



# वार्षिक प्रतिवेदन Annual Report 2018-19

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



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ANNUAL REPORT  
2018-19



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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, developed 38 IFS models and organic farming packages for 51 cropping systems which gives scope for doubling farmers income by March 2022 besides meeting the household level nutrition requirement of human, livestock and soil. The 63-farmer participatory refinement of farming systems and also documentation of 81 success stories of farmers have resulted in effective dissemination of component technologies of cropping and farming systems through various sources. The IFS models developed are found to be emission negative or low GHG emitters paving the way for promotion of climate friendly resilient farming in India.

The institute also worked on indices for evaluation of farming systems and identified the indices of ecological security index, economic efficiency index, social equity index and sustainable livelihood security index and statistical methodology for evaluation of on-farm farming systems Capacity building of scientists have been made by deputing them to national and international training. The Institute organized a number of trainings including training for certified farm advisors, group meetings and several kisan goshies and field days on different aspects of farming systems management.

The institute is challenged with several projected scenarios of change in climate, consumption pattern, reduction in resources especially land, labour, capital and water, enhanced consumerism for quality products due to economic improvement, urbanization, increase in absentee farming which needs to be addressed in holistic way manner. Further strengthening of the three research themes such as integrated farming systems, cropping systems and organic farming on which the institute and its partners are working is very much needed to address the issues in present and futuristic perspective.

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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## dk; Bkjh I kjk'k

### 1- I LFkku dk uke o irk %

भाकृअनुप-भारतीय कृषि प्रणाली अनुसंधान संस्थान,  
मोदीपुरम, मेरठ (उत्तर प्रदेश) 250110

### 2- ctV 2018&19½

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1	2	3	4	5	6	7	8
2164.90	2049.39	2064.48	100.42	2049.39	1993.85	55.54	2049.39

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ókr	ctV	0; ;
पेंशन और अन्य सेवानिवृत्ति लाभ	423.00	384.82
निजी ऋण और अग्रिम राशि	00	00
वाह्य वित्त पोषित परियोजनाएं	154.76	114.92
कुल	577.76	499.74

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ókr	/kujkf'k
प्रक्षेत्र उत्पाद	36.98
मत्स्य, दूध एवं पशु विक्रय	प्रक्षेत्र उत्पाद में शामिल
लाइसेन्स शुल्क/जल शुल्क	3.15
विविध	12.10
ऋण एवं अग्रिम राशि पर ब्याज	0.34
टी.डी.आर. पर ब्याज	21.01
अन्य (राजस्व और संस्थान शुल्क)	0.09
कुल	73.67



### 3- deþkþj; kadh fLFkfr ¼1-3-2018 rd½

Jskh	eatjh	fLFkfr	fjDr
<b>oKkfud</b>			
निदेशक	01	01	—
प्रधान वैज्ञानिक	07	03	04
वरिष्ठ वैज्ञानिक	12	10	02
वैज्ञानिक	19	16	03
<b>dy</b>	<b>39</b>	<b>30</b>	<b>09</b>
<b>Rkdudh deþkjh</b>			
श्रेणी-III (टी-6,7 / 8,7 / 9)	02	—	02
श्रेणी-II (टी-3, टी-4 एवं टी-5)	19	17	02
श्रेणी-I (टी-1 एवं टी-2)	03	03	—
<b>dy</b>	<b>24</b>	<b>20</b>	<b>04</b>
<b>izkkl fud deþkjh</b>			
वरिष्ठ प्रशासनिक अधिकारी	01	01	—
वित्त एवं लेखाधिकारी	01	0	01
सहायक प्रशासनिक अधिकारी	01	0	01
सहायक	04	04	—
वरिष्ठ लिपिक	02	02	—
निजी सचिव	01	01	—
व्यक्तिगत सहायक	02	03*+1	—
कनिष्ठ आशुलिपिक	01	02*+2	—
कनिष्ठ लिपिक	03	02	01
<b>dy</b>	<b>15</b>	<b>18</b>	<b>03</b>
सहायक कर्मचारी			
अस्थाई कर्मचारी	12	11	01
<b>dy</b>	<b>90</b>	<b>89</b>	<b>17</b>

