertilizer)	22.67	0.53	640.56
	Application of Neem coated urea	28.45	0.68	810.34
	Application of DCDA nitrification inhibitor	29.45	0.58	812.34
	Organic N management (through vermicompost)	33.45	0.59	912.45
Transplanted	Control (no fertilizer)	24.99	0.47	690.45
	Application of Neem coated urea	34.78	0.65	812.34
	Application of DCDA nitrification inhibitor	34.89	0.63	806.78
	Organic N management (through vermicompost)	39.45	0.58	955.67

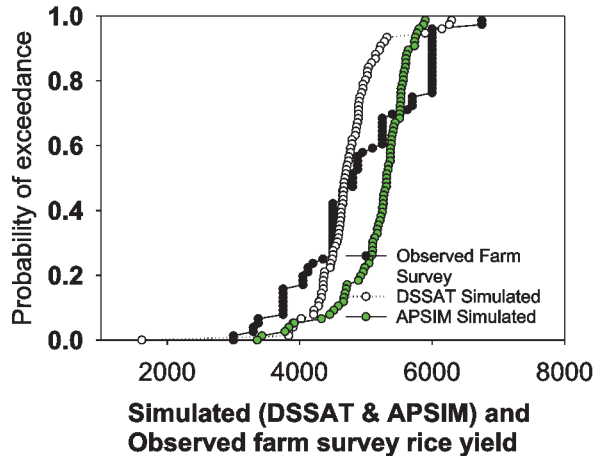


Fig. 1 Simulated (DSSAT & APSIM) and

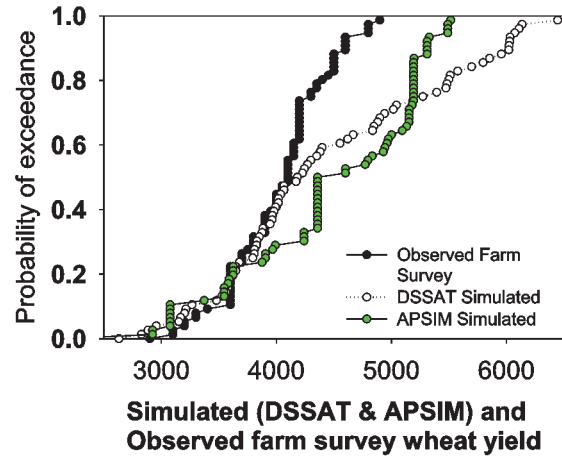


Fig. 2 Simulated (DSSAT & APRIM) and

Integrated assessment of impact of climate change on farm level productivity observed the methodological framework adopted from AgMIP protocol. Based on the survey and discussions with different stakeholders, following general problems identified,

- Less awareness of new technologies/management practices with its proper use
- Non-availability of improved varieties of rice, wheat and sugarcane.
- High rate of seed, fertilizer, pesticide use
- Non-availability of irrigation water at critical phases of the crop
- Non-availability of labour for critical farming operations
- Awareness and non-availability of improved breeds of livestock (cattle and buffalo)

Weather data for 30 years' period (1980-2010) collected from GBPUA&T, Pantnagar and calibrated APSIM and DSSAT based on experimental data from GBPUA&T, Pantnagar.

Simulated and observed farm survey showed same pattern in rice. However, in the case of wheat, after 50 % probability of exceedance, there is lot of difference between the observed and simulated in both the crop models (Fig 1 & 2).

Sustainable Agricultural Pathway– 2050s showed that after discussions with various stakeholders i.e., progressive farmers, researchers, developmental official and also using available literature, in future, it is expected that more allocation will be available for better management of natural resources and also farmers realizes long term gains from efficient resource use. This will ensure less degradation of natural resource base. The implementation of efficient technologies will ensure efficient use of on-farm resources and will lead to low cost of production. More farmers will use high tech agriculture with higher energy efficiency methodologies will lead to sustainable mechanization. Farm labour community will get good employment opportunities in rural areas and this leads to low income disparity among the farming community and finally the region will be food secure region on sustainable basis.

Project : Measurement and Estimation of Greenhouse Gases (GHG) emission and carbon footprint in sustainable Integrated Farming System (IFS) models of Western Plain Zone of Uttar Pradesh

This project was started in 2018 to quantify GHG emission from sustainable IFS models to assess carbon footprint of IFS models and to quantify climatic resilience of IFS Models. IPCC Tier-2 approach was used for estimating the GHG emission. During the year of reporting, estimated the GHG emission from the IFS model - Development of fruit crop based

farming systems for higher productivity and profitability. Highest emission of 472 CO₂-e in Kg was recorded under cereal based cropping system and least under vegetable based cropping system (Table 6). As far as individual crops are concerned, rice recorded highest emission of 44% followed by wheat (Table 7). Also studied the impact of different management practices on GHG emissions in rice-wheat and found that direct drill seeded on raised beds (rice) and Drill seeded on raised beds (wheat) combination reduced the emission by 34.3% compared to transplanted rice and drill seeded after conventional tillage wheat .

Table 6: Net GHG emission in IFS Model (CO₂-e in Kg)

Carbon Sources	Enterprices Cropping System	CO ₂ -e(kg)
CS ₁	Cereal based	472 (55 %)
CS ₂	Vegetable based	143 (17 %)
CS ₃	Fodder based	243 (28 %)
	Total	859

Table 7: Crop-wise GHG emission

Crop	CO ₂ -e(kg)	Crop	CO ₂ -e(kg)
Sugarcane	163 (19)	Berseem	26 (3)
Wheat	101 (23)	Urdbean	17 (2)
Rice	378 (44)	Sorghum	17 (2)
Daincha	17 (2)	Mustard	9 (1)
Maize	52 (6)	Mungbean	17 (2)
Chickpea	26 (3)	Nappier	9 (1)
Okhra	26 (3)		

Table 8: Impact of different management practices on GHG emissions in rice-wheat

Technologies	CO ₂ -e(kg)			
	Wheat	Rice	Wheat	Rice-wheat
Transplanted after puddling	Drill seeded after CT	795	259	1308
Transplanted after puddling	Drill seeded after no tillage	683(-14.1)	277(7.1)	1152(-11.9)
Direct drill seeded on raised beds	Drill seeded on raised beds	459(-42.2)	257(-0.6)	860(-34.3)
Transplanted on raised beds	Drill seeded on raised beds	552(-30.5)	251(-3.1)	964(-26.3)
Direct drill seeded after no-tillage	Drill seeded after no tillage	527(-33.7)	267(2.9)	952(-27.2)
Transplanted after no-tillage	Drill seeded after no-tillage	569(-28.4)	267(2.9)	1026(-21.5)



Table 9: Calculation of area under major cropping system of different district of Central alluvial plain

District	Total	Central alluvial plain		
		RFF	RMBR	RMJ
Murshidaba	397007	180281	73486	70270
Nadia	293879	133450	54397	52017
Howrah	82978	37680	15359	14687
Hooghly	211970	96256	39236	37519
Bardhman	455380	206788	84291	80602

RFF: -Rice-Fallow-Fallow; RMBR: - Rice-Mustard-Boro Rice; RMJ: - Rice-Mustard-Jute

Table 10: Pre-dominant cropping system identified for Central alluvial plain

Sr. No.	Central alluvial plain			
	Kharif	Rabi	Summer	% area
1	Rice	Fallow	Fallow	45.41
2	Rice	Mustard	Borrow Rice	18.51
3	Rice	Mustard	Jute	17.70

Project : Updating of Cropping System Atlas of India and Preparation of futuristic crop plan for 2030, 2040 and 2050

The first cropping system atlas of India was developed by ICAR-IIFSR during 2001. In last two decades, changes occurred in the cropping systems, because of Government policies (PDSs, MSP and Procurement policies), depletion in natural resources (decline ground water table), research and extension activities, extensions of irrigation projects, reforms of land due to implementation of land improvement programme, increases in purchasing power and food habits all impacting on cropping systems over the years. Therefore, a project was initiated to prepare the crop plan and update the cropping system atlas for the country

During the year of reporting, collection of primary data related to demographic information, cropping system area and variety, input usage (seed, manure and fertilizers), crop wise production and their disposal and economics of different crops under process. Two page questionnaires' based proforma

developed and circulated to the AICRP-IFS and NPOF centres along with KVKs through ATARIs. Till date, eight KVKs shared primary data of their respective districts viz. Champhai (Mizoram), Chandurayanahally (Karnataka), Gadag (Karnataka), Jalan (Maharashtra), Nagaur (Rajasthan), Porbandar (Gujarat), Ujwa (New Delhi) and Lalitpur (U.P.). Based on primary data available, three major cropping systems for Central alluvial plain sub-zone in the Lower Gangetic Plains (West Bengal). The result was found very promising near to existing practices (Table 9 & 10). Calculation of relative yield index (SYI) for rice and wheat for all the districts of country were completed.

Project : Identification of cropping system modules for different farming systems

For securing the food, income as well nutritional security of small and marginal farmers IFS approach can play a pivotal role. Under the IFS research, identification of suitable cropping systems for its inclusion into crop production module is of utmost importance to realize improved farm income, soil

Table 11: Initial soil fertility status of experimental soil

Sample	pH	Electrical Conductivity (dS m ⁻¹)	Organic carbon (%)	Available N(kg ha ⁻¹)	Available P(kg ha ⁻¹)	Available K(kg/ha)	Available Na(kg ha ⁻¹)
Composite sample	8.29	0.61	0.458	125	28.88	126	107
1	8.24	0.65	0.369	176	23.32	112	128
2	8.23	0.67	0.458	138	34.99	134	102
3	8.20	0.72	0.488	176	38.73	124	100
4	8.18	0.74	0.488	138	25.14	129	132
5	8.22	0.61	0.414	176	35.82	121	97
Mean	8.23	0.67	0.45	154.83	31.15	124.33	111

quality maintenance as well as health and productivity of livestock component. Since some of the pre-existing cropping systems have been showing signs of economic and ecological illness thus identification of new alternatives is the need of hour. The soil of experimental field was normal to saline in reaction with mean pH of 8.23 and electrical conductivity of 0.67 dS m⁻¹. The soil was low in organic carbon (0.45%) and available N (154.83 kg ha⁻¹), medium in available P (31.2 kg ha⁻¹), and low in available K (124.3 kg/ha). The available Na level was recorded at 111.0 kg ha⁻¹ (Table 11).

The productivity of different *kharif* season crops in the cropping systems was recorded. In all the cropping systems involving basmati rice variety Pusa basmati 1509 was grown. In existing basmati rice-wheat cropping system, basmati rice crop has recorded grain, straw and biological yields of 4.72, 6.39 and 11.10 tonnes ha⁻¹, respectively (Table 12). Likewise, in basmati rice-wheat + chickpea (4 :2 ratio) –green manure (*sesbania*) system, basmati rice has registered grain, straw and biological yields of 4.89, 6.69 and

11.58 tonnes/ha, respectively. In basmati rice-wheat+mustard (8 :1) –green gram and basmati rice-cauliflower-okra systems grain yield of 4.97 t ha⁻¹ and 4.84 t ha⁻¹, respectively were notice with basmati rice. The sweet corn variety Madhuri was grown in sweet corn-potato-onion cropping system and it has recorded green cob yield of 5.07 t/ha, green fodder yield of 9.06 t/ha and biological yield of 14.1 t ha⁻¹ in year 2019. In maize + vegetable cowpea intercropping system, maize hybrid CMH 08-292 was grown which recorded grain yield of 5.33 t ha⁻¹. It has also recorded the stover and total biomass yields of 7.27 and 12.60 t ha⁻¹ respectively in the first year of cultivation. In the same intercropping system vegetable cowpea has recorded green pod yield of 3.42 t ha⁻¹ in first year of experimentation. In pearl millet-berseem-sorghum (multicut), pearl millet crop has produced 34.5 t/ha of green fodder whereas in fodder maize-oat-sorghum (multicut) system fodder maize has produced 66.8 t ha⁻¹ of green fodder in first year of experimentation.



Table 12: Productivity of different crops in experiment

Cropping system	Grain/green pod/ green cob yield of <i>kharif</i> crop (t ha ⁻¹)	Straw/green fodder yield of <i>kharif</i> crop (t ha ⁻¹)	Biological yield of <i>kharif</i> crop (t ha ⁻¹)
Basmati rice–wheat Sugarcane – ratoon–wheat	4.72	6.39	11.10
Basmati rice–wheat + chickpea (4:2 ratio)–green manure (<i>sesbania</i>) Sugarcane+black gram (1:2)–ratoon+ black gram (1:2)–wheat+lentil (6 :2)	4.89	6.69	11.58
Basmati rice–wheat+mustard (8:1) –green gram	4.97	7.07	12.04
Maize+cowpea (1:1)–barley–black gram	5.33(3.42*)	7.27(1.14*)	12.60
Fodder maize–oat–sorghum (multicut)		66.8	
Pearl millet–berseem–sorghum (multicut)		34.5	
Basmati rice–cauliflower–okra	4.84	6.64	11.48
Sweet corn–potato–onion	5.07	9.06**	14.1

* Vegetable cowpea green pod and straw yield ** Sweet corn green fodder (green stem) yield

Theme IV

Technology Transfer and Assessment

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

This project was initiated in 2019 to develop farming system model for profitability and livelihood improvement of different farmer's categories and validation and refinement of on-station technologies

at farmers' field. The 6 villages identified (Muzaffarnagar- Badhai Kalan and Sahajpur Kalan; Shamli- Panjokhara and Ramgadi; Haridwar- Mandawali and Narsan Khurd) and basic information and base line survey has been completed. During the year of reporting, the survey data analysis of four villages (Badhai Kalan, Sahajpur Kalan, Mandawali and Narsan Khurd) completed.

Different technological interventions identified are given below table 13 and 14

Table 13: Crop based system

Interventions	Area (ha)	No. of farmers	Badhai Kalan	Sahajpur Kala	Mandawali	Narsan Khurd
1. Cropping System						
i) Introduction of HYV of Paddy	9.0	32	10	-	22	-
ii) Introduction of HYV of Wheat	10.0	30	8	7	7	8
iii) Introduction of HYV of Mustard.	6.0	26	12	-	10	4
iv) Intercropping of Spices with sugarcane	1.5	13+9	10+6	3+3	-	-
v) Introduction of HYV of Fodder crop(Oat)	0.4	10	4	-	4	2
vi) Introduction of HYV of Fodder crop(Berseem)	1.5	20	6	-	8	6
vii) Weed management in sugarcane	1.6	4	4	-	-	-

Table 14: Horticulture based system

Interventions	Area (ha)	No. of farmers	Badhai Kalan	Sahajpur Kala	Mandawali	Narsan Khurd
Horticulture based system						
a) Orchard management	-	-	-	-	-	-
b) Intercropping of vegetables with sugarcane (commercial)	1.8	18	13	5	-	-
c) Vegetables(NKG)	0.3	12	10	2	-	-



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

An MOU has been signed between C-DAC, Mumbai and ICAR-IIFSR, Modipuram to use their platform for real time dissemination of the weather based agroadvisory for farmers of Uttar Pradesh emphasising the latest technological interventions.

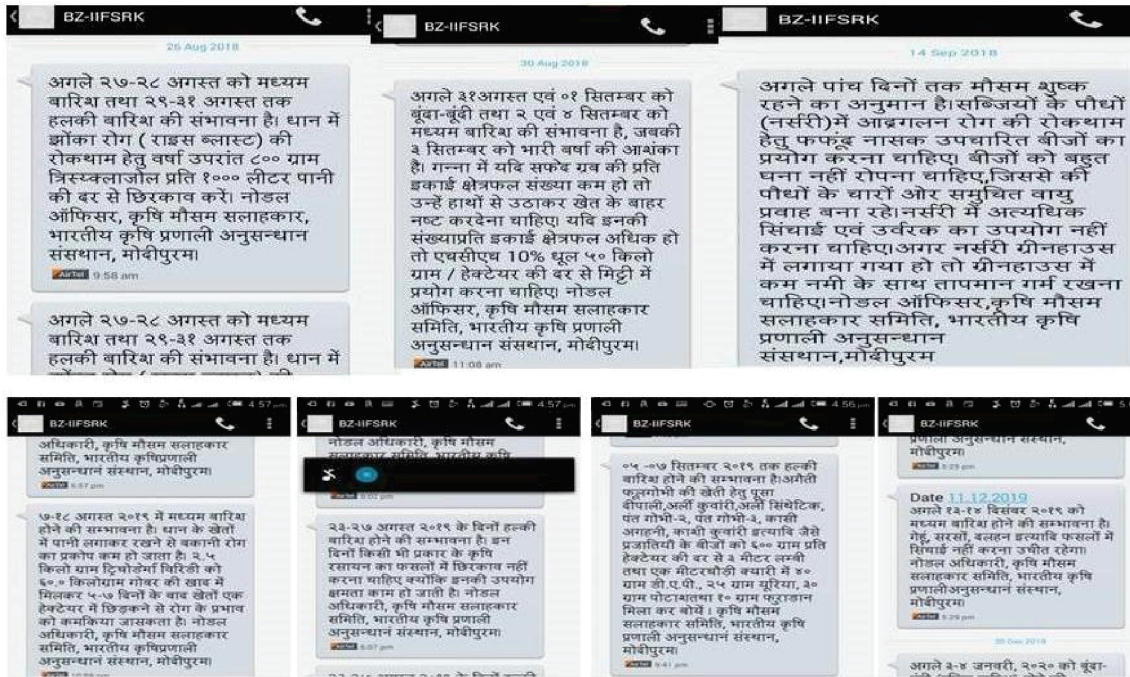


Plate 1: Snapshot of Agroadvisories disseminated to the various stakeholders including registered farmers of the various districts of Uttar Pradesh during 2019

Month-wise report of push SMS Services

S No.	Year/M	Month, Year	TRA	Mon TRA	Usage
1	IIFSRB	August, 2019	0	24009	Usage Details
2	IIFSRB	July, 2019	0	10428	Usage Details
3	IIFSRB	June, 2019	0	4999	Usage Details
4	IIFSRB	May, 2019	0	785	Usage Details
5	IIFSRB	April, 2019	0	1145	Usage Details
6	IIFSRB	March, 2019	0	1286	Usage Details
7	IIFSRB	February, 2019	0	3269	Usage Details
8	IIFSRB	January, 2019	0	5144	Usage Details
9	IIFSRB	December, 2018	0	10931	Usage Details
10	IIFSRB	October, 2018	0	3864	Usage Details
11	IIFSRB	September, 2018	0	11448	Usage Details
12	IIFSRB	August, 2018	0	6300	Usage Details
13	IIFSRB	July, 2018	0	7216	Usage Details
14	IIFSRB	June, 2018	0	1094	Usage Details

Plate 2: Monthwise report of push SMS services used for real time dissemination of technological interventions based agroadvisories to the registered farmers of various districts of Uttar Pradesh

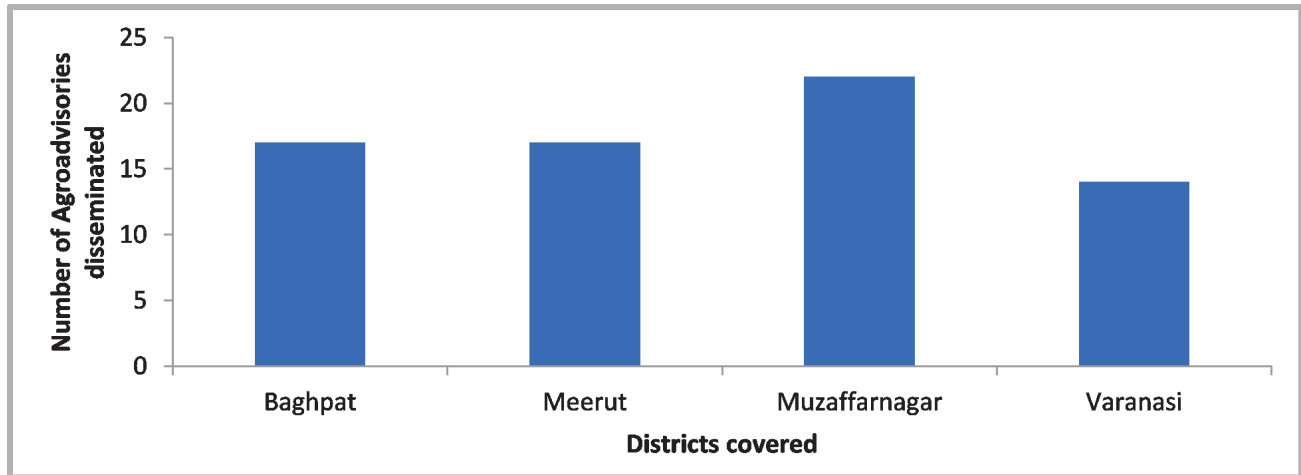


Fig. 3: District wise number of disseminated technological interventions based on anticipated weather conditions of the various districts of Uttar Pradesh during 2019

For smooth dissemination of agro-advisory, district wise group has been created namely Muzaffarnagar, Meerut, Baghpat and Varanasi. About 1000 farmers have been registered for adoption of weather based technological interventions in farming systems. Twice in a week or need based in anticipation of forecast of rainfall and other extreme weather, agro-advisories are being developed through involvement of multi disciplinary scientist and disseminated to the registered mobile of the farmers of these districts for risk management towards extreme or bad weather condition. Agro-advisory also include latest technologies for input application to reduce the cost of cultivation and also enhance the productivity of the major crops and livestock components of the existing farming systems of the respective districts of Uttar Pradesh.

