वार्षिक प्रतिवेदन
Annual Report
2017-18

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ICAR-Indian Institute of Farming Systems Research

Modipuram, Meerut - 250 110 (U.P.)

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ANNUAL REPORT

2017-18

भाकृअनुप
ICAR

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Modipuram, Meerut - 250 110, India

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

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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 naturally 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 and NPOF network with an aim to improve the productivity of existing systems and profitability. In this endeavour, established 38 region specific on station integrated farming systems models in all agro-climatic regions for research, extension, education and business (bankable projects) besides 63 farming systems have been refined with the participation of farmers. These models have potential to produce more (27.11 t/ha on rice equivalent basis), generate 58 % additional income, net income of > 10,000 rupees/month for 6-7 months in a year, generate additional employment of 20 man days/ month for 9-10 months. For livelihood security of tribal farmers, on-farm participatory research in tribal farming systems through cluster approach was undertaken in 14 locations covering 14 states. Organic production packages for 51 cropping systems suitable for 12 states were developed. More than 186 FLDs on oilseeds in farming systems perspective was conducted. Eighteen Integrated Farming System (IFS) models developed through on-station research have been included in the state level packages for up-scaling.

Farmer FIRST programme was undertaken in 3 villages during the year besides adopting 50 villages under Mera Gaon Mera Gaurav for penetrating the modern and suitable technologies to the farms for higher productivity with least uncertainties in Western Plain zone of Uttar Pradesh. Development of climate resilient farming systems programme under National Mission for Sustainable Agriculture (NMSA) is being undertaken in 3 adopted villages in Varanasi district in eastern Uttar Pradesh. Apart from these, quantitative analytical tools and models are 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 (10 no's) and international training (06 no's). The Institute organized a two summer schools, five trainings, one group meeting and several kisan gosthies and field days on different aspects of farming systems management.

Secretary, DARE and DG, ICAR Dr. Trilochan Mohapatra visited ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut and stressed upon ground level implementation of 'Swachhta Abhiyan' in ICAR office premises; adaptation of validated integrated farming system/ integrated organic system models by farmers and their impact analysis; generation and documentation of scientific informations from research on integrated farming systems besides focus upon disruptive technologies which can change the directions of agriculture and allied sectors in the country.

I express my gratitude to Dr.Trilochan Mohapatra, Secretary, DARE and Director General, ICAR, New Delhi and Dr. K. Alagusundaram, Acting 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 PME Cell and Editorial Committee in compiling and timely publication of the report is highly appreciated.

(A S Panwar)
Director

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*1 केन्द्रीय मृदा लवणता अनुसंधान संस्थान, करनाल से स्थानांतरित किए गए कनिष्ठ अभियन्ता का एक पद जो भविष्य में वापिस किया जा सकता है।

*2 प्रशासनिक संवर्ग के पुनर्गठन के बाद ये अतिरिक्त पद हैं जो भा.कृ.अनु.प. संस्थान के निर्देशानुसार ये अगले आदेश तक बने रहेंगे।

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1.	डॉ. कमलेश कुमार	वैज्ञानिक	16.10.2017	एनएआरएम	नई नियुक्ति

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1	डॉ. अनिल कुमार	वैज्ञानिक	16.06.2017	स्थानांतरण (सी०एस०एस०आर०आई०, करनाल)
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- प्रणाली की उत्पादकता का उच्च स्तर 1160.26 टन/हेक्टेयर/वर्ष और शुद्ध आमदनी रूपये 216421/हेक्टेयर/वर्ष बनाए रखने के लिए मौजूदा फसल प्रणालियों के विविधीकरण का उद्देश्य बहु–विकल्पीय फसलों को जैसे अनाज, दालें, तिलहन, नकदी फसल (गन्ना), हरा चारा और सब्जियों को उगाना है।
- चारा आधारित फसल अनुक्रम परिणामों से पता चला है कि अलग–अलग फसल अनुक्रमों में गेहूं अनाज सम्तूल्य उपज के मामले में क्लिटोरिया–सरसों–मूंग, (211.26 टन/हेक्टेयर/ वर्ष) अधिक उत्पादक और साथ ही लाभदायक पाई गयी थी, इसके बाद धान–चना–भिंडी फसल अनुक्रम (197.73 टन/हेक्टेयर/वर्ष) रहा। फरवरी (वसंत ऋतु) मे बोये जाने वाले गन्ना के साथ अंतर फसल लोबिया/भिंडी/उडद/मूंग/लौकी लेने पर अन्य फसल अनुक्रमों की तुलना में उच्च प्रणाली उत्पादकता प्राप्त हुई।
- उच्च उत्पादकता और लाभप्रदता के लिए पांच पूरक प्रणालियों का मूल्यांकन उच्चीकृत क्यारी और समतल भूमि विन्यास के तहत किया गया। अधिकतम गेहूं समकक्ष उपज (38.70 टन/हेक्टेयर) गन्ना–पेडी–गेहूं की फसल प्रणाली में दर्ज की गई जो मक्का लोबिया–मक्का चना – गेहूं + मेथी – मूंग में सबसे कम (14.21 टन/हेक्टेयर) पाई गई।
- अन्तः फसल मापांक (अनाज आधारित, सब्जी आधारित और चारा आधारित) के उपज स्तर (समतुल्य उपज) में महत्वपूर्ण अंतर पाया गया था। सब्जी आधारित अन्तः फसल मापांक सभी फसलों

और उनकी किस्मों में सबसे अधिक लाभदायक था।

- एक फसल अवधि में प्रदान की गई सिंचाई के लिए बिजली की ऊर्जा की बचत गन्ना, पैडी, बरसीम (चारा), गेहूं और सरसों में क्रमशः 1474, 1106, 705, 301 और 168 किलोवाट/हेक्टेयर भूमिगत पाइप लाइन में खुली सिंचाई नाली विधि की तुलना में देखी गई थी।
- कृषि प्रणालियों की प्रक्षेपित भेद्यता जलवायु परिवर्तन की सीमा (भविष्य मे फसल की कीमतों और कृषि संरचना) और विकास मार्गों पर निर्भर करती है। करनाल जिले में लगभग 31% खेत ग्रीन रोड (मध्यम उत्सर्जन) और ग्रे रोड (उच्च उत्सर्जन) दोनों के तहत जलवायु परिवर्तन के लिए कमजोर हैं।
- सीधी बुआई के साथ नीम लेपित यूरिया के प्रयोग से चावल उत्पादन के ग्लोबल वार्मिंग की संभाव्यता को सिंचाई वाले परिस्थितियों में सामान्य यूरिया के साथ गंदला धान रोपाई की तुलना में 35.9% तक कम किया जा सकता है। मीथेन और नाइट्रस ऑक्साइड उत्सर्जन क्रमशः 32.2 और 21.2% कम पाया गया।
- गेहूं में सिंचित स्थिति के तहत पारंपरिक जुताई और सामान्य यूरिया की तुलना में नीम लेपित यूरिया के प्रयोग के साथ शून्य–टिलेज को अपनाने से नाइट्रस ऑक्साइड उत्सर्जन को 5.8% तक कम किया जा सकता है।
- किसान प्रथम परियोजना के तहत विदेशी प्रजाती की सब्जी आधारित खेती प्रणाली मॉड्यूल किसान के खेत पर विकसित किया गया जिसने पश्चिमी उत्तर प्रदेश के छोटे किसानों के लिए 0.4 हेक्टेयर से 2,03,170 रुपये का अधिकतम शुद्ध लाभ प्रदान किया ।
- लाभप्रदता और स्थिरता के लिए बागवानी फसलों में बहु–स्तरीय फसल प्रणाली के माध्यम से स्ट्रॉबेरी+शिमला मिर्च– तुरई प्रणाली से 0.24 हेक्टेयर मे रुपये 2,21,375 शुद्ध लाभ प्रदान करने में फायदेमंद साबित हुई।
- गैर मौसमी फलों और सब्जियों के उत्पादन के लिए कम लागत वाली संरक्षित संरचनाओं में पौध को उगाने से, साहित्य के वितरण और कुशल प्रशिक्षण आयोजित करने के माध्यम से इस तकनीक को किसान के खेतों पर लोकप्रिय किया गया है।
- कृषि बागवानी, कृषि–होर्टी–सिल्वी और कृषि–होर्टी–सिल्वी–पासरल सिस्टम पैकेज और प्रथाओं को किसान प्रथम परियोजना के तहत गोद लिए हुये गांव सठेडी मे विकसित किया गया।
- केले आधारित कृषि प्रणालियों के विकास के लिए पैकेज और प्रथाओं को किसान प्रथम कार्यक्रम के तहत खेत पर मानकीकृत किया गया है।
- तालाब के डाइक पर सब्जियों के एकीकरण के साथ साल भर उच्च आय और प्रतिफल के लिए तालाब–डाइक प्रणाली विकसित की गई है।
- 1.5 हेक्टेयर के बागवानी आधारित कृषि प्रणाली मॉडल के परिष्करण के परिणाम स्वरूप रुपये 4,29,000/वर्ष की शुद्ध आय प्राप्त हुई।
- उत्तर प्रदेश के पश्चिमी मैदानी क्षेत्र में लिंग संवेदनशील कृषि प्रणालियों का चित्रण किया गया। एफएस 3 फसल़ बागवानी (सब्जियां) डेयरी लिंग संवेदनशील कृषि प्रणाली के रूप में चिह्नित की जा सकती है, जिसमें महिला कार्यरत परिवारों की अधिकतम संख्या है। कठोर प्रवण गतिविधियों पर अधिकतम कार्य भागीदारी सूचकांक शामिल है।
- तमिलनाडु के धर्मपुरी जिले में खेत की फसल+डेयरी सिस्टम ने अन्य सभी प्रणालियों की तुलना में

अधिकतम स्थायी आजीविका सुरक्षा सूचकांक (0.38) और सामाजिक न्याय संगतता सूचकांक (0.28) दर्ज किया। हालांकि, क्षेत्रीय फसलों+डेयरी+बकरी+मुर्गी सिस्टम (0.38) में पारिस्थितिकीय सुरक्षा सूचकांक बेहतर था जबकि आर्थिक दक्षता सूचकांक क्षेत्र फसलों+डेयरी+बकरी+मधुमख्खी पालन (0.55) में था।

- फसल प्रणाली के परिपेक्ष में 12 राज्यों के लिए उपयुक्त 51 फसल प्रणाली का जैविक फसलों के उत्पादन के लिए वैज्ञानिक पैकेज और प्रथाओं का विकास किया। 12 राज्यों के लिए विभिन्न मौसमों में जैविक खेती के लिए 15 फसलों की सर्वश्रेष्ठ प्रदर्शन करने वाली किस्मों की भी पहचान की गई है।
- डयूरम गेहूं (2.7 टन अनाज उपज/हेक्टेयर), कई बार कटने वाली बरसीम (76.5 टन/हेक्टेयर) और जई (2.57 टन/हेक्टेयर बीज उपज) उत्तर प्रदेश के पश्चिमी मैदानी क्षेत्र में एकीकृत जैविक खेती प्रणाली के लिए उपयुक्त मॉड्यूल हैं। 0.05 हेक्टेयर में रबी के दौरान उगाए जाने वाले कई बार कटने वाली बरसीम और जई जैवक खेती प्रणाली के तहत 135 दिनों के लिए 2 डेयरी जानवरों को हरी चारा की आपूर्ति कर सकती हैं। केरल के लिए विकसित मसालों आधारित एकीकृत जैवक खेती प्रणाली से 1.09 लाख रुपये/एकड़ शुद्ध आय प्राप्त करने की गुंजाइश प्रदान करता है।
- एकीकृत और अजैविक उत्पादन प्रणालियों की तुलना में जैविक खादों के दीर्घकालिक प्रयोग द्वारा पोटेशियम के व्यवस्थित प्रबंधन के साथ टाइपिक उस्टोक्रेप्ट मिट्टी की पोटेशियम बफरिंग क्षमता में सुधार किया जा सकता है।
- गन्ना लगाने की तारीख को पोका बोएन्ग रोग के प्रबंधन के लिए एक महत्वपूर्ण कारक के रूप में दर्ज किया गया। मई में लगाए गए गन्ने की फसल के मामले में अधिकतम बीमारी की घटनाएं (64%) देखी गई थीं। प्रारंभिक या समय पर बुआई बीमारी के हमले से कम पीड़ित होती है। गेहूं की फसल के बाद अप्रैल और मई के महीने में देर से बुआई क्षेत्र में गन्ना लगाने की एक आम प्रणाली है और इन परिस्थितियों में अच्छी फसल की कटाई के लिए मजबूत रोग प्रबंधन प्रणाली आवश्यक है।
- सभी कृषि–जलवायु क्षेत्रों में 38 एकीकृत कृषि प्रणाली मॉडल स्थापित किए गए। किसानों की भागीदारी के साथ 63 कृषि प्रणालियों को परिष्कृत किया गया है। इन मॉडलों में चावल समकक्ष आधार पर अधिक उत्पादन (27.11 टन/हेक्टेयर) करने की क्षमता है, जो सालाना 6–7 महीने के लिए अतिरिक्त आय, 10,000 रुपये/माह की शुद्ध आय उत्पन्न करती है, 9–10 महीने के लिए 20 व्यक्ति दिवस/माह का अतिरिक्त रोजगार भी उत्पन्न करती है के अलावा बेहतर उत्पादन (0.58) और आय (0.44) स्थिरता है। फास्फोरस और पोटेसिअम के अलावा आंतरिक पुनरावृत्ति लगभग 118 किलोग्राम एन/हेक्टेयर पाया गयी थी। सभी मॉडलों की क्षेत्रों में आंतरिक दर 118% होना पाई गई थी।
- अलग–अलग क्षेत्रों में पहचाने जाने वाले वैकल्पिक फसल प्रणालियों के कारण उत्पादकता में वृद्धि आर्द्र में 16.54 टन/हेक्टेयर, अर्द्ध शुष्क में 13.4 टन/हेक्टेयर और आर्द्र समकक्ष आधार पर आर्द्र क्षेत्रों में 10.6 टन/हेक्टेयर पाया गयी।
- खरीफ के दौरान 50% एन का प्रयोग एफ वाई एम के माध्यम से 50% आर डी एन और रबी में 100% आर डी एन से 8.9 2 टन/हेक्टेयर उत्पादकता दर्ज की गई, जो खरीफ और रबी में 100% आरडीएन से लगभग 7% अधिक थी।
- एकीकृत कृषि प्रणाली मॉडल में कार्बन पृथक्करण और जीएचजी उत्सर्जन अध्ययन शुरू किया गया

और आईपीसीसी मानकों के आधार पर उपयोगकर्ता के अनुकूल एकीकृत कृषि प्रणाली जीएचजी अनुमानक एक्सेल टूल विकसित किया गया है। यह शोधकर्ताओं को जीएचजी उत्सर्जन का आकलन करने और आईएफएस मॉड्यूल को संशोधित करने में मदद करेगा।

- 10 बैंक योग्य परियोजनाओं का विकास किया और ये सत्यापन और परिष्करण के विभिन्न चरणों में हैं।
- ऑन–स्टेशन शोध के माध्यम से विकसित अठारह एकीकृत कृषि प्रणाली (आईएफएस) मॉडल को राज्य स्तरीय पैकेजों में अप–स्केलिंग के लिए शामिल किया गया है। केरल सरकार ने 2300 फार्म परिवारों को शामिल करके पूरे राज्य में 4 गृहस्थ आधारित एकीकृत कृषि प्रणाली मॉडल को अप–स्केल करने के लिए 700 लाख रूपए की मंजूरी दे दी है। आईसीएआर–आईआईएफएसआर और एफएसआरसी, करमना के तकनीकी बैकस्टॉपिंग के साथ इन्हें प्रत्येक पंचायत में 1–2 की दर से स्थापित किया जाएगा।

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भारतीय कृषि अनुसंधान परिषद (आईसीएआर) कृषि अनुसंधान और शिक्षा विभाग (डीएआरई), कृषि मंत्रालय, भारत सरकार के तहत एक स्वायत्त संगठन है। जो 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 तहत एक पंजीकृत सोसाइटी के रूप में स्थापित किया गया जिसका मुख्यालय नई दिल्ली में है।

परिषद पूरे देश में बागवानी, मत्स्य पालन और पशु विज्ञान सहित कृषि में अनुसंधान और शिक्षा के समन्वयन, मार्ग र्दशन और प्रबंधन के लिए सर्वोच्च संस्था है। देश में फैली 102 आईसीएआर संस्थानों और 71 कृषि विश्वविद्यालयों के साथ यह दुनिया के सबसे बड़े राष्ट्रीय कृषि प्रणालियों में से एक है। संस्थानों और विश्वविद्यालयों में विकसित प्रौद्योगिकि या परिषद के 692 से अधिक कृषि विज्ञान केंद्रों (के.वी.के.) के माध्यम से हस्तांतरित और परिष्कृत की जा रही हैं।

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 2016 तक अनाज उत्पादन में 5 गुना, बागवानी के उत्पादन मे 9.5 गुना, मछली की मात्रा में 13 गुना, दुग्ध उत्पादन में 8.5 गुना और अंडे के उत्पादन में 43 गुना बढ़ा कर देश को राष्ट्रीय खाद्य और पोषण सुरक्षा में आत्मनिर्भर किया है।

कृषि में उच्च शिक्षा में उत्कृष्टता को बढ़ावा देने में परिषद ने भी एक प्रमुख भूमिका निभाई है। यह विज्ञान और प्रौद्योगिकी विकास के बढ़ते क्षेत्रों में लगी हुई है और इसके वैज्ञानिक अंतराष्ट्रीय स्तर पर उनके क्षेत्रों में स्वीकार किए जाते हैं। देश की बढ़ती आबादी के लिए पौष्टिक सुरक्षा, घटति खेती योग्य भूमि, पानी की कमी के साथ–साथ ग्लोबल वार्मिंग आईसीएआर के सामने एक बडी चुनौती है, जिसका निराकरण एकिकृत कृषि प्रणाली को अपनाकर किया जा सकता है। इसी कडी मैं भारतीय कृषि अनुसंधान परिषद (आईसीएआर) का संस्थान भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदिपुरम सतत कार्यरत है।

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कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) को पूर्ण विकसित संस्थान का दर्जा भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) के नये नाम के रूप में 27 नवंबर 2014 को दिया गया था तथा चार विभाग (एकीकृत कृषि प्रणाली प्रबंधन, फसल प्रणाली और संसाधन प्रबंधन, जैविक कृषि प्रणाली, और प्रौद्योगिकी स्थानांतरण शोधन एवं मानव संसाधन विकास) के साथ–साथ एकीकृत कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी–आईएफएस) और जैविक खेती पर नेटवर्क परियोजना (एनपीओएफ) भी संस्थान के अभिन्न अंग है।

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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 एक भा.कृ.अनु.प. परियोजना के रूप में शुरू हुई।

1968–89 : दो घटकों " आदर्श सस्य प्रयोग" और "सरल उर्वरक परीक्षण" को साथ जोडकर

योजना को अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना (एआईसीएआरपी) के रूप में पुनर्व्यवस्थित और स्वीकृत किया गया।

1989 : अ.भा.सम.सस्य अनु.परि. को फसल प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना के साथ "फसल प्रणाली अनुसंधान परियोजना निदेशालय" के नाम से मोदीपुरम मेरठ मे स्थापित किया गया।

2004–05 : 13 सह–संचालन केंद्रों के साथ नई योजना जैविक खेती पर नेटवर्क परियोजना (एनपीओएफ) को फ.प्र.अनु. परि.निदे. से जोड़ा गया।

2010 : फसल प्रणाली अनुसंधान परियोजना निदेशालय और फसल प्रणालीयो पर अखिल भारतीय समन्वित अनुसंधान परियोजना का नाम क्रमशः कृषि प्रणाली अनुसंधान परियोजना निदेशालय और कृषि प्रणालीयो पर अखिल भारतीय समन्वित अनुसंधान परियोजना के रूप में बदल दिया गया।

2014 : पीडीएफआरआर (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 नया नाम दिया गया। कृषि प्रणालियो पर अखिल भारतीय समन्वित अनुसंधान परियोजना और जैविक खेती पर नेटवर्क परियोजना (एनपीओएफ) संस्थान के अभिन्न अंग के रूप में रहें।

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फसल प्रणाली अनुसंधान परियोजना की उत्पत्ति डा ए.बी. स्टीवर्ट, (मैकले इंस्टीट्यूट ऑफ सॉइल रिसर्च, एबरडीन, यू.के.) के भारत यात्रा के दौरान कहीं उन्नीस सौ चालीस 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 जो बहुत ही कम समय के भीतर मिट्टी और जलवायु की विभिन्न स्थितियों के अंतर्गत पर्याप्त जानकारी प्राप्त कर आव यक कदम उठाए, ताकि कृषि विभाग फसल की पैदावार बढ़ाने के लिए किसानों को प्रासंगिक निर्देश दे सके। उनकी समीक्षा रिपोर्ट, 1947 में प्रकाशित हुई, जिसका देश में उर्वरक प्रयोगों के तत्त्व ज्ञान और अभ्यास पर काफी प्रभाव पड़ा। किसानो के खेतों पर होने वाले "सरल खाद परीक्षण" करने और चयनित केन्द्रों पर "जटिल प्रयोगों" के संचालन के महत्व को रिपोर्ट में बल दिया गया। 1953 में मिट्टी की उर्वरता और उर्वरक प्रयोग परियोजना के माध्यम से भारत–अमेरिकी प्रौद्योगिकी सहयोग समझौते के तहत खेती कर्ताओं के क्षेत्र पर "उर्वरक परीक्षण" की शुरुआत को निम्नलिखित उद्देश्यों के साथ प्रोत्साहित किया गया।

परियोजना (एआईसीआरपी–आईएफएस) के साथ–साथ और जैविक खेती पर नेटवर्क परियोजना भी निम्नलिखित जनादेशो के साथ संस्थान का एक अभिन्न अंग बने रेहः

- एकीकृत कृषि प्रणालियों में उत्पादकता और संसाधन उपयोग क्षमता में सुधार के लिए उत्पादन तकनीकों पर बुनियादी और सामरिक अनुसंधान करना।
- विभिन्न कृष 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 सूचना के एक भंडार के रूप में कार्य करना।
- देश में एकीकृत कृषि प्रणाली अनुसंधान का समन्वय और निगरानी 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
- जरूरत–आधारित कुशल और लाभदायक फसल/कृषि प्रणालियों का विकास करना
- विभिन्न फसल अनुक्रमों के लिए इष्टतम किस्मो का संयोजन
- इष्टतम फसल संयोजन और अंतर फसल प्रणाली केलिए रोपण ज्यामिति
- विभिन्न फसल प्रणालियों के तहत जुताई आवश्यकताओं और फसल स्थापना विधि
- विभिन्न कृषि–पारिस्थितिक क्षेत्रों कृषि स्थितियों के अंतर्गत कृषि संसाधनो का चरित्र चित्रण और बाधा विश्लेषण करना
- कृषि/फसल प्रणालियोंका विश्लेषण
- विभिन्न फसलों और मिट्टी के प्रकारों के लिए उर्वरकों के कुशल स्रोत
- विभिन्न कृषि/फसल प्रणालियों में एकीकृत पोषक प्रबंधन करना
- फसल की पैदावार और मिट्टी की उर्वरता पर दीर्घकालिक एकीकृत पोषक प्रबंधन और रासायनिक उर्वरक का प्रभाव
- अनाज–अनाज फसल प्रणालियों में फलीदार फसलों को शामिल करना
- संसाधन संरक्षण प्रौद्योगिकिया
- जलवायु लचकदार कृषि
- जैविक एवं परिशुद्धि खेती
- खेतों पर फसल प्रणाली प्रौद्योगिकियों का मूल्यांकन और शोधन
- फसल/कृषि प्रणाली से संबंधित डेटाबेस प्रबंधन
- कृषि प्रणाली अनुसंधान से सम्बंधित मानव संसाधन विकास का विकास करना

1. Hkk-Ñ-vu-i-&Hkkjrh; Ñf"k i.kkyh vuqla/kku lLFkku }kjk fuEufyf[kr rhu ;kstukvksa lapkfyr gSA

भा.कृ.अनु.प.–भा.कृ.प्र.अनु.सं.–कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) मोदीपुरम, मुख्यालय अपने चार विभागों (एकीकृत कृषि प्रणाली प्रबंधन, फसल प्रणाली और संसाधन प्रबंधन, जैविक कृषि प्रणाली, और प्रौद्योगिकी स्थानांतरण शोधन एवं मानव संसाधन विकास) के साथ भारतीय कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) के रूप मे उन्नत होकर पूर्ण विकसित संस्थान बना।

2- ,dh—r —f"k ç.kkfy;ksa ij vf[ky Hkkjrh; lefUor vuqla/kku ifj;kstuk ¼,vkbZlhvkjih&vkbZ,Q,l½

(ए) आईएफएस अनुसंधान केंद्र : एआईसीआरपी–आईएफएस का नेतृत्व एक परियोजना समन्वयक द्वारा किया जायेगा जो निदेशक आईआईएफएसआर के प्रशासनिक नियंत्रण के अंतर्गत होगा। ऑन–स्टेशन शोध 25 मुख्य केंद्रों और 12 उप केंद्रों पर शुरू किया गया है तथा ऑन–फार्म शोध 32 मुख्य केंद्रों और 6 उप केंद्रों पर शुरू किया गया है। ये केंद्र उन कृषि महाविद्यालयों के या उनके क्षेत्रीय अनुसंधान केंद्र या सामान्य विश्वविद्यालयों में जहां मजबूत कृषि अनुसंधान

आधार उपलब्ध है पर मूल और व्यावहारिक शोध में लगे हुए हैं। बारहवीं योजना के दौरान सभी मौजूदा केंद्र जारी रहेगें। भाकृअनुप–भाकृसाँअनुसं नई दिल्ली को एआईसीआरपी–आईएफएस के एक नए स्वैच्छिक केंद्र के रूप में स्वीकृत किया गया है।

(बी) खेत पर शोध : यह योजना 32 केंद्रो पर चल रही है ये केंद्र किसानों के सहभागिता अनुसंधान में लगे हुए हैं। खेत में शोध (पहले किसानों के खेतों पर प्रयोग के रूप में जाना जाने वाला) केन्द्र विभिन्न कृषि जलवायु क्षेत्रों में स्थित है और पूरे क्षेत्र को समाविस्ट करते हैं।

3- tSfod [ksrh ij uVodh ifj;kstuk ¼,uihvk,Q½

यह परियोजना वर्तमान में 16 राज्यों में स्थित कृषि विष्वविद्यालयों/आईसीएआर संस्थानों में 20 सहयोग केंद्रों पर प्रगति में है। भाकृप्रअनुसं में एनपीओएफ को एक प्रधान वैज्ञानिक (राष्ट्रीय प्रधान अन्वेशक) द्वारा समन्वित किया जाता है जो निदेशक भाकृप्रअनुसं के प्रशासनिक नियंत्रण के अधीन होता है।

EXECUTIVE SUMMARY

1. Name and address of the Institute ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250110, Uttar Pradesh, India

2. Budget (2017-18)

a) Institute (₹ 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
1864.00	1508.75	1864.00	00	1864.00	1508.75	00	1508.75

b) External sources (₹ in Lakhs)

Source	Budget	Expenditure
Pension and other retirement benefits	273.00	238.24
Personal loan and advances	3.00	–
Externally funded projects	131.48	24.77
Total	**407.48**	**263.01**

c) Revenue generated (₹ in Lakhs) during 2016-17

Source	Amount
Farm Produce	36.96
Sale of fish, milk and livestock	Included in Farm Produce
License fee/ water charges	3.15
Miscellaneous	10.45
Interest on loan and advances	2.10
Interest on TDR	21.01
Others (Royalty and Inst. Charges)	–
Total	**73.67**

3. Staff position (as on 31.03.2017)

Category	Sanction	Position	Vacant
Scientific			
Director	01	01	Nil
Principal Scientist	07	03	04
Senior Scientist	12	10	02
Scientist	19	16	03
Total	**39**	**30**	**09**

Category	Sanction	Position	Vacant
Technical Staff			
Category-III (T-6, 7/8)	02	-	02
Category-II (T-3, T-4 & T-5)	18	17	02
Category-I (T-1 & T-2)	03	03	-
Total	23	20	04
Administrative Staff			
Sr. Administrative Officer	01	01	-
F & A O	01	01	-
A A O	01	-	01
Assistant	04	04	-
U D C	02	02	-
P S	02	02+01*	-
P A	02	02	-
Jr. Steno Gr.III	01	01+01*	-
L D C	03	03	-
Total	17	17	01
Supporting Staff			
Temporary Status Casual Labourers	15	15	-

3.1 New appointments/joining

Sl. No.	Name	Designation	Date of Joining	From	Remarks
1	Kamlesh Kumar	Scientist	16/10/2017	NAARM	New Appointment

3.2 Selection/transfer/superannuation

Sl. No.	Name	Designation	Date	Selected to	Remarks
1	Dr. Anil Kumar	Principal Scientist	16.06.2017	CSSRI	Transfer
2	Dr. Sanjeev Kumar	Scientist	16.06.2017	NDRI	Transfer
3	Dr. S.A. Kochiwad	Scientist	16.06.2017	IVRI	Transfer
4	Sh. Krishan Pal	CTO	30.06.2017		Suppernnuation
5	Sh. Jatakant	Assitant	13.12.2017	IISR	Transfer
6	Sh. K.V. Anand	ACTO	31.07.2017		Suppernnuation
7	Sh. Ravikant	UDC	09.02.2018	Assistant	Promotion
8	Sh. Rajendra Kumar	LDC	09.02.2018	UDC	Promotion

4. Salient Research Achievements

- Diversification of existing cropping systems aimed to raise multi-choice crops like cereals, pulses, oilseed, cash crop sugarcane, green fodder and also vegetables for sustaining productivity of the system yielded higher level of productivity at 1160.26t/ha/yr and net return of Rs.216421/ha/yr
- In fodder based cropping sequences results revealed that among the different cropping sequences, clitoria- mustard- moong bean was found more productive as well as profitable in terms of wheat grain equivalent yield (211.26t/ha/yr) closely followed by rice- chickpea- okra cropping sequence (197.73t/ha/yr)Intercropping of sugarcane with cowpea/okra/urd bean/moong bean/loki in February (spring season) planted sugarcane gave higher system productivity as compared to other cropping sequence.
- Five complementary systems were evaluated for higher productivity and profitability under flatbed and raised bed land configuration. Maximum wheat equivalent yield (38.70 t/ha) was recorded in Sugarcane-ratoon-wheat cropping system which was lowest (14.21 t/ha.) in Maize+cowpea-maize+bengal gram-wheat+methi-green gram.
- There was significant difference in yield levels (REY) of intercropping modules (Cereal based, vegetable based and fodder based). Vegetable based intercropping module was most profitable in all crops and their cultivars.
- On average, the saving of electricity energy for irrigation provided in one crop duration was noticed 1474, 1106,705, 301, 168 kWh/ha in sugarcane ratoon, sugarcane, barseem (fodder), wheat and mustard, respectively, in underground pipe line as compared to open channel method.
- Projected vulnerability of farming systems depends on the extent of climate change and development pathways (future crop prices and farm structure). About 31% of farms are vulnerable to climate change under both the Green Road (moderate emissions) and the Grey Road (high emissions) in Karnal district.
- Global Warming Potential (GWP) of rice production can be reduced by 35.9 % by adopting direct seeding with the application of neem coated urea compared to puddled transplanted rice with normal urea under irrigated situations. It is also found that CH_4 and N_2O emission reduced by 32.2 and 21.2 %, respectively.
- N_2O emission can be reduced by 5.8 % by adopting zero-tillage with the application of neem coated urea compared to conventional tillage and ordinary urea under irrigated situation in wheat.
- Exotic vegetable based farming system module developed on-farm under farmer First project provided higher returns of Rs 2,03,170 from 0.4 ha for small farmers of Western Uttar Pradesh.
- Multi-tier cropping system for profitability and scalability in horticultural crops through Strawberry – Capsicum- Ridge Gourd system proved beneficial in providing net returns of Rs 2,21,375 from 0.24 ha
- Raising of seedlings of fruits and vegetables in low-cost protected structures for off-season production has been popularised at farmer's fields through distribution of literature and conducting the skilled trainings.
- Package and practices for developing Agri- Horti, Agri-Horti-Silvi and Agri-Horti-Silvi-Pastoral Systems have been developed under adopted Village Sathedi of Farmer First project.
- Package and practices for developing banana based farming systems have been standardised at on-Farm under Farmer First Programme.
- Pond-dyke system has been developed with integration of vegetables on the dyke throughout the year for higher income and returns.

- Refinement of Horticulture based farming systems model of 1.5 ha resulted in achieving net income worth 4,29,000/year.
- Gender sensitive farming systems in western plain zone of Uttar Pradesh have been characterized. FS_3: Crop + Horticulture (Vegetables) + Dairy (1C + 1B) may be tagged as gender sensitive farming system with respect to maximum number of female headed households contributing maximum work involvement including maximum work participation index on drudgery prone activities followed by FS_1: Crop+ Dairy (1C+1-2B).
- Field crops + dairy system in Dharmapuri district of Tamil Nadu recorded higher Sustainable livelihood security index (0.38) and social equity index (0.28) than all other systems. However, ecological security index was better in field crops + dairy + goat + poultry system (0.38) while economic efficiency index was higher in field crops + dairy + goat + honeybee (0.55).
- Developed the scientific package of practices for organic production of crops in cropping systems perspective for 51 cropping systems suitable for 12 states. Best performing varieties of 15 crops for organic farming in different seasons for 12 states have also been identified.
- Durum wheat (2.7 t grain yield/ha), multicut berseem (76.5 t/ha) and oat (2.57 t/ha seed yield) are suitable modules for integrated organic farming system in Western Plain zone of Uttar Pradesh. Multi-cut berseem and oat grown during *rabi* in 0.05 ha each can supply green fodder to 2 dairy animals for 135 days under organic farming system. Spices based integrated organic farming system developed for Kerala provides scope to obtain net income of Rs. 1.09 lakhs/acre.
- Potassium buffering capacity of typic Ustochrept soil can be improved by long term application of organic manures with systematic management of K compared to the integrated and inorganic production systems.
- The date of planting of sugarcane was recorded as a crucial factor for management of *pokah boeng* disease. Maximum disease incidence (64%) was noticed in case of May planted crop. Early or timely planting suffers less from the attack of the disease. Late planting in the month of April and May after harvest of wheat crop is a common system of sugarcane planting in the region and sound disease management system is necessary to harvest good crop under these situations.

INTRODUCTION

Indian Council of Agricultural Research-Indian Institute of Farming System 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 16 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 102 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 692 KrishiVigyanKendras (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 councils research and technology development enabled the country to increase the production of food grains by 5 times, horticultural crops by 9.5 times, fish by 13 times, milk by 8.5 times and eggs by 43 times since 1951 to 2016, 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 tonnes 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 ever-growing population of the country with little potential for increase in cultivable land area, ensuing shortage of water and global warming.

Mandate of ICAR-IIFSR

- 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 institute 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 4 divisions (Integrated Farming Systems Management, Cropping Systems & Resource Management, Organic Agriculture Systems and Transfer of Technology, Refinement & Human Resource Development) along with AICRP on IFS and 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 11th five year plan PDCSR has been re-designated as '**Project Directorate for Farming Systems Research (PDFSR)**' during 2009-2010. During 2014 (12th five year plan) PDFSR was upgraded to a full-fledged institute and renamed as "**ICAR-Indian Institute of Farming Systems Research**" besides AICRP on IFS (on 75 centres) and NPOF (on 20 centers) 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.

During the year 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, refinement & human resource development is being carried out.

AICRP on Integrated Farming Systems (IFS)

Under the aegis of AICRP on IFS, on-station research at 25 main centres with 12 sub centres and on-farm research at 32 centres and 6 ICAR institute based voluntary centers located in 15 agro climatic regions is being operating under the administrative control of Director, ICAR-IIFSR.

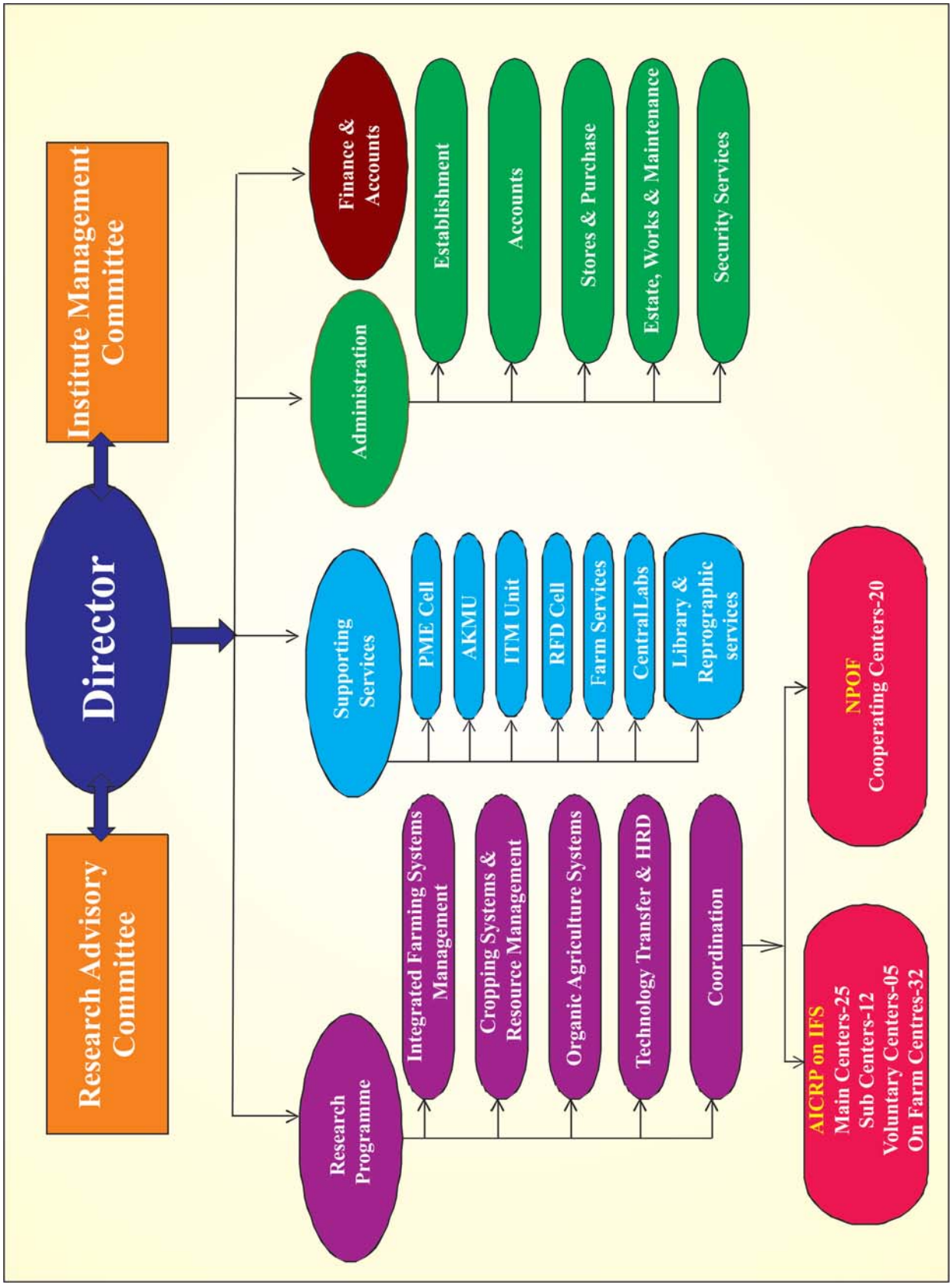
Network Project on Organic Farming (NPOF)

Research on Organic farming through Network Project on Organic Farming (NPOF) at 20 centres covering 10 agro-climatic regions involving 11 SAU's, 7 ICAR institutes and 1 special heritage university is being carried out covering 16 states.

Location

ICAR-IIFSR, Modipuram is situated at an elevation of 230 meters above mean sea level, 29°4' N latitude and 77°46' E longitude. As per Planning Commission of India this region falls under 'Western Plains Sub-Zone' of 'Upper Gangetic Plains'. However, as per National Bureau of Soil Survey and Land Use Planning, Nagpur, the area falls under 'Northern Plain and Central Highland's Hot Semi-Arid Eco-region' with Alluvium derived soils. Soil of the research farm is neutral to slightly alkaline in nature and belongs to Typic Ustochrept group.

ICAR-IIFSR ORGANOGRAM



SOIL AND CLIMATE

During the reporting year the onset of southwest monsoon was recorded on 27th June, which was timely onset. Total annual precipitation of 730.3 mm was received with uneven distribution. This was 2.2% lesser than the normal precipitation of 747.0 mm. Out of the total annual precipitation, Southwest monsoon contributed 83.8%. The mean maximum temperature varied from 20.7^{0}C in January to 38.4^{0}C in May, while the mean minimum temperature varied between 7.8^{0}C in January to 25.3^{0}C in July and August. The average relative humidity and sunshine hours were 72.7% and 6.5 hours/day, respectively. There were 37 rainy days with rainfall more than 2.5 mm. The highest daily maximum temperature recorded was 43.5^{0}C on 21st April and the lowest minimum temperature was 2.5^{0}C on 11thJanuary. 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^{0}C was recorded during the 16th SMW and lowest minimum temperature of 4.3^{0}C was recorded during the 2nd SMW.

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

Month	Temperature (^{O}C)		Avg. RH (%)	Sunshine hours (hrs/day)	Rainfall (mm)	Rainy days (nos.)	Pan evaporation (mm)
	Max.	Min.			Observed		
January	20.7	7.8	78.5	5.4	65.0	3	51.2
February	24.6	9.5	76.9	7.4	1.3	0	77.7
March	29.2	13.5	68.1	8.8	19.0	3	162.9
April	37.7	19.8	57.8	9.1	8.1	1	251.0
May	38.4	22.8	57.0	7.4	17.4	2	264.7
June	36.7	24.4	68.6	6.9	60.9	7	232.7
July	33.7	25.3	82.5	6.1	118.3	7	141.5
August	33.4	25.3	84.0	4.8	202.5	8	115.7
September	33.0	23.8	82.2	5.9	230.6	5	107.1
October	32.5	18.1	72.2	7.6	0.0	0	94.4
November	25.7	11.6	72.6	3.7	0.0	0	52.4
December	22.8	8.0	71.7	5.2	7.2	1	55.7
Annual Avg/Total	30.7	18.1	72.7	6.5	730.3	37	1607.0

The weekly pan evaporation reached 50.0 mm during the 15th standard meteorological week (SMW) and came down from 27th SMW onwards (Fig. 1 & 2). Highest maximum temperature of 40.9°C was recorded during the 20th SMW and lowest minimum temperature of 5.0°C was recorded during the 4th SMW.

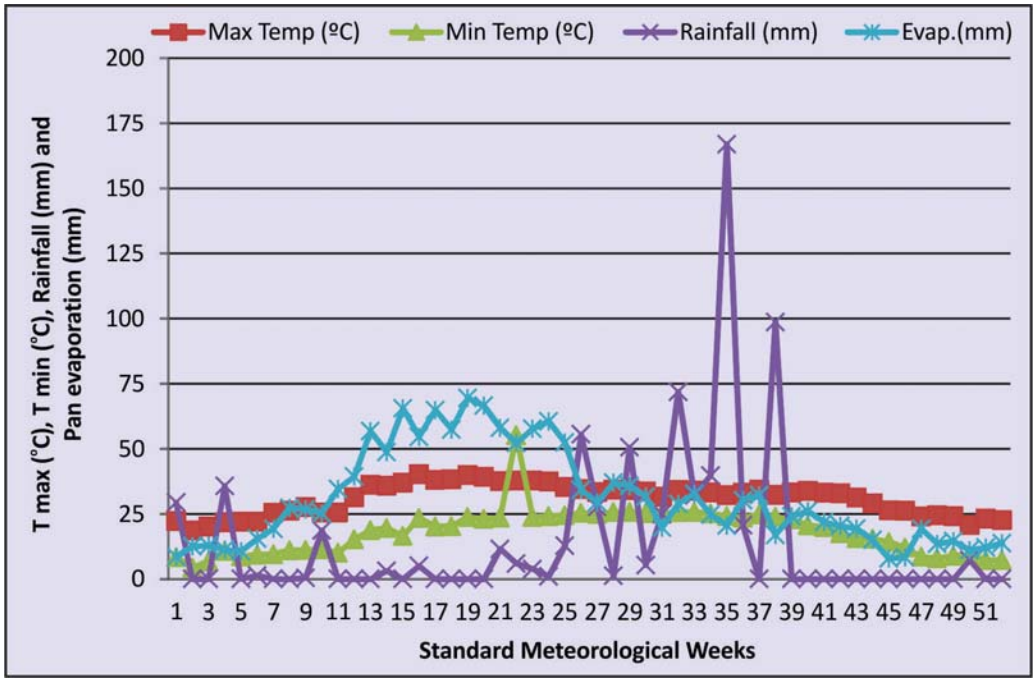


Fig. 1. Weekly Pan Evaporation, Rainfall, Maximum and Minimum temperature recorded during the year 2017

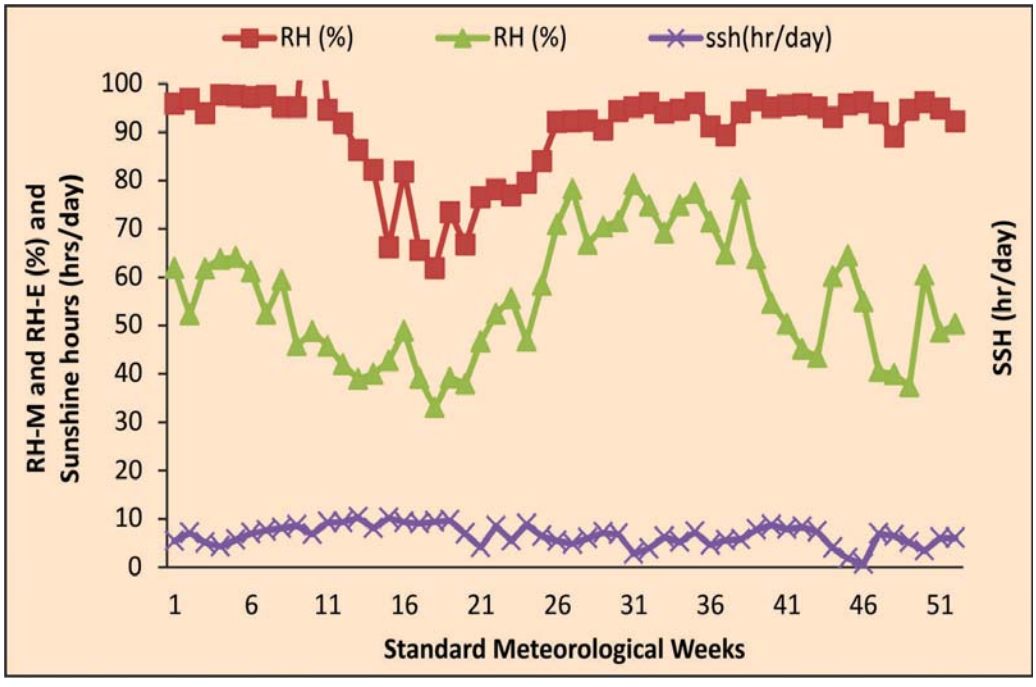


Fig. 2. Weekly RH (morning), RH (evening) and sunshine hours recorded during the year 2017

RESEARCH ACCOMPLISHMENTS

Integrated Farming Systems Management (IFSM)

Institute Funded Projects:

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

Crop component

Integrated farming system model of 1.5 ha area under assured irrigation conditions has been developed at main research farm of the Institute. The model comprised of crops/cropping systems on (1.04ha), fruit plantation (0.22ha), dairy unit (three milch animals, 2 Murrah buffaloes + 1HF cow), fresh water fish production (0.1ha), mushroom (100m^2), poultry (10 birds), kitchen garden (20 m^2), vermicompost unit (0.001ha) and boundary plantation to cater the need of 7 members, Indian family. Diversification of existing cropping systems in IFS model had produced sugarcane equivalent yield 1160.3t/ha/yr. Similarly intercropping in sugarcane has higher system productivity as compared to other cropping systems. The net return from crop component was Rs.216421/ha/yr (Table 2). Total N, P and K requirements of cropping system tested were 285.3, 116.3 and 109.9 kg/ha, respectively (Table 2). Recycling of farm by-produces as the sources of nutrients to meet out the total nutrients (NPK) requirement was by 65.7% (Table 3) and rest was supplied through chemical sources of nutrients. In this way, recycling of farm by products as crop residues, cowdung, tree leaves spent mushroom compost, vermicompost and green manuring save the expenditure on chemical inputs as well as reduced the cost of production.

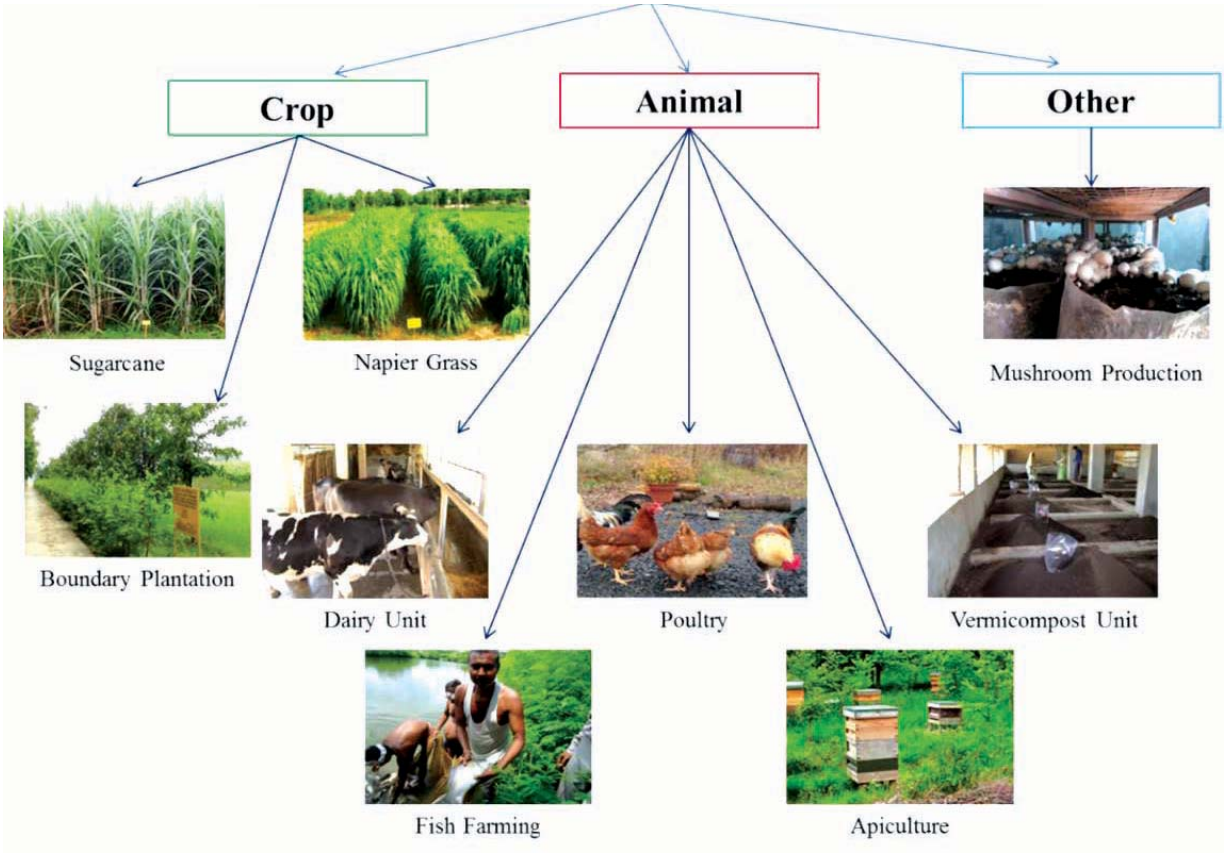


Photo 1. Components of Integrated Farming Systems

Table 2: Performance of different crops under diversification of existing cropping systems

Cropping system	Farm produce /annum (kg)			Production sugarcane equivalent yield in ton	Gross returns Rs./ Annum	Net returns Rs./Annum
	Kharif	Rabi	Summer			
Sugarcane(Cowpea/Okra/Moong bean/Urdbean) Sugarcane -Ratoon-Wheat	-	28112	2091	409.58	133182	65048
Rice-Wheat-Dhaincha (GM)	375	810	5500	117.80	38285	25735
Pigeonpea+Maize (2:1)* -Chickpea -Okra	162(492)*	396	2430	350.06	113766	66266
Maize-Berseem-Urd bean	605	6616	260	133.94	43531	26991
Sorghum-Mustard-Moong bean	5850	360	216	126.84	41217	27767
Napier + Subabool + Cowpea +Berseem	5500	1850	3700	68.28	22191	13271
Total (1.04ha)				1160.3	392172	225078
SEm±				12.79		
CD at 5%				40.84		

Table 3: Improved soil health through recycling of organic nutrients

Source of nutrients and per cent nutrient content (N:P:K) on dry wt. basis	Available quantity of farm produce in (kg)	Approx. N (kg)	Approx. P (kg)	Approx. K (kg)	Total NPK required in IFS
Sesbania aculeata (dhaincha) (1.39:0.38:1.64)	12040	31.06	8.77	39.49	79.32
Arhar leaves (1.29:0.36:1.64)	320	4.12	1.15	5.24	10.51
Sugarcane leaves (0.4:0.18:1.28)	1230	4.92	2.21	15.74	22.87
Mustard straw (0.48:0.25:1.36)	1600	7.68	4.00	21.76	33.44
Urd bean straw (1.60:0.15:2.00)	1440	23.04	2.16	28.80	54.00
Tree leaves (1.20:0.60:0.40)	200	2.40	1.20	0.80	4.40
Rice straw (0.59:0.07:1.75)	990	5.84	0.69	17.32	23.85
Maize stalk (0.59:0.31:1.31)	1080	6.37	3.35	14.15	23.87
FYM (0.5:0.2:0.5)	6000	30.00	12.00	30.00	72.00
Vermicompost (1.80:1.25:0.60)	6500	117.00	81.25	99.00	237.25
Poultry manure (3.03:2.63:1.4) (10 birds)	73	2.21	1.91	1.02	5.14
Green weeds (0.80:0.30:20)	300	2.40	0.90	0.60	3.90
Fish pond through pond water (1000 m^2) through pond silt		4.50	1.80	5.40	11.70
		90.90	0.51	24.20	115.61
Spent mushroom compost (0.7:0.3:0.3)	900	6.30	2.70	2.70	11.70
Total	32673	338.74	124.60	306.22	769.56
Nutrient requirement /year (field crops + plantation crops)	-	540	270	360	1170

Dairy component

Under IFS model two improved murrah buffaloes and one cross bred cow (*Holstein Friesian*) along with their three calves were reared. The milk production from three animals throughout the year was 3061 liters and its market value in terms of economic returns was Rs. 168355/annum. Thus, net profit by selling of milk was of Rs.93915/annually (Table 4). In addition to this, dairy component produced about 10.73t vermicompost/ year. The trend of milk production varied in the different months of the year and it was highest in August month (360.35 liters) followed by April month (355.50 liters) and minimum milk production was in March month.

Horticulture component

In horticulture component fruit tree species like mango, guava, peach, pear and karonda were planted. At present, their age is about 15 years and they yielded about 48.2quintals fresh fruits from 93 fruit plants throughout the year and net return was Rs. 57840/ annum after the selling of fruits (Table 5).

Fish component

Livestock shed based waste was allowed to drain into fish pond for fish farming. In fish component of IFS model, the fingerlings of Indian major carps were (Catla, Rohu and Mrigal) and exotic carps (Common carp and Silver carp) were kept for maximizing utilization of surface, column and bottom strata of the fish pond. Rice polish and pelleted feeds were used for feeding the fingerlings @5% of their body weight. The water quality of fish pond was assessed through using of multi-parameter water quality meter (Hach HQ 40d) as details are given in Table 6.

Photo 2. Fish pond of IFS unit

Table 4: Details of milk and other related farm produces and economics

Dairy component	Production/ Annum (kg/liter/ton)	Gross returns (Rs./Annum)	Production cost (Rs./Annum)	Net Returns (Rs./Annum)
2 Buffaloes + 1 Cow + 3 Calves	3061	1,68,355	74440	93,915
Vermi-compost/FYM	10.73	42920	15900	27020

Table 5: Production and profits from the horticulture unit

Fruit species	Tree (Nos.)	Yield (kg)	Value in (Rs.)
Guava	35	3350	50250
Mango	6	200	5000
Pear	10	530	5300
Peach	2	180	5400
Karonda	40	560	14000
Gross returns (Rs.)	-	-	79950
Net returns (Rs.)	-	-	57840

Selling price of guava @15/kg, mango 25/kg, pear 10/kg, peach 30/kg and karonda 25/kg

Table 6: Water quality of fish pond

Parameters studied	Range
Water Temp. (^{0}C)	18.2- 32.6
pH	7.6-8.90
Total alkalinity (mg/l)	222-365
Dissolved oxygen (mg/l)	6.8-8.5
EC (µs/cm)	620-942
TDS (mg/l)	262-480
Ammonia (mg/l)	0.02-0.04
ORP (mV)	219.39-322.8

The gross return from 0.1 ha pond was Rs. 22500 with a production of 250 kg fish. Besides additional income from pond dykes when citrus and guava were planted and net profit from the module was recorded at Rs.12250. Study of energy input and output of fish pond was also worked out (Table 7), results showed that input energy of 72.18 MJ per kg of fish production.

Table 7: Energy input and output in fish pond at IIFSR Modipuram

Energy Source	Energy Input (MJ)
1. Labor	893.76
2. Electricity	1620.00
3. Feed	
Rice bran & Broken rice	5670.00
Oil cakes	3600.00
4. Fertilizer	
Cowdung	4204.80
Cow urine	300.00
5. Water	1670.76
6. Seed	20.34
7. Lime	66.00
Total Energy Input	18045.66
Energy Output (Fish)	1152.5
Energy (MJ) input per kg fish production	72.18

Mushroom production

By utilizing 25% capacity of the crop storage room, 145kg of mushrooms (105 kg button and 40 kg oyster mushroom) were harvested along with additional yield of 500 kg of high quality organic manure (from button & oyster mushroom compost. From this module a total of Rs. 10800 was earned as a net profit (Table 8).

Table 8: Production and income from mushroom

Mushroom species	Production (kg)	Rate of sale (Rs.)	Net income (Rs.)
Button mushroom	105	80	8400
Oyster mushroom	40	60	2400
		Total (Rs.)	10800

Boundary plantation

All the field boundaries were planted mainly with fruit and fodder tree/ bushes like karonda, aonla, bael, jack fruit, lemon and subabool and they produced fruits and fodder. The main purpose of plantation of fruit and fodder trees was to provide regular income throughout the year by selling of fruits and meet out the animal fodder requirement from the fodder tree like subabool. The adverse effect of planted trees on field crops was also studied. To avoid the adverse effect of winds boundary plantation of trees, hybrid Napier grass was planted under of fruit plants to proper utilize the space for fodder production.

Developed IFS model, (1.5 ha) for the western plain zone of Uttar Pradesh provides SEY (sugarcane equivalent yield) round the year with an average production of 1206.7 t/ha/yr and generates round the year total employment 939 man days/year. Gross and net returns from the model were 763744 and 517308/ annum (Table 9).

Photo 3. Button Mushroom

Photo 4. Oyster Mushroom

Table 9: Economics of different components of IFS Model (2017-18)

Component of IFS Model	Farm products	Total farm production in kg/liter/ ton (SYE)	Gross returns (Rs./ annum)	Variable Cost (Rs.)	Net returns (Rs./ annum)	Man days**
Crops (1.04 ha)	Cereals, Pulses, Oilseeds, Green Fodder, Dry Fodder, Sugarcane	1160.26	392172	132094	260078	257
Dairy (2B+1C)	MilkVC/FYM	306110.73	16835542920	544408900	10391527020	21457
Horticulture	Fruits.	4820	79950	22110	57840	147
Fish production	Fish	250	22500	10250	12250	94
Mushroom	Mushroom Mushroom spent compost	145500	180501450	7250650	10800800	78
Boundary plantations	Fruits, G.F., Fuel wood	841	28397	8542	19855	65
Kitchen gardening	Seasonal vegetables	520	9000	1850	7150	27
Total IFS (1.5 ha)	-		7,63,744	2,46,436	517308	939
Per hectare basis			5,09,162	1,64,290	3,44,872	626

SEY: Sugarcane equivalent yield

Project title: Evaluation of fodder based cropping systems for sustained production and livelihood improvement of marginal farmers in Western Plain Zone of Uttar Pradesh

Among the different cropping sequences clitoria-mustard- moong bean system was found more productive and profitable in terms of wheat grain equivalent yield (211.3t/ha/yr) followed by rice-chickpea-okra cropping sequence (197.73t/ha/yr). When the yield of each crop was converted into wheat grain yield equivalent the highest yield was recorded in sugarcane (118.93t/ha) followed by clitoria (99.3t/ha) and okra (80.1t/ha) (Table 10). The SPAD reading was higher in stylo-berseem-maize+cowpea cropping sequence (73.76) followed by maize+black gram–pea-sorghum cropping sequence (54.86). Maximum per day production was recorded in sugarcane-ratoon–wheat cropping sequence (325.33kg/ha/day) then with

Table 10: Effect of different fodder based cropping sequences on wheat grain equivalent yield, productivity and profitability

Cropping system	Kharif	Rabi	Summer	SWGEY* (t/ha/yr)	Productivity (kg/ha/day)	Profitability (Rs./ha/day)
Maize + Black gram-Pea-Sorghum	79.00	59.5	46.87	185.37	73.03	677
Cluster bean-Wheat- Teosinte	45.00	62.48	66.30	173.78	51.13	450
Stylo-Berseem-Maize + Cowpea	29.25	89.37	56.70	175.32	64.48	601
Clitoria-Mustard- Moong bean	99.30	36.82	75.14	211.26	66.06	518
Rice-Chickpea- Okra	64.85	52.78	80.10	197.73	65.75	612
Rice-Wheat	63.00	48.53	-	111.96	46.36	492
Sugarcane – Ratoon - Wheat	-	118.93	-	118.93	325.33	366
SEm±				2.89	3.79	7.27
CD at 5%				9.00	11.83	22.67

* System wheat grain equivalent field

Table 11: Effect of different fodder based cropping sequences on nutrient uptake and spad reading

Cropping sequences	N uptake (kg/ha/yr)	P uptake (kg/ha/yr)	K uptake (kg/ha/yr)	SPAD reading
Maize+Balck gram-Pea-Sorghum	88.85	30.96	191.61	54.86
Clusterbean-Wheat- Teosinte	167.61	53.47	363.28	50.40
Stylo-Berseem-Maize+Cowpea	213.67	79.34	324.03	73.76
Clitoria-Mustard- Moong bean	273.49	87.61	411.79	50.50
Rice-Chickpea-Orka	203.46	70.89	433.03	52.33
Rice-Wheat 140.83	49.31	308.58	45.96	
Sugarcane – Ratoon - Wheat	68.50	46.28	174.25	45.93
SEm± 3.23	2.24	17.95	2.41	
CD at 5% 10.07	7.00	55.93	7.53	

Table 12: Effect of different fodder based cropping sequences on crop duration, land use efficiency and economic returns

Cropping sequence	Crops duration (days)	LUE (%)	Economic returns (Rs/ha/yr)		
			Cost of cultivation	Net	B:C ratio
Maize +Black gram-Pea-Sorghum	249(90+70+89)	68.22	65068	206860	3.17
Guar-Wheat-Teosinte	338(129+112+97)	92.60	64773	178603	2.75
Stylo –Berseem-Maize + Cowpea	272(102+95+75)	74.52	65864	184016	2.79
Clitoria-Mustard-Moon bean	320(125+115+80)	87.67	55821	204595	3.66
Rice-Chickpea-Okra	302(95+117+90)	82.73	64960	216332	3.33
Rice –Wheat	245(115+130)	67.12	62824	180250	2.86
Sugarcane-Ratoon-Wheat	365(365)	100	74436	190780	2.56

Table 13: Effect of different fodder based cropping sequences on soil fertility status after post-harvest

Cropping sequence	OC (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
Maize+Balck gram-Pea-Sorghum	1.007	187.04	31.90	208.00
Clusterbean-Wheat- Teosinte	1.064	201.51	30.91	231.34
Stylo-Berseem-Maize + Cowpea	1.337	204.58	34.02	228.57
Clitoria-Mustard- Moong bean	1.159	211.02	42.82	214.02
Rice-Chickpea-Orka	1.325	193.28	39.18	233.92
Rice-Wheat	1.129	197.46	33.18	220.96
Sugarcane – Ratoon - Wheat	0.929	179.37	30.30	196.88
SEm±	0.088	6.53	2.79	9.43
CD at 5%	0.262	19.55	8.36	NS

maize+black gram-pea-sorghum (73.03 kg/ha/yr). However, profitability per day was higher from maize+black gram- pea-sorghum (Rs.677/ha/day) cropping sequence followed by rice-chickpea- okra (Rs. 612/ha/day). Maximum nutrients removed by the crop was recorded under stylo-berseem-maize+ black gram (213.67kg/ha) cropping sequence. While in the case of, phosphorus removed was higher with clitoria-mustard- moong bean (87.61kg/ha) cropping sequence. On the other hand, potassium removed by

the crops was higher with rice-chickpea-okra (433.03kg/ha) (Table 11). The field occupied by crops was higher where sugarcane-ratoon-wheat crops were adopted in cropping sequence (365 days) and LUE (%) was also higher in the same system (100%) (Table 12). The soil OC and available nutrients(nitrogen, phosphorus and potassium) after the harvest of crops were found significant (Table 13). The lowest OC content (%) in soil was seem under sugarcane-ratoon–wheat cropping sequence (0.93%). Available N was observed higher under stylo-berseem-maize+cowpea cropping sequence (204.6kg/ha/day). The highest available P was assessed under clitoria-mustard-moong bean (42.8 kg/ha/yr) cropping sequence and available potassium was higher under rice-chickpea-okra cropping sequence (233.9kg/ha/yr). The maximum economic return was obtained from rice-chickpea-okra cropping sequence (Rs.216352/ ha/yr). Whereas, B:C ratio was highest (3.66) with clitoria-mustard-moong bean cropping sequence.. It can be inferred that fodder based cropping sequences gave better results in terms of productivity, profitability, sustainability and soil health improvement point of view.