\*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।

## lkedk vuq dku mi yfC/k; k;

- अन्य फसल प्रणालियों की अपेक्षा गन्ना-पेडी-गेहूँ फसल प्रणाली से सर्वाधिक सकल एवं शुद्ध आर्थिक लाभ क्रमशः रुपये 106795/वर्ष व रुपये 68295/वर्ष मिलते हैं। लेकिन अधिक लागत एवं मुनाफा अनुपात (2.94) अरहर-चना-भिण्डी फसल प्रणाली में दर्ज किया गया। 1.5 हेक्टेयर क्षेत्रफल पर तैयार मॉडल से कुल आमदनी रुपये 763744/- प्रति वर्ष हुई एवं शुद्ध लाभ रुपये 517308/- अर्जित किये गये। इसके अतिरिक्त 939 मानव दिवस भी पैदा किये जा सकते हैं।
- जब फसल क्रम में क्लार्इटोरिया-सरसों-मूंग आदि को उगाने के बाद इनकी उपज को गेहूँ की पैदावार के समतुल्य मापने 211.3 टन/हे./वर्ष हासिल होती है। इसके अलावा यह फसलचक्र अन्य फसल चक्रों की तुलना में अधिक उत्पादन एवं लाभ रुपये 216352/हे./वर्ष प्रदान करता है। जबकि धान-चना-भिण्डी फसलचक्र को अपनाने से सर्वाधिक लाभ प्राप्त किया जा सकता है।
- अमरूद की श्वेता किस्म अन्य किस्मों एवं फलदार वृक्षों की अपेक्षा अधिक लाभप्रद साबित हुई है।
- पारंपरिक विधि से फील्ड तैयार करने की अपेक्षा शून्य जुताई करने पर सबसे कम ऊर्जा का उपयोग होता है। धान की विभिन्न रोपित विधियों में कुल उपयोग की गई ऊर्जा की मात्रा 25724 से 27069 मेगा जूल/हे. दर्ज की गई। शून्य जुताई विधि से गेहूँ की बुवाई करने पर अधिक लाभ मिलता है तथा लागत एवं लाभ का अनुपात भी परंपरागत विधि से अधिक रहता है।
- गन्ने की दो किस्में क्रमशः कोपीके 05191 और कोसे 03234 की दोनों किस्मों को जैविक पद्धति के अन्तर्गत उगाने पर अन्य किस्मों की तुलना में पैदावार के तौर पर बेहतर पाया गया।
- सरसों की नवीन किस्में जैसे- 'आर बी 50' और 'एन आर सी एव बी 101' को जैविक पद्धति के अन्तर्गत उगाने पर बीज उत्पादन काफी अधिक रहता है।
- धान की उन्नत किस्में जैसे- 'पूसा सुगंधा 2' एवं 'पूसा सुगंधा 5' को जैविक प्रबंध प्रणाली के अन्तर्गत उगाने पर दाना उत्पादन पर काफी अनुकूल प्रभाव पाया गया है।
- पश्चिमी मैदानी क्षेत्र के लिए एक एकड़ के चार एकीकृत जैविक कृषि प्रणाली मॉड्यूल यह इंगित करते हैं कि दूसरे वर्ष में अच्छी किस्म और बेहतर प्रबंधन से बासमती चावल की उपज 17% बढ़ी। 0.05 हेक्टेयर में मक्का + लोबिया - ज्वार + लोबिया - बरसीम चारा प्रणाली से 2 डेयरी पशुओं को 258 दिनों तक हरा चारा दिया जा सकता है। ग्रह वाटिका प्रणाली के मूल्यांकन से यह पता चला है कि परिवार के 5 सदस्य की आवश्यकता अन्य सब्जियों द्वारा 261 दिनों के लिए, जड़ों और कंद फसलों से 331 दिनों के लिए और पत्तेदार सब्जियों से 184 दिनों की आवश्यकता की पूर्ति की जा सकती है।
- एक 0.72 हेक्टेयर वाले एकीकृत कृषि प्रणाली मॉडल जिसमें 53+ क्षेत्र फसल प्रणाली, 25% उद्यान-चारागाह, 17% कृषि- उद्यानिकी और 5% सीमा रोपण, पशुधन इकाई, और वर्मीकम्पोस्टिंग के द्वारा रुपये 1,37,733 की शुद्ध आय, 2.17 लाभ लागत अनुपात दर्ज किया गया। डेयरी मॉड्यूल ने फसल प्रणाली का (30%), उद्यान-चारागाह का (20.8%) और सीमा रोपण का (16.8%) के बाद शुद्ध आय का 32.4% योगदान दिया।
- 20 राज्यों के लिए जल और ऊर्जा कुशल फसल प्रणालियों की पहचान की गई है। एकीकृत कृषि प्रणाली के स्थान विशिष्ट के लिये सर्वश्रेष्ठ मॉड्यूल



की पहचान की गई जिसे 16 राज्यों के लिए प्रलेखित किया गया है। खेती प्रणालियों के निर्धारकों से संबंधित 39 प्रभावित करने वाली वस्तुएँ का उपयोग करते हुए टाइपोलॉजी विश्लेषण ने देश स्तर पर छह प्रमुख प्रकार की खेती प्रणालियों को निर्दिष्ट किया।

- जैविक किसानों के भू-संदर्भित निरूपण ने कई फसलों के लिए जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम में प्रयोगात्मक उपज के अंतर्गत प्राप्त पैदावार के बीच व्यापक अंतर के अस्तित्व का संकेत दिया। यह व्यापक अंतर मुख्य रूप से जैविक खादों की असंतुलित मात्रा और जैविक खेती के लिए केवल स्वदेशी प्रथाओं को अपनाने के कारण है।
- फार्म डिजाइन के माध्यम से उत्तर प्रदेश के मुजफ्फरनगर जिले के 3 प्रमुख कृषि प्रकारों की पहचान की गई, सीमांत गरीब, सीमांत यंत्रीकृत और मध्यम संपन्न किसान।
- शुष्क कृषि-पारिस्थितिकी और कम वर्षा की स्थितियों में, जैविक उत्पादन प्रणाली के अंतर्गत सोयाबीन ने अकार्बनिक की तुलना में 36.7% अधिक उपज के साथ बेहतर प्रदर्शन किया।
- परिणामों से पता चला है कि चावल पैदावार के लिए पात्र गुण संरक्षित प्रथाओं (सीधी धान की बुआई) की तुलना में पारंपरिक प्रथाओं (रोपित धान) की उपज अधिक थी।
- मक्का की फसल में पौधों की ऊँचाई और पौधों की संख्या प्रति मीटर संरक्षित प्रथाओं (सीए) की तुलना में पारंपरिक प्रथाओं (सीपी) विधि के तहत अधिक थी, हालांकि भुट्टे का वजन संरक्षित प्रथा के साथ अधिक था।
- संरक्षित प्रथाओं (शून्य कर्षण) की तुलना में पारंपरिक पद्धति में औसत आधार पर गेहूँ के अनाज और