During the reporting period (January to December, 2019) a total 70 numbers of technological interventions agro-advisories based on anticipated weather condition of the particular districts was disseminated on real time basis to the registered farmers of respective districts. Among the districts the highest number of agro-advisories (22 nos.) were disseminated in the Muzaffarnagar district whereas in Baghpat and Meerut districts 17 nos. Of agro-advisories were disseminated. Farmers of three villages of Varanasi districts have been received 14 nos. of agro-advisories (Fig. 3). The disseminated agro-advisories have covered all the major aspects of

predominant integrated farming system components of the respective districts. Accuracy level of prediction of rainfall events or number of rainy days as well as intensity of rainfall in terms of low rainfall (<5.0 mm), medium rainfall (05.00-15.00 mm) and heavy rainfall (>15.00 mm) were analysed for agro-advisories disseminated for Meerut districts using the actual rainfall data recorded at Agromet Observatory located at ICAR-IIFSR, Modipuram, Meerut. Results revealed that out of predicted 32 rainy days, 17 times it has turned in to happen with 53.0% of the accuracy level of the forecast during the reporting period i.e. January to December, 2019. During Monsoon (July to September) and Post Monsoon (October to June), the accuracy level was found to be reduced up to 50.0% of the prediction in terms of rainy days. Intensity wise accuracy level was also calculated and 100 per cent match between occurrence and prediction of heavy rainfall was found which may serve the purpose of the project in risk management related to extreme weather particularly for the case of heavy downpour. Accuracy level has been drastically reduced up to 29.0% in case of prediction of low rainfall and it was found good enough in occurrence of rainfall between 05.00 to 15.00 mm (medium rainfall) with 67.0% prediction accuracy which may drastically reduce the cost of cultivation on the irrigation and in enhancing the resource/input use efficiency in terms of fertilizer application, pesticide application, interculture operations etc (Fig. 4).

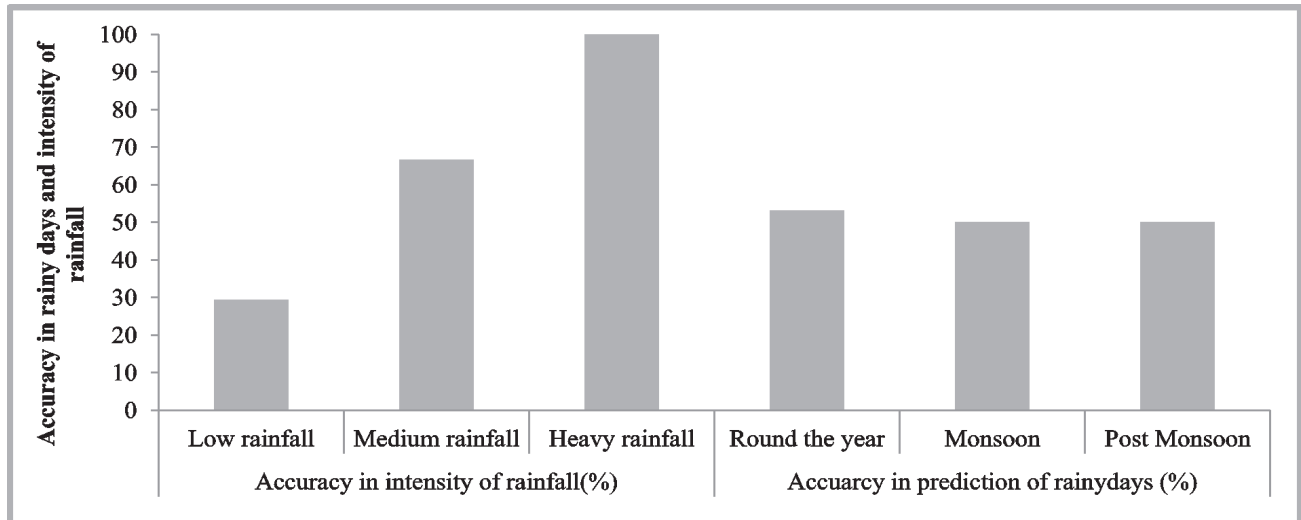


Fig. 4: Accuracy level of prediction of rainy days and intensity of rainfall in Meerut district during January to December, 2019

Outreach activities under TSP programme

Project : On-farm Participatory Research in Farming Systems Perspective under Tribal Sub Plan (TSP) (Haridwar,Uttarakhand)

This project was started in 2018 under tribal sub plan in Nayagaon and Mohallapuri villages of Haridwar, Uttarakhand. The baseline data collection completed (Table 1 & 2) and identified IFS interventions based on PRA technique. Major problems identified and suitable IFS inventions suggested for selected farmers

Table 1: Baseline Information of adopted villages

Item	Vill.-Nayagaon	Vill.-Mohallapuri
1. Block, District and State	Bahadrad, Haridwar, Uttarakhand	Bahadrad, Haridwar, Uttarakhand
2. GPS Coordinates	29°85'45"N, 78°32'61"E EMSL=372m	29°86'21"N, 78°32'42"E EMSL=369m
3. Total population of village	600	700
4. Total Farm families	100	110
5. Tribal farm families	90	100
6. Women headed farm families	05	10

Table 2: Land holding and farmer's categories

Farmers categories	No. of farmers in each category	
	Nayagaon	Mohallapuri
1. Marginal (<1ha)	16	20
2. Small (1-2 ha)	12	25
3. Semi medium (2-4 ha)	-	5
4. Medium (4-10 ha)	2	-
5. Large (>10 ha)	-	10
6. Landless	70	50
7. Total	100	110



Plate 1. Interaction with different stakeholders

Table 3 IFS Interventions imposed in adopted villages s

Interventions	Nayagaon (No. of farmers covered)	Mohallapuri (No. of farmers covered)	Total (No. of farmers covered)
1. Introduction of high yielding, disease resistant wheat varieties viz. HD3086 etc. with integrated nutrient and pest management (INPM) package	33	28	61
2. Introduction of high yielding, disease resistant paddy varieties (Sarbati) with integrated nutrient and pest management (INPM) package	40	35	75
3. Biological control of sugarcane borers (INPM in sugarcane)	54	57	111
4. Introduction of nutrition/kitchen garden integrated nutrient and pest management (INPM) package for improving nutritional security (Rabi-kharif-zaid)	261	254	515
5. Improved varieties of mustard/yellow sarson	45	45	90
6. Round the year Mushroom production technology	12	11	23
7. Improved agricultural tools (drudgery reducing tools)	80	77	157
8. Training and capacity building programmes	162	157	319
9. Tribal farmers fair and Agri-tech exhibition package for	1520 Farmers from different villages of Haridwar		1520
Total no. of beneficiary covered			2871



Major Constraints identified in the study villages,

- Low productivity of sugarcane due to water scarcity during April-June; attack of top borer, mealy bug insects
- Loss in yield of rice due to attack of leaf folder, yellow stem borer, false smut, blast etc.
- Yellow rust and karnal bunt problems in wheat
- Lack of knowledge for integrated pest management and pesticide dealer based pest management; spurious pesticide
- Wild animal problems

Project: Cluster based on-farm participatory research in Farming Systems under Tribal Sub plan (TSP) (Nainital-Uttarakhand)

The study area encompasses the tribal farming systems of Tarai and Bhabhar Zone of Uttarakhand. A survey was conducted in a cluster of two villages panchayats in Ramnagar block of Tarai and Bhabhar Zone of Uttarakhand. The total sample comprises of a clustered sample of 100 tribal farm households using purposive sampling frame. Both the quantitative and qualitative data has been collected in the study through semi-structured questionnaire, focus group discussions, in-depth interviews, case-studies etc. Benchmark survey of 100 households has been completed using a structured interview schedule before the initiation of technological interventions. Survey revealed that Crops (paddy-wheat) was the dominant farming system found in around 44 per cent of households followed by Crop (Paddy-Wheat) +Dairy farming system (30%). The survey on nutrition assessment depicted that the dietary diversity score was (DDS) found low (3.9 ± 1.5) amongst 5 food groups. Also, the diet availability was found inadequate in terms of pulses (27.12 ± 10.8), milk (99.5 ± 88.6 gm capita⁻¹ day⁻¹), green leafy vegetables (23.5 ± 13.6 gm capita⁻¹ day⁻¹), other vegetables (93.8 ± 41.9 gm capita⁻¹ day⁻¹), fruits (42.6 ± 39.2 gm capita⁻¹ day⁻¹) and animal foods (44.3 ± 39.7 gm capita⁻¹

day⁻¹). The resource characterization survey revealed around 1.23 tonnes household⁻¹ annum⁻¹ of wheat straw has been produced at tribal farmer's field. Amongst the total production 0.73 tonnes household⁻¹ annum⁻¹ of wheat straw has been sold by farmers @ 5230 Rs tonne⁻¹ household⁻¹ which is very less. Similarly, around 1.43 tonnes household⁻¹ annum⁻¹ of paddy straw has been produced at tribal farmer's field, out of which 0.77 tonnes of paddy straw has been sold at 1245 Rs tonne⁻¹ household⁻¹ which is meagre (Table 18). Further study shows that around 2.61 tonnes household⁻¹ annum⁻¹ of farm yard manure has been produced at tribal farmers field which is entirely consumed at tribal farmers field having less nutrient, ecological and economic value. Systematic interventions on nutrition, livelihood and optimum resource utilization has been imparted in farming systems mode in the year 2018-19.

Interventions made:

Cropping systems management

- i. Introduction of zinc (42.0 ppm) and iron (40.0 ppm) biofortified variety of wheat (WB2) to nutritionally destitute families. Area covered- 1.8 ha, household covered-30 Nos (2018-19). Line sowing in wheat. Area covered –1.8 ha household covered 30 Nos.
- ii. Motivated farmers for adoption of previously demonstrated high yielding wheat var HD3086.
- iii. Introduction of HYV, highly prized paddy var viz. PB 1509, PB1637, PB 1728, PB1718 (2018-19).
- iv. Introduction of trichocards for insect pest management in paddy.
- v. Diversification of rice-wheat system by integration of mustard crop (cv. RH 749) (for oilseed and green leaf consumption) Extended from 0.85 ha to 1.8 ha area.
- vi. Diversification of rice-wheat system as well as for enrichment of household nutrition and income improved varieties for the pulse crops. Lentil (Pant lentil 8, rust, wilt and pod resistant variety

was introduced and extended to 3.96 ha area covering 66 households from 1.32 ha from previous year.

Horticulture module

Promotion of nutritional kitchen gardening. Area covered 1000 m², household covered 100 Nos.

- i. Carrot (Pusa Rudhira), Radish (Japanese white), Fenugreek (pant ragini), Spinach (All green), Corriender (pant haritima) (Nov-Feb) (2018-19)
- ii. Cowpea (pusa komal), okra (Kasi pragati), bottle gourd (pant lauki 3) and ridgegourd (pant torai 1) (Feb- May , July-Oct) (2018-19)
- iii. Introduction of trichocards and pheromone traps for the management of borers and fruit fly.
- iv. Promotion of fruit plants: Lemon (Pant Lemon 1), Litchi (Rose cented), Guava (Pant prabhat) and mango plants (2018-19).
- v. Introduction of pheromone traps in existing guava plants for the management of fruit fly.

Livestock Module

- i. Balanced nutrition in milch animals through mineral mixture, Calcium & Vitamin mixture. Animals covered 51 (25 C+ 26 B), household covered – 40 Nos.
- ii. Integration of backyard poultry for livelihood security, poultry distributed-690, household covered – 58 Nos.

iii. Improved nutrition in poultry through introduction of poultry feed, calcium, vitamin mixture etc. poultry covered-690, household covered – 58 Nos.

iv. Introduction of poultry drinkers for safe water drinking practices for poultry. poultry covered-690, household covered – 58 Nos.

Drudgery reduction Module

- i. Demonstration of seed cum fertilizer drill. Area covered 500 m², household covered 10 Nos,
- ii. Demonstration of improved sickle for harvesting of field crops, fodder crops, household covered 100 Nos.
- iii. Demonstration of improved *Khurpi* for weeding in field and horticultural crops, household covered 100 Nos.
- iv. Demonstration of protective gloves for harvesting of field crops, household covered 100 Nos.
- v. Demonstration of ring cutter for plucking of okra, household covered 100 Nos.

Mushroom Module

Introduction of oyster (*Pleurotus* spp.) and milky (*Calocybe indica*) mushroom, household covered 10 Nos.

Vermicomposting module

Utilization of all kinds of farm wastes like dung from dairy animals, leaf litter of trees, crop residues and weeds for recycling into vermicompost in 4 x 12 x 2 ft HDPE vermibeds, household covered 8 Nos.



Table 3: Economic yield, price, cost of cultivation and net returns of different modules.

Improved IFS	Crop Module	Economic yield	Price (Rs/unit)	Cost of cultivation (Rs unit ⁻¹)	Net Returns (Rs unit ⁻¹)
CS _0.405 ha	Paddy-Wheat /Mustard/Lentil				
0.405 ha	Paddy (Q)	21.05	2748.28	11793.88	45987
	Wheat (Q) : 2018-19 : var. HD3086	23.35	1736	11528	29059
	Wheat (Q) : 2018-19 : WB2	18.21	1800	11688	21409.5
	Mean	20.78	1768	11608	25234.25
0.060 ha	Mustard (kg)	50.576	47.5	1108	1292
0.054 ha	Lentil (kg)	48.93	61.02	1000	1988.3
☒	Animal Module				
☒	1-2 Cow/1B				
☒	Milk (Litre/year)	1222.23	34.09	40934	12251.4
☒	Farm yard manure (q)	25.0	206.4	1000	4160
	Eggs (Nos.)	1538	10.0	1268	14119.5
	Meat (Kg)	5.5	550	-	1702.43
	Total				15821.95
	Nutrition Kitchen Garden				
☒	Okra (kg, 10.02 m ²)	63.4	25	120.8	1464.6
☒	Cowpea(kg, 8.8 m ²)	32.42	25	77.23	733.3
☒	Bottlegourd (kg, 6.24m ²)	37.07	12.40	45.96	420.6
☒	Ridgegourd (kg, 6.83m ²)	41.66	12.36	46.75	469.9
☒	Carrot (kg, 4.07 m ²)	26.66	19.44	50	472.2
☒	Radish (kg, 3.14 m ²)	27.68	12.34	32.5	309.8
	Coriander (kg, 7.47 m ²)	38.72	35	116.7	1238.7
	Fenugreek (kg, 4.30 m ²)	24.21	41.84	90	925.8
	Spinach (kg, 4.30 m ²)	30.27	23.06	60.68	625.1
	Total				6660.0
(1x1 m ²)	Mushroom module				
	Oyster (kg)	16.9	84	320	1110
	Milky (kg)	18	92	518	1122
	Total				2292
(4 x 12 x 2 ft)	Vermicomposting (kg)	1288.8	5	-	6444.44
	Total Return from the system				1,22131.3



Plate 2 Demonstration of mushroom cultivation



Plate 3 Demonstration of vermicomposting



Plate 4 Ready to use mushrooms



Plate 5 Ready to use vermicompost

Profitability of Rs 30,173 ha⁻¹ was noticed in improved production system Crop (paddy-wheat+ mustard+ lentil +chickpea) + Livestock (1C/1B + poultry) + KG (0.405 ha) in 2017-18 whereas, profitability of 1,08,866 ha⁻¹ was noticed in improved production system. Crop (paddy-wheat+ mustard+ lentil) + Livestock (1C/1B + poultry) + KG + Mushroom + Vermicomposting (0.405 ha) in 2018-19 as compared to farmers practice. Dietary diversity score has been improved from 3.9 ± 1.5 to 5.0 ± 0. Around 5.3-fold area has been extended for wheat var. HD3086 which has been adopted by 10 % farmers. The overall chapati making quality score was found best (8.8 ± 0.5) for PBW 154 (farmer’s variety) followed by WB2 (demonstrated variety) (7.25 ± 0.70) on 9-point hedonic scale. Working capacity of tribal farmers was found 147.3 m² hr⁻¹ while working with improved sickle as compared to 122.8 m² hr⁻¹ while working with traditional sickle. The total returns from

the improved tribal Integrated farming system Crop (paddy-wheat+ mustard+ lentil) + Livestock (1C/1B + poultry) + KG + Mushroom + Vermicomposting (0.405 ha) was found Rs 1,22,131.3 However, the total returns (Table 3) from benchmark farming system (0.405 ha) was found Rs 78055.68/-



Plate 6 Distribution of drudgery reduction tools to tribal farmers



Plate 7 Demonstration of improved sickle



Profitability of Rs 30,173.17/- ha⁻¹ was noticed in improved production system Crop (paddy-wheat+ mustard+ lentil +chickpea) + Livestock (1C/1B + poultry) + KG (0.405 ha) in 2017-18 whereas, profitability of 1,08,866/- ha⁻¹ was noticed in improved production system. Crop (paddy-wheat+ mustard+ lentil) + Livestock (1C/1B + poultry) + KG + Mushroom + Vermicomposting (0.405 ha) in 2018-19 as compared to farmers practice. Dietary diversity score has been improved from 3.87 ± 1.45 to 5.00 ± 00. Around 5.3 fold area has been extended for wheat var. HD3086 which has been adopted by 10 % farmers. The overall chapati making quality score was found best (8.75 ± 0.46) for PBW 154 (farmer’s variety) followed by WB2 (demonstrated variety) (7.25 ± 0.70) on 9 point hedonic scale. Working capacity of tribal farmers was found 147.27 m²hr⁻¹ while working with improved sickle as compared to 122.81 m²hr⁻¹ while working with traditional sickle. The total returns from the improved tribal Integrated farming system Crop (paddy-wheat+ mustard+ lentil) + Livestock (1C/1B + poultry) + KG + Mushroom + Vermicomposting (0.405 ha) was found Rs 1,22,131.3/- However, the total returns from benchmark farming system (0.405 ha) was found Rs 78055.68/-

Adhoc/Sponsored Projects

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

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

All India Network Programme on Organic Farming (AI-NPOF), a plan scheme initiated from 2004-05 operates currently with 20centres covering 10agro-climatic regions. The scheme is in operation at 11 SAU’s, 7 ICAR institutes and 1 special heritage university and covers 16 states. During the year under report, 13 experiments were undertaken. The recommended technologies and policy input in the XIV Annual Group Meeting of the Scheme held at ICAR-Central Inland Agricultural Research Institute, Port Blair during 12-14 November 2019 for upscaling

through the development schemes of Government of India and States are given below.