Project title: On Farm value addition for livelihood improvement of small farm households in Western Plain Zone of Uttar Pradesh

Red beetroot (*Beta vulgaris*) is a good natural food colorant because it contains significant amount of red-coloured betalain pigment. There is increasing interest in the use of natural food colours, which provide health benefits like antioxidant activity. The antioxidant capacity of beetroot has been associated with the constitutive presence of phenolic compounds, which allow nutraceutical benefits in the promotion of the human health and in the prevention of degenerative diseases and cancer. Fresh beet root have low shelf life moreover less demand due to non availability of value added products in the market. To create new entrepreneurs for increasing the income of small and marginal farmers through processing and value addition in beetroots, experiments were conducted for developing the protocol for production of beet root tuity fruity, nectar and jam. These products were optimized with different process variables and incase of tuity fruity, beetroot treated with slices thickness (8mm) followed by blanching (4min.) recorded the maximum overall acceptability score (8.1), taste score (8.3) and texture score (7.8) while, beetroot nectar standardized with 25% beetroot juice, 0.3% acidity and 22°Brix in the final products was found with acceptable colour and taste. Similarly, best quality of beetroot jam was optimized with using beetroot juices obtained by boiling of beetroots with water in the ratio of 1:2, pectin powder (1.2%), citric acid (0.4%) and final TSS (69%). However, in these products development status of phyto-chemical degradation was not known. Therefore, another experiment was conducted to know the optimum process for extraction of phyto-chemicals from Beetroots during processing.

Optimization of process for extraction of phyto-chemicals from Beetroots (Beta vulgaris L.) using response surface methodology

Freshly harvested beetroots with similar weight and maturity were used as raw materials and procured from the local market of Meerut, & from the Technology Park, ICAR-IIFSR, Modipuram during the year of 2016 and 2017 and were stored at 4°C prior to conduct the experiments. The beetroots were washed and skin was then peeled manually. The peeled beetroots were crushed to obtain homogenous pulp using laboratory grinder. The homogenous pulps were used for conducting experiments as per experimental design for optimum extraction of phyto-chemicals from beetroots. The experiments were conducted for extraction of phyto-chemicals from beetroots at process temperature (40-50°C), time (20-40 min) and pH (4-7) using water as solvent. The response surface methodology (RSM) design was considered for this experiment and final extraction of phyto-chemicals were evaluated for optimum extraction of betalain, ascorbic acid, antioxidants, polyphenols and flavonoids from beetroots. RSM was applied to the experimental data and the values of various responses at different experimental combinations are given in Table 14. Regression analysis and ANOVA were conducted for fitting the model and to examine the statistical significance of the model terms. The lack of fit, coefficient of determination (R^2) and coefficient of

Table 14: Treatment combinations with their responses obtained during beet roots phyto-chemical extraction (with 3 variable 2nd order polynomial model)

Run No.	T	pH	t	B	P	AA	F	An
1	45	7.0	40	323.7	10.8	84.2	72.3	31.4
2	45	5.5	30	425.2	11.4	62.6	81.1	41.6
3	45	5.5	30	415.5	11.5	61.9	84.1	31.0
4	45	5.5	30	425.1	9.5	53.4	82.5	27.8
5	40	5.5	40	463.6	16.0	69.7	81.4	77.4
6	45	4.0	20	190.5	10.1	17.4	49.6	45.8
7	40	5.5	20	496.4	17.5	40.0	81.3	72.9
8	40	7.0	30	460.5	15.4	87.9	87.5	57.3
9	50	5.5	20	276.5	11.2	26.2	55.2	51.8
10	45	4.0	40	175.4	9.0	26.5	51.4	58.9
11	50	7.0	30	492.6	14.9	86.1	84.1	57.8
12	50	5.5	40	485.2	11.2	49.7	84.3	58.0
13	45	5.5	30	480.3	9.7	57.0	76.2	26.0
14	50	4.0	30	478.5	16.1	58.4	81.4	76.9
15	40	4.0	30	470.2	17.7	45.6	83.2	74.1
16	45	7.0	20	183.6	11.5	48.0	61.7	32.6
17	45	5.5	30	432.2	9.1	51.0	78.3	52.9

T: Temperature (°C), t: Time duration, B: Betalain (mg/100g), P: Phenol (mg/100g), AA: Ascorbic acid (mg/100g), F: Flavonoids (mg/100g) and An: Antioxidant (%)

Table 15: ANOVA and regression coefficients of the second-order polynomial model for the response variables (in coded units)

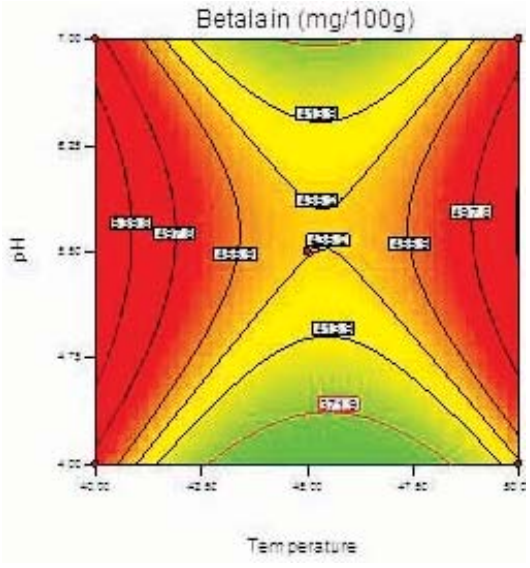
Variables	DF	Estimated coefficients					F-values				
		B	P	AA	F	An	B	P	AA	F	An
Model	9	435.7	10.24	57.17	80.44	35.86	12.64**	4.8*	12.19**	8.83**	4.36*
X_1	1	-19.7	-1.65	-2.85	-3.55	-4.66	1.76	7.5*	1.13	3.51	1.61
X_2	1	18.2	-0.04	19.80	5.00	-9.57	1.50	0.01	54.63***	6.79*	6.79*
X_3	1	37.6	-0.42	12.30	5.20	2.82	6.38*	0.48	21.09**	7.54*	0.59
X_1X_2	1	5.9	0.29	-3.64	-0.40	-0.59	0.08	0.12	0.92	0.02	0.01
X_1X_3	1	60.4	0.40	-1.53	7.25	0.43	8.22*	0.22	0.16	7.33*	0.01
X_2X_3	1	38.8	0.09	6.78	2.20	-3.58	3.40	0.01	3.19	0.67	0.47
X_1^2	1	126.0	4.69	7.36	10.21	26.76	37.65***	31.84***	3.98	15.28**	27.95**
X_2^2	1	-86.2	1.07	4.97	-6.60	3.89	17.62**	1.65	1.81	6.38*	0.59
X_3^2	1	-131.2	-0.95	-18.15	-15.10	2.41	40.86***	1.29	24.15**	33.43**	0.23
Lack of Fit	3						4.96	4.20	3.86	5.13	0.64
R^2		0.94	0.86	0.94	0.92	0.85					
Adj R^2		0.87	0.68	0.86	0.81	0.65					
CV%		10.73	13.65	13.92	7.14	20.20					

X_1: Temperture (°C), X_2: pH, X_3: Time duration, B: Betalain (mg/100g), P: Phenol (mg/100g), AA: Ascorbic acid (mg/100g), F: Flavonoids (mg/100g), An: Antioxidant (%), *Significant at $p < 0.05$, **Significant at $p < 0.01$, ***Significant at $p < 0.001$.

Table 16: Software generated three optimum conditions of independent variables with the predicted values of responses

S. No.	Process Variables			Response Variables					Desirability
	Temperature (°C)	pH	Time (min)	Betalain (mg/100g)	Ascorbic acid (mg/100g)	Phenol (mg/ 100g)	Flavonoids (mg/100g)	Antioxidant (%)	
1.	40	6.98	27.39	496.4	17.4	88.8	92.03	62.66	0.93
2.	40	6.42	33.89	536.9	16.3	87.9	92.47	63.66	0.91
3.	40	5.38	33.93	549.4	16.2	67.9	90.52	69.43	0.87

(A)



(B)

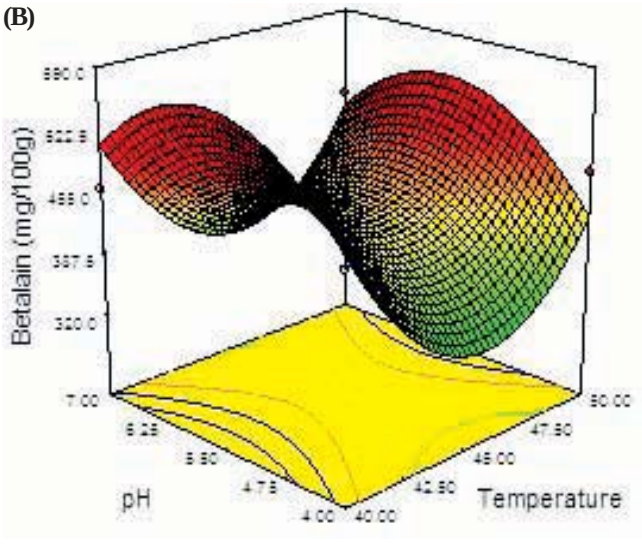
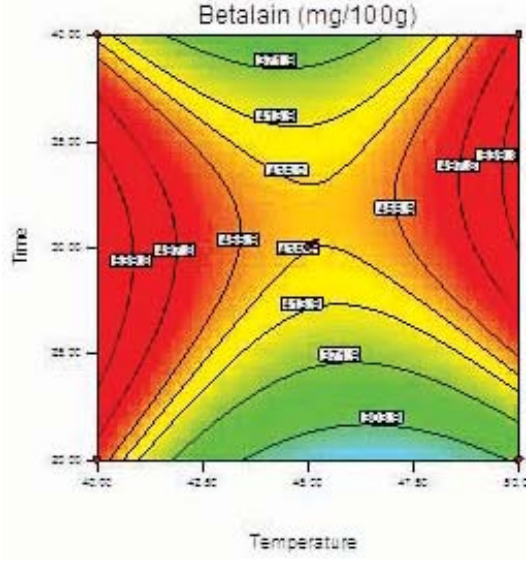


Fig. 3a. Contour plots (A) and response surface (B) for the effect of temperature and pH on betalain content (mg/100g) during beet root phyto-chemical extraction

(A)



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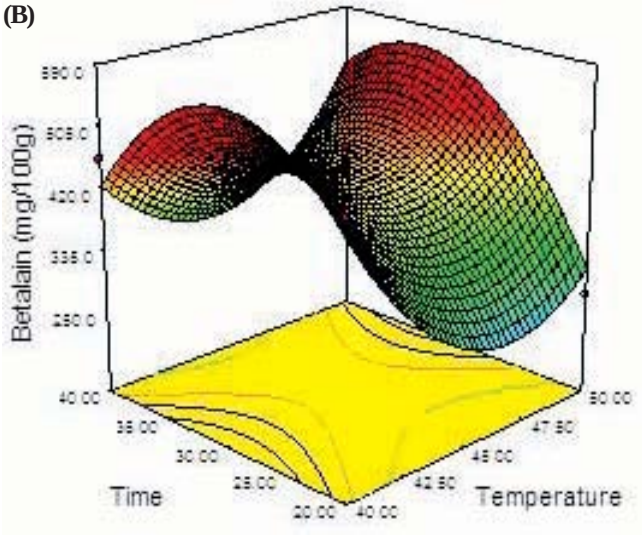
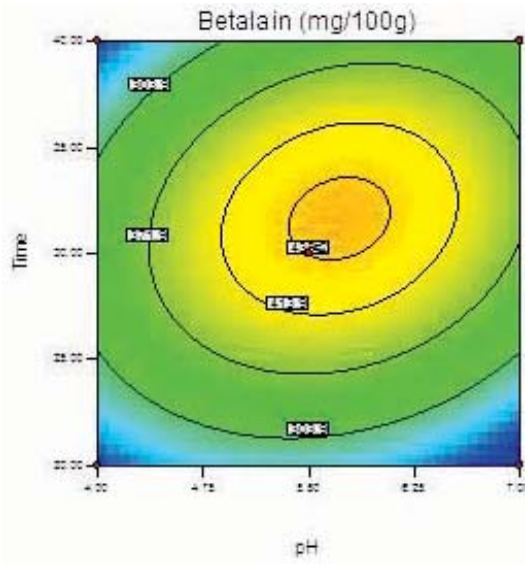


Fig. 3b. Contour plots (A) and response surface (B) for the effect of temperature and time on betalain content (mg/100g) during beet root phyto-chemical extraction

(A)



(B)

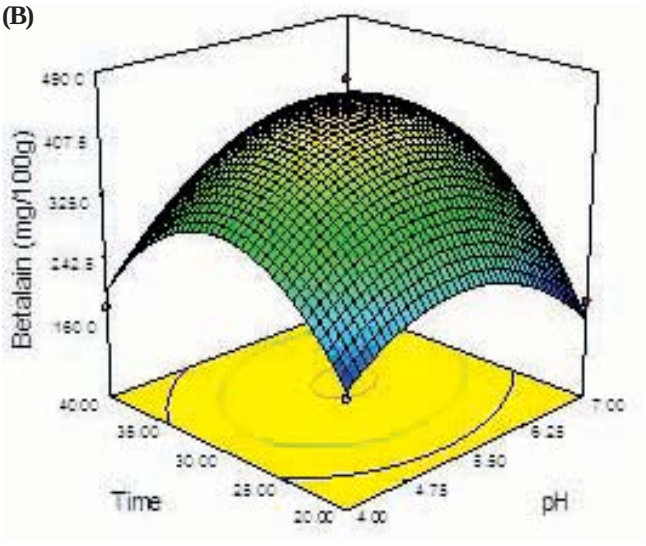
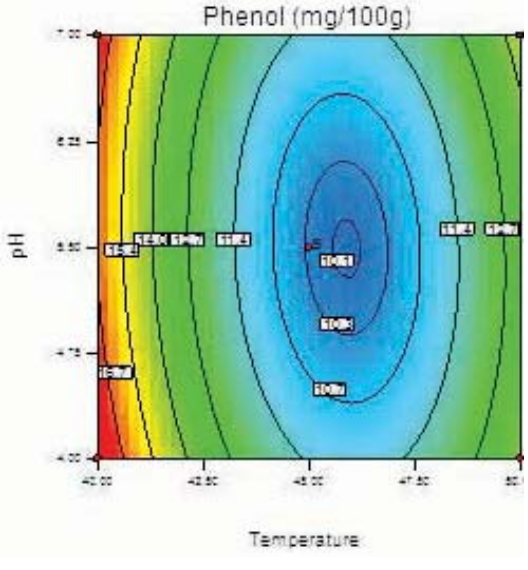


Fig. 3c. Contour plots (A) and response surface (B) for the effect of pH and time on betalain content (mg/100g) during beet root phyto-chemical extraction

variation (CV) values are given in Table 15. In this study, the lack of fit was found not significant indicating that these models are sufficiently accurate for predicting the responses.

Numerical optimization was carried out for the process parameters for extraction of beetroots for obtaining the best phyto-chemicals. The desired goals for each variable and response were chosen and different weights were assigned to each goal to adjust the shape of its particular desirability function. Table 16 showed software generated three optimum conditions of independent variables with the predicted values of responses. Solution no.1, having the maximum desirability value (0.93) was selected as the optimum process conditions for maximum extraction of phyto-chemicals. The phyto-chemicals from beetroots in terms

(A)



(B)

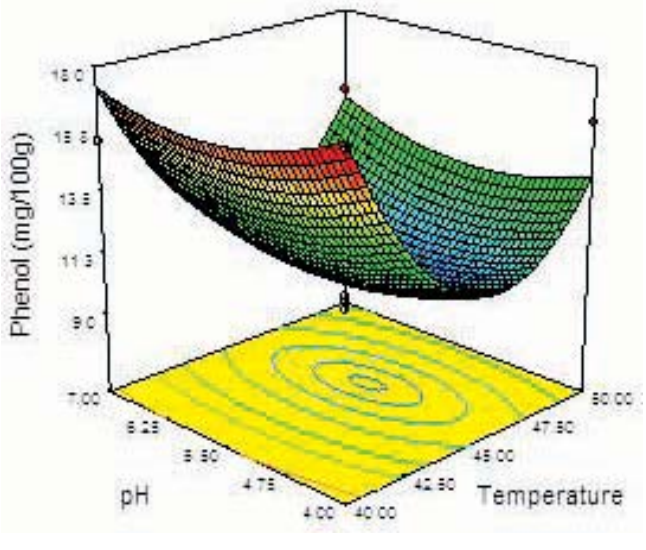


Fig. 4a. Contour plots (A) and response surface (B) for the effect of temperature and pH on phenol content (mg/100g) during beet root phyto-chemical extraction

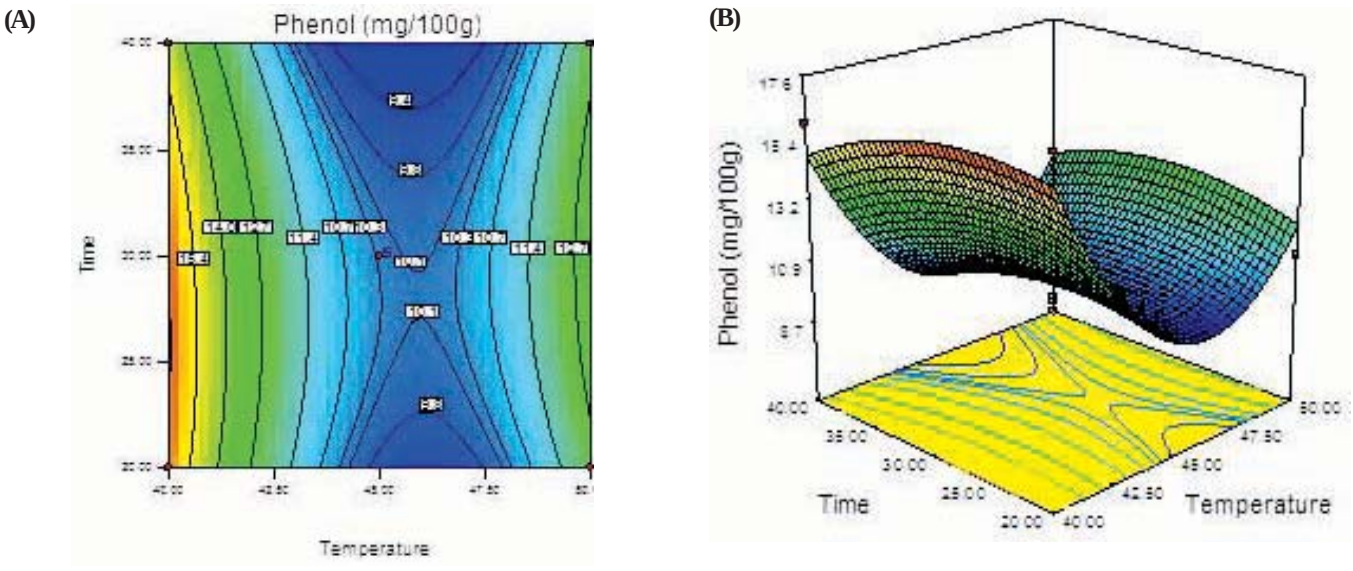


Fig. 4b. Contour plots (A) and response surface (B) for the effect of temperature and time on phenol content (mg/100g) during beet root phyto-chemical extraction

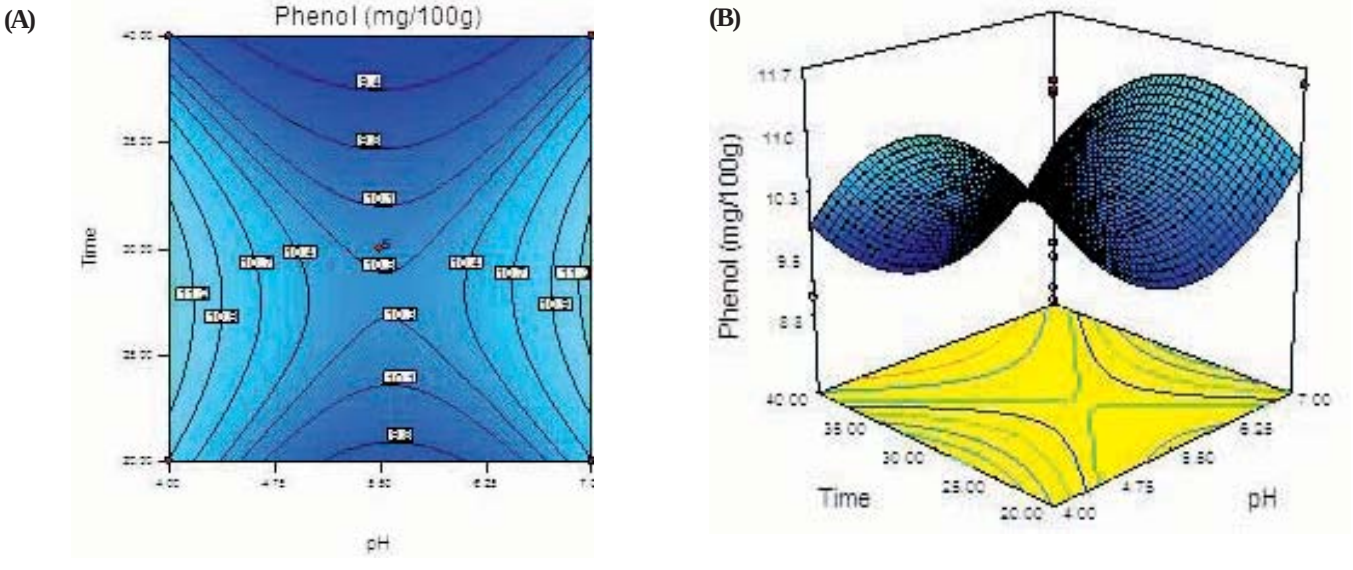


Fig. 4c. Contour plots (A) and response surface (B) for the effect of pH and time on phenol content (mg/100g) during beet root phyto-chemical extraction

of betalain (496.4 mg/100g), ascorbic acid (88.8 mg/100g), antioxidants (62.7%), polyphenols (17.4 mg/100g) and flavonoids (92.03 mg/100g) were obtained at process condition of temperature of 40°C, pH of 6.98 and time duration of 27.39 min. The variations of betalain, ascorbic acid, antioxidants, polyphenols and flavonoids of beetroots with different combinations of the process parameters were graphically shown in the 3-D surface plot and contour plot (Figs. 3 a,b,c & 4 a,b,c). RSM design was found suitable for the process optimization for extraction of phyto-chemicals from beetroots. Betalain, ascorbic acid, antioxidants, phenols and flavonoids of beetroots by extraction process were dependent significantly on the process variables namely, temperature, pH and time. Temperature and time had the greatest influence, whereas the effects of pH were

comparatively less during extraction of phyto chemicals from beetroots.

Project title : Development of a Web Based Integrated Information System for Indian Farming Systems Research

The objective of the project was to design and develop an integrated Information System on the Internet so that it will eventually allow potential users to query and obtain the desired information on Indian Farming Systems Research and to prepare database on various aspects of Indian Farming Systems Research that is to be stored using a central database and maintained by the main research institutes (IIFSR). In the reporting period the developed web based information system provides exhaustive information of 29 (Twenty Nine) ICAR-AICRP region specific synthesized integrated farming systems model in India. Information of particular center and information on its improved model as suggested by the domain experts at IIFSR can be accessed (as per the user's selection criteria) through a GUI Menu driven Web based mechanism. The web forms contains-

- General information of a selected centre in the country (Information fields are - District name, NARP Zone, Soil Type, Model Area (ha), Dominant farming, rainfall.)
- Existing Model practiced at a particular centre in the country (information fields are –Components of farming system, recycling of nutrients, internal supply (N, P_2O_5,K_2O), external purchase, production(REY:t/annum), water productivity (Rs/m^3), Cost Saving, net profit, employment generation (man days))
- Improved synthesized Model as suggested by IIFSR to meet the gaps in production (Information fields are - intervention of cropping systems, horticulture, livestock, complementary , supplementary to improve the production and profitability of farmer)

To achieve the objectives of database and the functional modules of Web based information System, the most relevant functionalities were embedded in this system to provide user with easy access and allow them to make queries in order to support strategic farming system model decision making. The functional module of this application software was divided into three parts i.e. presentation layer, application layer (Business Logic) and data access layer (DAL)

1. Presentation Layer (GUI)

Graphic User interface (GUI) was developed using ASP.NET for getting user input in a friendly manner, providing dropdown lists to select desired center in the hierarchy (State >>District >> Centre). The same single page layout for input as well as for output gives familiar and unified look to package, and makes it easy to use.

2. Application Layer (APL) Business Logic

It includes coding of all predefined functions and stored procedures which are used to find the desired records in database, depending upon different type of information given by user as input. Depending upon the selection criteria, tables of information were referenced for processing information retrieval process. For Web based application development Visual basic (VB) was used as scripting language. Server side application was implemented using ASP.NET technology. This technology generates HTML pages according to user's action and request. Visual Studio Ultimate 2012 software package was used for software coding.

3. Data Access Layer (DAL)

This layer describes database connection (ADO connectivity) and commands for updating, inserting and deleting records in the database. These commands were expressed through methods that are called with appropriate parameters. Object Data Source was associated with DAL through the command giving name of the DAL. DAL was implemented using SQL for creating database structure and tables of information. SQL Server Management Studio has been used for Database management. The summary report displays the requested data like on general information of particular center, existing farming model, improved model etc. for selected center.

The output of the project is in the form development of the following

Photo 5. Screen shot of menu driven selection criteria

Photo 6. Screen shot of improved farming model suggested by IIFSR at particular center

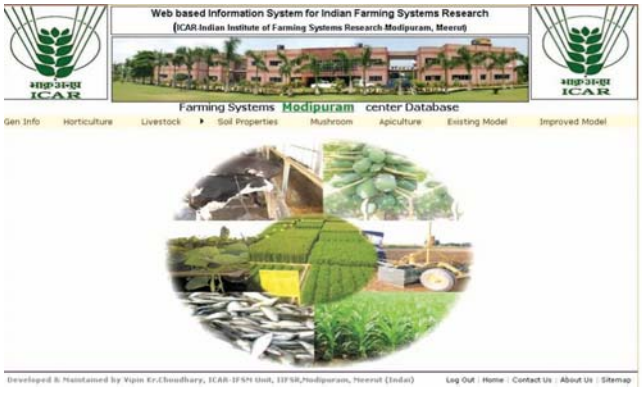


Photo 7. Screen shot of existing farming model practiced at particular center

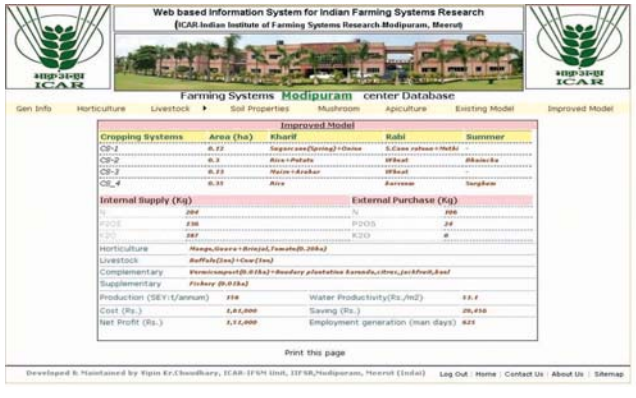


Photo 8. Screen shot of improved farming model suggested by IIFSR at particular center

- A web based Information system under user friendly environment using ASP.Net as front end and SQL Server as back end database
- An online as well as offline multi-modal information delivery arrangement linking online content and expert knowledge for Region specific synthesized Integrated Farming Systems Models for Improved Production, Profitability and Nutrition

Project Title: Development of suitable resource conservation modules to mitigate the ill-effects of climate change

The project was initiated to study the effect of tillage, mulch and fertilizer management practices on growth, productivity, soil fertility and economics of cereal cropping systems. Two tillage systems, four cropping systems and four crop residue mulching and fertilizer combination were tested in factorial analysis with split-split plot design having three replications. The tillage systems (main plots) were: no tillage (NT) and conventional tillage (CT), i.e. 4 harrowing and one patella. The cropping systems (sub-plots:C_1- rice-wheat; C_2- maize-wheat; C_3-rice-barley and C_4- rice-mustard). The crop residue used as mulching and fertilizer combination treatments (sub-sub-plots) consisted of four M_1 - No mulch + recommended dose of fertilizer (RDF), M_2 - Mulch (6 t/ha) + recommended dose of fertilizer (120:60:40 kg NPK) (RDF), M_3 - Mulch (0) +125% recommended dose of fertilizer (RDF), M_4 - Mulch (6 t/ha) +125 % recommended dose of fertilizer (RDF). A recommended fertilizer dose of 120:60:40 kg NPK/ha was applied in all *rabi* crops. All the crops were grown as per recommended package and practices with seed rate 100, 25, 100, 6 kg ha^{-1} and line spacing 20, 60, 20 and 45 cm apart of wheat (PBW-343), maize (Naveen), barley (K-508) and mustard (Pusa bold), respectively.

The Result indicated that higher REY was obtained in CT as compared to ZT over the years (Fig. 5). The tillage influenced significantly (P<0.05) on REY, whereas, the cropping systems and crop residue

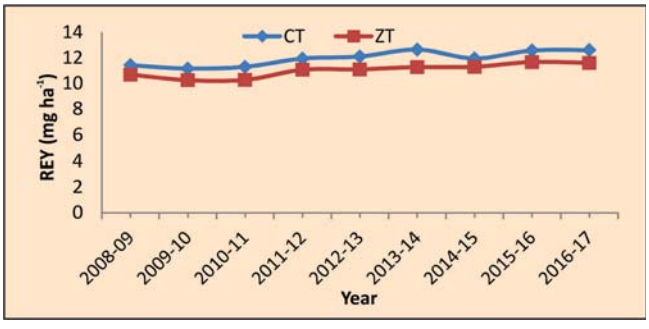


Fig. 5. Rice equivalent yield (REY) on different tillage system

mulching and RDF combination significantly affected REY at P=0.01. However, all the interactions were found to be non-significant. Greater REY observed in

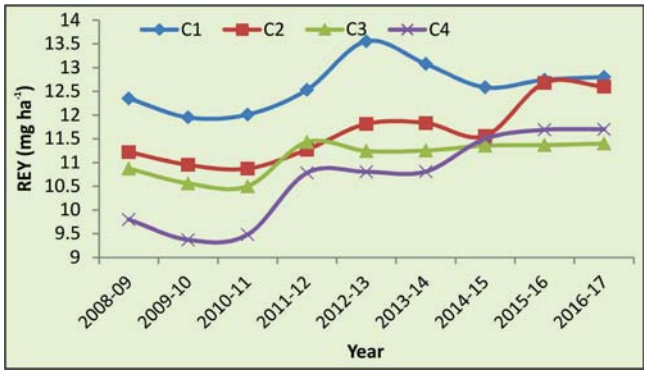


Fig. 6. Rice equivalent yield (REY) on various cropping system

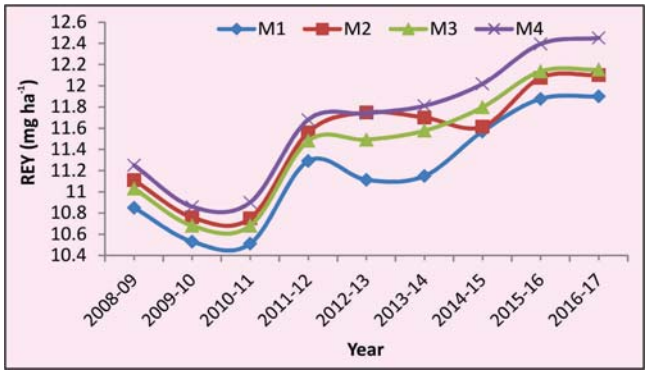


Fig. 7. Rice equivalent yield (REY) on different crop residue management and RDF combination

treatment of M4 (6 t/ha mulch + 125% RDF) followed by M2 (6 t/ha mulch + RDF). The REY in treatment M_4 and M_2 had shown at par value in all years. The REY was ranked in order $M_1<M_3<M_2<M_4$ in all years (Fig. 7). As far as the effect of cropping system (Fig. 6) is concerned, higher REY observed in C_1 (rice- wheat) followed by C_2 (maize –wheat), C_4 (rice mustard) and C3 (rice- barley).

Energy budgeting

Inputs Energy (EI) of different cropping system under two tillage system and four rice crop residue with RDF combination were estimated using direct and indirect energy inputs**.** A complete inventory of all crop inputs (fertilizers, seeds, plant protection chemicals, fuels, human labour, irrigation water and, machinery power) and outputs of both grain and straw yields were recorded. Energy inputs in different treatments were computed by multiplying the inputs with the corresponding energy coefficients and summing up of all these. The average grain and straw yields of all years were considered for calculating output energy. Energy outputs were calculated by multiplying the grain and straw yields with corresponding energy coefficients. Energy efficiencies or intensities of the different cropping systems were estimated as: i) net energy (NE) ii) ratio of output to energy input (energy use efficiency, EUE) and iii) specific energy i.e. energy use per kg production (SE).

Results revealed that on average of all cropping system the conventional tillage (i.e. 45828 MJ/ha) consumed higher input energy than zero till system (37731 MJ/ha). The lowest input energy was observed in ZT, C_2 and M_3 (Table 17). Highest input energy consumed in rice- wheat followed by rice–barley, rice-mustard and maize-wheat. Energy use efficiency (EUE) was highest in ZT, however, specific energy of grain (SE) was more in CT. Highest output energy & net energy was observed in ZT than CT. The energy budgeting indicates the tillage does not influence significantly on energy (i.e. EO, NE, EUE) however, SE was influenced significantly by different tillage. Various cropping systems and mulching and RDF influenced the significantly parameters i.e. EQ, NE, EUE and SE.

Table 17: Energy budgeting (MJ/ha) of different treatment as on various tillage, cropping system and residue management

Treatments	EI	EO	NE	EUE	SE
ZT	37731	170189	132458	4.51	3.42
CT	45828	157224	111396	2.43	4.43
Cropping systems					
C1	46040	181541	136067	3.94	3.70
C2	35469	164887	121437	4.65	3.89
C3	43733	161430	118263	3.69	3.95
C4	41877	146970	105658	3.51	4.16
Mulching & RDF combination					
M1	40788	160777	117509	3.94	3.99
M2	43951	164438	120103	3.74	4.00
M3	39839	163307	120938	4.10	3.85
M4	42541	166305	122874	3.91	3.87

Project Title: Long term effect of resource conservation technologies in rice-wheat system

(i) *Long term effect of resource conservation technologies on crop productivity, water requirement and soil health in rice-wheat cropping system*

The long-term experiments were carried at research farm Modipuram in *kharif* season to study the comparative performance of different methods of rice planting, namely; hand transplanting (HT), transplanting by self-propelled transplanter (MT), transplanting by manual transplanter (MaT), bed planting (BP), zero till drilling (ZT), strip till drilling (ST), rotary till drilling (RT), drum seeding (DS) and sprouted broadcasting (BS), with respect to rice yield (Y), benefit: cost ratio (B: C), energy output: input ratio (EE) etc. In *rabi* season, the comparative performance of different machines namely; bed planter (BP), zero-till drill (ZT), happy-turbo seeder (HT), rotary-till drill (RT), and conventional drill (CS), in terms of wheat yield (Y), benefit: cost ratio (B: C), energy output: input ratio (EE) in each succeeding rice plots were assessed. The experiments were design in randomized block designed with three replications. Both the crops were grown with recommended package of practice. A recommended fertilizers dose of 120-60-40 kg ha^{-1} was applied in rice (saket-4) and wheat (PBW-343).

The study also included evaluation of the energy input, GWP potential and yield-scaled GHG emissions of different methods of rice cultivation *viz.*, zero tillage (ZT), happy turbo seeder (HTS), bed planting (BP), reduced tillage (RT), conventional sowing (CS). The HTS saved the diesel (70%), time (80%), and energy (65%) due to no-till sowing under crop residue. The rice crop sowing was done 22 cm row spacing by ZT, HTS, RT and CS. The highest effective field capacity was observed in ZT (0.44 ha/h) followed by HT (0.41 ha/h), RT (0.21 ha/h) and BP (0.30 ha/h), however, highest field efficiency was measured in HT (60 %) followed by ZT (55%), BP (50%) and RT (45%).

The effect of planting methods on wheat yield over the years is depicted in Fig. 8. The over the year the higher yield was observed in ZT followed by RT and RT. The lowest yield was noticed in conventionally tilled plot (CS). The higher yield was found in BP than CS but lower than ZT, RT and HT. The higher yield was observed in ZT (11%), HT (8%), and RT (7%) than CS.

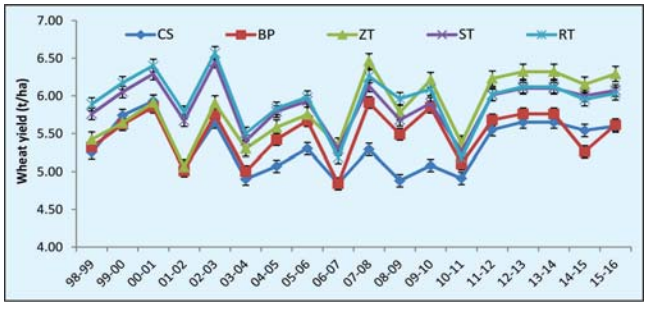


Fig. 8. Effect of different RCT machineries used for wheat crop establishment on yield over the year

The comparative performance of different methods of rice planting, namely, hand transplanting (HT), transplanting by self-propelled transplanter (MT), transplanting by manual transplanter (MaT), bed planting (BP), zero till drilling (ZT), happy-turbo seeder (HT), rotary till drilling (RT), drum seeding (DS) and sprouted broadcasting (BS), with respect to rice yield (Y), benefit: cost ratio (B: C), energy output: input ratio (EE) was evaluated. The effect of planting methods on rice yield over the year is depicted in Fig. 9. The highest yield was found in MaT followed by MT, HT among the puddled transplanted rice. It was observed that the yield was

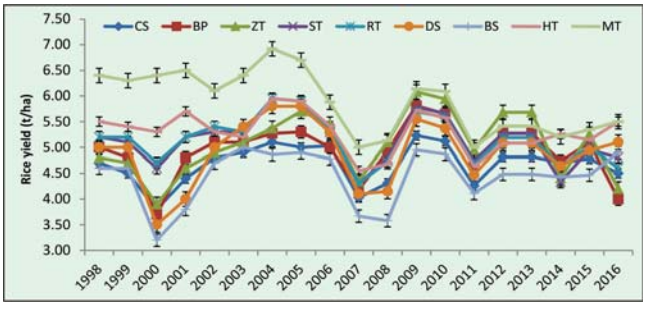


Fig. 9. Effect of planting methods on rice yield over the year

higher in MaT (5%) and at par with MT (4%) with comparison to traditional transplanting method. The higher net return was noticed in the five direct seeded rice as compared to three puddled transplanted rice (i.e. HT, MT MaT) and two sprouted rice seeding method. The energy net return was 9 to 11% higher in ZT and HTS, as compared to HT. Energy output: input ratio was 20% higher in ZT, 15 to 4% higher in all the methods except DS, CS and BS, where it was 2 to 10% lower, compared to HT.

ii) *Long term influence of resource conservation technologies and crop residue management practices on crop productivity and soil health in rice-wheat cropping system*

The comparative performance of different methods of wheat planting machines, namely; zero till drill (ZT), rotary tiller (RT) and conventional sowing (2 harrow +2 tiller followed by ZT) (CS) as a horizontal plots and rice residue recycling as RR: residue removal, RB: residue burning and RI: residue in-corporation as a vertical plots., with respect to wheat yield (Y), benefit: cost ratio (B: C), and weed infestation (We) was evaluated. The effect of planting methods and residue managements on wheat and rice yield are depicted in Figs. 10 & 11.

The crop residue recycling was done before planting of both crop seasons (as *kharif* and *Rabi*). The residue recycling were done as rice residue (5 to 6 t ha^{-1}) as well as wheat straw (8 to 8.6 t ha^{-1}) and the degree of recycling was 76-81%. The wheat yield varied from (5.6 to 6.2 t/ha) in rice residue managements viz., RR, RB and RI and crop establishment methods viz., ZT, RT and CS**.** The wheat yield has no significant difference among the treatments. There was appearance of yellowing in seedlings at the initial stage but subsequent establishment and growth of crops was found similar to non-straw recycled fields. The recycled wheat straw got decomposed after about 50 to 55 days in rice fields.

In case of kharif crop (rice), the highest yield was observed in residue recylining (5.37 t/ha) (RR) followed residue incorporation (RI) and residue burning (RB). However, highest yield was observed HT (5.43 t/ha) followed by ZT and CS Plot.

The input cost was lowest in zero till drill (ZT) field followed by rotary tiller (RT) and conventional sowing (CS), however, output cost was higher in ZT and RT as compared to CS. The weed populations were found less numbers in residue in-corporation.

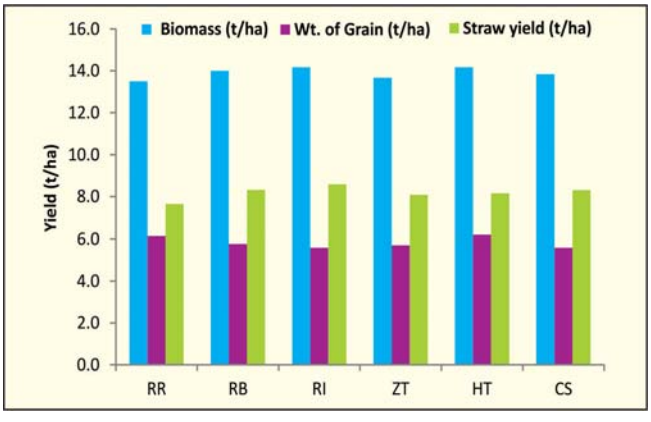


Fig. 10. Effect of residue management and different machineries on wheat yield

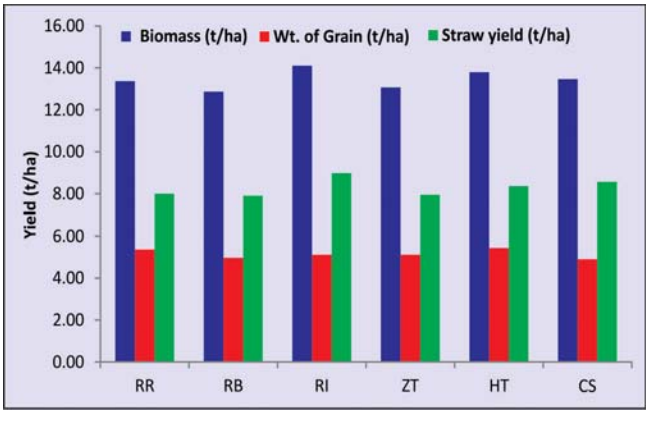


Fig. 11. Effect of residue management and different machineries on rice yield

The effects of various wheat planting method of resource saving technologies revealed that zero till sown field given about 60 and 80 higher benefit and B: C ratio as compared to conventional sowing, however, rotary till sown produced 20 and 25 % higher benefit and B: C ratio as compared to conventional sowing (Fig. 12). The yield and yield attributes has no significance difference among the treatments.

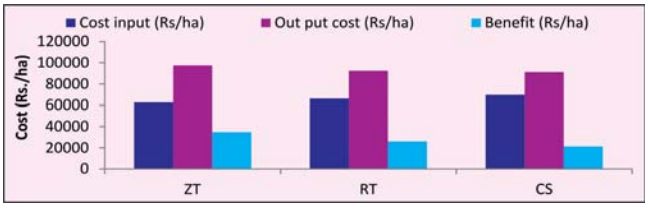


Fig. 12. Effect of residue management and various machineries on cost analysis

Project title: Development of fruit crop based high density farming systems for higher productivity and profitability under small farm conditions

After attaining food security, our next focus is nutritional security. Fruit crops are well known for nutritional security along with environmental security. In order to achieve additional income, nutritional and environmental security, present project on development of fruit crop based farming system is underway to identify most profitable fruit crops, their cultivars and intercropping module. As per approved technical program, field planting of experiment was done during July – August 2014. Plants of three varieties of guava (*Psidium guajava*) viz., Allahabad Safeda, Sardar (L-49) and Sweta, three varieties of Ber (*Jujupus mauritiana) viz.*Gola, Seb, Umran, Three varieties of Pomegranate (*Punica granatum*) viz., Bhagwa, Arakta and G-137, were planted along with plants of Sweet orange/ Mosambi (*Citrus sinensis*) Nagpur mandarin (*Citrus reticulata*) and Kinnow (Mandarin X Orange). Observations on vegetative growth, flowering, fruiting, yield and quality of fruit crops were recorded and yield of intercrops was also recorded. Results are presented in Table 18.

During fourth year of establishment, vegetative growth (tree height and canopy spread) of crops was recorded. Among fruit crops and cultivars, vegetative growth of Ber cv. Gola was significantly higher than other crops and cultivars. Its height was 2.60 m and canopy spread was 3.35 m. But at the same time, fruit yield parameters were recorded highest from guava crop. Among guava cultivars, Cv Shweta yielded significantly higher fruit than any other crop or cultivar. it yielded 46 kg / plant followed by Allahabad Safeda (39.00kg / pl).

Table 18: Growth and fruit yield of fruit crops under experiment (2017-18)

S. N	Crop	Cultivar	Height (m)	Canopy spread (m)	Fruit yield (kg/pl)
1	Ber	Gola	2.60	3.35	16.30
2		Seb	2.53	3.20	14.50
3		Umran	2.55	3.10	12.00
4	Guava	Shweta	2.35	2.25	46.00
5		Allahabad Safeda	2.33	2.20	39.00
6		Lucknow -49	2.35	2.20	37.00
7	Pomegranate	Arakta	2.35	1.65	15.00
8		Bhagwa	2.00	1.60	14.00
9		G-137	2.10	1.65	10.00
10	Citrus	Kinnow	2.30	1.20	06.00
11		Mosambi	2.30	2.00	04.00
12		Mandarin	2.40	2.00	03.00
CD at 5 %			1.036	0.460	4.645
Sem			0.334	0.172	1.603

Among ber cultivars, there was no significant difference in yield levels. All the three Cvs of Pomegranate (Arakta, Bhagwa and G -137) came in bearing during. Fruit yield was estimated by counting the number of fruits. Average fruit yield at the plant age of three years was 15.0 kg, 14.0 kg and 10.00 kg in Cultivars Arakta, Bhagwa and G-137 respectively. Plants of citrus fruits showed only stray flowering with no significant difference in yield In control plots, where only fruit crops were grown without intercropping, the yield of fruit crops was at par with crops grown with intercrops.

Observations on temperature and relative humidity inside plant canopy and under open conditions were recorded in experimental plot. Microclimate in plant canopies was modified due to shading by plant canopies. During summer months (May 2017) when temperature in open area was 45.4 ^{0}C, it was 43.2 ^{0}C in canopies of fruit crops. This reduction in 2.0 ^{0}C in temperature was reported as 4.84 per cent reduction of temperature. During winter months (January 2017), when open temperature was 7.0 ^{0}C, it was 7.5 ^{0}C under the tree canopies. This showed 7.14 per cent increase in canopy temperature. Similar trends in change of microclimate due to vegetation were reported in preceding year also.

In all fruit crops, different intercropping modules (vegetable based, cereal based and fodder based) were evaluated. Due to excessive vegetative growth in ber

Table 19: Yield of intercrops (REY) grown under different cultivars of fruit crops

Cropping systems	Plot size for cropping 30 m^2 Yield of intercrops (REY) in kg/ plot in cultivars of Fruit crops								
	Guava			Pomegranate				Citrus spp	
	Shweta	A Safeda	L-49	Arakta	Bhagwa	G 137	Kinnow	s. orange	Mandarin
Cereal based	19.30	20.56	15.09	13.97	20.51	16.11	15.78	12.41	14.11
Vegetable based	17.53	23.40	20.70	23.86	19.64	21.24	18.50	19.45	19.60
Fodder based	4.83	4.90	5.07	5.04	4.73	5.24	4.94	4.87	5.28
CD	0.325								
SEm	0.118								

Table 20: Interaction between cropping systems and cultivars of Guava.

Cropping system		Yield in kg/ plot (REY) of intercrops in cultivars of Guava		
		Shweta	Allahabad Safeda	L-49
Cereal based	Wheat	15.13	11.14	11.11
	Moong	-	-	-
	Rice	4.17	2.83	4.67
	CD	0.637		
	SEm	0.222		
Vegetable based	Potato	14.57	20.93	15.89
	Okra	0.39	0.37	0.39
	Cow pea	2.56	2.56	2.20
	CD	0.240		
	SEm	0.084		
Fodder based	Berseem	2.30	2.43	2.33
	Cow pea	1.66	1.79	1.72
	Jawar	0.88	0.83	0.87
	CD	0.033		
	SEm	0.011		

Plot size for cropping 30 m^2

Table 21: Interaction between cropping systems and cultivars of Pomegranate.

Cropping system		Yield in kg/ plot (REY) of intercrops in cultivars of Pomegranate		
		Arakta	Bhagwa	G -137
Cereal based	Wheat	15.89	14.84	9.08
	Moong	-	-	-
	Rice	4.67	5.67	3.33
	CD	0.637		
	SEm	0.222		
Vegetable based	Potato	20.57	16.78	16.16
	Okra	0.53	0.39	0.79
	Cow pea	2.29	2.47	2.30
	CD	0.240		
	SEm	0.084		
Fodder based	Berseem	2.39	2.20	2.37
	Cow pea	1.67	1.73	1.68
	Jawar	0.81	0.79	0.81
	CD	0.033		
	SEm	0.011		

Plot size for cropping 30 m^2

crop, intercropping in ber crop and cultivars was not possible, while in other crops, intercropping modules were evaluated. There was significant difference in yield levels (REY) of intercropping modules (Cereal based, vegetable based and fodder based). Vegetable based intercropping module was most profitable in all crops and their cultivars (Table 19). Interaction between cropping systems and fruit crops and their cultivars is presented in Tables 20-22.

Table 22: Interaction between cropping systems and species of Citrus

Cropping system		Yield in kg/ plot (REY) of intercrops in different Citrus *spp*		
		Kinnow (Mandarin X Orange)	Sweet orange (*C.sinensis*)	Mandarin (*C . reticulata*)
Cereal based	Wheat	11.26	7.77	11.11
	Moong	-	-	-
	Rice	3.83	5.00	3.00
	CD	0.637		
	SEm	0.222		
Vegetable based	Potato	17.83	18.19	16.60
	Okra	0.47	0.67	0.53
	Cow pea	2.38	2.39	2.47
	CD	0.24		
	SEm	0.084		
Fodder based	Berseem	2.48	2.53	2.46
	Cow pea	1.69	1.78	1.80
	Jawar	0.90	0.92	1.01
	CD	0.033		
	SEm	0.011		

Plot size for cropping 30 m^2

Among crops and their cultivars, guava cv Shweta performed significantly better than other crops and cultivars. Among intercropping systems, vegetable based module was found most profitable.

Study on suitability of non-traditional high value fruit crops under small farm conditions of Western U. P.

For development of fruit crop based farming systems, we need more options in fruit crops. Due to introduction of some nontraditional and high value fruit crops in country, there is possibility of exploring those crops in farming system perspective. Under above project some introduced crops / cultivars of fruit crops were studied to see their performance under western UP conditions and to explore the possibility of including above crops in Integrated Farming System. The crops were, low chilling apple (*Malus domestica*) Cv. Anna, Dorsett Golden and Michel, Dragon fruit (*Hylocereus undatus*), Valencia orange, Apple Ber Seedless Jamun (*Syzygium cumini*), Assam Lemon and, Khasi mandarin. All the crops are growing well under field conditions.

Studies on Low Chilling Apple cv Anna

Low chilling apple Cv Anna was introduced for evaluation under western UP conditions. Planting of Anna apple was done during March 2014. Apple plants are reported as deciduous but under western UP conditions, it shed only 60 per cent leaves and retained 40 per cent leaves during winters.

Flowering, pollination and fruiting

Three years old plants of low chilling apple cv Anna and one year old plants of Dorsett Golden came in flowering during February 2017. Plants of another low chilling apple cv Michel showed sparse flowering during first week of April. Objective of introducing Dorsett Golden and Michel was to make provision of pollenizer cultivar for Anna. The vegetative growth and flowering time of Dorsett Golden was very close to Anna and it served the purpose of pollenizer. Flowering started from second week of February and continued up to end of March. Floral biology of both the cultivars was studied. Observations were recorded on time of flower bud emergence, fruit setting and fruit set retention (Table 23).

Table 23: Relationship between time of bud emergence and fruit set in Anna apple at the age of three years

Time of bud emergence (Feb- March 2017)	Number of flowers opened (March – April 2017)	Number of fruit set (April 2017)	Fruit set retention (June 2017)
07-14 February 2017	298	109	37
15 – 21 February 2017	694	271	64
22-28 February 2017	811	334	127
1-7 March 2017	586	343	109
8-14 March 2017	685	211	83
15-21 March 2017	499	181	66
22-28 March 2017	397	091	55
Total	3970	1540	541

Table 24: Effect of pollinizer cultivar on fruit set percentage in Anna apple

Parameter	2015-16	2016-17	2017-18
Number of flowers opened	94	612	3970
Number of fruit set	37	171	1540
Fruit set (%)	39.36	27.94	38.79
Fruit set retention	5	44	541
Fruit set retention (%)	5.31	7.189	13.63

Since low chilling apple cv Anna was planted at Institute during March 2014 and it came in flowering during fruiting season of 2015-16 and 2016-17. Both the previous flowering seasons were devoid of pollenizer cultivar and there was 5.31 to 7.19 per cent of fruit set retention respectively. During the bearing season of 2017-18, the plants of Dorsett Golden came in flowering and the flowering period of Anna and Dorsett Golden coincided. This made the provision of pollenizer cultivar and there was significantly high number of final fruit set retention (Table 24). During this year, flowering (pink bud stage) to fruit harvesting duration was recorded as 115 days.

Pest dynamics

Main pollinator insects observed during this period were Honey bee (Apis melifera) Wasp (*Palaeovespa florissantia*,) Hover fly *(Syrphidae spp)* and House fly (*Musca domestica*) (Table 25). No harmful insect or disease was reported on fruits during fruits development period except mango mealy bug . But the number of mealy bug insects was beyond the threshold level. Some beneficial insects were also reported during period under report; they were Lady bird beetle and black ant. They are reported to eat aphids However; bird damage started from last week of May 2017 to end of June 2017. This year fruits were protected with net covering of experimental plot. After fruit harvesting, Leaf eating hairy caterpillar was reported during first week of September and it was controlled by spray of insecticide.

Fruit Quality

Fruit quality was analyzed and it was observed that there was improvement in fruit quality parameters with advancement of age. During this year, average fruit weight was reported as 180 gram, Fruit dimensions were 3.2 inch diameter, 3.4 inch length, Total soluble solids (TSS) was observed 16.0 ^{0}B.

Pruning for canopy management

Height and canopy spread of plants was measured during December 2017 and it was reported as 3.9 m and 3.6 m respectively. In order to control plant size and manage the canopy of plants, pruning was done during first week of January 2018.followed by pasting of copper based fungicide on cut ends.

Pruning time

Pruning timings were also evaluated in low chilling apple Cv Anna. Late pruning (mid January) resulted in emergence of significantly more number of floral buds (6.22/feet shoot length) and less number of vegetative buds (3.34 /feet shoot length) as compared to early pruning (mid December) which resulted in more vegetative buds (7.13/feet shoot length) and less number of floral buds (2.44/feet shoot length). This trend was also observed during 2016-17 also.

Adoption at Farmers field and their feedback

As per rough estimate about 5000 plants have been planted in different parts of country as a impact of media coverage of our experiment. Main plantations of 1000 plants have been done in West Bengal by Department of Panchayati Raj and Rural Development under MNREGA scheme in tribal districts of West Bengal. Growers from Gujarat also planted about 4000 plants in different locations. Feedback from farmers who planted this cultivar during January 2017 was obtained; they all reported that their plants came in bloom during February 2018

Dragon Fruit

Dragon Fruit (*Hyalocerous undatus*) or Pitaya is a lithophytic or hemiepiphytic fruit from cactus family.

Table 25: Dynamics of pollinator insects in apple under western UP conditions

S.No	Pollinaors	Duration of visit
1	Honey bee *(Apis melifera)*	07 February 2017 to last week of March 2017
2	Hover fly *(Syrphidae spp)*	07 February 2017 to last week of March 2017
3	Wasp (*Palaeovespa florissantia*,)	mid February 2017 to last week of March 2017
4	House fly (*Musca domestica)*	mid February 2017 to last week of March 2017

It is a high value and nontraditional fruit crop for India. It is a fruit crop of Central American origin but well exploited in South East Asia. In many S E Asian countries, economy of farmers and country is significantly shared by this fruit. In India, research and development on this fruit crop of cactus family is in infancy stage. Keeping these points in view, we started a trial on this important fruit crop at experimental farm of our Institute during August 2014.

Initial vegetative growth was poor but the height of plants after three year of growth was about 6.5 feet. It was restricted at this height due to pillars ending, spreading of plant starts after this stage. Spreading of 3.20 feet was observed. Ideal temperature range of 20-30 ^{0}C is recommended for successful cultivation of this crop, but under conditions of western UP, this crop successfully tolerated temperature range of 1 ^{o}C during winters to about 45 ^{o}C during extreme summers.

Standardization of vegetative propagation techniques for dragon fruit

Since it is a new crop in farming system of India, there is great demand of its planting materials. Its medicinal properties and higher rates are attracting growers towards its cultivation. Presently, few nurseries of private sector are supplying the planting material of dragon fruit from Maharashtra, Gujarat and West Bengal. Under our trial which was conducted during May-June 2017, we tried three sizes of cuttings and three concentrations of IBA and concluded that the survival percentage of dragon fruit cuttings was cent per cent in all treatment combination. Not even a single stem cutting failed to root or sprout. Time taken for rooting or sprouting varied with reference to size of cuttings and concentration of IBA. Earliest rooting was observed after 10 days of treatment application (IBA 100 ppm) in stem cuttings of 10.0 cm length. The highest shoot initiation percent (83.33 %) was observed with IBA100 ppm in 10 cm length of cutting after 25 days of treatments of cutting which was follow by (66.67 %) in both IBA 250 ppm in 15 cm length of cutting and IBA 500 ppm in 10cm length of cutting. No sprouting was recorded in control up to 25 th day of placing in pot.

Flowering

At the age of 33 months, flowering for second bearing (2017-18) started during June 2017. Unlike previous years, it continued for a longer period, up to October 2017. There were two distinct flushes of flowering during 2017, first flush of flowering continued from June to August and second flush came during September-October 2017. Details of flowering in both the flushes and fruit setting percentage is given in Table 26.

This plant seems very hardy and no pest or disease was observed during two years of field trial. Bird damage was reported in fruits when they attained bright and attractive red colour.

As per our experience, we concluded that fruits developed from first flush of flowering (during summer months, June to August) were average in fruit size, weight and quality parameters specially TSS. While, fruits developed from second flush of flowering (September-October) were heavier in weight with better fruit quality (Table 27).

As per our experimental findings, fruits developed from first flush of flowering (during summer months, June to August) were average in fruit size, weight (220 g) and quality parameters specially TSS (14^0 brix).