पुआल की पैदावार लगभग 12.7 और 68.3% अधिक दर्ज की गई।

- गेहूँ की अधिकतम समतुल्य पैदावार (20.20 टन/ है.) गन्ना-पैडी-गेहूँ प्रणाली में दर्ज की गई थी, जिसके बाद मक्का (भुट्टा) दृमटर (फली) – गेहूँ – लोबिया (13.62 टन/ है.)।
- सभी फसल प्रणालियों ने संरक्षित प्रथाओं की तुलना में पारंपरिक प्रथाओं के तहत श्रेष्ठ पर्दर्शन किया। हालांकि लाभ लागत अनुपात गन्ना-पैडी-गेहूँ और धान-गेहूँ-ढैचा प्रणाली में अधिकतम रहा उसके बाद संरक्षित रहा जो मुख्य रूप से खेती की कम लागत के कारण है।
- विभिन्न फसल प्रणालियों में धान और गेहूँ के भूसे, मूंग, लोबिया और सूरजमुखी जैसे फसलों के अवशेषों के पुनर्चक्रण को अपनाने के साथ फॉस्फोरस, पोटेशियम और जैविक कार्बन थोड़ा बढ़ा है। शुष्क आधार पर औसतन 16.58 टन/हेक्टेयर दलहन फसल के अवशेषों को संरक्षित प्रथाओं के साथ पुनर्चक्रण किया जा रहा है, जिससे मिट्टी की जैविक कार्बन सामग्री 0.42 से 0.44 हो गई है।
- उच्च कार्बन भू-स्तर के अंतर्गत रोपित धान की तुलना में सीधी बुआई वाले धान में 13.9 प्रतिशत की कमी आई, जबकि मध्यम कार्बन मिट्टी के स्तर में यह 4.6 प्रतिशत कम हो गया।
- डीसीडीए नाइट्रिफिकेशन अवरोधक के प्रयोग ने उच्च कार्बन मिट्टी के स्तर में रोपित चावल की तुलना में सीधी बुआई वाले धान में जीडब्ल्यूपी को 15.2 प्रतिशत कम कर दिया, जबकि मध्यम कार्बन मिट्टी के स्तर में यह 10.8 प्रतिशत कम हो गया।
- उच्च कार्बन और मध्यम कार्बन मिट्टी के स्तर के पर रोपाई वाले चावल की तुलना में सीधी बुआई वाले चावल में मीथेन उत्सर्जन में क्रमशः 18.5 और 6.7 प्रतिशत की कमी हुई।

- भा.कृ.अनु.प.—भा.कृ.प्र.अनु.सं, मोदीपुरम में 10 वर्षों से लगातार जैविक खेती के तहत विभिन्न कृषि प्रणाली में मृदा कार्बन अनुक्रमिक क्षमता का मूल्यांकन किया गया। चार फसल प्रणाली (फप्र.1 बासमती चावल – दुरम गेहूँ –हरी खाद (ढेंचा) य फप्र.2—मोटा चावल – जौ (माल्ट) – मूंग – फप्र. 3—मक्का (पॉपकॉर्न) – आलू – भिंडी ढेंचा और फप्र. 4— मक्का (स्वीट कॉर्न) – सरसों – हरी खाद (ढेंचा) का मूल्यांकन जैविक, एकीकृत और रासायनिक उर्वरक पोषक तत्व प्रबंधन प्रथाओं के अंतर्गत किया गया। रासायनिक प्रबंधन में फप्र. 1 के तहत (40.9 मिलीग्राम/है.) की तुलना में कार्बनिक प्रबंधन में फप्र.4—74 एमजी/हेक्टेयर के उच्च कार्बन स्तर को देखा गया। मक्का (स्वीट कॉर्न) – सरसों— हरी खाद (ढेंचा) जैविक खेती के अंतर्गत फसल प्रणाली ने अन्य सभी फसल प्रणाली के साथ—साथ एकीकृत और रासायनिक उपचारों की तुलना में अधिक कार्बन का जब्तीकरण किया।
- यह पाया गया है कि मेरठ में 52% खेत कमजोर होंगे, जबकि 2050 में स्थायी ग्रीन रोड पाथवे (मध्यम उत्सर्जन) के तहत करनाल जिले में 35% खेत होंगे। क्रमशः 57% और 62% खेत ग्रीन पाथवे के तहत जलवायु परिवर्तन के जवाब में अनुकूलन पैकेज को अपनाने से मेरठ और करनाल को फायदा होगा।
- एपीएससीएम और डीएसएसएटी के माध्यम से 29 GCM का उपयोग करके मध्य सदी 2041—2070 के दौरान अनुमानित सिंचाई जल उत्पादकता को क्रमशः 4.87—12.15 किग्रा है.<sup>-1</sup> मिमी<sup>-1</sup> और 6.77—12.63 15 किग्रा है.<sup>-1</sup> मिमी<sup>-1</sup> आरसीपी 4.5 के तहत दिखाया गया है, जो आधार रेखा अवधि के दौरान औसत 7.81 और 8.53 किग्रा है.<sup>-1</sup> मिमी<sup>-1</sup> था। यह RCP 8.5 के तहत क्रमशः। PSIM और DSSAT के माध्यम से घटकर 4.22—10.64 और 6.37—12.56 kgha<sup>-1</sup>mm<sup>-1</sup> हो गया।
- पहले वर्ष के परिणाम ने रोपण की तीन तारीखों (डीओपी) अर्थात शरद ऋतु, वसंत और गर्मियों के बीच यह पाया गया कि शरद ऋतु में बोया हुआ गन्ना अन्य रोपण तारीखों की तुलना में सभी उपचारों में सबसे अधिक उपज देता है।
- जीवामृत और अपशिष्ट के उपचार स्त्रे (104.79 '000' / हेक्टेयर) के साथ विभिन्न उपचारों के बीच NMC शरद ऋतु रोपण में सबसे अधिक था।
- सर्वेक्षण में शामिल किए गए जिलों यानी जम्मू और शम्बा में मुख्य रूप से धान— गेहूँ और मक्का—गेहूँ की फसल के साथ—साथ चावल—गेहूँ/ दलहन—गेहूँ/ दाल—दलहन प्रणाली का पालन किया गया है। क्षेत्र की सामान्य विशेषता डेयरी है और लगभग सभी किसानों ने गाय या भैंस, बैल को पाल रखा है। कुछ किसान घरेलू आय बढ़ाने के लिए अतिरिक्त उद्यम के रूप में मुर्गी पालन और बकरी पालन को भी अपना रहे हैं।
- मृदा में फास्फोरस के व्यवहार का आकलन करने के लिए जैविक खेती नेटवर्क प्रोजेक्ट (NPOF) के तहत, तीन उत्पादन प्रणालियों अर्थात जैविक, अजैविक और एकीकृत से वर्ष 2018 के दौरान सतह परत (0—30 सेमी) से तीन मिश्रित मिट्टी के नमूने एकत्र किए गए थे जो 2004 से बासमती चावल—गेहूँ—ढेंचा फसल प्रणाली अपनाये हुए है। पानी में घुलनशील पी को क्रमशः 8.2, 11.36 और 10.24 मिलीग्राम किलोग्राम—1 दर्ज किया गया, जो चावल, गेहूँ के फसल प्रणाली में जैविक, एकीकृत और अकार्बनिक पोषक तत्वों से प्रबंधित थे। लंबे समय तक संतुलित निषेचन मिट्टी में पी के लिए संबंध ऊर्जा और सोखने की क्षमता को कम करता है और इस तरह इसकी कमेवतचजपवद क्षमता में वृद्धि होती है। यह प्रक्रिया पौधों के लिए पी उपलब्धता और उपज स्थिरता को बढ़ाती है। मिट्टी के जैविक गुणों पर विभिन्न पोषक तत्व प्रबंधन