- 1. Technologies recommended for promotion under the schemes of Paramparaghat Krishi Vikas Yojana and MOVCD-NEH of DAC & FW, GoI, New Delhi along with policy input Technologies. Application of 75 % of nutrients only through combination of organic manures (FYM, Vermicompost, oil cakes, enriched compost) + location specific innovative inputs and management as per NPOP standards**

State	Cropping system
Chhattisgarh	Soybean-Maize
Karnataka	Groundnut +Cotton (2:1)
Kerala	Turmeric
Rajasthan	Cluster bean-fennelMaize + black gram- durum wheat- sesbania

- 2. Application of 100 % of nutrients only through combination of organic manures (FYM, Vermicompost, oil cakes, enriched compost) + location specific innovative inputs and management as per NPOP standards**

State	Cropping system
Gujarat	Groundnut –Wheat - Green gram
Himachal Pradesh	French bean-Cauliflower-French bean
Kerala	Cassava- Groundnut
Madhya Pradesh	Soybean–chickpea, Soybean-wheat, Rice– Berseem (Fodder & Seed)
Maharashtra	Rice-Brinjal, Rice – White onion
Punjab	Basmati rice-wheat-GMMoong-wheat-Summer moong
Sikkim	Maize + ginger (1:1) – french bean
Uttarakhand	Grain Amaranth - Wheat+ Lentil (2:1), Rice - chickpea
Uttar Pradesh	Maize (Popcorn)- Potato - Okra + Sesbania (GM)
West Bengal	Rice-Capsicum-Green Gram;

3. Towards organic approach of integrated use of organic and inorganic nutrients without pesticides

State	Cropping system
Jharkhand	Rice-Potato
Kerala	Ginger-fellow
Meghalaya	Broccoli-Tomato
Tamil Nadu	Green manure - Brinjal - Pearl millet

4. Recommended varieties for promotion under organic farming

State	Kharif Crop	Rabi Variety	Summer Crop	Variety	Crop	Variety
Chhattisgarh	Rice	C.G. Sugandhit Bhog C.R. Sugandhadhan - 907	Chickpea	VaibhavJG-226	-	-
Gujarat	Groundnut	GJG 17GG 20	Wheat	GW 451GW 496	Green Gram	GM 4 GM 5
Himachal Pradesh	Okra French bean	Indiranil, P-8i Contender, Pusa Parvat	Pea Cauliflower	Nirali, Ten plus US-178, Chandramukhi	Tomato	Red gold, RK-123
Jharkhand	Rice	MTU 1010 Lalat	Wheat	K 0307 Raj 4229		
Karnataka			Chickpea Wheat	JAKI-9218, BGD-103UAS 446UAS 347		
Kerala	Cassava Turmeric	CR-24-4 Sree Vijaya PragatiKanthi				
Madhya Pradesh	Soybean Maize Rice	RVS-2004, RVs-2006 Proagro 4412 Kanchan Pusa Sugandha 3 Pusa Sugandha 5	Chickpea Wheat Wheat	JG 130 JG 163 GW 366 GW 322 HI 1500 HI 1418		
Maharashtra	Rice	Sahyadri-5S ahyadri-3	Groundnut	TG-26 Phule-6021		
Meghalaya	Maize	DA 61AR CM 75	French bean	Naga Local RCM FB 18		
Punjab	Basmati rice	RYT 3677 Pusa basmati 1509	Wheat	Unnat PBW 550 BWL 3504		



Rajasthan	Maize	VL Amber Sugar 75	Coriander Fennel Wheat	Azad Dhania 1 ACr 1 GF 12 AF 1 HI 8713 HI 8663		
Sikkim	Maize	Vivek sankul 35RCN 75	Buck wheat	IC 49671 IC 109433		
Tamil Nadu	Rice	Co (R) 48 CB 05022				
Uttar Pradesh	Maize	PMH 5 Pioneer 3396	Mustard	Pusa bold Pusatarak		
Uttarkhand	Rice	Pant Sugandha 27 Pant Sugandha 25	Wheat	HD 2967UP 2565		

B. Policy

Out of 682 farmers studied through Geo-referenced characterization in 15 States, only 6.7 % of farmers were using the SPNF inputs restricted to only 4 States. Further all the pillars of natural farming are not adopted by SPNF farmers. The yield level also found to be low compared to the organic growers. Therefore, crop and region-specific promotion of ZBNF/SPNF under Government schemes should be taken up after the validation of technology by the scientific institutions.

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

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

AICRP on Integrated Farming Systems, a plan scheme initiated from 2010-11 operates currently with 74 centres (25 on-station main, 11 on-station sub, 32 on-farm and 6 ICAR institute based voluntary centres) covering all the 15 agro-climatic regions. The scheme is in operation at 34 SAU's, 1 central university and 6 ICAR institutes and covers 25 States/UT's. During

the year under report, seven experiments/study namely Sustainable resource management for climate smart IFS (32 locations), Development of region specific IFS models (9 locations), Identification of cropping systems module for different farming systems (37 locations), Evaluation of weed management practices under organic production system (8 locations) and Carbon crediting and GHG emission in IFS models (32 locations) were taken up at on-station centres while 3 experiments namely on-farm crop response to plant nutrients in predominant cropping systems (768 farm households in 192 villages in 64 blocks of 32 districts in 21 states), Diversification of existing Farming Systems under marginal household conditions (768 farm households in 192 villages in 64 blocks of 32 districts in 21 states) and On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers (384 farm households in 192 villages in 64 blocks of 32 districts in 21 states) and On-Farm participatory research in tribal farming systems through cluster approach under Scheduled tribe component (12 locations) and Scheduled Caste Sub Plan (06 locations) were undertaken through on-farm research centres. The salient achievement of farming systems typology analysis carried out for Indo-Gangetic plains is given below.

Characterizing farm types and diversity of smallholder farming systems in Indo-Gangetic plains of India

A study was made to classify the diversity of small holder farm types in Indo-gangetic plains according to their crop, livestock and income related characteristics and investigate the association of these farm types with their mechanization. Using principal component analysis and cluster analysis, survey conducted for 252 farm households, typology has been constructed (Fig 1).

Type 1. Small Farm households with cereal-based cropping system and subsistence livestock (39 % of the sampled farms) : This type was dissociated from the others due to the strong discriminating power for variables related land holding (1.2 ha) having second largest area under cereal crops (167.1% cereal intensity) among other types. This type relied heavily on the sale of crop products as 80.1% share of income

is obtained by selling crop produce. Conversely, the percentages of livestock sales were the lowest among all farm types (18.3% of the share in income from livestock component.).

Type 2. Small Farm households with diversified cropping system dominated by cereal and fodder crops with only cattle herd (8 % of the sampled farms): Type 2 was the smallest cluster, characterized by small farm HH (1.1 ha) diversified in cropping system having 152.1 % cereal intensity, largest fodder intensity (42.9%) among all other types. This type possess livestock unit consisted entirely of cattle. The crop and livestock sources had 61: 39 % ratio respectively in total income of the farm HH.

Type 3. Marginal Farm household with diversified cropping system dominated by cash crop and and herd comprising of only cattle (39% of the sampled farms): Type 3 was characterized by the marginal farm HH (average of 0.9 ha), with diversified cropping

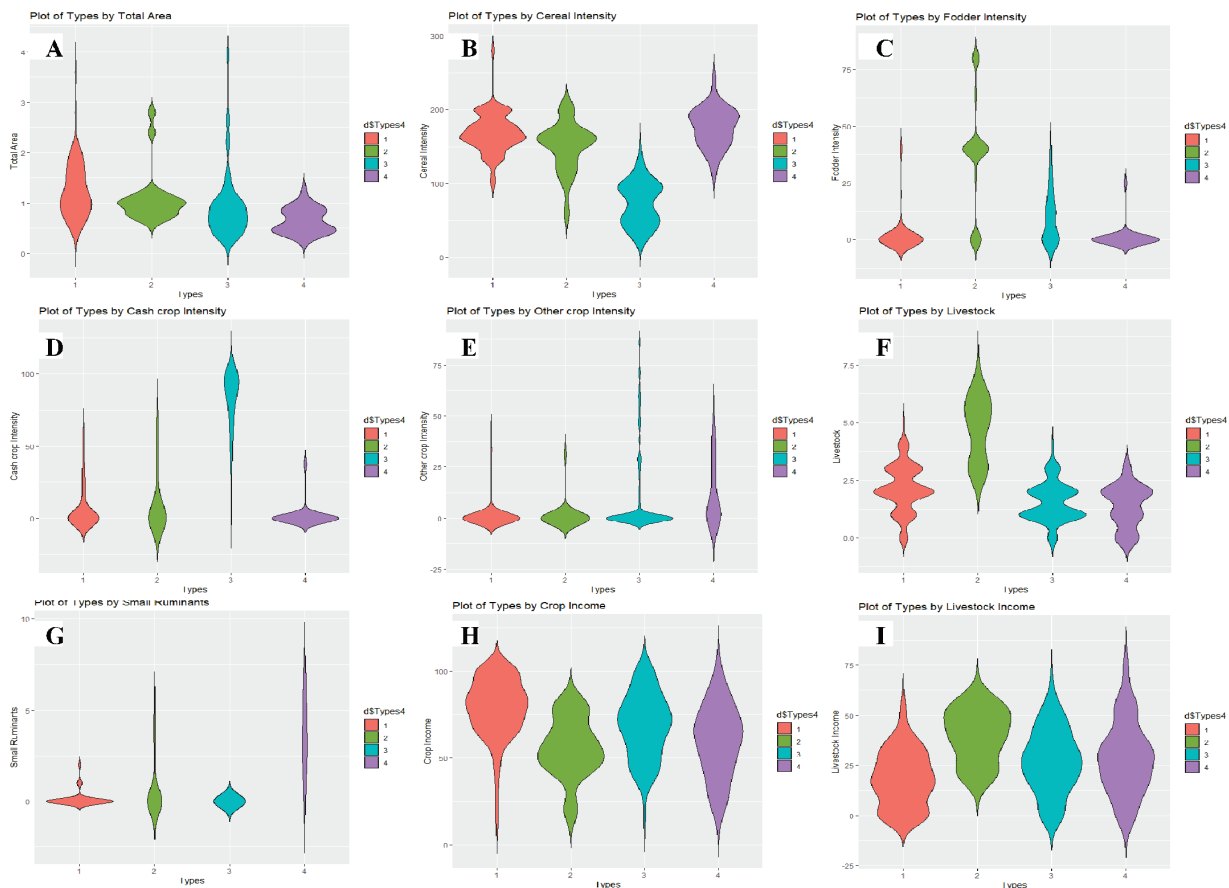


Fig 1. Violin plots showing results of scenario analysis of different variables in farm types



system largest area under cash crops with 81.4% cash crop intensity, 72 % cereal intensity, 9.9 % fodder intensity. Livestock component consisted only of cattle which is for subsistence.

Type 4. Marginal Farm household with diversified cropping system dominated by cereal crops and herd dominated by small ruminants (15 % of the sampled farms): For Type 4, the main distinguishing features included herd composition cereal intensity. The herd consisted mainly (about 65%) of small ruminants (on average 2 cattle, 3-4 goats and sheep). With 0.7 ha on average, this group cultivated the largest area under cereals with 172.9% cereal intensity.

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

Increasing the nutrient use efficiency in major food production systems has always been a major concern because of escalating costs of production of crops, especially with regard to nutrient management. 'Researcher-designed farmer managed trials' were conducted during 2018-19 through farmer participatory research covering the major food production systems in India. A total of 552 trials; 168 in rice-wheat, 48 each in rice-rice, rice-mustard and maize-wheat, 24 each in rice-gram, rice-maize, maize-gram, rice-vegetable, pearl millet-wheat, pearl millet-mustard, sorghum-wheat and soybean-sorghum, 12 each in maize-field pea, finger millet-tomato (S) and cotton-fallow and 6 each in soybean-wheat and soybean-chickpea were conducted with 7 treatments. Across various NARP zones and cropping systems, farmer's package resulted in lower yield compared to recommended package owing to the lower application of N, P_2O_5 , K_2O and micronutrients. On-farm system yield gap between recommended dose of N, P_2O_5 , K_2O + micronutrient and farmer's package were found to be higher in rice-rice, rice-wheat, maize-wheat, and rice-mustard cropping systems. Application of micronutrients based on soil test resulted in additional yield of in rice-rice, rice-wheat, maize-wheat, and rice-mustard systems. In all the NARP zones and systems, application of recommended N, P_2O_5 , K_2O alone or N, P_2O_5 , K_2O +

micronutrient resulted in higher yield and use efficiency of nutrients. Suboptimal application in terms of number and quantity resulted in significantly lower yield and use efficiency of nutrients especially nitrogen.

Project : Ensuring Food and Nutritional Security through Integrated Farming Systems in Western Plain Zone of Uttar Pradesh

Farmer First programme (FFP), a flagship programme of Indian Council of Agricultural Research (ICAR) funded under ICAR-KVK scheme is being implemented by ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram in 3 selected villages of Muzaffarnagar district in western Uttar Pradesh. The prime objective of the project is to understand the constraints and opportunity available in the region along with designing and implementation of holistic farming systems interventions for ensuring food and nutritional security through increasing the farm productivity and profitability with small and marginal farmers in focus. Under this programme 1036 households in a cluster belonging to 3 contiguous villages i.e. Bhaingi-Bhangela, Satheri and Sonta in Khatauli block of Muzaffarnagar district were chosen for technological intervention in different modules of farming system. Farming systems intervention proved to be a useful tool for leveraging the small and marginal farmers for their livelihood security.

Baseline information of farm households

Farm households of all the three adopted villages have been categorized into different category of farmers based on land holding size. The results revealed significant presence of landless farmers (36.29%) while marginal. Small and landless farmers together constitute about 87.45 % of the farming community. Highest number of landless farmers were found in Sathedi village (49%) followed by Sounta (33.4%) and Bhangela (19.7). Highest percentage of marginal farmers were present in Bhangela village. Overall percentage representation of medium farmers



Plate 1 View of Farmer First interventions in field

were very meager (2.1%) while large farmers were absent in the adopted villages suggesting defragmentation of landholdings.

Brief description of modulewise interventions

During the reporting period of 2019-20 based on constraint analysis and requirement needs of different category of farmers module wise technological interventions were planned and implemented in the field.

Crop Module:

Trench planting of sugarcane in autumn with intercropping of mustard

A strategic intervention was imposed on new variety of sugarcane “CoPk 05191” and mustard

variety (RH 749) as an intercropping with autumn sugarcane planting in paired rows at trench method of transplanting was clamped in the adopted village (Sathedi).

The experiment conducted at farmers field revealed that sugarcane variety CoPk 05191 (96.18 t/ha) recorded higher cane yield over Co 0238 (66.14 t/ha) and same trend was also observed in case of number of tillering as well as NMC (Number of Millable Cane) when planting was done in May by traditional method (Table 1). Besides intercropping of mustard gave an additional income of Rs. 72000h⁻¹ without additional land requirement.

Performance evaluation of late sown cultivars of wheat

Three improved cultivars intervention (PBW 550, PBW 658 and DBW 90) one farmers practices (PBW-226) were taken for evaluation during 2018-19, alongwith the farmers practices (PBW 226) for performance evaluation of the various cultivars in terms of grain yields and other yield attributing characters. Management practices like application dose of N, P and K and number of irrigations applied during each crop season was analysed to know the effect of these parameters on yield improvement of the crop. Highest grain yield was observed in late sown variety PBW 658 (Table 2).

Table 1 Average cane yield of sugarcane varieties farmer’s field

Yield parameters	CoPk 05191	Co 0238
No. of tillers ‘000’/ha	166.52	109.53
NMC ‘000’/ha	157.90	99.25
Single cane weight (kg)	1.10	1.30
Cane height (cm)	253.55	240.36
Cane girth (cm)	2.289	2.72
Cane yield (kg/plot)	350.00	240.00
Cane yield (t/ha)	97.30	66.72
Green leaves top (yield t/ha)	18.05	14.68



Table 2 Plant height, grain yield and yield attributes of wheat during *rabi* 2018-19

Treatments	Plant height (cm)	Effective tillers/plant	Ear length (cm)	Grains/ear	Test wt (g/100 seeds)	Grain Yield (kg/ha)
PBW-226	89.9	4.4	5.7	56.6	2.9	4373
PBW-550	80.4	6.9	7.7	61.7	3.0	4654
PBW-658	97.4	7.3	8.6	66.4	3.0	5326
DBW-90	85.2	6.6	9.2	55.8	4.5	4489
C.D.	1.7	1.1	1.3	6.0	0.3	239
SE(m)	0.6	0.4	0.5	2.0	0.1	81
SE(d)	0.8	0.5	0.6	2.9	0.2	115
C.V.	2.0	17.6	17.4	10.1	10.0	518

Coorelation coefficients important environmental variables with respect to grain yield revealed imporatnce of temperature during grain filling stage (Fig. 2).

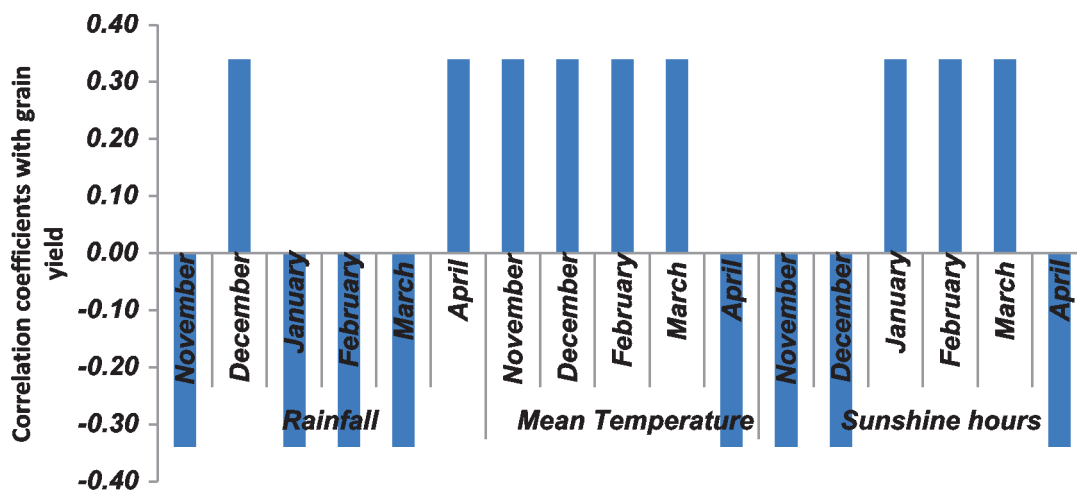


Fig. 2 Correlation coefficients of important environmental variables with respect to wheat grain yield

Performance evaluation of HYV of mustard

RH-749 variety of mustard were used for on-farm trial and yield was compared with that of local variety Varuna. Average yield enhancement upto 25.47% was observed in the cluster.

Livestock Module:

Technological intervention for improved fodder production

For steady supply of green fodder berseem and oats were evaluated with improved management practices

and proper seed rate which resulted in about 27.5% yield enhancement (Table 3).

Impact on milk yield due to animal health management and improved fodder supply

Supplementation of mineral mixture along with balanced nutrition was carried out for enhancing milk production in milching animals along with improved supply of quality green fodder which resulted in improvement in milk yield by 19.30%.

Table 3: Performance evaluation of fodder crops under improved management practices

	Village	No of demonstrations	Yield (q/ha) Improved practice	Yield (q/ha) Farmer practice	Increase in yield (q/ha) (%)
Berseem (1kg seed per 400 m ²)	Sounta	35	792.86	613.93	178.93 (29.25%)
	Sathedi		789	613	176 (28.78 %)
	Bhayangi-Bhangela		795.9	608.63	187.27 (30.89%)
	Mean		792.6	611.9	180.7 (29.5%)
Oats (Kent)	Sounta	22	474	370	104 (28.17%)
	Sathedi		476.43	367.14	109(30.21 %)
	Bhayangi-Bhangela		466.25	373.75	92.5 (24.97%)
	Mean		472.2	370.3	101.8 (27.5%)

Table 4. Income enhancement through technological intervention in animal husbandry

Component	Village	No of Households	Increase in Annual income (Rs)	Increase in Annual income (%)
Piggery				
Large White Yorkshire (1 M + 1 F to each farmer)	Sounta	15	9400	48.81
	Sathedi		11400	30.48
	Bhayangi-Bhangela		12400	41.96
	Mean		11066	40.42
Poultry				
Nirbheek(12 birds to each farmer)	Sounta	24	13000	31.18
	Sathedi		12500	30.23
	Bhayangi-Bhangela		10800	27.27
	Mean		12100	29.56
Goatary				
Jamnapari(2 goats to each farmer)	Sathedi	9	12200	32.79
	Bhayangi-Bhangela		11080	32.5
	Mean		11640	32.65

Animal husbandry

For ensuring the livelihood security of marginal and landless farmers, animal husbandry based IFS involving piggery, goatary and poultry were carried out and evaluated. Landless farmers were provided with Large White Yorkshire breed of piglets for enhancing their livelihood through pig rearing. Each farmer was provided with 1 Male and 1 Female piglet. Results indicated 40% increase in their income from pig rearing. Landless farmers were provided with

backyard poultry for enhancing their livelihood through backyard poultry. Each farmer was provided with 12 birds of CARI Nirbheek. Results indicated that, there was 29% increase in farmers income from pig rearing. Marginal and landless farmers were provided with Jamanapari goat for enhancing their livelihood through goat rearing. Each farmer was provided with 2 goats (Plate 1). In each village 1 male was maintained, rest being females. There was 32% increase in farmer's income through addition of goat rearing (Table 4).



Plate 2 : Different interventions under animal husbandry

Horticulture Module:

Improved package of practice has been provided to the farmers for successful cultivation of the exotic vegetables viz., broccoli, chinese cabbage, Kale and lettuce in vegetables module for enhancing profitability through demonstrations at 50 farmers field. Demonstration of improved package of practices in vegetable crop production was carried out at 250 farmers field. Low cost poly tunnels were demonstrated for off season nursery raising of vegetable seedlings. Orchard based model with intercropping of pulses in Guava and litchi was carried out (Table 5). With diversification B:C ratio was increased from 1.89 to 2.12.