Table 26: Flowering and fruit setting in dragon fruit grown under western UP

S N	Parameters	Observations	
		First flush	Second flush
1	Number of flower buds	35	20
2	Flower buds open	28	18
3	No. of Fruit set	24	17
4	Time taken from fruit setting to harvesting	45 days	55 days
5	No. of fruits reached harvesting maturity	24	17

Table 27: Fruit quality of dragon fruit grown under western UP

S N	Parameters	First flush	Second flush	Average
1	Fruit weight	220 g	350 g	285 g
2	Fruit length	7.3 cm	9/0 cm	8.15
3	Fruit diameter	6.5 cm	8.0	7.25
4	Moisture %	82	88	85
5	Reducing sugars	4.6	5.0	4.8
6	Non reducing sugars	3.4	4.1	3.75
7	Total sugars	8.0	9.1	8.55
8	TSS	14	18	16
9	Acidity %	0.44	0.48	0.46
10	Ascorbic Acid (mg/100 g juice)	10.45	12.25	11.35
11	Antioxidant value in terms of scavenging activity through DPPH assay	27.8 %	29.44 %	28.62 %

Photo 9 & 10. Vegetative propagation in dragon fruit

While, fruits developed from second flush of flowering (September-October) were heavier in weight (350g) with better fruit quality in terms of high TSS (18^0brix).

Area expansion at farmers field in western UP

During the year 2017-18, farmers started planting dragon fruit in western UP. Farmers in contact of Institute, planted about 4000 plants in Hapur, Bulandsahar, Bijnour and Delhi. Farmers from Haryana, Jharkhand and Bihar are also in touch with Institute for technical advice on dragon fruit cultivation.

Valencia orange

Valencia orange is a sweet orange from California, USA. Budded plants of Valencia orange, procured from nursery of Central Institute of Horticulture (CIH), Nagaland were planted in experimental plot during March 2015. Plants showed fast upright and healthy growth and attained desired maturity for flowering at the age of one year. First flowering was reported in April 2016 and harvesting during December 2016 with less number of fruits and average quality (Table 28).

Table 28: Observations on growth, fruiting and quality of Valencia orange under western plain zones

Parameter	Observations	
	2016-17	2017-18
Tree height	1.50m	1.76 m
Canopy spread	1.45 m	1.64 m
Days taken from fruit set to harvesting	270 days	270 days
Fruit per tree	15	45
Fruit diameter (mm)	76 mm	75 mm
Rind thickness	3.0 mm	3.0 mm
Fruit weight (g)	240 g	220-240 g
Cm3 juice in per 100 gram fruit	50.0 ml	55.0 ml
TSS (°Brix)	7.0	12.0
Acidity (%)	1.2	1.4
Ascorbic acid (mg/ 100ml juice)	40.0	52.9
Number of seeds per fruit	5.78	5.74
Total phenolic content (mg GAE/100 mL	—	33.13

Improvement in fruit quality

Fruits obtained during first year, showed TSS values below standards. This low TSS might be due to two factors, i.e., small canopy area to support developing fruits and soil factors. Development of canopy with age is a natural process. In order to improve fruit quality by cultural management, we enriched basin soil with mixture of nutrients (10 kg vermicompost, 110 g urea, 300 g Single super phosphate and 100 g Muriate of potash) immediately after harvesting of crop. Next flowering started in April 2017 and it produced fruits with improved quality (in terms of TSS, juice content, and ascorbic acid content).

Photo 11. Valencia plant in bearing

Photo 12. Attractive fruits of Valencia orange

Photo 13. Shape, size and color at harvesting time

Assam Lemon (Citrus Limon L. Burmf)

Plants of Assam Lemon, planted in field during March 2015, showed comparatively slower growth and attained maturity for flowering at the age of two years. At that age, plant height was 1.14 m and canopy spread was 1.55 m. Plant growth was spreading type. First flowering was observed in April 2016 and harvesting in August 2017. It took about 150 days from fruit setting to harvesting. Elongated fruits were seedless.

Plants of seedless variety of Jamun are growing well and are under vegetative phase. After three and half years of growth, plants have attained the height of 210 cm and canopy spread of 188 cm.

Demonstration of improved fruit cultivars and techniques in western UP

Three improved cultivars of mango (Ambika, Arunika and Amrapali), Two bael (CISH B 1 and CISH B 2), Three Jamun Cultivars (CISH-J 37, CISH J 42 and Thai Jamun), Jack fruit (Thaland) and ultra high density of guava are planted in field. Plants are under growth phase. Mango cultivars started flowering during February 2018.

Project Title: Evaluation of sugarcane and wheat varieties for sugarcane-ratoon-wheat cropping system under organic and inorganic conditions

In order to assess the effect of summer planting on cane yield and other traits, the nine early maturing varieties of sugarcane were evaluated in RBD under organic condition in first plant and ratoon crops. The variety CoPk 05191 produced highest NMC of 136.44 ('000'/ha) in summer planting followed by CoLk 013201which was 119.65 ('000'/ha). Indeed, Variety CoPk 05191 recorded highest cane yield (126.28 t/ha) followed by Co098014 (123.97 t/ha) in summer planting under organic condition. Highest green top under same condition was registered in variety CoSe 03234 (24.42 t/ha) followed by CoLk013201 (23.94 t/ha) (Table 29). While, in ratoon crop the highest NMC count of 144.90 ('000'/ha) was recorded again in CoPk 05191followed by CoLk 013201which was 134.13 ('000'/ha). Moreover, in terms of cane yield the varieties CoPk 05191 and Co 098014 first and second positions in ratoon as well while, CoPk 05191 produced highest green top (33.62 t/ha) followed by CoSe 03234(32.84t/ha) (Table 30). The findings of this experiment revealed that variety CoPk 05191 was the

Photo 14. A view of CoPk 05191 at grand growth phase

Table 29: Performance of early maturing varieties (first plant) under organic condition

Varieties	NMC* '000'/ha	Single Cane Weight (kg)	Cane height (cm)	Brix % (300 days)	Cane yield (t/ ha)	Green Top Yield (t/ ha)
Co 0238	109.95	1.140	221.66	21.36	117.81	19.54
Co Se 03234	110.26	0.940	205.22	20.15	109.03	24.42
UP 05125	120.11	0.668	185.77	20.48	72.38	15.85
CoS 03251	117.80	0.875	193.78	20.46	112.42	21.78
Co 098014	98.93	1.288	272.88	19.60	123.97	14.24
Co 0118	98.40	0.867	204.77	21.60	97.02	17.03
CoLk 011201	110.56	0.707	197.66	21.01	77.00	17.35
CoLk 013201	119.65	0.822	223.77	18.73	88.55	23.94
CoPk 05191	136.44	0.956	235.88	20.81	126.28	22.59
CD(0.05)	16.17	0.257	25.83	1.41	11.55	4.62
CV %	8.15	16.15	6.86	3.94	6.44	13.47

Table 30: Performance of early maturing varieties (ratoon) under inorganic condition

Varieties	NMC* '000'/ha	Single Cane Weight (kg)	Cane height (cm)	Brix % (300 days)	Cane yield (t/ ha)	Green Top Yield (t/ ha)
Co 0238	129.3	1.496	255.99	21.33	133.21	28.67
Co Se 03234	130.28	1.392	259.88	18.55	131.67	32.84
UP 05125	113.49	1.041	221.88	20.18	90.86	20.91
CoS 03251	117.65	1.072	210.77	20.77	120.89	25.32
Co 098014	127.71	1.210	316.66	20.77	140.91	28.19
Co 0118	106.41	1.162	211.55	21.51	112.42	26.52
CoLk 011201	102.25	0.835	210.33	18.83	70.84	20.98
CoLk 013201	134.13	1.150	260.88	19.99	124.74	28.44
CoPk 05191	144.90	1.513	257.77	19.83	143.22	33.62
CD (0.05)	17.44	0.267	53.76	N/A	11.56	5.55
CV %	8.31	12.08	12.67	6.86	5.57	11.55

best performer in cane as well as green top yield under organic management in summer planting. However, its further performance under summer planting season in western plain zone of U.P. needs to be further verified.

Project Title: Effect of RCT and potassium application on soil health and productivity and quality of produce in integrated farming system

The effect of ten formulations /Treatments were assessed on the Basmati Rice (Var. PB 1509) across three replications. The highest grain / spike (86) was noticed when treatment (T_8) was applied, however T_6 and T_7 yielded equal number of grains. While, T_1 & T_7 treatments were found effective for producing higher biomass/ m^2 (2.675 kg) followed by T_9. The ear length and plant height were found to be more influenced by T_2 and T_6. In fact, Urea and mulch were crucial in forming higher biomass in the crop. Indeed, numbers of tillers were maximum under the treatment of T_4 and T_8 (Table 31).

Table 31: Effect of various treatments on the key traits of Basmati Rice (PB 1509)

Treatment	Number of tiller/ clump	Ear length (cm)	Plant height (cm)	No. of grain/ Spike	Biomass (kg/m^2)
T_1	10	8.2	75.5	77	2.675
T_2	14	11.6	83.5	78	2.315
T_3	12	9.3	74.1	67	2.450
T_4	15	11.3	74.3	65	2.350
T_5	13	10.4	78.1	73	2.125
T_6	14	11.6	82.1	79	2.015
T_7	13	9.9	79.6	79	2.675
T_8	15	11.4	80.7	86	2.330
T_9	12	8.3	74.5	67	2.490
T_{10}	11	9.1	81.1	75	2.465
SEm±	N/A	N/A	N/A	N/A	N/A
CD at 5%	16.96	20.74	6.69	14.69	20.97

Exploratory studies

Development of mustard varieties for organic farming

F_2 population of six crosses (procured from ICAR-DRMR, Bharatpur) were put in separate six blocks with spacing planting for tapping individual plant having physiological vigor, high seed yield, oil content and resistance to diseases and insects. Near about 257 individual plants selection had been made in first round of selection from F_2 segregating generation on the basis of higher number of branching, higher number of siliqua and physiological vigor etc. Plants selected in F_2 generation have been advanced in F_3 generation from which 109 individual plants tapped for further selection in F_4 progeny (Table 32). A set of six crosses procured from ICAR-DRMR, Bharatpur in 2017, their F_2 progeny have been space planted and as many as 104 individual plants tapped for further selection in F_3 population (Table 33).

Table 32: Selection of individual plant among the crosses in F_2 and F_3

Sl. No.	F_2 population of Crosses	Selected plant (F_2)	Selected plant (F_3)
1	IJ31 × EC597313	54	40
2	MJA38 × MJR-9	77	21
3	MJA25 × MJR3	49	15
4	MJA39-3-2-2 × MJR8	51	12
5	EC597326 × RB50	14	18
6	EC597326 × EC597313	12	03
	Total selection	257	109

Table 33: Selection of individual plants among the crosses in F_2

F_2 population of Crosses	Selected plant (F_2)
MJA 25x MJR-3	31
MJA38 xMJR-8	22
EC 597326 x EC597313	06
EC 597337 x EC 597313	17
MJA 39-3-2-2 x MJR-8	12
EC 597313 x MJR-13	16
Total selection	104

Performance evaluation of different soybean varieties under organic and inorganic conditions

Among the tested varieties, highest grain yield was registered by 'DS 2705' followed by 'SL 982' and 'JS 20-71' under organic and inorganic management. Highest biological yield was also recorded by 'SL 982' and 'DS 2705' in organic and inorganic management, respectively. In general, grain and biological yield in tested varieties was higher under inorganic management as compared to organic management. The varieties DS 2705 and SL 982 may be grown in non-traditional western plain zone under duo organic and inorganic management.

Photo 15. A view of soybean variety SL 982 at vegetative phase

Evaluation of potato clones under organic and Inorganic management

Among the clones tested, Kufri Mohan yielded highest marketable tuber yield (18.992t/ha) and total tuber yield as well in organic condition followed by

Photo 16: Tuber of Kufri Mohan (Potato)

KufriGarima (17.637t/ha). While, both the clones remained on first (24.073t/ha) and second (23.870 t/ha) position in terms of marketable tuber production under Inorganic management too. The tuber production of all the clones was higher under inorganic management than organic ones.

Productivity potential of Sorghum cultivars in non-traditional area

Ten sorghum cultivars were evaluated in collaboration with ICAR-IIMR, Hyderabad. The cultivar CSH 30 recorded highest grain yield (5.721t/ha) followed by CSV 20 (5.123 t/ha). Cultivar CSV 27 yielded maximum green fodder (66.299t/ha) under inorganic conditions. The cultivars CSH 13, CSH 14, CSV 23 and CSH 16 can be grown for dual purpose in summer season. While, the CSH 30 and CSV 15 were noticed to be early maturing.

Photo 17. Ear head of CSH 30

Evaluation of varieties (Basmati Rice)

A total of 24 varieties of Basmati rice were tested under Organic & Inorganic management for their grain and dry biological yield. Amongst the varieties, the Pusa Sugandha- 2 yielded highest grain (6.560 t//ha) followed by Pusa Sugandha-5 (5.220 t/ha) under organic management. However under inorganic management the same varieties i.e. Pusa Sugandha -2 recorded highest grain yield (6.495t/ha) followed by Pusa Sugandha-5 (5.865 t/ha).

Externally funded/Outside Project

Project Title: Evaluation of rapeseed and mustard strains in zone II at IIFSR, Modipuram (funded under AICRP on Oilseeds)

A total of 24 strains of Indian mustard were evaluated in RBD with three replications under AICRP multi-location trials. Among the strains, the strain RH 406 gave highest seed yield (3510 kg/ha) surpassing numerically all the checks. While, NPJ 204 (3475 kg/ha) and Kranti (3423 kg/ha) recorded first and second position, respectively. Highest seed weight was registered by SVJ-72 followed by RH 749 and DRMRC1-55 (Table 34). As far as maturity is concerned, the strains Griraj, NPJ 203 and RRN 296 were found to be earliest maturing (135 days).

Table 34: Mean Performance Indian Mustard Strains in Initial varietal trials

Strains	Days to maturity	1000 seed weight (g)	Seed yield (kg/ha)
Divya-99	142	5.2	2903
Kranti (NC)	136	4.6	3423
DRMRC1-55	137	6.6	3381
RB-69	137	5.5	2956
DRMR 4041	137	6.2	2896
SKM 1104	137	5.6	2941
KMR 16-3	140	6.2	2826
RLMCP 626	139	5.8	3356
PR-2013-02	141	5.5	2869
SVJ-72	140	6.9	3181
PHR-240	138	3.7	3074
RH 1326	137	5.7	3196
Giriraj LR)	135	6.3	2940
RH 1207	137	6.2	3106
NPJ 204	138	6.2	3475
RH 749 (ZC)	139	6.6	3191
DRMRIJ 16-1	137	5.6	3157
RH 406 (Filler)	138	5.9	3510
NPJ 203	135	5.8	3121
TM 172	138	5.2	3197
RRN 896	135	6.2	3098
RGN 394	135	5.5	3169
KMR 16-4	137	5.8	3320
PR 2013-07	137	5.6	3315
CD (0.05)	1.902	0.373	494
CV %	7.45	3.925	9.67

A set of 8 strains of Indian mustard has been tested in AVT-I. In the strain Griraj (LR) recorded numerical superiority (2586.48 Kg/ha) over RH 749 (ZC) and Kranti (NC) rest of the strains could not fare well (Table 35). RH 749 (ZC) was one of the heaviest seeded strains; on the other hand, strains viz. KM 126, Kranti and NPJ-195 were ascertained early maturing.

Table 35: Mean performance of Indian mustard strains in advanced varietal trial

Strains	Days to maturity	1000 seed weight (g)	Seed yield (kg/ha)
KM 126	129	5.93	2331.54
Kranti (NC)	129	4.40	2501.91
NPJ -195	129	5.17	2242.65
RH 749(Filler)	134	5.37	2522.90
Griraj (LR)	133	6.00	2586.48
Griraj(Filler)	134	6.37	2498.21
PBR 422#	136	4.80	2471.05
RH 749 (ZC)	137	6.47	2358.08
CD at 5%	1.614	1.062	NS
CV %	0.689	10.793	2.908

Project Title: Development of Package of Machineries for Complete Mechanization of Small Land Holders under different Farming Systems Situation (ICAR-Extra Mural Fund)

The present study has been conducted to know the mechanization gap in different farming situations by administering well-structured questionnaire in Western Plain Zone of Uttar Pradesh in order to develop mechanization model village for the region. The results revealed that the major cropping system was found sugarcane-ratoon-wheat (85%) followed by wheat-sorghum (15%) and rice- wheat (5%). As per base line survey data, around 65 per cent of farmers come under marginal and small land holder categories in Mawana Block of Meerut whereas in Kharkhoda block (Meerut) only 40 per cent of farmers were found under marginal and small land holder category. The mechanization level in the tillage operation was noticed about 90-95% (i.e. 40-50% -own & 50-60% - rental basis). Automatic sugarcane cutter cum planter used by farmers is only rare. The half mechanized system are being used in sugarcane planting, furrow making is being done by tractor operated furrower by 90% followed by manual cutting and dropping of sets in furrow. The indigenously design small tools are being used by both male and female farmers which are not ergonomically design tools. Factors for the low mechanization by the farmers have been examined. Farmers were asked for possible constraints they experienced which hinder in the adoption of desirable farm mechanization. The farmers perceived very high cost of improved farm implements and machines as a major cause for non- adoption supported by the next followed constraint i.e. poor economic condition of farmers.

The machineries demonstration and training was initiated after selecting village with identifying the farm tools as per their cropping patterns. The demonstration of line sowing of various crops in rabi season (i.e. mustard & wheat) was done through multi crop seed drill. Sugarcane cutting and planting through IISR sugarcane cutter planter, use of reaper binder, brush etc. has been demonstrated and evaluated for harvesting of field crops. Ergonomic evaluation have been done on various manually operated/self-propelled implements for assessing the working efficiency and comfort among the farmers. All the demonstrations com evaluations have been done through farmers' participatory mode.

The mustard crop (variety RH 749) was sown in the field by seed drill with row spacing of 40 cm at seed rate of 4 to 5 kg/ha on 10 farmers (*i.e.* 2 ha). The line sown mustard crop has higher plant height (189.27 cm) and number of branches (17.26) as compared to farmers practices field (i.e. 178.19 cm & 15). The plant population in line sown crop (13.83) was lower than broad casting method (20.67). The yield in line sown was about 6 percent higher than farmers practice (*i.e.* broad casting). The line sowing of wheat (variety PBW 658 & PBW 725) crop was done by seed cum ferti drill with row spacing of 20 to 22 cm and seed rate of 75 to 80 kg/ha about 20 farmers (i.e. 5 ha). As per comparative study, the plant population, number/m^2 (505, 459), plant height (106, 105 cm) and lower count

of weed population/m^2 (8) was observed in line sown wheat crop of variety PBW-658, PBW-725, respectively than broad casted field (farmers' practice). The highest yield was observed in line sown wheat in PBW-725 (5.84 t/ha) followed by PBW-568 (5.72 t/ha), farmers practice (5.25 t/ha).

Evaluation and demonstration of reaper binder

The field performance and evaluation of BCS reaper binder (with three wheels type and oscillating head type cutter blades) was carried out in farmer's (Mr Kiran Pal) field at vill.- Pahadpur (Mawana, Meerut, UP) for harvesting of wheat crop. The actual field capacity of the reaper-binder was observed as 0.280 ha/h with field efficiency of 64.65 per cent at an average operating speed of 3.6 km/h. The fuel consumption was observed as 3.52 l/ha and time of harvesting about 3.52 h/ha. Labour requirements by mechanical harvester (i.e. BCS reaper binder) was observed 3 man-h/ha for harvesting and 28 man-h/ha for collecting the bundle, however, total labour required 200 man-h/ha in manual harvesting, binding in bundle and its collection. It saves labour and time about 70% as compared to traditional method. The cost of operation of reaper binder is Rs 767/h and Rs 2703/ha. The farmer earns about 35 thousand Rs after harvesting wheat. Problem of trained operator and comfort are facing by the farmers. There is a need for ergonomically designed of seat for operator.

Photo 18. Demonstration cum evaluation of reaper binder for harvesting of field crops

Evaluation and demonstration of sugarcane planter

The field performance and evaluation of tractor operated IISR sugarcane cutter planter (two row planting with spacing of 70 cm) was done in farmer's (Mr Sanser Pal) vill.- Pahadpur (Mawana, Meerut, UP) for sugarcane planting. The field capacity of the machine was found to be 0.18 ha/h with the field efficiency of 73.02 percent at effective working width 1.50 m (row to row spacing of 0.75 m) and forward speed of 1.85 km/hr at 1 st low gear. At cutting speed of 1600 rpm (engine) a set length of 26.96 cm at forward speed of 1.8 km/hr (l st low gear) an overlap of 3.68 cm was observed. The seed requirement was observed 9.23 tonnes per hectare at the forward speed of 1.85 km/hr at I st low gear. Mean value of cut seed-sett length was 34.2 cm with 2 to 3 buds. At forward speed of 0.5 ms^{-1}, overlapping varied between two successive setts 2 - 4 cm, which was well acceptable and within the desired overlapping range of 5–10 cm for subtropical India. Farmers were convinced to use this machinery and used for planting of sugar cane for about 5 acre area.

Photo 19. Demonstration cum evaluation of sugarcane cutting and planting device

Ergonomic evaluation of tools and implements in Sugarcane-wheat-paddy production system

Ergonomics study in Sugarcane-wheat-paddy production system of Western plain zone of Uttar Pradesh under the project shows that activities of sugarcane cultivation *viz* de-topping de-trashing, of sugarcane leaves, manual loading of bundles of sugarcane entails high energy expenditure i.e. 7.81 ± 0.18 $kJmin^{-1}$, 11.03 ± 0.22, 12.0 ± 0.87 $kJmin^{-1}$ respectively. The postural discomfort was found to be higher depicted by their body part discomfort score (BPDS) 18 for sugarcane loading activitiy as compared to sugarcane de-trashing and de-topping activities (17 for each). Manual uprooting and transplanting of paddy seedlings entails high muscular discomfort (BPDS = 16). In wheat harvesting activity, working efficiency for improved sickle (falcon make) was found to be 15 % higher with substantial reduction (upto 25 per cent) in physiological cost of work as compared to local sickle. Whereas, the working efficiency for brush cutter was found to be 81.75 % higher with negative physiological cost of reduction (-17.8 per cent) as compared to local sickle. Use of brush cutter can be effective for the harvesting operations in field crops with.

Photo 20. Wheat harvesting through brush cutter

Cropping Systems Resource Management (CSRM)

INSTITUTE FUNDED PROJECTS

Project Title: Identification of bio-intensive, complementary cropping systems for high productivity and efficient resource use

Five complementary systems were evaluated for higher productivity and profitability under flatbed and raised bed land configuration. The cropping systems evaluated were, **T_1:** maize (Cob)+veg. cowpea (BB)+sesbania (F)-lentil (BB)+mustard (F)-green gram (G+R) **T_2:** maize+ cowpea (fodder)-maize (cob) +black gram-wheat+methi (6:1)-green gram (G+R) **T_3:** sorghum+ cluster bean (f)-maize(C)+black gram (1:1)-methi-cowpea (V+R), **T_4:** sugarcane-ratoon-wheat and **T_5:** maize (cob)-potato-okra. As indicated in Fig.11 maximum wheat equivalent yield (38.70 t/ha) was recorded in Sugarcane-ratoon-wheat cropping system which was lowest (14.21 t/ha.) in Maize+cowpea-maize+bengal gram-wheat+methi-green gram. Systems productivity (106 kg/ha/day) and profitability (Rs. 967 /ha/day) were also highest in Sugarcane-ratoon-wheat followed by maize (cob)-potato-okra (Fig. 13 & 14).

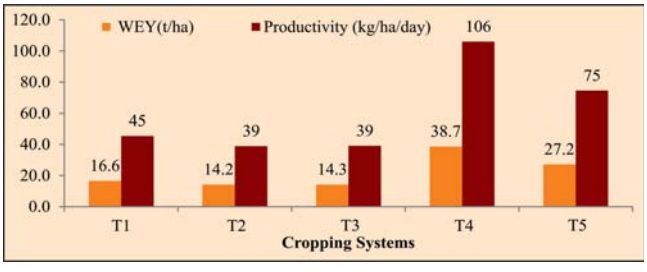


Fig. 13. Effect of bio-intensive complementary cropping systems on wheat equivalent yield and productivity

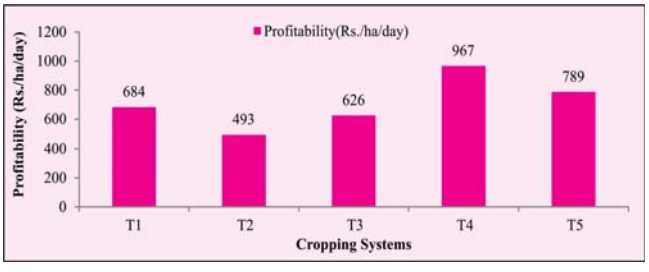


Fig. 14. Effect of bio-intensive complementary cropping systems on profitability

EXTERNALLY FUNDED PROJECTS

Project title :Adaptation and mitigation potential through conservation agriculture and IFS modules (NICRA)

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 in IIFSR network in at least two treatments (farmers' practice vs. the best practice) throughout the season at periodical intervals and modeling studies with farming systems experimental data and relating it to GCMs to assess the adaptation potential of IFS to climate change. During the year 2017-18, we have completed the following tasks,

GHG measurement under different crop establishment methods and different source of Nitrogen under rice-wheat system

A field experiment was carried out for three years (2014-15 to 2016-17) to monitor GHG emission from rice-wheat system under different crop establishment methods and different source of nitrogen. Three different source of nitrogen were applied as per treatment viz. normal (S1), neem coated (S2) and sulfur treated (S3) under different establishment methods viz. conventional (T1), direct seed (Wet)-(T2), direct seed (Dry) -(T3) and System of rice intensification (SRI)-(T4). The treatment plots were laid out in a randomized block design with three replications. The crop was raised as per the locally recommended agronomic practices except for the fertilization, which was done as per the treatments. The treatments in rice included: T1S1-Conventional +Urea, T1S2- Conventional + Neem coated, T1S3- Conventional+ Sulphur treated Urea, T2S1- DSR (wet)+Urea, T2S2- DSR (wet)+Neem Coated Urea, T2S3- DSR (wet)+Sulphur treated Urea, T3S1 -DSR(Dry)+Urea, T3S2- DSR (Dry)+Neem Coated Urea, T3S3- DSR (Dry)+Sulphur treated Urea, T4S1- SRI+Urea, T4S2-

SRI+Neem Coated Urea, T4S3- SRI+ Sulphur treated Urea. As far as wheat is concerned, two establishment methods viz., Zero tillage (T1) and conventional (T2) methods and different source of nitrogen viz. normal (S1), neem coated (S2) and sulfur treated (S3) were tested. Methane and nitrous oxide flux from the rice-wheat field plots was monitored by using the manual closed chamber method.

Methane emission from rice

The methane emission from direct seeded rice (wet) with the application of neem coated urea showed less emission of 27.1 kg/ha and conventional puddle rice with ordinary urea showed highest emission of 39.99 kg/ha. The treatment direct seeded rice (wet) with the application of neem coated urea found statistically significant less emission compared to all other treatment combinations. DSR (wet)+Sulphur treated Urea, DSR(dry)+ normal urea and SRI+ NCU are statistically at par while SRI + normal urea is statistically at par with Conventional + Neem coated and SRI+ Sulphur treated Urea treatments. The application of neem coated urea under conventional treatment reduced 20.2 % emission of methane whereas sulfur treated urea reduced 8.2 % (Fig. 15) methane emission compared to conventional urea. Duncan's Multiple Range Test (DMRT) at the 0.05 level of probability, it was found that direct seeded rice with neem coated urea has the best treatment and conventional method with normal urea plots has the poorest performing treatment.

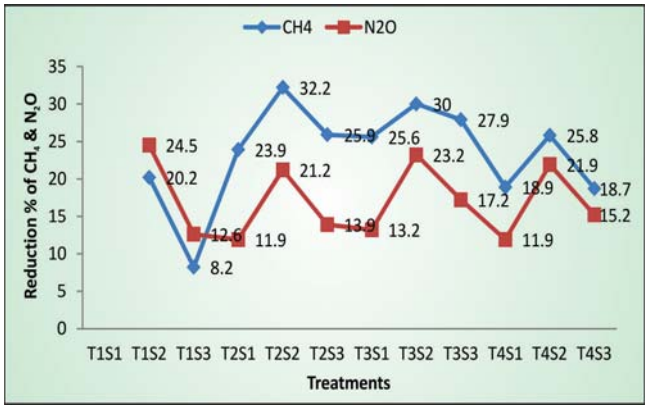


Fig. 15. Reduction percentage of CH_4 & N_2O in different treatments

Nitrous Oxide Emission from rice

Significantly lower N_2O emissions were recorded following the application of neem coated Urea in conventional methods of paddy cultivation, when compared to the other treatments. The emission of Nitrous Oxide from T4S1, T2S3 and T3S3 was also statistically ($p<0.05$) at par. The nitrous oxide emission varies from 0.04 mg $m^{-2} h^{-1}$ to 0.05mg $m^{-2} h^{-1}$ from the different establishment method of paddy , treated with different types of Urea (Table 36). The neem coated Urea reduces the nitrous oxide emission 16.4%, 14.07%, 8.67% and 12.9% less as compare to the normal urea treated plots under conventional, DSR(dry), DSR(wet) and SRI method of paddy cultivation respectively. Sulfur treated urea in SRI paddy field reduce 7.29 % less N_2O emission as compare to the Normal Urea treated plots where as in conventional plots sulfur treated urea reduces 11.84% less nitrous oxide as compare to normal urea. The emission of nitrous oxide from sulfur treated urea was statistically at par in DSR (Wet) and DSR (Dry). In respect of nitrous oxide emission, Neem coated Urea treatment in Direct seeded Rice establishment methods has the best treatment and normal Urea application in conventional method and Direct seeded Rice (Wet) has the poorest performing treatments.

Global warming potential (GWP) and carbon equivalent emission (CEE) in rice

Global warming potential in terms of gaseous carbon emission varied significantly with various treatments between 1306.5 kg CO2 equivalent ha^{-1} in the conventionally paddy cultivation plots treated with normal urea to 938.95 kg CO2 equivalent ha^{-1} after application of neem coated urea in DSR (Wet). GWP on CO2 equivalent basis in DSR (Dry) establishment method with neem coated urea has the best treatment in respect of global warming. The effect of neem coated urea in conventionally cultivated plots was also statistically ($p<.05$)at par with the plots under SRI systems and also from sulfur treated urea applied plots of DSR (Wet). There was a good effect of neem coated urea in all the four establishment methods of paddy.Neem coated urea reduces the GWP values of

Table 36: Total methane and nitrous oxide emission and other characteristics of emission from rice under different treatments (Average of three years)

Treat-ments	Methane Emission (Kg / ha)	Nitrous Oxide Emission (Kg/ha)	GWP of rice systems (Kg CO_2/ha)	Carbon Equivalent Emission (Kg C /ha)	Yield of crop (Kg/ha)	Total carbon fixed (Kg/ha)	Carbon Efficiency Ratio
T1S1	39.99^{i}	1.51^{e}	1306.55^{g}	356.33^{g}	4839	2268.48	7.16
T1S2	31.92^{f}	1.14^{a}	1023.33^{c}	279.09^{c}	4422	2069.37	8.30
T1S3	36.70^{h}	1.32^{d}	1181.10^{f}	322.12^{f}	4535	2123.21	7.42
T2S1	30.42^{e}	1.33^{d}	1052.37^{d}	287.01^{d}	4340	2032.59	8.22
T2S2	27.12^{a}	1.19a^{b}	938.95^{a}	256.08^{a}	4406	2064.02	9.34
T2S3	29.64^{d}	1.30^{cd}	1026.71^{c}	280.01^{c}	4413	2066.93	8.45
T3S1	29.75^{d}	1.31^{d}	1032.37^{cd}	281.56^{cd}	4373	2047.98	8.73
T3S2	28.00^{b}	1.16^{a}	947.10^{a}	258.30^{a}	4278	2004.64	9.63
T3S3	28.83^{c}	1.25^{bc}	992.81^{b}	270.77^{b}	3930	1840.65	8.37
T4S1	32.44f^{g}	1.33^{d}	1092.51^{e}	297.96^{e}	4776	2234.67	8.77
T4S2	29.67^{d}	1.18^{a}	990.15^{b}	270.04^{b}	4622	2162.07	9.38
T4S3	32.53^{g}	1.28^{cd}	1078.70^{e}	294.19^{e}	4759	2228.22	9.17
SEm±	0.271	0.028	9.65	2.63	472.85	217.96	0.812
LSD (P=0.05)	0.562	0.0586	20.02	5.46	980.65	452.03	1.68

the order of 20.96%, 7.46%, 8.84% and 10.16 % in all the four methods of paddy establishment in comparison to normal urea application in respective different rice establishment methods. In case of carbon equivalent emission, best treatments was the DSR (Dry) treated with neem coated urea which was statistically at par with the same treatment under DSR(wet). Among the treatments highest value of CEE was recorded in conventional treatment with normal urea.

In each column the mean values followed by common letters are not significantly ($p<0.05$) different between treatments by Duncan's multiple range test (DMRT).

Nitrous Oxide emission from wheat and GWP

The lowest emission of Nitrous Oxide was recorded in zero tillage with neem coated urea treatment. As compare to conventional method in zero

Table 37: Total nitrous oxide emission and other characteristics of emission from wheat under different treatments (Average of three years)

Treatments	Nitrous Oxide Emission (Kg/ha)^{a}	GWP of Wheat (Kg CO_2/ha)^{b}	Carbone Equivalent Emission (Kg C /ha)^{c}	Yield of crop (Kg/ha)^{d}	Total carbon fixed (Kg/ha)^{e}	Carbon Efficiency Ratio^{f}
T1S1	0.52	159.77	43.57	5800.00	2395.40	54.97
T1S2	0.47	145.58	39.70	6066.67	2505.53	63.10
T1S3	0.51	158.16	43.13	5333.33	2202.67	51.07
T2S1	0.55	170.92	46.62	5466.67	2257.73	48.43
T2S2	0.49	150.93	41.16	6200.00	2560.60	62.21
T2S3	0.53	164.45	44.85	5733.33	2367.87	52.80

[a] LSD (P = 0.05): N source, 0.0298; tillage, .024; N source × tillage,0.042; [b] LSD (P = 0.05): N source, 8.79367; tillage, 7.1800 ; N source × tillage, 12.436; [c] LSD (P = 0.05): N source, 510.262 ; tillage, 416.627; N source × tillage, 3.392; [d] LSD (P = 0.05): N source, 2.39854; tillage, 1.95840; N source × tillage, 721.62; [e] LSD (P = 0.05): N source, 210.22834; tillage, 171.65072,N source × tillage, 297.307; [f] LSD (P = 0.05): N source, 6.34564; tillage, 5.18119,N source × tillage, 8.974

tillage practice emitted lower nitrous oxide in all fertilizer treatment (urea, neem coated urea and sulfur coated urea).In zero tillage with neem coated urea was less emission of nitrous oxide i.e. 0.47 kg/ha and almost same in conventional with neem treated urea i.e. .49 kg/ha. Global warming potential in terms of gaseous carbon emission varied significantly with various treatments between 170.92 kg CO_2 equivalent ha^{-1} in the conventional cultivation plots treated with normal urea to 145.58 kg CO_2 equivalent ha^{-1} after application of neem coated urea in Zero tillage (Table 37).

Project Title: CRP on Conservation Agriculture Project

A (1): *On - farm trial of zero tillage, residue retention and crop rotation practices in rice- wheat cropping system*

Two varieties of rice viz. PB-1121 and PB-1509 and five varieties of wheat namely PBW-226, HD-3086, DBW-17, HD-2967 and WH-1105 were evaluated at eight farmers field adopting conventional practice and conservational aspects. WEY, Net returns and B:C ratio are given in Table 38.

WEY (9.80 t/ha) was recorded higher under conventional practices, which was about 10.9% higher as compared to conservational practices. However benefit cost ratio was higher (1.85) under CA practices (Table 38).

A (2): *On - farm trial of zero tillage, residue retention and crop rotation practices in maize -wheat cropping system*

Maize variety viz. African tall for fodder and two varieties of wheat namely PBW-226 and HD-2967 were grown at eleven farmers field adopting conventional and conservational practices. WEY, Net returns and B:C ratio are given in Table 39.

WEY (7.72 t/ha) was recorded higher under conventional practices, which was about 5.2% higher as compared to conservational practices. However benefit cost ratio was higher (2.12) under CA practices (Table 39).

B (1): *Agronomic evaluation of sugarcane varieties under CA practices*

Nine varieties of sugarcane viz. Co 0238, CoS 03234, UP 05125, CoS 03251, Co 0118, CoLK 011201, CoLK 013201, CoPK 05191, Co 098014were evaluated under CA practices.

Agronomic evaluation of elite lines is extremely important for expression of the traits suitable for practices of conservation agriculture. An experiment on varietal evaluation has been initiated on summer planting of sugarcane in which planting of sugarcane is done after the harvest of wheat crop. Varieties respond differently as number of millable cane (106250 per hectare) in variety CoLk 011201, cane height (218.44 cm) in

Table 38: WEY (t/ha) and net returns as influenced by CA and CP in rice - wheat cropping system

S No.	CA			CP		
	WEY(t/ha)	Net returns (Rs/ha)	B:C ratio	WEY(t/ha)	Net returns (Rs/ha)	B:C ratio
1	7.03	63087	1.23	8.88	73329	1.03
2	9.01	95294	1.86	12.03	124402	1.75
3	7.50	70741	1.38	5.51	18566	0.26
4	7.67	73363	1.43	7.84	50585	0.71
5	10.20	114485	2.25	10.29	96166	1.35
6	9.81	108170	2.11	11.04	108440	1.53
7	8.82	92181	1.80	10.49	99386	1.40
8	11.88	141926	2.77	12.30	128914	1.81
	8.99	**94906**	**1.85**	**9.80**	**73723**	**1.23**

Table 39: WEY (t/ha), net returns and B:C ratio as influenced by CA and CP in maize-wheat cropping system

S No.	CA			CP		
	WEY(t/ha)	Net returns (Rs/ha)	B:C ratio	WEY(t/ha)	Net returns (Rs/ha)	B:C ratio
1	8.11	93656	2.45	7.75	76693	1.56
2	7.87	89702	2.35	7.22	68108	1.38
3	7.24	79482	2.08	7.62	74512	1.51
4	5.82	56347	1.48	7.89	79041	1.60
5	5.61	53074	1.39	7.27	68192	1.40
6	7.68	86657	2.27	7.41	71134	1.44
7	6.23	63143	1.65	7.85	78351	1.59
8	7.71	87157	2.28	8.64	91143	1.85
9	7.93	90625	2.37	7.38	70635	1.43
10	8.41	98546	2.58	8.00	80772	1.64
11	8.15	94219	2.47	7.86	78497	1.59
	7.34	**81146**	**2.12**	**7.72**	**76098**	**1.54**

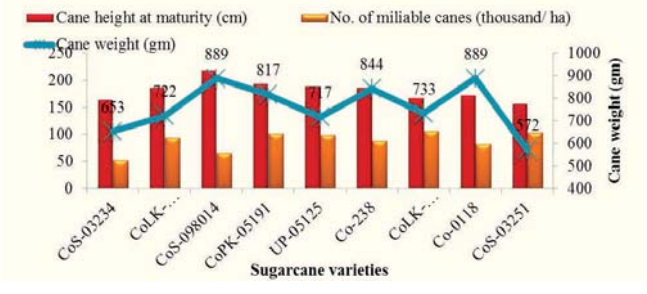


Fig. 16. Yield and yield attributes of sugarcane varieties under CA practices

variety CoS 098014, no of green top leaves (11) in variety CoS 03251, leaf area (618.22) in variety Co 0238, single cane weight (888.89 gm) in varieties Co 0118 and CoS 098014, single green top yield (111.11

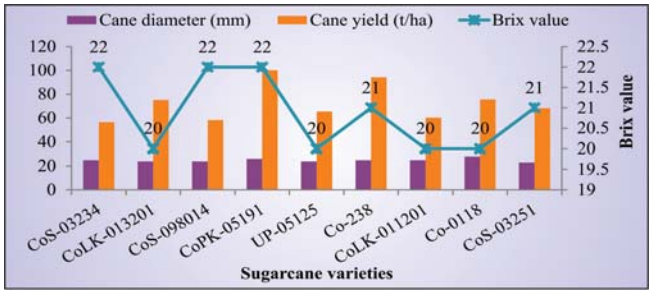


Fig. 17. Yield and yield attributes of sugarcane varieties under CA practices

gm) in variety CoLk 011201, brix value (22) in varieties CoS 098014, CoS 3234 and CoS 5191 recorded highest while values for cane diameter (28 mm) for Co 0118 and cane yield (100.2 t/ha) found highest in variety CoPk 05191 (Fig. 16 & 17).

B (2): *Agronomic evaluation of rice and wheat varieties under CP and CA practices*

In Kharif season eight varieties of rice was planted in conventional practice and sowing with DSR method in conservation practice for varietal evaluation. The values for plant height (99.93 cm) and number of filled grains/panicle (81.33) recorded higher in variety Pusa 2511with conventional practice. While number of panicle per meter row length(37.83) in variety Pusa 1121 in conventional practice, no. of unfilled grains per panicle(51.2) in variety Pusa 2511 with conservation practice, straw yield(45.83 q/ha) in variety Pusa 1121 in conventional practice ,grain yield (15.28 q/ha) in variety Pusa Basmati – 1 with conservation practice and days to flowering recorded earliest 50 days in variety Pusa 1460 with conventional practice and last at 80 days in variety Pusa 1401 with conventional practice.

All the yield attributes of wheat viz. plant height, number of tillers, spike length and grains per spike were recorded in higher order under conventional practices and therefore grain yield was also recorded 5.03% higher under CP as compared to CA practices. Among the varieties DBW-90 recorded the highest grain yield of 6.11 t/ha followed by DBW-17 (5.89 t/ha) under conventional practice however DBW-88 and WH-1105 were the higher yielders under conservational practice (Fig. 18).

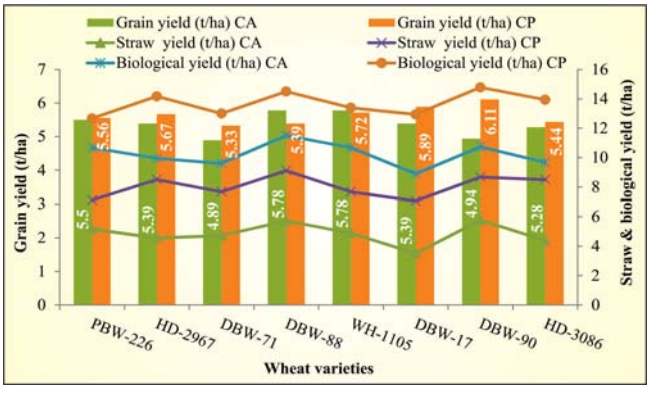


Fig. 18. Yield attributes of wheat under CP and CA practices

B (3): *Evaluation of different cropping sequences for crop intensification under CA practices.*

The field experiment was undertaken at Modipuram to study the effect of tillage, mulch as well as residue retention with adaptation of cropping sequences with two factors which is Tillage practices and cropping systems. These management practices impact on growth, productivity, soil fertility and economics of rice-wheat based cropping systems. Two tillage systems, four cropping systems combination were combined in a randomized block design with three replications. The tillage systems (main plots) were: Conventional practices(CP) i.e. 4 harrowing and one patella and conservation practices (CA), The cropping systems (sub-plots:CS_1Sugarcane-Ratoon-Wheat, CS_2 Rice-Wheat-Green Gram, CS_3 Rice-Wheat-Susbenia,CS_4 Maize(Cobs)-Peas(Pod)-Wheat-Cowpea). The crop residue retention used to be as mulch crops were sown as per recommended package and practices with seed rate 100, 15, 25, 25 and 6000 kg/ ha and line spacing 20, 60, 30,20 and 60 cm apart of wheat (DBW-17), maize (PAC-740 Hybrid), pea (PS-1100 Hybrid), DSR rice (Pusa-1509) and sugarcane (Co-0118), respectively.

In CS_1 Sugarcane planted 60 cm line spacing with use of mulch and without mulch. There was no earthing up and tillage used in conservation practice and the results found that number of millable cane/m^2 (10.47), cane diameter (28.63 mm), cane length (205.44 cm), single cane weight (1094.44 g), leaf area (677.94 mm^2), SPAD reading (31.32),cane yield (90.69 t/ha) and green top yield (21.94 t/ha) was found higher as compared to conventional practice.

In cropping sequences two and three Kharif crop was rice with two tillage practices. There was only two parameters no of effective tillers (862) and no. of unfilled grains (47.60)in CS_2 recorded high in value with conservation practice while plant height (264.60), grain yield(62.5 q/ha) and straw yield (111.46 q/ha) with $CS_3$and panicle length (7.43cm) in CS_2 were recorded higher with conventional practice. Followed by rice wheat crop was cultivated in both cropping sequences.

In cropping sequence four, maize was grown as kharif crop and some characters like cob length (29.03 cm), cob diameter (17.02 cm), grain rows/cob (12.87) and no. Of grains/cob (521.93) in conservation practice while plant height (223.58 cm), cob yield(104.37 q/ha) and stover yield (213.19 q/ha) found high with conventional practice. After Maize vegetable pea cultivation followed in this system and the results shows that in terms of plant population/meter row length (9.06), single pod weight (8.78 gm), grain weight/pod (4.02) in conventional practice and shelling percentage (47.06) and pod yield(26.93 q/ha) found higher with conservation practice. Followed by pea wheat crop was cultivated in this sequence.

In wheat crop CS_2, CS_3 and CS_4 all the three sequences were engaged and the result shows that SPAD reading (40.64) at 60 DAS in CS_3 and spike length (9.87 cm) in CS_4 found highest over all three cropping sequences with conservation practice while plant height at 60 DAS(59.89 cm), leaf area(226.41 cm and 296.56 cm) at 60 and 90 DAS recorded superior in CS_2 and no. of tillers/meter row length

Table 40: Component yield and WEY influenced by conventional and conservational practices under different cropping systems

Cropping System	Component grain yield (t/ha)								Av. WEY
	CA				CP				
	Kharif	Rabi	Summer	WEY (t/ha)	Kharif	Rabi	Summer	WEY (t/ha)	(t/ha)
Sugarcane-ratoon -wheat	90.69			15.07	90.28			15.00	15.04
Rice-wheat-green gram	4.88	3.81		8.36	6.14	3.26		8.97	8.66
Rice-wheat-sesbania	3.95	3.75		7.43	6.25	4.03		9.84	8.64
Maize (cob)-pea (veg)-wheat-cowpea	9.30	2.69		11.82	10.43	1.95		11.77	11.80
		3.61				3.54			

(167.67), plant height at 90 DAS (94.56 cm), tillers/ meter row length (124), grains/ear (44.33) and grain yield (40.28 q/ha) recorded highest in CS_3 and plant stand/meter row length (158.67) and plant height at harvest (90.20 cm) was found highest with CS_4 in Conventional practice.

Maximum wheat equivalent yield (15.04 t/ha) was recorded under sugarcane-ratoon-wheat system followed by maize(cob)-pea(veg.)-wheat-cowpea (11.80 t/ha) whereas rice-wheat-sesbania system recorded the lowest WEY of 8.64 t/ha (Table 40).

Project Title: Efficient ground water management for enhancing adaptive capacity to climate change in sugarcane based farming system in Muzaffarnagar district

Energy measurement at farmer's field

The energy measurement was performed on farmers' field at village Rasulpur Jatan, Muzaffarnagar in various crops under pipeline and open channel irrigation system. The installation of five energy meters was done on farmers' field at village Rasulpur Jatan, Muzaffarnagar. Out of five, three were installed on underground pipe line for irrigation of crops and two on farmers' method of irrigation (open channel). The flood irrigation was given in different crops through both method of irrigation (*i.e.* open unlined channel and underground pipe line). The observation of electricity energy consumption (kWh) and duration of irrigation (h) for both irrigation system by underground pipeline and open channel system were taken in different crops (i.e. sugarcane, wheat, barley, mustard, sugarcane ratoon, barseem etc.). The data about duration of irrigation and electricity consumption of both method of irrigation per area basis were recorded for irrigating of above various crops. The estimation of electricity energy consumption as well as time of irrigation for whole crop duration of different crops was done in both irrigation methods.

Irrigation time and energy consumption

On average, the saving of electricity energy for irrigation provided (Fig. 19 & 20) in one crop duration was noticed 1474, 1106,705, 301, 168 kWh/ha in sugarcane ratoon, sugarcane, barseem (fodder), wheat and mustard, respectively, in underground pipe line as compared to open channel method. The time of irrigation was also saved in underground pipe line than open channel method (i.e. 70, 58, 27, 17, 9 hours/ha in sugarcane ratoon, sugarcane, barseem (fodder), wheat and mustard, respectively). Keeping all parameters were constant in both cases such as depth of irrigation was kept 2-5 cm as crop wise and conveyance length of open channel (upto 100 m) and underground pipe was about same. Same crops were considered for observation.

It is estimated that the electricity energy was saved about 62, 49, 39, 37 and 34% under sugarcane ratoon, sugarcane, barseem (fodder), wheat and mustard, respectively in underground pipe line as compared to open unlined channel for irrigation of one hectare in whole crop duration.

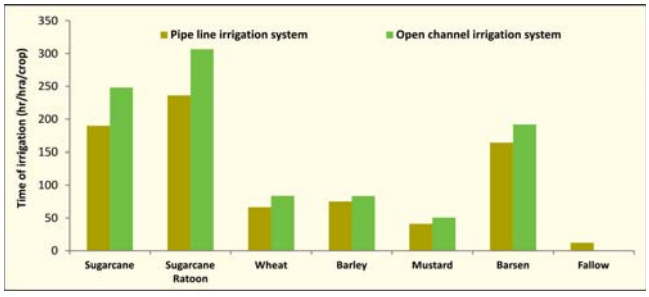


Fig. 19. Total irrigation time consumed (hr/ha/crop) under pipeline and open channel irrigation system in various crops in Rasulpur Jatan (Muzaffarnagar District)

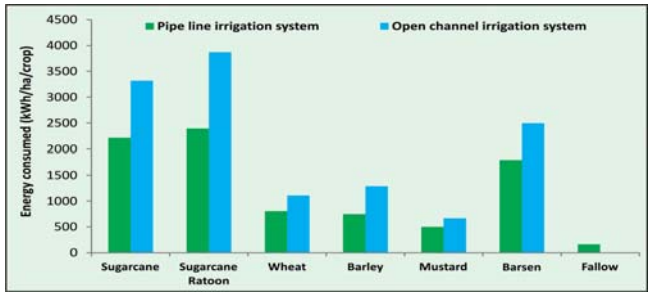


Fig. 20. Total energy consumed (kWh/ha/crop) under pipeline and open channel irrigation system in various crops in Rasulpur Jatan (Muzaffarnagar District)

Quantification in saving of underground water through pumping

The discharge of each bore well was observed which is found to be 13.22 l/sec for 10 HP motor and 17.52 l/sec for 15 HP motor. The saving of underground water through pumping was estimated from saving in time of irrigation and it was found to be 39, 32, 15, 9.6, 5.2 ha.cm in whole crop duration under sugarcane ratoon, sugarcane, barseem (fodder), wheat and mustard crops, respectively, when it was irrigated from pipe line irrigation system. If we provide 5 cm irrigation depth for sugarcane /ratoon crop, then 6 to 7 number of irrigation can be given from saved water (32 to 39 ha.cm). The over exploitation of ground water can be saved through underground pipe line irrigation system.

Household GHG Estimation

A study was carried out to estimate the baseline GHG emission (Kg CO_2-e) from application of synthetic fertilizer, FYM and also emission from livestock at Rasulpur Jatan, Muzaffarnagar. The methodology for estimating GHG emitted from the activity data based on the methodologies provided in the agriculture section of the IPCC 2006 & IPCC 1996 Revised Guidelines. Country specific emission coefficient (Tier-III) and IPCC default coefficient will be applied to get total emission from each category of IFS modules. The basic data for the estimation of GHG from 12 farmers' field were collected and the GHG emissions (kg CO_2-e $farm^{-1}$) from application of synthetic fertilizers, FYM application in crops and livestock components were estimated and it is given in the following tables. The study was conducted on 12 farms of village having total area of 20.1 ha. The highest emission was found 3121.4 Kg CO_2-e and 6749.3 Kg CO_2-e from fertilizer, FYM application and livestock respectively, and the minimum emission was found 501.0 Kg CO_2-e and 1071.7 Kg CO_2-e from fertilizer, FYM application and livestock respectively. Total GHG emission from 12 farms was found 76034.7 Kg CO_2-e out of which the total emission from fertilizer, FYM application and livestock was found 20933.1 Kg CO_2-e and 55101 Kg CO_2-e respectively which are 27.5% and 72.5% of total emission.

Development of self-resilient farming system models

Farming system models with crops and cropping system, vermicomposting, boundary plantation and various irrigation systems (water saving devices) such as drip irrigation, rain gun, and flood irrigation system are under developing conditions. Karonda and papaya plants are planted as boundary plantation. Sugarcane crop with five treatments viz. T_1: Farmer's practice, T_2: RDF through NPK, T_3:25% N substitution through vermicompost, T_4:50% N substitution through vermicompost, T_5:100% N substitution through vermicompost have been planted for studying the nutrient dynamics and water requirement of the crop. Total 5000 m^2 area has been covered under the sugarcane crop.

During the period under report the following activities have been performed under the project:

1. **Boundary plantation:** 500 plants of Karonda (*Carissa carandas)* at each location were planted. The

growth of plants is quite satisfactorily, however it will start fruiting after two years. After attaining the full growth it will also act as good fencing and will protect the field from the wild animals.

2. Sugarcane planting: To study the nutrients and water dynamics the present field experiment with five treatments (T_1: Farmer's practice, **T_2:** RDN, **T_3:** 25% N substitution with VC, **T_4:** 50% N substitution with VC and **T_5:** 100% N substitution with VC) has been planned at two different locations in RasulpurJatan village of district Muzaffarnagar. The treatment details are given in Table 41.

Papaya, maize (cob) and turmeric crops were also tried as inter crops in sugarcane, however papaya and maize crops were damaged by the wild animals (wild pig) and turmeric crop is growing well as an intercrop with sugarcane.

Growth parameters and yield of sugarcane under various treatments

Following periodical observations have been recorded in sugarcane, however detailed results will be presented after harvest of the crop:

25 % N substitution through vermi compost attained the maximum plant height and number of nodes followed by farmers practice. 50% of N substitution through vermi compost recorded the maximum cane weight whereas brix value was highest when 100% N was substituted with vermi compost.

It was noted that integration of vermin-compost along with fertilizer nutrient enhanced the brix value (22.0%) which was highest when 100% N was substituted with vermin-compost. RDF recorded the maximum sugarcane yield (124 t/ha) which was about 12.7% higher than the yield obtained under farmers condition. 25% of nitrogen substitution through vermin-compost recorded 4.54% higher yield than farmer's condition (110 t/ha) (Table 41).

GHG Emission

The 4-day average Nitrous Oxide emission after application of fertilizer under different treatments is given in Table 42. It is found that there is 63% and 39.1% reduction in nitrous oxide emission under 100% substitution of vermi compost and 50% substitution of vermi compost, respectively compared to farmers practice.

Table 41: Yield attributes and brix value as influenced by different treatments

Treatment	Plant height (cm)	No. of nodes	Cane weight (kg.)	Top weight (kg)	Brix value (%)	Yield (t/ha)
T1	268	17	1.325	0.275	17.5	110
T2	252	14	0.975	0.225	19.6	124
T3	304	18	1.050	0.200	20.0	115
T4	248	15	1.350	0.300	21.4	92.1
T5	245	16	1.175	0.225	22.0	62.5

Photo 21. Measurement of GHG emission in sugarcane crop

Table 42: Nitrous Oxide Emission under different management practices in Sugarcane

Treatment	Nitrous Oxide Emission kg/ha	% reduction over farmers practice
Farmer Name: Mr. Bachan Singh		
Farmer's Practice-350kg N and 69 kg P_2O_5/ha	1.423615	-
RDF-200:60:90 Kg N:P_2O_5:K2O/ha	1.000289	29.7
RDF+25%N Substitution through VC	0.96476	32.2
RDF+50% N Substitution through VC	0.676095	52.5
100% N Substitution through VC	0.531253	62.7
Farmer Name: Mr. Bablu Singh		
Farmer's Practice-350kg N and 69 kg P_2O_5/ha	1.396188	-
RDF-200:60:90 Kg N:P_2O_5:K2Oha	1.272901	8.8
RDF+25%N Substitution through VC	1.053051	24.6
RDF+50% N Substitution through VC	1.036896	25.7
RDF: Recommended Dose of Fertilizer, VC: Vemi compost		

Project Title: Strengthening Simulation Approaches for Understanding, Projecting and Managing Climate Risks in Stress-prone Environments Across the Central and Eastern Indo-Gangetic Basin (AgMIP)

This AgMIP-ICAR collaborative international project apply simulation tools in the major production ecologies of the central and eastern Indo-Gangetic Basin (India, Nepal, Bangladesh) in order to understand the integrated assessment of climate change impact on agricultural productivity. It will also assess the value of adaptation strategies under current and projected climatology by considering whether simulation tools and approaches and adequately capture the potential of different strategies for building resilience. The effort aims to fortify an existing network for agricultural simulation modeling while broadening it to include stronger linkages to climate and socioeconomic scientists. During the year 2017-18, the following research activities done under the study site Karnal District

Farm returns

The TOA-MD models simulated the potential impact of adoption of adaptation packages for RCP 4.5 and 8.5 for different GCMs and crop models under high and low price scenario. The simulated results for potential impact of farm returns demonstrate that; at the predicted adoption rates, farmers could increase their net farm returns substantially, depending upon the RCPs and GCMs. On an average irrespective of RCPs and GCMs and models, adoption of adaptation packages could increase farm net returns by 15% with a range of 3% to 34%. The current analysis shows that for each of the RCPs, GCMs, crop models and stratum farmers could increase the net farm income indicating that the proposed adaptation strategy could minimize the climate change impacts in the region. However, while comparing average farm returns for high and low price scenarios, the impact on farm net returns was higher in the high price scenario (18.22%) than in low price scenario (17.8%) for RCPs 4.5, irrespective of crop models and GCMs. We observed the similar trends has followed for the RCP 8.5 as well in which the increase in farm returns for RCP 8.5 for high price scenario was higher (13.23%) and low price scenario (12.5%).

On the other the DSSAT and APSIM simulations for RCP 8.5 simulations under different GCMs shows that the range of crop model variability is very less across high and low price scenarios and both of the model shows only 13% increase in farm returns due to adoption

of adaptation packages (A3). Similar results were found for the case of low price scenario for APSIM and DSSAT for RCP 8.5 scenario. The overall results indicate that the proposed adaptation packages developed for rice and wheat could benefit for the farming populations in the western IGB and these results are sensitive that increase in price could increase the farm returns and decrease in price decreases the farming systems returns indicating that any changes in rice and wheat causes farming systems returns substantially.

Impact of adaptation on poverty

The adoption of adaptation packages could impact on poverty in the region, even though, it should be noted that; poverty in Karnal is not the major issue because at the baseline poverty level in the region is less than 15%, unlikely with other regions in India. Nevertheless, rice and wheat being the major crop in intensive areas, any changes in the crop yield could change the poverty of farming populations. In this case the adoption of adaptation packages can have substantial reduction in the poverty in the region that ranges from 0.1% to 8% for the aggregated population. The results also indicate that the farming population is sensitive to any changes in the rice and wheat. However, the simulated impact of adaptation packages on poverty was different for different RCPs. The simulated percentage decrease in poverty rates for the aggregated population (irrespective of stratums) due to adoption of adaptation packages for RCP 4.5 and 8.5 GCMs from the simulated outputs of APSIM and DSSAT. The adoption of adaptation packages at the predicated adoption rates for RCP 4.5 can reduce poverty level that ranges from 0.1 to 8% while these results for the RCP 8.5 ranges from 0.1 to 3% indicating that the adaptation proposed adaptation could benefit for both the GCMs.

Project Title: Global Yield Gap and Water Productivity Atlas (GYGA)

The main aim of this project is to assess the yield potential (Yp) or water-limited yield potential (Yw), yield gap (Yg) and water productivity (WP) using a bottom-up approach based on actual data and robust crop simulation models. GYGA aspires for global coverage of yield gaps for all major food crops and countries that produce them, focuses on maize, rice, wheat, sorghum and millet in 20 countries spread over all the continents. In south Asia, during the first phase India and Bangladesh are participating in this project. During the year 2015, based on the area of five major crops, reference weather stations (RWS) were identified over India. Thirty Reference weather stations and respective climatic buffer zones for estimating actual and potential yields of rice have been identified and soil and crop related basic data was collected for these weather stations. Similarly, reference weather stations for wheat (20), maize (30), sorghum (30) and bajra (30) were also identified in different agro-climatic zones of India. Actual crop yields for 10 years were estimated for thirty climatic buffer zones taking the respective district and surrounding district weighted mean of major crops with in 100km radius.

The simulation of potential yields of rice and wheat obtained through APSIM model was further verified and quality control exercise has been done. Accordingly, the potential yields, actual yields and yield gap trend of different climatic buffer zones were estimated. The yield gap of these two crops was assessed based on the difference between mean actual yield of ten year period from 2001-2011and potential yield.

The yield gap of rice ranged between 52.6% in Patiala (Punjab) to 83.4 % in Patna (Bihar) (Fig. 21). As per the protocol of GYGA, the yield potential of

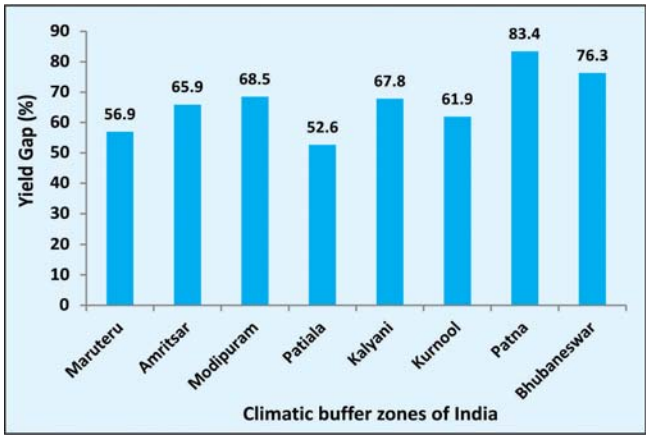


Fig. 21. Yield gap (%) trend of rice in different climatic buffer zones of India

rice of Patiala climatic buffer zone of Punjab was estimated as 8.32 t ha^{-1} using APSIM and its mean actual yield (10 years) was 3.94 t ha^{-1}, hence the yield gap of about 4.38 t ha^{-1} was recorded in this climatic buffer zone which accounts to 52.6 % of the potential yield.

The yield gap of wheat ranged between 22.5 % in Patiala (Punjab) to 68.2 % in Palampur (Himachal Pradesh) (Fig. 20). The yield potential of wheat of Patiala climatic buffer zone of Punjab was estimated as 5.92 t ha^{-1} using APSIM and its mean actual yield (10 years) was 4.59 t ha^{-1}, hence the yield gap of about 1.33 t ha^{-1} was recorded in this climatic buffer zone which accounts to 22.5 % of the potential yield.