प्रथाओं के प्रभाव का भी आकलन किया गया। ग्लोमालिन की उच्चतम मात्रा (मिट्टी में एक संकेतक arbuscular mycorrhizal गतिविधि) को 100% अरबसकुलर माहिकोरायजा व्यवस्थित रूप से प्रबंधित भूखंड से निकाला गया था। 100% कार्बनिक और 100% अकार्बनिक भूखंडों में कुल ग्लोमालिन सामग्री में एक महत्वपूर्ण अंतर देखा गया था।

- शून्य बजट खेती के मूल्यांकन के दौरान बीजामरी, जीवामृत और घनजीवमृत से युक्त बासमती चावल-गेहूं की फसल प्रणाली में एनपीओएफ पैकेज द्वारा प्रबंधित भूखंडों में बैक्टीरिया, कवक और एक्टिनोमाइसेट्स की संख्या उच्चतम पाई गई थी, लेकिन आपस के बीच अंतर महत्वपूर्ण नहीं थे।
- फसल प्रणाली/कृषि प्रणाली दृष्टिकोण के माध्यम से जलवायु परिवर्तन के अनुकूलन और शमन क्षमता के अध्ययन के दौरान, अलग-अलग परिस्थितियों में चावल-गेहूं प्रणाली से उत्सर्जन ग्रीनहाउस गैसों की मात्रा का आकलन करने के लिए सिंचित परिस्थितियों में विभिन्न जैविक स्तर (मध्यम और उच्च) अलग-अलग स्थापना विधियों (धान में रोपाईं किए गए चावल और सीधे बोए गए चावल, गेहूं में शून्य जुताई और पारंपरिक जुताई) और नाइट्रोजन के विभिन्न स्रोत (नियंत्रण, नीम लेपित यूरिया, वर्मी कम्पोस्ट और डीएमपीपी/डीसीडी नाइट्रिफिकेशन के अनुप्रयोग) अवरोध करनेवाला) मोदीपुरम में 2017-18 में एक क्षेत्र प्रयोग शुरू किया गया था।
- प्रारंभिक अध्ययन से संकेत मिलता है कि ग्लोबल वार्मिंग पोटेंशियल (GWP) हाई सीड मिट्टी स्ट्रेटा के तहत रोपित किए गए चावल की तुलना में सीधे बुआई में 13.9 प्रतिशत की कमी आई, जबकि मध्यम कार्बन मिट्टी के स्तर में यह 4.6 प्रतिशत कम

हो गया था। डीसीडीए नाइट्रिफिकेशन अवरोधक के प्रयोग से उच्च कार्बन मिट्टी का स्तर रोपित चावल की तुलना में सीधे बिजाई वाले चावल में जीडब्ल्यूपी को 15.2 प्रतिशत कम कर दिया, जबकि मध्यम कार्बन मिट्टी के स्तर के तहत 10.8 प्रतिशत कम हो गया। उच्च कार्बन और मध्यम कार्बन मिट्टी के स्तर के तहत रोपाईं वाले चावल की तुलना में मीथे उत्सर्जन में क्रमशः 18.5 और 6.7 प्रतिशत की कमी हुई।

- पांच पूर्व-प्रमुख कृषि प्रणालियों की पहचान की गई है। कृषि प्रणालि 1: बागवानी (सब्जी/मसाले) + पशुधन (डेयरी/मुर्गी/बकरी) + फसल, कृषि प्रणालि 2: पशुधन (डेयरी/मुर्गी/बकरी) + फसल बागवानी (सब्जी/मसाले/फल) + कृषि प्रणालि 3: फसल पशुधन (डेयरी/डेयरी) मुर्गी/बकरी), कृषि प्रणालि 4: बागवानी (सब्जियां/मसाले) + फसल और कृषि प्रणालि 5: बागवानी (फल/सब्जियां) + उत्तराखंड के पहाड़ी इलाके में डेयरी। कृषि प्रणालि 5 को उत्तराखंड के पहाड़ी इलाके में उच्चतम हिस्सेदारी (52.05 प्रतिशत क्षेत्र) के लिये लिंग संवेदनशील कृषि प्रणाली के रूप में चिह्नित किया जा सकता है। उच्चतम किसान वितरण (26.6 प्रतिशत), उच्चतम शुद्ध रिटर्न 73,128/- गैर-कृषि आय का कम से कम हिस्सा (17.74 प्रतिशत) प्रदर्शित करना अधिकतम महिला भार को कठिन श्रम सूचकांक (0.56 ± 0.15) और 65.55 प्रतिशत महिला योगदान को प्रदर्शित करता है।
- विविध आदिवासी एकीकृत कृषि प्रणाली फसल (धान-गेहूं / सरसों/मसूर/छोला), पशुधन (1C/1B + पोल्ट्री) + के लिए ग्रहवाटिका (0.405 हेक्टेयर) 1,04,312.76/- रुपये के वार्षिक शुद्ध लाभ के साथ किसान के खेत विकसित किया गया।

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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 दर्शन और प्रबंधन के लिए सर्वोच्च संस्था है। देश में फैली 111 आईसीएआर संस्थानों और 73 कृषि विश्वविद्यालयों के साथ यह दुनिया के सबसे बड़े राष्ट्रीय कृषि प्रणालियों में से एक है। संस्थानों और विश्वविद्यालयों में विकसित प्रौद्योगिकी या परिषद के 640 से अधिक कृषि विज्ञान केंद्रों (केवीके) 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 में 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 अंतरराष्ट्रीय स्तर पर उनके क्षेत्रों में स्वीकार किए जाते हैं। देश की बढ़ती आबादी के लिए पौष्टिक सुरक्षा, घटती खेती योग्य भूमि, पानी