Technological Intervention:

- POP for Litchi and Guava with intercropping of pulses (black gram/green gram/ chick pea)
- Lemon and Karonda as boundary plantation
- Feed supplement of animals (mineral mixture,

Calcium, Vitamin mixture) Vermicomposting and kitchen Garden.

Table 5. Diversification through orchard based IFS for higher income

Benchmark	Crop Module
0.8 ha.(58.3 %)	Sugarcane-ratoon-Wheat
	Animal Module:
	3 Cows
	Manure
Net Return: 1.29 lakhs, B: C Ratio 1.89	
Improved IFS	Orchard Module
0.4 ha (50%)	Guava (Intercropping of pulses)
0.4 ha (50 %)	Litchi (Intercropping of pulses)
	Animal Module:
	3 Cows
	Manure ; Vermicompost
Net Return: 1.73 lakhs, B:C Ratio 2.12	

Table 6 Economics of water chestnut production in leased pond

IFS module		Farmers (02 nos)
Farmer Practice	Intervention	
Dependent of Wages only	Water Chestnut + POP + Poultry (12)	Pond rent = Rs. 0.40 Lakhs Annual return = Rs. 3.00 Lakhs Expenditure = Rs. 0.50 Lakhs Net return = Rs. 1.90 Lakhs Poultry Cost = Rs. 0.05 Lakhs Gross return = Rs. 0.21 Lakhs Net return = Rs. 0.16 Lakhs Total Income = 2.06 Lakhs
Village pond on lease	Size = 1.50 and 0.60 ha	



Secondary Agriculture Module

Water chestnut cultivation in leased ponds for landless farmers

For alternative resource generation for landless farmers water chestnut cultivation in leased village ponds was carried out and the results are presented in Table 6.

Drudgery reduction in farm women

Improved sickle for harvesting of field/fodder crops were demonstrated to 800 farmers. The working capacity of improved sickle was 405.89 hr/ha which is significantly higher ($p < 0.05$) as compared to the traditional sickle (499.31 hr/ha). The mean value for strain index by using improved sickle was found to be 18.96 whereas it was 35.53 by using traditional sickle by the farmers and the difference was found significant ($p < 0.05$).

Value addition of farm produce

Under this module for value addition of farm produce for higher income through SHG, a Women Self Help group (Devanjali Mahila Samuh) bearing Registration. No. 353883 in Sathedi village of Muzaffarnagar district has been formulated. The members were given training on preparation of different value added products using their on-farm produce viz. Pickle, Jagery cubes etc. Technology of blended squash (guava+orange) and (guava +

pineapple + pomegranate), Mixed jam (guava+apple+aonla +orange+ ramphal) and (guava+pineapple+ pomegranate + apple), Ginger



Plate 4 . Shri Giriraj Singh, Hon'ble Union Minister of Animal Husbandry, Dairying and Fisheries & Dr Sanjeev Baliyan, Hon'ble MoS Animal Husbandry, Dairying and Fisheries with members of SHG at ICAR-IIFSR



Plate 5. Snap shot of SMS agro-advisory services

paste and labeling, branding and marketing on developed products through exhibitions and door to door marketing techniques for skill enhancement and income alternate income generation from value addition module were also carried out during the reporting period.

Risk management through SMS based agro-advisory services:

Farmers of all the three villages were provided with weekly weather based agro-advisory for farm management for different modules of farming systems. Besides weekly advisory, need based advisory on crop specific management depending on weather condition requiring immediate attention were also provided. A SMS based agro-advisory service named IIFSRK was started with technical support from C-DAC under which 1036 farmers of all the three villages were registered. Farmers were given information about rainfall predictions as well as improved practices and crop specific disease and pest management advisories specific to different season through SMS (Plate 5).

Impact on Household Nutrition due to Technological Intervention through IFS approach

Changes in food consumption pattern after the farming systems interventions

A study on food consumption pattern was

conducted in the cluster of three villages to know the accessibility of food to farm households as per recommended dietary allowances (RDA) and it was found that the farm households were marginally lacking in cereal and millet consumption (mean consumption: 357.8 gms capita⁻¹ day⁻¹), pulse consumption (mean consumption: 32.1 gms capita⁻¹ day⁻¹), fats and oils (mean consumption: 22.72 gms capita⁻¹ day⁻¹), whereas the farm households were severely lacking in vegetables specially green leafy vegetables (mean consumption: 8.64 gms capita⁻¹ day⁻¹) and other vegetables (mean consumption: 65.46 gms capita⁻¹ day⁻¹). However, the mean consumption in terms of milk, sugar and jaggery was found higher than RDA in the adopted cluster. This is due to the sugarcane and dairy based farming systems prevailing in the villages of adopted cluster. After the implementation of farming systems interventions, food consumption pattern was again studied it was observed that the mean food consumption pattern in terms cereals and millets (423.7 gms capita⁻¹ day⁻¹), green leafy vegetables (23.48 gms capita⁻¹ day⁻¹), other vegetables (136.07 gms capita⁻¹ day⁻¹), roots and tubers (99.42 gms capita⁻¹ day⁻¹), fruits (57.78 gms capita⁻¹ day⁻¹), fats and oils (32.16 gms capita⁻¹ day⁻¹) meat products (4.82 gms capita⁻¹ day⁻¹) have been improved. However, the mean consumption of pulse have remained same besides the integration of pulse crop and the mean consumption pattern for milk have increased to 496.15 57.78 gms capita⁻¹ day⁻¹ which is 165.38% as RDA but the higher milk consumption is

necessary to compensate protein requirements of the household as the mean pulse consumption is still less (Fig 26). Interestingly, the mean sugar and jaggary

consumption pattern have reduced to 47.7 gms capita⁻¹ day⁻¹ which is almost equivalent to RDA.

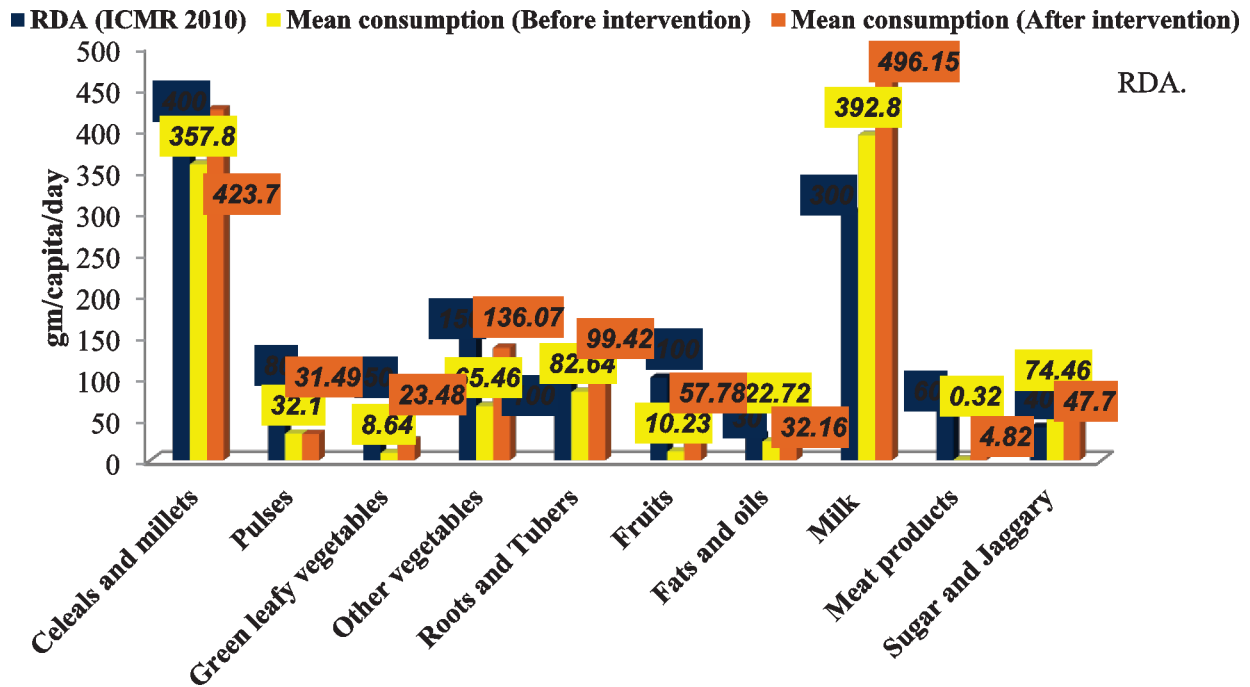


Fig.3. Food consumption pattern before and after farming system intervention



RESEARCH COORDINATION AND MANAGEMENT

32nd Meeting of Institute Research Committee

The 32nd meeting of Institute Research Committee (IRC) of institute was held during 4th October 2019 at ICAR-IIFSR, Modipuram. The meeting was chaired by Dr A. S. Panwar, Director, ICAR-IIFSR. Dr. Peyush Punia, Member Secretary, welcomed the Chairman and all the members of the IRC. Dr A. S. Panwar, Director and Chairman, 32nd IRC meeting welcomed all the member scientists for the meeting and suggested that the project proposals should aim towards achieving the larger goal of doubling farmers income in terms of productivity, profitability and nutrition. He emphasized to merge all small-small experiments to form a result oriented project so that, meaningful results can be drawn Dr. A. K. Prusty presented the action taken report of the 31st IRC proceeding and research highlights of on-going projects in brief.

All the principal investigators of the projects presented their findings of their respective projects and after each presentation exhaustive discussions and suggestions for further improvements in the projects and their objectives were done. Dr A S Panwar, Director and Chairman, 32nd IRC meeting in his concluding remarks appreciated the efforts of the scientists for the results achieved in their respective projects and suggested that quarterly meetings should be held in the respective divisions to review the progress of the ongoing projects for better results.

Third Meeting of Institute Research Advisory Committee

The third meeting of the 8th Research Advisory Committee of ICAR-Indian Institute of Farming Systems Research, Modipuram was held on 2-3 August, 2019. Chairman of the Committee Dr. A. K.



Singh, and members Dr. S. Bhashkar, ADG (Agronomy, Agroforestry and Climate Change), ICAR, Dr. H. Ravishanker, Dr. N. Sarangi, , Dr. N. Devakumar, Dr U. K. Behra, Sh. Momraj Gurjar, farmer's representative and scientists of the Institute participated in the meeting. Member Secretary, Dr. Peyush Punia, welcomed the Chairman and the RAC committee members for the meeting

Dr. A S Panwar, Director, ICAR-IIFSR welcomed the Chairman and Members of RAC and briefed the Committee on programmes, achievements and activities undertaken at the institute during the year 2018-19. The significant research achievements highlights included development of 45 models of IFS suitable for 23 states, success stories by the institute, refinement of 63 farming systems with farmers participation in 19 States, crop diversity of IFS models spatial distribution of farming systems in India, identification of eco-friendly integrated farming systems, farmer participatory refinement of farming systems, geo-tagged characterization of organic farmers, resource conservation practice identified for organic production system, monetized impact of selected technologies, experiments on Zero Budget Natural Farming (ZBNF) and programmes to be undertaken in next SFC (2020-25).

In his opening remarks, Dr A K Singh, Chairman appreciated the efforts and achievements of the institute for their work on integrated farming system and referred to ZBNF which is occupying center stage. He emphasized on quantification of carbon, water energy and nutrient in IFS models with primary processing/value addition to be part of IFS. He further pointed out the deficiencies in the IFS models and suggested improvements in terms of market linkage, precision farming, sensor based farming and inclusion of interventions in IFS. Dr S Bhashkar welcomed the RAC Committee and requested the RAC members to guide the research of the institute for years to come as the role and responsibilities of the institute are increasing in the current scenario. He emphasized undertaking research by the institute in mission mode on water conservation in crops, effects of climate change and to address the problems of the farmers. Dr N Sarangi appreciated the research work progress and highlighted that the integrated farming system is largely dominated by small and marginal farmers. As such the IFS models needed to be validated for a minimum of two years as total quantification is required in terms of cost, benefit, energy budgeting, carbon sequestration etc. He further informed that bioflux aquaculture system in IFS needs to be looked into in places where water availability is





less. Dr H. Ravishankar complimented the scientists of the institute for undertaking excellent work in farming system for the benefit of the farmers of the country. He emphasized on the need to have studies on input output relationships in IFS model and objective analysis of yield, quality of crops in IFS models with sustainable use of resources and utilization. Dr. N. Devakumar congratulated on the work carried out by the institute and felt the need of more analytical and awareness about ZBNF practices should be undertaken. He also felt the need to send advisories for IFS models to all the states and revalidate the developed indices for organic and inorganic farming evaluation. He further stressed on emphasis to be given for ecological services/ ecological conditions which should be taken into account while working out the benefits of organic and related farming systems. Dr U K Behera appreciated the work done in the institute and felt the challenge is to increase the productivity, production and income of the small and marginal farmers. He presented the talk on IFS and road map for promotion of IFS in India using Farm Development Card (FDC) which gives holistic approach to farmers with diagnostics

and recommendations to improve their livelihood. Dr Momraj Gurjar felt the need for undertaking extension activities for the dissemination of technologies/models developed by IIFSR for better visibility of the institute. Dr Asish Prusty then presented the action taken report on the recommendations of second meeting of 8th RAC meeting and the committee members were satisfied with the progress and accepted the action taken report.

The Programme Facilitators and Heads of different divisions presented the highlights of research achievements of the respective divisions. The Chairman and the members of the RAC expressed their critical views during the presentations made by the concerned scientists/team and given their valuable inputs and directions for the improvement of IFS research and IIFSR in the future. The RAC committee then deliberated for making recommendations for improvement and formulations of future research programs to be undertaken by the institute. The RAC committee then visited farm of the institute and experiments being conducted in the farmers field and gave critical inputs for improvement of the experiments.

PUBLICATIONS, AWARDS AND RECOGNITIONS

Research Paper (International Paper)

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Awards

Name of Award	Received by
Young Scientist Award 2019 in the field of Fisheries on the occasion of International Conference on 3 rd Global meet on science and technology for ensuring food and nutritional security (GMST 2019)	A.K. Prusty
Distinguished Scientist Award by the Agro Environmental Development Society (AEDS), Majhra Ghat, Rampur UP, India	M. Shamim
Best poster award in the National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced productivity and Economic Prosperity) at University of Agriculture Sciences, Bengaluru.	L.R. Meena Suresh Malik Dushyant Mishra Devendra Kumar Chandra Bhanu A.K. Prusty A.L. Meena
Lifetime Achievement Award 2019 by The Society of Tropical Agriculture (Reg. No. S/1714/2017), New Delhi, India	L.R. Meena
International Fellow Award 2019 by New Age Society of New Delhi	L.R. Meena
Distinguished Scientist Award by United Lightning Vision Association, Bengaluru, Karnataka, India	Vinod Kumar
Young Scientist Award 2019 in the field of Horticulture on the occasion of International Conference on 3 rd Global meet on science and technology for ensuring food and nutritional security (GMST 2019) held during 1-3 December 2019	Poonam Kashyap
Women Scientist Award (<i>In absentia</i>) from Pragati International Scientific Research Foundation Meerut, India	Nisha Verma
Fellowship award 2019 conferred by Pragati International Scientific Research Foundation Meerut	D.K. Singh
Distinguished Scientist Award -For outstanding contribution in the field of Farm Machinery and Power in International Conference on 'Sustainable Agriculture Production for Food, Nutritional and Livelihood Security: A Challenge for Asian Farmers' during 25-27 September 2019 at Pattaya, Thailand.	V.P Chaudhary

Recognitions

Recognition	Awarding institute/ association	Name of the awardees
Recognized as member of Scientific Advisory Committee (SAC)	Krishi Vigyan Kendra, Muzaffarnagar-I (S.V.P. U.A.T., Meerut) (Ref. No.KVK/2019, 10.12.2019)	L. R. Meena
Best Oral Presentation Nutrient Management in Integrated Farming Systems Through Recycling of Farm Based by Products	United Lightning Vision Association, Bengaluru, Karnataka, India	Vinod Kumar L.R. Meena Suresh Malik Amit Nath Dushyant Mishra Devendra Kumar Chandra Bhanu A.K. Prusty and S.P. Singh
Distinguished Scientist Award	United Lightning Vision Association, Bengaluru, Karnataka, India	S.P.Singh
Recognized Expert (Horticulture) for fruit growers of Uttar Pradesh state under KKMS Scheme of Ministry of Agriculture and Farmers Welfare	GOI, New Delhi	Dushyant Mishra
Nominated as Member in executive organizing committee for National Conference on Identification, Convergence, Implementation & Extension of Science-Tech-Research For Sustainable Development ICISSD-2019	SVPUAT, Meerut, Uttar Pradesh	Dushyant Mishra
Nominated as Co Chairman in Session 6 on Research and Challenges: Horticulture, Floriculture, Agro-forestry, Fishries during National Conference on Identification, Convergence, Implementation & Extension of Science-Tech-Research For Sustainable Development ICISSD-2019	SVPUAT, Meerut, Uttar Pradesh	Dushyant Mishra
Nominated as Member in selection committee for recruitment of Assistant Professor (Horticulture)	CCS Haryana Agricultural University Hisar	Dushyant Mishra
Nominated as Member in judging committee for fruit show during Kisan mela evam pradarshani	SVPUAT, Modipuram	Dushyant Mishra



Acted as Member in judging committee during 28 th National Mango show	Yadvindra garden, Pinjore, Panchkula	Dushyant Mishra
Received appreciation letter for an excellent program on Swacchata He sewa	Public Representative of Khanpur, Jani, Meerut	Dushyant Mishra
Received appreciation for outstanding work and farmers satisfaction on Independence day 15 August 2019	Director, ICAR-IIFSR	Dushyant Mishra
Received recognition as Fruit Expert from farmers of western UP (More than 100 letters, emails forwarded)	Director, ICAR-IIFSR	Dushyant Mishra
Member Secretary, Quinquennial Review Team (QRT)	ICAR-IIFSR including AICRP on IFS and AI-NPOF	N. Ravisankar
Member of the Institute Management Committee	Secretary (DARE) and Director General, ICAR for ICAR-IISS, Bhopal and ICAR-NRC Orchids, Pakyong, Sikkim	N. Ravisankar
Member Secretary, Core Committee to prepare policy document on Futuristic crop planning for 2030/2050's	Secretary (DARE) and Director General, ICAR	N. Ravisankar
Member Secretary of the committee constituted for validating the results of SPNF model	Secretary (DARE) and Director General, ICAR	N. Ravisankar
Member of GoI for assessing the impact of floods on natural farming and other farmers in Maharashtra	Secretary (DARE) and Director General, ICAR	N. Ravisankar
Member, Core Committee to prepare policy document on Futuristic crop planning for 2030/2050's	Secretary (DARE) and Director General, ICAR	N. Subash
Rapporteurs in technical sessions of Annual Group Meeting of AI-NPOF at ICAR-CIARI, Port Blair	ICAR-IIFSR	P.C. Ghasal
Rapporteurs in technical sessions of International Seminar on Climate Smart Farming at NASC complex, Pusa, New Delhi	ICAR-IIFSR	Debashis Dutta
Resource Person for Crop Modeling Community	CGIAR Platform for Big Data in Agriculture Convention 2019 held during 16-18 th October, 2019 organized by ICRISAT, Hyderabad	N. Subash

RESEARCH PROJECTS

Institute funded projects

Project title	Duration	Principal Investigator	Co-PIs
Integrated Farming Systems			
Characterization of Existing Farming Systems of Uttarakhand	Jan18- Dec 22	Nisha Verma	Kushyal Singh, V. P. Chaudhary, Vipin Kumar Chaudhary, Associate- Amit Nath
Development of Sustainable IFS Model for Western Plain Zone of Uttar Pradesh	June 2017- June 2022	L.R. Meena	D. Kumar, D. Mishra, P. Punia and Raghavendra KJ, Associates- AK Prusty, C. Bhanu, S. Malik and Amit Nath
Evaluation and Identification of Farm Implements under Different Farming Systems	Oct. 2018 – Sept. 2024	V.P. Chaudhary	D. Mishra, N. Verma and P.P. Singh
Sustainable livelihood generation through IFS involving uneconomic cattle	June 2019- Oct. 2024	S. Malik	M. P. Singh, Raghuveer Singh, Chetan Kumar G, L. K. Meena, Kushyal Singh, Lalit Kumar, Associates- SK Dhoop Singh, A.S. Sirohi, H. L. Singh
Refinement of vegetable Based Farming Systems model for Food and Nutritional Security of Farmers of Western Uttar Pradesh	Dec 18- Dec 22	Poonam Kashyap	A. K. Prusty, Sunil Kumar, Lalit Kumar, Associates- Jairam Chaudhary, D. Dutta
Influence of pesticides application in IFS on fisheries and quantification of GHGs emission	Nov19- Dec 22	A. K. Prusty	Peyush Punia, Associate- D. Dutta