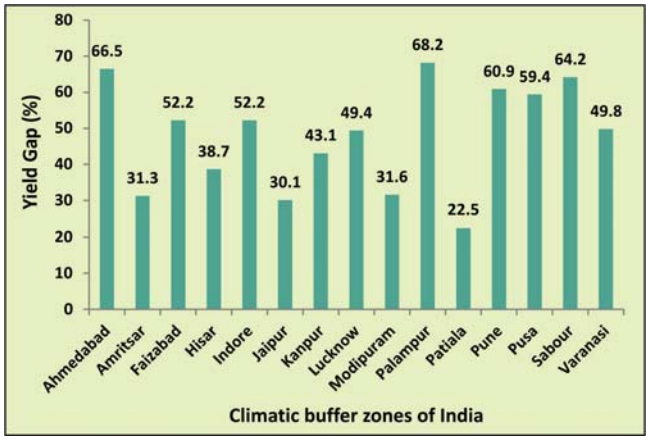


Fig. 22. Yield gap (%) trend of wheat in different climatic buffer zones of India

Organic Agriculture Systems (OAS)

EXTERNALLY FUNDED PROJECTS

Project Title: Network Project on Organic Farming -Modipuram centre: (Funded under NPOF)

Influence of organic, inorganic and integrated crop management in Basmati rice-wheat-green manure system on potassium buffering capacity of soil

Imbalanced application of nutrients in the intensively cropped areas results in deterioration of soil fertility and application of potassium (K) contributes for enhancing the use efficiency of other nutrients. Three composite soil samples were collected from surface soil (0-30 cm) during 2015 from 3 production systems viz., organic, inorganic and integrated which was maintained from 2004 with basmati rice-wheat-Sesbania system under Network Project on Organic Farming at ICAR-Indian Institute of Farming Systems Research, Modipuram to assess the buffering capacity of soil. The results revealed that available potassium (ammonium acetate method) in the soils ranged from 119.51 to 135.01 mg/kg with mean of 126.02±5.24 mg/kg while water soluble and nitric acid extracted potassium ranged from 28.51 to 29.05 mg/kg and having mean of 25.95x102± 19.33 mg/kg in various production systems. The mean free energy of replacement was found to be "1998.01±28.38 cal/mol indicating that soils have comparatively higher potassium supply under organic system. The potassium buffering capacity of the soils were found to be 0.75±0.16 mg/kg, 0.63±0.20 mg/kg and 0.68±0.09 mg/kg in organic, integrated and inorganic systems respectively. The amount of potassium adsorbed on un-specific sites of the organic, integrated and inorganic systems were found to be 7.47±1.81, 15.11±2.40 and 11.6 89 ±3.58 mg/kg respectively. It can be concluded that K+ buffering capacity of Typic Ustochrept soil can be improved by long term application of organic manures with systematic management of K compared to the integrated and inorganic production systems.

- Irrespective of cropping system acid and alkaline phosphatase activity was higher in organic management practice.
- Acid and alkaline phosphatase activity was observed highest under CS4 (Maize – mustard – Sesbania) cropping system

The carbon sequestration potential of Maize – mustard – Sesbania cropping systems under organic nutrient management was 2.79 Mg / hac. after 12 years of experiment in Western plain zone of Uttar Pradesh upto depth of 60 cm soil.

Project Title: Sustainable resource management for climate smart Integrated Farming Systems under AICRP on Integrated Farming Systems, On-station centre at Modipuram (Funded under AICRP on IFS On-station)

Seven modules *viz.*, Cropping systems, horti-pasture, agri-horti, dairy, vermicompost, boundary plantation and secondary agriculture (value addition) modules were integrated in 0.72 ha area in order to develop sustainable resource management packages for climate smart integrated farming systems for marginal farm households. The details of the area and composition of each module is given in Table 43.

The first-year results of the study is given below.

Initial soil status

Soil was found saline in nature and pH varied from 8.10 to 8.21 under different modules. Organic carbon content was found low (0.39-0.45%). Available K content was found medium in agri-horti and higher in cropping system and horti-pasture modules (Table 44).

Performance of different modules

Cropping systems: Three cropping systems namely basmati rice-wheat + mustard/gram-green manure, *Sesbania* (seed)-chickpea-greengram and okra-cauliflower-babycorn + cowpea was planned under the module to meet the household demand of food, feed and generate income for the family under changing

Table 43: Composition of climate smart IFS modules evaluation for marginal households

Modules	Net area (m^2)	Composition				
Cropping systems	3800		*Kharif*	*Rabi*	*Summer*	Area
		CS I	Basmati rice	Wheat + mustard (0.065ha) & Wheat + Gram (0.065 ha)	G. manure	1250 m^2
		CS II	Sesbania (seed production)	chickpea	Green gram	1250 m^2
		CS III	Okra	cauliflower	Baby corn + cowpea	1250 m^2
Horti-pasture	1800	Kinnow + Sorghum-Berseem(300 m^2) Kinnow + pearlmillet-lucerne (300 m^2) Kinnow + cowpea-oat (300 m^2) Kinnow + maize-mustard (300 m^2) Kinnow + maize + cowpea- Makhhan grass (300 m^2)				
Agri-Horti	1200	Crop (soybean-vegetable pea-green manure) + papaya (600 m^2) Crop (soybean-vegetable pea-green manure) + banana (600 m^2)				
Dairy	50	1 Desi cow + 1 Buffalo				
Vermicompost	50					
Boundary plantation	—	Karonda, guava				
Secondary agriculture (value addition)	-	Marketable surplus will be converted in value added products				
Area under supporting activities	100	Manure pit and Fodder chopping unit				
Total	7200					

Table 44: Initial soil status in different modules of IFS

Module	pH	EC	OC (%)	K (kg/ha)	Mn (ppm)	Cu (ppm)	Zn (ppm)	Fe (ppm)
Cropping system	8.10	0.25	0.39	309.12	2.014	1.316	2.017	5.274
Horti-pasture	8.19	0.28	0.45	321.44	1.376	1.720	3.853	9.361
Agri-horti	8.21	0.18	0.43	225.12	2.583	2.185	3.940	16.331

climate. The *kharif 2017* results indicates that basmati rice (variety PB 1) resulted in 313 kg of grain (2499 kg/ha) and 500 kg straw from 1250 m^2. The straw of rice was recycled in as mulch in cauliflower under okra-cauliflower-baby corn + cowpea system. Seed production of green manure could not be taken up and *Sesbania* was incorporated in the soil at 50 DAS for green manuring for timely sowing of next crop. Okra recorded 1135 kg of green pod yield (9080 kg/ha) from 1250 m^2 area. Stalks of okra was incorporated *insitu* to increase soil fertility. *Rabi* experiments are in progress.

Horti-pasture: Five fodder crops *viz*. sorghum, pearlmillet, maize, cowpea and maize+cowpea were evaluated during *kharif* 2017 in 5 strips (300 m^2 each) of kinnow plantation. Kinnow recorded 849 kg of fruits from 0.18 ha (27416 kg/ha). Among fodder crops, maize + cowpea recorded higher fodder production

(1170 kg from 300 m^2) followed by maize (1080 kg from 300 m^2), sorghum (810 kg from 300 m^2), pearlmillet (720 kg from 300 m^2) and cowpea (450 kg from 300 m^2) (Table 45). It can be inferred that with the cultivation of maize + cowpea for fodder during *kharif* in 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 195 days. Intercropping of fodder maize, sorghum, pearlmillet and cowpea in horti-pasture can supply fodder to two animals for 180 days, 135 days, 120 days and 75 days only, respectively.

During the *rabi* season fodder crops *viz.* mustard, berseem, lucerne, oat and rye (makkhan) grass were grown under inter-row space of kinnow. Proximate analysis of these crops was done in collaboration with ICAR-Central Institute for Research on Cattle, Meerut. Highest ash content was found in berseem (14.03%) followed by lucerne (13 %) and lowest in mustard (7.24%) (Table 46). Acid insoluble ash content was found highest (3.90%) and lowest (0.48%) in oat and mustard respectively. Mustard recorded highest fibre content (48.03%) and least under lucerne (29.01%). Higher fat content was found under rye (makkhan) grass (3.18%) followed by mustard (1.30%) and lowest was with lucerne (0.20%). Berseem (25.11%) and lucerne (32.73%) were found superior in terms of protein over mustard, oat and rye (makkhan).

Dairy: The dairy unit is having one buffalo (murrah) and one desi cow. A total of 2533 litre of milk were produced out of which buffalo produced 1899.5 litres while and cow produced 633.5 litres (Table 47). Total cost works out to Rs. 79,205 with share of 64.5, 20.3 and 15.2% respectively on concentrates, green fodder and straw, respectively. Total gross return and net returns from dairy unit was found to be Rs. 1,13,985 and Rs. 34,780, respectively. Average daily dung production from dairy unit was found to be 54 kg which works out to 19.7 t/year.

Table 45: Production of different fodder crops during *kharif* 2017 and kinnow under horti-pasture system

Component	Yield (kg) in 300 m^2 area	Yield in 0.18 ha of horti-pasture (kg) (area of fodder, 0.15 ha)	Fodder sufficient for feeding 2 animals (number of days) *
Kinnow	-	849	-
Maize + cowpea	1170	5850	195
Maize	1080	5400	180
Sorghum	810	4050	135
Pearlmillet	720	3600	120
Cowpea	450	2250	75

* 15 kg green fodder/ day/animal

Table 46: Proximate analysis of fodder crops during *rabi* 2017 under horti-pasture system

Fodder crop	Ash (%)	AIA* (%)	Fiber content(%)	Fat content(%)	Protein content (%)
Mustard	7.24	0.48	48.03	1.30	11.64
Barseem	14.03	1.17	34.44	0.71	25.11
Lucerne	13.00	1.92	29.01	0.20	32.73
Oat	11.28	3.90	34.89	0.24	10.06
Rye (makkhan) grass	12.23	3.03	30.79	3.18	11.38

* AIA: Acid Insoluble Ash

Table 47: Economics of dairy module

Dairy	Production (milk in litres)	Gross income (Rs)	Total cost (Rs)	Net returns (Rs.)
Buffalo (1 no's)	1899.5	85,478	44,530	40,948
Desi cow (1 no's)	633.5	28,507	34,675	-6,167
Total	2533	1,13,985	79,205	34,780

*Price of milk @ Rs. 45/litres

Boundary plantation: On the boundaries of farming system model, guava and karonda plants were planted. A total 60 kg of guava fruits were harvested from boundaries.

Secondary agriculture (value addition): Protocol for production of kinnow mandarin squash (squash) was evaluated during October, 2017 (Table 48). The fruit juice recorded initial TSS of 8.3% with juice recovery of 55.5%. The final products were analysed for total soluble solids (TSS), titrable acidity and organoleptic score (Table 49). Among different treatments, the kinnow squash with 45% juice and 55 % syrup with 65°Brix had recorded 41% TSS with high overall acceptability score (8.2) having attractive colour, flavour and taste. Economic analysis of value addition to kinnow indicates that additional income of Rs 0.28 lakhs can be obtained from 0.18 ha by making kinnow mandarin squash. The increase in net income due to value addition was found to be 2.17 times when 50 % of produces are made as kinnow mandarin squash and 50 % sold as fresh fruits. If 100 % of produces are subjected to value addition in the form of kinnow mandarin squash, the net income increases by 3.32 times over net income obtained by selling fresh kinnow (Table 50).

Table 48: Experimental composition for development of kinnow mandarin squash

Sl. No.	Ingredients	Juice (%)				
		T_1(30%)	T_2(35%)	T_3(40%)	T_4(45%)	T_5(50%)
1	Kinnow juice, ml	300	350	400	450	500
2	Syrup, ml	700	650	600	550	500
	Syrup strength (°Brix)	50	55	60	65	70
3	Citric acid , g	9.0	9.0	9.0	9.0	9.0
4	KMS, g	0. 20	0.20	0.20	0.20	0.20
5	Colour, g	0. 10	0.10	0.10	0.10	0.10
6	Essence, ml	1.0	1.0	1.0	1.0	1.0

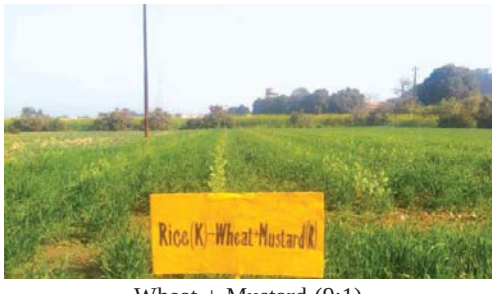
Table 49: Quality of kinnow mandarin squash influenced by experimental composition

Sl. No.	Parameters	Treatments				
		T_1	T_2	T_3	T_4	T_5
1	TSS (%)	36.5	38.6	40.8	41.0	43.0
2	Acidity (%)	1.03	1.12	1.08	1.02	1.03
3	Appearance	7.5	7.1	8.0	8.0	7.2
4	Colour	6.7	7.2	8.1	8.1	7.5
5	Flavour	6.6	6.9	8.0	8.0	6.9
6	Taste	6.9	7.2	7.9	8.3	7.9
7	OAA Sensory	7.1	7.5	8.1	8.2	7.6

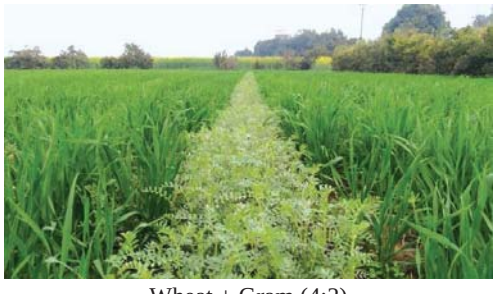
Table 50: Economics of kinnow from 0.18 ha influenced by secondary agriculture (value addition through kinnow mandarin squash)

Sl. No.	Inputs	Quantity for 10 litres of kinnow mandarin squash	Cost (Rs/unit)	Amount (Rs) for 10 litres of kinnow mandarin squash	Amount (Rs) for 50 % mandarin production as kinnow mandarin squash	Amount (Rs) for 100% mandarin production as kinnow mandarin squash
Cost						
1	Kinnow mandarin	9	20 /kg	180	8490*	16980*
2	Sugar	5.5	40/kg	220	10376	20753
3	Additives (colour, essence, KMS)	-	1/litres	10	472	943
4	Cost of fuel and labour	-	10/litres	100	4720	9430
5	Packaging and labelling	-	10/litres	100	4720	9430
	Total cost	-	-	**610**	**28778**	**57536**
Income						
7	Final product	-	litres	10	472	943
8	Gross income by sale raw kinnow mandarin	-	20/kg	180	16980	16980
9	Gross income by sale of kinnow mandarin squash	-	100/litres	1000	47200 + 8480=55680	94300
10	Cost of cultivation	-	10/kg	90	8490	8490
11	Cost of value addition	-	-	610	28792	57584
12	Net income by sale of raw kinnow mandarin	-	-	90	8490	
13	Net income by sale of kinnow mandarin squash	-	-	500	18398	28226
14	No. of times of improvement in net income due to value addition	-	-	-	2.17	3.32

*Yield of kinnow is 849 kg from 0.18 ha of horti-pasture system



Wheat + Mustard (9:1)


Wheat + Gram (4:2)

Chickpea


Cauliflower

Photo 22. Cropping system module

Photo 23. Kinnow + fodder (Horti-pasture module)

Photo 24. Kinnow mandarin squash (Value addition)

Exploratory Study

Impact study of On-farm Integrated Farming Systems Research" in Kailawara-Kalan village

Effect of integrated nutrient and pest management (INPM) technology in sugarcane

An "On-farm Integrated Farming Systems Research" project was launched by ICAR-IIFSR in Kailawara-Kalan village of Muzaffarnagar district in 2014-15 and project ran for a period of three years (from 2014-15 to 2016-17). As a part of the project, on-farm trials were conducted on integrated nutrient and pest management (INPM) in sugarcane (var. CoJ 88) during 2015-16 on plant crop and 2016-17 on ratoon crop in the same field in non-replicated strips of 2000m^2. Treatments consisted of 1. recommended dose of NPK (150:60:60 in kg/ha) + three releases of trichocards (for top borer management) and one foliar spray of carbendazim @0.1% (to manage *pokah boeng* disease), 2. recommended dose of NPK+S (150:60:60:30 in kg/ha) + three releases of trichocards (for top borer management) and one spray of carbendazim @0.1% (to manage *pokah boeng* disease) and 3. recommended dose of NPK+S+Zn (150:60:60:30:20 in kg/ha) + three releases of trichocards (for top borer management) and one spray of carbendazim @0.1% (to manage *pokah boeng* disease). In addition, 25% additional nitrogen was applied in all the treatments in ratoon crop. Farmer's practice of higher doses of nitrogen (300kg/ha) with lesser doses P_2O_5 (40kg/ha) and no application of potash, micronutrients (S and Zn); increased application of chemical pesticide (2-3 applications of insecticide chlorantranillipore) to control top borer was treated as control. Observations were recorded on length and weight of millable cane, length and weight of green top, dry leaves/plant, number of borer exit holes/plant (to assess the infestation of top borer), incidence of *pokah boeng* disease and finally the average yield of sugarcane (q/ha).

Table 51: Effect of integrated nutrient and pest management (INPM) on yield parameters, disease and pest incidence and yield of sugarcane

Treatment	Yield of millable cane		Yield of Green top		Yield of dry cane leaves (g)	No. of top borer exit holes/ plant	Incidence of *Pokah boeng* disease (%)	Avg. cane yield (q/ha)	% increase in cane yield
	Length (meter)	Weight (kg)	Length (meter)	Weight (g)					
1. Rec. NPK+IPM	3.02	1.65	1.66	194.20	141.20	1.60	8.00	910	44.9
2. Rec. NPK+S+IPM	3.08	1.70	1.66	211.40	144.40	0.40	4.00	985	56.8
3. Rec. NPK+S+ Zn+IPM	3.13	1.74	1.66	243.40	135.60	0.40	4.00	1050	67.2
4. Farmers Practice	2.90	1.13	1.64	119.20	125.20	3.40	26.00	628	-

All the nutrient and pest management treatments have their visible effects on yield parameters and yield of sugarcane. Maximum millable cane yield (1050q/ha) was observed with treatment 3 (recommended dose of NPK+S+Zn+IPM) and there was 67.2 per cent increase in millable cane yield over control (Table 51). Yield parameters (cane length and weight) were remarkably higher in INPM treatments. The yield of green top was also higher with INPM treatments which ensure increased fodder supply to livestocks. Incidence of *pokah boeng* disease and infestation of top borer were reduced to a greater extent and attributed to higher yield of cane yield in IMPM treatments. Application of micronutrients (sulphur and zinc) had positive effect on millable cane yield and their combination with recommended NPK gave highest cane yield in treatment no. 3. The higher yield of dry cane leaves in INPM treatments ensures greater availability of raw materials for composting/mulching and other uses in the farming system. This INPM technology also reduced the pesticide application in sugarcane by 50 per cent.

Spread of INPM technology and its effect on yield of sugarcane

To understand the impact of "On-farm Integrated Farming Systems Research" project and INPM technology on the yield of sugarcane in Kailawara-Kalan village, a survey was conducted during 2017 *kharif* season involving 15 farmers. Since inception of the project, farmers of the village were provided with need based agro-advisory time to time with publications on INPM recommendations in sugarcane. Kisan gosthis, field visits and mobile based advisory were also given time to time. Farmers were asked for the average increase in yield of sugarcane in first (2015-16) and second (2016-17) years.

It was clear from the survey data of current season that, INPM technology had remarkable effects on yield of sugarcane and income of the farmers. During 2015-16, there was about 15% increase in the yield of sugarcane by adopting INPM technology (805q/ha) as compared to previous year (700q/ha in 2014-15) (Fig. 23). Increase in per hectare income was Rs.31500/- over the base year of 2014-15. During 2016-17, there was tremendous increase in sugarcane yield (948q/ha, 35% increase) with increase in per hectare income by Rs.74400/-. Most of the farmers reported to apply lesser quantity of pesticides (40-50% less) to manage top borer. Higher cane yield was attributed to location specific balanced application of fertilizers and reduction in loss of cane yield caused by top borer insect due to release of trichocards. These two parameters alongwith increased awareness of farmers for integrated nutrient and pest management were main reasons for success of this technology.

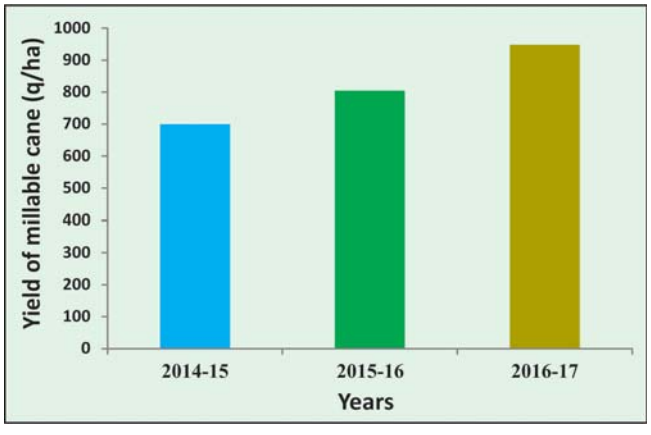


Fig. 23. Effect of INPM technology of yield of sugarcane in Kailawara Kalan village

Effect of different dates of sowing and INPM on disease and pest incidence and yield of sugarcane

Pokah boeng caused by fungus *Fusarium moniliforme* has emerged as a major disease of sugarcane during recent years due to large scale adoption of a single susceptible variety of this crop (Co 0238) in the region. Since there were variability in the incidence of *pokah boeng* disease in the field with respect to date of sowing and management practices, a survey was conducted during 2017-18 in Kailawara-Kalan village to know the effect of different dates of sowing and management practices on the incidence of this disease and yield of sugarcane. Observations on disease and pest incidence and yield parameters of sugarcane were collected from the 10 fields of sugarcane having different dates of sowing (Table 52).

Table 52: Effect of date of sowing on *Pokah boeng* disease incidence and yield parameters of sugarcane in Kailawara Kalan village during 2017-18

Treatment Date of sowing and management system	Yield of millable cane		Yield of Green top		No. of top borer exit holes/ plant	Incidence of *Pokah boeng* disease (%)
	Length (meter)	Weight (kg)	Length (meter)	Weight (g)		
1. March + INPM	3.59	2.15	1.68	167.80	0.60	4.00
2. March + No INPM	2.59	1.27	1.64	147.80	1.80	22.00
3. April + INPM	3.28	1.78	1.66	181.20	0.40	8.00
4. April + No INPM	2.98	1.53	1.70	130.69	1.60	32.00
5. May + INPM	2.91	1.51	1.79	216.80	0.20	18.00
6. May + No INPM	2.82	1.41	1.62	162.80	1.20	40.00
7. May + INPM	3.09	1.55	1.61	124.40	1.20	26.00
8. May + No INPM	2.49	1.22	1.51	118.60	2.80	64.00
9. Ratoon crop + INPM	3.82	2.40	1.54	119.40	1.20	4.00
10. Ratoon crop + No INPM	2.71	1.41	1.42	92.60	2.00	16.00

It is clear from the data of Table 51 that, different dates of sowings do have visible effect on incidence of *pokah boeng* disease in sugarcane. Maximum disease incidence (64% and 40% in field no. 8 and 6 respectively) was noticed in case of May planted crop of sugarcane without integrated nutrient and pest management (INPM). April planting stood next in terms of disease incidence. March planted plant crop and ratoon crops faced lesser attack of *pokah boeng* disease. It may be due to hardening of plant. The effect of INPM technology was more effective in case of March planting and ratoon crops (only 4% incidence reocrded in both the fields). However, due to heavy initial load of disease, INPM was less effective in case of May planting. The result from this study clearly indicates that, date of planting is a crucial factor for the management of *pokah boeng* disease in sugarcane crop. Early or timely planting suffers less from the attack of disease. Late planting in the month of April and May after harvest of wheat crop is a common system of sugarcane planting in the region and sound disease management system is necessary to harvest good crop under these situations.

Technology Transfer And Human Resource Development (TT & HRD)

INSTITUTE FUNDED PROJECTS

Project Title: System based proven technologies in farming system perspective under demonstration in Technology park

Demonstrations of vegetable based module, higher rice equivalent yield (REY) was obtained from Basmati rice (Sugandha-4) –potato (K. Bahar)– Maize (T_2) (10.5 t/ha), Basmati rice (Sugandha-4)-potato (K. Bahar)–Green gram (T_3) (9.7 t/ha), Basmati Rice - potato (Chipsona-4)–green gram (T_4) (9.2 t/ha), Maize–Broccoli–Tomato (T_5) (6.2 t/ha), Maize-Cauliflower- Maize (T6) (4.1 t/ha) and Rice (Sugandha-4)-Wheat was recorded 6.4t/ha respectively. Highest net return and income per day was also obtained from rice –potato -maize (Rs. 570) as compare to different tested vegetable based modules.

In different technology based cropping systems modules highest Rice equivalent yield (t/ha) was obtained from Rice (SRI, nutrient management)–wheat (ZT, nutrient management)–Sesbania (T_3) (5.8 t/ha) and followed by rice (MT , nutrient management) –wheat (RFD,)–Sesbania (T_4) (5.7 t/ha), rice (SSNM)–wheat(SSNM)–Sesbania (T_3) (5.6 t/ha), rice (DSR)–wheat (SSNM)-Sesbania (T_1) (5.2 t/ha)and lowest under rice(SSNM)-wheat (RFD)-Sesbania (T_5) (4.6t/ha). The maximum return in two systems was recorded at par (Rs 275/day/ha) 'rice (SRI.SSNM) -wheat (ZT, nutrient management) –Sesbania (T_3)and rice (MT, SSNM)–wheat (RFD) – Sesbania.

Under demonstrations of different varietal comparison, maximum REY was recorded in rice(1612)–wheat (HD2967) (T_3) (6.3 t/ha) followed by rice (PB-1)–wheat (DBW 71) (T_2) (10.89 t/ha), Rice (PB-6)–wheat (PBW725) (T_4) and Basmati rice(1509)–Barley (BH946) (T_5) was recorded at par REY 5.7 t/ha respectively.Thelowest REY yield was obtained from Basmati rice (1509)–wheat (PBW658) (T_1) (5.1t/ha). Highest return per day was obtained from rice(1612)–wheat (HD2967) (T_3) (Rs 317per day/ha) and lowest return per day was recorded Rs. 223 in Basmati rice (1509)–wheat (PBW658) (T_1).

The crop diversification modules were demonstrated in Technology Park of the Institute (Tables 53-56). It was found that Maize(R&F), SSNM) – Mustard (SSNM) –Summer mung (T2) gave highest REY (6.9 t/ha) followed by Maize (FB)-Mustard (FB)-S. Moong (T_1) (5.9 t/ha), Maize(R&F, SSNM)-Wheat (RDF)-S.mung. (T_3) (5.8 t/ha), Maize(R&F, SSNM) - Wheat (RDF) – (T_4) (5.3 t/ha),

The maximum return per day per hectarewas obtained from Maize (R&F), (SSNM)–Mustard (SSNM)–summer mung (T2) Rs.375/-) systems amongst all the systems under crop diversification.

The systems comprised of different proven improved technologies *viz.* improved varieties, system for rice intensification (SRI), mechanical transplanting of rice, nutrient management, , green manuring (GM), July sown maize (BB), raised bed planting (RB), broad bed furrow system(BBF), zero tillage technology in wheat, crop residue management in wheat.

Basmati rice (Sugandha-4) –potato (K. Bahar)–Maize (T_2) (10.5 t/ha) Highest net return and income per day was also obtained from rice –potato -maize (Rs. 570)rice(1612)–wheat (HD2967) (T_3) (6.3 t/ha)Rice equivalent yield (t/ha) was obtained from Rice (SRI, nutrient management)–wheat (ZT, nutrient management)–Sesbania (T_3) (5.8 t/ha) The maximum return in two systems was recorded at par (Rs 275/day/ha) 'rice (SRI.SSNM) -wheat (ZT, nutrient management) –Sesbania (T_3)and rice (MT, SSNM)–wheat (RFD) – Sesbania.Maximum REY was recorded in rice (1612)–wheat (HD2967) (T_3) (6.3 t/ha). Highest return per day was obtained from rice(1612)–wheat (HD2967) (T_3) (Rs 317per day /ha)Maize (R&F), SSNM) –Mustard (SSNM) –Summer mung (T2) gave highest REY (6.9 t/ha). The maximum return per day per hectarewas obtained from Maize (R&F), SSNM) –Mustard (SSNM) –summer mung (T2) Rs.375/-).

Table 53: Economics of vegetable based cropping systems

Cropping Systems	System Gross Return (Rs)	System Cost of cultivation (Rs)	Net Return (Rs.)	REY(t/ha)	Income/day (Rs.)
B. rice- Wheat	192278	72000	120278	6.4	330
B.Rice -potato- maize	316111	108000	208111	10.5	570
B.rice - potato- Green gram	291926	108000	183926	9.7	504
B.rice - potato- Green gram	274889	90000	184889	9.2	507
Maize - Broccli- Tomato	185185	105000	80185	6.2	220
Maize- cauliflower- Maize (Greencobs)	121574	45000	76574	4.1	210

Table 54: Economics of technology based cropping systems

Cropping Systems	System Gross Return (Rs)	System Cost of cultivation (Rs)	Net Return (Rs.)	REY(t/ha)	Income/day (Rs.)
B.rice(DSR)- wheat (SSNM) - Sesbania	157204	70000	87204	5.2	239
B.rice (SSNM) -wheat (SSNM) -Sesbania	167309	70000	97309	5.6	267
B.rice (SRI ,SSNM) –wheat (ZT,SSNM) -Sesbania	172878	72500	100378	5.8	275
B.rice (MT,SSNM)–wheat (RFD) -Sesbania	170330	70000	100330	5.7	275
B.rice (SSNM) –wheat (RFD)-Sesbania	140530	73000	67530	4.7	185

Table 55: Economics of varietal based cropping systems

Cropping Systems	System Gross Return (Rs)	System Cost of cultivation (Rs)	Net Return (Rs.)	REY(t/ha)	Income/day (Rs.)
Rice (1509) -wheat (PBW658)	224815	72000	152815	7.5	419
B. rice (PB-1) –wheat (DBW71)	216052	72000	144052	7.2	395
B. rice (1612) –wheat (2967)	196516	72000	124516	6.6	341
B. rice (PB-6) -wheat (PBW725)	219763	72000	147763	7.3	405
B. rice (1509)-Barley (BH946)	200417	72000	128417	6.7	352

Table 56: Economics of diversified based cropping systems

Cropping Systems	System Gross Return (Rs)	System Cost of cultivation (Rs)	Net Return (Rs.)	REY(t/ha)	Income/day (Rs.)
Maize(FP) -Mustard –S. Mung	177247	71000	106247	5.9	291
Maize(R&F,SSNM)) –Mustard (SSNM) –S. Mung	207805	71000	136805	6.9	375
Maize(R&F,SSNM)) –Wheat (RDF) –S. Mung	172656	70000	102656	5.8	281
Maize(R&F,SSNM)) –Wheat (RDF) –S. Mung	159359	70000	89359	5.3	245

Project Title: Diversification of existing Farming Systems through integration of poultry for improving livelihood of marginal and landless farmers

The project was started with major objective to identify the suitable poultry module for improving the existing farming system of marginal and landless farmers. Four varieties of poultry namely Gramapriya, Vanaraja, CARI Nirbheek and CARI Dhanraja were used in different numbers with supplement and without supplement feeding to assess the suitability of variety, its number and feeding system in the backyard system of rearing. The chicks were brooded up to 04 weeks of age at the brooding unit of the Institute under deep litter system. After brooding, the chicks were distributed free of cost to the marginal and landless farmers of the Muzaffarnagar district. A total of 256 chicks of Gramapriya, 240 chicks of Vanaraja, 320 chicks of CARI Nirbheek and 960 chicks of CARI Dhanraja were distributed, each variety to 16 farmers. It was found that overall performance with supplement feeding of average household body weight as well as average household egg production was higher than without supplement feeding. The average household egg production with 20 numbers of birds of Gramapriya variety was higher than all the other varieties. The gross as well as net income was higher with supplement feeding than without supplement feeding. The highest average net income of Rs. 25,450.00 was observed with 100 numbers of birds of CARI Dhanraja feeding supplement feed. In layer varieties, 20 numbers of birds of Gramapriya with supplement feeding generated higher net income followed by dual purpose Vanaraja variety. It is concluded that 100 numbers of CARI Dhanraja variety with supplement feeding can be reared in backyard system for higher income if optimum space/ resources are available. Alternatively, 20 numbers of Gramapriya with supplement feeding is good option for higher income followed by dual purpose Vanaraja variety for marginal and landless farmers.

Project title: Productivity and economic evaluation of horticulture based farming systems

Experiments were conducted at ICAR-IIFSR, Modipuram to develop horticultural crop based model for improving profitability, enhancing productivity and nutritional security of small and marginal farmers particularly of western plain zone of Uttar Pradesh. Three modules, viz. Fruit based (CS 1, 0.8 ha), vegetable crops based (CS 2, 0.3 ha) and field crop based (CS 3, 0.3 ha) were evaluated under this project

Under fruit crop based system (CS-1), mango, guava, banana and kinnow were grown as the main crops whereas cucumber, radish, carrot and onion as the intercrop in mango, brinjal, veg pea and okra as intercrops in guava and turmeric as intercrop in banana and onion-okra-beans-pea in kinnow, respectively. In vegetable based system (CS-2) turmeric, bottle gourd-cauliflower-tomato and brinjal-potato were grown while under crop based system (CS-3), Rice-wheat and sugarcane-ratoon- wheat system were evaluated. The performance of different modules in presented in Table 57. Among the different modules in study highest

Table 57: Economics of different modules under study

Gross returns	COC	Net Returns
Module- 1 Fruit based system		
2,10,520	60,254	1,50,266
Module- 2 Vegetable based system		
1,95,550	77,768	1,17,782
Module- 3 Crop based system		
1,90,748	45,550	1,45,198

net return of Rs. 1,50,266 were recorded from the module 1 (fruit based systems with intercropping of vegetables) as compared to module 2 (vegetables based systems) and module 3 (crop based systems)as shown in Fig. 24. The highest B:C ratio of 3.18 was recorded

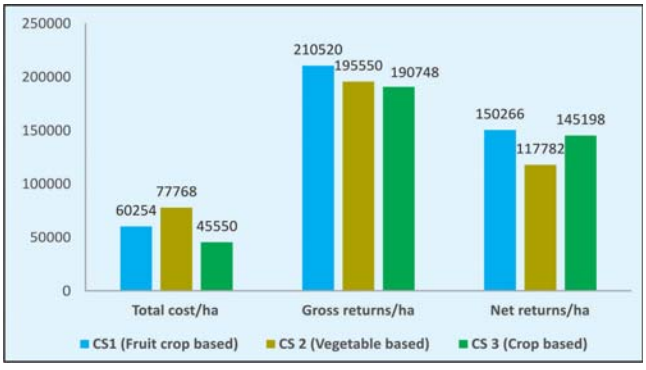


Fig. 24. Economics of different modules under study

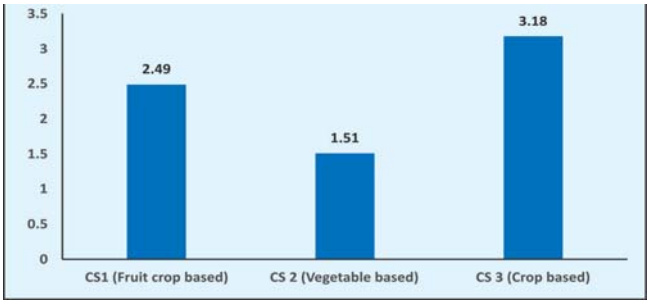


Fig. 25. B:C ratio of different modules under study

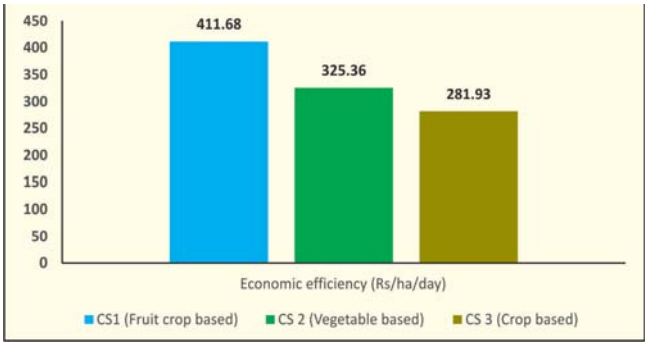


Fig. 26. Economic efficiency of different modules under study

for module 3. This is because of the less cost incurred for cultivation of crops as compared to the fruits and vegetables grown under study as shown in Fig. 25. Economic efficiency of different modules is given in Fig. 26.

A Pond-dyke system has been developed in 2017 to integrate fish component in the existing horticulture based farming systems and to evaluate its viability in profitability in the system. The net returns from pond-dyke system excluding fish in the 1st year of its establishment have been recorded for Rs. 5784.00 from 0.09 ha.

In the on-going research project, another study has been conducted to evaluate the growth and yield performance of cauliflower (*Brassica oleracea* L.var. botrytis) as influenced by different combinations of NPK fertilization has been studied to delineate the best performing combinational doses of NPK application on two varieties of cauliflower *(Brassica oleracea L.var. botrytis)* cv. Pusa Snowball K-1 and Pusa Himjyoti. Four different combinations of NPK *viz.* T0:0:0:0, T1:80:30:60, T2:120:60:80 and T3:150:70:100 NPK with 3 replications each were used in the present study to study the effect of NPK combinations in terms of growth, yield and quality attributes of cauliflower using two way factorial analyses. Results (Tables 58-60) revealed that NPK application of 120:60:80 kg ha^{-1} was found to be performing better for yield contributing characters of cauliflower var. Pusa Snowball K-1 with maximum plant weight (1.50 kg/plant), net curd weight (659 g/plant), curd diameter (13.33 cm), curd height (10.12 cm), stalk length (3.25 cm) and curd yield per plot (14.29 kg/plot), whereas, treatment T3 when applied on Pusa Snowball K-1 resulted in better growth of cauliflower in terms of plant height (37.16 cm), plant spread (47.23 cm) and number of leaves (14.93) as shown in Table 58. The study also revealed that ascorbic acid as well as â-carotene content in harvested curds showed a decreasing trend with increasing level of NPK inputs irrespective of variety. Evaluation of comparative performance of cauliflower varieties viz. Pusa Snowball K-1 and Pusa Himjyoti in the climatic condition of Western plain zones of Uttar Pradesh suggested better performance of Pusa Snowball K-1 with NPK application of 120:60:80 could be suitable combination for cauliflower cultivation in Western Uttar Pradesh over Pusa Himjyoti in terms of growth and yield attributes as shown in Table 58.

Similarly in an another study, experiment has been conducted during 2016-2017 to examine the higher doses of P_2O_5 application on pea *(Pisum sativum* L.*)* cv. Arkel and Azad P-1 as affected by P2O5 of western plain zone Uttar Pradesh 2016-17.Four levels of P2O5 viz. T_0:0, T_1:60, T_2:90 and T_3:120 P_2O_5 with 3 replications each were used in the present study two way factorial (factor 1: 4 levels of NPK combination X factor 2: two varieties of pea) analysis. Two different varieties of pea namely Arkel and Azad P-1 were used in the present study for delineating the effect of different P2O5 levels on pea growth, yield and quality attributes. Results revealed that P2O5 application of 120 kg ha^{-1} was found to be performing better for pea var. Arkel and Azad P-1 in terms of overall attributes with maximum pod yield per plot (9.24 kg/plot). Thus, application of 120 dose of P2O5 was found to be suitable for pea production. Evaluation of comparative

Table 58: Effect of different NPK combinations on growth attributes of cauliflower

Treatment#	Plant Height 30 DAT	Plant Height 45 DAT	Plant Spread 30 DAT	Plant Spread 45 DAT	Number of Leaves 30 DAT	Number of Leaves 45 DAT	Plant Stand (%)
NPK level							
T0 (control)	18.40^{a}	29.33^{a}	23.93^{a}	38.23^{a}	9.95^{a}	12.52^{a}	86.34^{a}
T1	21.06^{b}	30.76^{b}	25.95^{b}	39.21^{a}	10.48^{b}	12.65^{a}	88.89^{b}
T2	23.16^{c}	32.90^{c}	27.44^{c}	41.27^{c}	10.55^{b}	13.03^{b}	92.13^{c}
T3	23.43^{c}	33.81^{c}	27.79^{c}	42.22^{c}	11.57^{c}	14.13^{c}	87.35^{a}
SEM±	**0.17**	**0.32**	**0.26**	**0.36**	**0.11**	**0.11**	**0.35**
Variety							
V1 (Pusa Snowball) K-1	24.67^{b}	34.71^{b}	31.24^{b}	45.06^{b}	12.65^{b}	13.89^{b}	89.39^{b}
V2 (Pusa Himjyoti)	18.35^{a}	28.69^{a}	21.32^{a}	35.40^{a}	8.63^{a}	12.27^{a}	87.96^{a}
SEM±	**0.12**	**0.23**	**0.18**	**0.25**	**0.04**	**0.08**	**0.25**
NPK level x Variety							
V1T0	23.33^{e}	32.53^{d}	29.06	42.23	11.77^{d}	13.52	87.04
V1T1	24.26^{f}	32.71^{d}	30.70	43.94	12.42^{e}	13.35	89.82
V1T2	25.71^{g}	36.43^{e}	32.49	46.82	12.44^{e}	13.74	93.06
V1T3	25.39^{g}	37.16^{e}	32.71	47.23	13.96^{f}	14.93	87.67
V2T0	13.46^{a}	26.12^{a}	18.81	34.22	8.13^{a}	11.52	85.65
V2T1	17.86^{b}	28.80^{b}	21.20	35.48	8.55^{ab}	11.94	87.96
V2T2	20.61^{c}	29.37^{bc}	22.38	35.71	8.66^{b}	12.31	91.21
V2T3	21.46^{d}	30.46^{c}	22.87	37.21	9.19^{c}	13.32	87.04
SEM±	**0.24**	**0.46**	**0.36**	**0.50**	**0.15**	**0.16**	**0.49**
ANOVA, P>F							
NPK Level	**	**	**	**	**	**	**
Variety	**	**	**	**	**	**	**
NPK level x Variety	**	*	NS	NS	**	NS	NS

Mean values (* P<0.05, ** P<0.01, NS = Non-Significant); Data expressed as Mean of Triplicate measurements (n = 3)
#T0:0:0:0, T1:80:30:60, T2:120:60:80 and T3:150:70:100

Table 59: Effect of different NPK combinations on yield contributing characters of cauliflower

Treatment#	Gross Plant Weight (kg)	Net Curd Weight (g)	Curd Diameter (cm)	Curd Height (cm)	Stalk Length (cm)	Curd Yield/ Plot (kg)
NPK level						
T0 (control)	1.21^{a}	390.56^{a}	10.06^{a}	7.67^{a}	2.11^{a}	7.69^{a}
T1	1.27^{b}	419.95^{b}	10.36^{a}	7.92^{b}	2.22^{a}	8.65^{b}
T2	1.41^{d}	497.45^{d}	11.64^{b}	8.54^{d}	2.71^{b}	10.92^{d}
T3	1.33^{c}	455.77^{c}	10.39^{a}	8.14^{c}	2.23^{a}	9.43^{c}
SEM ±	**0.01**	**2.61**	**0.13**	**0.06**	**0.05**	**0.11**
Variety						
V1 (Pusa Snowball K-1	1.37^{b}	553.45^{b}	12.17^{b}	9.72^{b}	2.80^{b}	11.50^{b}
V2 (Pusa Himjyoti)	1.24^{a}	328.39^{a}	9.05^{a}	6.41^{a}	1.83^{a}	6.85^{a}
SEM ±	**0.01**	**1.85**	**0.09**	**0.04**	**0.04**	**0.08**

Treatment#	Gross Plant Weight (kg)	Net Curd Weight (g)	Curd Diameter (cm)	Curd Height (cm)	Stalk Length (cm)	Curd Yield/ Plot (kg)
			NPK level x Variety			
V1T0	1.26	455.90^{c}	11.47	9.32	2.58	8.96^{c}
V1T1	1.32	516.10^{d}	12.01	9.61	2.78	10.67^{d}
V1T2	1.50	659.00^{f}	13.33	10.12	3.25	14.29^{f}
V1T3	1.41	582.80^{e}	11.88	9.84	2.60	12.06^{e}
V2T0	1.16	325.13^{ab}	8.65	6.03	1.63	6.43^{a}
V2T1	1.22	323.80^{a}	8.70	6.23	1.66	6.64^{a}
V2T2	1.32	335.90^{b}	9.95	6.95	2.16	7.55^{b}
V2T3	1.25	328.73^{ab}	8.90	6.45	1.85	6.80^{a}
SEM ±	0.02	3.69	0.18	0.08	0.07	0.15
			ANOVA, P>F			
NPK Level	**	**	**	**	**	**
Variety	**	**	**	**	**	**
NPK level x Variety	**NS**	**	**NS**	**NS**	**NS**	**

Mean values (* P<0.05, ** P<0.01, NS = Non-Significant); Data expressed as Mean of Triplicate measurements (n = 3)

#T0:0:0:0, T1:80:30:60, T2:120:60:80 and T3:150:70:100

Table 60: Effect of different NPK combinations on Ascorbic acid and â-Carotene content of Cauliflower

Treatment#	Ascorbic Acid (mg/100 g)	â-Carotene (ug/100 g)
	NPK Levels	
T0 (control)	57.24^{d}	0.30^{d}
T1	54.65^{c}	0.27^{c}
T2	52.11^{b}	0.24^{b}
T3	49.93^{a}	0.22^{a}
SEM ±	**0.29**	**0.01**
	Variety	
V1 (Pusa Snowball K-1)	44.09^{a}	0.20^{a}
V2 (Pusa Himjyoti)	62.88^{b}	0.30^{b}
SEM ±	**0.21**	**1.85**
	NPK level x Variety	
V1T0	47.69	0.24
V1T1	45.03	0.21
V1T2	42.89	0.18
V1T3	40.75	0.16
V2T0	66.79	0.35
V2T1	64.27	0.33
V2T2	61.33	0.30
V2T3	59.12	0.28
SEM ±	**0.41**	**0.01**
	ANOVA, P>F	
NPK Level	**	**
Variety	**	**
NPK level x Variety	**NS**	**NS**

Data expressed as Mean ± SE of triplicate measurements (n=3); Mean in the same column bearing different superscripts vary significantly (P<0.05)

#T0:0:0:0, T1:80:30:60, T2:120:60:80 and T3:150:70:10

performance of pea varieties viz. Arkel and Azad P-1in the climatic condition of Western plain zones of Uttar Pradesh suggested better performance of Azad P-1 over Arkel in terms of growth and yield attributes. The study also revealed that ascorbic acid as well as Total Sugar content in harvested pods showed a decreasing trend with increasing level of P_2O_5 inputs irrespective of variety as shown in Fig 27. It can be concluded from this study that cauliflower variety Pusa Azad P-1 with P2O5 application of 120 kg ha^{-1} was found to be

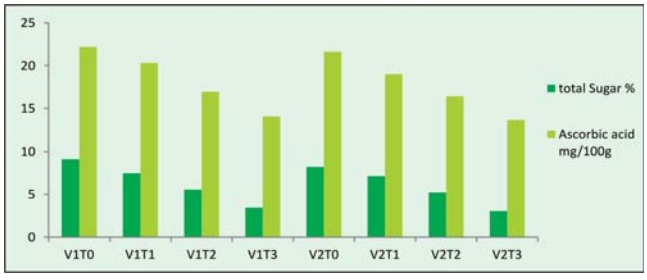


Fig. 27. Interaction of NPK levels and variety on quality attributes of table pea

Table 61: Interaction of NPK levels and variety on growth attributes of table pea

Treatment	Days to germination	Plant Height 20 Days	Plant Height 40 days	Plant Height 60 Days	Plant stand 15days	Plant stand 30days	Plant stand 60days	Plant stand 90days
NPK level								
T0 (control)	9.39^{c}	8.04^{a}	22.31	31.27^{a}	73.81^{a}	76.93^{a}	77.38^{a}	71.09^{a}
T1	8.49^{b}	8.40^{a}	22.65	32.39^{b}	77.85^{b}	79.80^{b}	81.23^{b}	75.03^{b}
T2	8.16^{b}	9.21^{b}	23.08	34.38^{c}	82.86^{c}	84.24^{c}	85.31^{c}	77.63^{b}
T3	7.44^{c}	11.38^{c}	23.78	36.92^{d}	89.07^{d}	90.53^{d}	91.34^{c}	81.33^{c}
SEM±	0.18	0.24	0.19	0.18	0.53	0.46	0.44	0.94
Variety								
V1 (Arkel)	8.41	7.74^{a}	22.88^{a}	32.96^{a}	79.75^{a}	82.13^{a}	83.47	72.70^{a}
V2 (Azad P-1)	8.32	10.77^{b}	23.03^{b}	34.53^{b}	82.04^{b}	83.62^{b}	84.16	79.84^{b}
	0.12	0.17	0.14	0.13	0.38	0.32	0.31	0.67
NPK level x Variety								
V1T0	9.44	7.42^{a}	22.00	29.91^{a}	70.51^{a}	74.70^{a}	75.25^{a}	66.84
V1T1	8.22	7.54^{a}	22.55	31.77^{b}	75.33^{b}	78.07^{b}	80.14^{b}	70.14
V1T2	8.33	7.72^{ab}	23.13	34.16^{d}	81.66^{c}	83.11^{c}	84.62^{d}	73.85
V1T3	7.66	8.31^{abc}	23.85	36.01^{e}	91.10^{f}	92.66^{f}	93.88^{f}	79.96
V2T0	9.33	8.67^{bc}	22.61	32.64^{c}	77.10^{b}	79.17^{b}	79.51^{b}	75.33
V2T1	8.77	9.26^{c}	22.76	33.01^{c}	79.96^{c}	81.55^{c}	82.33^{c}	79.92
V2T2	7.99	10.71^{d}	23.05	34.63^{d}	84.07^{d}	85.36^{d}	85.99^{d}	81.40
V2T3	7.21	14.45^{e}	23.70	37.83^{f}	87.05^{e}	88.40^{e}	88.80^{e}	82.70
	0.25	**0.34**	**0.27**	**0.26**	**0.75**	**0.65**	**0.62**	**1.32**
ANOVA, P>F								
Main effect								
NPK Level	**	**	NS	**	**	**	**	**
Variety	NS	**	**	**	*	*	NS	**
NPK level x Variety	NS	**	NS	*	**	**	**	NS

Mean values (* P<0.05, ** P<0.01, NS = Non-Significant)
Data expressed as Mean of Triplicate measurements (n = 3)

appropriate for western plain zones of Uttar Pradesh in terms of growth, yield and quality attributes as shown in Table 61.

Project title: Comparative study of role of women in predominant farming systems of Western plain zone of UP and Hillzone of Uttarakhand

The study area encompasses the pre-dominant farming systems of Western plain zone of Uttar Pradesh, India. A survey was conducted in three districts of Western plain zone of Uttar Pradesh i.e Meerut and Saharanpur and Bulandshahar in the year 2015-2016. The total sample comprises a random sample of 180 households i.e. (3 District x 3 blocks/district x 2 villages/ block x 10 households) using a stratified sampling frame. A total of 180 households were selected for the study. Four pre-dominant farming systems have been further identified covering a total of 176 households. Data was collected by personal interview method using pre-tested structured questionnaire through face to face interaction with the men and women farmers. Both the quantitative and qualitative data were used in the study.

The analysed data revealed that around 62.9% of households were having Crop+ dairy (1C+1-2B) farming system covering 57 per cent total farming area with annual net return of Rs 1,24730/- and was a dominant farming system in western plain zone of Uttar Pradesh (Table 62).

Around 94 per cent households were found under the male headship and reaming was found under the female headship. Amongst them maximum numbers of female headed households were found in FS_3 (17%) whereas FS_2 and FS_4 were found under the male headship. Further study shows that around 89 per cent farmers were involved in farming as a major occupation and remaining 11 % were found engaged in farming along with farm labour as major occupation. All the households were doing farming in FS_2 whereas in FS_3 around 25 per cent households were working as labourers along with farming. The average landholding was found 2.59 ha per farm household under men ownership and 0.17 ha per farm household under women ownership. Amongst them FS_2 was having maximum farm size i.e. 6.60 ha per farm household under men ownership and 0.45 ha per farm household under women ownership. FS_4 exhibiting the least farm size as 1.07 ha per farm household under men ownership and nil area under women ownership (Table 63).

Data pertaining to Table 64 and Fig. 28 clearly shows that the maximum female contribution was found

Table 62: Pre-dominant farming systems of Western plain zone of Uttar Pradesh

		Pre dominant farming systems			
		FS_1 (n=113)	**FS_2 (n=17)**	**FS_3 (n=34)**	**FS_4 (n=12)**
Area share (%)	*Meerut*	74.8	1.2	19.4	4.5
	Saharanpur	23.7	62.6	9.3	4.3
	Bulandshahar	72.9	3.1	23.9	-
	Overall	57.1	22.3	17.53	2.93
Farmer's distribution (%)	*Meerut*	80	1.6	15	3.3
	Saharanpur	36.6	26.6	19.6	17
	Bulandshahar	72.1	3.5	23.9	-
	Overall	62.9	10.6	19.6	6.77
Net Return (Rs)	*Meerut*	118340	265800	112650	120420
	Saharanpur	145600	426460	130420	122600
	Bulandshahar	110250	254000	108500	-
	Overall	124730	315420	117190	121510

*FS_1: Crop+ Dairy (1C+1-2B), FS_2 : Crop + Horticulture (Fruits)+ Dairy (2C+ 1-2 B), FS_3 : Crop + Horticulture (Vegetables) + Dairy (1C + 1B), FS_4 : Horticulture +Crop+ Dairy (1C+1B)

Table 63: Socio-economic status of farmers in pre-dominant farming systems of Western Plain Zone of Uttar Pradesh

Variables	FS_1: (n=113)	$FS_{2:}$(n=17)	$FS_{3:}$ (n=34)	FS_4: (n=12)	Mean±Sd
Household headship (%)					
Male	105 (92.9)	100	28(82.35)	**100**	**93.8**±8.36
Female	8 (7.07)	0	**6 (17)**	0	6.01±8.004
Occupation (% of households)					
Farming	100 (82.30)	**100**	33(97.05)	9 (75)**3 (25)**	88.58±11.91
Farming + Farm labour	20 (17.69)	0	1(2.94)		11.40±11.91
Farm size (ha/farm household)					
Male	1.28	6.60	1.41	**1.070**	**2.59**±2.67
Female	0.06	**0.45**	0.17		0.17±0.19
Leased Farm size(ha/farm household)					
Male	**0.80**	0.26	0.29	0.15	0.37±0.28
Female	0.021	**0**	0	0	0.005±0.01
Access to land (% of households)					

in FS_3 : Crop + Horticulture (Vegetables) + Dairy (1C + 1B) followed by FS_1: Crop+ Dairy (1C+1-2B). In various activities/farm operations *viz.* Collection and carrying of wood for fuel through headload, carrying of fodder through headload as well as through cart, collection as well as carrying of dung through headload, milking, chaff cutting using electric/diesel machine, sett planting through manual dropping of sugarcanes, weeding, harvesting of field crops, dehusking of maize, seed treatment using local materials, winnowing through fan as well as under natural wind the female contribution was found highest (34.8-100%). However in terms of activities/farm operations *viz.* paddy transplanting, FYM preparation, furrow irrigation, harvesting of sugarcane and seed treatment for storage using chemical the female contribution was found highest (28-95 %). The least female contribution was observed in FS_2: Crop + Horticulture (Fruits) + Dairy (2C+ 1-2 B) farming system, however the female contribution through hired labour was found maximum in $FS_{2.}$ Collection and carrying of fodder and paddy transplanting are main activities that has been exclusively carried out by hired

Table 64: Women participation index on drudgery prone activities

Feminine Farm operations		FS_1 (n=113)		FS_2 (n=17)		FS_3 (n=34)		FS_4 (n=12)	
Drudgery prone activities		Women Participation Index (%)							
		FL	HL	FL	HL	FL	HL	FL	HL
Carrying of dung	Headload	94.0	-	64.91	-	**100**	-	**100**	-
Collection and carrying of fodder	Headload	66.63	29.54	10.76	86.15	65.30	39.69	92.6	-
Cane cutting	*Balkati/Kasola*	35.71	11.42	24.32	-	45.16	-	33.0	-
De-trashing and de-topping	Using traditional knife	44.44	25.0	33.7	33.7	35.93	46.97	50.0	16.6
Harvesting of field crops	Using serrated sickle	55	37	19	68	82	12	83	8
Paddy transplanting	Manual	27.7	72.9	0	100	7.31	92.68	24.24	75.75
Total Mean ± SE		53.91± 9.79	29.31± 110.25	25.44± 9.18	47.97± 17.6	55.95± 13.6	31.89± 14.6	63.80± 13.18	16.72± 12.10

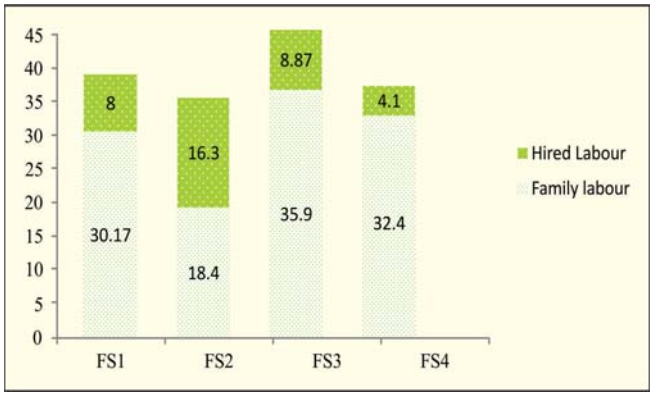


Fig. 28. Female contribution (%) in pre-dominant farming systems

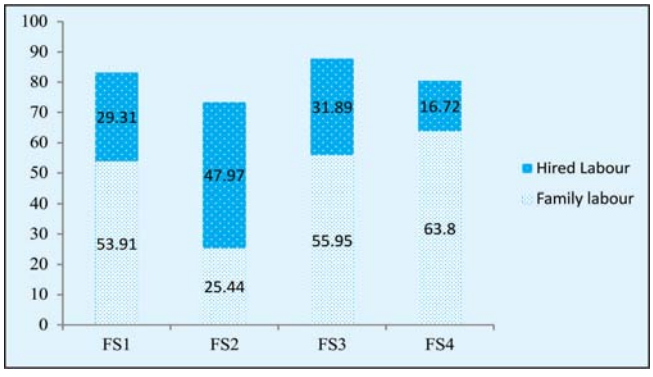


Fig. 29. Women participation index (%) on drudgery prone activities in pre-dominant farming systems of WPZ of UP

female workers. This is due to the highest farm size under both the male and female ownership as well as highest net returns under FS_2.

The women participation index on drudgery prone activities was found highest in the female workers (family and hired) of FS_3 (87.8 per cent) followed by FS_1 (83.21 per cent). However, the highest women participation index on drudgery prone activities amongst family female workers was found in FS_4 (63.8 per cent). This may be due to reason of least farm size (1.07 ha^{-1} household) under male ownership as well as nil farm size under female ownership. Similarly, the highest women participation index on drudgery prone activities amongst hired female workers was found in FS_4 (47.97 per cent). This is due to the highest farm size under both the male and female ownership (6.60 and 0.45 ha^{-1} household) respectively (Table 64 and Fig. 29).

Externally Funded Projects

Project Title: Ensuring Food and Nutritional Security through Integrated Farming System in Western Plain Zone of U.P. (Farmers First Programme)

Under the FARMER FIRST programme of the ICAR, a project has been undertaken in the Khatauli block of district Muzzafarnagar, in the Western plain zone of Uttar Pradesh. Three villages have been selected under the programme viz. Sonta, Sathedi and Bhangela villages. During the reporting period the following activities/interventions were carried out in different modules of the farming system prevalent in the villages.

On farm trial was conducted in all the three villages namely Sonta, Sathedi and Bhangela of the Farmer FIRST project. A total of 659 trials were conducted on management of nutrients (N 175, P 80. K 120, Sulfur 40, Zinc 25 and Boron 5 kg. per hectare) and plant protection measures (for controlling shoot borer and milli-bug, Trico card was used 3 times in the rainy season and for the control of pokkahboeng disease Carbendazim @ 0.2% sprayed on the crop) for improving the yield and quality of sugarcane. It was found that yield of sugarcane was improved to15.01, 14.66 and 10.22 %, respectively in different villages in comparison to Farmer's practice (Table 65).

The following three interventions have been adopted in wheat crop for improvement in yield:

i. **Introduction of improved varieties of late sown wheat:** Improved varieties of wheat namely PBW-658, PBW-590 and DBW-71, along with nutrient management and improved package of practices were demonstrated at farmer's field in all the 3 villages. The details of quantity of seed, area and number of household covered for different varieties have been presented in Table 66.

ii. **Line sowing and Fertilizer management in wheat:** Line sowing of wheat using seed drill and multi crop seed drill was demonstrated at Farmers field. Besides recommended dose of fertilizer trial was demonstrated and compared with farmers practice.

Activities organized under Farmer First Project

Sl No	Particulars	Date	Participants (nos.)
1	Training on value addition of farm produce (Mixed jam, Blended Squash, Ginger paste)	10-11-2017	10
2	Training on value addition of farm produce (Mixed jam, Blended Squash, Ginger paste)	24-11-2017	10
3	World Soil Health Day	05.12.2017	150
4	Training of value added jaggery production to Self-Help Groups (SHG)	15-12-2017	10
5	Kisan Gosthi on raising of disease free nursery of fruits and vegetables through improved technologies	20.02.2018	235
6	MahilaKrishakGosthi cum Nutritional awareness camp.	09-03-2018	147
7.	Kisan Gosthi cum Animal Health Camp.	14.03.2018	271
8.	Kisan Gosthi on Crop Management and Animal Health Camp.	23.03.2018	247

Module wise (crops, livestock, enterprise, NRM and IFS) progress of technology assessment and demonstration

1. Cropping Systems Management:

Sugarcane –ratoon- wheat system:

A. Nutrient and plant protection management in Sugarcane:

1.	Problem	Low production due to application of imbalance fertilizer and poor plant protection management.
2.	Name of Technology	Intervention of Nutrient and pest management in Sugarcane.
3.	Potential Solutions	Farmers trained for application of balance nutrients and protection of crop from insect, pest and diseases.
4.	Expected Out put	Improvement in yield and B:C ratio.
5.	Plot area	0.20ha.
6.	Source of Technology	ICAR-IIFSR, Modipuram
7.	Nos. of house hold	659
8.	Critical Inputs	Fertilizer, micronutrients and pesticides.
9.	Area covered	131.80ha.

Table 65: Comparative performance of sugarcane between Farmer's practice and on Farm trials.