की कमी के साथ-साथ ग्लोबल वार्मिंग आईसीएआर के सामने एक बड़ी चुनौती है, जिसका निराकरण एकीकृत कृषि प्रणाली को अपनाकर किया जा सकता है। इस कड़ी में भारतीय कृषि अनुसंधान परिषद (आईसीएआर) का संस्थान भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदिपुरम सतत कार्यरत है।

### Hkk—vuqi-&Hkkjrh; —f"k izkkyh vuq dkku I 1Fkku

कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) कोपूर्ण 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।

### Hkk—vuqi-&Hkkjrh; —f"k izkkyh vuq dkku I 1Fkku dh mn; ;k=k

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" कोसाथ जोडकर योजना को



वृद्धि हो और बढ़ती मांगों को पूरा किया जा सके। कृषि सांस्कृतिक प्रथाओं, सिंचाई, पोषण, रासायनिक घास नियंत्रण और बहु फसलों को शामिल करके अनुसंधान क्षेत्र का विस्तार किया गया। लेकिन मिट्टी की उर्वरता और उर्वरक उपयोग दक्षता पर जोर जारी रहा। 1968-69 में इस योजना को अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना (एआईसीआरएपी) के रूप में दो घटकों "आदर्श सस्य प्रयोग" और "सरल उर्वरक परीक्षण" के साथ स्वीकृत किया गया था।

कृषि अनुसंधान, हरित क्रांति के बाद भी पृथक् फसल पर पर केन्द्रित रहा लेकिन एक स्थायी विकास के लिए प्रणाली दृष्टिकोण होना चाहिए इस अहसास ने फसल प्रणाली उन्मुख अनुसंधान शुरू करने के लिए प्रोत्साहन दिया और 7वीं पंचवर्षीय योजना के दौरान यह परियोजना निदेशालय में बदल दी गई और इसे फसल प्रणाली अनुसंधान परियोजना निदेशालय के नाम के रूप में मार्च, 1989 में मुख्यालय के नाते मोदीपुरम, मेरठ, यूपी स्थापित किया गया। इसके अलावा, 11वीं पंचवर्षीय योजना के दौरान पीडीसीएसआर को 2009-10 के दौरान कृषि प्रणाली अनुसंधान परियोजना निदेशालय (पीडीएफएसआर) के रूप में पुनः नामित किया गया। 2014 के दौरान (12वीं पंचवर्षीय योजना) पीडीएफआरआर को पूर्ण विकसित संस्थान भारतीय कृषि प्रणाली अनुसंधान संस्थान के रूप में उन्नत और नामित किया गया और एकीकृत कृषि प्रणालियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी-आईएफएस) के साथ-साथ (मौजूदा 74 केंद्रों) और जैविक खेती पर नेटवर्क परियोजना भी (एनपीओएफ, मौजूदा 20 सह-संचालन केंद्रों) निम्नलिखित जनादेशों के साथ संस्थान का एक अभिन्न अंग बने रहे:

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

- विभिन्न कृषि स्थितियों के लिए कुशल, आर्थिक रूप से व्यवहार्य और पर्यावरण की दृष्टि से स्थायी एकीकृत खेती प्रणाली मॉडल विकसित करना।
- प्रणाली आधारित कृषि उत्पादन प्रौद्योगिकियों के ऑन-फार्म परीक्षण, सत्यापन और परिशोधन करना।
- एकीकृत कृषि प्रणालियों में मानव संसाधन विकास और क्षमता निर्माण करना।
- कृषि प्रणालियों के अनुसंधान और विकास के सभी पहलुओं पर 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 किस्मों का संयोजन
- इष्टतम फसल संयोजन और अंतर फसल प्रणाली के लिए रोपण ज्यामिति
- विभिन्न फसल प्रणालियों के तहत जुताई आवश्यकताओं और फसल स्थापना विधि
- विभिन्न कृषि-पारिस्थितिक क्षेत्रों कृषि स्थितियों के अंतर्गत कृषि संसाधनों 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
- खेतोंपर फसल प्रणाली प्रौद्योगिकियों का मूल्यांकन और शोधन
- फसल/कृषि प्रणाली से संबंधित डेटाबेस प्रबंधन
- कृषि प्रणाली अनुसंधान सेसम्बंधित मानव संसाधन विकास का विकास करना

**Hkk—vuqi-&Hkkjrh; -f"k izkkyh vuq akku l fFku }kjk fuEufyf[kr rhu ;kstukval pkfyrg%**

1. भा.कृ.अनु.प.-भा.कृ.प्र.अनु.सं.-कृषि प्रणाली अनुसंधान संस्थान (आईआईएफएसआर) 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 में उन्नत होकर पूर्ण विकसित संस्थान बना।

**2- ,dh-r -f"k ç.kkfy; ka ij vf[ky Hkkjrh; l eflor vuq akku ifj ;kstuk ¼ vkbZ hvkj ih &vkbZ Q, l ½**

**¼ ½ vkbZ Q, l vuq akku dæ%** एआईसीआरपी-आईएफएस का नेतृत्व एक परियोजना समन्वयक द्वारा किया जायेगा जो निदेशक आईआईएफएसआर के प्रशासनिक नियंत्रण के अंतर्गत होगा। ऑन-स्टेशन शोध 74 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 रहेंगे।

**¼ch½ [kr ij 'kksk %** यह योजना 32 केंद्रों 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 समाविष्ट करते हैं।

**3- tfod [krh ij ušodZ ifj ;kstuk ¼ ui hvks Q½**

यह परियोजना वर्तमान में 16 राज्यों में स्थित कृषि विश्वविद्यालयों/आईसीएआर संस्थानों में 20 सहयोग केंद्रों पर प्रगति में है। भाकृप्रअनुसं में एनपीओएफ को एक प्रधान वैज्ञानिक (राष्ट्रीय प्रधान अन्वेषक) द्वारा समन्वित किया जाता है जो निदेशक भाकृप्रअनुसं के प्रशासनिक नियंत्रण के अधीन होता है। एनपीओएफ के मौजूदा 20 सहयोगी केंद्रों इस नेटवर्क परियोजना में शोध किया गया 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 (2018-19)**