Carbon crediting and Greenhouse gases emission integrated farming system models under AICRP on Integrated Farming Systems	2018-2022	D. Dutta,	N. Subash and M. M. Shamim
Development of an intelligent model for predicting mango yields using artificial neural networks		Vipin Kumar Chaudhary	
Development of protocol for value added product from organic sugarcane	Oct 2018-Sep 2021	Amit Nath	R.P.Mishra Devedra Kumar
Organic Agricultural Systems			
Status of Organic Agriculture in Western Himalayan Region	Aug. 2018-Aug. 2023	Sunil Kumar	Chetan Kumar G., Associate- L. K. Meena
Crop improvement for organic production system	Oct'2015-April 2022	Devendra Kumar	L.R. Meena, Raghavendra K.J.
Nutrient management in different cropping systems under organic production systems	Oct. 2018-Dec. 2023	P. C. Ghasal	A L Meena, Chandra Bhanu, Jairam Choudhary, Chethan Kumar G., Amit Kumar, Lalit Kumar
Development and validation of microbial consortia for crop residue recycling under organic farming system	Jan2019-Dec 2023	Jairam	D. Dutta Chaudhary
Development of Integrated Organic Farming System (IOFS) models for different regions of India (Institute-AI-NPOF linked)	Nov'2016-March 2023	N. Ravisankar	Amit Kumar, P. C. Jat, S. Malik, Poonam Kashyap, Lalit Kumar, Associate- Chandra Bhanu
Identification of climate resilient production systems for different ecology (Institute-AI-NPOF Linked)	Nov.2016-Nov-2022	M Shamim	R.P.Mishra
Development of pest and disease management package for organic farming	May 2018-June 2022	Chandra Bhanu	AL Meena, Jairam Choudhary

Cropping System and Resource Management

Measurement and Estimation of Greenhouse Gases (GHG) emission and carbon footprint in sustainable Integrated Farming System (IFS) models of Western Plain Zone of Uttar Pradesh (Institute Project)	2019-2021	N. Subash	Debashis Dutta and Suresh Malik
Updating of Cropping System Atlas of India and Preparation of futuristic crop plan for 2030, 2040 and 2050 (Institute-AICRP -IFS linked)	Oct-2019-Sep'2023	Raghuveer Singh	N Ravisankar, N Subash, Chethan Kumar G, Ramamoorthy (NBSSLUP), BMK Raju (CRIDA), Ramarao (CRIDA), Associate- M. Shamim
Identification of cropping system modules for different farming systems		Amit Kumar	Prem Singh, Debashis Dutta, L.K. Meena, P.C. Ghasal, Chethan Kumar, G., Sunil Kumar and Jairam Choudhary

Technology Transfer and Assessment

On-farm evaluation of farming system modules for profitability and livelihood improvement of different farmers categories of Western Plain Zone of Uttar Pradesh and Uttarakhand.	Jan. 2018-March 2022	P. C. Jat	Poonam Kashyap, Peyush Punia and Lalit Kumar
Weather based on-farm technological interventions in farming systems perspective for improving livelihood of farm households	June 2018-May 2021	M. Shamim,	Poonam Kashyap, Associate-Sunil Kumar



Externally funded project

Project title	Duration Investigator	Principal	Co-PIs	Source of fund	Budget
ICAR funded					
Ensuring Food and Nutritional Security through Integrated Farming Systems in Western Plain Zone of Uttar Pradesh” (Farmer FIRST)	First phase	A.S. Panwar	M. P. Singh, Poonam Kashyap, A. K. Prusty, M. Shamim, N. Verma, Sunil Kumar P. C. Jat, and Devendra Kumar	ICAR-ATARI, Kanpur	10.00 Lakh/year (2018-19)
All India Network Programme on Organic Farming (National)	April 2017- March 2026	N. Ravisankar	M. Shamim Raghuv eer Singh M.A. Ansari Raghavendra K.J.	NRM Division, ICAR	177.66984 Lakh/year (2018-19)
AICRP on Integrated Farming Systems- On station (National)	2021-2026	Scheme Leader : A.S. Panwar, PI (IFS-on-station & OFR); N. Ravisankar; PI (Cropping Systems & long term nutrient management), Debashis Dutta; PI (Carbon crediting & GHG); M Shamim PI (Bankable IFS model and)	Associates; N. Subash (CC & GHG), A. K. Prusty (IFS-On -station), and Raghuv eer Singh (OFR-Co -PI)	NRM Division, ICAR	278.454 Lakh/year (2018-19)
Sustainable resource management for climate smart IFS under AICRP on Integrated Farming Systems	April 2017- March 2026	N. Ravisankar	P.C. Ghasal, D. Dutta, S. Malik, . A. K Prusty, Poonam Kashyap, Associate- M. Shamim	ICAR- IIFSR, Modipuram	12.53Lakh/year (2018-19)
All India- Network Programme on Organic	2004-2026	R.P. Mishra	Debashis Dutta Chandra Bhanu	ICAR- IIFSR,	6.72Lakh/year (2018-

Farming, Modipuram Centre			P.C. Ghasal Jairam Choudhary	Modipuram	19)
On-farm Participatory Research in Farming Systems Perspective under Tribal Sub Plan in Haridwar (TSP)	May 2018- March 2022	Chandra Bhanu	Jairam Chaudhary, Associate- A. K. Prusty	ICAR- IIFSR, Modipuram	11.13 Lakh/ year (2018- 19)
Adaptation and mitigation potential through Cropping System/ Farming System approach (NICRA)	2020-2025	N. Subash	Debashis Dutta P.C. Ghasal	ICAR- CRIDA, Hyderabad	52.7Lakh/ year (2018- 19)
Evaluation of different cropping sequences for crop intensification under CA practices (Consortium Research Platform on Conservation Agriculture)	July 2015 – March 2025	Prem Singh	L.R. Meena P.C. Jat D.K. Singh Sunil Kumar Jairam Choudhary	ICAR-IISS, Bhopal	10.3Lakh/ year (2018- 19)
Cluster based on farm participatory research in farming systems perspective under tribal sub plan in Uttrakhand (TSP)	2017-2022	Nisha Verma	V. P. Choudhary, Amit Kumar, S. Malik, Amit Nath, Associate- Chandra Bhanu	ICAR- IIFSR, Modipuram	1.22Lakh/ year (2018- 19)
Outside ICAR funded					
Development of climate resilient sustainable integrated farming system models for optimizing farm productivity (NMSA)	Oct. 2017- March 2021 (Completed)	A.S. Panwar	M.P. Singh A.K. Prusty Chandra Bhanu Debashis Dutta M. Shamim P.C. Jat	NMSA, Govt. of India	234.24 Lakh

Contract Research project

Project title	Duration I	Principal investigator	Co-PIs	Source of	Budget fund
Testing of products for irrigation and water management, Fertilizer and pesticide at ICAR-IIFSR, Meerut	Nov. 2019- June 2021	M. Shamim	Poonam Kashyap Raghuveer Singh N. Ravisankar A.S. Panwar	BTN Insulo India Pvt. Ltd. Ghaziabad	12.69 Lakh



HUMAN RESOURCE DEVELOPMENT

Seminars/symposia/training/workshop/conference /summer School/Winter School/ Meeting attended

Title of training/seminar/symposia/ workshop	Period	Venue	Name of participant
VI meeting of QRT of ICAR-IIFSR including AICRP on IFS and AI-NPOF	10-12 Jan 2019	Trivandrum	A. K. Prusty
Indian Horticulture Congress 2018	17-21 Jan 2019	IGKV, Raipur, Chattisgarh	M. Shamim
SMD level 6 monthly Review meeting of Foreign aided Projects	24 Jan 2019	NASC, New Delhi	A. K. Prusty
Brainstorming Workshop on “Elevated temperature and its impact on fragrance of basmati rice and strategies for mitigation”	2 Feb 2019	College of Biotechnology, SVPUAT, Meerut	Chethan Kumar G L.K. Meena
Seventh meeting of QRT of ICAR-IIFSR (including AICRP on IFS and AI-NPOF)	4-6 Feb 2019	ICAR-CIARI, port Blair	A. K. Prusty
International Symposium on Advances in Agrometeorology for Managing Climatic Risks of Farmers (INAGMET-2019)	11 - 13 Feb 2019	JNU, New Delhi, India	M. Shamim
Workshop on Technical Collaboration on Agribusiness between India and Argentina	15 Feb 2019	NASC, New Delhi	
Write lab meeting of AICRP on Prusty IFS to prepare the publications related to FarmDesign and Farming Systems Typology from AICRP on IFS along with selected centres and experts from CIMMYT, India and also Wageningen University of Research, The Netherlands.	26 Feb -01 Mar 2019	PAU, Ludhiana	N. RavisankarA. K.
Meeting-cum-workshop of Scientist in IT/Computer Application	6 Mar 2019	NASC Complex, New Delhi	Vipin Kumar Choudhary

Brain storming session on sustainability of livestock and fishery production systems in India	20 Apr 2019	ICAR-NDRI, Karnal	A. K. Prusty A. S. Panwar
National conference identification, convergence, implementation & extension of science-tech-research for sustainable development (ICIESSD-2019)	20-21 Apr 2019	Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India	L.R. Meena Dushyant Mishra
Management Development Program on leadership development (for Pre-RMP Cadre)	11-22 Jun 2019	ICAR-NAARM, Hyderabad	L.R.Meena Suresh Malik
1 st International Conference on Food, Agriculture & Innovations.	19-23 Jun 2019	Bangkok, Pattaya, Thailand	Vinod Kumar P.C. Jat
9 th International Conference on Agriculture, Horticulture and plant science	27-28 Jun 2019	Inn Resort Dharamshala (H.P.), India	L.R.Meena
Science administration and Research management	1-12 Jul 2019	ASCI, Hyderabad	A. K. Prusty M. Shamim
CAFT training “Statistical advances in designing agricultural experiments and data analysis”	19 Jul - 8 Aug 2019	ICAR-IASRI, New Delhi	Raghuveer Singh
Workshop on Awareness on Intellectual Property Right (IPR) and its management	23 Jul 2019	ICAR-CIRC, Meerut	P.C. Ghasal
XXV meeting of ICAR-Regional Committee No. VII	10-11 Aug 2019	ICAR-NBSS& LUP, Nagpur	M. Shamim
6th Farming systems design conference	18-21 Aug 2019	Montevideo, Uruguay	A. K. Prusty
Brainstorming Session on Zero Budget Natural Farming: Myth or Reality	21 Aug 2019	NAAS, New Delhi	N. Ravisankar
Hands on training On-line submission and analysis of on-farm farming systems research data and preparation of NARP	27-29 Aug 2019	ICAR-IIFSR	L.R. Meena



zone wise promising farming systems for scaling up.			
Review Workshop on GHG emissions studies and future planning under NICRA	29 Aug 2019	ICAR-NRRI, Cuttack	N. Subash Debashis Dutta
2nd International Conference on “Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development (RAAEASGD-2019)”	27-29 Sept 2019	Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh	M. Shamim
J-Gate@ Cera Regional Training Program	23 Oct 2019	NASC Complex, New Delhi, India	N. Subash Sunil Kumar
Second naturopathy day / Organic agriculture workshop	6 Nov 2019	ICAR-IIFSR	Dushyant Mishra A.L.Meena L.K. Meena Chandra Bhanu Sunil Kumar
Annual Group Meeting (AGM) of AI-NPOF	12-14 Nov2019	ICAR-CARI, Port Blair	N. Ravisankar A. K. Prusty M. Shamim P.C. Ghasal Raghuveer Singh Vipin Kumar
60 th Annual conference and international symposium on “Microbial technologies in sustainable development of energy, environment agriculture and health.	15-18 Nov 2019	CUH, Mahendergarh, Haryana 123031	Jairam Choudhary
Annual Group Meeting (AGM) of AICRP-IFS	27-29 Nov 2019	JAU, Junagarh	N. Ravisankar A. K. Prusty M. Shamim Raghuveer Singh Vipin Kumar Brij Mohan Debashis Dutta Nisha Verma

Seminar on Horticultural Crops	9 Dec 2019	Fruit Research Centre, Bahadurgarh, Patiala (Punjab)	
Training of Trainers (TOT) under Agril. Skill Council of India(ASCI)	10-12 Dec 2019	ICAR – ATARI, Kanpur	L.R.Meena Suresh Malik P.C. Ghasal
International Seminar on Climate Smart farming Systems	11-13 Dec 2019	NASC, New Delhi	N. Ravisankar A. K. Prusty Debashis Dutta
7th annual review workshop of NICRA	17-18 Dec 2019	NASC Complex, Pusa New Delhi.	N. Subash Debashis Dutta

Training /Workshop/Schools organized

Programme	Number of participant	Venue	Period	Name of the Scientist	Role
On Farm “Skill development 3 days training on scientific goat farming to the adopted farmers under the Climate resilient sustainable IFS model for optimizing farm productivity”	100	Jayapur, Varanasi	4-6 Jan 2019	M. Shamim	Course Coordinator
Entrepreneurship Development in Farming System through Round the Year Mushroom Production Technology	21	ICAR-IIFSR	15-22 Jan 2019	Chandra Bhanu P.C. Ghasal A.L. Meena L.K. Meena	Organizing team
Discussion meet on side lines of International workshop on Technical cooperation in Agri-business between India and Argentina	30	ICAR-IIFSR	17 Feb 2019	N. Ravisankar M. Shamim A .K. Prusty Raghuveer Singh	Programme Facilitator Course Director Course Coordinator
Training-cum-exposure visit on Organic Farming for Farmer’s	50	ICAR-IIFSR	21-23 Feb 2019	N. Ravisankar A. K. Prusty	Course Director Course



of Nilgiri district				M. Shamim Raghuveer Singh	Coordinator Course
Farmers' Fair	1500	Gaindhkhata, Haridwar (Uttarakhand)	23 Feb 2019	Chethan Kumar G.	Member
Writing Lab for identified centres of AICRP on IFS (CU)	20	Punjab Agricultural University, Ludhiana	25 Feb- 01 Mar 2019	N. Ravisankar	Programme Facilitator
New technologies and developments in oilseeds cultivation for changing climate	23	ICAR-IIFSR	18-19 Mar 2019	M. Shamim A. K. Prusty Raghuveer Singh	Course Director Course Coordinator Course Coordinator
Training programme on "Diversification of tribal farming systems through mushroom production, vermicomposting and improved livestock production techniques" under TSP	.	Thari, Veerpur Tara and Mallapuri, Ramnagar Block	30 May- 01 Jun 2019	Chandra Bhanu Nisha Verma Suresh Malik	Organizing Team
International Day of Yoga	70	ICAR-IIFSR	07-21 Jun 2019	Prem Singh Sunil Kumar L.K. Meena Chethan Kumar G	Organizing team
On-line submission and analysis of on-farm farming systems research data and preparation of NARP zone wise promising farming systems for scaling up organized by ICAR-IIFSR, Modipuram, in collaboration with ICAR-IASRI, New Delhi	32	ICAR-IIFSR	27-29 Aug 2019	N. Ravisankar Raghuveer Singh Cini Varghese (ICAR-IASRI)	Organizing Secretary Programme Coordinator Programme Coordinator

Training on packaging and labelling cum exhibition and sale of value added products to Women's Self help Group		ICAR-IIFSR	31 Aug – 01 Sept 2019	Nisha Verma Amit Nath M. P. Singh Poonam Kashyap	Organizing Team
Integrated Pest Management, vermicomposting and drudgery reduction in farming systems perspective		Cluster of three villages viz., Thari, Veerpur Tara and Mallapuri of Ramnagar block, Dist. Nainital, Uttarakhand	2-3 Sept 2019	Nisha Verma Chandra Bhanu Amit Kumar	Organizing Team
Livestock's and crops management for higher production in farming systems" SC-SP programme	200	Rasulpur and Kashiara villages, Charthawal Block District Muzaffarnagar	2-13 Sept 2019	Sunil Kumar Suresh Malik Amit Kumar	Organizing Team
Farm Management	33	ICAR-IIFSR	17-23 Sept 2019	Suresh Malik Sunil Kumar P.C. Ghasal Chethan Kumar G	Course Director Members
Swachta hi Sewa programme 2019	500	Primary School, Budana no. 02, Budana Block, Muzaffarnagar.	30 Sept 2019	Peyush Punia Poonam Kashyap Sunil Kumar	Organizing Team
Swachhta Hi Sewa	-	ICAR-IIFSR	2 Oct 2019	P.C. Ghasal Jairam Choudhary	
Certified Farm Advisor (CFA) on Organic Farming (Module-II) first batch sponsored by National Institute of Extension Management (MANAGE), Hyderabad, Telangana	27	ICAR-IIFSR	10- 24 Oct 2019	N. Ravisankar Chandra Bhanu Poonam Kashyap M. Shamim P.C. Ghasal Raghuveer Singh	Course Director Course Coordinator



Vigilance Awareness Week	150	ICAR-IIFSR	28 Oct - 2 Nov 2019	Peyush Punia Poonam Kashyap A. K. Prusty Sunil Kumar Vipin Kumar	Organizing Team
Kissan mela exhibition stall for IFS Technologies	>1000	SVPUT campus, Modipuram, Meerut	8-10 Nov 2019	A.L.Meena Chethan Kumar G	Member
XIV Annual Group Meeting of All India Network Programme on Organic Farming (AI-NPOF)	-	Central Island Agricultural Research Institute, Port Blair	12-14 Nov 2019	N. Ravisankar A. K. Purusty M. Shamim Raghuveer Singh	National PI Organizing Secretary Coordination Unit Associate Scientist
Annual Day Celebration	100	ICAR-IIFSR	27 Nov 2019	Prem singh Sunil Kumar	Organizing Team
Annual Group Meeting of AICRP on Integrated Farming Systems	-	Junagadh Agricultural University, Junagadh (Gujarat)	27-29 Nov 2019	N. Ravisankar A. K. Purusty M. Shamim Raghuveer Singh	National PI Organizing Secretary Coordination Unit Associate Scientist, AICRP-IFS
Certified Farm Advisor (CFA) on Organic Farming (Module-II) first batch sponsored by National Institute of Extension Management (MANAGE), Hyderabad, Telangana	23	ICAR-IIFSR	5-19 Dec 2019	N. Ravisankar M. Shamim Raghuveer Singh	Course Director Course Coordinator
World Soil Days	-	ICAR-IIFSR	5 Dec 2019	P.C. Ghasal	Member
International Seminar on Climate Smart Farming Systems (BIMSTEC delegates) Complex/ICAR-IIFSR	11	NASC	11-13 Dec 2019	N Ravisankar R P Mishra A K Prusty Poonam Kashyap	Organizing Team

Training on production of low chilling apple in subtropical zones	5	ICAR-IIFSR	13-17 Dec 2019	Dushyant Mishra	Organizer
One day exposure visit cum training to trainee students from MIET, Meerut	60	ICAR-IIFSR	31Dec 2019	Debashis Dutta P.C. Ghasal Chethan Kumar. G	Organizers

Lectures delivered in trainings / PG Students CU

Name of Programme/ topic/title of the lecture	Date of lecture	Venue (Organized by)	Resource person
Recycling of spent mushroom substrate in farming system and commercial compost production” in a training on “Trainers Training Programme on Entrepreneurship Development in Farming System through Round the Year Mushroom Production Technology”	15-22 Jan 2019	ICAR-IIFSR	A.L. Meena L.K. Meena
Development of horticulture based farming systems for small and marginal farmers	11Feb 2019	ICAR-IIFSR	Poonam Kashyap
Soil Quality/Soil Health Management: Capacity building and skill upgradation programme for technical staffs on “Farm Management” from 13 th to 19 th February	14 Feb 2019	ICAR-IIFSR	Chethan Kumar G
Farm residue management	16 Feb 2019	ICAR-IIFSR	Jairam Choudhary
Principles of Selection of Enterprises for Multi-enterprise Farm	19 Feb 2019	ICAR-IIFSR	N. Ravisankar
Organic Farming: Concept and Practices : Organic Crop Production’ training to Farmers of Nilgiri District, Tamil Nadu on Organic Farming for 3 days from 21 st to 23 rd February	21 Feb 2019	ICAR-IIFSR	Chethan Kumar G