Name of the village	Farmer Practice				On Farm Trials				
	Length of Cane (cm)	Weight of cane (Kg)	No per running meter (No.)	Total production (Q/ha)	Length of Cane (cm)	Weight of cane (Kg)	No per running meter (No.)	Total production (Q/ha)	Percent increase in yield
Sonta	209.67 ± 4.96	1.61 ± 0.06	5.90 ± 0.11	678.35 ± 6.91	242.07 ± 5.65	2.00 ± 0.06	6.50 ± 0.10	780.17 ± 9.97	15.01
Sathedi	288.10 ± 4.54	1.82 ± 0.04	13.95 ± 0.30	637.6 ± 8.64	323.6 ± 4.48	2.10 ± 0.03	15.25 ± 0.19	731.1 ± 7.95	14.66
Bhangela	290.6 ± 4.45	1.73 ± 0.05	12.75 ± 0.16	654.00 ± 8.33	316.60 ± 5.43	1.95 ± 0.05	13.4 ± 0.15	720.85 ± 5.99	10.22
Overall Mean	238.64 ± 4.95	1.67 ± 0.04	8.61 ± 0.35	666.51 ± 5.13	270.44 ± 5.24	2.01 ± 0.04	9.34 ± 0.37	760.46 ± 7.02	14.09

B. Introduction of improved varieties of Wheat with full package and practice:

1.	Problem	Low production due to late sowing of wheat after harvesting of sugarcane ratoon and poor crop management.
2.	Name of Technology	Demonstration of high yielding late sown varieties of wheat with full package and practice.
3.	Potential Solutions	Introduction of late sown improved varieties of wheat (PBW658, PBW 590 and DBW 71) with crop management.
4.	Expected Out put	Improvement in yield as well as in B:C ratio.
5.	Plot area	0.15 ha.
6.	Source of Technology	ICAR-IIFSR, Modipuram
7.	Nos. of house hold	301
8.	Critical Inputs	Seed of improved wheat varieties, Fertilizer and weedicide.
9.	Area covered	70 ha.

Table 66: The details of quantity of seed, area and number of household covered

Name of the variety	Bhangela			Sathedi			Sonta		
	Quantity (q.)	Area covered (ha)	No. of house-holds covered	Quantity (q.)	Area covered (ha)	No. of house-holds covered	Quantity (q.)	Area covered (ha)	No. of house-holds covered
Wheat									
PBW658	4.0	4.0	17	4.0	4.0	12	12.0	12.0	35
PBW 590	7.0	7.0	26	12.0	12.0	57	6.0	6.0	20
DBW71	12.0	12.0	56	8.20	8.20	41	4.80	4.80	40
Total	23	23	96	24.2	24.2	110	22.8	22.8	95

iii. Weed Management: Weed management in wheat through application of weedicide named "Total"(Sulfosulfuron 75% + Metsulfuron methyl 5% WG)@ 16 g in 150 liters water in wheat was demonstrated at farmer's field.

All the three varieties are late sown varieties of wheat recommended for this region. The variety DBW 71 was found superior in all the growth and production traits than the other two varieties and exceeded 14.84 % in grain yield in comparison to farmers practice (Table 67). The DBW 71 is also superior in all the growth indicators resulting its better performance in grain and straw production. The variety PBW 658 followed the same trend and comparable to DBW 71 but recorded superior from PBW 590, both in grain as well as in straw yield (Table 68). The farmers accepted DBW 71 as superior variety not only in grain yield but in taste and quality of chapatti.

Microclimatic variations in Agri-horti farming System

Four crop environment namely Banana sole crop, Sugarcane sole crop, Poplar+wheat and Poplar+ banana were undertaken for quantification of the micro climate influenced by the different crop combinations. To quantify the variation in microclimate, in-situ observations of CO_2 (ppm), RH (%) and temperature (^oC) were recorded during clear sky mid-day at two height i.e. 50 cm and 100 cm above the ground level. The microclimate condition at 50 cm above the ground in banana sole crop was found to be moderate with 594.2 ppm CO_2, 18.9% RH and 36.9^oC temperature in comparison to bare field (592.6 ppm CO_2, 19.3% RH and 35.1^oC temperature) and Sugarcane sole crop (594.8 ppm CO_2, 19.2% RH and 37.7^oC temperature). In Poplar-banana system significantly higher concentration of CO_2 (596.0 ppm) was

Table 67: Growth Indicators of different Wheat varieties

Name the variety	Av. of Tillers/ plant	Total tillers / sq.m	Length of ear head (cm)	Av. no. of grains / ear head	Fresh wt. (kg)	Dry wt. (Kg)	Plant height (in ft.)	No. of irrigation
PBW 658	5.68 ± 0.18	330.21 ± 12.77	10.14 ± 0.23	50.23 ± 1.20	2.02 ± 0.03	1.92 ± 0.04	2.47 ± 0.05	5.07 ± 0.12
PBW 590	5.28 ± 0.14	331.77 ± 10.93	8.21 ± 0.08	45.97 ± 0.59	1.83 ± 0.03	1.75 ± 0.03	2.50 ± 0.04	5.20 ± 0.08
DBW 71	6.38 ± 0.12	369.49 ± 11.77	11.75 ± 0.17	59.88 ± 0.44	2.49 ± 0.02	2.41 ± 0.03	2.52 ± 0.04	5.23 ± 0.07

Table 68: Comparative production performance of different varieties of Wheat

Name of the variety	OFT Yield		FP Yield		Percent increase in yield	
	Grain q./ha	Straw q./ha	Grain q./ha	Straw q./ha	Grain q./ha	Straw q./ha
PBW 658	48.83	52.36	42.0	46.0	16.26	13.82
PBW 590	45.15	49.15	41.00	50.0	10.12	-0.09
DBW 71	50.53	53.23	44.0.0	52.0	14.84	2.40
Mean =	48.17	51.58	41.50	49.53	13.79	5.38

recorded however, RH (18.2%) and temperature (35.6°C) were found lower than the banana sole crop. At 100 cm above the ground level, the highest CO_2 concentration (599.9 ppm) was recorded in Poplar+banana farming systems with 18.4% RH and 35.5°C ambient temperature followed by Poplar+wheat with 595.3 ppm CO_2 (Fig. 30). Better condition of banana crop was recorded under Poplar+banana forestry-horti system than the banana sole crop.

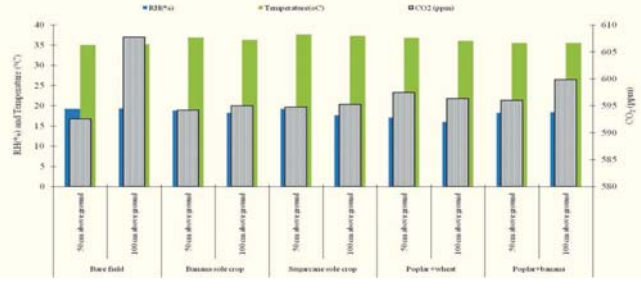


Fig. 30. Influence of various crops and its combination on microclimate i.e. CO_2 (ppm), RH (%) and temperature (°C)

Critical input intervention in horticultural crops

Among the different horticultural crops, fruit plantation of banana, lemon, guava, mango and litchi were carried out in the rainy season (July 2017) in the orchards of 5 farmers of Bhangela village. During the study, farmers were made aware regarding the significance of fruits, vegetables and kitchen gardening. For this, plantation of improved varieties of fruit plants was done. Also farmers were imparted skill about the scientific management of different fruits and vegetables. Promotion of nutritional kitchen gardening on bare land nearby house/water sources etc. was promoted by providing mini kit of seasonal vegetables to the farmers. Cost of these mini kits were Rs. 35-40/kit. With such intervention, monthly vegetable availability increased from 45-50 kg/house.

Initial bench mark survey made in the study reveals that farmers spend Rs. 400 to 700/ month on purchase of vegetables, which can easily be saved with kitchen gardening alongwith nutritious vegetables. In our study, estimated average saving of 500 to 850 during *Kharif* (monsoon) and Rs1000- 1200/- during *Rabi*(winter) was obtained through kitchen gardening. Such interventions were eye opener to many progressive farmers of the study area. The details of few innovative farmers who were encouraged to develop horticulture based farming systems are being presented here under:


Photo 25. In-situ observation of the CO_2 (ppm), RH (%) and temperature (°C)

1. Name of Farmer : Shyam Pal
Village : Sathedi
District : Muzaffarnagar
Area : 2.40 ha.

Names of Intervention given: Improved variety of wheat (PBW 658, PBW 590 and DBW 71), intercropping, promotion of pulse crop, Banana cultivation (Agro-Hort.), Feed supplement of animals (mineral mixture, Calcium, Vitamin mixture) Vermicomposting and kitchen Garden.

Mr. Shyam Pal of Sathedi village has been selected as innovator farmer for cropping system management

Table 69: Economic analysis of farming system of Sh. Shyam Pal

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
CS 1_1.24 ha	Sugarcane+ Blackgram-ratoon-Wheat	393305	203360	189945
CS2_0.10 ha	Sorghum-Berseem-Moong	24400	8500	15900
CS3_0.10 ha	Bajra-Oat-Black gram	17550	6200	11350
CS4_0.40 ha	Popular		Output awaited	
CS5_0.40 ha	Popular + Banana			
CS6_0.16 ha	Banana			
	Animal Module			
	3 Cows (4750 lts. Milk) (1Sahiwal +1HF+1Crossbred)	148500	81200	67300
	Manure (101 q.)	10100	2000	8100
	Vermin-compost (30 q.)	12000	3000	9000
	Kitchen Garden	1225	450	775
	Total Returns from system	607080	304710	302370
	B:C Ratio		**1.99**	
Benchmark	Crop Module			
1.40 ha.	Sugarcane-ratoon-Wheat	367115	228790	138325
0.20 ha	Sorghum-Berseem	32000	12800	19200
0..80 ha	Popular	Output awaited		
	Animal Module:			
	3 Cows Milk (4150 Lts.)	124500	75200	49300
	Manure (131 q.)	13100	3000	10100
	Total Returns from system	536715	319790	216925
	B:C Ratio		**1.68**	

module. He has planted banana in as intercropping in popular crop. The benchmark income of Shri Shyam Pal was Rs. 2,16,925/- before the intervention of improved IFS. But after the initiation of programme he developed different modules as specified in the Table 69 and his net income was improved to Rs. 3,02,370/- by the intervention in different modules during the period.

2. Name of Farmer : Charan Singh
Village : Bhangela,
District : Muzaffarnagar
Area : **0**.4 ha model

For horticulture module, Mr. Charan Singh of Bhangela village has been identified as Farm innovator. Mr. Singh imparted training for cultivation of high value exotic vegetables (broccoli, lettuce, parsley, leek and coloured capsicum) and production of strawberry. He is given mineral mixture, calcium and vitamin mixture and advised how to prepare balanced ration by using local feed ingredients. He is maintaining a cow and buffalo and he has been trained by our team to convert animal dung into vermin-compost for using in his vegetable production. Detailed economic analysis of two adopted farmers under horticultural interventions is given in Tables 70 & 71.

3. Name of Farmer : Mr. Sameer
S/o Shri Akbar Ali
Village : Sonta
District : Muzaffarnagar
Area : **0.13** ha.

Name of Interventions given: Improved variety of vegetable seeds (Pumpkin, cucumber, bottle guard, Tomato, Brinjal, chilies, Turnip and cabbage), Feed supplement to the animals (mineral mixture, Calcium, Vitamin mixture) and improved variety CARI Nirbheek) of poultry.

Table 70: Improved vs benchmark farming system of Sh. Charan Singh

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
CS 1_0.15 ha	Broccoli_2 crops (Oct-April) -Maize (F)_(June-Sept)	35750	10800	24950
CS2_0.10 ha	Lemon Grass (Feb-Dec)+ Leek (Sept-April)	61250	4200	57050
CS3_0.03 ha	Lettuce-red (Sept-April)- Tomato (April-July)	12300	3360	8940
CS4_0.03 ha	Lettuce-green(Sept-April) -Chilli (April_Aug)	13500	2310	11190
CS5_0.03 ha	Chinees Cabbage (Sept-April)- Okra (May-Aug)	13500	2460	11040
CS6_0.03 ha	Cherry Tomato-2 crops (Sept-July)	19200	4800	14400
CS7_0.03 ha	Papaya Boundary Plantation at nursery area	18000	3000	15000
		173500	30930	142570
	Animal Module			
	1 Buffalo+ 1 Cow	120600	60000	60600
	Total Returns from system (0.4 ha)	**294,100**	**90,930**	**2,03,170**
	B:C Ratio		**3.23**	
Benchmark	Crop Module			
	Sugarcane based system	82575	22500	60075
	Animal Module			
	1 Buffalo+ 1 Cow	93000	45000	48000
	Total Farm_0.4 ha	175575	67500	108075
	B:C Ratio		**2.60**	

Table 71: Improved vs benchmark farming system of Sh. Joginder

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
CS1_0.04 ha	Tomato-Cucumber-Cabbage	32500	16000	16500
CS2_0.04 ha	Bottle gourd-Turnip-Brinjal	24000	11875	12125
CS3_0.05 ha	Chillies-Tomato-Pumpkin	41500	19625	21875
	Animal Module			
	02 Buffaloes	115920	82450	33470
	Manure (88 qtl)	8800	2000	6800
	Goat (04 nos.)	21000	9840	11160
	Poultry (06 F + 4 M, 744 eggs*)	10528	1752	8776
	Manure (7 q.)	1400	300	1100
A	Total Returns from system	255648	143842	111806
	B:C Ratio		**1.78**	
Benchmark	Crop Module			
0.13 ha	Rice-Wheat	30600	11600	19000
	Animal Module:			
	02 Buffaloes	100800	82450	18350
	Manure	8800	2000	6800
B	Total Returns from system	140200	96050	44150
	B:C Ratio		**1.46**	

* 08 months egg production.

Nutritional intervention was adopted for improvement in growth and milk production in cattle and buffaloes. Farmers were trained on how to make affordable balance ration using localfeed ingredients. Ration of the milking animals was also balanced by supplementing mineral mixture, fortified Calcium and vitamin mixture (Vimeral). The mineral mixture supplements were given to 460 farm households. For eradiating calcium deficiency in animals 275 farm households were provided with fortified Calcium supplement. Besides vitamin mixtures were provided to 300 farm households. Medicines were also given for the effective control of endo and ecto parasites. The details of the feed supplements and medicines their effects on animals are given in Table 72.

Livestock Module:

A. Nutritional and Animal Management:

1.	Problem	Low production due to imbalance ration and poor management of animals.
2.	Name of Technology	Intervention of nutritional and animal management.
3.	Potential Solutions	Farmers trained for feeding of balance rationwith optimum animal management.
4.	Expected Out put	Improvement in growth and milk yield as well as in B:C ratio.
5.	Animal nos.	500
6.	Source of Technology	ICAR-IIFSR, Modipuram
7.	Nos. of house hold	450
8.	Critical Inputs	Mineral mixture, Calcium, Vitamin mixture, Ecto and Endo parasites control medicines.
9.	Area covered	Farmers of Sathedi,Bhangella and Sontavillages.

Table 72: Details of animal medicines supplied

Name of feed supplement/ Medicine	Quantity supplied (nos.)	Dose per adult animal/ day	Nos. of animals covered	Nos. of household covered	Effect on animals
Mineral Mixture (Agrimin forte)	500 (1 Kg. pack)	100 g. (milking animals) 50 g. (Heifers/dry animals)	500	460	Improving growth rate, Better utilization of absorbed nutrients, increases milk production in animals, improves reproductive efficiency and reduces inter- calving period, improves immunity status.
Calcium	300 (1 Litre Pack)	100 ml (milking animals)	300	275	Sustain milk production, control milk fever and maintain hormonal balance.
Vitamin Mix. (Vimeral)	300 (120 ml Pack)	20 ml	300	300	Removes stress, acts as immunestimulant, increases milk production, improve growth & egg production.
FENTAS PLUS	500 tab.	1 tab./30kg B.W.	90	90	Removing Tapeworms, Roundworms, Hookworms and Whipworms
Taktic 5% (Amitraz I.P. (Vet) 50 mg)	200 (6 ml pack)	2 ml/ litrein water	200	200	Effective control of ticks, mites, lice.
Flupor (Flumethrin -10mg)	200 (30 ml pack)	1 ml/ 10kg B.W.	200	200	Effective control of Ticks, Fleas & Lice.

The result of the effect of nutritional management on milk production is presented in Table 73. The application of balance nutrition resulting overall per day improvement in milk yield in different villages was observed 1.03 ± 0.03 litres/day, which is an improvement of 12.95% as compared to farmer's practice. The per lactation improvement in milk production is expected 225-250 litres of milk. Not only improvement in milk production but animals expressed improvement in reproductive cycles and fertility by getting timely pregnant.

Table 73: Improvement in per day milk production in buffaloes by nutritional management.

Name of the village	Average per day milk production before treatment (lts.)	Average per day milk production after treatment (lts.)	Average per day increase in milk production (lts.)	% increase in per day milk production
Satedi	7.995 ± 0.31	9.027 ± 0.29	1.032 ± 0.04	12.91
Bhangella	7.815 ± 0.25	8.842 ± 0.26	1.027 ± 0.06	13.15
Sonta	8.040 ± 0.21	9.070 ± 0.19	1.030 ± 0.08	12.81
Overall	7.950 ± 0.15	8.980 ± 0.14	1.030 ± 0.03	12.95

Animal husbandry approach for livelihood security of landless farmers

For livelihood security of landless farmers, they were provided with poultry, piggery and goats. 288 Number of poultry (24 landless households, 8 household from each village), 30 piglets (15 landless households, 2 piglets per household) and 18Jamunapari breed of goats (9 landless households with 2 goats per household) were given to the farmers. All the species of animals reared in backyard system. The mean performance of body weights and 8 months egg production of poultry in different villages is presented in table. It was found that the 8 months egg production is higher in Satedi village in comparison to other two villages. The performance of birds of Bhangela village was comparable but the Sonta village shown lower performance (Table 74). The overall mean performance of 8 months egg production is 93.66 ± 2.11eggs.

IFS Models

Cluster wise percentage of households study revealed that the highest landless farmers were reported from the Satheri cluster, whereas least percentage in the same category was recorded in Bhangella cluster with 19.67 %. The highest percentage of households falls under marginal category inBhangela cluster (46.0 %) and Sathedi was found to be the cluster with lowest percentage of households under the same category of farmers. A total of 16.13 % households were recorded in small category of farmers where least percentage (7.0%) of households was recorded in Bhangella cluster. Under Semi-medium category of farmers, Sonta cluster was found to be the highest percentage of households with 10.30% of total households of the village (Table 75). Very meager percentage of households was recorded in medium category of farmer in all the three clusters and total percentage was only 2.03% of the sample size.

The basic aim of the above study was to provide suitable interventions under different category of farmers which are described below.

1. Medium Farmer:

Names of Interventions given: Improved variety of wheat (PBW 658, PBW 590 and DBW 71), Nutrient and pest management in Sugarcane, Feed supplement to animals (mineral mixture, Calcium, Vitamin mixture) and ecto and endo parasite control in animals and kitchen Garden.

The average holding size of the medium farmer was estimated 3.05 ha. The medium farmers are only 8.65 % and lower in numbers in comparison to small,

Table 74: Mean body weights at 20 and 40 weeks of age and 8 months egg production at farmer's field.

Name of the village	*BW 20WK (Kg.)	BW 40WK (Kg.)	Egg Production (nos.)
Sonta	1.375 ± 0.032	2.339 ± 0.047	78.25 ± 4.01
Sathedi	1.313 ± 0.051	1.823 ± 0.056	104.28 ± 2.27
Bhangela	1.106 ± 0.033	1.594± 0.042	99.78 ± 2.33
Overall Mean	1.262 ± 0.025	1.923 ± 0.043	93.66 ± 2.11

*BW = Body weight; WK= Week

Table 75: Cluster wise percentage of household under different categories of farmers

Cluster	Landless	Marginal (<1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)
Sonta	33.40	30.90	23.60	10.30	1.75
Sathedi	49.00	28.30	12.00	7.33	3.00
Bhangela	19.67	46.00	7.00	6.00	0.67
Total (%)	36.22	36.97	16.13	8.65	2.03

marginal and landless farmers. The most prominent cropping system is Sugarcane-Ratoon-Wheat and the most prominent farming system is Crop-Dairy (03 dairy animals). The average benchmark net income of the farmer is Rs. 4,08,002/-, before the intervention of improved IFS, which improved to Rs. 5,32,190/- after the intervention in different modules as specified in the table. The B:C ratio improved from 1.72 to 1.94 (Table 76).

2. Small Farmer:

Names of Intervention given: Improved variety of wheat (PBW 658, PBW 590 and DBW 71), Nutrient and pest management in Sugarcane, Feed supplement to animals (mineral mixture, Calcium, Vitamin mixture), ecto and endo parasite control in animals.

The average holding size of the small farmer was estimated 1.45 ha. The small farmers are 16.13 % and lower in numbers in comparison to marginal and landless farmers. The most prominent cropping system is Sugarcane-Ratoon-Wheat and the most prominent farming system is Crop-Dairy (02 dairy animals). The benchmark net income of the farmers was Rs. 2,02,770/- before the intervention of improved IFS. But after the initiation of programme,their net income was improved to Rs. 314270/- by the intervention in different modules during the period. The B:C ratio improved from 1.68 to 1.88 (Table 77).

3. Marginal Farmer:

Names of Interventions given : Improved variety of wheat (PBW 658, PBW 590 and DBW 71), Nutrient and pest management in Sugarcane, Feed

Table 76: IFS system developed for medium farmer

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
CS1: 2.50 ha	Sugarcane-Ratoon-Wheat	794325	387500	406825
CS2: 0.20 ha	Berseem-Sorghum	34500	17900	16600
CS3: 0.35 ha	Paddy-Wheat	82225	33950	48275
	Animal Module			
	01 Cow	58170	41525	16645
	02 Buffaloes	115920	82950	32970
	Manure (131 q.)	13100	3000	10100
	Kitchen Garden	1225	450	775
A	Total Returns from system	1099465	567275	532190
	B:C Ratio		**1.94**	
Benchmark	Crop Module			
CS1: 2.50 ha	Sugarcane-Ratoon-Wheat	701097	387500	313597
CS2: 0.20 ha	Berseem-Sorghum	34500	17900	16600
CS3: 0.35 ha	Paddy-Wheat	78330	32900	45430
	Animal Module:			
	01 Cow	52500	41225	11275
	02 Buffaloes	100800	82450	18350
	Manure	3750	1000	2750.00
B	Total Returns from system	970977	562975	408002
	B:C Ratio		**1.72**	

Table 77: IFS system developed for small farmer

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
CS1: 1.30 ha	Sugarcane-Ratoon-Wheat	413049	201500	211549
CS2: 0.15 ha	Berseem-Sorghum	25875	13425	12450
	Animal Module			
	01 Cow	58170	41525	16645
	01 Buffaloes	57960	41475	16485
	Manure (88 q.)	8800	2000	6800
A	Total Returns from system	563854	299925	263929
	B:C Ratio		**1.88**	
Benchmark	Crop Module			
CS1: 1.30 ha	Sugarcane-Ratoon-Wheat	364570.44	201500	163070.44
CS2: 0.15 ha	Berseem-Sorghum	25875	13425	12450
	Animal Module:			
	01 Cow	52500	41225	11275
	01 Buffaloes	50400	41225	9175
	Manure	8800	2000	6800
B	Total Returns from system	502145	299375	202770
	B:C Ratio		**1.68**	

supplement to animals (mineral mixture, Calcium, Vitamin mixture), ecto and endo parasite control in animals and Vermi-composting.

The average holding size of the marginal farmer was estimated 0.42 ha. The marginal farmers are 36.96 % and majority in numbers in comparison medium and small farmers. The most prominent cropping system is Sugarcane-Ratoon-Wheat and the most prominent farming system is Crop-Dairy (02 dairy animals). The benchmark net income of the farmers was Rs. 75,690/- before the intervention of improved IFS. But after the initiation of programme, his net income was improved to Rs. 1,03,804/- by the intervention in different modules during the period. The B:C ratio improved from 1.53 to 2.0 (Table 78).

4. Landless Farmer:

a) Landless Farmer (Piggery based):

Name of Intervention: Supply of improved breed Large White Yorkshire breed of piglets, Feed supplement (mineral mixture, Calcium, Vitamin mixture).

The Landless farmers are 36.22 % and majority in numbers in comparison medium and small farmers. Mostly they are doing labour work on daily payment basis. For supporting of their livelihood they are keeping some animals mostly one cow/buffalo or few pigs and some poultry. Mostly they are keeping local nondescript animals having lower growth and production. Therefore, 15 landless farmers of the concerned villages distributed 02 nos. of Large White Yorkshire piglets per farmer to

Table 78: IFS system developed for marginal farmer

Improved IFS	Crop Module	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
	Cropping System			
CS1: 0.32 ha	Sugarcane-Ratoon-Wheat	101674	49600	52074
CS2: 0.10 ha	Berseem-Sorghum	17250	8950	8300
	Animal Module			
	01 Cow	58170	41525	16645
	01 Buffaloes	57960	41475	16485
	Manure (63 qtl)	6300	2000	4300
	Vermicompost (25 q)	10000	4000	6000
A	Total Returns from system	251354	147550	103804
	B:C Ratio		**2.00**	
Benchmark	Crop Module			
CS1: 0.32 ha	Sugarcane-Ratoon-Wheat	89740	49600	40140
CS2: 0.10 ha	Berseem-Sorghum	17250	8950	8300
	Animal Module:			
	01 Cow	52500	41225	11275
	01 Buffaloes	50400	41225	9175
	Manure	8800	2000	6800
B	Total Returns from system	218690	143000	75690
	B:C Ratio		**1.53**	

Table 79: Improved Pig based Farming

	Components	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns(Rs)
	Animal Module:			
	Local pig-2	12800	2000	10800
	Large white York shire-2	32000	7300	24700
	Piglets-05	10000	2000	8000
	Manure (44 q.)	4400	1000	3400
	Total Returns from system	65020	13300	51720
	B:C ratio		**4.88**	
Benchmark				
	Animal Module:			
	Local pig-2	12800	2000	10800
	Manure (q.)	1750	500	1250
	Total Returns from system	14550	2500	12050
	B:C ratio		**5.82**	

Table 80: Livestock based IFS model for marginal farmer

Improved Livestock based farming:	Components	Gross Returns(Rs)	Cost of cultivation (Rs)	Net Returns(Rs)
	Animal Module:			
	Buffalo -1	57960	41475	16485
	Manure	4400	1000	3400
	Poultry (5 F+ 4 M, 470 eggs)*	7240	1575	5665
	Manure (2.5 q.)	540	50	490
	Total Returns from system	70140	44100	26040
	B:C ratio		**1.59**	
Benchmark				
	Buffalo-1	50400	41225	9175
	Manure	4400	1000	3400
	Total Returns from system	54800	42225	12,575
	B:C ratio		**1.30**	

* 08 months egg production.

improve their livelihood. The benchmark net income before the intervention of improved IFS of the farmers was Rs. 12,050/-, which is improved to Rs. 51,720/- by the intervention of improved package of practices (Table 79).

b) Landless Farmer (Poultry +1 Buffalo):

Name of Intervention: Supply of improved variety of poultry (Nirbheek), Feed supplement (mineral mixture, Calcium, Vitamin mixture) and endo (Round worm, tape worm etc.) and ecto parasite control.

For supporting of livelihood of landless farmers, 24 numbers of farmers (08 farmers from each village) distributed 12 poultry chicks per farmer. Some farmers keeping 01 dairy animal for their food security, they have been supported nutritional supplement (mineral mixture, Calcium, Vitamin mixture). The benchmark net income before the intervention of improved farming system of the farmers was Rs. 12,575/-, which is improved to Rs. 26040/- by the intervention of improved package of practices. The B:C ratio improved from 1.30 to 1.59 (Table 80).

Photo 26 & 27. Visit of Shri Suresh Chandel, GB Member, ICAR at farmer's field


Photo 28 & 29. Visit of Dr V. P. Chahal, ADG (Ag. Ext.), ICAR visiting farmer's field

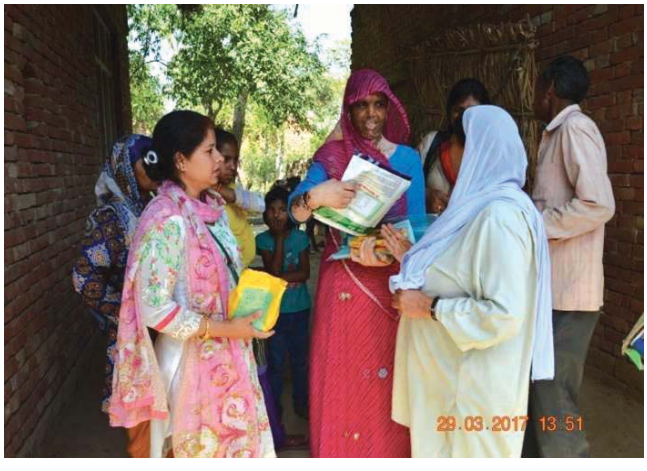



Photo 30 & 31. Promotion of Nutritional Kitchen gardening through distribution of seasonal vegetable kits

a) Other Activities:

1. Blended squash (guava+orange) and (guava+ apple+aonla+orange+ramphal) mixed jam:

For preparation of blended squash fully matured guavas were taken and washed with clean water. The fruits were sliced and dipped for 4-5 hours into drinking water in 1:1 ratio. Afterwards sliced guavas alongwith water was heated and removed the pan before reaching the boiling point so that the pectin content of the guavas could be extracted in water. Afterwards the sliced guavas were crushed into mixer grinder, strained and then juice extracted from oranges was blended together. (The water containing pectin content was kept aside for further use for the preparation of jam). The sugar syrup has been prepared (60%) and mixed with 40 % of blended mixture (guava + orange extract) Citric acid was mixed into the squash (0.4 per cent). Potassium metabisulphite was added as per (FPO, 1954). TSS of blended squash was 48° brix. Blended squash was then packed into PET bottles.

2. Blended squash (guava + pineapple + pomegranate) and mixed jam (guava+ pineapple+pomegranate+apple):

For preparation of blended squash fully matured guavas were taken, and washed with clean water. The fruits were sliced and dipped for 4-5 hours into drinking water in 1:1 ratio. Afterwards sliced guavas alongwith water was heated and removed the pan before reaching the boiling point so that the pectin content of the guavas could be extracted in water. Then the sliced guavas were crushed into mixer grinder, strained and then mixed into crushed and strained pomegranate and pineapple juice.

(The water containing pectin content was kept aside for further use for the preparation of jam). The sugar syrup has been prepared (60%) and mixed with 40 % of blended mixture (guava + pomegranate + pineapple extract) Citric acid was mixed into the squash (0.4 per cent). Potassium metabisulphite was added as per (FPO, 1954). TSS of blended squash was 42°brix. Blended squash was then packed into PET bottles. For the preparation of mixed jam apple and pineapple were washed, peeled, sliced and made into pulp by using mixer grinder. Pomegranate was peeled and the fruit was crushed, strained and extracted into juice. All the material was then mixed into the water in guava pectin. Sugar was taken equal to the weight of the pulp. Around 2/3rd sugar was mixed into the pulp initially while the pulp was kept for heating. Rest of the sugar was mixed after the start of boiling. Before reaching the end point Carboxymethyl Cellulose (0.1 percent along with 1.2 per cent sugar was powdered into fine particles and sprinkled into mixture). Citric acid was mixed into the mixture (0.4 per cent). The end point of the jam was checked using sheet test. The prepared jam was then removed from the flame. Potassium metabisulphite was added as per (FPO, 1954). TSS of mixed jam was 67° brix. The mixed jam was filled into glass bottles.

3. Ginger paste:

Gingers were sorted, washed and the skin was peeled. Then the peeled gingers were cut into small pieces through knife. The ginger pieces were then crushed into paste by using mixer grinder. The ginger paste was heated with 2 percent salt and 0.02 percent glacial acetic acid. After the start of boiling, the paste was removed from heat Potassium metabisulphite was added as per (FPO, 1954). The ginger paste was then filled into glass bottles.

Photo 32. Exhibition cum sale of various products by women SHG

Project title: Cluster based on-farm participatory research in Farming Systems under Tribal Sub plan (Funded under Tribal Sub-plan)

The study area encompasses the tribal farming systems of Tarai and Bhabhar Zone of Uttarakhand. A survey will be conducted in a cluster of two village 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 will be 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. Around 60 per cent of tribal farm households were taken from Thari village Panchayat and 40 per cent of farm household from Veerprur Tara village Panchayat. Under Veerpur Tara village panchayat 20 percent farm households were taken from Maalapuri village and 20 per cent farm household were taken from Tarapuri village. Survey revealed that mean holding size of the households to be 0.52 ha. Small and marginal farms constituted to be around 99 percent. Amongst them 87 percent households were having marginal land size (<1 hactare) Paddy, wheat are the major crops being cultivation in selected cluster. Surghum, berseem and napier crops are being used for green fodder for animals. Crops (paddy-wheat) + Livestock was the dominant farming system found in around 85 per cent of households. Preference among livestock for farm households was 1-2 cows with 1 buffallo. Around 10 per cent of families are also preferred to have goats. The major farm power source used in agriculture is 4-wheel tractor (i.e. 25 to 60 hp) which is about 90 % (i.e. 10 % owned & 70-80% % hired tractor. The electric power is used by 70-80 % only for irrigation purpose. The mechanization level in the tillage operation was noticed about 85-90%

Photo 33. On farm sowing demonstration of improved wheat variety HD 3086

Photo 34. Comparative performance of introduced variety and practice versus farmers variety and practice in wheat

(i.e. 10 % -own & 70-80 % - rental basis). In sowing operation study revealed that the machineries (seed drill) used 10-15 % in cereal crops. The hand operated chaff cutter was around 90%. Harvesting operation was found to be done by combine harvester (15-20 %), and 80-85 % using sickles, threshing (80-85 % using thresher (on rent basis including 2% own).

On-farm sowing of wheat crop with fertilizer-cum-seed drill was demonstrated at 80 farmers' fields. A newly released and improved wheat variety HD 3086 (8 kg seed was given per household for sowing in 0.06 ha land area) was promoted in the region through on-farm demonstration for higher productivity with high resistance to diseases and pests.

Diversification of rice-wheat system by integration of mustard crop (cv. RH 749) (for oilseed and green leaf consumption) was carried out at 50 farmers field (500 g per 0.16 ha). Moreover, for diversification of rice-wheat system as well as for enrichment of household nutrition and income improved varieties for the pulses crops such as lentil (Pant lentil 5, rust resistant) and chick pea (pant gram 186, wilt resistant) were also introduced. The above inclusion was carried out at 58 farmers' field in case of lentil crop and 21 farmer's field in case of chick crop.

Introduction of seasonal vegetables of viz brinjal (cv), (Pant Rituraj) and (Pant Samrat) cowpea (pusa komal) , okra (Kasi pragati) , bottle gourd (pant lauki

Photo 35. Mustard seed distribution to tribal farmers

Photo 36. Krishak Goshthi on seasonal vegtable production cum seed distribution with tribal farmers/women farmers

Photo 37. Demonstration of sowing of okra and cowpea through manually operated seed cum fertilizer drill

3) and ridgegaurd (pant torai 1) was carried out for nutritional kitchen gardening to 100 farmers for better family nutrion under horticulture module. On farm trials for sowing of okra and cowpea through manually operated seed cum fertilizer drill was demonstrated at 10 farmers field.

Skill upgradation in mushroom cultivation through a training programme entitled "Enterpreneurship development in mushroom production for rural and urban youths" conducted by the institute. A total of four farmers were benefited by the training.

Project Title: Development of Climate Resilient Sustainable Integrated Farming System Models for Optimizing Farm Productivity (NMSA)

During the reporting period the following activities were carried out which are listed as under:

Participatory Rural Appraisal (PRA) of 3 villages has been completed by identifying problem and constraints. Selection of beneficiary farmers: Landless and marginal farmers have been selected as per the project proposal. However, small and medium size farmers are not in sufficient number in all the three villages under the project. Survey in all the three villages in the survey schedule developed for the purpose. Benchmark source of farm income and family expenditure is given in Fig. 31 & 32, respectively. Crop and milk productivity in the cluster is given in Fig. 33.

Integrated farming systems model for land less, marginal and small farmers

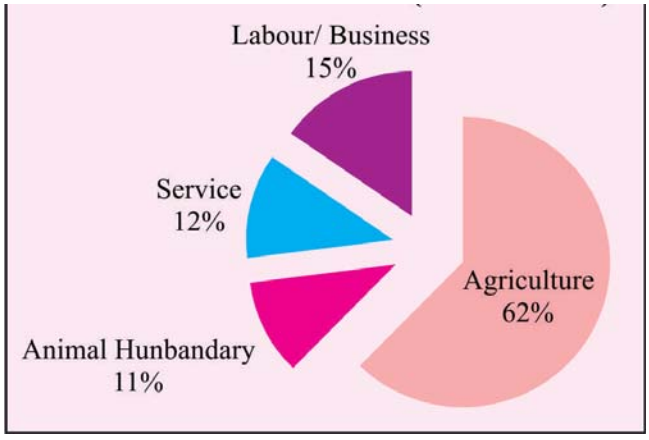


Fig. 31. Status of benchmark farm income

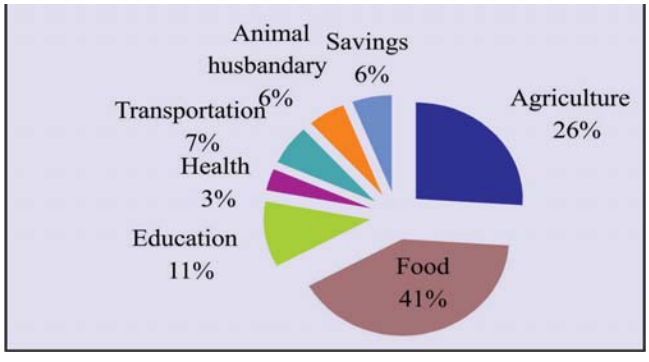


Fig. 32. Status of benchmark family expenditure

Fig. 33. Status of crop and milk productivity in the study cluster

- A training programme on skill development on Mushroom cultivation was successfully organized on February, 2018 for development. Fifty six farmers of the selected villages participated and benefited.
- A training programme on skill development on Fishery was successfully organized on February,

2018 for development. Fifty two male farmers of the selected villages participated and benefited.

- Thirty farmers have been selected for development of Oyester Mushroom module as complementary enterprise. On an average 12 to 15 kg Mushroom was harvested and it was sold in the market @Rs100/-and some of the farmers reported that mushroom was also taken by their family members for their nutritional security. The farmers were very happy and also enthusiastic to adopt the mushroom cultivation in their farming activity.





Photo 38-43. Capacity building programmes under taken in the project

Development of kitchen garden

Promotion of kitchen gardening 60 farmers , improved different vegetables seeds line bitter gourd , pumpkin, bottle gourd , brinjal etc was distributed among the farmers for the establishment of kitchen garden.

Promotion of vegetable base module during summer season , on 75 farmers field were developed to ensure nutritional and livelihood security of farm families. Due to this intervention , about 15 to 20 % farm income was enhanced.

- Forty eight farmers of the three village were given plant protection measures in mustard against Aphid and *Alternaria* blight of mustard and resulted 10-12% enhancement of mustard yield.
- Diversification of improved variety of Sugarcane Co 0238 was incorporated in their existing farming systems model for better generation of farm income, nutrient management and the technical guidance for sugarcane cultivation was given to 29 farm households.

Low yielding sugarcane varieties with inefficient production technology in small fields is prevalent in the area. Seeds of the high yielding sugarcane variety Co-0238 @ 2.5 q /0.0375 ha was given in three villages for cultivation under improved agro-technique.

Availability of green fodder to milch animals during summer is a great problem in the area. Improved seeds of Sudan and cowpea were given to 60 farmers in three villages for green fodder cultivation during summer in 0.0625 ha area each farmer.

Photo 44-45. Development of Kitchen Gardening

Photo 46-47. Insect-pest management

Selection of the Farmers for development of IFS models and demonstration of technology

Based on the survey farmers under small/marginal and landless categories have been selected. However, the farm households under medium category are not sufficient. Therefore, it has been decided to increase the number of small/marginal and landless farm households.

Collection of soil samples for analyses

GPS based soil samples from the fields of beneficiary farmers are being collected for laboratory analyses to assess the soil fertility and to suggest nutrient doges to different crops.

Farmers training

Three days training programme on mushroom cultivation and fishery was successfully organized in collaboration with Scientists from IIFSR, Modipuram during 4 to 6 February, 2018. Fifty two farmers of the selected villages participated and benefited.

Excellence award

Three farmers, one from each *Adarsh Gaon viz*. Surendra Yadav (Nagepur), Hiraman Singh Patel (Jayapur) and Siya Ram Maurya (Sewon) received excellence award from Hon'ble Agriculture Minister Shri Radha Mohan Singh on 22nd February 2018 on the Foundation day of ICAR Research Complex for Eastern Region, Patna.

Photo 48-49. Scientist-farmer interaction meeting

Photo 50. Progressive farmers receiving excellence award from Hon'ble Agriculture Minister, Sh. Radha Mohan Singh

Photo 51. Farmers receiving Certificate of Appreciation

Coordination Unit (CU)

INSTITUTE FUNDED PROJECTS

Project Title: IOFS model for Western plain zone of Uttar Pradesh

The IOFS comprised of cropping systems (basmati rice-durum wheat-sesbania in 0.15 ha, basmati rice-mustard-green gram in 0.05 ha), fodder cropping systems (sorghum + cowpea-maize+cowpea-oat and maize + cowpea- sorghum + cowpea-berseem) in 0.1 ha area, kitchen garden in 0.026 ha, pest repellent plants in 0.024 ha and dairy (1 buffalo and 1 cow in 0.05 ha). Since study was initiated from *rabi 2016-17*, the results of crops grown during the season is given below.

Productivity of components

Cropping Systems including fodder: Durum wheat [variety MPO (JW 1215)] recorded grain and straw yield of 2.6 and 2.7 t/ha respectively under first year of organic system (Table 81). The variety possessed resistance traits against different types of rusts. Besides this, owing to presence of more number as well as long awns in spikes, wheat grains were not damaged by bird's after ripening. Mustard (variety RH 749) recorded 0.55 t/ha of seed and 2.39 t/ha of residues. Berseem and oat as fodder was also tested under organic production system. Multicut berseem variety BL 10 was used and three harvests have been made. The first cut was taken on 55 days after sowing (DAS) which resulted in 2.65 kg green fodder yield/m^2. Second cut was taken about 35 days after the first which yielded around 2.32 kg green fodder/m^2. Similar amount of forage yield was also obtained from the third cut. Therefore, under organic production system, the crop has produced around 3825 kg of green fodder (around 76.5 t/ha) after three cuttings from (0.05 ha) which can support 2 dairy animals for 95 days. Cut from berseem is usually taken around 50-60 days after sowing. One dairy animal requires around 20-25 kg green fodder/day, around 10 m^2 area needs to be harvested daily. Therefore, 0.05 ha needs to be divided into 6 units (around 83.3 m^2 each) and staggered sowing can be done. This system of staggered sowing will assure regular supply of quality green fodder for organic production system. Oat (single cut variety Kent) as fodder under organic production system also resulted in seed yield of 128.5 kg (2.57 t/ha) and 293.5 kg of feed from 0.05 ha. It was also estimated that around 1630 kg of green fodder (around 32.6 t/ha) from Oat grown in 500 m^2 area can be harvested at 55 DAS which can easily supply the green fodder for 40 days.

Table 81. Productivity of cropping systems and kitchen garden module during *rabi* 2016-17

Crop	IOFS model area (kg)			Productivity (kg/ha)	
	Area (ha)	Grain yield (kg)	Straw yield (kg)	Grain/seed yield (kg/ha)	Straw / green fodder yield (kg/ha)
Crops (*for food and feed*)					
Durum wheat	0.15	390	405	2600	2700
Mustard	0.05	27.5	119.5	550	2390
Crops *(for fodder)*					
Oat (Single cut)	0.05	128.5	293.5	2570	5870(3260 kg*)
Berseem (green fodder)	0.05	-	3825	-	7650*
Crops *(for nutrition in kitchen garden)*					
Fenugreek	0.0043	3	3.42	690	795
Lentil	0.0043	2.8	7.9	650	1837
Potato	0.0043	45	7.50	10460	1740

In overall, around 135 days green fodder availability for organic production system can be ensured by growing berseem and oat in 1000 m^2 area.

Kitchen garden: Potato (variety Kufri bahar), lentil (variety VL masoor 126), and desi fenugreek crops were evaluated in 43 m^2 area each in the kitchen garden module and resulted in 45 kg tuber yield, 2.8 and 3 kg seed/grain yield respectively.

Nutrient assimilation

Nutrient content of food and feed: K, Zn, Mn and Fe uptake of wheat, mustard, oat and fenugreek were analysed. Nutrient content in grain and straw of the different crops indicates oat recorded higher K uptake in grain and straw (2.0 and 1.97 %, respectively) compared to other crops (Table 82 and Fig. 34). It also recorded the highest Mn content in grain (73.5 mg/kg) and straw (165.9 mg/kg) over other crops. Similarly, the highest Fe content in grain (1733.4 mg/kg) and straw (4819.1 mg/kg) was observed in fenugreek followed by oat grain (290.2 mg/kg) and straw (911.5 mg/kg).

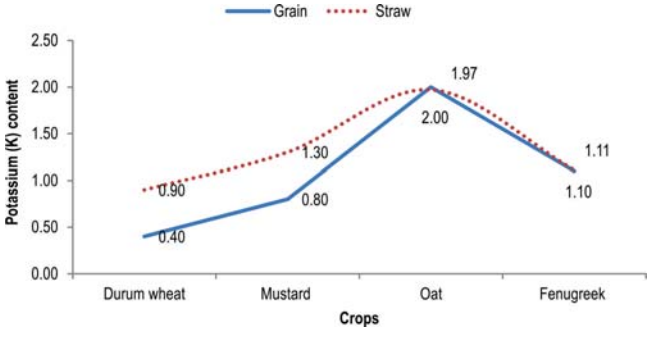


Fig. 34. K concentration (%) in different crops under organic production system

Nutrient uptake

K uptake in the grain and straw varied significantly among the crops. The highest K uptake (2.6 kg in grain and 5.8 kg in straw and a total of 8.4 kg) was recoded with the oat crop followed by durum wheat. For Zn the highest uptake was noted with durum wheat (17.4 g by grain and 9.7 g in straw) followed by oat (Table 83).

Performance of IOFS at other locations under NPOF

Out of 7 locations, one acre integrated organic farming system models evaluated at Coimbatore recorded higher net returns of Rs 2.09 lakhs followed by 1.08 lakhs at Calicut (Table 84). Higher income at Coimbatore and Calicut could be attributed to integration of dairy components in to the system besides

Table 82: Nutrient content in grain and straw of different crops

Crop	K (%)		Zn (mg/kg)		Mn (mg/kg)		Fe (mg/kg)	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Durum wheat	0.4	0.9	44.6	23.9	28.9	29.6	182.3	337.6
Mustard	0.8	1.3	50.7	15.1	49.8	10.2	290.0	461.6
Oat	2.0	1.97	27.0	33.4	73.5	165.9	290.2	911.5
Fenugreek	1.1	1.1	60.7	28.6	14.5	22.8	1733.4	4819.1

Table 83: K , Zn, Mn and Fe uptake in different crops

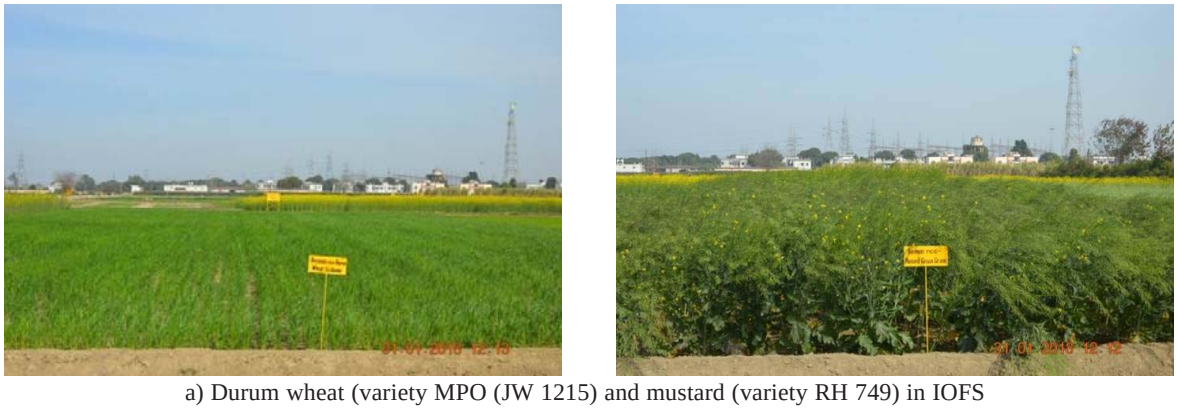
Crop	K (kg)			Zn (g)			Mn (g)			Fe (g)		
	G	S	T	G	S	T	G	S	T	G	S	T
Durum wheat (0.15 ha)	1.6	3.6	5.21	17.4	9.7	27.1	11.3	12.0	23.3	71.1	136.7	207.8
Mustard (0.05 ha)	0.2	1.5	1.8	1.4	1.8	3.2	1.4	1.2	2.6	8.0	55.4	63.4
Oat (0.05 ha)	2.6	5.8	8.4	3.5	9.8	13.3	9.4	48.7	58.1	222.7	1414.4	1637.2
Fenugreek (0.0043 ha)	0.06	0.07	0.13	0.08	0.11	0.19	0.22	0.56	0.78	5.16	16.36	21.52

G-grain, S-Straw, T-Total

Table 84: Economic performance of IOFS at different locations of India

Location	Area (ha)	Gross income (Rs)	Cost (Rs)	Net income (Rs)
SK Nagar*	0.40	99,915	73,676	26,239
Calicut	0.40	2,61,410	1,53,000	1,08,410
Umiam	0.43	1,30,593	57,588	73,005
Udaipur*	0.45	47,553	27,114	20,539
Coimbatore	0.40	3,04,930	95,030	2,09,900

*Dairy component yet to be integrated



a) Durum wheat (variety MPO (JW 1215) and mustard (variety RH 749) in IOFS

b) Berseem (var. BL 10) and Oat (var. Kent) in IOFS

c) Potato in kitchen garden module

Photo 52. Glimpses of different modules (cropping systems, fodder and kitchen garden) under IOFS

high value crops such as vegetables, banana, teak, annual *moringa* and boundary plantation at Coimbatore and turmeric, ginger, tapioca and banana at Calicut.

Project Title : Development of fish based farming systems for marginal farmers

A 0.09 ha fish pond having pond water area in 0.042ha (47%) and dyke area of 0.036 ha (53 %) was established in the Siwaya farm of the institute in 2017. Top width of the dyke was kept at 2.5 m for utilization for seasonal vegetables. The Table 85 shows economics of developed pond dyke systems where vegetables were grown on the dyke area so as to get the additional returns apart from harvesting of fish from the system. The net returns from pond-dyke system excluding fish in the 1st year of its establishment have been recorded for Rs. 5784.00 from 0.09 ha.

Table 85. Economics of the established pond-dyke system

	2017-18	Area (ha)	Cost of cultivation	Yield (kg)	Rate per kg (Rs.)	Gross Return (Rs.)
A.	Water spread area (for fish culture)	0.0420	—	——	—	
B.	Pond dyke (for vegetable cultivation)	0.0360				
	Bottle gourd	0.018	950.00	109.0	10	1090.00
	Bitter gourd	0.009		18.0	10	180.00
	Pumkin	0.009		62.0	10	620.00
	Cabbage	0.018	1020	310.0	10	3100.00
	Cauliflower	0.009		150.0	10	1500.00
	Broccoli	0.009		63.2	20	1264.00
	Total		**1970.00**			**7754.00**




Photo 53-56. View of pond-dyke system for marginal farmers

Externally Funded Projects (EFP)

Project Title: AICRP on Integrated Farming Systems (National)

AICRP on Integrated Farming Systems, a plan scheme initiated from 2010-11 operates currently with 75 centres (25 on-station main, 12 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, 1 General university and 6 ICAR institutes and also covers 23 states and 2 union territories. 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), Permanent plot experiment on integrated nutrient management in cereal-based cropping systems (14 locations), Evaluation of weed management practices under organic production system (8 locations), Carbon crediting and GHG emission in IFS models (32 locations) and Preparation of Bankable IFS project using available data bank (10 locations) were initiated 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), On-Farm participatory research in tribal farming systems through cluster approach (14 locations) and FLDs on farming systems involving oilseeds (186 no's) were undertaken through on-farm research centres. Spatial distributions of centres are given in Fig. 35.

Fig. 35. Locations of On-station centres of AICRP on IFS

The salient research achievements of the scheme for 2015-17 are given below

On-station research

- Established 38 IFS models in all agro-climatic regions. Besides 63 farming systems have been refined with the participation of farmers. These models have potential to produce more (27.11 t/ha on rice equivalent basis), generate 58 % additional income, net income of > 10,000 rupees/month for 6-7 months in a year, generate additional employment of 20 man days/month for 9-10 months besides better production (0.58) and income (0.44) sustainability. Internal recycling was found to be around 118 kg N/ha besides P and K. The internal rate of return of all the models across regions was found to be 118 %.
- Increase in productivity due to alternate cropping systems identified in different regions were found to 16.54 t/ha in arid, 13.4 t/ha in semi-arid and 10.6 t/ha in humid regions on yield equivalent basis.
- Application of 50% N through FYM + 50% RDN during *kharif* and 100% RDN in *rabi*) recorded 8.92 t/ha/year productivity, which was about 7% higher than 100% RDN in *kharif and rabi*).
- Carbon sequestration and GHG emission study has been initiated in IFS models and developed a user-friendly IFS GHG estimator excel tool based on the IPCC standards. This will help researchers to assess the GHG emission and modify the IFS modules.
- Developed 10 bankable projects and these are in various stages of verification and refinement.
- Eighteen Integrated Farming System (IFS) models developed through on-station research have been included in the state level packages for up-scaling. Kerala Government has sanctioned Rs 700 lakhs for up-scaling the 4 homestead-based IFS models in entire state by involving 2300 farm households. These will be established @ 1-2 in each panchayat with technical backstopping of ICAR-IIFSR and FSRC, Karamana.

On-Farm Research

Response of cropping systems to nutrients: Across various NARP zones and cropping systems, farmer's package resulted in lower yield compared to recommended package owing to the 26, 23, 73 and 100 % 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 951, 865, 1970, 1698 and 621 kg ha^{-1} in rice-rice, rice-wheat, maize-wheat, soybean-onion and rice-green gram cropping systems, respectively. Application of micronutrients based on soil test resulted in additional yield of 218, 224, 295, 234 and 85 kg ha^{-1} in rice-rice, rice- wheat, maize- wheat, soybean-onion and rice-green gram cropping systems, respectively. 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.

Diversification of farming systems in marginal farm households: The number of farming systems in different districts ranged between 1 (Samba, Sirsa, Amritsar, Sivagangai & Pudukottai and Gadag) to 7 (Srikakulam). Panchmahal, Palghar and Kabirdham districts were having 5 farming systems while Kendrapara has 6 systems. Field crops + dairy was found to be the dominant farming system based on number of households in 18 districts (64 % of total districts studied). Highly diversified system was observed in Srikakulam district of Andhra Pradesh, South 24 Paragnas in West Bengal, Panchmahal district of Gujarat having many components of farming system namely field crop, dairy, goat, poultry, fish in different combinations ranging from 1 to 5. Horticulture component was found to be contributing for better income in Pune, Pathinamthitta and Palghar districts. In general, at all the locations, constraint-based interventions in crop, livestock, processing and optional modules resulted in improvement in production (1.5 times), marketable surplus (2 times) and profit (2 times).

Estimation of impact of farming system interventions in different modules in 5 districts: Module wise impact of farming system interventions in Kamrup (Assam), Srikakulam (Andhra Pradesh), Kawardha (Chattisgarh), Panchmahal and Mehsana (Gujarat) were analysed using data of farming system diversification in marginal households. Across the districts, productivity and profitability improvement was found to be higher in livestock diversification (91 and 305 % respectively) module. Among the different modules, interventions made in product diversification module recorded higher impact as 83 % farm households have continued the interventions without physical and technical inputs. Total package of interventions made in crop and livestock diversification modules were continued by 76 and 57 % farm households. Rejection of interventions were found to be higher (26 %) in livestock diversification module compared to cropping system (7 %) and product (13 %) diversification. It was also found that partial adoption of interventions with modifications were made by 17 % each in crop and livestock diversification modules while it is only 4 % for product diversification module. Among the different districts, interventions made in cropping systems in Panchmahal district was highly effective as 94 % households have continued the interventions without the input support. In case of livestock diversification, Kamrup district recorded the highest households continuing the interventions (91 %). Product diversification was more effective in Srikakulam, Kamrup and Kawardha districts compared to Mehsana and Panchmahal. In terms of livestock diversification, Mehsana and Srikakulam had the highest per cent households rejecting the interventions (50 %). Module wise spread of farming system interventions in Kamrup (Assam), Srikakulam (Andhra Pradesh), Kawardha (Chattisgarh), Panchmahal and Mehsana (Gujarat) were studied. Interventions made in Winter rice of Kamrup, rice, cashew, kitchen garden and vermicompost in Srikakulam had the highest spread (90 %) among non-experimental farm households.

Exploration of application of Ecological security index (ESI), Economic Efficiency index (EEI), social equity index (SEI) and Sustainable livelihood security index (SLSI) in on-farm farming systems

Among the 5 farming systems in Krishnagiri/ Dharmapuri district of Tamil Nadu, 41 % households have field crops + dairy system followed by 33 % having field crops + dairy + poultry system. Ecological security index (manure application, organic carbon and number of legume crops grown per year) was higher in field crops + dairy + goat + poultry system (0.38) while economic efficiency index (per capita land, total food grain production, milk yield and gross cropped area) was higher in field crops + dairy + goat + honeybee (0.55). Social equity index (literacy rate, per capita food grain and milk production, per capita cereals, pulses, vegetables and milk consumption) was found higher in field crops + dairy system (0.28). The Sustainable livelihood security index which combines all the above indices was higher in field crops + dairy system (0.38) indicating better sustainable livelihood generation among the all existing systems.

Improvement of farming systems in small holder farms: The number of farming systems in different districts ranged between 1 (Samba, Sirsa, Amritsar, Sivagangai & Pudukottai and Gadag) to 7 (Srikakulam). Panchmahal, Palghar and Kabirdham districts were having 5 farming systems while Kendrapara has 6 systems. Field crops + dairy was found to be the dominant farming system based on number of households in 18 districts (64 % of total districts studied). Highly diversified system was observed in Srikakulam district of Andhra Pradesh, South 24 Paragnas in West Bengal, Panchmahal district of Gujarat having many components of farming system namely field crop, dairy, goat, poultry, fish in different combinations ranging from 1 to 5. Horticulture component was found to be contributing for better income in Pune, Pathinamthitta and Palghar districts. In general, at all the locations, constraint based interventions in crop, livestock, processing and optional modules resulted in improvement in production (1.5 times), marketable surplus (2 times) and profit (2 times).

On-Farm participatory research in tribal farming systems through cluster approach: The programme was undertaken in 14 locations covering 14 states namely Andaman and Nicobar Islands, Andhra Pradesh, Chhatishgarh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Uttarakhand and West Bengal. A total of 52 training programmes were organized on various aspects of farming systems. Farming System interventions have been made in 1850 farm households during the year. At Bali Island (West Bengal), nineteen types of farming systems were found in 120 number of farm households and crop + dairy + sheep system recorded the maximum gross return (Rs 41,824/ household) in bench mark. Interventions in crop module comprised of *kharif* rice, boro rice, potato, sunflower, khesari, chilli, water melon and other vegetables contributed for additional income of Rs 6317, 949, 1104, 1463, 3937, 9375, 15,551 and 289 /household respectively. Interventions made in dairy, poultry, duckery, goat and sheep contributed income of Rs 4751, 3981, 2660, 5912 and 2654/ household respectively. At Kanker in Chhatisgarh, fish cum duck model demonstrated in the tribal villages resulted in net income of Rs. 1,60,000/year. Crop diversification model under upland situation with *Semialata* cultivation for lac production and intercropping with vegetables and hybrid maize cultivation also demonstrated. Crop + fish cum duck + dairy + poultry + vermicomposting in 2.4 ha area resulted in gross income of Rs. 13,98,000 with diversified farming system approach. One ha IFS model comprising of rice + vegetable + vermicomposting + poultry + goatery + piggery + azolla resulted in net income of Rs 1,45,130. Rice - vegetable + backyard poultry + piggery + goatry + vermicomposting in 0.60 ha resulted in net income of Rs. 165670. In Karnataka, interventions were undertaken in IFS perspective by integrating 275 honey bee boxes and 20 honey extractors to 275 tribal families for effective demonstration of honey bee rearing in the cluster. Integrated 4750 Swarnadhara poultry chicks along with scientific and modern poultry rearing equipment's and 1850 kgs of poultry feed. The eggs of swarnadara chicks have been utilized for family consumption.Also integrated 146 sheeps of improved breed in the cluster. In Jammu, poultry enterprise with 1200 birds have been started by two unemployed tribal youth who have realized net profit of Rs 26,000 per lot in 32-38 days.

FLDs on farming systems involving oilseeds: 161 FLDs on farming systems involving oilseeds were conducted through OFR centres of AICRP on IFS and ICAR-IIFSR in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu and Kashmir, Meghalaya, Punjab, Rajasthan, Telangana, Uttar Pradesh and Uttarakhand with total budget outlay of Rs 3.48 lakhs. In general, in all the cropping and farming systems FLDs resulted in improvement in yield to the level of 22-48 % at various locations. Six trainings on "New technologies in oilseed cultivation" were imparted to development officers, input dealers in Bihar, Gujarat, Tamil Nadu and Uttar Pradesh.

Other activities

- IFS models developed at on-station have been exposed to all stake holders. About 93,533 farmers, 12,088 extension officials, 6255 VIPs/ other officials visited on-station IFS models during 2012 to 2017.
- Soil health cards (577 no's) were issued by 10 centres covering 10 states.
- Custom hiring centres for farm machinery have been established in 4 states namely Rajasthan (Udaipur), Karnataka, Madhya Pradesh and Odisha.
- Impact study of farming system interventions have been made in 31 districts and the results are encouraging. During the course of impact study, identified the farming system interventions/modules which are preferred by the farmers in particular region as well as reason for partial adoption and rejection.
- On-farm research centres (31 no's) have been moved to new districts as per QRT recommendations. Benchmarking, selection of farmer households and farming system wise technical programme have been approved for 26 districts.

- A total of 252 NAAS rated research papers have been made during XII plan with paper/scientist ratio of 2.15.
- Besides this, 197 popular articles, 218 conference presentation, 133 books and chapters, 136 radio talks and 93 TV talks have been made during XII plan.

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

Network Project on Organic Farming (NPOF), a plan scheme initiated from 2004-05 operates currently with 20 centres covering 10 agro-climatic regions. The scheme is in operation at 11 SAU's, 7 ICAR institutes and 1 special heritage university and covers 16 states. Distribution of locations is given in Fig. 36.