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
2164.90	2049.39	2064.48	100.42	2164.90	1993.85	55.54	2049.39
b) External sources (₹ in Lakhs)							
Source				Budget	Expenditure		
Pension and other retirement benefits				423.00	384.82		
Personal loan and advances				0.00	-		
Externally funded projects				154.76	114.92		
<b>Total</b>				<b>577.76</b>	<b>499.74</b>		
c) Revenue generated (₹ in Lakhs) during 2016-17							
Source				Amount			
Farm Produce				36.98			
Sale of fish, milk and livestock				Included in Farm Produce			
License fee/ water charges				3.15			
Miscellaneous				12.10			
Interest on loan and advances				0.34			
Interest on TDR				21.01			
Others (Royalty and Inst. Charges)				0.09			
<b>Total</b>				<b>73.67</b>			

**3. Staff position (as on 31.03.2018)**

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

Category	Sanction	Position	Vacant
<b>Technical Staff</b>			
Category-III (T-6, 7/8)	02	-	02
Category-II (T-3, T-4 & T-5)	19	17	02
Category-I (T-1 & T-2)	03	03	-
Total	24	20	04
<b>Administrative Staff</b>			
Sr. Administrative Officer	01	01	-
F & A O	01	0	01
AAO	01	-	01
Assistant	04	04	-
UDC	02	02	-
PS	01	01	-
PA	02	03*+01	-
Jr. Steno Gr.III	01	02*+02	-
LDC	03	02	01
Total	16	17	01
<b>Supporting Staff</b>			
Temporary Status Casual Labourers	12	11	01
<b>Total</b>	<b>26</b>	<b>27</b>	<b>05</b>

### Silent Research Achievements

- The higher gross and net returns were fetched from sugarcane-ratoon-wheat cropping system (Rs.106795/yr and 68295/yr). The highest benefit: cost ratio was accorded from pigeonpea-chickpea-okra cropping system (2.94). Thus, from 1.5ha IFS model, the total gross and net returns were of (Rs.763744/yr) and (Rs. 517308/yr.) and concurrently 939 man days/yr were also generated.
- Among the guava cultivars, 'Shweta' yielded higher fruits than other fruit crops and their cultivars.
- The vegetable based intercrop module was realized higher profit than other crops modules in the horticulture system.
- The lowest input energy was used in zero tillage (ZT) than conventional tillage of field preparation. The total energy used in different rice establishment methods ranges varies from 25724 to 27069 MJ/ha.
- Sugarcane varieties 'CoPK05191' and 'CoSe 03234' were found more suitable for higher number of milling able cane (NMC) and green top. Both the varieties also performed well under organic production system than remaining varieties.
- Four modules of one acre integrated organic farming system for Western plain zone indicates that in the second year the yield of basmati rice improved by 17 % through better variety and management. Seven IOFS models are under development in six states.
- A 0.72 ha IFS model covering 53% area under cropping system, 25% under horti-pasture 17% under agri-horti and 5 % under boundary plantation, livestock unit, and vermicomposting recorded net return of Rs. 1, 37,733/- with 2.17

of B:C ratio. Dairy module contributed 32.4% of net income followed by cropping system (30 %), horti-pasture (20.8%) and boundary plantation (16.8%).

- Water and energy efficient cropping systems have been identified for 20 states. Location specific best modules of IFS has been identified and documented for 16 states. Typology analysis performed using 39 variables related to determinants of farming systems indicated six prominent types of farming systems at the country level.
- Geo-referenced characterization of organic farmers indicated existence of wider yield gap between yields obtained by organic farmers under AI-NPOF experimental yield for many crops. The wider yield gap is mainly due to under dose application of organic manures and adopting only indigenous practices for organic farming.
- Through FarmDESIGN, 3 major farm types were identified viz. Marginal poor, Marginal mechanized and medium well-endowed farmers for Muzaffarnagar district of Uttar Pradesh.
- In arid agro-ecosystems and deficit rainfall situations, soybean grown under organic production system performed better over inorganic and integrated crop management production system with 36.7% higher yield in comparison to inorganic.
- On average basis and across the cropping systems in wheat conventional practice recorded about 12.7 and 68.3 % higher grain and straw yields as compared to conservational practice (zero till wheat).
- There is little built up of phosphorus, potassium and organic carbon with the adoption of recycling of crops residues like rice and wheat straw; green gram, cowpea and sunhemp residue in various cropping systems. On an average 16.58 t/ha legume crop residue on dry basis is being recycled under conservational practices, which enhanced the organic carbon content of soil from 0.42 to 0.44.
- CH<sub>4</sub> emission reduced in direct seeded rice compared to transplanted rice by 18.5 and 6.7 per cent under high carbon and medium carbon soil strata, respectively.
- Four cropping systems were evaluated under organic, integrated and chemical fertilizer nutrient management practices. Higher carbon buildup of 74 Mg/ha noticed under CS4 in organic management compared to 40.9 Mg/ha under CS1 in chemical management. Maize (sweet corn)-mustard-GM(Sesbania) cropping system under organic cultivation sequestered more carbon compared to all other cropping system as well as integrated and chemical treatments.
- Projected irrigation water productivity during mid-century period 2041-2070 using 29 GCMs showed a range of 4.87-12.15 kgha<sup>-1</sup>mm<sup>-1</sup> and 6.77-12.63 kgha<sup>-1</sup>mm<sup>-1</sup> through APSIM and DSSAT, respectively under RCP4.5, which stands an average of 7.81 and 8.53 kgha<sup>-1</sup>mm<sup>-1</sup> during the baseline period. It reduced to 4.22-10.64 and 6.37-12.56 kgha<sup>-1</sup>mm<sup>-1</sup> through APSIM and DSSAT, respectively under RCP8.5.
- The first year result revealed that between three date of planting (DOP) viz., autumn, spring and summer; autumn planting gives highest cane yield in all the treatments as compare to other DOP.
- Between various treatments NMC was highest in autumn planting with the treatments spray of jeevamrit and waste (104.79 '000'/ha).
- The districts i.e. jammu and shamba covered in survey follow mainly Rice-Wheat and Maize-Wheat cropping systems along with patches of Rice-Wheat/Pulses-Wheat/pulses-pulses system.
- Under Network Project on Organic Farming (NPOF) experiments, to assess the behaviors of phosphorus in soil, three composite soil samples were collected from surface layer (0-30 cm) during the year 2018 from three production systems. Water soluble P were recorded 8.2, 11.36 and 10.24 mg



kg<sup>-1</sup>, respectively in organic, integrated and inorganic nutrient managed plots in rice-wheat cropping system. Effect of different nutrient management practices was also assessed on soil biological properties. The highest amount of glomalin was extracted from the 100% organically managed plot. A significant difference was observed in the total glomalin content in 100% organic and 100% inorganic plots.