Gender friendly tools and implements for reducing drudgery in Training programme for KVK Scientists held during	15-16 March, 2019 16 Mar 2019	SVPUA & T, Meerut	Nisha Verma
Optimum weather and management packages for realizing potential yield in oilseeds	19 Mar 2019	ICAR-IIFSR	M. Shamim
Dragon fruit – An emerging crop for nutritional security in climate change scenario	20 Aprl 2019	SVPUATModipuram	Dushyant Mishra
Advances in mango production technologies	6 Jul 2019	Yadvindra Garden, Pinjore, Panchkula	Dushyant Mishra
Future potentials in Agriculture-Horticulture sector	8 Aug 2019	School of Agricultural Studies, Quantum University, Roorkee	Dushyant Mishra
Integrated farming system for livelihood security	14 Aug 2019	College of Agriculture, Mandore, JAU, Jodhpur	Raghuveer Singh
Crop residue management in rice-wheat cropping system to protect environmental	14 Aug 2019	College of Agriculture, Mandore, JAU, Jodhpur	Raghuveer Singh
Role of Horticulture in Agri-entrepreneurship development	27 Aug 2019	College of Hort., SVPUAT, Meerut	Poonam Kashyap
Importance of organic farming in water conservation and crop residue management during Farmers Fair	3 Sept 2019	KVK, Bhagpat	P.C. Ghasal
Fish culture in rainfed Grampanchayat pond, individual culture ponds, marketing and issues & Challenges	11 Sept 2019	Vikas Bhawan, Meerut	A. K. Prusty
Integrated Farming system models for different agri-climatic	17 Sept 2019	ICAR-IIFSR	L.R. Meena
Soil Testing Procedures and calculation of fertilization Doses in Capacity Building and Skill Upgradation Programme for Technical Staffs on “Farm Management”	18 Sept 2019	ICAR-IIFSR	Debashis Dutta

Soil Carbon Sequestration in relation to Soil and Environmental Quality and Food Security in Summer School organized by Rajasthan Agriculture Research Institute (RARI) , Jaipur , Rajasthan	19 Sept 2019	Rajasthan Agriculture Research Institute (RARI) , Jaipur , Rajasthan	Debashis Dutta
Estimation of Green House Gas Emission from Agricultural Field in Summer School organized by Rajasthan Agriculture Research Institute (RARI) , Jaipur , Rajasthan	19 Sept 2019	RARI, Jaipur	Debashis Dutta
Farm management and Bio-security measures in poultry	20 Sept 2019	ICAR-IIFSR	Suresh Malik
Climate Smart Farm Management- Capacity Building and Skill Upgradation Programme for Technical Staffs on “Farm Management” at ICAR-IIFSR, Modipuram during	17-23 September, 2019 20 Sept 2019	ICAR-IIFSR	N. Subash
Horticulture based Integrated Farming Systems for ensuring food and nutritional security	21 Sept 2019	ICAR-IIFSR	Dr. Poonam Kashyap
Scientific management of orchards	23 Sept 2019	ICAR-IIFSR	Poonam Kashyap
Scope of ICTs for entrepreneurship in agriculture	23 Sept 2019	ICAR-IIFSR	Sunil Kumar
Importance of gender friendly tools and equipments for improving efficiency and comfort in training on Farm Management (17-23 September 2019)	23 Sept 2019	ICAR-IIFSR	Nisha Verma
Different methods of composting under organic farming” in CFA training on organic farming Module-II.	10-24Oct 2019	ICAR-IIFSR	A.L. Meena
Physiological aspects for crop production under organic farming in CFA training on organic farming Module-II.	10-24 Oct 2019	ICAR-IIFSR	L.K. Meena



Identification of green manures and its utilization in organic production system during Module-II of Certified Farm Advisor (CFA) on Organic Farming training (10 -24 October, 2019)	11 Oct 2019	ICAR-IIFSR	Chethan Kumar G
Solid and liquid organic manure preparations and usage (preparation of Beejamrit, Jeevamrit, Ghanjeevamrit, cow urine/dung based formulations) during Training programme on Certified Farm Advisor on organic Farming	15 Oct 2019	ICAR-IIFSR	P.C. Ghasal
Biofertilizers and its role in organic farming	15 Oct 2019	ICAR-IIFSR	Jairam Choudhary
Minimum Data set for Crop Modeling- CGIAR Platform for Big Data in Agriculture Convention 2019	16-18 Oct 2019	ICRISAT, Hyderabad	N. Subash
Identification of different weeds and management during Training programme on Certified Farm Advisor on organic Farming	19 Oct 2019	ICAR-IIFSR	P.C. Ghasal
Quality aspects of organic crops in training on Certified Farm Advisor (CFA) on Organic Farming Module II (10-24 October, 2019)	20 Oct 2019	ICAR-IIFSR	Nisha Vermaproduce
Different methods of composting under organic farming” in CFA training on organic farming Module-II.	5-19 Dec 2019	ICAR-IIFSR	A.L. Meena
Agronomic tools and techniques for nutrient management under organic production system during Training programme on Certified Farm Advisor on organic Farming	6 Dec 2019	ICAR-IIFSR	P.C. Ghasal
Biofertilizers and its role in organic farming	6 Dec 2019	ICAR-IIFSR	Jairam Choudhary

Identification of green manures and its utilization in organic production system during Module-II of Certified Farm Advisor (CFA) on Organic Farming training (5- 19 December, 2019)	6 Dec 2019	ICAR-IIFSR	Chethan Kumar G
Herbal pesticides (Leaf extracts, NSKE, Brahmastra, neemasthra, dasparni extract etc) during Training programme on Certified Farm Advisor on organic Farming	7 Dec 2019	ICAR-IIFSR	P.C. Ghasal
Solid and liquid organic manure preparations and usage (preparation of Beejamrit, Jeevamrit, Ghanjeevamrit, cow urine/dung based formulations) during Training programme on Certified Farm Advisor on organic Farming	9 Dec 2019	ICAR-IIFSR	P.C. Ghasal
Techniques for profitable	9 Dec 2019	Fruit Research Station (PAU) Bahadurgarh, Patiala	Dushyant Mishra
Technology of low chilling apple production Trainees from West Bengal	13-17 Dec 2019	ICAR-IIFSR	Dushyant Mishra
Agrobiodiversity setting in organic farming in Certified Farm Advisor (CFA) on organic farming: Module-II	13 Dec 2019	ICAR-IIFSR	Amit Kumar
Quality aspects of organic crops produce in training on Certified Farm Advisor (CFA) on Organic Farming Module II (5-19 December, 2019)	13 Dec 2019	ICAR-IIFSR	Nisha Verma
Identification of different weeds and management during Training programme on Certified Farm Advisor on organic Farming	14 Dec 2019	ICAR-IIFSR	P.C. Ghasal



Horticulture based farming system (Theory and practical), Field visit to Siwaya Farm	15 Dec 2019	ICAR-IIFSR	A. K. Prusty Poonam Kashyap
Livelihood sustainability and income diversification among rural households through horticulture based farming systems	15 Dec 2019	ICAR-IIFSR	Poonam Kashyap
Sustainable soil health management for organic farming in CFA training on organic farming Module-II.	19 Dec 2019	ICAR-IIFSR	Debashis Dutta
Pesticides Residue Analysis CFA training on organic farming Module-II.	19 Dec 2019	ICAR-IIFSR	Debashis Dutta
Preparation of agricultural inputs for organic farming to Trainees of Winter School Organised by MIET, Meerut	31 Dec 2019	ICAR-IIFSR	Debashis Dutta P.C. Ghasal
Soil Probiotics for Sustainable Soil Health Management” during one day exposure visit cum training to group of 60 trainee students from MIET, Meerut	31 Dec 2019	ICAR-IIFSR	Chethan Kumar G

Other Programmes/programmes organized for farmers

Title of Training/events	Venue and date	Duration	No. of participants	Name of Organizer
Fruit production	All parts of country (through mail, mobile or personal visit)	Jan - Dec 2019	865	Dushyant Mishra
Exhibition of the improved Integrated farming systems for livelihood and nutritional security of farmers in Krishi dham expo 2019	ICAR CPRS, Modipuram	15-17 Feb 2019	5000	M. P. Singh Peyush Puniya P. C. Jat Poonam Kashyap Khushyal Singh Nisha Verma

Kissan Mela Krishidham Expo 2019	ICAR-CPRI, RS, Modipuram Campus	15-17 Feb 2019	1000	Poonam Kashyap Sunil Kumar P.C. Gashal Nisha Verma Khushal Singh
Demonstration of IFS Technologies in Pusa Krishi Vigyan Mela	IARI, New Delhi	5-7 Mar 2019	10000	M.P. Singh Peyush Punia Suresh Malik P. C. Jat Khushyal Singh Poonam Kashyap Nisha Verma Jai Ram Chaudhary
Distribution of small agricultural implements and advisory for reduction in drudgery	Bhalwa, Paldi and Ramnagar	7 Jun 2019	160	L.R.Meena D. Kumar Khusyal Singh.
Introduction about SCSP Project	Village - Nannu, Dholdi Block – JaniMeerut	11 Jun 2019	40	Dushyant Mishra
Distribution of small tools and animal minerals for enhancing milk production	Bhalwa, Paldi and Ramnagar	11 Jun 2019	150	L.R.Meena D. Kumar Khusyal Singh
Distribution of small tools and animal minerals for enhancing milk production	Bhalwa, Paldi and Ramnagar	14 Jun 2019	165	D. Kumar Khusyal Singh.
Introduction about SCSP Project	Village - Basateekri, and Khanpur, Block – Jani, Meerut	6 Aug 2019	20	Dushyant Mishra A.L. Meena
Distribution of Black Gram seed (PU31) to ensure nutritional security and economic	Bhalwa, Paldi and Ramnagar	20 Aug 2019	63	D. Kumar K. Singh.
Mera Gaon Mera Gaurav	Village - Surajpur, Kithor, Meerut	26 Aug 2019	25	Dushyant Mishra Vinod Kumar
Farmer Scientist interaction	ICAR-IIFSR	1 Sept 2019	300	Poonam Kashyap P. C. Jat



Awariness program on Swacchata Hi Sewa	Village - Surajpur, Kithor, Meerut	11 Sept 2019	400	Dushyant Mishra Vinod Kumar
Organised the filed visit of Dr Punjab Singh, President . NAAS, New Delhi	ICAR-IIFSR	16 Sept 2019		N. Ravisankar Prem Singh Poonam Kashyap
Celebration of Swachhta hi Sewa at TSP sites, Uttarakhand	Thari, Veerpur Tara and Mallapuri village, Block Ramnagar, Nainital, Uttarakhand	18-19 Sept 2019	215	Nisha Verma Amit Kumar
Livestock and crop management for higher production in farming systems. Livestock and crop management for higher production in farming systems.	Vill. Rasulpur, Charthawal Block (M. Nager) Vill. Kashiara, Charthawal Block (M. Nager)	28Sept and 1 Oct 2019	202	Sunil Kumar S. Malik Amit Kumar
Awariness program on	Village – Khanpur, Block – Jani, Meerut	30 Sept 2019	300	Dushyant Mishra Vipin Kumar Chaudhary Kishan Kumar
Swacchata Hi Sewa program	ICAR-IIFSR	02 Oct 2019	15	Dushyant Mishra Vipin Kumar Chaudhary A.L. Meena
Swacchata Hi Sewa program at ICAR-IIFSR Farmer Scientist Interaction	Khanpur	2 Oct 2019	15	Farmers visited Institute(Veer Pal +14)
Swachhta hi Sewa Programme Krushak-Vaigyanik Sangosti	ICAR-IIFSR	2 Oct 2019	200	R.P. Mishra Debashis Dutta A.L. Meena L.K. Meena Chetan Kumar, G.
Technical assistance regarding IFS Models, Banda University of Agriculture and Technology (UP).	ICAR-IIFSR	10 Oct 2019	1	L. R. Meena
Agriculture tour for progressive farmer of	ICAR-IIFSR	19 Oct 2019	50	L.R. Meena

Gujarat state (Banaskantha district)				
Distribution of Mustard (RH749) and Barseem (Kent) for diversifying farming system	Bhalwa, Paldi and Ramnagar	31 Oct 2019	112	L.R.Meena D. Kumar Khusyal Singh
Introduction of New sugarcane variety CoS 08272 for varietal diversification	Bhalwa and Paldi	02 Nov 2019	07	L.R. Meena D. Kumar Khusyal Singh
Demonstration of IFS Technologies in All India Farmer's Fair and Agr-Industrial exhibition organised by SVPUAT, Modipuram	SVPUAT, Modipuram, Meerut	8-10 Nov 2019	5000	M. P. Singh Peyush Puniya P. C. Jat Poonam Kashyap Khushyal Singh Nisha Verma
Progress of mustard seed in field Farmer Scientist Interaction	Khanpur Dholdi	18 Nov 2019	25	Dushyant Mishra Vipin Kumar Chaudhary A.L. Meena
Introduction of New wheat variety HD 3086 for enhancing wheat production and straw for dairy farming	Bhalwa, Ramnagar and Paldi	29 Nov 2019	120	L.R.meena D. Kumar Khusyal Singh
Subtropical Fruit culture including low chilling apple	ICAR-IIFSR	14 Dec 2019	50	L.R.Meena
Management of mango and low chilling apple to farmers team from Gujarat	ICAR-IIFSR	18 Dec 2019	50	L.R.Meena
Kisan Diwas	ICAR-IIFSR	23 Dec 2019	50	Prem Singh Dushyant Mishra Nisha Verma
Awareness generation on recycling of waste water and collection of plastic under Swaccha Pakhwada programme	Pallav Puram phase II, Colony premises, Modipuram	28 Dec 2019	15	Nisha Verma Raghuveer Singh



EVENTS ORGANIZED

Observance of Vigilance Awareness Week

The following activities were undertaken during the Vigilance Awareness week (28 October to 2 November 2019) by ICAR-IIFSR, Modipuram.

Date	Activity Undertaken
28 October 2019	Pledge, Integrity Pledge and Citizens Integrity Pledge by staff and invited guests (school principals and general public) Random preventive vigilance checks in selected sections
31 October 2019	Elocution competition for students and staff Topic: Integrity-a way of life
02 November 2019	Painting Competition for School/college and staff children's (Above 4 th standard)



Administering vigilance pledge to staff and public representatives by Director, ICAR-IIFSR



Elocution competition for school children's and award winners



Painting competition for schoolchildren's and award winners



Prize distribution to winners for elocution and painting competition

Tv/Radio Talks

Topic	Broadcasted/telecasted in	Date	Name of speaker
फसलों में समेकित नाशीजीव प्रबंधन	All India Radio, Nazibabad	27 Feb. 2019	Chandra Bhanu
पश्चिमी उ.प्र. एवं उत्तराखण्ड के मैदानी क्षेत्रों में वर्ष भर मशरूम उत्पादन	All India Radio, Nazibabad	01 March 2019	Chandra Bhanu
जैविक कृषि भविष्य की कृषि	All India Radio, Nazibabad	04 March 2019	R.P.Mishra
समेकित कीट प्रबंधन	All India Radio, Nazibabad	05 March 2019	Chandra Bhanu
मिट्टी की जाँच क्यों व कैसे	All India Radio, Nazibabad	05 March 2019	Debashis Dutta
मिट्टी की जाँच एवं मृदा स्वास्थ्य कार्ड	All India Radio, Nazibabad	06 March 2019	Debashis Dutta
गन्ने की फसल में नाशीजीवों का जैविक नियंत्रण	All India Radio, Nazibabad	06 March 2019	Chandra Bhanu
गन्ने की फसल में समेकित पोषण प्रबंधन	All India Radio, Nazibabad	08 March 2019	Chandra Bhanu
गन्ने में कीटों का जैविक नियंत्रण	All India Radio, Nazibabad	10 March 2019	Chandra Bhanu
गर्मियों में दूधिया मशरूम की खेती	All India Radio, Nazibabad	11 March 2019	Chandra Bhanu
जैविक उत्पादों का उचित विपणन प्रबंधन	All India Radio, Nazibabad	12 March 2019	R.P.Mishra
तकनीकी आधारित कृषि सलाह सेवाएं एवं बदलते जलवायु में इसका महत्व	FM Radio Najafgarh	13 March 2019	Dr M Shamim
गन्ने में फसल विविधीकरण द्वारा कृषकों की आय में वृद्धि	All India Radio, Nazibabad	13 March 2019	Chandra Bhanu
संतुलित पोषक तत्वों द्वारा मृदा स्वास्थ्य प्रबंधन	All India Radio, Nazibabad	13 March 2019	Debashis Dutta
Cultivation of Basmati rice	All India Radio, Nazibabad	16 March 2019	Dr. P.C. Ghasal
Exotic vegetables for higher profits and returns	DD Kisan	09 May 2019	Poonam Kashyap
जैविक खेती: आज की आवश्यकता	All India Radio, Nazibabad	25 Sept. 2019	Jairam Choudhary

बिम्सटेक प्रतिनिधिमंडल ने क्लाइमेट स्मार्ट जैविक कृषि प्रणाली मॉडल का किया अवलोकन

राष्ट्रीय कृषि विज्ञान कांप्लेक्स, पूसा, नई दिल्ली में दिनांक 11-13 दिसंबर, 2019 तक "जलवायु समोत्थानशील कृषि प्रणाली मॉडल" पर एक तीन दिवसीय अंतर्राष्ट्रीय सेमिनार का आयोजन कृषि एवं शिक्षा विभाग, कृषि मंत्रालय, भारत सरकार द्वारा किया गया। इस सेमिनार में "बंगाल की खाड़ी बहु-क्षेत्रीय तकनीकी और आर्थिक सहयोग उपक्रम" (बिम्सटेक) के सदस्य देशों भारत, बांग्लादेश, बर्मा, श्रीलंका, थाईलैण्ड, भूटान और नेपाल आदि देशों के प्रतिनिधियों ने भाग लिया। इस सेमिनार के दौरान जलवायु परिवर्तन के विपरीत प्रभावों से बचने हेतु जलवायु समोत्थानशील कृषि प्रणालियों पर चर्चा एवं सदस्य देशों के बीच आपसी सहयोग पर विचार-विमर्श किया गया। आज दिनांक 13.12.2019 को बिम्सटेक प्रतिनिधिमंडल दल ने मोदीपुरम स्थित भारतीय कृषि प्रणाली अनुसंधान संस्थान का दौरा किया एवं संस्थान में स्थित जलवायु समोत्थानशील कृषि प्रणाली मॉडल एवं जैविक कृषि प्रणाली मॉडल का अवलोकन किया। इसके बाद प्रतिनिधिमंडल ने कृषि प्रणाली संस्थान के सिवाया स्थित शोध प्रक्षेत्र पर बहुउद्देशीय वृक्षों का पौधरोपण भी किया और अनुपजाऊ पशु आधारित कृषि प्रणाली मॉडल का अवलोकन भी किया। प्रक्षेत्र भ्रमण के उपरांत बिम्सटेक प्रतिनिधिमंडल के वैज्ञानिकों एवं अधिकारियों ने संस्थान के सभागार में आयोजित वैज्ञानिक परिचर्चा में भाग लिया एवं जलवायु

परिवर्तन के दुष्प्रभावों से बचने हेतु कृषि में तकनीकी एवं नीतिगत सुधारों पर विचार-विमर्श किया एवं आपसी सहयोग बढ़ाने पर भी जोर दिया।

कृषि प्रणाली संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने सेमिनार में भाग लेने वाले सभी प्रतिभागियों का स्वागत किया एवं किसानों की खाद्य, पोषण एवं आजिविका सुरक्षा के साथ-साथ जलवायु परिवर्तन के दुष्प्रभावों को कम करने वाले समेकित कृषि प्रणाली मॉडल के बारे में विस्तार से बताया। डॉ. एन. रविशंकर ने कृषकों एवं देश की आवश्यकताओं को ध्यान में रखते हुए विकासशील कृषि प्रणाली मॉडल पर हो रहे शोध कार्यों की विस्तृत जानकारी दी। पूर्वाह्न में बिम्सटेक प्रतिनिधिमंडल ने मेरठ के सरधना ब्लॉक स्थित कुशावली गाँव के अग्रणी किसान श्री विनोद सैनी जी के प्रक्षेत्र का भ्रमण किया एवं उनके यहाँ प्रमाणित जैविक खेती के अंतर्गत विभिन्न प्रकार की ठोस एवं तरल खादों के उत्पादन एवं प्रयोग, नाशीजीव प्रबंधन हेतु वानस्पतिक/जैविक खादों के उत्पादन एवं प्रयोग करने के जैविक उत्पादन, गन्ने में सहफसलीकरण द्वारा लागत में कमी एवं गुणवत्तायुक्त फसलों के उत्पादन की तकनीकों का वास्तविक वस्तुस्थिति का जायजा लिया। प्रतिनिधिमंडल ने कुशावली गाँव के अन्य किसानों के साथ भी वार्तालाप किया एवं जैविक खेती के





अंतर्गत कम खर्च में ही रासायनिक कृषि के बराबर ही गन्ना एवं अन्य फसलों के उत्पादन पर हर्ष व्यक्त किया तथा अधिक से अधिक किसानों को वैज्ञानिक तरीके से जैविक खेती करने की सलाह दी। कार्यक्रम में केन्द्रीय आलू अनुसंधान संस्थान, मेरठ के संयुक्त निदेशक डॉ. मनोज