During the year under report, 11 experiments namely Evaluation of organic, inorganic and integrated production systems (20 locations), Evaluation of response of different varieties of major crops for organic farming (20 locations), Evaluation of bio-intensive complimentary cropping systems under organic production systems (3 locations; Pantnagar, Dharwad, Umiam), Development of Integrated Organic Farming System models (7 locations; Calicut, Thiruvananthapuram, Coimbatore, Umiam, Udaipur, SK Nagar, Almora), Evaluation of Farm waste recycling techniques for organic farming (3 locations; Dharwad, Modipuram, Almora), Documentation & validation of organic ITKs (4 locations; Udaipur, Narendrapur, Gangtok, Ajmer), Evaluation of organic management practices for insect pest in various crops (3 locations; Almora, Gangtok, Ajmer), Evaluation of organic management practice for diseases in crops (Gangtok and Ajmer), Development of scientific organic package for large cardamom (Gangtok), Biochemical characterization & molecular identification of microbial population of different organic manures (Narendrapur) and Evaluation of zero budget farming practices in

Fig. 36. Locations of NPOF centres

basmati rice-wheat system (Modipuram, Ludhiana, Pantnagar and Gurukul) were undertaken. Besides these, 2 studies namely Geo-referenced characterization of organic farmers (20 locations) and Cluster based demonstration of Organic Farming Package under TSP (2 locations, Coimbatore and Umiam) were also undertaken. The Salient achievements are summarized below.

Geo-referenced characterization of organic farmers

In order to understand the successful practices and constraints of organic farmers, a study on Geo-referenced characterization of organic farmers was initiated during 2014-15. A minimum of 30 farm households was fixed as target for collection of information. However, some centres have collected information from less or more number of farmers depending on the resources. During 2016-17, a total of 560 farmers have been characterized. Yield gap analysis of experimental and organic grower practices were undertaken during the year. It was found that yield gap ranging from 5 to 40 % are existing in various crops which needs to be bridged by promoting scientific organic farming through extension programms.

Scientific PoPs for Organic farming

Developed the scientific package of practices for organic production of crops in cropping systems perspective for 51 cropping systems suitable for 12

Table 86: State wise package of practices developed for various cropping systems

Sl. No.	Cropping systems	Suitable State
1.	Soybean-chickpea	Chhattisgarh
2.	Soybean-onion	
3.	Rice-chickpea	
4.	Maize - Garlic	Himachal Pradesh
5.	Cauliflower - Pea -Tomato	
6.	Coriander - Pea -Tomato	
7.	Rice (Basmati type)-wheat	Jharkhand
8.	Rice (Basmati type)-lentil	
9.	Rice (Basmati type)-linseed	
10.	Rice (Basmati type)-potato	
11.	Soybean-wheat	Karnataka
12.	Groundnut-sorghum	
13.	Chilli + cotton	
14.	Maize-chickpea	
15.	Turmeric-fallow	Kerala
16.	Ginger-fallow	
17.	Black pepper	
18.	Soybean-Wheat	Madhya Pradesh
19.	Soybean-Mustard	
20.	Soybean-Chickpea	
21.	Soybean-Linseed	
22.	Soybean-Isabgol	
23.	Sunhemp-scented rice-durum wheat	
24.	Scented rice-chickpea-maize (fodder)	
25.	Scented rice-berseem (fodder + seed)	
26.	Scented rice-vegetable pea-sorghum (fodder)	
27.	Rice-groundnut	Maharashtra
28.	Rice-Dolichos bean	
29.	Rice-cucumber	
30.	Rice-red pumpkin	
31.	Rice-Carrot (Raised beds in lowland)	Meghalaya
32.	Rice-Tomato (Raised beds in lowland)	
33.	Maize + soybean- French bean (Upland)	
34.	Maize-potato-summer greengram	Punjab
35.	Turmeric-onion	
36.	Basmati rice-wheat-green manure *(Sesbania)*	
37.	Maize-durum wheat-cowpea (fodder)	
38.	Maize-berseem-bajra (fodder system)	
39.	Maize-berseem-maize+cowpea (fodder system)	
40.	Cotton-maize-green manure (*sesbania*)	Tamil Nadu

Sl. No.	Cropping systems	Suitable State
41.	Chillies-Sunflower-green manure (*sesbania*)	
42.	Beetroot-maize- green manure (*sesbania*)	
43.	Basmati rice- wheat-*Sesbania*	Uttarakhand
44.	Basmati rice- Lentil-*Sesbania*	
45.	Basmati rice- Vegetable pea-*Sesbania*	
46.	Basmati rice- *Brassica napus* –*Sesbania*	
47.	Basmati rice- Chickpea –*Sesbania* (under biodynamic practices)	
48.	Basmati rice – wheat - *Sesbania* green manure	Uttar Pradesh
49.	Coarse rice– barley + mustard – greengram	
50.	Maize (grain) – potato– okra	
51.	Maize (green cobs) – mustard + radish - *Sesbania* green manure	

states. Updated list of PoPs developed for different crops and systems are given Table 86.

Identification of varieties for organic farming

Best performing varieties of crops for organic farming in different seasons for 12 states have also been identified. Updated list of varieties suitable for organic farming in different states are given in Table 87.

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

The project aims to address the issue of sustainability of organic farming by minimizing external inputs such as seeds, organic manures and bio-pesticides through farming systems approach. Location specific integration of different modules such as cropping systems including fodder, dairy, orchard, fisheries, pest repellent cafeteria, kitchen garden and boundary plantations are undertaken at 8 locations covering 8

Table 87: Best performing varieties of identified crops in different states

State	*Kharif*		*Rabi*	
	Crop	Variety	Crop	Variety
Himachal Pradesh	Okra	Chameli 015Indranil	Pea	Ten PlusNirali
			Cauliflower	US 178Chandramukhi
			Tomato (Summer)	Red goldHybrid 7730
Chhattisgarh	Rice	Jayagundi CR Sugandh dhan-907	Chickpea	VijayDaftari-21
Jharkhand	Rice	MTU-10Lalat	Wheat	K-0307Raj-4229
Karnataka	Soybean	DSB-16	Wheat	DWR 162
	Groundnut	TGLPS 3	Chickpea	BGD103JAKI 9218
	Cotton	GHAM 34	Wheat (Bread wheat)	UAS 347NIAW 1415
Kerala	Turmeric	Sudarshana, Suvarna	-	-
	Black pepper	Sreekara, Panniyur-1	-	-
Madhya Pradesh	Soybean	RVS-2002-4 JS-20-41	Wheat	GW-366HI-8498
	Maize	Kanchan 101Proagro-4412	Chickpea	JG-130RVG-203
	Rice	Madhuri	Wheat	HW 2004
Maharashtra	Rice	Sahyadri-5Sahyadri-3	Groundnut	Konkan GauravTG-26
Meghalaya	Maize (Pre *kharif)*	DA-61-ARCM-75	French bean	Naga localRCM-FB-18

State	*Kharif*		*Rabi*	
	Crop	Variety	Crop	Variety
			Tomato (Summer)	MT-2O-17
Punjab	Rice	Pusa Basmati 150 9Pusa Basmati 1121	Wheat	PBW 621PBW 644
Tamil Nadu	-	-	Rice	CB05022Mapilai Samba
Uttar Pradesh	Maize	PMH-4Seed Tech-2324	Mustard	RGN-229RH-0406
Uttarakhand	Rice coarse	NDR-359	Wheat	HD-2967UP-2565
	Basmati rice	Pant Basmati 1		

*Dairy component is yet to be established

The results of study undertaken at Modipuram and other locations are summarized below.

states *viz.*, SK Nagar (Gujarat), Calicut (Kerala), Thiruvananthapuram (Kerala), Umiam (Meghalaya), Udaipur (Rajasthan), Coimbatore (Tamil Nadu), Modipuram (Uttar Pradesh) and Almora (Uttarakhand). The details of the locations, components, area and source of funding are given in Table 88.

Table 88. Locations, components, area and source of funding of Integrated Organic Farming System models study

State	Location	IOFS composition	Area (ha)	Year of start / establishment	Source of funding
Gujarat	SK Nagar*	Field crop based system (Groundnut-potato-pearlmillet; Fodder bajra-fodder maize+oat-fodder bajra; boundary plantation) + dairy	0.40	2015-16	NPOF
Kerala	Calicut	Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost, 2 milch cows)	0.40	2014-15	NPOF
	Thriuvanant hapuram*	Cassava, Taro , fodder + dairy	0.24	2016-17	NPOF
Meghalaya	Umiam	Field & horticulture based system (Cereals + pulses + vegetables +fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost	0.43	2013-14	NPOF
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) + dairy	0.45	2015-16	NPOF
Tamil Nadu	Coimbatore	Field crop based system (Green manure-okra-maize; green manure-cotton-sorghum, fodder, pest repellant cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow,			

State	Location	IOFS composition	Area (ha)	Year of start / establishment	Source of funding
		1 heifer & 1bull calf + vermicompost + boundary plantations (Gliricidia, coconut)	0.40	2013-14	NPOF
Uttar Pradesh	Modipuram*	Cropping systems + dairy + kitchen garden + pest repellant cafteria	0.40	2016-17	Institute
Uttarakhand	Almora*	Vegetable based system (Field crops, vegetables, fruits, fodder)	0.43	2015-16	NPOF

Project Title: Developing and targeting climate smart agriculture practices portfolios for diversity of farming systems (Funded by: CIMMYT)

Activities such as on-station and On-farm testing and evaluation of identified potential CSAP's and their prioritization, implement portfolio of CSAP's in identified Climate Smart Village (CSV), database on science based evidencing of farming systems through quantitative analysis tools viz. FarmDesign and capacity building training for application of quantitative analysis tools for analysis of existing farming systems were undertaken during the year.

Enhancing nutrient use efficiency and resilience

Experiment on validation of sensor based N management in Maize using decision support tools viz. Nutrient expert® (NE), STCR and green seeker was started in *Kharif* 2017 with following treatment details with 3 replications for each treatment groups following a randomized block design (Table 89). Plot size of each replication was 40 m^2.

The results revealed that Highest cob yield (7935 kg/ha) and grain yield (5800 kg/ha) was obtained under 33% basal N + Green Seeker based N at knee high & tasseling stage treatment with application of 144 kg N as compared to recommended dose of 150 kg N (Table 90).

Green House Gas (GHG) emission mitigation option tool (GHG-MOT) for agriculture developed by CCAFS was used for estimation of GHG's under current management practices (Fig. 37) and their mitigation potential options for different practices were explored (Fig. 38). The results revealed GHG emission of 959.8 kg CO_2 eq ha^{-1} at current management practices with recommended level of fertilizer application while the emission was 0.178 kg CO_2 eq kg^{-1}.

Table 89. Treatment details of sensor based nutrient management in maize

Treatments	
T1	Control
T2	RDF (1/3+1/3+/1/3 N splitting at basal, knee high and tasseling)
T3	STCR (1/3+1/3+/1/3 N splitting at basal, knee high and tasseling)
T4	Nutrient expert (1/3+1/3+/1/3 N splitting at basal, knee high and tasseling)
T5	33% basal N + Green Seeker based N at knee high & tasseling stage
T6	60% basal N + Green Seeker based N at knee high
T7	70% basal N + Green Seeker based N at knee high
T8	60% basal N + Green Seeker based N at tasseling stage
T9	70% basal N + Green Seeker based N at tasseling stage
T10	30% Basal N + 30% at 25 DAS + Green Seeker based N at tasseling stage
T11	35% Basal N + 35% at 25 DAS + Green Seeker based N at tasseling stage
T12	N rich strip (300:60:40) (1/3+1/3+/1/3 N splitting at basal, knee high and tasseling)

Table 90. Effect of green seeker based nitrogen management on grain and straw yield of maize.

Treatments	Cob yield(kg/ha)	Grain yield(kg/ha)*	Straw yield(kg/ha)	Biological yield (kg/ha)
T1	4317	3156	3988	8305
T2	7358	5378	7600	14958
T3	7390	5402	7413	14803
T4	7214	5274	7667	14881
T5	7935	5800	7923	15858
T6	7342	5367	7454	14796
T7	7277	5319	7783	15060
T8	6769	4948	7500	14269
T9	7105	5194	7550	14655
T10	7526	5502	7412	14938
T11	7454	5449	7447	14901
T12	7695	5625	8117	15812

*average shelling percentage was 73.1%.

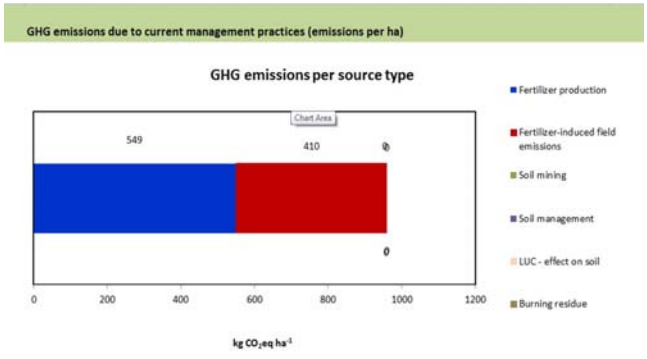


Fig. 37. Estimated GHG emission due to current management practices from different sources expressed as kg CO_2 eq per ha

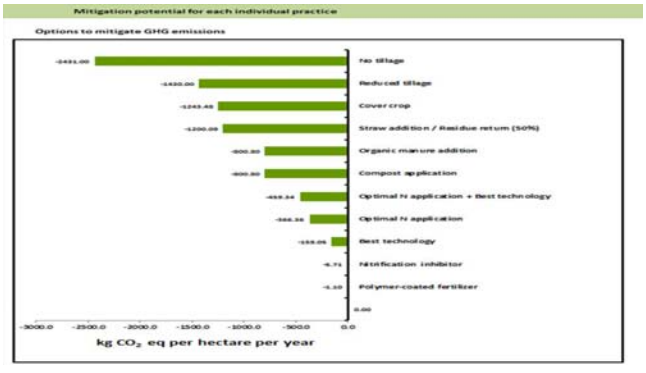


Fig. 38. Different mitigation options and their respective potential expressed as kg CO_2 eq per ha year

Photo 57. Standing crop of Maize (PMH -1)

Photo 58. NDVI reading being taken using Green Seeker

Different mitigation options explored suggested optimal N application could alone reduce 366.36 kgCO_2 eq per ha per year while optimal N application coupled with best technology can reduce 459.34 kgCO_2 eq per ha per year (Fig. 38). Accordingly, sensor based management for optimal N application was field evaluated for validation of mitigation options. Comparative performance of different combinations of optimal N application in terms of GHG emission as estimated using GHG-MOT tool is presented in Table 91.

Table 91. GHGs emission estimation under different combinations of optimal N application with best technologies.

Treatment	Per area GHG emission (kg CO_2 eq ha^{-1})	Per yield GHG emission (kg CO_2 eq kg^{-1})
T2: RDF	959.8	0.178
T5	921.1	0.159
T6	766.9	0.143
T7	722.0	0.136
T8	683.7	0.138
T9	786.1	0.151
T10	683.7	0.124
T11	754	0.138

On-farm experimentation on Diversification of sugarcane based cropping systems through intercropping of legumes and vegetables

Diversification of cropping systems provides an opportunity to introduce varieties that are more resilient and may also provide economic benefits. Stress-resistant or more efficient varieties (resistant to heat, disease resistance and water and nutrient efficient) will prove beneficial for farmers in changing climatic scenario. Sugarcane -ratoon- wheat is the major cropping system of the region.

Sugarcane crop remains in the field for a year or Hence, besides suppressing weeds in the inter-row spaces, additional production could be taken by growing suitable intercrops in between the cane rows. Some of the Intercrops have been found to have no/ negligible adverse effect on sugarcane yield. Accordingly, Different intercrops viz. green gram, black gram, okra, cucumber and bottle guard were planted in sugarcane. Diversification in sugarcane through five intercrops viz. green gram, black gram, okra, cucumber and bottle guard at ridge with spring sugarcane was compared with sole crop of sugarcane. Results revealed 6.5, 7.15,13.26, 14.53 and 14.87 % decrease in cane yield respectively for sugarcane intercropped with green gram, black gram, okra, cucumber and bottle gourd

Table 92. Comparative performance of sugarcane sole and intercrops.

	Cane yield (t/ha)	Intercrop yield (t/ha)	Cane eq. yield (t/ha)
Sugarcane (sole)	86.7	0	86.70
Sugarcane + Okra	75.2	9.34	103.50
Sugarcane + Cucumber	74.1	12.01	128.69
Sugarcane + Bottle gourd	73.8	10.24	104.83
Sugarcane + Greengram	81	0.48	89.00
Sugarcane + Black gram	80.5	0.41	87.08

Photo 59 & 60. Diversification in sugarcane

respectively as compared to sole crop sugarcane. However, sugarcane equivalent yield (SEY) were higher in all the intercropping systems with highest being in sugarcane intercropped with cucumber (128.69 t/ha) as compared to sole crop of sugarcane (86.7 t/ha) (Table 92).

Typology of existing farming systems

With the aim to compare performance of local farms with the prototype farm system and assess the potential role of the prototype farm system for farm development. A typology was constructed to understand the diversity of farming systems in the vicinity of Modipuram and to select representative farms for the assessment. The typology revealed 3 different types of farm households with following characteristics (Table 93).

Photo 61. Survey of farmers for typology

Table 93: Mean outcomes of selected variables for each types of households

Type & Percentage of households	Total Land managed (ha)	Land allotted to sugarcane (%)	Land allotted to Sorghum (%)	Land allotted to wheat in kharif (%)	Total Livestock Units (Nos.)	Total Household members (nos.)
1 (32 %)	0.6	96.1	3.6	48.9	1.5	5.4
2 (41 %)	0.8	72.3	22.7	44.5	2.8	7.9
3 (27 %)	2.7	86.6	9.4	23.5	3.8	9.7

Application of quantitative analysis tool Farm Design for farming system analysis

Farm Design analysis tool was applied to prototype integrated farming system model developed for marginal farmers at ICAR-IIFSR, Modipuram for systems analysis of IFS model for science based evidencing of farming systems and synthesis of alternative farm configurations, characterization of nutrient flows (Fig. 41 and 42), nutritional self sufficiency and trade-offs between different objectives and constraints in a systems perspective.

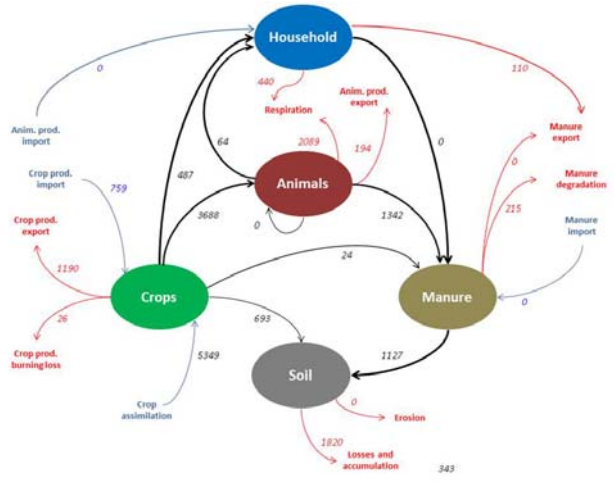


Fig. 41. C Cycle in IFS model for marginal farmers (0.70 ha) analysed using FarmDesign

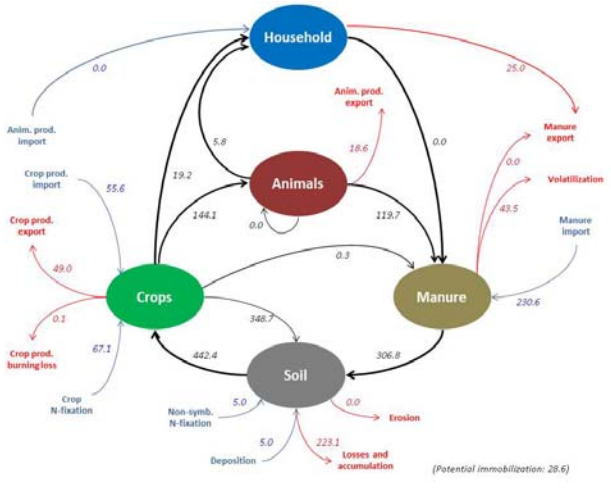


Fig. 42. N Cycle in IFS model for marginal farmers (0.70 ha) analysed using FarmDesign

SUCCESS STORIES

1. Exotic vegetable based farming system model for income enhancement and sustainability of small farmers of Western Uttar Pradesh: A Success Story (Under Farmer FIRST Programme)

Poonam Kashyap, M P Singh, A. S. Panwar, Suresh Malik, A. K. Prusty, M. Shamim, Sunil Kumar, Nisha Verma and P C Jat

Focus Area: Cultivation of exotic vegetables for higher income and livelihood security.

A brief about the Farm Innovation

Charan Singh, a farmer from Khatauli block of Muzaffarnagar district of Uttar Pradesh having only 0.4 ha of land with 1 buffalo and 1 cow had been doing the cultivation of sugarcane-ratoon-wheat system for years which was not able to give him the returns enough to meet his needs all the year round. With the sugarcane-ratoon based system he was able to get a net returns of Rs. 60,075 from cropping system and Rs 48,000 from animal component. The farmer was adopted under Farmer FIRST Programme and was advised through training field visits and technical guidance to diversify his cropping system with cultivation of different exotic vegetables like broccoli, lettuce, chinese cabbage, cherry tomato, leek along with okra, chilli and fodder maize with boundary planation of papaya to minimize the risk of heavy dependence on single crop besides generating year round income. The land allocation of 0.4 ha was reallocated as follows for crop module:

Besides crop module, nutritional management through mineral mixture supplementation was carried out for enhancing milk production for 1 buffalo and 1 cow. The improved system could gave net returns of Rs. 2, 03, 170 with cost of cultivation at Rs. 90,930.

Impact

Exotic vegetable based cultivation technologies popularized by ICAR-Indian Institute of Farming Systems Research, Modipuram, have also spread to the adjoining blocks in the district, where large numbers of farmers have now started vegetable cultivation as an option for their income improvement. As there is a huge demand of fresh vegetables in the nearby markets and well connectivity of roads to Haridwar and Dehradun, the farmer is supplying the produce directly to the markets in the nearby towns and fetching a good price in returns.

Economics

With adoption of diversified exotic vegetable based cropping system the net returns from 0.4 ha was increased 119 % from Rs. 92575 to Rs. 2,03,170 with only 9.5 % increase in cost of cultivation based on 2 years of average. The contribution from animal module to the net income was enhanced by 26 % in the improved farming system while there was significant improvement of 219 % from the crop module solely due to diversification by exotic vegetables as compared to existing sugarcane based system. The benefit cost ratio was enhanced from 2.11 in the existing farming systems to 3.23 in the improved system.

CS 1_0.15 ha	Broccoli_2 crops (Oct_April)-Maize (F)_(June_Sept)
CS2_0.10 ha	Lemon Grass (Feb_Dec)+ Leek (Sept_April)
CS3_0.03 ha	Lettuce_red (Sept-April)- Tomato (April_July)
CS4_0.03 ha	Lettuce_green (Sept-April)- Chilli (April_Aug)
CS5_0.03 ha	Chinese Cabbage (Sept-April)- Okra (May_Aug)
CS6_0.03 ha	Cherry Tomato_2 crops (Sept_July)
CS7_0.03 ha	Boundary plantation of papaya and nursery area

Photo 62. Charan Singh with his ready to harvest crop of Red and Green Lettuce

Photo 63. Charan Singh interacting with scientist in his healthy broccoli field

Detaills of Farmer:

Name of Farmer	Sh Charan Singh
Age	54 years
Phone	9568796749
Education	Matriculation
Address	S/o Sh Harish Chand, Village- Bhangela, P.O.- Khatauli, Distt Muzzafara-nagar, U.P.
Land holdings	0.4 ha
Livestock	1 cow, 1 buffalo
Farming Experience	25 years

2. Multi-tier fruit cum vegetable based system for profitability and scalability in horticultural crops: A Success Story (under Farmer FIRST Programme)

Poonam Kashyap, M P Singh, A. S. Panwar, Suresh Malik, A. K. Prusty, M. Shamim, Dr Sunil Kumar, Dr Nisha Verma and Dr P C Jat

Focus Area:

Cultivation of fruits and vegetables in multitier system through optimum land allocation for marginal farmers.

A brief about the Farm Innovation

Joginder Singh, a marginal farmer from Khatauli block of Muzaffarnagar district of Uttar Pradesh having only a meagre 0.24 ha of land was struggling to meet his livelihood with paltry sum of returns from sugarcane system due to land resource constraint. He was adopted by the scientists of ICAR-Indian Institute of Farming Systems Research, Modipuram under Farmer FIRST Programme as a challenge to improve his earnings from the existing land holding. Keeping in mind the small piece of land, a multi-tier horticulture system, comprising of strawberry at lower strata, capsicum at middle strata

and sponge gourd at upper strata in the vertical system was developed for maximum utilization of the land. The improved system could substantially enhance his net income from a meager Rs. 28,200 to Rs. 2,21,375.

Impact

Cultivation of fruit crops like strawberry with accessibility to markets of NCR region besides additional vegetable crops of sponge gourd and capsicum in a small piece of land generated lot of interest in the farmers of locality. The system could meet expectation of the farmer in meeting the livelihood and gaining popularity among neighborhood farmers especially marginal land holders.

Economics

With adoption of multitier fruit cum vegetable based horticultural system, the net returns from 0.24 ha was increased 6.85 times from Rs. 28,200 to Rs. 2,21,375 with 3.25 times increase in cost of cultivation based on 2 years of average when compared with his earlier sugarcane system. The cost of cultivation of the improved system was Rs. 97,000 for 0.24 ha land. The benefit cost ratio was enhanced from 2.24 in the existing systems to 3.20 in the improved system.

Photo 64. Interaction of Scientist with the adopted farmer on the progress of developed multi-tier system

Photo 65. On farm Multi-tier cropping system of Strawberry- Capsicum- Ridge gourd

Detaills of Farmer:

Name of Farmer	Sh Jogender Singh
Age	43 years
Phone	8397800112
Education	8 th class
Address	S/o Sh Mangal Das, Village-Bhangela, P.O.- Khatauli, Distt Muzzafaranagar, U.P.
Land holdings	0.24 ha
Livestock	NIL
Farming Experience	20 years

3. ICAR-IIFSR agro-advisory on integrated nutrient and pest management (INPM) boosted productivity and income from orchard based farming system in Bhudhana, Muzaffarnagar

Chandra Bhanu and Dushyant Mishra

Shree Subodh Tyagi, Vill. -Galla Mandi, Block-Bhudhana, Distt.- Muzaffarnagar is a large farmer with joint family of 13 family members. He is having 20 hectares of land, out of which 7.5 hectare land is under orchard with mid to old age fruit trees. Orchard is contributing more than half of the income of farming system (orchard+ field crops+ livestock). His orchard include mango, guava, sapota, bael, pear, aonla, litchi and jackfruit. Mango occupies about 95 per cent of orchard area and contributes to major share of his income from orchard. Dashehari, Langra, Chausa, Lucknow Safeda and Hapus are major mango varieties. Shree Subodh Tyagi visited ICAR-IIFSR in December, 2014 and explained about lower productivity and decline in his orchard due to lack of knowledge in scientific orchard management and pest/disease management. He desired the help of IIFSR scientists to provide technological back-up to solve the problems of his orchard and increase the productivity and income.

Photo 66. Bumper produce of mango under INPM

Scientists of ICAR-IIFSR visited the orchard of Shree Sobodh Tyagi in December, 2014 and made a proper listing of problems associated with his orchard. The major problems identified were low productivity of mango, lack of integrated nutrient management, shoot borer, mealy bug, hopper, die back, gummosis, decline, sooty mold in mango orchard and inflorescence and fruit rot in jackfruit. Technical interventions of integrated nutrient and pest management (INPM) were given to him and other farmers of the area by organizing Kisan Gosthi and training; leaflet distribution, field visits and

Photo 67. INPM in mango

mobile based advisory etc. to solve the problems of pests and improving the productivity of orchard. Application of urea (2.17 kg), single super phosphate (3.12 kg), muriate of potash (1.67 kg), zinc sulphate (200 g), ferrous sulphate (100 g), copper sulphate (150 g) and borex (100 g) per tree, in the month of July after harvesting of fruits+ one foliar spray of copper oxychloride (0.3%) and starch (0.3%), in the month of November; pruning of unproductive/dead branches; centre opening of trees during December, application of methyl parathion dust around the stem in January; and need based spray of Imidacloprid 17.8 SL(1ml/4l water), wettable sulphur (0.25%) during February (after flowering) were major interventions given in mango and one spray of copper oxychloride (0.3%) at flower bunch initiation in jackfruit were major part of INPM interventions.

Photo 68. Pest management in mango

After one year of interventions, clear results of INPM technology were visible in mango. Yield of mango increased and orchard received higher bidding rates by contractors and sold for Rs.12 lakhs in 2016 and Rs. 14 Lakhs in 2017 against Rs.10 lakhs in 2015. Dying of mango trees was stopped and insect-pests and

diseases were satisfactorily managed. Rotting in jackfruit inflorescence and developing fruits stopped and tree produced excellent and full fruiting (85% more fruits than previous years). Unwanted expenditure on the undesired pesticide application was also stopped and this reduced the cost of orchard management by about 5%. Shree Subodh Tyagi is very much satisfied with ICAR-IIFSR technical interventions in the form of INPM technology for increasing orchard productivity and he is advocating the same to other orchard farmers also. This success story indicates the scope of INPM in increasing productivity and income of orchard owners.

Photo 69. Happy farmer with INPM interventions in mango

4. Employment and income generation in rural/urban youths through round the year mushroom production module

Chandra Bhanu

ICAR-IIFSR developed a year round production module of mushroom and started agro-advisory on mushroom production for employment and income generation in rural/urban youths in 2016. Many farmers visited the office and shown their interest in mushroom production, but due to unviability of organized market facilities in the region they were hesitating to start the business of mushroom. Recently three farmers (S. No.1, 2 and 3 in Table 94) took marketing risk and started mushroom production at their own home/rented rooms. The details of growers, type of advisory provided by IIFSR, production capacity of their mushroom farm/rooms, gross and net income from mushroom production are given in Table 94. One urban youth Dr. Anuj who is an agricultural graduate and having his own business in Noida, started oyster mushroom production as a side business in 2016 after taking proper advice from IIFSR. He has targeted Noida and Delhi market and established his own market of oyster mushroom.

Photo 70. Dr. Anuj and his office employees at oyster mushroom farm, Noida

He earned about Rs.70000/- of net income in 2016 and Rs.280000/- in 2017 and generated round the year employment for two unskilled personnel at his farm. At present he is a well-known oyster mushroom provider in Delhi-NCR. The success of Dr. Anuj indicates that there is also a scope for income and employment generation through oyster mushroom if it is grown after proper market survey.

Two other mushroom growers, Saksham Singh Rana (S. No. 2) and Sh. Virendra Kumar (S. No. 3) from Meerut successfully grew Button mushroom during this year after taking proper advice from the ICAR-IIFSR. They earned remunerative prices of their produce and built their marketing skill at local level. These two and rest of other mushroom producers got a successful training and confidence in mushroom production at their own farm and with their own hands and skills by applying the advice of IIFSR. These farmers are planning to grow mushrooms at larger scale as a full-fledged business in years to come. This may led the foundation of mushroom.

Photo 71. Oyster mushroom farm of Dr. Anuj at Noida, U.P.

Table 94: Production capacity of mushroom farmers and income generation at their farms

S. No.	Name of farmer /grower	Address	Month/year of Ist contact/visit and type of Technology provided	Mushroom species grown	Quantity of substrate used (kg)	Mushroom production (kg)	Sale rate of mushroom (Rs./kg)/ (Average/kg)	Gross income (Rs.)	Net Income (Rs.)	Recycling of spent substrate in field crops/ animal feed/ sale(kg)	Re-marks
1.	Dr. Anuj (Vegan Fresh Mushroom Farm)	Plot No.240/ 241, Surajpur Police line, Greater Noida, (U.P.)	March, 2016 Oyster mushroom production technology Design of crop room and mushroom cropping schedule Need based advise on crop care and IPM on phone/visits	Oyster mushroom (*Pleurotus florida*)	30 q (2016) 40q (2017)	1000 kg 3000 kg	100-150 (120) 150-180 (160)	120000 480000	70000 280000	Compost making	-
2.	Sh. Saksham Singh Rana (Gayatri Mushroom SHG)	Sarai Colony, Near Radha Govind College, Garh Road, Meerut	Oct., 2017 Button/Oyster mushroom production technology Design of crop room and mushroom cropping schedule Need based advise on crop care and IPM on phone/visits	Button mushroom (*Agaricus bisporus*) Oyster mushroom (*Pleurotus florida*)	25 q 1q	375 kg 50 kg	100-140 (110/-) 100	41250 5000	26250 3000	Recycled in crop fields	-
3.	Sh. Virendra Kumar	Vill. Pabarsa, Daurala, Meerut	Nov., 2017 Button mushroom production technology Design of crop room and mushroom cropping schedule Need based advise on crop care and IPM on phone/visits	Button mushroom (*Agaricus bisporus*)	10 q	180 kg	80-120(90/-)	16200	11000	Recycled in sugarcane crop fields	-

S. No.	Name of farmer /grower	Address	Month/year of Ist contact/visit and type of Technology provided	Mushroom species grown	Quantity of substrate used (kg)	Mushroom production (kg)	Sale rate of mushroom (Rs./kg)/ (Average/kg)	Gross income (Rs.)	Net Income (Rs.)	Recycling of spent substrate in field crops/ animal feed/ sale(kg)	Re-marks
4.	Nayab Subedar Suresh K. Singh and Nayak Vijay Kumar	22 Punjab Regement, Meerut Cantt., Meerut	Feb., 2018 Oyster mushroom production technology Design of crop room and mushroom cropping schedule Need based advise on crop care and IPM on phone/visits	Oyster mushroom (*Pleurotus florida*)	12 kg	10kg	Self-consumption	-	-	Animal feed in dairy	Grown Ist time as a training for army personals
5.	Sh. Arvind Kumar	Vill. Gotka, Sardhana, Meerut	Dec., 2017 Oyster mushroom production technology Design of crop room and mushroom cropping schedule Need based advise on crop care and IPM on phone/visits	Oyster mushroom (*Pleurotus florida*)	1q	50kg	100-140 (110)	5500	3000	Animal feed	-

RESEARCH COORDINATION AND MANAGEMENT

30th Meeting of Institute Research Committee

The 31st meeting of institute research committee (IRC) of institute was held during 23 - 24 September, 2017 at ICAR-IIFSR, Modipuram. The meeting was chaired by Dr A. S. Panwar, Director, ICAR-IIFSR while Dr. S. Bhaskar, ADG (AAF and CC), NRM Division, ICAR, New Delhi was special invitee. During the meeting, action taken report of 30th IRC meeting, results of on-going research projects as well as exploratory studies were discussed. Dr. Peyush Punia, Member Secretary, 31st IRC meeting, welcomed the Chairman, ADG and all the members of IRC. Dr A. S. Panwar, Director during his remarks, welcomed ADG, Dr. S. Bhaskar and all the member scientists. He suggested that, number of projects should be reduced without affecting the mandate of Institute. There should be a main programme for each division as per divisional mandate and suitable activities under the main programme should be taken up as sub-projects under the divisional programme in farming systems perspective to achieve the goals of the Institute. Dr. S. Bhaskar suggested that, the projects can be clubbed under major theme and individual scientist (PI and Co-PI) must formulate the ongoing as well as new projects under the major theme for each divisions. He emphasized to merge all 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 30th IRC proceeding and research highlights of on-going projects in brief. All the scientists presented findings of their projects and presentations were followed by exhaustive discussions for further improvements in the projects. Ten major themes were finalized for all the divisions and all the existing projects were merged into the themes.

Photo 72. Dr. S. Bhaskar, ADG (AAF and CC), NRM Division, ICAR addressing the scientists during 31st IRC

First meeting of 8th Research Advisory Committee

The first meeting of the 8th Research Advisory Committee of ICAR-Indian Institute of Farming Systems Research, Modipuram was held on 13-14 June, 2017. 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. Naresh Sirohi, farmer's representative, Sh. Rajesh Kumar Garg and scientists of the institute participated in the meeting. Member Secretary, Dr. Peyush Punia presented the action taken report on the recommendations of last RAC meeting and the committee was satisfied with the action taken report. He also presented in brief, the research achievements of AICRP-IFS.

Dr. Azad Singh Panwar, Director, ICAR-IIFSR welcomed the Chairman and Members of RAC and presented the overall progress and vision of the institute. He also briefed about the activities being undertaken by the Institute for economic empowerment and livelihood improvement of small farming communities in the country.

Photo 73. RAC meeting of ICAR-IIFSR

In his opening remarks, Chairman applauded the efforts and achievements of the institute in the farming system mode and pointed out that the basic aim of

Photo 74. RAC members during the meeting

Photo 75. Dr. A.S. Panwar presenting Institute achievements to RAC Committee

farming systems research should be to find solutions to farmers problems for sustained income throughout the year as well as more focus should be on farmer's field. The need of the hour is to refine IFS system by interventions, input requirements with focus on mechanization with implements for small and marginal farmers. Dr S Bhaskar welcomed the RAC committee and requested them to give inputs to lead the institute for next three years in tune with Government's expectations. He emphasized on developing indicators for sustainable development in organic farming and show visibility of OFR models with proper dissemination of success stories and extension activities of the institute. Dr N Sarangi appreciated the transformation of institute from cropping system to farming system, highlighted the importance of nutrient management in IFS models as well as addition of different modules as per farmers choice such as horticulture, fisheries, animal husbandry, poultry, piggery etc. He also mentioned importance of processing and value addition among the farmers. Shri Naresh Sirohi explained about the challenges for small and marginal farmers as well as employment generation for the rural youth in agriculture sector. Dr U K Behera highlighted he importance of dissemination of IFS models and modules of small and marginal farmers with convergence of all resources to increase the farmers income substantially. He also told that the need of the hour is to replace the soil health card with Farm Development Card as it is holistic and involves more components of IFS . Mr R K Garg in his remarks wanted some research work on potato as intercrop. Dr H Ravishankar complimented the scientists and NRM division for undertaking excellent work in farming system mode for the benefit of the farmers of the country. He emphasized on the need to have thorough understanding of socio economic and agrocimatic conditions to develop IFS models and modules. Dr N Dev Kumar felt the need to have better understanding of water management practices to be adopted in IFS and demonstrate it in the farmers field. He also felt the need to further promote the SSNM approach and organic farming to be developed in permanent organic plots for demonstration purpose to farmers.

The Programme Facilitators and Heads of different sections presented the highlights of research achievements of the respective sections. The Chairman and the members of 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 future.

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सुनील कुमार, आजाद सिंह पंवार, प्रेम सिंह, पूनम कश्यप और आशीश कुमार प्रूष्टी, पोस्टर प्रदर्शनी, शीर्षः ''आधुनिक कृषि का ज्ञान'', 26.09.2017 को हिन्दी पखवाड़ा का आयोजन भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ (उ.प्र.) द्वारा किया गया।

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SEMINARS/SYMPOSIA/WORKSHOP/CONFERENCE / SUMMER SCHOOL/WINTER SCHOOL/ MEETINGS ATTENDED

Name of Participants	Title of Seminar/ Symposia/Workshop	Venue	Period
Dr Sunil Kumar and Dr Amit Kumar	Workshop on Potential Application of Quantitative Analysis Tools in Farming Systems using Farm Design.	ICAR-IIFSR, Modipuram, Meerut	17-18 March, 2017
Dr N. Ravisankar	Group meeting on Uttar Pradesh State Coordination Committee for doubling farmers income by March 2022	ICAR-Indian Veterinary Research Institute, Izatnagar	5 April, 2017
Dr M Shamim	National conference on climate change and agricultural production	Birsa Agricultural University, Sabour	5-9 April, 2017
Dr P. C. Jat	State Coordination Committee meeting on Doubling Farmers Income of Sikkim state	NRC Pekyong, Sikkim	01 May, 2017
Dr. N. Subash	International Conference Climate Change and Adaptation: Empowering Small Holders and Ensuring Food Security	Organized by TNAU under ClimaAdapt at Chennai, Tamil Nadu	11-12 May, 2017
Dr N. Ravisankar	Technical Programme finalization workshop of AICRP-Dryland Agriculture	ICAR-Central Research Institute for Dryland Agriculture, Hyderabad	27 May, 2017
Dr Peyush Punia, Dr Poonam Kashyap, Dr Sunil Kumar and Dr P.C. Ghasal	21 days Summer School on Modern concepts and practices of organic farming for safe, secured and sustainable food production,	ICAR-IIFSR, Modipuram, Meerut	14 July to 3 August, 2017
Dr. N. Ravisankar	Review meeting of Vigilance Officers	ICAR-Central Institute of Agricultural Engineering, Bhopal	18 August, 2017
Dr N. Ravisankar, Dr A. K. Prusty and Dr. P.C. Ghasal	CIMMYT-WUR Joint Workshop "Science of Farming Systems: Moving from Prototyping to Model Based Assessment and Designing of Sustainable and Resilient Farming Systems in South Asia"	Wageningen University and Research, The Netherlands	21-24 August, 2017
Dr. R.P. Mishra, Dr. Debashis Dutta Dr P.C. Jat and Dr. Chandra Bhanu	International Conference on "Advances in Potassium Research for Efficient Soil and Crop Management" organized by International Plant Nutrition Institute (IPNI)	NASC Complex, Pusa, New Delhi	28-29 August, 2017
Dr P C Jat	International Conference on Advances in Potassium Research for Efficient Soil and Crop Management	NASC, New Delhi	28-29 August, 2017
Dr. N. Subash	National Workshop on "Developing a Roadmap for Agricultural Knowledge Management in India"	Organized by ICAR-DKMA at NASC Complex, New Delhi	27-28 September, 2017

Name of Participants	Title of Seminar/ Symposia/Workshop	Venue	Period
Dr. N. Ravisankar	SFC meeting of scheme 4 (Sustainable cropping and farming systems research)	Krishi Bhawan, New Delhi	28 September, 2017
Dr P C Jat	77th Annual National Conference of Indian Society of Agricultural Economics	CPGS,CAU, Barapani, Meghalaya	12-14 October, 2017
Dr Poonam Kashyap, Dr A. K. Prusty, Dr Sunil Kumar	International Conference on Advances in agricultural and Biodiversity conservation for Sustainable Development (ABCD-2017)	Brahaspati Bhawan, C.C.S. University, Meerut, U.P.	27-28 October, 2017
Dr P. C. Jat	Review for Varanasi project "On-farm demonstration and refinement of improved IFS technologies for livelihood security".	BHU Varanasi	30 October, 2017
N. Ravisankar	Vigilance Awareness Week-2017	ICAR-IIFSR, Modipuram and RARI, Durgapura, Rajasthan	30 October to 4 November, 2017
Dr. R.P. Mishra, Dr. Debashis Dutta,	Annual Group Meeting of AICRP on Integrated Farming Systems	Rajasthan Agricultural Research Institute, SKNAU, Durgapura	3-5 November, 2017
Dr N. Ravisankar Dr A. K. Prusty, Dr M Shamim, Mr D. Tripathi and Dr Brij Mohan Garg	Annual Group Meeting of AICRP on Integrated Farming Systems	Rajasthan Agricultural Research Institute, SKNAU, Durgapura	3-5 November, 2017
Dr Poonam Kashyap	Third International conference on Bioresource and Stress Management.	Jaipur, Rajasthan	8-11 November, 2017
Dr. Amit Kumar, Dr Kamlesh Kumar	Winter School New Generation smart agro-chemical oriented approaches for crop and human health management	ICAR-IARI, New Delhi	7 -27 December, 2017
Dr N. Ravisankar, Dr Debashis Dutta and M. Shamim	Interactive Seminar Agrimonde-Terra for 2050, The Indian Perspective	National Agricultural Science Complex, New Delhi	7-9 December, 2017
Dr. NishaVerma	HWWE 2017 International Conference on Ergonomics for Improved Productivity	Aligarh Muslim University, Aligarh	8-10 December, 2017
Dr N. Ravisankar, Dr Debashis Dutta	82 National Convention and Nation Seminar of Indian Society of Soil Science	Amity University, Kolkata	11-12 December, 2017
Dr. N. Subash	International Seminar (CCAW 2017) on "Global Climate Change: Implications for Agriculture and Water Sectors"	Organized jointly by Agricultural Universities in Maharashtra and WALMI at Aurangabad	14-16 December, 2017
Dr N. Ravisankar A. K. Prusty	Annual Group Meeting of Network Project on Organic Farming	ICAR-Indian Institute of Farming Systems Research, Modipuram	18-19 December, 2017
Dr. R.P. Mishra, Dr. Debashis Dutta and Dr. Chandra Bhanu	Annual Group Meeting of Network Programme on Organic Farming	ICAR-Indian Institute of Farming Systems Research, Modipuram	18-19 December, 2017

Name of Participants	Title of Seminar/ Symposia/Workshop	Venue	Period
Dr V.P. Chaudhary	Attended the International Seminar on "land and water issues in South East Asia: Status, challenges and opportunities: at NERIWALM	Tejpur (Assam).	18-20 January, 2018
Dr. N. Subash	Second Half yearly foreign aided projects review meeting	NRM Division, ICAR, KAB-II, New Delhi	31 January, 2018
Dr. Nisha Verma	Ist International Extension Congress 2018 on New Horizons of Extension Challenges and Opportunities	ICAR-CIWA, Bhubaneshwar	1-3 February, 2018
Dr. N. Ravisankar and Dr. M Shamim	Divisional Review Meeting	NASC Complex, New Delhi	5-6 February, 2018
Dr. N. Subash	NICRA Technical Program Review Meeting of NRM Institutes	ICAR-NIASM, Baramati	8-9 February, 2018
Dr. N. Subash	NICRA Technical Program Review Meeting of Modeling Group	NASC Complex, New Delhi	13 February, 2018
Dr V.P. Chaudhary	Attended in the all India Seminar on "High Tech Cultivation of Vegetable & Flowers" at Institution of engineers	Dehradun.	10-11 March, 2018
Dr. Amit Kumar	National workshop on "Revisiting Foundation Course for Agricultural Research Service (FOCARS): Reflections and feedback of trained scientists"	ICAR-NAARM, Hyderabad	15-16 March, 2018
Dr A. K. Prusty, Dr M. Shamim and Dr. P.C. Ghasal	ICAR-IIFSR-AICRP-IFS-CIMMYT Joint Workshop on "Science of Farming Systems: Moving from Prototyping to Model Based Assessment and Designing of Sustainable and Resilient Farming Systems in South Asia"	Udaipur (Rajasthan)	19-23 March, 2018
Dr. N. Ravisankar, Dr. A. K. Prusty and Dr. M Shamim	ICAR-IIFSR-AICRP-IFS-CIMMYT Joint Workshop on "Science of Farming Systems: Moving from Prototyping to Model Based Assessment and Designing of Sustainable and Resilient Farming Systems in South Asia"	Hotel Hill Top Palace, Udaipur	19-23 March, 2018

TRAININGS/ WORKSHOPS ORGANISED AND ATTENDED

Trainings /Worshop Organised

Name	Training/workshop/schools organized	Venue	Period
Dr M. Shamim, Dr A. K. Prusty, Dr Poonam Kashyap	Training programme on Agro-Meteorological applications and post harvest management in oilseeds production	ICAR-IIFSR	16-17 March, 2018
Dr A. K. Prusty, Dr Poonam Kashyap, Dr P. C. Ghasal	Workshop on Potential application of Quantitative Analysis tools in Farming system using Farm Design	ICAR-IIFSR	17-18 March, 2017
Dr M. Shamim, Dr A. K. Prusty and Dr Poonam Kashyap	Training on Improved Techniques of raising oilseeds in farming Systems	ICAR-IIFSR	21-22 March, 2017
Dr. Dushyant Mishra	Demonstration on mango thrips management in association with Dow Agro Sciences.	Raj Garden, Sardhana, Meerut	11 April, 2017
Dr VP Chaudhary and Dr Nisha Verma	Demonstration cum training programme on Use of brush cutter and Mist blower in different farm operations in collaboration with Industry (STHIL company)s	Pahadpur village, block Mavana, Meerut	24 April, 2017
Dr. R.P. Mishra, Dr. L. K. Meena, Dr. P.C. Ghasal	Sawchchh Bharat Pakhwada	ICAR-IIFSR (Office & resident Campus)	16-31 May, 2017
Dr. M.P. Singh, Dr. N. Ravishankar, Dr. R.P. Mishra, Dr. M. Shamim, Dr. PoonamKashyap, Dr. NishaVerma, Dr. L. K. Meena, Dr. P.C. Ghasal, Dr. Amit Kumar	Sawchchh Bharat Pakhwada	Jaitpur (MGMG Village)	31 May, 2017
Dr. Dushyant Mishra	Workshop on World environment day	Pallav Tower Modipuram	05 June, 2017
Dr. Chandra Bhanu	Kisan Sewa Yatra-*Kharif*	10 villages of Meerut and Muzaffarnagar	29 June -07 July, 2018
Dr. N. Ravisankar Dr. Dushyant Mishra Dr. Poonam Kashyap	Interface Meeting for Integrated Development of Horticulture in Western Uttar Pradesh and Uttarakhand	ICAR-IIFSR, Meerut	11 July, 2017
Dr. A.S. Panwar, Dr. N. Ravishankar, Dr. D. Dutta, Dr. A. Prusty, Dr. M. Shamim, Dr. L.K. Meena	21 days Summer School on Modern concepts and practices of organic farming for safe, secured and sustainable food production	ICAR-IIFSR, Modipuram	14 July– 03 August, 2017
Dr. N. Ravisankar	Training on stability/combined analysis methodology for NPOF experimental data	ICAR-Indian Institute of Farming Systems Research, Modipuram	25-26 July, 2017

Name	Training/workshop/schools organized	Venue	Period
Dr Peyush Punia, Dr Poonam Kashyap Dr A. K. Prusty Dr Sunil Kumar	Model Training Course on Agriculture entrepreneurship through farming systems approach	ICAR-IIFSR	22 -29 August, 2017
Dr VP Chaudhary, Dr Dr. M Shamim and Dr Nisha Verma	ICAR sponsored summer school on Machinery for conservation in agriculture for mitigation and adaptation of Climate Change	ICAR-IIFSR, Modipuram	5-25 September, 2017
Dr. Prem Singh, Dr. L.R. Meena, Dr. D. Kumar, Dr. Khushyal Singh, Dr. L.K. Meena, Dr. P.C. Ghasal	Swacchta Bharat Abhiyan	Dashrathpur, Meerut	23 September, 2017
Dr. Amit Kumar Dr. Nisha Verma	Krishak Goshthi	Krishak Goshthi Thari and Veerpur Tara village Block Ramnagar, Distict Nanitital.	15 October, 2017
Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim	Annual Group Meeting of AICRP on Integrated Farming Systems	Rajasthan Agricultural Research Institute, SKNAU, Durgapura	3-5 November, 2017
Dr. Nisha Verma and Dr. Amith Nath	Value addition in farm produces into blended squash, mixed jam and ginger paste through SHG formulation	Post Harvest Technology Lab, Modipuram, Meerut	9 November, 2017, 24 November, 2017
Dr Poonam Kashyap Dr Sunil Kumar	Training Programme on Development of varieties and technology for specialty melon production under protected condition in North Indian Plains and its dissemination among the farmers	ICAR-IIFSR	5 December, 2017
Dr. Dushyant Mishra	One day training on canopy management for improving fruit quality in mango	Kharad, Muzaffarnagar	5 December, 2017
Dr. Dushyant Mishra	One day Training to mango growers for management of thrips insect	Budhana Muzaffarnagar.	5 December, 2017
Dr. R P Mishra, Dr. Debashis Dutta, Dr. Poonam Kashyap, Dr. A K Prusty	Soil Health day	ICAR-IIFSR, Modipuram	5 December, 2017
Dr. Nisha Verma and Dr. Amith Nath	Value addition of Sugarcane into value added jaggery for SHG (Devanjali Mahila Samuh).	Post Harvest Technology Lab, Modipuram, Meerut	15 December, 2017
Dr. N. Ravisankar Dr. A.K. Prusty Dr. M. Shamim	Annual Group Meeting of Network Programme on Organic Farming	ICAR-Indian Institute of Farming Systems Research, Modipuram	18-19 December 2017
Dr. Dushyant Mishra	Training to officers from Panchayat and Rural Development Department, West Bengal Government	ICAR-IIFSR, Modipuram	21-22 January, 2018
Dr. Dushyant Mishra	One day training on Improving productivity of crops.	Jhidio, Naval Surajpur, Govindpur, Kithor	25 January, 2018

Name	Training/workshop/schools organized	Venue	Period
Dr A. K. Prusty, Dr M. Shamim Dr Poonam Kashyap	Training Programme on dissemination and Upscaling of Improved IFS Technologies through KVK Scientists	ICAR-IIFSR	30 January - 1 February, 2018
Dr. M. P. Singh, Dr P C Jat, Dr. Khushyal Singh, Dr. Chandrabhanu	Training Programme on Farming System diversification through Mushroom and Fish Farming	BHU, Varanasi	4-6 February, 2018
Dr. Prem Singh, Dr. Sunil Kumar, Dr. L. K. Meena, Dr. Amit Kumar	Productivity Week Celebration	ICAR- IIFSR, Modipuram Meerut (U.P.)	12-18 February, 2018
Dr. Prem Singh, Dr. L. K. Meena, Dr. Amit Kumar, Dr. C. Bhanu, Dr. V. P. Chaudhary, Dr. D. Kumar	Productivity Week Celebration	Barwala (Muzaffarnagar)	18 February, 2018
Dr. Poonam Kashyap, Dr. A K Prusty, Dr. M Shamim, Dr. P C Jat, Dr. Nisha Verma, Dr. Sunil Kumar	Raising disease free and healthy nursery of fruits and vegetables for quality fruit production	Bhayangi Bhangela village, Muzaffarnagar	20 February, 2018
Dr Suresh Malik, Dr Poonam Kashyap , Dr Sunil Kumar, Dr A. K. Prusty	Capacity Building and Skill Upgradation Programme on Farm Management	ICAR-IIFSR	6-10 March, 2018
Dr. Prem Singh, Dr. M.P. Singh, Dr. L. K. Meena, Dr. Amit Kumar, Dr. C. Bhanu, Dr. V. P. Chaudhary, Dr. D. Kumar	Kisan Gosthi	Rashoolpur-jatan	7 March, 2018
Dr. Dushyant Mishra	One day training on Management of mango crop	Surajpur, Govindpur, Kithor	12 March, 2018
Dr. Chandra Bhanu, Dr. L.K. Meena, Dr. R. P. Mishra and Dr. P.C. Ghasal	"मशरूम उत्पादन के माध्यम से ग्रामीण और शहरी युवाओं में उद्यमिता विकास"	ICAR-IIFSR, Meerut	13-19 March, 2018
Dr. P. C. Jat, Dr. Poonam Kashyap, Dr. M. P. Singh, Dr. Suresh Malik, Dr. A. K. Prusty Dr. M Shamim, Dr. Sunil Kumar, Dr. Nisha Verma	Kisan ghosti cum Animal health camp	Sathedi , Muzaffarnagar	14 March, 2018
Dr. Prem Singh, Dr. Sunil Kumar, Dr. L. K. Meena	Kisan Gosthi	Gandewada (Shamli)	15 March, 2018

Name	Training/workshop/schools organized	Venue	Period
Dr. A.S. Panwar, Dr. M.P. Singh, Dr. Prem Singh, Dr. L.R. Meena, Dr. S. Malik, Dr. D. Kumar Dr. Khushyal Singh,	Farmers-Scientists Interface	ICAR- IIFSR, Modipuram Meerut (U.P.)	17 March, 2018
Dr. Prem Singh, Dr. N. Subash, Dr. Sunil Kumar, Dr. L. K. Meena, Dr. V. P. Chaudhary, Dr. D. Kumar, Dr. C. Bhanu	Kisan Gosthi & World Meteorological Day Celebration	Gandewada (Shamli)	23 March, 2018
Dr. Suresh Malik, Dr. P . C. Jat, Dr. Poonam Kashyap, Dr. M. P. Singh, Dr. A. K. Prusty, Dr. M Shamim, Dr. Sunil Kumar, Dr. Nisha Verma	Kisan gosthi cum Animal health camp	Sonta, Muzzafarnagar	24 March, 2018

Trainings attended

Name	Title of training	Venue	Period
Dr Poonam Kashyap and Dr. A.K. Prusty	Advanced Training on Recent Trends in Agriculture Science	SVPUAT Modipuram, Meerut	19 April-2 May, 2017
Dr. P. C. Ghasal Dr. Poonam Kashyap Dr. Peyush Punia Dr. Sunil Kumar	Summer School on Modern concepts and Practices of Organic Farming for Safe, Secured and Sustainable Food Production	ICAR-IIFSR, Meerut	14 July - 3 August, 2017
Dr. Nisha Verma	Good Practices in Quantitative Social Science Research	ICAR-CTCRI, Thiruvanthapuram, Kerala	7 -12 August, 2017
Dr. Chandra Bhanu	Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR-IIFSR, Meerut	05-25 September, 2017
Dr A.K. Prusty Dr. Peyush Punia	Recent advances in ornamental aquaculture	Central Institute of Freshwater Aquaculture, Bhubaneswar	12-16 September, 2017
Dr Vipin Chaudhry	Developing a Roadmap for Agricultural Knowledge Management in India	NASC Complex, New Delhi	27-28 September, 2017
Dr M Shamim	Methodological framework for implementation of FFP	ICAR-CISH, Luknow	3-6 October, 2017
Dr P C Jat	Advance Training programme on Conservation Agriculture-Asia	Ludhiana & Karnal	23 October - 6 November, 2017
Dr M Shamim	Methodological framework for implementation of FFP	ICAR-IISWC, Dehradun	6-9 November, 2017
Dr. P. C. Ghasal	Refresher Course on Organic Agriculture and Its relevance in present day agriculture	UAS, Dharwad, Karnataka	9-29 January, 2018

TECHNOLOGY TRANSFERED AND ASSESSED

Name of the Participant	Title of training	Technology transfered	No of farmers
Dr. Amith Nath and Nisha Verma	Value addition in farm produces into blended squash, mixed jam ginger paste and value added jaggery through SHG formulation	Technology of blended squash (guava+orange) and (guava + pineapple + pomegranate), mixed jam (guava+apple+aonla+orange+ramphal) and (guava+pineapple+pomegranate+apple), ginger paste, has been transferred to women SHG of Sathedi village	10 SHGs
Dr. VP Chaudhary and Dr. Nisha Verma	Demonstration cum training programme on Use of brush cutter and Mist blower in different farm operations in collaboration with Industry (STHIL company)	Technology of brush cutter and Mist blower in different farm operations in collaboration with Industry (STHIL company) has been transferred	70 farmers
Dr. Poonam Kashyap, Dr. M. P. Singh, Dr. A S Panwar, Dr. Suresh Malik, Dr. A K Prusty, Dr. M Shamim, Dr. Nisha Verma, Dr. Sunil Kumar, Dr. P C Jat	Demonstration cum training programme on raising disease free and healthy nursery of fruits and vegetables	Technology of use of soiless media 9 vermiculite + Perlite+ cocopit) in pro-trays has been transferred to the visiting farmers and at on fields of farmers	250 farmers
Dr. Poonam Kashyap, Dr. M. P. Singh, Dr. A S Panwar, Dr. Suresh Malik, Dr. A K Prusty, Dr. M Shamim, Dr. Nisha Verma, Dr. Sunil Kumar, Dr. P C Jat	Technology for offseason production of fruits and vegetables	Technology of use of low ccost protected structures like poly tunnels like poly tunnels and net house for raising offseason vegetables and fruits (strawbeery and papaya) has been transferred to the farmers under farmer first project	200 farmers
Dr. Poonam Kashyap, Dr. A K Prusty, Dr. Peyush Punia	Technology for development of pond-dyke system has been developed at Siwaya Farm and has been transfeered to the farmers and other visitors	Use of Pond-dyke system for higher gains and profits	5 farmers
Dr. A.S. Panwar and Dr. N. Ravisankar	Four Integrated Farming System (IFS) models *viz* homestead, coconut, banana and rice-based systems developed through AICRP on Integrated Farming Systems have been transferred to Kerala State Government	A total of 2300 IFS models are proposed to be established in various panchayats by State Government with total financial outlay of Rs 700 lakhs and with technical support of ICAR-IIFSR through AICRP on IFS (No R3/65700/2017 dated 30/10/2017	1000 farmers
Dr. L.R. Meena and Dr. J.P. Singh	IFS Modal at main farm	Integrated Farming System for sustaining production and livelihood improvement of small farmers in western plain zone of Uttar Pradesh	20
Dr. L.R. Meena, Dr. Devendra Kumar, Dr. L.K. Meena and Dr. A.L. Meena	IFS Modal at main farm	Technology for round the year fodder production	25

Name of the Participant	Title of training	Technology transfered	No of farmers
Dr. Devendra Kumar, Dr. A.S. Panwar and Dr. L.R. Meena	Crop improvement programme at siwaya farm	Pusa Sugandha-2 (Basmati Rice) - Highest grain yield recommended for organic and inorganic conditions.	5
Dr. Devendra Kumar, Dr. A.S. Panwar, Dr. L.R. Meena and Dr. L.K. Meena	Crop improvement programme at main & siwaya farm	Kufri Mohan (Potato) - Highest marketable as well as total tuber yield, blight and frost tolerant, recommended for organic and inorganic conditions	6
Dr. Devendra Kumar, Dr. A.S. Panwar, Dr. L.R. Meena and Dr. P.C. Ghasal	Crop improvement programme at main farm	DS 2705 (Soybean) - Mid-late maturing, high seed yield and tolerance against yellow mosaic and blight, recommended for organic and inorganic conditions	5
Dr. Devendra Kumar, Dr. A.S. Panwar, Dr. L.R. Meena and Dr. P.C. Ghasal	Crop improvement programme at main farm	SL 982 (Soybean) - Mid-late maturing, high seed yield and tolerance against yellow mosaic and blight, recommended for organic and inorganic conditions	5
Dr. Devendra Kumar, Dr. L.K. Meena and Dr. A.L. Meena	Crop improvement programme at main farm	CoPk 05191 (Sugarcane) - Early maturing, high cane yield and suitable for summer planting, recommended for organic and inorganic conditions	8
Dr. Devendra Kumar, Dr. A.S. Panwar, Dr. L.R. Meena and Dr. L.K. Meena	Crop improvement programme at main farm	CSH-30 (Sorghum) - Early maturing, higher grain yield, recommended in non-traditional area (western plain zone) under inorganic condition	4
Dr. Devendra Kumar, Dr. A.S. Panwar, Dr. L.R. Meena and Dr. L.K. Meena	Crop improvement programme at main farm	CSV-27 (Sorghum) - Highest green fodder yield, recommended in non-traditional area (western plain zone) under inorganic condition	4
Dr. Amit Nath, Dr. L. R. Meena and Dr. AS Panwar	Value addition on farmer field	Developed process technology for production of Tulsi beverages/jam/concentrate/tea	15
Dr. Amit Nath, Dr. Dushyant Mishra, Dr. D. Dutta and Dr. Nisha Verma	Value addition on farmer field	Standardized process technology for production of Carrot Tuity-Fruity, jam and powder	12
Dr. Amit Nath, Dr. PC Gashal, Dr. N. Ravishankar, Dr. S. Mallik, Dr. D. Dutta, Dr. AK Prusty and Dr. AS Panwar	Value addition on farmer field	Optimized the protocol for production of Squash from Kinnow mandarin	18
Dr. Amit Nath, Dr. D. Dutta and Dr. AS Panwar	Value addition on farmer field	Optimized the protocol for production of green mango panna and amchur powder	20
Dr. Amit Nath, Dr. Nisha Verma, Dr. Dushyant Mishra and Dr. AS Panwar	Value addition on farmer field	Protocols standardized for production of blended jam, squash and RTS	15

Name of the Participant	Title of training	Technology transfered	No of farmers
Dr. Dushyant Mishra, and Dr. L K Meena	Fruit based farming at main farm	Technology for vegetative propagation of Dragon fruit	12
Dr. Dushyant Mishra and Dr. Amit Nath	Fruit based farming at main farm	Quality improvement in Valencia Orange	10
Dr. Dushyant Mishra	Fruit based farming at main farm	Pruning time in low chilling apple	18
Dr. VP Chaudhary	Long term effect of resource conservation technologies in rice-wheat system	Promoting and transferring technologies for rice crop establishment (11 Nos.) under different field conditions *viz.*, Direct seeded rice (DSR) in wet & dry field under unpuddled & puddled field condition	100
Dr. VP Chaudhary	Long term effect of resource conservation technologies in rice-wheat system	Demonstrating the technology for rice residue management of wheat sowing by advance machineries (i.e. happy turbo seeder, rotary tiller, strip till drill, double disc planter etc.)	150
Dr. VP Chaudhary	Long term effect of resource conservation technologies in rice-wheat system	Promoting and transferring the resource conservation technologies (RCTs) for resilient agriculture under changing climate scenario such as sowing in no-till with full residue field.	100
Dr. VP Chaudhary and Dr. Nisha Verma	Development of package of machineries for complete mechanization of small land holders under different farming systems situation (ICAR-Extramural project)	Improved tools in sugarcane-wheat-paddy production system *viz.* sugarcane de-topper, de- trasher, cane cutting knife (ICAR-IISR developed), improved sickles (CIAE/falcon/VPKAS) make, brush cutter have been ergonomically assessed on men and women farmers for its efficiency and comfort over the traditional tools and transferred to the clients	60
Dr. VP Chaudhary and Dr. Nisha Verma	Development of package of machineries for complete mechanization of small land holders under different farming systems situation (ICAR-Extramural project)	Technologies transfer to farmers fields & popularization of sugarcane cutter planter, brush cutter, mist blower, weeder and intercultural by manually operated rotary tiller among the farmers	70
Dr. Dushyant Mishra and Dr. A S Panwar	Print and electronic media interaction	Low chilling apple cultivation for plains	> 2.0 lakh
Dr. Dushyant Mishra and Dr. A S Panwar	Print and electronic media interaction	Dragon fruit cultivation	> 1.0 lakh
Dr. Dushyant Mishra and Dr. A S Panwar	Print and electronic media interaction	Valencia orange cultivation	> 2.0 lakh
Dr. Dushyant Mishra	Print and electronic media interaction	Apple ber for western plains	> 1.0 lakh
Dr. Dushyant Mishra and Dr. L K Meena	Farmers- Scientist Interface meetings	Technology for vegetative multiplication of Dragon fruit	20
Dr. Dushyant Mishra	Farmers- Scientist Interface meetings	Technology for pruning time in low chilling apple	50

AWARDS/HONOURS AND RECOGNITIONS

Awards and Honours

Dr. Lalit Krishan Meena received best Poster Presentation Award (2nd) as co-author in International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD 2017) 27-28 October, 2017 held at BrahaspatiBhawan, C.C.S. University, Meerut, Uttar Pradesh, India.