- During the evaluation of zero budget farming involving Beejamri, Jeevamrit and Ghanjeevamrit in basmati rice –wheat cropping system, highest population of bacteria, fungi and actinomycetes was found in the plots managed by NPOF package, but the differences among the treatment were not significant.
- During the study of the adaptation and mitigation potential of climate change through Cropping

System/Farming System approach preliminary study indicated that global warming potential (GWP) reduced in direct seeded rice by 13.9 per cent compared to transplanted rice under high carbon soil strata, while it was reduced by 4.6 per cent under medium carbon soil strata. CH<sub>4</sub> emission reduced in direct seeded rice compared to transplanted rice by 18.5 and 6.7 per cent under high carbon and medium carbon soil strata, respectively.

- Five pre-dominant farming systems have been identified in hillzone of Uttarakhand.
- Diversified Tribal Integrated farming system Crop (paddy-wheat/ mustard/ lentil /chickpea) + Livestock (1C/1B + poultry) + Kitchen Garden for (0.405 ha) with annual Net Returns of Rs 1,04,312.76/- has been developed at farmers field.

## INTRODUCTION

### Indian Council of Agricultural Research-at a glance

Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established on 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 co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 111 ICAR institutes and 73 agricultural universities spread across the country this is one of the largest national agricultural systems in the world. The developed technologies at institutes and universities are being transferred, validated and refined through more than 640 Krishi Vigyan Kendras (KVKs) of the council.

The ICAR has played a pioneering role in ushering Green Revolution and modernization of agriculture in India through its research, education and extension activities. Developments in agriculture in India through 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

- 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. 27<sup>th</sup> 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 n“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 7<sup>th</sup> 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 11<sup>th</sup> five year plan PDCSR has been re-designated as ‘**Project Directorate for Farming Systems Research (PDFSR)**’ during 2009-2010. During 2014 (12<sup>th</sup> 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 (in 74 centres) and NPOF (in 20 co-operating centres,) as an integral part of institute (with the following mandates:

- To undertake basic and strategic research in integrated farming systems on production technologies for improving productivity and resource use efficiencies.
- To develop efficient, economically viable and environmentally sustainable integrated farming systems models for different farming situations.
- To undertake on-farm testing, verification and refinement of system-based farm production technologies.
- To undertake human resource development and capacity building in integrated farming systems.

- To act as a repository of information on all aspects of farming systems research and development.
- To coordinate and monitor integrated farming systems research in the country

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

#### Some of the major areas of research are:

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

- On-farm evaluation and refinement of cropping systems technologies.
- Cropping/ farming systems related database management
- Human Resource Development related to Farming Systems Research

#### 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.

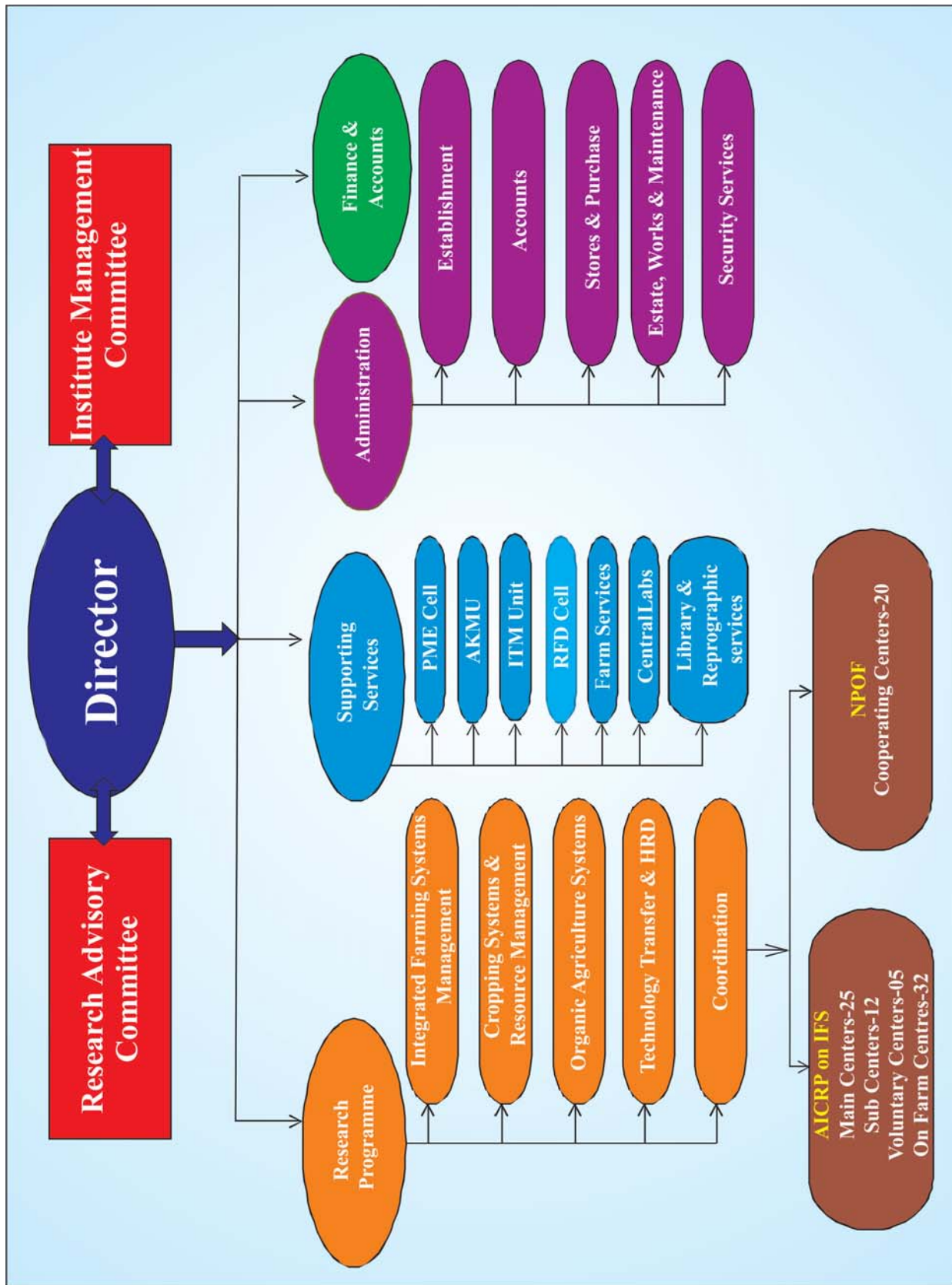
##### AICRP on Integrated Farming Systems (IFS)