कुमार, कृषि प्रणाली संस्थान से डॉ. एम.पी. सिंह, डॉ. आर.पी. मिश्र, डॉ. देवाशीष दत्ता, डॉ. चन्द्रभानु, डॉ. ए.एल. मीणा, डॉ. एल.के. मीणा सहित सभी वैज्ञानिकों ने भाग लिया। वैज्ञानिक परिचर्चा का संचालन डॉ. पूनम कश्यप ने किया।



“स्वच्छता ही सेवा” कार्यक्रम

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ द्वारा दिनांक 16.09.2019 को हस्तिनापुर विधानसभा क्षेत्र के बी.आर.सी. आफिस पर स्वच्छता ही सेवा कार्यक्रम का आयोजन किया गया, जिसमें क्षेत्र के किसानों एवं विद्यालय के छात्र-छात्राओं को स्वच्छता के प्रति जागरूक किया गया। कार्यक्रम में क्षेत्र के किसानों एवं छात्रों सहित कुल 150 लोगों ने भाग लिया। कार्यक्रम की अध्यक्षता डा.एन.सुभाष (प्रधान वैज्ञानिक) ने की एवं श्री वरुण कुमार (चेयरमैन, नगर पंचायत, हस्तिनापुर) मुख्य अतिथि रहे। श्री ध्यानचंद, खण्ड शिक्षा अधिकारी, हस्तिनापुर, विशिष्ट अतिथि रहे। मुख्य एवं विशिष्ट अतिथियों ने अपने संबोधन में सभी किसानों व छात्रों से स्वच्छता के प्रति जागरूक होने की सलाह दी तथा प्लास्टिक

के उपयोग को कम करके अपने पर्यावरण को विभिन्न प्रकार के प्रदूषण से बचाने की अपील की। कार्यक्रम के दौरान विद्यालय के छात्र-छात्राओं हेतु स्वच्छता ही सेवा कार्यक्रम के ऊपर एक कला प्रतियोगिता का आयोजन भी किया गया, जिसमें सभी छात्र-छात्राओं ने बढ़-चढ़कर भाग लिया। उपरोक्त कार्यक्रम भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ द्वारा दिनांक 11 सितंबर से 2 अक्टूबर 2019 तक मनाये जाने वाले “स्वच्छता ही सेवा” के तहत मनाया गया जिसका मुख्य नारा “एक कदम प्लास्टिक अपशिष्ट मुक्त भारत की ओर” है। कार्यक्रम का संचालन डॉ. प्रकाश चंद घासल (वैज्ञानिक) एवं सहयोगी डॉ. जयराम चौधरी (वैज्ञानिक) द्वारा किया गया। श्री ब्रह्मदत्त एवं श्री समरवीर आदि का सहयोग रहा।



हिंदी पखवाड़े एवं कृषक वैज्ञानिक परिचर्चा का आयोजन

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 13.09.2019 को 13 से 27 सितंबर, 2019 तक चलने वाले हिंदी पखवाड़े का शुभारम्भ किया गया एवं इसी दौरान किसानों की आय दोगुनी करने के उपायों पर एक कृषक वैज्ञानिक परिचर्चा का आयोजन भी किया गया जिसमें संस्थान के सभी कर्मियों सहित क्षेत्र के लगभग 40 प्रगतिशील किसानों भाग लिया। श्री राम कुमार सहरावत, अध्यक्ष किसान मोर्चा, पश्चिमी उत्तर प्रदेश, कार्यक्रम के मुख्य अतिथि एवं श्री अजय भराला, उपाध्यक्ष, किसान मोर्चा, पश्चिमी उत्तर प्रदेश, विशिष्ट अतिथि रहे। कार्यक्रम की अध्यक्षता संस्थान के निदेशक डॉ आजाद सिंह पँवार ने की। मुख्य अतिथि ने अपने सम्बोधन में देश एवं किसानों के विकास हेतु हिन्दी भाषा के प्रचार- प्रसार को जरूरी बताया। उन्होंने किसानों की आय दोगुनी करने एवं खेती का खर्च घटाने हेतु सरकार द्वारा चलाई जा रही विभिन्न योजनाओं की जानकारी दी एवं किसानों से इन योजनाओं का अधिक से अधिक लाभ उठाने की अपील की। विशिष्ट अतिथि श्री भराला जी ने हिन्दी भाषा को देश की विकास के लिए अति

आवश्यक बताया एवं किसानों के कल्याण एवं आमदनी बढ़ाने हेतु सरकार द्वारा चलाई जा रही विभिन्न योजनाओं की जानकारी दी। कार्यक्रम अध्यक्ष एवं संस्थान के निदेशक डॉ आजाद सिंह पँवार ने सभी अतिथियों, किसानों व कार्यालय कर्मियों का स्वागत किया एवं कृषि प्रणाली संस्थान द्वारा हिन्दी भाषा को बढ़ावा देने, किसानों की आय दोगुनी करने हेतु समेकित कृषि प्रणालियों एवं प्लास्टिक अपशिष्ट मुक्त भारत बनाने हेतु देश भर में अपने 94 केन्द्रों के माध्यम से किये जा योजनाओं एवं कार्यक्रमों की जानकारी दी। कृषक वैज्ञानिक परिचर्चा के दौरान विभिन्न क्षेत्रों के प्रगतिशील किसानों एवं ब्लाक प्रमुख श्री हरेन्द्र सिंह, ग्राम प्रधानों श्री जितेन्द्र सिंह एवं श्री यशपाल सिंह ने अपने-अपने विचार रखे। मुख्य अतिथि ने परिचर्चा के दौरान उठाये गये जरूरी मुद्दों को सरकार तक पहुँचाने का आश्वासन भी दिया। परिचर्चा में डा. प्रेम सिंह, डा. एल.आर. मीणा, डा. दुष्यन्त मिश्र, डा. चन्द्रभानु एवं डा. ए.एल. मीणा आदि ने भाग लिया। डा. ए. के प्रुष्टि ने धन्यवाद ज्ञापन दिया। श्री आर. बी. तिवारी, श्री सदा राम आदि का सहयोग रहा।



एक दिवसीय सेमिनार का आयोजन

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में इंटरनेशनल नैचुरोपैथी आर्गनाइजेशन, मेरठ-एन.सी.आर. के सहयोग से आज दिनांक 16 नवम्बर, 2019 को संस्थान के सभागार में **नैचुरोपैथी एण्ड ऑर्गेनिक फार्मिंग विषय पर एक दिवसीय विचार गोष्ठी एवं प्रदर्शनी** का आयोजन किया गया। कार्यक्रम की अध्यक्षता प्रभारी निदेशक डॉ. एम. पी. सिंह ने की तथा डॉ. जे.पी. राणा मुख्य अतिथि रहे। मंच पर विराजे अति विशिष्ट आगंतुकों के सम्मान पञ्चात विभिन्न पहलुओं पर वरिष्ठ वैज्ञानिक एवं अनुभवी चिकित्सकों ने अपने विचारों से ज्ञान वर्षा की। फिट इंडिया मिशन की सार्थकता पर डॉ. एच.सी. शर्मा ने समाज के स्वास्थ्य की ओर जागरूकता का आवाहन किया। स्वस्थ व्यक्ति ही भरपूर शक्ति से कार्य करने में समर्थ होता है, जिससे आउटपुट अधिक होगा और सभी ऐसा करेंगे, तब देश की विकास-गति तेजी से बढ़ेगी, जिसकी वर्तमान में महती आवश्यकता है। आधुनिकता की सुविधाओं से कार्यव्यस्तता के कारण हम प्रकृति से दूर होते गए। परिणामस्वरूप हमने पाया, रोगों की श्रृंखला। इस विषय पर डॉ. एस.डी. धीमान ने अपने अनुभव से बताया कि विलासिता से उत्पन्न रोगों से छुटकारा पाने हेतु हैबिट्स (आदतें) बदलनी होंगी। अपने भोजन का चुनाव, योगाभ्यास, सृजनात्मक कार्य एवं पॉजिटिव सोच अपनाने का सुझाव दिया।

इस बीच प्रदर्शनी का अवलोकन दर्शकों ने किया, जिसमें प्राकृतिक चिकित्सा के प्रयोगात्मक उपचार यथा मिट्टी पट्टी, गर्म-ठण्डी सेक, छाती की लपेट, सूत्र एवं जलने की सीखने को मिले। सेमिनार के दूसरे सत्र में डॉ. चन्द्रभानु ने छत पर जैविक सब्जियाँ उगाने की विधि का चित्रों की सहायता से समझाया। यह आज के समाज की महत्वपूर्ण आवश्यकता है। आगंतुकों ने अधिक जानकारी हेतु प्रश्नों के माध्यम से समाधान पाया। प्राकृतिक चिकित्सा में भोजन परिवर्तन एवं उपवास के महत्व पर डॉ. मनोज शर्मा ने अपने लम्बे चिकित्सीय

अनुभव से गंभीर विषय को बड़ी सहजता से साधकों को जानकारी दी। अतः पाचनतंत्र को विश्राम देने पर ही उपचार अधिक प्रभावशाली कार्य करेंगे और रोगी को शीघ्र स्वास्थ्य लाभ मिलेगा। जैविक खेती में पोषण प्रबंधन महत्वपूर्ण पहलू है। अतः वर्मी खाद बनाने की सरल विधि को विस्तार से डॉ. चन्द्रभानु ने प्रस्तुत किया। स्लाइड के माध्यम से वैज्ञानिक जानकारी को आगंतुकों ने सरलता से समझा। पर्यावरण की स्वच्छता का प्राकृतिक चिकित्सा में योगदान पर डॉ. मनोज राणा ने दूषित वायु एवं जल के दुष्परिणामों से अवगत कराया तथा प्रचुर मात्रा में शुद्ध वायु एवं जल की उपलब्धता के लिए पर्यावरण की स्वच्छता के पहलुओं पर सबको जागरूक किया।

डॉ. एस.डी. धीमान द्वारा लिखित **प्राकृतिक चिकित्सा एवं योग** पुस्तक का विशिष्ट अतिथियों द्वारा विमोचन किया गया। साथ ही डॉ. अनिल सिरोही ने पुस्तक को बहुत महत्वपूर्ण बताया, जिसमें मुख्य पहलुओं को विस्तार से दर्शाया गया है। INO मेरठ NCR की ओर से डॉ. मनोज शर्मा ने अध्यक्ष महोदय के साथ अतिथियों को सहभागिता प्रमाण-पत्र वितरित कराए। इसी कड़ी में वयोवृद्ध प्राकृतिक चिकित्सक श्री काशीनाथ जी एवं डॉ. सुदेश यादव दिव्य को उनके प्राकृतिक चिकित्सा एवं योग के क्षेत्र में उत्कृष्ट कार्यों के लिए मुख्य अतिथि कैप्टन जे.पी.एस. राणा ने स्मृति चिन्ह देकर सम्मानित किया। डॉ. प्रेम सिंह, डॉ. आर.पी.मिश्र, डॉ. एल.के. मीणा, डॉ. अमित कुमार, श्री आर.बी. तिवारी आदि का सहयोग किया। कार्यक्रम का संचालन डॉ. ए.एल. मीणा ने किया। अंत में डॉ. चन्द्रभानु, कार्यक्रम संयोजक द्वारा सभी को सहर्ष धन्यवाद दिया तथा राष्ट्रगान के बाद कार्यक्रम का समापन हुआ।



“अंतर्राष्ट्रीय योग दिवस” एवं “योग साधना शिविर” का आयोजन

भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम मेरठ में आज दिनांक 21.06.2019 को पाँचवें “अंतर्राष्ट्रीय योग दिवस” का आयोजन किया गया जिसमें संस्थान के अधिकारियों, कर्मचारियों व उनके परिवार के सदस्यों तथा आस-पास के आवासीय कालोनियों के लोगों, किसानों व छात्रों ने बढ़-चढ़कर भाग लिया। इसी के साथ संस्थान में 07 से 21 जून तक चलने वाले “योग साधना शिविर” का भी समापन किया गया। कार्यक्रम का शुभारंभ करते हुए संस्थान के कार्यकारी निदेशक डॉ. महेन्द्र पाल सिंह ने सभी अतिथियों व प्रतिभागियों का स्वागत किया। उन्होंने अपने संबोधन में योग को स्वस्थ जीवन की कुंजी बताया तथा सभी से अपने कार्यालयीन कार्यों व निजी जीवन में सकारात्मक सोच के साथ काम करने की सलाह दी। इस दौरान संस्थान के निदेशक महोदय द्वारा सभी योग गुरुओं एवं योग साधक कुमारी श्रेष्ठा शर्मा को सम्मानित भी किया गया।

दिनांक 07 से 21 जून, 2019 तक अंतर्राष्ट्रीय नेचुरोपैथी संगठन (INO), मेरठ के सहयोग से चलने वाले योग साधना शिविर का आयोजन योगगुरु डॉ. एस. डी. धीमान के मार्गदर्शन में किया गया, जिसमें संस्थान के कर्मचारियों ने प्रत्येक दिन सुबह 5:30 से 6:30 बजे के बीच बढ़-चढ़कर भाग लिया। योग साधना शिविर के दौरान डॉ. धीमान जी ने महर्षि पतंजलि के अष्टांग योग दर्शन अर्थात् यम, नियम, आसन, प्राणायाम, प्रत्याहार, धारणा, समाधि एवं मोक्ष के बारे में

विस्तार से बताया एवं संस्थान कर्मियों को पूरे योग पखवाड़े के दौरान विभिन्न प्रकार के आसन एवं प्राणायाम का अभ्यास करवाया। उन्होंने पर्यावरण एवं आहार; मानव जीवन के चार सोपानों (धर्म, अर्थ, काम और मोक्ष); स्वस्थ जीवन हेतु प्रकृति की महत्ता; प्राकृतिक चिकित्सा एवं योग आदि विभिन्न बिन्दुओं पर अपना व्याख्यान भी दिया। योग साधना शिविर के दौरान अंतर्राष्ट्रीय नेचुरोपैथी संगठन, मेरठ से आये विभिन्न योग गुरुओं श्री विनोद पँवार, डॉ. नीलम गोस्वामी, डॉ. नवनीत कुमार, श्रीमती प्रीति बंसल, डॉ. मनोज राणा, श्री मनोज शर्मा एवं डॉ. सुरेश यादव आदि ने स्वस्थ जीवन हेतु विभिन्न प्रकार के शारीरिक, मानसिक एवं आत्मिक योग जैसे- आसन, व्यायाम, सूक्ष्म यौगिक व्यायाम, प्राणायाम, ध्यान, शान्ति योग आदि की विभिन्न मुद्राओं का विधिवत रूप से सभी प्रतिभागियों को प्रशिक्षण देकर अभ्यास भी करवाया। नवोदित योग साधक कुमारी श्रेष्ठा शर्मा ने विभिन्न प्रकार के यागासन मुद्राओं का प्रदर्शन किया। विभिन्न योग गुरुओं ने फिजियोथेरेपी के लाभ, पेट संबंधी रोगों के निवारण, जल और मिट्टी से उपचार, स्वस्थ शरीर हेतु जीवनचर्या में बदलाव एवं योग आधारित भोजन आदि के बारे में व्याख्यान भी दिये। पूरे कार्यक्रम का संचालन कार्यक्रम समन्वयक डॉ. प्रेम सिंह ने किया। डॉ. सुनील कुमार ने धन्यवाद ज्ञापन दिया। डॉ. ललित कृष्ण मीणा, डॉ. चेतन कुमार जी, डॉ. अमित कुमार आदि का सहयोग रहा।



गाँधी जयंती के अवसर पर “राष्ट्रीय स्वच्छता दौड़” एवं “स्वच्छता ही सेवा” कार्यक्रमों का आयोजन

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 02 अक्टूबर 2019 को राष्ट्रपिता महात्मा गाँधी की 150वीं जयंती के अवसर पर **राष्ट्रीय स्वच्छता दौड़** और **स्वच्छता ही सेवा कार्यक्रम** के समापन समारोह का आयोजन किया गया। डॉ. संजीव कुमार बालियान, माननीय केन्द्रीय राज्यमंत्री, पशुपालन, डेयरी एवं मत्स्यपालन विभाग, भारत सरकार, कार्यक्रम के मुख्य अतिथि रहे। मुख्य अतिथि ने सुबह 08:00 बजे संस्थान परिसर में आयोजित होने वाली **राष्ट्रीय स्वच्छता दौड़** को हरी झण्डी दिखाकर कार्यक्रम का शुभारम्भ किया। उन्होंने अपने संबोधन में देश को स्वच्छ एवं साफ-सुथरा बनाने हेतु लोगों से दृढ़ संकल्प के साथ एक बार प्रयोग में आने वाली प्लास्टिक के उपयोग बंद करने की सलाह दी। माननीय मुख्य अतिथि ने अपनी भावी पीढ़ी के टिकाऊ एवं सफल जीवन हेतु जल संरक्षण के तरीके अपनाने की सलाह भी दी। विशिष्ट अतिथि श्री मनिन्दरपाल सिंह, अध्यक्ष जिला सहकारी बैंक मेरठ/बागपत ने सभी से स्वच्छता के प्रति जागरूक होने तथा प्लास्टिक प्रदूषण से मुक्ति दिलाने हेतु संकल्प लेने की अपील की।

श्री प्रसन्न चौधरी, जिला पंचायत अध्यक्ष, शामली समापन समारोह के मुख्य अतिथि रहे। श्री प्रसन्न चौधरी जी ने राष्ट्रपिता महात्मा गाँधी जी के जन्मदिवस को स्वच्छता जागरूकता दिवस के रूप में मनाने को एक अच्छा कदम बताया और सभी से अपनी भावी पीढ़ियों के स्वस्थ जीवन हेतु भारतवर्ष को स्वच्छ एवं साफ-सुथरा बनाने की अपील की। संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने सभी अतिथियों का स्वागत किया तथा कृषि प्रणाली संस्थान द्वारा स्वच्छता ही सेवा एवं प्लास्टिक अपशिष्ट से मुक्ति दिलाने हेतु किये जा रहे जागरूकता अभियानों एवं गतिविधियों से सभी को अवगत कराया। उन्होंने यह भी बताया कि आज प्लास्टिक कचरे से विश्व के महासागरों में हानिकारक प्रदूषण हो रहा है और इसके कारण वहाँ के जैव-पारिस्थितिकी तंत्र पर बुरा प्रभाव पड़ रहा है। प्लास्टिक कचरे से हमारा भूमिगत जल प्रदूषित होने के अतिरिक्त मानव व अन्य जीव-जंतुओं

के स्वास्थ्य पर भी हानिकारक प्रभाव पड़ रहा है। कृषि प्रणाली संस्थान देश भर में स्थित अपने 94 सहयोगी केन्द्रों के माध्यम से वर्तमान स्वच्छता जागरूकता कार्यक्रम के दौरान देश के 14 राज्यों के 50 से अधिक गाँवों के 7000 से अधिक किसानों, छात्रों एवं युवाओं को स्वच्छता के प्रति जागरूक कर चुका है। इसके पूर्व सभी अतिथियों एवं संस्थान के अधिकारियों एवं कर्मचारियों ने राष्ट्रपिता महात्मा गाँधी जी के फोटो के समक्ष पुष्पांजलि अर्पित करके, देश के प्रति उनके योगदान एवं संकल्पों को याद किया तथा सभी प्रतिभागियों को स्वच्छता की सपथ भी दिलाई।

कार्यक्रम समन्वयक डॉ. आर. पी. मिश्र, स्वच्छता कार्यक्रम प्रभारी डॉ. एल. आर. मीणा, नोडल अधिकारी, डॉ. देबाशीष दत्ता ने सभी का स्वागत किया तथा स्वच्छता के प्रति संस्थान के दृढ़ संकल्प को याद कराया। कार्यक्रम में संस्थान द्वारा अनुसूचित जाति उपयोजना के अन्तर्गत अँगीकृत गाँवों के 242 किसानों सहित कुल 392 लोगों ने भाग लिया। इस दौरान किसानों को उन्नतशील प्रजातियों के सरसों व सब्जियों के बीज, पशु स्वास्थ्य किट, स्वच्छता किट एवं कृषि उपयोगी पाठन सामग्री भी बाँटी गयी। कार्यक्रम के अन्त में एक कृषक-वैज्ञानिक परिचर्चा का आयोजन किया गया, जिसकी अध्यक्षता सामाजिक कार्यकर्ता एवं किसान नेता श्री नरेश सिरोही जी एवं संचालन डॉ. एल. आर. मीणा ने किया। डॉ. दुष्यंत मिश्र, डॉ. सुरेश मलिक, डॉ. पी. सी. जाट, डॉ. देवेन्द्र कुमार, डॉ. डी. दत्ता, डॉ. चन्द्रभानु एवं डॉ. प्रकाश चन्द घासल ने किसानों से उनकी कृषि प्रणाली के समसामयिक विषयों से सम्बन्धित समस्याओं पर चर्चा की तथा उचित समाधान बताये। इस अवसर पर क्षेत्र के प्रगतिशील किसान श्री जितेन्द्र प्रधान, श्री अरविन्द मलिक, श्री अरुण कुमार आदि मौजूद रहे। कार्यक्रम का संचालन डॉ. पूनम कश्यप ने किया। डॉ. चन्द्रभानु ने धन्यवाद ज्ञापन दिया। डॉ. ए. एल. मीणा, डॉ. एल. के. मीणा, डॉ. प्रकाश चन्द घासल, डॉ. चेतन कुमार जी., डॉ. अमित कुमार, डॉ. जयराम चौधरी, श्री आर. बी. तिवारी आदि का सहयोग रहा।