Dr. Lalit Krishan Meena, Dr. P.C. Ghasal, Dr. Jairam Choudhary and Mr. Kamlesh Kumar received Third prize in 100x4 meter relay race in ICAR-Zonal Tournament (North Zone)-2017 during 30th October - 02ed November, 2017 at ICAR-IISR, Lucknow as representing ICAR-IIFSR, Modipuram.

Dr. Lalit Krishan Meena received Best Poster Presentation Award- on "Identification of suitable sugarcane clones for higher cane and green top yield for western plain zone". National Conference on Intervention of climatic change in Sustainable Development of Agriculture, Food and Nutrition Security and its Amelioration held on March, 24-25, 2017 organized by Society for World Environment, Food and Technology(SWEFT), New Delhi (India) at Swami Vivekanand Subharti University, Meerut(U.P),India.

Dr. Amit Kumar received best poster presentation award (1st) as co-author in the International conference on Advances in Potassium Research for Efficient Soil and Crop Management held during 28-29 August, 2017 at NASC Complex, New Delhi, India

Dr. Amit Kumar received 1st prize in Hindi essay writing competition organized for the scientists on 14/09/2017 at ICAR-IIFSR, Modipuram on the occasion of Hindi Pakhwada during 14th-28th September 2017

Dr. Amit Kumar received 3rd prize in Hindi writing competition organized on 23/09/2017 at ICAR-IIFSR, Modipuram on the occasion of Hindi Pakhwada during 14th-28thSeptember 2017

Dr. Sunil Kumar received certificate of appreciation for imparting his outstanding and lasting contribution as advisory member on the occasion of International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD 2017) during 27-28 October, 2017 at Brahaspati Bhawan, C.C.S. University, Meerut, Uttar Pradesh, India.

Dr. Sunil Kumar Received 2ndprize in poster presentation on "Computational Modeling and Analysis of Varietal Effects on Growth and Yield of Rice using IFSS Ver. 1.1 Model in Western Plain Zone of Uttar Pradesh" in the International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD 2017) 27-28 October, 2017 held in Brahaspati Bhawan, C.C.S. University, Meerut, Uttar Pradesh, India

Dr. Sunil Kumar received Certificate of Appreciation for participating in Poster Presentation on the occasion of Hindi Pakhwara (14-28 September, 2017 held in ICAR-IIFSR, Modipuram, Meerut.

Dr Poonam Kashyap received Best Oral Presentation Award in the theme Entitled NRM- Resource Integration for livelihood and nutritional security of farmers of Tehri Himalayas of India during third International conference on Bioresource and Stress Management held during 8-11 Nov, 2017 at Jaipur, Rajasthan.

Dr Poonam Kashyap received Best Oral Presentation for a presentation on Agri-Entrepreneurship development through Horticulture in the International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD-2017) During 27-28 October, 2017 at Brahaspati Bhawan, C.C. S. University, Meerut, U.P.

Dr Poonam Kashyap bagged second prize prize in Hindi essay writing competition organized for the scientists on 14/09/2017 at ICAR-IIFSR, Modipuram on the occasion of Hindi Pakhwada during 14th-28th September 2017

Dr Nisha Verma received best poster paper presentation for the research paper entitled ''पश्चिमी उत्तर प्रदेश की प्रमुख कृषि प्रणालियों में महिलाओं से जुड़े कृषि कार्य एवं उनसे सम्बन्धित कठिनाइयाँ'' by IIFSR on 26-09-2017 during Hindi Pakhwada.

Dr. Khushyal Singh received Outstanding Achievement Award-2018 for recognition of research quality, novelty and significance conferred in the "International Conference on Food & Agriculture" held during March 29-31, 2018 in Dhanbad, India.

Dr. Debashish Dutta received 2nd Position for Poster presentation in International Conference on "Advances in Potassium Research for Efficient Soil and Crop Management" organized by International Plant Nutrition Institute (IPNI) at New Delhi, India during August 28-29, 2017

Dr. Chandra Bhanu received 3rd Prize for best Poster presentation during the International Conference on "Advances in Potassium Research for Efficient Soil and Crop Management" organized by International Plant Nutrition Institute (IPNI) at New Delhi, India during August 28-29, 2017

Dr. Chandra Bhanu received Ist prize in Research poster presentation during Hindi Pakhwara organized by ICAR-IIFSR, Modipuram from 14-28 September, 2017

Dr. P.C. Ghasal received best poster presentation as co-author in National conference on intervention of climate change in sustainable development of agriculture, food and nutrition security and its amelioration held during 24-25th March, 2017 at Shubharti University, Meerut (U.P.), India.

Dr. P.C. Ghasal received best poster presentation as co-author in International conference on Advances in Potassium Research for Efficient Soil and Crop Management held during 28-29 August, 2017 at NASC Complex, New Delhi, India.

Dr. P.C. Ghasal received 2nd Award of Poster Presentation as co-author in International Conference on Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD 2017) 27-28 October, 2017 held at Brahaspati Bhawan, C.C.S. University, Meerut, Uttar Pradesh, India.

Dr. P.C. Ghasal received second prize in 200 meter men race and Third prize in 100x4 meter relay race at ICAR Inter-Institutional Sports Tournament-2017 (North Zone) organized at ICAR-IISR, Lucknow during 30th October to 2nd November, 2017.

Dr A.K. Prusty received Young Scientist Award- 2017 from Agricultural technology Development Society, Ghaziabad, Uttar Pradesh on the occasion of International Conference on Advances in agricultural biodiversity conservation for sustainable development organized at CCS University, Meerut during 27-28 October, 2017.

Dr. A. K. Prusty received 1st prize in Hindi dictation writing competition organized for the scientists on 15/09/2017 at ICAR-IIFSR, Modipuram on the occasion of Hindi Pakhwada during 14th-28th September 2017.

Dr. A K Prusty received 1st prize in Hindi extempore competition organized for the scientists on 16/09/2017 at ICAR-IIFSR, Modipuram on the occasion of Hindi Pakhwada during 14th-28th September 2017.

Dr. L.R. Meena received best poster Award 2016 from Hi-Tech Horticulture Society in International conference of global agriculture and innovation conference GAIC 2016, held during 27-29 November 2016 at Noida International University, Greater Noida (U.P.) India.

Dr. L.R. Meena received reviewer Excellency Award on 17 November 2016. Indian Journal of Agricultural Research and Legume research- An Internal Journal, (ARCC, Karnal).

Dr. L.R. Meena received Major R.S. Yadav SRDA Award. 2016 on the occasion of International Conference on Global Agriculture & Innovation Conference (GAIC-2016) held during 27-29 November 2016 at Noida International University, Greater Noida (U.P.) India. Society for recent development in agriculture, SVPUAT, Meerut (UP).

Dr. L.R. Meena received Distinguished Scientist Award. 2016 on the occasion of National Conference held during March 24-25, 2017 on "Intervention of climatic change in Sustainable of Agriculture, Food and Nutrition Security and its Amelioration". Development of Society of World Environment, Food and Technology, New Delhi.

Dr. L.R. Meena received Excellency in Research Scientist award. 2017 on the occasion of International Conference on " Advances in Agricultural and Biodiversity conservation for Sustainable Development (ABCD-2017)" during 27-28 October, 2017 at Brahaspati Bhawan, C.C.S. University, Meerut, Uttar Pradesh, India. The Agricultural Technology Development Society (ATDS).

Dr. L.R. Meena received outstanding achievement award 2018 from Endling International society during 2nd International conference held on Food & Agriculture, 2018 from 29-31 March 2018, Dhanbad, Jharkhand.

Dr. Amit Nath received IAHF Fellow Award-2015 by given the Society Indian Association of Hill Farming, ICAR Recsearch Comlex for NEH Region, Umiam, Meghalaya, India for his outstanding contribution in the field of Hill Agriculture during the National Seminar on Smart Farming for Enhancing Input Use efficiency, Income and Environmental Security held on 19-21 September, 2017.

Dr. Amit Nath Acted as a Rappoteurs for the technical session, II: "Review of Results- I" during 12th Annual Group Meeting of Network Project on Organic Farming during 18-19 December, 2017 held at ICAR-IIFSR, Modipuram, Meerut (Uttar Pradesh).

Dr. Devendra Kumar received Fellow Award-2016for outstanding contribution in the field of "Genetics and Plant Breeding" on the occasion of National Conference held during March, 24-25, 2017 on Intervention of climatic change in Sustainable Development of Agriculture, Food and Nutrition Security and its Amelioration. Organized by the Society for World Environment, Food and Technology (SWEFT), New Delhi (India)

Dr. Devendra Kumar received Best Poster Award- on "Identification of suitable sugarcane clones for higher cane and green top yield for western plain zone". National Conference on Intervention of climatic change in Sustainable Development of Agriculture, Food and Nutrition Security and its Amelioration held on March, 24-25, 2017 organized by Society for World Environment, Food and Technology (SWEFT), New Delhi (INDIA) at Swami Vivekananda Subharti University, Meerut (U.P), India.

Dr. Devendra Kumar received Excellence in Research Scientist Award - 2017 for his outstanding contribution and recognition in the field of "Plant breeding and Genetics" on the occasion of International Conference on "Advances in Agricultural and Biodiversity Conservation for Sustainable Development (ABCD -2017)" during 27-28 October, 2017 at Brahspati Bhawan, CCS University Meerut, Uttar Pradesh (India).

Dr. Devendra Kumar received Outstanding Achievement Award-2018 for recognition of research quality, novelty and significance conferred in the "International Conference on Food & Agriculture" held during March 29-31, 2018 in Dhanbad, Tharkhan India.

Dr. Dushyant Mishra received Received first prize in Hindi writing competition (Scientific group) during Hindi Pakhwara held on 14 September, 2017.

Dr. Dushyant Mishra received second prize in Hindi speech competition during Hindi Pakhwara held on 14-28 September, 2017.

Dr. Dushyant Mishra received Received second prize in Hindi writing competition during Hindi Pakhwara held on 14-28 September, 2017.

Dr. Dushyant Mishra Received third prize in Hindi poster presentation competition during Hindi Pakhwara held on 14-28 September, 2017.

Recognitions

Dr. N Subash was invited as an expert in Working Group Meeting of AICRP on Agrometeorology at Sher-e-Kashmir University of Agricultural Sciences and Technology, Chatha during 27-29th November, 2017.

Dr. N Subash was invited as lead speaker for a topic "Application of farming systems modeling for assessment of climate change impacts and adaptation" in International Seminar (CCAW 2017) on "Global Climate Change: Implications for Agriculture and Water Sectors" organized jointly by Agricultural Universities in Maharashtra and WALMI organized at Aurangabad during 14-16th December, 2017.

Dr. N Subash delivered key note address on "Impact of Climate Change on Agriculture over Indo-Gangetic Plains" in International Conference on Climate Change and Adaptation: Empowering Small Holders and Ensuring Food Security under ClimaAdapt organized by TNAU at Chennai during 11-12th May, 2017.

Dr. N. Subash attended Second Half yearly foreign aided projects review meeting NRM Division, ICAR, KAB-II, New Delhi on 31st January, 2018

Dr. N. Subash attended NICRA Technical Program Review Meeting of NRM Institutes at ICAR-NIASM Baramati on 8-9 February, 2018

Dr. N. Subash attended NICRA Technical Program Review Meeting of Modeling Group at NASC Complex, New Delhi on 13th February, 2018.

Dr. N. Ravisankar Principal Scientist nominated as Expert by Agricultural Education division of ICAR for evaluating a training on "Culturing techniques for bio-fertilizers and bio-pesticides" organized during 7-27 November, 2017 under Centre of Advanced Faculty Training (CAFT) in Organic Farming by Department of Soil Sciences, Faculty of Agriculture, Assam Agricultural University, Jorhat (Assam) (council letter F.No. Ag.Edn./1/38/2017/HRD/ dated 10 July 2017). Evaluated the training on 23 November 2017.

Dr. N. Ravisankar Principal Scientist was nominated as Member of the committee for developing PG syllabus on Organic Farming constituted by Agricultural Education Division of ICAR, New Delhi.

Dr. N. Ravisankar, Principal Scientist & National PI, NPOF acted as Member of the committee constituted by Government of India, Ministry of Agriculture to examine the issues relating to Biological Products/Bio fertilizers.

Dr. N. Ravisankar, Principal Scientist & National PI, NPOF acted as Member of Science track paper review committee in Organic World Congress-2017 held during 9-11 November 2017 at Noida.

Dr. N. Ravisankar, Principal Scientist served as the External Examiner for M.Sc and Ph.D thesis evaluation to Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. During the year, evaluated 1 M.Sc and 3 Ph.D thesis for award of degree.

Dr. N. Ravisankar, Principal Scientist served as the External Examiner for M.Sc thesis evaluation to ICAR-Indian Agricultural Research Institute, New Delhi. During the year, evaluated 1 M.Sc thesis for award of degree.

Dr. Amit Nath acted as a Rappoteurs for the technical session, II: "Review of Results- I" during 12th Annual Group Meeting of Network Project on Organic Farming during 18-19 December, 2017 held at ICAR-IIFSR, Modipuram, Meerut (Uttar Pradesh).

Dr. Poonam Kashyap guided and acted as major advisor for two Msc. Students of Horticulture students of MJRP University, Jaipur, Rajasthan viz., Shiv Shankar Sharma completed his MSc. Dissertation on Effect of nutrient Management on growth, yield and quality of cauliflower (*Brassica oleracea* L. Var. botrytis) and Jakir Husain completed his MSc. Dissertation on Effect of phosphorus fertilization on growth, yield and quality of Table pea (Pisum sativum L.).

Dr. Poonam Kashyap conducted Viva-Voice of two M.Sc. students of MJRP University, Jaipur, Rajasthan on 7-12-2017 at MRJP Univeristy, Achrol Campus, Jaipur.

Dr. Poonam Kashyap conducted the programme for the visit of Mr Sushil Kumar (IAS, Additional Secretary and financial Advisor), New Delhi on 29th April 2017 at ICAR, IIFSR, Modipuram, Meerut.

Dr. Poonam Kashyap acted as an external member of selection committee for the selection of SRF at ICAR-CIRC, Meerut on 15-9-2017.

Dr. Poonam Kashyap discharged duty in exhibiting ICAR-IIFSR technologies in a Kisan Mela organized by Sardar Vallabhbhai Patel University of Agriculture and technology from Oct 7-9, 2017.

Dr. Poonam Kashyap acted as Judge for evaluation of post-harvest products at Exhibition stalls of Agricultural fair organised by Sardar Vallabh Bhai Patel University of Agriculture and Technology from 8 October, 2017.

Dr. Poonam Kashyap nominated as Chairperson, Women's compliance committee of ICAR-IIFSR for the year 2017-18.

Dr. Poonam Kashyap discharged her duties as member Institute Staff Welfare Committee for 2017-18.

Dr. Nisha Verma acted as Member, Screening Committee for screening the applications of RA/ SRF and YP-I during walking interview held on 15, 16 and 17 February 2017.

Dr. Nisha Verma acted as Member, Screening Committee for screening the applications of RA/ SRF/YP II and YP-I during walking interview held on 22nd March 2018.

Dr. Nisha Verma acted as rapporteur for the Technical Session II in Annual Group Meeting of AICRP on Integrated Farming Systems held at RARI, Durgapura, Jaipur w.e.f. 03-05 November 2017.

Dr. P C Jat participated and coordinated the exhibition of IIFSR technologies in a kisam mela at CPRI, Regional station Modipuram, Meerut on Aloo Divas on 15th February, 2018.

Dr. P C Jat discharged duty in exhibiting ICAR-IIFSR technologies in a Krishi Unnati Mela organized by IARI New Delhi from 16-19 March, 2018.

Dr. P C Jat attended State Coordination Committee meeting on Doubling Farmers Income of Sikkim state 01st May, 2017

Dr. P C Jat attended a review meeting for Varansi project "On-farm demonstration and refinement of improved IFS technologies for livelihood security". On 30th Oct.,2017

Dr. P C Jat acted as reviewer of Legume Research for year 2017-18, published by Agriculture Research Communication Centre Karnal, Haryana.

Dr. P C Jat discharged the duties as In-charge Farm (Main Campus) for year 2017-18 at ICAR-IIFSR.

Dr. Debashish Dutta worked as Co-Major advisor of Two M.Sc (Hort.) student of Mahatma Jyoti Rao Phoole University , Department of Horticulture , MJRP College of agriculture and research , Jaipur. Rajasthan

Dr. Chandra Bhanu represented as ICAR-member in Scientific Advisory Committee (SAC) Meeting of Krishi Vigyan Kendra, Baghra, Muzaffarnagar held on 06.12.2017.

Dr. P.C. Ghasal received membership certificate as associate editor for contribution to the quality and

success of International Jounal of Agriculture Science from Bioinfo Publication on 14 July, 2017.

Dr. Dushyant Mishra received recognition as an Expert (Horticulture) for Uttar Pradesh state by Ministry of Agriculture and Farmers Welfare, New Delhi.

Dr. Dushyant Mishra received recognition as reviewer in International Journal of Agricultural Sciences.

Dr. Dushyant Mishra received recognition as expert (Horticulture) in selection committee for Assistant Professors at CCS Haryana Agricultural University, Hisar on 18-19th March 2018.

Dr. Dushyant Mishra received recognition as guest speaker during training program on "Banana cultivation in western UP" sponsored by Department of Biotechnology, Government of India and SVPUAT, Modipuram on 20th March 2018.

Dr. Dushyant Mishra acted as a member in judging committee for competitions of Agriculture Education Day on 3rd December 2017 at ICAR CPRI Regional Station, Modipuram.

Dr. Dushyant Mishra received an appreciation letter for transfer of guava and apple production technology from DD Kisan Channel, New Delhi on 20th June 2017.

Dr. Dushyant Mishra received certificate of commitment from Central Vigilance Commission, New Delhi on 2nd November 2017.

Dr. Dushyant Mishra acted as external examiner of Ph D student at department of Horticulture, CCSHAU, Hisar on 11/10/2017.

Dr. Dushyant Mishra acted as external examiner of Ph D student at department of Vegetable science, CCSHAU, Hisar on 6th February 2018.

Dr. Dushyant Mishra evaluated thesis of M.Sc Horticulture student of ASPEE College of Horticulture and Forestry, NAU, Navsari 5th May 2017.

Dr. S.P. Singh, ACTO, received outstanding achievement award.2018. Endling International society during 2nd International conference held on Food & Agriculture, 2018 from 29-31 March 2018, Dhanbad, Jharkhand.

LECTURES DELIVERED

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. Poonam Kashyap	Recent trends in propagation of fruits and vegetable crops	Capacity Building and Skill Upgradation Programme on Farm Management	ICAR-IIFSR	10 March, 2018
Dr. Poonam Kashyap	Management and recycling of Kitchen waste	Swacchata Pakhwada from 16-31 May, 2017	Jaitpur, Budhana block, district muzzafarnagar, U.P.	31 May, 2017
Dr. Poonam Kashyap	Nutritive value of mustard and its byproducts management	Training Programme on Improved Techniques of Raising oilseeds in farming Systems Farm Management	ICAR-IIFSR	22 March, 2017
Dr. Poonam Kashyap	Vegetable modules for horticulture based farming systems in different agro-climatic regions	Dissemination and up-scaling of ICAR-IIFSR technologies through KVK Scientists	ICAR-IIFSR	1 Feb., 2018
Dr. Poonam Kashyap	Integration of horticultural crops for food and livelihood security	Training programme on development of varieties and technology for specialty melon production under green house organized by ICAR-IARI and ICAR-IIFSR	ICAR-IIFSR	5 Dec., 2017
Dr. Nisha Verma	Off farm activities/interventions in different farming systems for income enhancement in different agro-climatic regions of Uttar Pradesh	Dissemination and up-scaling of ICAR-IIFSR technologies through KVK	ICAR-IIFSR	30 Jan., 2018
Dr. Nisha Verma	Off farm entrepreneurship activities for landless, small and marginal farmers	Model Training Course on Agri-Entrepreneurship Development through Farming systems	ICAR-IIFSR	23Aug., 2017
Dr. Nisha Verma	Role of women in organic farming	ICAR Sponsored summer school on “Modern concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-IIFSR	25 July, 2017
Dr. Nisha Verma	Gender friendly small tools and implements for enhancing working efficiency	ICAR sponsored summer school on Machinery for conservation for mitigation and adaptation of climate change	ICAR-IIFSR	19 Sept., 2017
Dr. Suresh Malik	Breeding, feeding and health care management in poultry”	Refresher course on “Farm Management"	ICAR-IIFSR	22 Sept., 2017
Dr. Peyush Punia	Ornamental fish production	Model Training Course on Agri-Entrepreneurship Development through Farming systems	ICAR-IIFSR	21 Aug., 2017

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. Peyush Punia	Organic fish farming	ICAR Sponsored summer school on "Modern concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-IIFSR	27 July , 2017
Dr. Peyush Punia	Fish Pond Mangement	Refresher course on "Farm Management"	ICAR-IIFSR	25 Sept., 2017
Dr. Peyush Punia	Fish culture and pond mangement	Dissemination and up-scaling of ICAR-IIFSR technologies through KVK Scientists	ICAR-IIFSR	1 Feb., 2018
Dr. Peyush Punia	Fish Pond Mangement	ICAR sponsored summer school on Machinery for conservation for mitigation and adaptation of climate change	ICAR-IIFSR	19 Sept., 2017
Dr. Amit Nath	Post harvest management, processing and value addition in agricultural produces for enhancement of farmers income	National Seminar on Smart Farming for Enhancing Input Use efficiency, Income and Environmental Security	ICAR Research Complex for NEH Region, Umiam, Meghalaya.	20 Sept., 2017
Dr. Amit Nath	Farmers friendly post harvest management and value addition technologies for horticultural crops (Vegetable & Flowers) for doubling farmers income	All India Seminar on High Tech Cultivation of Vegetable & Flowers,	The Institution of Engineers (India), Uttarakhand State Centre, Dehradun	10 & 11 March, 2018
Dr. Prakash Ghasal	Effect of carbon sequestration on climate change and farming systems	Carbon sequestration and green house gas (GHG) measurement in Integrated Farming System Models	ICAR-IIFSR, Modipuram	02 Aug., 2016
Dr. Prakash Ghasal	Basics of layout and conducting agricultural field experiments	Capacity building and Skill Upgradation Programme for Technical Staffs on Farm Management	ICAR-IIFSR	27th Oct., 2017.
Dr. L.K. Meena	Physiological parameters for measuring performance of crops under organic production system	21 days training on "Modern concepts and practices of organic farming for safe, secured and sustainable food production"	C.C.S. University, Meerut, Uttar Pradesh, India	16th July, 2017
Dr. L K Meena	Nutrient deficiency symptoms in crop plant and their management	Capacity Building and Skill Upgradation Programme for Technical Staffs on "Farm Management	ICAR-IIFSR, Modipuram Meerut (U.P.)	25 Oct., 2017
Dr. N. Ravisankar	Organic and towards organic farming approaches for safe and secured food production	Recent innovations in management of organic production systems, FAO sponsored for officials of Mauritious	ICAR-Indian Agricultural Research Institute, Port Blair	15 June, 2017

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. N. Ravisankar	Organic and towards organic agriculture in India for safe and secured food	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	14 July, 2017
Dr. M. Shamim	Tools and techniques for Identification of climate resilient production system	ICAR sponsored Summer School on "Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production"	ICAR-IIFSR, Modipuram	25 July, 2017
Dr. N. Ravisankar	Organic agriculture: Certification methods and issues	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	31 July, 2017
Dr. N. Ravisankar	Niche areas and crops: Parameters and methodology	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	31 July, 2017
Dr. N. Ravisankar	Organic Farming: Farmers and consumer version	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	01 Aug., 2017
Dr. M. Shamim	Identification of climate resilient production systems	ICAR sponsored Summer School on "Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production"	ICAR-IIFSR, Modipuram	02 Aug., 2017
Dr. A.K. Prusty	Theory and practices of fish farming	Model training course on Agri- entrepreneurship development through farming systems	ICAR-IIFSR, Modipuram	25 Aug., 2017
Dr. A.K. Prusty	Resource optimization through multi-objective linear programming in IFS models	Refresher course on Farm Management	ICAR-IIFSR, Modipuram	9 Mar., 2018
Dr. A.K. Prusty	Aquaculture module and technologies and suitable for different agro-climatic regions of Uttar Pradesh	Training programme on diversification & upscaling of IIFSR technologies through KVK	ICAR-IIFSR, Modipuram	30 Jan., 2018
Dr. M. Shamim	Tools and Techniques for Identification of Climate Resilient Production System	ICAR Summer School on Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR-IIFSR, Modipuram	7 Sept., 2017
Dr. M. Shamim	Crop Growth Simulation Modeling: A Powerful Decision Support Systems in Changing Climate Scenario	ICAR Summer Scholl on Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR-IIFSR, Modipuram	08 Sept., 2017
Dr. N. Ravisankar	Non-chemical farming: Approaches, methods and practices for crop production	Training for officials from the Ministry of Agriculture, Irrigation & Livestock, Government of Afghanistan	Centre for Science and Environment, New Delhi	13 Sept., 2017

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. N. Ravisankar	Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR summer school on Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR-IIFSR, Modipuram	15 Sept., 2017
Dr. N. Ravisankar	Organic Farming Production issues and Strategies	ICAR winter school on Developments in organic farming in tropical Islands	***(Through Skype)*** ICAR-Central Island Agricultural Research Institute, Port Blair	23 Nov., 2017
Dr. N. Ravisankar	Organic and integrated farming system for enhancing water productivity	Improving Water Productivity in Rainfed Agriculture	ICAR-Indian Institute of Water Management	21 Dec., 2017
Dr. M. Shamim	Weather based planning of agricultural operations and contingency plans for different regions of Uttar Pradesh	Dissemination and up-scaling of ICAR- IIFSR Technologies through KVK Scientists	ICAR-IIFSR, Modipuram	30 Jan., 2018
Dr. N. Ravisankar	How to conduct on-farm research in farming systems?	Dissemination and up-scaling of ICAR- IIFSR Technologies through KVK Scientists	ICAR-IIFSR, Modipuram	01 Feb., 2018
Dr. M. Shamim	Climate Change: An Indian Perspective	Environment Awareness Campaign	Ginni Devi Modi Girls P.G. College Modinagar	09 Feb., 2018
Dr. N. Ravisankar	Basic agricultural enterprise selection principles for development of multi-enterprise farm	Refresher course on Farm Management	ICAR-Indian Institute of Farming Systems Research, Modipuram	9 March, 2018
Dr. N. Ravisankar	Role of oilseeds in farming systems & cropping systems involving oilseeds and its sustainability	Agro-meteorological applications and Post-harvest management in oilseeds production	ICAR-IIFSR, Modipuram	16 March, 2018
Dr. N. Subash	Climate Smart Farm Management	Capacity building and skill upgradation programme Farm Management Training	ICAR-IIFSR, Modipuram Meerut (U.P.)	9 March, 2018
Dr. N. Subash	Contingency Plans for oilseeds cultivation with special reference to Mustard	Training Programme on Improved Techniques of Raising oil seeds in farming Systems Farm Management	ICAR-IIFSR, Modipuram Meerut (U.P.)	17 March, 2018
Dr. N. Subash	Integrated assessment of climate change impact on agricultural productivity - A multi climate-crop-economic modeling approach. Demonstration of measurement techniques of GHG in rice-wheat system	ICAR summer school on Machinery for conservation agriculture for mitigation and adaptation of climate change	ICAR-IIFSR, Modipuram Meerut (U.P.)	25 Sept., 2017

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. N. Subash	Climate smart farm management	Capacity building and Skill Upgradation Programme for Technical Staffs on Farm Management	ICAR-IIFSR, Modipuram Meerut (U.P.)	27 Oct., 2017
Dr. N. Subash	Organic production systems in different agro climatic regions	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-IIFSR, Modipuram Meerut (U.P.)	27 July, 2017
Dr. Sunil Kumar	Use of ICTs for entrepreneurship	Agri-Entrepreneurship development through farming systems approach"	ICAR-IIFSR, Modipuram Meerut (U.P.)	29 March, 2017
Dr. Sunil Kumar	Scope and importance of ICTs in a research farm	Capacity building and skill upgradation programme Farm Management Training	ICAR-IIFSR, Modipuram Meerut (U.P.)	9 March, 2018
Dr. D. Dutta	Soil testing procedures and calculation of fertilization doses	Capacity Building and Skill Up-gradation Programme on "Farm Management"	ICAR-IIFSR, Modipuram	6-10 March, 2018
Dr. D. Dutta	GHG measurement techniques under rice-wheat system	ICAR Summer School on "Machinery for conservation agriculture for mitigation and adaptation of climate change"	ICAR-Indian Institute of Farming Systems Research, Modipuram	15 Sept., 2017
Dr. D. Dutta	Carbon sequestration and GHG emission under organic production system	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	24 July, 2017
Dr. D. Dutta	Measurement and estimation of organic carbon fractions and carbon pools	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	31 July, 2017
Dr. D. Dutta	Estimation procedure of carbon sequestration under organic production systems	ICAR Summer School on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production	ICAR-Indian Institute of Farming Systems Research, Modipuram	01 Aug., 2017
Dr. D. Dutta	Long-term influence of different production systems on potassium buffering capacity of Typic Ustochrepts soils	International Conference on Advances in Potassium Research for Efficient Soil and Crop Management	ICAR-NASC New Delhi	28-29 Aug., 2017
Dr. Dushyant Mishra	Introduction of non-traditional fruit crops	Capacity building and skill upgradation programme Farm Management Training	ICAR–IIFSR, Modipuram	20 Sept., 2017
Dr. Dushyant Mishra	Orchard management		ICAR–IIFSR, Modipuram	28 Oct., 2017

Name	Title of lecture	Name of training	Venue	Date of lecture
Dr. Dushyant Mishra	Agri- Entrepreneurship Development through Farming Systems Approach" delivered lecture on Non conventional fruit production	Agri-Entrepreneurship development through farming systems approach"	ICAR –IIFSR, Modipuram	29 Aug., 2017
Dr. V.P. Chaudhary	Conservation agriculture: Concepts, Practices and Prospects for mitigation of climate change Small farm mechanization for conserving farm resources Visit of second generation machinery Demonstration of small tools and implements	Summer school on "Machinery for conservation agriculture for mitigation and adaptation of climate change" held on Sept. 5 to 25, 2017 at ICAR-IIFSR, Modipuram	ICAR –IIFSR, Modipuram	5 Sept., 2017 7 Sept., 2017 7 Sept., 2017 22 Sept., 2017
Dr. V.P. Chaudhary	Conservation agriculture and climate change Climate Smart Integrated Farming Systems- Role of Water, Nutrients and Energy	Winter school on "Climate smart agricultural machinery for conservation agriculture" held on Nov, 6-26, 2017 at ICAR-CIAE, Bhopal	ICAR –IIFSR, Modipuram	17 Nov., 2017 18 Nov., 2017
Dr. V.P. Chaudhary	Farm mechanization technologies for different agro- climate zones of Uttar Pradesh	Training on Dissemination and up-scaling of ICAR-IIFSR Technologies Through KVK Scientists held on Jan. 30 to Feb. 01, 2018 at ICAR-IIFSR, Modipuram	ICAR –IIFSR, Modipuram	01 Feb., 2018
Dr. V.P. Chaudhary	Farm Implements and gender sensitive farm tools	training on "Farm management"held on March 6-10, 2018 at ICAR-IIFSR, Modipuram	ICAR –IIFSR, Modipuram	9 March, 2018

OTHER PROGRAMMES ORGANIZED

Name/ of events	Title of Training	Venue	Duration and date	No. of participants	Name of Organizer
Demonstration	Demonstration of mango thrips management	Raj Garden, Sardhana, Meerut	11/04/2017	25	ICAR-IIFSR in association with Dow Agro Sciences
Demonstration	Canopy management for improving fruit quality in mango	Budhana Muzaffarnagar	05/12/2017	35	ICAR-IIFSR
Demonstration	Canopy management for improving fruit quality in mango	Kharad, Muzaffarnagar	05/12/2017	15	ICAR-IIFSR
Scientist Farmer interface	Training to mango growers for management of thrips insect	Sardhana	23rd-24th January 2018	30	ICAR-IIFSR and ICAR -NCIPM New Delhi.
Scientist Farmer interface	Loss assessment of mango growers due to heavy storms	Farmers fields of Meerut - Muzaffarnagar	22-05-2017	50	ICAR-IIFSR
Scientist Farmer interface	Improving productivity of crops	Jhidio, Naval Surajpur, Govindpur, Kithor	25-01/2018	40	ICAR-IIFSR
Scientist Farmer interface	Management of mango crop	Surajpur, Govindpur, Kithor	12/03/2018	25	ICAR-IIFSR

OTHER PROGRAMMES ORGANIZED FOR FARMERS

1. Dr Poonam Kashyap conducted field visit of 17 scientists associated with soil testing lab of ICAR Institutes, State Dept of Agriculture and fertilizer industry at ICAR-IIFSR on 22 Dec 2017.
2. Dr Poonam Kashyap conducted visits of visitors from SAUs, Schools, College students, Forest and other state Dept. officers and apprised the visitors about horticulture based farming systems at Siwaya Farm of Institute.
4. Dr Nisha Verma and Dr P C Jat organized Annual Day of ICAR-IIFSR, Modipuram (Member, Sports/Awards/Felicitaion committee) on 27 -11-2017.
5. Dr Nisha Verma and Dr Amit Nath organized stall on annual day by SHG at IIFSR on 27 -11-2017.
6. Dr Nisha Verma and Dr P C Jat organized Krishak Vaigyanik Paricharcha at ICAR-IIFSR on 17-03-2017.
7. Dr Khsuhyal Singh conducted field visit of a group of 52 farmers from six blocks Purkazi, Budhana, Baghra and Sadan in the leadership of ShriAshwani Kumar (Assistant Manager) and ShriNeerajKumar (BDM) of ICAR-IIFSR, Modipuram Meerut on 6-6-2017.
8. Dr P C Jat and Dr Khushyal Singh conducted field visit a group of seven member of agricultural officer / employees of Agriculture Department (ATMA) District Shivpuri of Madhya Pradesh visited farm field under the leadership of ShNaresh Kumar Meena (ADA) Shivpuri (M.P) on 12-3-2018.
9. Dr P C Jat, Dr Khushyal Singh and Dr Poonam Kashyap conducted field visit participants of 14th Advanced Level training in soil testing, Plant analysis and water quality assessment visited the institute on 22.12.2017
10. Dr P C Jat and Dr Khushyal Singh conducted field visit group of seven member of agricultural officer / employees of Agriculture Department (ATMA) District Shivpuri of Madhya Pradesh visited farm field under the leadership of ShNaresh Kumar Meena (ADA) Shivepuri (M.P) on 12-3-2018.
11. Dr P C Jat and Khushyal Singh conducted field visit a group of 15 farmers of Jhabua district of Madhya Pradesh (ATMA) visited farm field under the leadership of Sh Deepak Patidar on 17-3-2018.
12. Dr Sunil Kumar, vide office order by F.No.3-24/ Estt (RA/SRF/YP-I) 2018 dated 12.02.2018, acted as member of the computer test for the selection of RA/SRF/ and YP-I to be held on 15, 16 and 17th February 2018 at IIFSR, Modipuram, Meerut.
13. Dr Prem Singh and Dr Sunil Kumar, vide office order dated 15.02.2018, acted as member for organizing of the "*Utpadakta Saptah*" held on 12-18, Feb. 2018 organized by ICAR-IIFSR, Modipuram, Meerut.
14. Dr. Dushyant Mishra and Dr Sunil Kumar, vide office order F.NO.PS/2017/758 dated 29.05.2017, acted as member for organizing of the "World Environment Day" held on 5 June, 2018 organized by ICAR- IIFSR, Modipuram, Meerut.
15. Dr. Dushyant Mishra and Dr Sunil Kumar, vide office order FNO.PS/2017/1009 dated 14.06.2017, acted as members for organizing of the Van Mahostsav, (1st July to & 7th July, 2017) at IIFSR, Modipuram, Meerut.
16. Dr Sunil Kumar, vide office order F.NO. IIFSR-P/TTR/HRD/2016 dated 23.12.2017 was Associated with Dr Suresh Mailk, Nodal officer, HRD Unit at IIFSR, Modipuram, Meerut.
17. Dr Sunil Kumar, vide office order FNO.2-1/W&E/ Voll-II/2017-2018/1917 dated 10.08. 2017, acted as member of the Determination of cost of services provided by Ministry/ Department at IIFSR, Modipuram, Meerut.

18. Dr Sunil Kumar, vide office order FNO.2-19/Estt/ 1990360-390 dated 03.05.2017, acted as member of the Soil Lab & Plant Analysis lab Agro-met & AKMU inspection of at IIFSR, Modipuram, Meerut.
19. Dr Sunil Kumar, vide office order by F.No.3-24/ Estt(RA/SRF/YP-I) 2018/ 528 dated 20.03.2018, acted as member for conducting computer test for the selection of RA/SRF/YP-II and YP-I to be held on 22nd March 2018 at IIFSR, Modipuram, Meerut.
20. Dr Sunil Kumar under office order by F.No.3-24/ RA/SRF/2017 dated 05.08.2017. A member of the Paper Scrutiny Committee to be held on 22nd March 2018 at IIFSR, Modipuram, Meerut.
21. Dr. L. K. Meena, Dr. Amit Nath and Naval Singh exhibited ICAR-IIFSR in a Kissan mela, organized on 13-19th April, 2017 at Motihari (Bihar).
22. Dr V.P. Chaudhary Invited key speaker topic on "*Conservation of agriculture for natural resource management.*" in the "International Seminar on land and water issues in South East Asia: Status, challenges and opportunities" during held on 18-20 January, 2018 organized by NERIWALM at Tejpur (Assam).
23. Dr V.P. Chaudhary Invited key speaker as lead paper topic on "*Mechanization options in protected cultivation of vegetables and flowers*" in "All India Seminar on High Tech Cultivation of Vegetable & Flowers" during 10th & 11th March, 2018 organized by Institutions of Engineers (India) at Dehradun (Uttrakhand).
24. Dr. V.P. Chaudhary discharged his duties as Nodal officer of MGMG for 2017-18.
25. Dr. V.P. Chaudhary discharged his duties the Member of the 'Farm management committee' for 2017-18.
26. Dr V.P. Chaudhary discharged his duties as I/c of the 'Institute Farm machinery at Farm' for 2017-18.
27. Dr V.P. Chaudhary discharged his duties *Chairman, Food and Refreshment Committee* for organizing 'Annual day of Institute' function held on Nov. 23, 2018.
28. Dr. V.P. Chaudhary discharged his duties as *Chairman of Hall Management Committee* for organizing the *'Farmers- Scientist Interface'* held March 17, 2018 at ICAR-IIFSR, Modipuram.
29. Dr. Dushyant Mishra Received appreciation certificate from Director, ICAR-CISH, Lucknow for efforts of area expansion under guava cv. Shweta in western UP.
30. Dr. Dushyant Mishra Recognition as Chairman in World Environment Day celebrations.
31. Dr. Dushyant Mishra Recognition as Member Secretary during Van Mahotsav week programs.
32. Dr. Dushyant Mishra Recognition as Reviewer in International Journal of Agricultural Sciences.
33. Dr. Dushyant Mishra Received Certificate of commitment from Central Vigilance Commission, New Delhi on 2nd November 2017.
34. Dr. Dushyant Mishra Participated in all the activities of **'Swachhta Hi Seva"** (15 September to 2nd October 2017) program.
35. Dr. Dushyant Mishra Acted as Chairman of Technical Committee during Interface Meeting on Integrated Development of Horticulture in western UP and Uttarakhand.
36. Dr Dushyant Mishra Acted as Chairman in Cultural Program Committee during Institute foundation day celebration held on 27th November 2017.
37. Dr. Dushyant Mishra Participated in panel discussion as expert (horticulture) organized during National Productivity week on 16th February 2018.
38. Dr. Dushyant Mishra Surveyed the zero budget organic farm of Gurukul, Kurukshetra for studying their system, recycling of resources, management of crops, animals etc. Submitted detailed report to Director for onwards transmission. September 5-8, 2017.

39. Dr. Dushyant Mishra Acted as Co Chairman in Institute Staff welfare committee during the year
40. Dr. Dushyant Mishra Acted as Co Chairman in Institute Farm Produce price fixation committee during the year.
41. Dr. Dushyant Mishra Advisory services to more than 1000 farmers on different aspects of fruit production.
42. Dr. Dushyant Mishra Facilitated booking of planting materials for farmers of western UP.
43. Dr. Dushyant Mishra Visit of Additional Secretary. Finance advisor of ICAR to research block of non-raditional fruits, Inaguration on 29th April 2017.
44. Dr. Dushyant Mishra On 27th May 2017, students of DMI along with teachers and principal visited block of non traditional and high value fruit crops.
45. Dr. Dushyant Mishra Member in organizing committee for Independence day celebrations.
46. Dr. Prem Singh and Dr. Lalit Krishan Meena-Monitoring visit to AICRP-IFS and NPOF Ludhiana center dated 9-10th August, 2017.
47. Dr. Lalit Krishan Meena-Member of Library physical verification committee.

EVENTS ORGANIZED

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संस्थान में दिनांक 21/06/2017 को अंतर्राष्ट्रीय योग दिवस मनाया गया। कार्यक्रम का शुभारंभ संस्थान के प्रभारी निदेशक डा. एम. पी. सिंह ने किया। उन्होंने मुख्य योग प्रशिक्षकों श्री. विनोद पँवार, डा. भांभू दत्त धीमान एवं सभी सहभागियों का स्वागत करते हुए अंतर्राश्ट्रीय योग दिवस की महत्ता के बारे में विस्तार से जानकारी दी तथा योग को अपने दैनिक जीवन का अभिन्न अंग बनाने व इसके निरंतर प्रयोग में लाने की अपील की। योग गुरू डा. शंभू दत्त धीमान ने योग के महत्व का वर्णन करते हुए बताया कि योग आत्मा को परमात्मा से जोड़ता है तथा शरीर के विकारों को दूर भगाता है। उन्होंने योग के विभिन्न स्तंभों जैसे सूक्ष्म यौगिक व्यायाम, आसन, प्राणायाम, सामान्य व्यायाम, अष्टचक्र, यम, नियम आदि के बारे में विस्तार से जानकारी दी तथा विभिन्न प्रणायामों जैसे भस्त्रिका, कपाल भाति, वाह्य प्राणायाम, अनुलोम–विलोम, भ्रामरी, प्रलव आदि का प्रशिक्षण भी दिया। योग प्रशिक्षक श्री. विनोद पँवार ने विभिन्न सूक्ष्म व्यायाम व आसन जैसे सूर्य नमस्कार, धनुर्आसन, सर्वांगआसन, मकरासन इत्यादि का प्रदर्शन भी कराया। कार्यक्रम में संस्थान के अधिकारियों

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एवं कर्मचारियों ने बढ़–चढ़कर, परिवार सहित भाग लिया। कार्यक्रम का संचालन डा. प्रेम सिंह, प्रधान वैज्ञानिक ने किया। उन्होनें बताया कि 27 सितम्बर 2014 को भारत के प्रधानमंत्री श्री नरेन्द्र मोदीजी ने संयुक्त राष्ट्र संघ में, 193 सदस्य देशों के प्रतिनिधियों की उपस्थिति में अंतर्राष्ट्रीय योग दिवस की घोषणा की थी जिसको संपूर्ण विश्व में, 21 जून को अंतर्राष्ट्रीय योग दिवस के रुप में मनाने हेतु 11 दिसंबर 2014 को संयुक्त राष्ट्र द्वारा मान्यता मिली। कार्यक्रम के अंत में योग प्रशिक्षक डा. शंभू दत्त धीमान एवं श्री. विनोद पँवार जी को संस्थान की ओर से सम्मानित भी किया गया।

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भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 11/7/2017 को पश्चिमी उत्तर प्रदेश एवं उत्तराखण्ड में बागवानी के समेकित विकास हेतु एक सहभागिता बैठक का आयोजन किया गया जिसमें क्षेत्र के अग्रणी कृषकों व बागवानों, विषय विशेशज्ञ वैज्ञानिकों, राज्य सरकारों के बागवानी विभाग के अधिकारियों, पेस्टीसाइड व एग्रो–इनपुट कंपनियों,

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निर्यातक किसानों, कृषि उपज मंडी के आढ़तियों, किसान नेताओं, गैर सरकारी संस्थाओं, महिला कृषकों, राष्ट्रीयकृत बैंकों, व क्षेत्र के प्रिंट एवं इलेक्ट्रानिक मीडिया के जाने–माने संवाददाताओं सहित लगभग 322 लोगों ने भाग लिया। कार्यक्रम की अध्यक्षता किसान नेता चौ. नरेश टिकैत द्वारा की गयी। डा. गया प्रसाद कुलपति स.व.भा.प.कृषि एवं प्रौ. विश्वविद्यालय, मेरठ, व डा. एस. राजन निदे ाक, केन्द्रीय उपोश्ण बागवानी संस्थान, लखनऊ कार्यक्रम में मुख्य अतिथि रहे। संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी अतिथियों का स्वागत करते हुए पश्चिमी उत्तर प्रदेश व उत्तराखण्ड में बागवानी की अपार संभावनाओं के बारे में जानकारी दी। उन्होंने अपने व्याख्यान में संस्थान द्वारा क्षेत्र में बागवानी की उत्पादकता बढ़ाने हेतु संस्थान के वैज्ञानिकों के माध्यम से बागवानों को उपलब्ध करवाई जा रही तकनीकी सहायता के बारे में विस्तार से जानकारी दी। उन्होंने बताया कि इस क्षेत्र में आम व सब्जियों के निर्यात की अच्छी संभावनायें हैं जिसका लाभ उठाने हेतु उन्होंने कृषकों को वैज्ञानिकों, एवं निर्यातकों से तालमेल बैठाकर, उन्नत तकनीकों को अपनाने की सलाह दी। निदेशक महोदय ने किसानों व महिला कृषकों की उत्साहवर्धक भागीदारी पर हर्ष व्यक्त किया तथा सभी बागवानों से अपनी बागवानी संबंधित समस्याओं को एक–एक करके तकनीकी सत्र के दौरान उठाने की सलाह दी ताकि विषय विशेषज्ञों के माध्यम से उन समस्याओं का समाधान बताया जा सके तथा एक संबंधित दीर्घकालीय योजना की रूपरेखा बनाई जा सके।

कार्यक्रम के अध्यक्ष चौ. नरेश टिकैत जी ने कृषि व बागवानी को एक अच्छा व्यवसाय बताया तथा किसानों की संपन्नता में कृषि विविधीकरण व पर्यावरण सुधार में बागवानी के महत्व को बताया। उन्होंने कृषि व बागवानी में पानी के सद्उपयोग करने की सलाह दी तथा गावों में ही बागवानी व कृषि आधारित उद्योगों को स्थापित करने की आव यकता जताई जिससे श्रम भाक्ति के पलायन को भी रोका जा सके।

डा. गया प्रसाद ने वैज्ञानिकों से किसानों के घर पर जाकर उनकी बागवानी व कृषि संबंधित समस्याओं के निवारण व किसानों की उपज के सही मूल्य निर्धारण व विपणन की व्यवस्था की आवश्यकता जताई। तकनीकी सत्र की अध्यक्षता डा. एस. राजन ने की तथा डा. आजाद सिंह पँवार सत्र के उपाध्यक्ष रहे। डा. दुश्यंत मिश्र व वैज्ञानिक फल विज्ञान ने तकनीकी सत्र का संचालन किया। तकनीकी सत्र का भ्ाुभारम्भ करते हुए अध्यक्ष डा. एस राजन ने वर्तमान में आम के बागानों में कीट एवं व्याधियों से होने वाले नुकसान की जानकारी दी। उन्होंने जलवायु परिवर्तन के कारण कुछ क्षेत्रों में आम की फसल में चुरदा (थ्रिप्स) के बढ़ते प्रकोप व उसके समाधान का उल्ल्लेख किया। कुछ क्षेत्रों में आम के पेड़ की औचक मृत्यु एवं उल्टा सूखा रोगों के बढ़ते प्रकोप व उनके प्रबंधन, फलों के निर्यात योग्य गुणवत्ता पाने हेतु उनकी बैगिंग के सस्ते व सरल तरीकों व उनमें प्रयुक्त होने वाली मशीनरी के बारे में विस्तार से बताया। अध्यक्ष महोदय ने बागवानों से एक–एक करके अपने प्रश्न उठाने व परिचर्चा में भाग लेने की अपील की। सत्र के दौरान बागवानों व किसानों द्वारा अनेकों प्रश्न उठाये गए एवं विशेषज्ञों द्वारा उनकी समस्याओं के समाधान का भी प्रयास किया गया। किसानों द्वारा उठाए गए विभिन्न प्रश्नों व समस्याओं का बिन्दुवार विवरण निम्नवत है। कार्यक्रम का संचालन डा. पूनम कश्यप ने किया।

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(क) **QykRiknu lc/kh**	1. आम में एकांतर फलत की समस्या	1. उचित प्रजातियों के चुनाव पर जोर दिया गया 2. उचित पोषण प्रबंधन के साथ पैक्लोब्यूट्राजोल के प्रयोग के सुझाव
	2. आंवले में फल न लगने की समस्या	1. एक ही प्रजाति न लगाकर परागदाता प्रजातियों के साथ रोपण की सलाह दी गयी 2. एक प्रजाति के बगान के पेड़ों पर परागदाता प्रजाति की ग्राफ्टिंग पर जोर दिया गया
	3. कम चिलिंग चाहने वाले सेब की जानकारी व पौध की उपलब्धता	1. पश्चिमी उत्तर प्रदेश में कृषि प्रणाली संस्थान द्वारा सेब की "अन्ना" प्रजाति का मूल्यांकन किया जा रहा है
	4. आम अमरूद व अन्य फलों की गुणवत्ता नर्सरी के स्त्रोत	1. सी.आई.एस.एच. लखनऊ व कृषि प्रणाली संस्थान मोदीपुरम के माध्यम से गुणवत्ता युक्त नर्सरी की खरीद की सलाह दी गयी 2. केवल प्रमाणित नर्सरी से व मात्रि पौधों को देखकर ही पौध खरीदने की सलाह दी गयी
	2. मिश्रित बागवानी की संभावनायें	1. आम, अमरूद, लीची, आंवला व आडू इत्यादि को उनकी बढ़वार के अनुसार समायोजित करके रोपण के विषय में बताया गया
(ख) **Qly lj{kk**	अ. आमः सूटी मोल्ड, पाउडरी मिल्ड्यू, उल्टा सूखा, आम का औचक मृत्यु रोगों व भुनगा (हापर), थ्रिप्स (चुरदा), तनाबेधक, इल्ली, व चमगादड़ों आदि की समस्याऐं ब. जैविक बागवानी के लिए छिड़काव की जानकारी स. बागों में जैवनाशियों का अंधाधुंध प्रयोग द. लीची में चमगादड़ व फलों के फटने की समस्यायें	1. आम के लिए एकीकृत नाशीजीव प्रबंधन विषय में सुझाव दिये गये 2. कीटनाशीयों का छिड़काव पुष्प खिलने से पहले व फल लगने की अवस्था पर ही करने पर जोर दिया गया 3. जैविक बागवानी में जैव फफूँद व कीटनाशियों का प्रयोग 4. चमगादड़ों के लिए सस्ते प्रबंध उपयों पर शोध की आवश्यकता को महसूस किया गया

fOk"k;	ç'u@leL;k;sa	Lk>ko@;kstuk
(ग) dVkbZ@rqMkbZ mijkr izca/ku o foi.ku	अ. जैविक फलों के बाजार की उपलब्धता ब. निर्यात योग्य आम के उत्पादन	1. किसानों से इंटरनेट के माध्यम से सीधे बाजार से जुडकर पेस्टीसाइड व कार्बाइड रहित आम के उत्पादन पर जोर दिया गया 2. अच्छी गुणवत्तायुक्त फलों के लिए बैगिंग को अपनाने की सलाह
(घ) vU;	गन्ने में पोखा बोंग रोग एवं मिली–बग व टाप बोरर कीटों की समस्यायें	1. बदलती जलवायु के कारण गन्ने में बीमारियों व कीटों की अधिक प्रकोप की जानकारी व समेकित पोषण व नाशीजीव प्रबंधन की जानकारी दी गई

डा. राजन ने बागवानों के बाग में सर्वे करके आम के औचक मृत्युरोग के प्रबंधन के ऊपर बागों में ही प्रदर्शन लगाने की आवश्यकता बताई। उन्होंने किसानों से सी.आई.एस.एच., लखनऊ की वेबसाइट पर आम के सीजन में जारी एडवाइजरी के अनुसार बागों के प्रबंधन करने तथा संस्थान के वाट्सएप ग्रुप से जुड़कर सही सूचनायें साझा करने की सलाह दी। साथ ही साथ आम व फलों के बागानों का एक सहकारी समूह (FPO) बनाने का प्रस्ताव रखा जिससे जुड़कर सदस्य बागवान फल के शुरूआती सीजन में देख–रेख व नाशीजीव प्रबंधन के खर्चों हेतु पैसे ले सकेंगे किसानों के अधिक प्रश्नों व समस्याओं को देखते हुए डा. राजन ने ऐसी ही अन्य सहभागिता बैठक कराने की आवश्यकता जताई जिसमें अलग–अलग विषयों के और अधिक विशेषज्ञ सम्मिलित हों ताकि किसानों को और सही जानकारी व लाभ मिल सके। डा. चन्द्रभानु ने किसानों को गन्ने में लगने वाले कीड़ों व रोगों की सही पहचान का प्रदर्शन किया तथा इनके प्रबंधन की जानकारी भी दी।

उत्तराखण्ड प्रदेश के संयुक्त बागवानी निदेशक डा. रतन कुमार ने उद्यान व प्रसंस्करण विभाग द्वारा प्रदेश के बागवानों हेतु फलों सब्जियों, मसाला, पुष्पोत्पादन, मशरूम उत्पादन व मौनपालन पर सरकार द्वारा संचालित विभिन्न योजनाओं व किसानों को इन योजनाओं के लाभ उठाने के तरीकों को विस्तार से बताया। मुजफ्फरनगर के जिला उद्यान अधिकारी श्री ए.सी. पाठक ने विभिन्न किसानों की श्रेणियों के लिए बागवानी पर मिलने वाले सरकारी अनुदान के बारे में बताया। उत्तर प्रदेश से क्षेत्र के किसान नेता चौ उद्यम सिंह कृषि प्रणाली संस्थान द्वारा सामान्य किसान व बागवानों को एक मंच पर लाने पर हर्ष व्यक्त किया तथा लोगों से अधिक आय हेतु बागवानी अपनाने की सलाह दी। उन्होंने संस्थान के वैज्ञानिकों द्वारा क्षेत्र में फसलों व बागवानी के ऊपर किये जा रहे कार्यों की सराहना भी की। उत्तराखण्ड से चौ. ऋशिपाल सिंह ने किसानों के अधिक उत्पादित उत्पाद के सही विपणन व मूल्य निर्धारण न होने पर चिंता जताई और वैज्ञानिकों से कृषि व पर्यावरण के प्रति मित्रवत नाशीजीव प्रबंधन पैकेज विकसित करने की सलाह दी। साथ ही साथ उन्होंने उत्तराखण्ड के गावों में कृषि प्रणाली संस्थान, मेरठ द्वारा क्षेत्र में फसलों व कृषि प्रणाली के ऊपर किये जा रहे कार्यों की प्रसंसा भी की। कृषि नजर समाचार पत्र के प्रतिष्ठित संपादक श्री विकास बालियान ने किसानों से बागवानी अपनाने व सामान्य खेती से ऊपर उठकर फसलों के व्यापार में भी कदम रखने की अपील की। कार्यक्रम के दौरान क्षेत्र के 25 प्रगतिशील

किसानों व प्रमुख पत्रकारों को संस्थान द्वारा सम्मानित भी किया गया।

71oa Lorarrk fnol dk vk;kstu

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम में 15 अगस्त, 2017 को राष्ट्र के 71 वें स्वतंत्रता दिवस का धूमधाम से आयोजन किया गया जिसमें संस्थान के सभी कर्मियों ने बढ़–चढ़कर भाग लिया। कार्यक्रम का शुभारम्भ संस्थान के निदेशक डा. आजाद सिंह पँवार द्वारा झण्डा रोहण व तत्पश्चात् राष्ट्रगान के

QkVk 79- Lorarrk fnol lekjkg

साथ हुआ। अपने सम्बोधन में निदेशक महोदय ने देश व क्षेत्र के कृषि विकास में कृषि प्रणाली संस्थान द्वारा दिये गये योगदान व भविष्य की चुनौतियों के बारे में बताया। उन्होंने वैज्ञानिकों से देश की खाद्य व पोषण

QkVk 80- Lorarrk fnol lekjkg

सुरक्षा के साथ–साथ "मुस्कान सुरक्षा" सुदृढ़ करने का भी आह्वान किया तथा यह भी बताया कि कृषि शोध का लाभ देश के गरीब से गरीब किसानों तक भी पहुंचना चाहिये जिससे उनके जीवन स्तर में सुधार किया जा सके। कार्यक्रम के दौरान कार्यालय कर्मियों के लिये रस्साकसी, संगीतमय कुर्सी दौड़ व बच्चों के लिये आशु भाषण आदि प्रतियोगिताओं का आयोजन भी किया गया जिसमें लोगों ने बढ़–चढ़कर भाग लिया। कार्यक्रम का समापन निदेशक महोदय द्वारा विभिन्न प्रतियोगिताओं के प्रतिभागियों को पुरस्कृत करने व राष्ट्रगान के पश्चात् किया गया।

okf"kd fnol dk vk;kstu ¼fnukd 27-11-2017½

संस्थान में दिनांक 27–11–2017 को वार्षिक दिवस का आयोजन किया गया। कार्यक्रम का शुभारम्भ करते हुए संस्थान के निदेशक डॉ आजाद सिंह पँवार ने सभी अतिथियों एवं कर्मचारियों का स्वागत किया और एक छोटे लक्ष्य से प्रारम्भ करके राष्ट्रीय स्तर के संस्थान का दर्जा दिलाने के लिए वर्तमान व पूर्व वैज्ञानिकों एवं कर्मचारियों की कड़ी मेहनत की सहारना की तथा उन्हें इस हेतु धन्यवाद भी दिया। उन्होंने देश के किसानों की खाद्य एवं पोषण सुरक्षा तथा आय बढ़ाने हेतु इस संस्थान के योगदान को महत्वपूर्ण बताया। इस अवसर पर निदेशक महोदय ने संस्थान के सभी सेवानिवृत्त वैज्ञानिकों व कर्मचारियों तथा कार्यक्रम में पधारे हुए अतिथियों को अंगरखा ओढ़ाकर सम्मानित किया। कार्यक्रम में कृषि प्रणाली संस्थान के अधिकारियों व कर्मचारियों सहित केन्द्रीय आलू अनुसंधान संस्थान परिसर मेरठ व केन्द्रीय गोपशु अनुसंधान संस्थान के अधिकारियों व कर्मचारियों ने भी परिवार सहित भाग लिया। संस्थान के पूर्व प्रधान वैज्ञानिक डॉ सेवाराम जी ने कृषि प्रणाली निदेशालय को आज के दिन संस्थान का दर्जा मिलने पर हर्ष व्यक्त किया तथा इसके लिए सभी को बधाई दी। डॉ प्रेम सिंह, प्रधान वैज्ञानिक व कार्यक्रम संम्नवयक ने सभी अतिथियों का स्वागत किया। पूर्वाह्न में ज्योतिशाचार्या डॉ अनिता सिंह ने कार्य स्थल पर तनाव

QkVk 81- okf"kd fnol lekjkg

प्रबंधन एवं ध्यान विषय पर व्याख्यान दिया एवं तनाव के प्रकारों, योग एवं प्रणायाम पर विस्तृत चर्चा कीं तथा व्यायाम एवं ध्यान पर प्रयोग भी करवाया। इस अवसर पर केन्द्रीय आलू अनुसंधान संस्थान परिसर मेरठ के संयुक्त निदेशक डॉ मनोज कुमार भी उपस्थित रहे। अपराह्न में केन्द्रीय आलू अनुसंधान संस्थान परिसर मेरठ व कृशि प्रणाली संस्थान के कर्मचारियों के बीच रस्साकसी प्रतियोगिता का आयोजन किया गया जिसमें कृषि प्रणाली संस्थान की टीम विजयी रही। वॉलीवाल शूटिंग प्रतियोगिता में केन्द्रीय आलू अनुसंधान संस्थान परिसर, मेरठ की टीम विजयी रही। महिलाओं के लिए म्यूजिकल चेयर तथा तम्बोला आदि प्रतियोगितायों का आयोजन किया गया। म्यूजिकल चेयर में डॉ पूनम कश्यप ने प्रथम स्थान प्राप्त किया। संध्याकाल में सास्कृतिक कार्यक्रम का आयोजन किया गया जिसमें तीनों संस्थानों के कर्मचारियों व परिवारजनों ने बढ़–चढ़कर हिस्सा लिया। कार्यक्रम के अंत में निदेशक महोदय द्वारा सभी प्रतियोगिताओं के विजयी प्रतिभागियों को पुरस्कार देकार सम्मानित किया गया।

QkVk 82- okf"kd fnol ij [kydn ifr;kfxrk

fo'o eˆk fnol dk vk;kstu

संस्थान में दिनांक 5/12/2017 को **fo'o eˆk fnol** का आयोजन किया गया। कार्यक्रम का उद्घाटन करते हुए संस्थान के प्रभारी निदेशक डा. एम. पी. सिंह ने मृदा या मिट्टी को कृषि उत्पादन का आधार बताया तथा क्षेत्र के किसानों की मिट्टी की उत्पादकता बनाये रखने हेतु कृषि प्रणाली संस्थान द्वारा किसानों के लिए कराये जाने वाले विभिन्न कार्यक्रमों की जानकारी भी दी। भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली के प्रधान वैज्ञानिकों डा. हर्षवर्धन व डा. श्रीधर ने भी मृदा स्वास्थ्य पर अपने–अपने विचार रखे व उचित सब्जी व फसल उत्पान हेतु स्वस्थ्य मृदा को आवश्यक बताया। डा. सुरेश मलिक ने पशुओं के स्वास्थ्य के लिए भी मृदा स्वास्थ्य को आवश्यक बताया तथा इसके लिए किसानों को उचित विधि से गोबर व कंपोस्ट खाद बनाने व फसलों में संतुलित उर्वरक प्रयोग पर विशेष जोर दिया। किसान प्रतिनिधि व ग्राम भायंगी–भंगेला के प्रधान श्री ओम प्रकाश जी ने किसानों को कृषि प्रणाली संस्थान द्वारा विकसित कृषि प्रणाली मॉडल से किसानों की आय में हो रही वृद्धि के बारे में जानकारी दी तथा अन्य किसानों से भी इन उन्नत कृषि प्रणाली मॉडल को अपनाने की सलाह दी।

QkVk 83- fo'o eˆk fnol

कार्यक्रम में फार्मर फर्स्ट परियोजना के तहत अंगीकृत ग्राम भायंगी–भंगेला व सिवाया के 80 किसानों सहित लगभग 150 लोगों ने भाग लिया। इस दौरान 50 किसानों को संस्थान द्वारा मृदा स्वास्थ्य कार्ड भी वितरित किये गये। डा. देबाशीष दत्ता ने किसानों को

Table 96: Summary report of the 'World Soil Day' celebrated on 05.12.2017 at ICAR-IIFSR, Modipuram, Meerut

S. No.	Name of the Institute	No. of Participants attended		No. of Soil Health Card distributed to farmers	No. of VIPs attend-ed	Name of prominent VIPs (MP/MLAs etc.) attended
		Total Participants	Farmers attended			
1.	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut - 250 110 (U.P.)	150	80	50	1	Shri Om Prakash, Village Pradhan, Vill. Bhayangi-Bhangela, Distt.- Muzaffarnagar (U.P.)

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उचित फसल उत्पादन हेतु मृदा स्वास्थ्य प्रबंध विषय पर एक व्याख्यान भी दिया। अपराह्न में किसानों के लिए राष्ट्रीय बागवानी मिशन के अंतर्गत भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली व कृषि प्रणाली संस्थान, मेरठ द्वारा संयुक्त रूप से "पालीहाउस में बेमौसमी विशिष्ट खरबूजे के उत्पादनकी तकनीकी" विषय पर एक प्रशिक्षण कार्यक्रम का आयोजन भी किया गया। इस प्रशिक्षण कार्यक्रम में डा. हर्षवर्धन, डा. श्रीधर व डा. पूनम कश्यप ने अपने–अपने व्याख्यान दिये तथा प्रयोग भी करवाये। कार्यक्रम का संचालन डा. पूनम कश्यप ने किया।

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भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में अटारी, कानपुर के सहयोग से के.वी.के. वैज्ञानिकों के लिए दिनांक 30.01.2018 से 01.02.2018 तक तीन दिवसीय प्रशिक्षण कार्यक्रम का आयोजन किया गया। दिनांक 30 जनवरी से 1 फरवरी, 2018 तक चलने वाले इस तीन दिवसीय प्रशिक्षण कार्यक्रम के दौरान देश व प्रदेश के विभिन्न कृषि जलवायुवीय क्षेत्रों के लिए समेकित कृशि प्रणाली मॉडल, किसानों की आय दोगुनी करने हेतु कृषि प्रणाली मॉडल के संस्लेशण और विश्लेशण की विधियों, सब्जी, फल व डेरी आधारित कृषि प्रणाली मॉडल, कृषि प्रणाली मॉडल में विविध व्यवसायों जैसे फसलोत्पादन, मछलीपालन, बकरी व भेंड़ पालन, वर्श भर मशरूम उत्पादन, केंचुआ खाद उत्पादन, मुर्गी पालन, प्रक्षेत्र उत्पादों के मूल्यवर्धन व उत्पाद बनाने, प्रक्षेत्र मशीनीकरण आदि विषयों पर व्याख्यान के साथ–साथ प्रयोग भी करवाये गये। संस्थान के निदेशक डा. आजाद सिंह पँवार ने अपने संबोधन में बताया कि समेकित कृषि प्रणाली के वैज्ञानिक प्रबंधन से ही किसानों की आय को बढ़ाया जा सकता है। उन्होनें यह भी बताया कि कृषि प्रणाली संस्थान देश भर में फैले अपने शोध केन्द्रों के माध्यम से स्थान विशेष व छोटे, मध्यम व सीमांत कृषकों के लिए अलग–अलग समेकित कृषि प्रणाली मॉडल विकसित कर रहा है जो कि किसानों की खाद्य, पोषण व आय सुरक्षा में महत्वपूर्ण भूमिका निभा रहे हैं। अब तक संस्थान में लगभग 38 समेकित कृषि प्रणाली मॉडल विकसित कर लिए हैं और विभिन्न सरकारी प्रसार माध्यमों से इस तकनीकी को किसानों तक पहुँचाया जा रहा है। समेकित कृषि

प्रणाली मॉडल में अलग–अलग कृषि जलवायवीय क्षेत्रों के किसानों के लिए विविध तरह के व्यवसायों के विकल्प हैं जिन्हें किसान भाई अपनी सुविधानुसार अपना कर अपनी आमदनी बढ़ा सकते हैं। डा. पँवार ने प्रस्तुत प्रशिक्षण कार्यक्रम को किसानों की आय बढ़ाने की दिशा में एक महत्वपूर्ण कदम बताया। इस प्रशिक्षण के उपरांत कृशि विज्ञान केन्द्रों के प्रशिक्षित वैज्ञानिकगण अपने–अपने क्षेत्रों के किसानों तक समेकित कृशि प्रणाली मॉडल को फैलायेंगें और उनकी आय बढ़ाने की दिशा में अग्रसर होंगे। कार्यक्रम समन्वयक डा. एन. रविशंकर जी ने बताया कि समेकित कृषि प्रणाली के वैज्ञानिक तरीके अपनाकर किसान भाई अपनी खाद्य, पोशण, आजीविका और आय सुरक्षा को सुदृढ़ कर सकते हैं। उन्होनें यह भी बताया कि कृषि प्रणाली संस्थान प्रदेष में स्थित कृषि विज्ञान केन्द्रों के माध्यम से प्रदेष के किसानों के यहाँ समेकित कृषि प्रणाली मॉडल स्थापित करने में अपना तकनीकी सहयोग भी देगा। प्रशिक्षण कार्यक्रम में उत्तर प्रदेश के सभी नौ कृषि जलवायवीय क्षेत्रों में स्थित 21 जिलों के कृषि विज्ञान केन्द्रों के 21 वैज्ञानिकों ने भाग लिया। समापन समारोह के दौरान सभी प्रशिक्षणार्थियों को निदेशक महोदय द्वारा प्रमाण–पत्र भी वितरित किये गये।

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भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 17.03.2018 को एक **þÑ"kd &oKkfud ifjppk**" का आयोजन किया गया जिसमें पश्चिमी उत्तर प्रदेश के 400 किसानों सहित कुल 650 लोगों ने भाग लिया। दौराला क्षेत्र के ब्लाक प्रमुख श्री सचिन कुमार जी इस कार्यक्रम के अध्यक्ष और किसान नेता श्री परविंदर तेवतिया जी मुख्य अतिथि रहे। सिवाया व अन्य गावों से ग्राम प्रधान कार्यक्रम में विशिष्ठ अतिथि रहे। कार्यक्रम के अध्यक्ष श्री सचिन कुमार जी ने अपने संबोधन में बताया कि आज किसानों की उन्नति व आय बढ़ाने के लिए सरकार द्वारा तमाम प्रयास किये जा रहे हैं जिनका लाभ उठाकर किसान अपनी आय में वृद्धि कर सकते हैं। उन्होंने किसानों से गन्ने के क्षेत्र में फसल विविधीकरण अपनाने की सलाह दी और कृषि में रासायनिक उर्वरकों और जैवनाशीयों के प्रयोग घटाने व पर्यावरण को सुरक्षित बनाने की आवश्यकता जताई। मुख्य अतिथि श्री परविंदर तेवतिया जी ने अपने संबोधन में भारतीय कृषि अनुसंधान परिशद के संस्थानों के वैज्ञानिकों द्वारा कृषकों व देश की खाद्य व पोशण सुरक्षा सुनिश्चित करने हेतु किये जा रहे शोध कार्यों व विकसित कृषि तकीनीकों की सराहना की तथा किसानों से इन नवीन कृषि तकनीकों का अधिक से अधिक लाभ उठाने की सलाह दी। संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी अतिथियों व कृषिकों का स्वागत किया तथा बताया कि कृषि प्रणाली संस्थान समेकित कृषि प्रणाली और जैविक कृषि प्रणाली पर विकसित मॉडलों के माध्यम से देश भर के किसानों की आय बढ़ाने व उनकी पोषण व आजीविका सुरक्षा सुनिश्चित करने की दिशा में अग्रसर हैं। उन्होंने यह भी बताया कि संस्थान द्वारा पश्चिमी उत्तर प्रदेश व उत्तराखण्ड के जिलों के किसानों के लिए भी विभिन्न परियोजनायें संचालित की जा रही हैं जिनके माध्यम से प्रक्षेत्र उत्पादकता व आय में बढ़ोत्तरी में आशानुरूप वृद्धि हो रही है। श्री जितेन्द्र प्रधान जी व अन्य गावों के ग्राम प्रधानों ने किसानों से कृषि प्रणाली संस्थान द्वारा कृषि प्रणाली मॉडल पर विकसित तकनीकों का फायदा उठाने की सलाह दी।

कार्यक्रम के दौरान किसानों को भारतीय कृषि अनुसंधान संस्थान, पूसा, नई दिल्ली द्वारा आयोजित कृषि उन्नति मेले में माननीय प्रधानमंत्री श्री नरेन्द्र मोदी व माननीय कृषि मंत्री श्री राधा मोहन सिंह द्वारा मेले के भ्रमण के साथ–साथ कृषि प्रणाली, जैविक कृषि, कृषि मशीनीकरण, सौर उर्जा के उपयोग, फसल अवषेश प्रबंधन, पशुपालन, सब्जी व फलोत्पादन, सहित अनेकों

नीवनतम कृषि तकनीकों और सरकार द्वारा कृषक हित में चलाई जा रही विभिन्न योजनाओं व माननीय प्रधानमंत्री के संबोधन के सीधे प्रसारण को भी पर्दे पर दिखाया गया। इस दौरान गन्ने में समेकित पोषण व नाशी जीव प्रबंधन, आम के बागों का प्रबंधन कृषि मशीनीकरण आदि विषयों पर किसानों व वैज्ञानिकों के मध्य परिचर्चा का आयोजन किया गया और किसानों की समस्याओं के समाधान भी बताये गये। इसके साथ–साथ किसानों को समसामयिक फसलों जैसे गन्ना, उर्द/मूँग, आम व समेकित कृषि प्रणाली की उन्नत तकनीकों पर कृषि प्रणाली संस्थान द्वारा विकसित प्रकाशन भी उपलब्ध कराये गये।

कार्यक्रम का संक्षिप्त आंकड़े नीचे की तालिका 97 में दिये गये हैं:

S. No.	Particulars	Numbers
1.	No. of Farmers attended	400
2.	No. of public representatives attended the events	9
3.	No. of other officials	241
5.	Broadcasting of programme by Meerut City Hulchal Channel during night of 17.03.2018 onwards	More than 1 lakhs peoples covered

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Important meetings organized

XII Group Meeting of NPOF organized at ICAR-IIFSR, Modipuram, Meerut

ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut hosted the XII Group meeting of Network Project on Organic Farming (NPOF) from 18-19 December, 2017. A total of 45 Scientists from 20 different NPOF centres participated in the meeting. Dr. S. Bhaskar, ADG (Agronomy, Agroforestry and Climate Change) was the Chief guest in inaugural function organized on 18.12.2017. In his inaugural address, Dr. Bhaskar worried about about lower nutrient use efficiency in traditional farming and advocated for adoption of organic farming for increasing the nutrient use efficiency. Looking for increasing area of organic farming in the country, he has addressed scientists for estimation of livestock dung, urine and other organic inputs and speeding up of research on increasing the nutrient use efficiency in organic farming through these nutrient sources. Director, ICAR-IIFSR Dr. Azad Singh Panwar welcomed all the guests and presented the brief report of NPOF achievements. He stated that, the area under organic farming is increasing at faster rate in the country and presently occupied about 1.49 million hectares. There was 29 % growth in the organic produce during last five years in the country. Dr. Krishan Chandra, Director, National Centre for Organic Farming and guest of honour appreciated the publication of package of practices of about 20 crops for organic production system in the form of a book by NPOF Scientists group. These packages of practices are now providing a lot of technical backstopping to organic farmers in the county.

During two days of the meeting, Principal Investigators from different NPOF centres presented the progress report of Research Project/ experiments of their centres. After thorough review of the results of experiments of each centres, recommendations was brought out for circulation to different stakeholders. Special lectures were also organized on non-chemical management of pests under organic farming including

Photo 86. Dr. A.S. Panwar, Director, ICAR-IIFSR, addressing the participants of 12th Annual Group Meeting of NPOF

liquid organic manures: prospects and methodologies; organic pest management with *Ayurveda* herbs, functioning of NCOF and its products including PGS certification system, Bio-chemical characterization of *panchagavya* and its importance in organic farming and pest repellant formulation for organic production system by various specialists/industry representatives during the meeting.

Photo 87. Release of special publications at 12th Annual Group Meeting of NPOF

Valedictory session was chaired by Dr. Gaya Prasad, Vice-Chancellor, SVBPUA and Technology, Meerut. In his valedictory remarks, Dr. Gaya Prasad states that organic farming is necessary for health of humans, soil and the environment. He also stressed upon immediate attention for research on effective nutrient and pest management package for organic farming of crops. ICAR-Research complex Umiyam was awarded with best centre for organic farming research on the basis of overall performance of all the centres. Dr. N. Ravishanker, National PI, NPOF coordinated the programme.

Photo 88. 12th AGMof NPOF in progress

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भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में राजभाषा हिंदी के अधिकाधिक प्रयोग को बढ़ावा देने एवं समस्त कार्यालय कर्मियों में राजभाषा हिंदी के प्रति अभिरूचि पैदा करने के उद्देश्य से 14–28 सितंबर 2017 तक हिंदी पखवाड़े का आयोजन किया गया। इस दौरान हिंदी से संबंधित विभिन्न कार्यक्रमों/प्रतियोगिताओं जैसे निबंध लेखन, टिप्पण एवं प्रारूप लेखन, हिंदी सामान्य ज्ञान प्रश्नोत्तरी, आशुभाषण, श्रुतलेख, शोध पत्र पोस्टर प्रदर्शन एवं स्वरचित काव्य पाठ आदि का आयोजन किया गया। सभी प्रतियोगिताओं के विजयी प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं प्रोत्साहन पुरस्कार देकर सम्मानित किया गया। इसके अतिरिक्त वर्ष 2016–17 के दौरान

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हिंदी में सर्वाधिक कार्य/लेखन करने वाले कर्मियों को भी पुरस्कृत किया गया। उक्त प्रतियोगिताओं में सभी संवर्ग के अधिकारियों एवं कर्मचारियों ने बढ़–चढ़ कर प्रतिभागन किया। इनके अतिरिक्त, इसी दौरान संस्थान में "जलवायु परिवर्तन के दुष्प्रभावों को कम करने हेतु संरक्षण कृषि" विषय पर आयोजित किये गये 21 दिवसीय ग्रीष्मकालीन स्कूल में देश के नौ विभिन्न राज्यों से आये हुए सभी प्रतिभागियों ने भी निबंध लेखन प्रतियोगिता में भाग लिया। संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने विजयी प्रतिभागियों को बधाई देते हुए सभी वैज्ञानिकों एवं अधिकारियों से अपने अधिक से अधिक कार्यालयीन कार्यों को हिंदी में करने तथा शोध कार्यों को हिंदी पत्रिकाओं में लोकप्रिय लेखों के माध्यम से किसानों तक पहुँचाकर उनकी समस्याओं का समाधान करने का आग्रह किया।

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जनवरी – मार्च	21 मार्च 2017
अप्रैल – जून	27 जून 2017
जुलाई – सितंबर	26 अगस्त 2017
अक्टूबर – दिसंबर	16 दिसंबर 2017

Swachhata Pakhwara organized from 16-31 May, 2017

Institute organized '*Swachhata Pakhwara*' from 16-31 May, 2017 during which a series of cleanliness activities and awareness programmes were organized to create Swachhata awareness among different sections of the society. These activities included Swachhata Pledge; cleanliness drive in the institute premises, laboratories, research farm, farm roads, individual sections, farmer's training hostel etc.; awareness programmes for farmers in villages, farm labourers and laboratory workers, residents of Pallavpuram colony, shopkeepers and common public in market; Swachh Awash Abhiyan, Swachh Gaon Abhiyan; inspection of sections for cleanliness award; collaborative programme with NCOF Ghaziabad on demonstration of Waste Decomposer and closing ceremony in adopted village under MGMG programme.

During inaugural function of 'Swachhata Pakhwara' renowned farmer's leader Sh. Rakesh Tikait was chief

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1	हिंदी कार्यशाला	एक दिवसीय/25.03.2017	कार्यालय कर्मी एवं आमंत्रित अथिति
2	हिंदी कार्यशाला	एक दिवसीय/19.06.2017	कार्यालय कर्मी एवं आमंत्रित अथिति
3	हिंदी कार्यशाला	एक दिवसीय/27.09.2017	कार्यालय कर्मी एवं आमंत्रित अथिति
4	हिंदी कार्यशाला	एक दिवसीय/29.12.2017	कार्यालय कर्मी एवं आमंत्रित अथिति

Photo 91-94. Inaugural Function of '*Swachhata Pakhwara*' on 16 May, 2017 and address by chief Guest Sh. Rakesh Tikait, the rebound farmer's leader

guest. In his address, Sh. Tikait Ji emphasized that major attention of Swachhata campaign should be given to villages because majority of the national population live in villages. He also administered the Swachhta Pledge to all the participants. Dr. Azad Singh Panwar, Director of the Institute welcomed all the guests and participants in the function and appealed for greater participation in the cleanliness campaign to make programme more successful. He also elaborated the co-relation between cleanliness and health. Distinguished speakers given their views on the importance of swachhta abhiyan and appealed to public for their active and greater participation to make our country neat and clean. Employees of Institute, guests, shopkeepers from Chauhan market and residents of Pallavpuram did brooming works in the campus, in and around the Chauhan Market and residential area of Pallavpuram.

The date wise cleanliness activities conducted during '*Swachhata Pakhwara*' of 16-31 May, 2017 are given in Table 100.

Photo 95-98. Swachhata awareness programme and cleaning campaign in Chauhan Market on 16.05.2017 by ICAR-IIFSR employees and common public

Table 100: Date wise cleanliness activities conducted during '*Swachhata Pakhwara*' of 16-31 May, 2017

Date	Activity conducted	Location/site
16.05.2017	Inaugural function, Swachhta Pledge and cleaning campaign	Office campus, Chauhan Market and Pallavpuram
17.05.2017	Cleaning of Siwaya Farm and cleanliness awareness for farm labourers	Siwaya Farm of ICAR-IIFSR
18.05.2017	Cleaning of Main Research Farm, roads etc and cleanliness awareness for farm labourers Main Research Farm	Main Research Farm of ICAR-IIFSR
19.05.2017	Cleaning programme of Soil laboratory and awareness about precautionary measures in the Lab.	Soil lab. of ICAR-IIFSR
20.05.2017	Cleaning programme of Crop Physiology laboratory and awareness about precautionary measures in the Lab.	Crop Physiology Lab.of ICAR-IIFSR
22.05.2017	Inspection of sections for cleaning award	All the Sections of ICAR-IIFSR
23.05.2017	Demonstration of rapid composting and degradation of farm waste and residues by using NCOP bio-inoculant	Main Research Farm of ICAR-IIFSR
24.05.2017	Cleaning of Main Campus	ICAR-IIFSR
25.05.2017	Cleaning of OAS Section	ICAR-IIFSR
26.05.2017	Cleaning of CSRM Section	ICAR-IIFSR
27.05.2017	Cleaning of IFSM Section	ICAR-IIFSR
29.05.2017	Cleaning of Farmer's Trainees Hostel	ICAR-IIFSR
30.05.2017	Swachh Aawas Abhiyan and cleanliness awareness programme	Official and private colony of Pallapuram, Meerut
31.05.2017	Swachh Gaon Abhiyan and Closing ceremony in MGMG adopted village	Jaitpur Village of Muzaffarnagar District

Photo 99-102. Demonstration of preparation and use of waste decomposer by the expert from NCOF Ghaziabad for rapid decomposition of waste on 23.05.2017 at ICAR-IIFSR

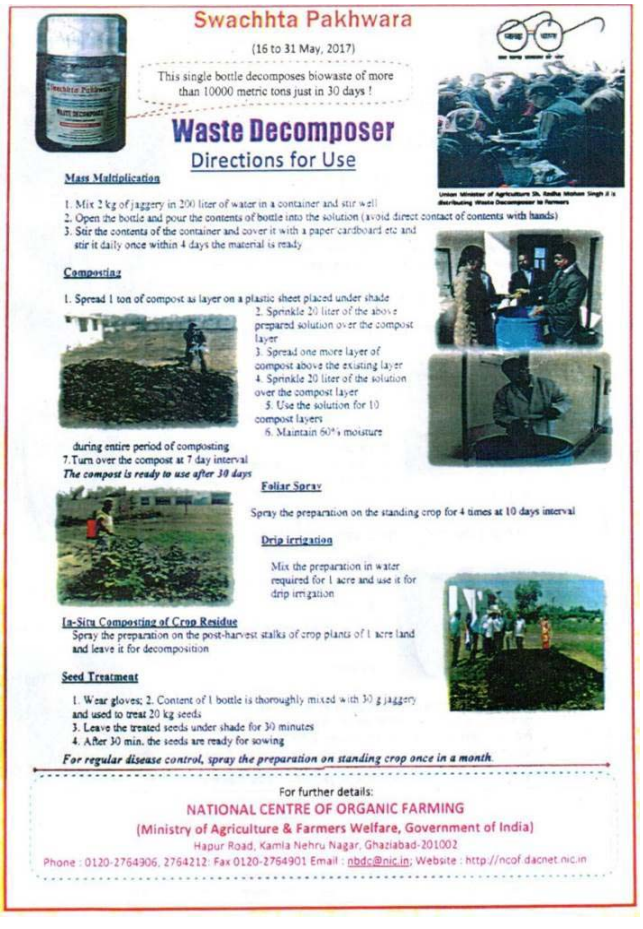

Photo 103 & 104. Waste decomposer developed by NCOF Ghaziabad demonstrated for rapid decomposition of waste on 23.05.2017 at ICAR-IIFSR

Swachh Awaas Abhiyan

Institute organized "***Swachh Aawaas Abhiyan***" on 30.05.2017 in and around official quarters of IIFSR located at Pallavpuram, Phase II, Meerut under the aegis of Swachh Bharat Abhiyan. This program was organized as a part of Swachhta Pakhawara celebrated by the Institute from 16-31 May, 2017. Director In-charge Dr. M.P. Singh inaugurated the programme in

Photo 105 & 106: Cleanliness activities of "*Swachh Aawaas Abhiyan*" organized on 30.05.2017 by ICAR-IIFSR

Photo 107 & 108: Demonstration on Collection of dry and wet garbage and their proper disposal by officials of ICAR-IIFSR during "*Swachh Aawaas Abhiyan*" organized on 30.05.2017

the morning in the presence of employees of IIFSR, residents and their family members of PH quarters. More than one hundred participants including residents of official quarters with their family members and employees actively participated in the cleaning campaign. Programme started with brooming on divider and service roads; collection and disposal of garbage left around roadsides; cleaning of sewage and drainage lines; weeding around roadsides; grading of biodegradable and non-biodegradable wastes, their collection and proper disposal through composting and other means at ICAR-IIFSR Farm. Official quarters located at PH, OH and O blocks were covered during the programme. During the occasion, about 75 nos. of houses and their surroundings and 2Km. of colony roads were cleaned with the help of colony residents.

During **"***Swachh Aawash Abhiyan***"** a practical demonstrations on the collection and grading of dry (non-biodegradable) and wet (biodegradable) garbage from home and their proper disposal was also demonstrated to the residents of Pallavpuram.

Cleanliness Drive in Adopted Villages

Institute organized "***Swachh Gaon Abhiyan***" on 31.05.2017 at Jaitpur Village of Bhudhana Block, District Muzaffarnagar, U.P. More than 150 participants including officials from ICAR-IIFSR, Modipuram, Meerut and villagers including farmers, their family members and children participated in the programme. Village Pradhan Sh. Rishipal was chief guest of the occasion. A series of activities were conducted during the programme. Director In-charge Dr. M.P. Singh




Photo 109-112: Director In-charge administering the Swachhata pledge and addressing the farmers on 31.05.2017 at Jaitpur Village

administered the Swachhta Pledge to all the participants. During his address, he appealed all the participants to be attentive and responsible about cleanliness of our surroundings and also about proper disposal and recycling of the wastes.

Village Pradhan Sh. Rishipal thanked Director and team ICAR-IIFSR for organizing such a useful programme in the Jaitpur village. He requested all the villagers and children to become aware about Swachhta Campaign and follow the tips given by the scientists of ICAR-IIFSR for keeping village neat and clean. Dr. N. Ravisanker welcomed all the villagers and guests in the function and highlighted welfare activities, FLDs and Swachhta campaign being undertaken in Jaitpur village under MGMG programme by the Institute. DR. R. P.



Photo 113-116: Demonstration for preparation and use of waste decomposer by the Scientists of ICAR-IIFSR during *"Swachh Gaon Abhiyan"* at Jaitpur Village on 31.05.2017

Mishra, Nodal Officer, Swachhta Pakhwara emphasized the role of Swachhta in avoiding common contagious diseases in villagers and given ways to reduce expenditures on treatment of diseases related to cleanliness and hygiene. He also appealed villagers not to put dungs on roadsides and given tips for proper composting of dung and domestic wastes. Dr. Nisha Verma delivered a detailed lecture on women health, balance nutrition, common nutritional disorders of women, cleaning of cloths, kitchen and utensils, toilets,




Photo 117-120: Cleaning of roads, home fronts and other community areas by villagers and employees of ICAR-IIFSR during "*Swachh Gaon Abhiyan*" at Jaitpur Village on 31.05.2017

drain channels etc. and avoidance common contagious diseases through cleanliness and hygiene. Dr. Poonam Kashyap told about proper disposal of kitchen and domestic wastes and ways for using those wastes as nutrients for crops of our kitchen garden.

After Swachhta pledge and awareness lectures, a practical demonstration was given to villagers by the Scientists of ICAR-IIFSR on culture multiplication and waste recycling using 'Waste decomposer'-a liquid microbial formulation developed by NCOF, Ghaziabad.

Pamphlets and calendars on integrated nutrient and pest management in crops and waste recycling were distributed to farmers. Dr. D. Dutta, Dr. L.K. Meena and Dr. Amit Kumar coordinated the distribution of cleaning aids to villagers. This was followed by cleaning and brooming works on roads, home fronts and community areas of the village. Proper collection and grading of biodegradable and non-biodegradable wastes and their disposal through appropriate methods was also demonstrated to villagers by the scientists

Important Visitors

Hon'ble Secretary DARE and DG-ICAR Dr. Trilochan Mohapatra visited ICAR-IIFSR, Modipuram on 31.10.2017

Secretary, DARE and DG, ICAR Dr. Trilochan Mohapatra visited ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut on 31st October, 2017. In his address to the staff, he stresses upon ground level implementation of 'Swachhta Abhiyan' in ICAR office premises; adaptation of validated integrated farming system/ integrated organic system models by farmers and their impact analysis; generation and documentation of scientific informations from research on integrated farming systems; and more focus upon **disruptive technologies** which can change the directions of the agriculture and allied sectors in the country. He further stressed on publication and wide dissemination of developed IFS models and success stories for adoption by all state governments and related development agencies.

Photo 121. Visit of Dr Trilochan Mohapatra, Hon'ble DG, ICAR and Secy. DARE to ICAR- IIFSR

Photo 122. Release of fish seed by Dr Trilochan Mohapatra, Hon'ble DG, ICAR and Secy. DARE in fish pond of IIFSR

Director ICAR-IIFSR Dr. Azad Singh Panwar welcomed the Hon'ble DG and guests and given a brief presentation on research achievements of the Institute. Dr. Mohaptra administered the 'oath on vigilance awareness' and leaded the 'run for unity' in ICAR-IIFSR premises on the occasion of birth anniversary of Bharat Ratna Sardar Vallabbahi Patel, the former Deputy Prime Minister of the country. Hon'ble DG also inaugurated the new farm office building and newly developed horticulture based farming system model on Siwaya research farm of ICAR-IIFSR. A number of publications i.e. books on 'Organic Farming – crop production guide', 'Modern techniques of farm management', 'Training Manual on carbon sequestration and GHG measurement in IFS models', 'Reference manual on statistical analysis of on-station research experiments planned under AICRP on IFS' and success stories CDs on IFS from four states of country were also released by him. Dr. Brihm Prakash, Director ICAR-CIRC, Meerut and Dr. Manoj Kumar, Joint Director, ICAR-CPRIC, Meerut and employees from these Institutes were also present during the meeting.

Photo 123. Vigilance pledge to ICAR-IIFSR staff by Dr. Trilochan Mohapatra, Hon'ble DG, ICAR and Secy. DARE

ICAR summer school on Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production (14 July to 3 August, 2017)

Considering the importance of producing safe and sustainable food, network project on organic farming was initiated by council in which currently 16 states are covered. Due to the continuous efforts, package of practices for organic production of crops in cropping/ farming systems perspective have been developed. Considering the importance of capacity building on organic farming especially on modern concepts and practices, ICAR-Indian Institute of Farming Systems Research, Modipuram proposed a summer school training on "Modern Concepts and Practices of Organic Farming for safe, secured and sustainable food production" to ICAR which was approved.

The training was inaugurated on 14 July 2017 by Dr M. Premjit Singh, Vice Chancellor, Central Agricultural University, Imphal. Dr A.S. Panwar, Director, ICAR-IIFSR is Course Director of the training. The training will continue up to 03 August 2017.

Photo 124. Participants of ICAR Summer school organized at ICAR-IIFSR, Modipuram

Trainees from 8 states namely Bihar, Haryana, Jharkhand, Gujarat, Maharashtra, Tamil Nadu, Uttarakhand and Uttar Pradesh are attending the training. They are from 8 state agricultural universities, 5 KVKs and multi-discipline (10 subjects).

The participants will be exposed to all aspects of organic farming including modern concepts and practices on all crops including certification. Resources persons from all the ICAR institutes and SAUs are delivering the lecture. Besides participants will also be taken to progressive farmers field for interaction.

Vigilance Awareness Week (30 October – 4 November 2017)

Vigilance Awareness week on the theme of "My Vision-Corruption Free India" was organized during 30 October -4 November 2017 with various events such as administering the pledge by Dr A.S. Panwar, Director, ICAR-IIFSR on 30 October, 2017 followed by administration of pledge to all the staff of ICAR-IIFSR, ICAR-CIRC, Meerut & ICAR-CPRI campus, Modipuram by Dr Trilochan Mohapatra, Secretray (DARE) & Director General, ICAR on 31 October 2017. Painting competition on the theme was organized for school children's on 01 November 2017 in which Public school (Pavlikhas), RN International Public School (Pallavpuram), Heritage School (Pallavpuram) and DMI (Modipuram) have participated in the event apart from children's of staff. On 4th November 2017, Dr S. Bhaskar, ADG (AAFCC) administered the pledge to all the group Scientists of AICRP on Integrated Farming Systems during Annual Group Meeting held at RARI, Durgapura, Rajasthan.

Photo 125. Dr S. Bhaskar, ADG (AAFCC) administering the pledge on 4 November 2017 during Annual Group Meeting of AICRP on Integrated Farming Systems held at RARI, Durgapura

Annual Group Meeting of AICRP on Integrated Farming Systems (3-5 November 2017)

The Annual Group Meeting of ICAR-AICRP on Integrated Farming Systems was organized during 03-05 November 2017 at Rajasthan Agricultural Research Institute (RARI), Durgapura, Jaipur under Sri Karan Narendra Agriculture University, Jobner (Rajasthan) in which review of on-going research programmes of on-station and on-farm centres including Tribal Sub Plan, administrative, financial issues were undertaken. The inaugural programme of the workshop started with ICAR song and lighting of lamp. Dr P.S. Rathore, Vice Chancellor, SKNAU, Jobner welcomed the guests and delegates. He briefly informed about research activities being carried out by the university and the importance of systems research for enhancing the sustainability and income of the farmers. Dr. N.S. Rathore, Deputy Director General (Education), ICAR New Delhi graced the inaugural programme as Chief guest. The session was also attended by Dr. S. Bhaskar, ADG (Agronomy, Agroforestry and Climate Change), ICAR, New Delhi as guest of honour, Dr. A.S.Panwar, Director, ICAR-IIFSR, Dr. P.L.Saroj, Director, ICAR- Central Institute of Arid Horticulture, Bikaner, Dr. S.J. Singh, Director, RARI, Jaipur and Dr V.K. Yadav, Director (Research), SKNAU, Jobner. Dr N.S. Rathore highlighted the fact that agriculture is on crossroads and emphasized on integrated approach than isolated approach with right kind of transformation for farmers empowerment. He also emphasized that integrated farming systems is the only way by which the vision of Hon'ble Prime Minister on doubling farmers income can be achieved. He further asked the group scientists to establish the farmer friendly IFS models throughout India to show case the technologies. Dr. P.S. Rathore, emphasized about the importance of IFS approach in changing scenario of water scarcity and nutritional deficiency particularly in rainfed ecosystem. Dr. S. Bhaskar, ADG (Agronomy Agroforestry & Climate change), ICAR highlighted the need for upscaling of IFS with special reference to small holder farming system to spread the benefits of IFS. Dr. A.S.Panwar, Director, ICAR-IIFSR while welcoming the guests, presented the brief achievements of the scheme (Annexure-I). Dr. P.L. Saroj highlighted about the importance and role of horticulture especially arid fruits in IFS for doubling farmers's income & need for diversification. Dr. V.K Yadav & Dr. S.S. Singh, highlighted the activities of the SKNAU and progress of IFS research activities in Rajasthan. In the inaugural session, Annual Report (2015-16) of the scheme and publications brought out by the centres were also released by dignitaries. Dr. Rakesh Sammuria, Local organizing secretary & Chief Agronomist, AICRP-IFS, RARI proposed the vote of thanks. The plenary session was chaired by Dr. A.S. Panwar, Director, ICAR-IIFSR and Co-chaired by Dr S.J. Singh, Director, RARI and Dr V.K. Yadav, Director (Research), SKNAU, Jaipur. The rapporteurs of the session were Dr. M. Shamim, Scientist, ICAR-IIFSR and Dr. Vipin kumar, Assistant Professor (Entomology). At the start of the session, few left over publications made by AICRP-IFS centres were released. Session wise recommendations were presented by Dr. A.K. Prusty, Scientist, Dr (Mrs) Nisha Varma, Scientist, Dr M. Shamim, Scientist, Dr Debashis Dutta, Senior Scientist, Dr N. Ravisankar, Principal Scientist and Dr Rani Saxana, Assistant Professor. The recommendations were discussed and finalized. Dr V.K. Yadav, Director (Research) in his concluding remarks informed that up-scaling of IFS models is essential and needs to be done on priority. Dr S.J. Singh, Director, RARI thanked the ICAR-IIFSR for hosting the group meeting at RARI, Durgapura and informed that it will help re shape the IFS research activities in India and Rajasthan in particular. Dr A.S. Panwar, Director, ICAR-IIFSR in his concluding remarks emphasized that quality experimentation, data collection, submission of reports, publications and out-reach activities are essential for the scheme and requested all the centres to pro-actively involve in spreading the IFS message

Photo 126. Release of Annual Report of AICRP on Integrated Farming Systems by Dr N.S. Rathore, DDG (Agricultural Education), ICAR and other dignitaries during inauguration of Annual Group Meeting

to state agencies and all the stake holders. Dr R. Sammauria, Chief Agronomist also thanked the delegates for their cooperation and smooth conduct of the meeting. The Annual group meeting was formally concluded with vote of thanks proposed by Dr.N. Ravisankar, PS & PF (CU), ICAR-IIFSR, Modipuram.

XII Annual Group Meeting of Network Project on Organic Farming (18-19 December, 2017)

ICAR-Indian Institute of Farming Systems Research (ICAR-IIFSR), Modipuram is operating a Network Project on Organic Farming (NPOF) from 2004 with 13 co-operating centres representing 9 agro-climatic regions, 13 NARP zones and 12 states. Seven new centres were approved in XII plan and have been made functional from 2015-16, thus covers 16 states. The 12th Annual Group Meeting of Network Project on Organic Farming was organized at ICAR-Indian Institute of Farming Systems Research, Modipuram (Uttar Pradesh) during 18-19 December 2017 as approved by ICAR (F.No. NRM-7-7/2015-AFC dated 27 November 2017). The group meeting started with ICAR song followed by welcome of the participants by the Dr AS Panwar, Director, ICAR-IIFSR, Modipuram. Dr S. Bhaskar, Assistant Director General (Agronomy, Agroforestry and Climate Change), NRM division, ICAR was Chief guest while Dr Krishan Chandra, Director, National Centre of Organic Farming (NCOF), Ghaziabad was Guest of honour. Dr Manoj Kumar, Joint Director, ICAR-Central Potato Research Institute Campus, Modipuram participated as special invitee. Dr A.S. Panwar, Director, ICAR-IIFSR while welcoming the guests and participants, presented the brief scheme report in which he highlighted that the area under organic farming is growing steadily over the years due to the government interventions in the form of Parambaraghat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development Scheme for North Eastern hill region and there is a dire need to provide technological back stopping for these schemes. In this connection, NPOF has developed package of practices for 47 cropping systems suitable to 12 states and have been compiled in the form of Organic Farming: Crop Production Guide. He also highlighted that stability analysis training has been conducted for all the centres which will help to identify the best varieties suitable to organic farming. Further, he emphasized that as per the need of present government, the issues such as zero budget farming, evaluation of indigenous products are need to be undertaken by this project. Dr Manoj Kumar, Joint Director, ICAR-CPRIC, Modipuram in his special invitee address highlighted that organic farming is need of the hour to provide safe food to the people and also informed that potato can also be taken up under organic farming with specific management practices. Dr Krishan Chandra, Director, NCOF while briefing about the schemes and PGS certification system introduced by the government, informed that more collaboration between ICAR-IIFSR and NCOF will further strengthen the cause of organic farming in India. He also briefed about waste decomposer developed by NCOF and how it is benefitting the farmers. Dr S. Bhaskar, ADG (AAFCC) and other dignitaries released the publications of the scheme brought out by different centres of the scheme. In his Chief guest address, Dr S. Bhaskar, highlighted the various initiatives taken by the council to promote organic farming which included education programmes for farmers, development of course curriculum for post graduate *etc*. He also categorically emphasized that organic farming in India should be aimed only for niche crops and areas. Dr Bhaskar also pointed that the package of practices for organic production needs to be fine-tuned and improved continuously as per the changing scenario. Organic farming in farming systems perspective needs to be given more emphasis with plan on Integrated Organic Farming System concepts, he pointed out. Dr N. Ravisankar, National PI, NPOF proposed the vote of thanks.

The plenary session was chaired by Dr Gaya Prasad, Vice Chancellor, SVPUAT, Modipuram and co-chaired by Dr A.S. Panwar, Director, ICAR-IIFSR, Modipuram. Dr M. Shamim, ICAR-IIFSR acted as rapporteur. The rapporteurs of respective session have presented the proceedings of all the session. The recommendations from various sessions were discussed and finalized. Dr Gaya Prasad, Vice Chancellor, SVPUAT, Modipuram in his valedictory address gave the importance of balancing the nature and meeting the human needs. He emphasized that plants do not discriminate the organic and inorganic way of supply of nutrients and solutions for addressing the pest and disease concerns under organic farming are limited. Dr

Prasad asked the group scientists to be more pragmatic in organic farming research by including the indigenous successful practices adopted by the farmers. Dr AS Panwar, Director, ICAR-IIFSR emphasized on improving the quality of research and publications. Based on the overall performance, ICAR Research Complex for NEH region, Umiam (Meghalaya) centre of NPOF was selected as best centre and a certificate was issued in the plenary session. The group meeting ended with vote of thanks proposed by Dr A.K. Prusty, Scientist, Coordination Unit, ICAR-IIFSR.

Agrimonde -Terra Interactive Seminar

Photo 127. Agrimonde-Terra 2050 interaction seminar at NASC complex, New Delhi

Capacity building programme for out-scaling of improved prototype IFS models for resilience

Capacity building training cum workshop involving researchers from different agro-ecological zones was organized at Wageningen University, The Netherlands during 22-24 August, 2017 for development of methods for out-scaling and validation of alternative farming system models.

Photo 128. Capacity building training at Wageningen University, The Netherlands

For out-scaling of application of quantitative analysis tools in farming systems using FarmDesign software a special lecture was delivered at annual group meeting of AICRP of IFS at RARI, Jaipur during 3-5 November, 2017.

Farmer-scientist interaction workshop on 18-03-2018 at ICAR-IIFSR with selected represented farmers of each type based on typology. Dr. Santiago Lopez Ridaura, Farming Systems Analyst from CIMMYT, Mexico explained the farming systems of each type of farmers in a systems perspective.

Photo 129. Interaction meeting with farmers for farming systems diagnosis

Photo 130. Training programme on Oilseed

Photo 131. Dissemination of ICAR-IIFSR technologies through KVK scientists for upscaling during 30 January- 01 Februray, 2018

ICAR-IIFSR IN MEDIA

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'पर्यावरण सुरक्षा के लिए जैविक खेती जरूरी'

भारतीय कृषि प्रणाली मोदीपुरम में चल रहे कार्यक्रम के समापन पर प्रथम स्थान आइसीआर मेघालय को देते हुए निदेशक डॉ. एएस पंवार व कुलपति डॉ. गया प्रसाद।

अपशिष्ट पदार्थों के प्रयोग से बढ़ सकती है किसानों की आय

मोदीपुरम। सरदार वल्लभ भाई पटेल कृषि एवं प्रौद्योगिकी विश्वविद्यालय में जैव प्रौद्योगिकी द्वारा कृषि अपशिष्ट पदार्थों से किसानों की आय बढ़ सकती है। इस दिशा में बीटेक के छात्र कार्य कर रहे है। बीटेक चतुर्थ वर्ष के छात्र राहुल कुमार, अनुराग पटेल, हरिओम चौरसिया, अनुराग, विद्यार्थी ने बताया कि प्रयोगशाला में चल रहे प्रोजेक्ट से अच्छे परिणाम सामने आए हैं। पोस्ट हार्वेस्टिंग कृषि अपशिष्ट जैसे धान का पुआल, धान की भूसी, गेहूं का भूसा, मक्के का ठंठल केले का छिलका, संतरे का छिलका आदि तथा अन्य अपशिष्ट जिनका किसानों को कोई आर्थिक लाभ नहीं मिलता है। इन कृषि अपशिष्ट पदार्थों को विशिष्ट तरह के एन्जाइम के माध्यम से काम में लिया जा सकता है। किसानों को भी इसका लाभ मिलेगा और वह आय बढ़ा सकते हैं।

अमर उजाला ब्यूरो

मोदीपुरम।

भारतीय कृषि प्रणाली अनुसंधान संस्थान में जैविक खेती नेटवर्क परियोजना पर चल रहे दो दिवसीय वैज्ञानिक समागम का मंगलवार को समापन हो गया। इसमें वैज्ञानिकों ने जैविक खेती पर जोर दिया।

मुख्य अतिथि कृषि विवि के कुलपति डॉ. गया प्रसाद ने कहा कि जैविक खेती देश की खाद्य एवं पोषण सुरक्षा के साथ मानव स्वास्थ्य, मृदा स्वास्थ्य एवं पर्यावरण सुरक्षा के लिए जरूरी है। संस्थान के निदेशक डॉ.

वैज्ञानिक समागम का समापन

एएस पंवार ने जैविक कृषि द्वारा खाद्य, पोषण, स्वास्थ्य एवं पर्यावरण सुरक्षा सुनिश्चित करने में जैविक खेती नेटवर्क परियोजना के वैज्ञानिक शोध परिणामों और संस्तुतियों को मील का पत्थर बताया। दो दिवसीय वैज्ञानिक समागम के दौरान 16 राज्यों के 20 केंद्रों से आए लगभग 35 वैज्ञानिकों ने अपने-अपने केंद्रों द्वारा जैविक खेती पर हो रहे शोध कार्यों की प्रगति रिपोर्ट प्रस्तुत की। जैविक खेती पर चल रहे प्रयोगों में पाया गया कि जैविक तकनीक से धान, आलू, भिंडी, सोयाबीन, चना सरसों व अन्य सब्जियों की उपज व किसान की आय में वृद्धि के साथ मृदा में पोषक तत्वों की उपलब्धता एवं मृदा के भौतिक, रसायनिक व जैविक गुणों में भी सुधार हुआ है।

कार्यक्रम समन्वयक डॉ. एन रविशंकर ने समागम की संक्षिप्त प्रगति रिपोर्ट प्रस्तुत की। आईसीआर रिसर्च कॉम्प्लेक्स उमियाम मेघालय को उत्कृष्ट कार्य के लिए मुख्य अतिथि ने प्रथम स्थान से सम्मानित किया। डॉ. एमपी सिंह, डॉ. एलआर मीणा, डॉ. चंद्रभानु, डॉ. पीयूष पूनिया आदि लोग मौजूद रहे।

मेरठ LIVE कैंपस

बुधवार, 20 दिसंबर 2017 18

हिन्दुस्तान

मंगलवार को दो दिवसीय जैविक खेती कार्यशाला का समापन हो गया। • हिन्दुस्तान

दो दिवसीय कार्यशाला संपन्न

कृषि प्रणाली अनुसंधान संस्थान में चल रहे दो दिवसीय जैविक खेती की कार्यशाला का मंगलवार को समापन हो गया। इसमें देशभर के 25 से ज्यादा कृषि वैज्ञानिकों ने हिस्सा लिया था। इस दौरान मुख्य अतिथि कृषि विश्वविद्यालय मेरठ के कुलपति डा. गया प्रसाद ने कहा कि जैविक खेती को देश की खाद्य एवं पोषण सुरक्षा के साथ-साथ मानव स्वास्थ्य, मृदा स्वास्थ्य, एवं पर्यावरण सुरक्षा के लिए जरूरी है। उन्होंने कृषि वैज्ञानिकों को जैविक खेती में फसलों के पोषण प्रबंधन के लिए आवश्यक गोबर, गोमूत्र व अन्य नवीन खादों की आवश्यक मात्रा का सही से आकलन करने की सलाह दी। कृषि प्रणाली संस्थान के निदेशक डा. आजाद सिंह पंवार, डा. एन. रविशंकर, डा. एमपी सिंह, डा. एलआर मीणा, डा. पीयूष पुनिया आदि रहे।

8 दैनिक जागरण मेरठ, 19 दिसंबर 2017

'जैविक खेती समय की जरूरत'

मोदीपुरम : भारतीय कृषि प्रणाली अनुसंधान संस्थान की मोदीपुरम शाखा में जैविक खेती नेटवर्क परियोजना के 12वें समूह समागम का शुभारंभ हो गया। दो दिवसीय कार्यक्रम में 16 राज्यों के 20 नेटवर्क परियोजना केंद्रों से आए 70 वैज्ञानिकों ने भाग लिया। मुख्य अतिथि भारतीय कृषि अनुसंधान परिषद के सहायक महानिदेशक डॉ. यश भास्कर ने उद्घाटन किया। संस्थान के निदेशक डॉ. आजाद सिंह पंवार ने कहा कि आज देश में 14.90 लाख हेक्टेयर क्षेत्रफल में जैविक खेती की जा रही है। गाजियाबाद की राष्ट्रीय जैविक खेती केंद्र से आए डॉ. कृष्ण चंद्र ने भी विचार रखे। कार्यक्रम मंगलवार को भी सुबह दस से शाम पांच बजे तक चलेगा। संचालन डॉ. निशा वर्मा ने किया। डॉ. वैज्ञानिक चंद्रभानु के अलावा अन्य वैज्ञानिक भी मौजूद थे।

बुधवार, 19 दिसंबर 2017 23

हिन्दुस्तान

मेरठ LIVE सिटी

देश को जैविक खेती की जरूरत: एस. भास्कर

मेरठ | वार्तालिप संवाददाता

आज देश को जैविक खेती की सबसे जरूरत है। रासायनिक खेती ने जहां एक ओर उत्पादन तो बढ़ाया है, लेकिन मृदा की उर्वरा शक्ति कम कर दी है। पंजाब से समझा जा सकता है कि रासायनिक खाद और कीटनाशकों के उपयोग से कृषि उत्पादन में वृद्धि तो हुई है, लेकिन वहां कैंसर के मरीज भारत में सबसे ज्यादा हैं। उक्त विचार मोदीपुरम स्थित भारतीय कृषि प्रणाली अनुसंधान संस्थान में सोमवार से शुरू हुई दो दिवसीय 'जैविक खेती पर कार्यशाला' में मुख्य अतिथि भारतीय कृषि अनुसंधान परिषद के सहायक महानिदेशक डा. एस भास्कर ने व्यक्त किए।

डॉ. भास्कर ने कहा कि आज कृषि के सामने कई चुनौतियां हैं, रासायनिक खाद और कीटनाशकों का ज्यादा उपयोग इसमें से एक है। कृषि उत्पादों की गुणवत्ता घट रही है। उन्होंने जैविक खेती पर हो रहे शोध कार्यों का जायजा बढ़ाने की आवश्यकता भी जताई।

पांच साल में 29 प्रतिशत बढ़ी जैविक खेती: डॉ. पंवार

संस्थान के निदेशक डा. आजाद सिंह पंवार ने कहा कि पांच वर्षों में जैविक खेती में 29 प्रतिशत की बढ़ोतरी हुई है। देश के 14.90 लाख हेक्टेयर क्षेत्रफल में जैविक खेती की जा रही है। इसमें कृषि वैज्ञानिकों की सराहनीय भूमिका रहा है। राष्ट्रीय जैविक खेती केंद्र, गाजियाबाद के निदेशक एवं विशिष्ट अतिथि डॉ. कृष्ण चन्द्र, डा. मनोज कुमार ने भी विचार रखे। संचालन डा. निशा वर्मा ने किया। डा. एन. रविशंकर ने धन्यवाद ज्ञापित किया।

सोमवार को भारतीय कृषि प्रणाली अनुसंधान संस्थान में कार्यशाला का आयोजन हुआ।

8 दैनिक जागरण मेरठ, 20 दिसंबर 2017 मेरठ जागरण

'पर्यावरण सुरक्षा के लिए जरूरी है जैविक खेती'

जागरण संवाददाता, मोदीपुरम : सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिकी विवि के कुलपति प्रो. गया प्रसाद ने कहा कि देश की खाद्य एवं पोषण सुरक्षा के साथ मानव स्वास्थ्य, मृदा स्वास्थ्य व पर्यावरण सुरक्षा के लिए जैविक खेती जरूरी है।

मंगलवार को भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम में चल रहे जैविक खेती नेटवर्क परियोजना के दो दिवसीय वैज्ञानिक समागम के समापन पर बतौर मुख्य अतिथि उन्होंने कहा कि जैविक खेती में गोबर, गोमूत्र व अन्य पोषक तत्वों का संतुलित प्रयोग करें। शोध कार्यों की प्रगति तेज करने की सलाह दी।

कृषि प्रणाली संस्थान के निदेशक डॉ. आजाद सिंह पंवार ने खाद्य, पोषण, स्वास्थ्य व पर्यावरण सुरक्षा सुनिश्चित करने के लिए जैविक खेती नेटवर्क परियोजना को महत्वपूर्ण बताया।

कार्यक्रम में 16 राज्यों के 20 केंद्रों से आए करीब 70 वैज्ञानिकों ने भाग लिया। मुख्य अतिथि समेत रिसर्च करने वालों को सम्मानित किया। डॉ. एमपी सिंह, डॉ. एलआर मीणा, डॉ. पीयूष पुनिया और डॉ. चंद्रभानु आदि वैज्ञानिक मौजूद थे।

कृषि प्रणाली अनुसंधान संस्थान में दो दिवसीय वैज्ञानिक समागम के समापन कार्यक्रम में मुख्यअतिथि कुलपति प्रो. गया प्रसाद को सम्मानित करते हुए।

LIST OF ON-GOING PROJECTS DURING 2017-18 AS PER 30th IRC PROCEEDING#

S.No	Project Title and Code	PI	Co PI's
	I. Integrated Farming Systems Management		
1.	Development of cost effective and sustainable Integrated Farming System models for livelihood improvement of small farm holders	Dr. L.R. Meena	Dr. S. Malik Dr. D. Mishra Dr. C. Bhanu Dr. A.K. Prusty
2.	Evaluation of fodder based cropping systems for sustained production and livelihood improvement of marginal farmers in western plain zone of Uttar Pradesh	Dr. L.R. Meena	Dr. L.K. Meena Mr. A.L. Meena Dr. D. Kumar
3.	On-farm value addition for livelihood improvement of small farm house hold in Western plain zone of Uttar Pradesh.	Dr. Amit Nath	Dr. M.P Singh Dr. D. Dutta Dr. R.P Mishra Dr. P. Kashyap Dr. Nisha Verma
4.	Development of a Web Based Integrated Information System for Indian Farming Systems Research	Shri Vipin Kumar Choudhary	Dr. Sunil Kumar
5.	Development of suitable resource conservation modules to mitigate the ill-effects of climate change	Dr. V. P. Chaudhary	Dr. C. Bhanu
6.	Long term effect of resource conservation technologies in rice-wheat system	Dr. V. P. Chaudhary	
7.	Development of fruit crop based high density farming systems for higher productivity and profitability under small farm conditions (Institute funded). **Sub Project**: Study on suitability of non-traditional high value fruit crops under small farm conditions of western U. P.	Dr. Dushyant Mishra	Dr. J.P Singh Dr. Amit Nath Dr. C. Bhanu Dr. L.K Meena
8.	Evaluation of sugarcane and wheat varieties in Sugarcane-ratoon-wheat cropping system under inorganic and organic conditions**.** (Institute funded).	Dr. D. Kumar	Dr. L.K Meena Dr. L.R. Meena Dr. A.L. Meena
9.	Effect of RCT and potassium application on soil health and productivity and quality of produce in integrated farming system (Institute funded).	Dr. D. Kumar* (Present PI after transfer of Dr. Sanjeev Kumar during the period)	Dr. L. R. Meena Dr. L.K. Meena Dr. V.P. Choudhary
10.	Evaluation of rapeseed and mustard strains in zone II at IIFSR Modipuram (Funded Under AICRP on Oilseeds)	Dr. D. Kumar	Dr. L. R. Meena Dr. L.K. Meena Dr. V.P. Choudhary
11.	AICRP on IFS OFR, Modipuram Centre (Funded under AICRP on IFS)	Dr. L. R. Meena	
12.	Development of Package of Machineries for Complete Mechanization of Small Land Holders under different Farming Systems Situation (ICAR-Extra Mural Fund)	Dr. V. P. Chaudhary	Dr. Nisha Verma

S.No	Project Title and Code	PI	Co PI's
	II. Organic Agriculture Systems (OAS)		
13.	Sustaining Rice wheat productivity through integrated nutrient supply system. (Institute funded)	Dr. R. P. Mishra	
14.	Network Project on Organic Farming, (NPOF), Modipuram Centre (Funded under NPOF)	Dr. R. P. Mishra	Dr. D. Dutta Dr. C. Bhanu Dr. P. C. Ghasal Dr. J. Choudhary
15.	On-farm Participatory Research in Farming Systems Perspective under Tribal Sub Plan in Nayagaon and Mohallapuri of Laldhang cluster under Bahadrabad block District Haridwar (Funded under TSP)	Dr. C. Bhanu	Dr. R. P. Mishra Dr. D. Dutta Dr. J. Choudhary Dr. N. Ravisanker Dr. A.K. Prusty
16.	On-farm precision nutrient management under pre-dominant cereal-cereal cropping system using Nutrient Expert®. (Funded by IPNI)	Dr. R. P. Mishra	
17.	Sustainable resource management for climate smart Integrated Farming Systems under AICRP on Integrated Farming Systems, On-station centre at Modipuram (Funded under AICRP on IFS On-station)	Dr. N. Ravisankar	Dr. P. C. Ghasal Dr. D. Dutta Dr. Suresh Malik Dr. Amit Nath Dr. A. K. Prusty (others to be confirmed)
	III. Cropping Systems Resource Management (CSRM)		
18.	Identification of bio-intensive, complementary cropping systems for high productivity and efficient resource use. (Institute funded)	Dr. Prem Singh	
19.	Adaptation and mitigation potential through conservation agriculture and IFS modules (Funded under NICRA)	Dr. N. Subash	Dr. D. Dutta Dr. P.C. Ghasal Dr. L.K. Meena
20.	CRP on CA Project (Funded under CA platform)	Dr. Prem Singh	
21.	Efficient ground water management for enhancing adaptive capacity to climate change in sugarcane based farming system in Muzaffarnagar district (Extramural Proejct)	Dr. Prem Singh	Dr. V. P. Chaudhary Dr. N. Subash
22.	Strengthening Simulation Approaches for Understanding, Projecting and Managing Climate Risks in Stress-prone Environments Across the Central and Eastern Indo-Gangetic Basin (AgMIP)- (Foreign aided project)	Dr. N. Subash	
23.	Global Yield Gap and Water Productivity Atlas (GYGA)	Dr. N. Subash	
	IV. Technology Transfer and Human Resource Development (TTHRD)		
24.	System based proven technologies in farming system perspective under demonstration in Technology park (Institute funded)	Dr. M. P. Singh	Dr. Prem Singh Dr. R. P. Mishra
25.	Diversification of existing Farming Systems through integration of poultry for improving livelihood of marginal and landless farmers (Institute funded)	Dr. S. Malik	
26.	Productivity and economic evaluation of horticulture based farming systems (Institute funded).	Dr. P. Kashyap	Dr. A. L. Meena Dr. A. K. Prusty

S.No	Project Title and Code	PI	Co PI's
27.	Comparative study of role of women in predominant farming systems of Western plain zone of UP and Hill zone of Uttarakhand. (Institute funded)	Dr. Nisha Verma	Dr. M. P. Singh Dr. P. Kashyap Dr. Amit Nath
28.	Ensuring Food and Nutritional Security through Integrated Farming System in Western Plain Zone of U.P. (Funded under Farmers First Programme)	Dr. M. P. Singh/ Dr. S. Malik	Dr. P. Kashyap Dr. A. K. Prusty Dr. Nisha Verma Dr. M. Shamim Dr. Sunil Kumar Dr. P. C. Jat
29.	Cluster based on-farm participatory research in Farming Systems under Tribal Sub plan (Funded under Tribal Sub-plan)	Dr. Nisha Verma	Dr. Suresh Malik Dr. C. Bhanu Dr. V.P. Chaudhary Dr. Amit Kumar Dr. Alka Verma Dr. Dinesh Kumar
30.	Development of Climate Resilient Sustainable Integrated Farming System Models for Optimizing Farm Productivity (NMSA).	Dr. M. P. Singh	Dr. N. Ravisankar Dr. D. Dutta Dr. P. C. Jat Dr. Khusyal Singh Dr. C. Bhanu Dr. A. K. Prusty
	V. Coordination Unit (CU)		
31.	IOFS model for Western plain zone of Uttar Pradesh (Institute funded) at IIFSR and NPOF scheme at other locations	Dr. N. Ravisankar	Dr Amit Kumar Dr P.C. Jat Dr M. Shamim Dr D. Dutta Dr Suresh Malik Dr P. Kashyap Dr C. Bhanu
32.	Development of fish based farming systems for marginal farmers	Dr. A. K. Prusty	Dr. Peyush Poonia Dr. P. Kashyap
33.	AICRP on Integrated Farming Systems (National) (Funded under AICRP on IFS)		
34.	All India Network Programme on Organic Farming (National) (Funded under NPOF)		
35.	Developing and targeting climate smart agriculture practices portfolios for diversity of farming systems (Funded by CIMMYT, Mexico)	Dr. A. K. Prusty	Dr. P.C. Ghasal

#- The projects completed/modified/merged or new projects initiated after 30th IRC will be updated after due approval in the next IRC w.e.f. their date of initiation.

NOTES

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