जल, जैव-विविधता एवं पर्यावरण संरक्षण हेतु करें वृक्षारोपण

भारतीय कृषि प्रणाली अनुसंधान मोदीपुरम, मेरठ में दिनांक 6 जुलाई, 2019 को वन महोत्सव मनाया गया। कार्यक्रम में संस्थान के सभी कर्मचारियों के अतिरिक्त, केन्द्रीय आलू अनुसंधान संस्थान, कैम्पस, मेरठ केन्द्रीय, गोपशु अनुसंधान संस्थान मेरठ एवं सरदार वल्लभभाई पटेल कृषि विश्वविद्यालय, मेरठ, आस-पास के कालोनियों के निवासियों/गैर सरकारी संगठनों व मिडियाकर्मियों सहित लगभग 250 लोगों ने भाग लिया। डा. गया प्रसाद कुलपति, सरदार पटेल कृषि विश्वविद्यालय, मेरठ कार्यक्रम के मुख्य अतिथि रहे। डा. एन.वी. पटिल, डा. मनोज कुमार, श्री दीपक विहान (एशियन गेम्स 2018 में स्वर्ण पदक विजेता, श्री सार्दुल विहान के पिताजी), श्रीमती शिप्रा रस्तोगी एवं श्रीमती मधु वत्स कार्यक्रम के विशिष्ट अतिथि रहे। कृषि प्रणाली संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी अतिथियों का स्वागत किया। डा. पँवार ने अपने संबोधन में बताया कि आज पेड़ों के कटने की गति पेड़ लगाने की गति से अधिक है अतः पर्यावरण संतुलन हेतु वृक्षारोपण अवश्य करना चाहिए। जल, जैवविविधता एवं पर्यावरण संरक्षण हेतु कृषि-वानिकी आधारित कृषि प्रणाली को बढ़ावा देने हेतु संस्थान कृत संकल्प है। उन्होंने आज के दिन सभी अतिथियों एवं संस्थान कर्मियों द्वारा 2000 बहुउपयोगी वृक्षों के रोपण करवाने के बारे में सभी को अवगत कराया।

मुख्य अतिथि प्रोफेसर डा. गया प्रसाद ने अपने संबोधन में बताया कि मनुष्य ने अपनी असीमित आवश्यकताओं की

पूर्ति के लिए वनों की अंधाधुंध कटाई की जिससे आज पर्यावरण असंतुलन की स्थिति बन गयी है। जल संरक्षण, जैवविविधता एवं पर्यावरण पर गम्भीर संकट उत्पन्न हो गया है। अतः सभी के मन में जल एवं पर्यावरण संरक्षण हेतु वृक्षारोपण के विचार को जागृत करने की आवश्यकता जताई। उन्होंने पर्यावरण संरक्षण हेतु कृषि प्रणाली संस्थान द्वारा वृक्षारोपण कार्यक्रम कराने के लिए किये जा रहे प्रयासों की सराहना की तथा अपने विश्वविद्यालय द्वारा 5000 पौधे लगाने का वचन दिया।

केन्द्रीय गोपशु अनुसंधान संस्थान मेरठ के निदेशक एवं विशिष्ट अतिथि डा. एन.वी. पाटिल ने अपने संबोधन में गोवंश एवं जैवविविधता के संरक्षण में बहुआयामी पौधों के महत्व के बारे में बताया तथा उनके अधिकाधिक वृक्षारोपण की आवश्यकता जताई। उन्होंने पशुपालन हेतु सहजन एवं खेजरी जैसे वृक्षों के महत्व के बारे में भी सभी को अवगत कराया। केन्द्रीय आलू अनुसंधान संस्थान के संयुक्त निदेशक एवं विशिष्ट अतिथि डा. मनोज कुमार ने वर्षा को आकर्षित करने, जल एवं पर्यावरण संरक्षण हेतु वृक्षारोपण को जरूरी बताया। उन्होंने खेतों के किनारों पर करौंदा की बाड़ लगाकर मनुष्य में लौह तत्व की कमी को पूरा करने का रास्ता बताया। गैर सरकारी संगठन हर्ष संस्था की प्रतिनिधि श्रीमती शिप्रा रस्तोगी ने आने वाली पीढ़ियों के लिए स्वच्छ जल, स्वच्छ वायु एवं स्वच्छ वातावरण के लिए वृक्षारोपण को जरूरी बताया। श्रीमती मधु वत्स ने विभिन्न रोगों में लाभकारी, भूजल शुद्धिकरण





में उपयोगी, एवं पूरक आहार के रूप में सहिजन वृक्ष के महत्व को विस्तार से बताया तथा जल एवं पर्यावरण संरक्षण हेतु छोटे-छोटे प्रयासों की आवश्यकता जताई। उन्होंने विभिन्न महिला समूहों को अन्य लक्ष्यों के अतिरिक्त जल एवं पर्यावरण संरक्षण पर कार्य करने की सलाह दी तथा अपने संगठन के माध्यम से 50000 पौधों के वृक्षारोपण करने का वचन दिया।

कार्यक्रम में श्रीमती पूनम गुप्ता, श्रीमती अनीता मित्तल, श्रीमती बबिता चौधरी, श्री धीरेन्द्र सिंह आदि ने विशिष्ट अतिथि के रूप में अपने-अपने विचार रखें। पश्चात में सभी अतिथियों एवं कार्यालय कर्मियों ने कृषि प्रणाली संस्थान के

सिवाया फार्म पर शीसम, सहजन, यूकेलिप्टस एवं सागौन जैसे बहुपयोगी वृक्षों का वृक्षारोपण किया। आज के दिन सभी कर्मियों व अतिथियों द्वारा लगभग 1200 पेड़ लगाये गये। सभी ने यह भी संकल्प लिया कि इसी वर्ष वर्षा ऋतु में 800 और पौधे लगाकर 2000 वृक्ष लगाने के लक्ष्य को पूरा किया जायेगा। कार्यक्रम का संचालन डा. प्रेम सिंह, प्रधान वैज्ञानिक ने किया। डा. सुरेश मलिक ने धन्यवाद ज्ञापन दिया।



Plate Tree plantation drive at Siwaya Farm

कृषि प्रणाली संस्थान में श्री गिरिराज सिंह, माननीय केन्द्रीय मंत्री व डा० संजीव बालियान, माननीय केन्द्रीय राज्यमंत्री के दौरे का कार्यवृत्त

भारतीय कृषि प्रणाली संस्थान मोदीपुरम मेरठ में दिनांक 01.09.2019 को एक कृषक—वैज्ञानिक संगोष्ठी का आयोजन किया गया जिसकी अध्यक्षता श्री गिरिराज सिंह, माननीय केन्द्रीय मंत्री मत्स्य पालन, पशुपालन एवं डेयरी, भारत सरकार ने की। डा० संजीव बालियान, माननीय केन्द्रीय राज्यमंत्री, मत्स्य पालन, पशुपालन एवं डेयरी, भारत सरकार कार्यक्रम के विशिष्ट अतिथि रहे। संगोष्ठी में उत्तर प्रदेश एवं उत्तराखण्ड के विभिन्न जिलों के 250 किसानों सहित कुल 360 लोगों ने भाग लिया। माननीय मंत्री जी ने अपने संबोधन में किसानों की आय दोगुना करने हेतु एक एकड़ में कृषि प्रणाली माडल पर किसानों व वैज्ञानिकों से अलग-अलग राय ली और चार तरह के सुझाव दिये, जैसे कि, फल व सब्जियों आधारित कृषि प्रणाली माडल; गन्ने के साथ सहफसली खेती; आलू के साथ रबी मक्के की सहफसली खेती एवं फसलों के साथ-साथ पशुपालन व खाद्य प्रसंस्करण का समावेश।

माननीय मंत्री जी ने किसानों के साथ खुलकर चर्चा की और उनकी आमदनी बढ़ाने हेतु एक एकड़ कृषि प्रणाली माडल जिसमें हरा चारा (मोरिंगा व हाइब्रिड नैपियर) + पशुपालन (गाय, भैंस, बकरी, मुर्गी इत्यादि), केंचुआ खाद उत्पादन इत्यादि अपनाने की सलाह दी जिसमें एक वर्ष में 2-3 लाख रुपये की शुद्ध आमदनी हो सकती है। इससे सड़क पर घूमने वाले बेसहारा पशुओं को भी संरक्षण मिलेगा। माननीय मंत्री महोदय ने इस तरह के हरा चारा व पशुपालन आधारित कृषि प्रणाली माडल को कृषि प्रणाली संस्थान व किसी एक कृषक के प्रक्षेत्र पर विकसित करवाने का आश्वासन दिया और इसके लिए लागत धनराशि मंत्री महोदय क्षेत्र के किसी एक किसान को अपने विभाग के माध्यम से उपलब्ध करवायेंगे। माननीय मंत्री जी ने किसानों से जल की बचत करने की सलाह दी और देश के घटते भूमिगत जल स्तर पर चिंता भी जताई। संगोष्ठी के दौरान वाराणसी, मेरठ व मुजफ्फरनगर के चार प्रगतिशील किसानों ने बागवानी व गन्ने के साथ सहफसली खेती वाले कृषि प्रणाली माडल के माध्यम से अपनी एक एकड़ प्रक्षेत्र से एक लाख रुपये सालाना के शुद्ध मुनाफे कमाने के तरीकों को सबके साथ साझा किया।

विशिष्ट अतिथि डा. संजीव कुमार बालियान जी ने माननीय मंत्री जी एवं सभी अतिथियों एवं किसानों का स्वागत किया तथा क्षेत्र के किसानों से गन्ने आधारित कृषि

प्रणाली में उन्नत पशुपालन तकनीकों के समावेश से प्रक्षेत्र की आय दोगुनी करने की सलाह दी। इस अवसर पर डॉ. एस. भास्कर, सहायक महानिदेशक, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली ने विविधीकृत एवं समेकित कृषि प्रणाली माडल के माध्यम से कृषकों की आय बढ़ाने हेतु कृषि प्रणाली संस्थान के प्रयासों की सराहना की।

कृषि प्रणाली संस्थान के निदेशक डा० आजाद सिंह पँवार ने माननीय मंत्री जी एवं सभी अतिथियों व किसानों का स्वागत किया। उन्होंने अपने प्रस्तुतीकरण में कृषि प्रणाली संस्थान द्वारा विकसित एवं किसानों की आय बढ़ाने वाले विभिन्न प्रकार के कृषि प्रणाली माडल व उनकी क्षमताओं के बारे में विस्तार से बताया। कृषि विश्वविद्यालय के कुलपति डा. आर. के. मित्तल जी ने फसलोत्पादन के साथ-साथ पशुपालन, मौनपालन, मुर्गीपालन व मशरूम उत्पादन युक्त समेकित कृषि प्रणाली को किसानों की आय बढ़ाने का तरीका बताया। केन्द्रीय गोवंश अनुसंधान संस्थान, मेरठ के निदेशक डा. एन. वी. पाटिल जी ने संस्थान द्वारा विकसित फ्रीजवाल नस्ल की दुधारू गाय, केंचुआ पालन व गोबर व मूत्र से बनाये गये मूल्यवर्धित उत्पादों से किसानों की आय बढ़ाने का तरीका बताया। डा. पाटिल ने माननीय मंत्री जी को गोबर से बनी गणेश जी की मूर्ति भेंट की और कम खर्च में मूर्ति बनाकर अधिक लाभ कमाने की जानकारी भी दी। केन्द्रीय आलू अनुसंधान संस्थान मेरठ के संयुक्त निदेशक डा. मनोज कुमार ने प्रसंस्करण हेतु विकसित उन्नतिशील किस्म के आलू उगाकर अधिक लाभ कमाने की जानकारी दी।

बाद में माननीय मंत्री जी व अन्य अतिथियों ने कृषि प्रणाली संस्थान द्वारा विकसित गोवंश पशुधन आधारित कृषि प्रणाली माडल; मछली एवं उद्यान आधारित कृषि प्रणाली माडल एवं जैविक खेती एवं शून्य लागत प्राकृतिक खेती यूनिट प्रयोगों का अवलोकन किया। इस अवसर पर माननीय मंत्री जी एवं विशिष्ट अतिथियों ने संस्थान के सिवाया स्थित प्रक्षेत्र पर बहुउद्देशीय पौधों का पौधारोपण भी किया। इस कृषक वैज्ञानिक संगोष्ठी में उत्तर प्रदेश के वाराणसी, मेरठ, मुजफ्फरनगर एवं उत्तराखण्ड के हरिद्वार जिले के लगभग 250 किसानों ने भाग लिया। इन सभी जिलों में सैकड़ों किसानों के यहाँ कृषि प्रणाली संस्थान द्वारा समेकित कृषि



प्रणाली पर विभिन्न शोध परियोजनाओं का संचालन किया जा रहा है। संगोष्ठी के दौरान किसानों ने अपनी-अपनी कृषि प्रणाली की समसामयिक समस्याओं के बारे में चर्चा की एवं संबंधित विषय वस्तु विशेषज्ञ/वैज्ञानिकों द्वारा उनका समाधान भी पाया। डा. एम. पी. सिंह व डा. प्रेम सिंह ने किसानों को समेकित कृषि प्रणाली के माध्यम से आय, पोषण व पर्यावरण सुरक्षा तथा कृषिप्रणाली के विविधीकरण के गुर सिखाये। डा. दुष्यन्त मिश्र ने उन्नत बागवानी तकनीकी की जानकारी दी। डा. चन्द्रभानु ने किसानों को फसलों में समेकित नाशी जीव प्रबंधन के तरीकों को बताया। संगोष्ठी

के दौरान सटेड़ी गाँव के देवांजली महिला स्वयं सहायता समूह द्वारा कृषिप्रणाली संस्थान के सहयोग से बनाये गये मूल्य संबंधित उत्पादों की प्रदर्शनी भी लगायी गयी। संगोष्ठी के उपरांत हरिद्वार जिले से आये हुए किसानों हेतु एस.सी. एस. पी एवं टी.एस.पी. परियोजनाओं के अंतर्गत प्रक्षेत्र उत्पादों के प्रसंस्करण एवं मूल्यवर्धन के ऊपर प्रशिक्षण भी दिया गया जिसका संचालन डा. अमित नाथ व डा. आर. पी. मिश्र ने किया। कार्यक्रम का संचालन डा० पूनम कश्यप ने किया। डा० एल. आर. मीणा जी कार्यक्रम के समन्वयक रहे।



Plate Visit of Shri Giriraj Singh, Hon'ble Cabinet Minister, Ministry of Fisheries, Animal Husbandry & Dairying, GOI and Dr. Sanjeev Baliyan, Hon'ble Minister of State, Ministry of Fisheries, Animal Husbandry & Dairying, GOI visited IIFSR and interacted with farmers and also visited experimental farm

STAFF LIST

As on 31.12.2019

S. No.	Name of the Scientist	Designation	Discipline
RMP	Dr. A.S. Panwar	Director	Agronomy
Principal Scientist			
1.	Dr. M.P. Singh	Pr. Scientist	Agril. Extension
2.	Dr. Prem Singh	Pr. Scientist	Agronomy
3.	Dr. Peyush Punia	Pr. Scientist	Fisheries Resource Management
4.	Dr. L. R. Meena	Pr. Scientist	Agronomy
5.	Dr. N. Ravisankar	Pr. Scientist	Agronomy
6.	Dr. Suresh Malik	Pr. Scientist	Poultry Science
7.	Dr. Amith Nath	Pr. Scientist	Food Technology
8.	Dr. Lalith Kumar	Pr. Scientist	Agril. Chemicals
9.	Dr D K Singh	Pr. Scientist	Ag. Engineering
10.	Dr Lalit Kumar	Pr. Scientist	Agril. Chemicals
11.	Dr. R.P.Mishra	Pr. Scientist	Agronomy
12.	Dr. N.Subash	Pr. Scientist	Agri-Meteorology
13.	Dr. V.P.Chaudhary	Pr. Scientist	Farm Machinery and Power
14.	Dr. Dushyant Mishra	Pr. Scientist	Fruit Science
15.	Dr. Debasish Dutta	Pr. Scientist	Agril. Chemicals
16.	Dr. Devendra Kumar	Pr. Scientist	Plant Breeding
17.	Dr Pushendra Pratap Singh	Pr. Scientist	Vegetable Science
Sr. Scientist			
1.	Dr. P C Jat	Sr. Scientist	Agronomy
2.	Dr. Chander Bhanu	Sr. Scientist	Plant Pathology
3.	Dr. Poonam Kashyap	Sr. Scientist	Fruit Science
4.	Dr. A. K. Prusty	Sr. Scientist	Aquaculture
5.	Dr. M. Shamim	Sr. Scientist	Agri-Meteorology
Scientist			
1.	Shri Vipin Kumar Chaudhary	Scientist	Computer Application
2.	Dr. Sunil Kumar	Scientist	Computer Application & Agriculture statistics
3.	Dr. Nisha Verma	Scientist	Home Science



4.	Dr. Raghuveer Singh	Scientist	Agronomy
5.	Dr. Amrit Lal Meena	Scientist	Soil Science
6.	Dr. L.K. Meena	Scientist	Plant Physiology
7.	Dr. P.C. Ghasal	Scientist	Agronomy
8.	Dr. Amit Kumar	Scientist	Agronomy
9.	Dr. Jairam Choudhary	Scientist	Soil Microbiology
10.	Dr. Chetan Kumar. G	Scientist	Soil Science
11.	Shri Kamlesh Kumar	Scientist	Agronomy

Administrative

S. No.	Name of the Officers	Designation	
1.	Shri Ravinder Singh	Senior Admn. Officer	
2.	Shri T.C. Sharma	F & A O	
3.	Shri Surya Kant	P S	
4.	Shri Attar Singh	P.A.	
5.	Shri Rai Bahadur	P.A.	
6.	Smt. Jailata Sharma	P.A.	
7.	Smt. Alka Jain	Assistant	
8.	Shri Sanjay Kumar Gupta	Assistant	
9.	Shri S. K. Bansal	P. A.	
10.	Shri Rajesh Kumar	P. A.	
11.	Shri Brij Beer singh	P. A.	
12.	Smt. Sheela Devi	Assistant	
13.	Shri Ravi Kant	U.D.C. 9.2.2018	Promoted to Asst on
14.	Shir Prem Singh	U.D.C.	
15.	Sh. Rajender Kumar	L.D.C. 9.2.2018	Promoted to UDC on
16.	Sh. Permanand	L.D.C.	
17.	Sh. Prasant Panwar	L.D.C.	

Supporting Staff

S. No.	Name of the Officers	Designation
1.	Shri Anand Singh	SSS
2.	Shri Prem Kumar	SSS
3.	Shri Rakesh Kumar	SSS
4.	Shri Kripa Shankar Pandey	SSS
5.	Shri Ayodhya Prasad Dubey	SSS
6.	Shri Prem Singh	SSS
7.	Shri Mahavir Singh	SSS
8.	Shri Siddh Kumar	SSS
9.	Shri Harshnath Singh	SSS
10.	Shri Sada Ram	SSS
11.	Shri Gajendra Kumar	SSS

Technical Staff

S. No.	Name of the Officers	Designation
1.	Dr Yogendra Singh	CTO
2.	Shri D. Tripathi	CTO
3.	Dr Vipin Kumar	CTO
4.	Dr. Brij Mohan	ACTO
5.	Dr Om Kumar Tomar	ACTO
6.	Shri. Naval Singh	ACTO
7.	Shri. P.P. Mishra	ACTO
8.	Dr. S.P. Singh	ACTO
9.	Shri R. B. Tewari	STO
10.	Shri S. K. Duhoon	STO
11.	Dr Vinod Kumar	STO
12.	Shri. D.P. Singh	STO
13.	Shri. D.K. Pandey	TO
14.	Shri. Kishan Kumar	TO
15.	Shri A. P. Dwivedi	T O
16.	Shri Uma Shankar Pandey	STA
17.	Shri Ashok Kumar	STA
18.	Smt. Anju Verma	Sr. Technician
19.	Shri Raj Kumar Meena	Sr. Technician