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

##### Network Project on Organic Farming (NPOF)

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

# ICAR-IIFSR ORGANOGRAM



## SOIL AND CLIMATE

During the reporting year the onset of southwest monsoon was recorded on 27<sup>th</sup> June, which was timely onset. Total annual precipitation of 976.7 mm was received with uneven distribution. This was 30.8 % higher than the normal precipitation of 747.0 mm. Out of the total annual precipitation, Southwest monsoon contributed 95.5 %. The mean maximum temperature varied from 20.0°C in January to 38.5°C in May and June while the mean minimum temperature varied between 5.7°C in December to 25.8°C in July. The average relative humidity and sunshine hours were 72.7% and 6.7 hours/day, respectively. There were 44 rainy days with rainfall more than 2.5 mm. The

highest daily maximum temperature recorded was 43.5°C on 26<sup>th</sup> May and the lowest minimum temperature was 2.0°C on 30<sup>th</sup> December. The summary of the monthly meteorological data are presented in Table 1.

The weekly pan evaporation reached 69.5 mm during the 19<sup>th</sup> standard meteorological week (SMW) and came down from 26<sup>th</sup> SMW onwards (Fig. 1 & 2). Highest maximum temperature of 40.3°C was recorded during the 16<sup>th</sup> SMW and lowest minimum temperature of 4.3°C was recorded during the 2<sup>nd</sup> SMW.

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

Month	Temperature (°C)		Avg. RH (%)	Sunshine hours (hrs/day)	Rainfall (mm)	Rainy days (nos.)	Pan evaporation (mm)
	Max.	Min.					
January	20.0	6.6	75.1	5.7	2.9	1	53.10
February	24.2	10.6	68.6	7.6	3.3	1	65.00
March	30.1	15.2	66.4	8.7	0.0	0	135.80
April	35.7	19.1	64.6	8.0	14.0	3	261.00
May	38.5	22.1	62.1	8.1	18.3	2	298.60
June	38.5	25.0	69.8	6.4	48.1	4	248.60
July	33.7	25.8	85.2	4.4	494.5	15	148.00
August	33.0	25.5	86.7	5.1	209.9	8	125.00
September	31.7	23.5	83.9	7.0	180.4	9	115.20
October	31.5	17.2	71.7	8.1	4.0	1	97.20
November	26.9	12.1	70.0	6.0	1.3	0	71.80
December	21.9	5.7	68.2	6.0	0.0	0	62.10
Annual	30.5	17.4	72.7	6.7	976.7	44	1681.4

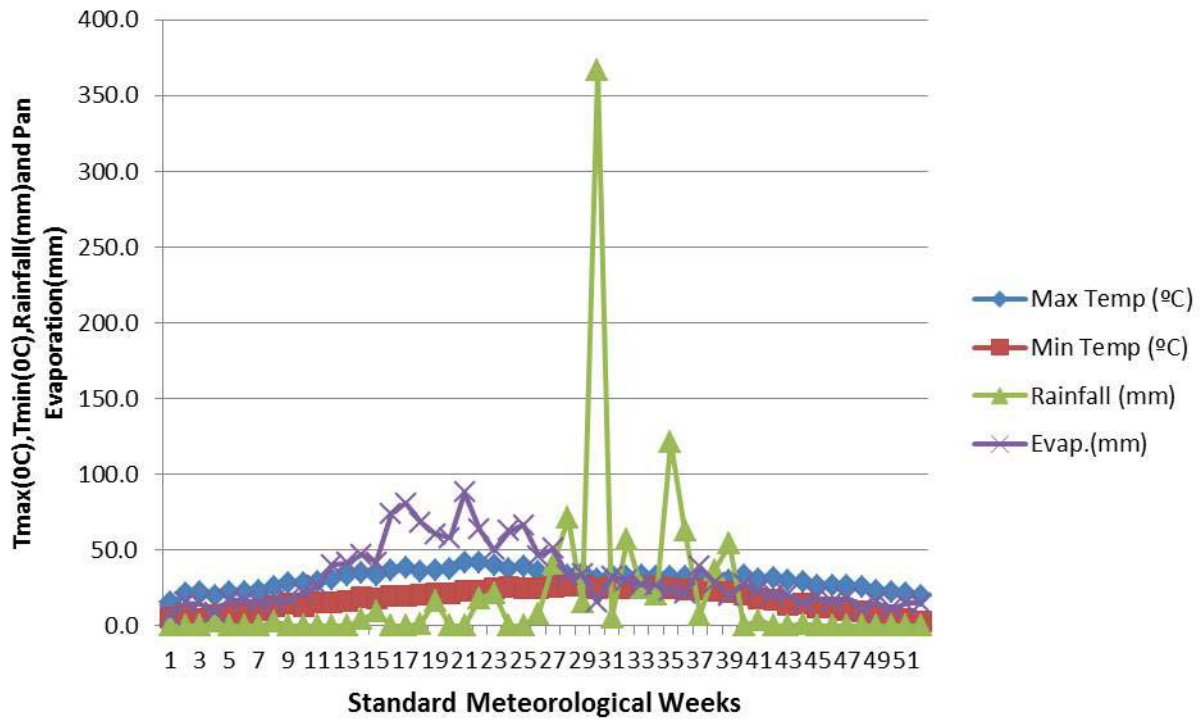


Fig. 1. Weekly Pan Evaporation, Rainfall, Maximum and Minimum temperature recorded during the year 2018

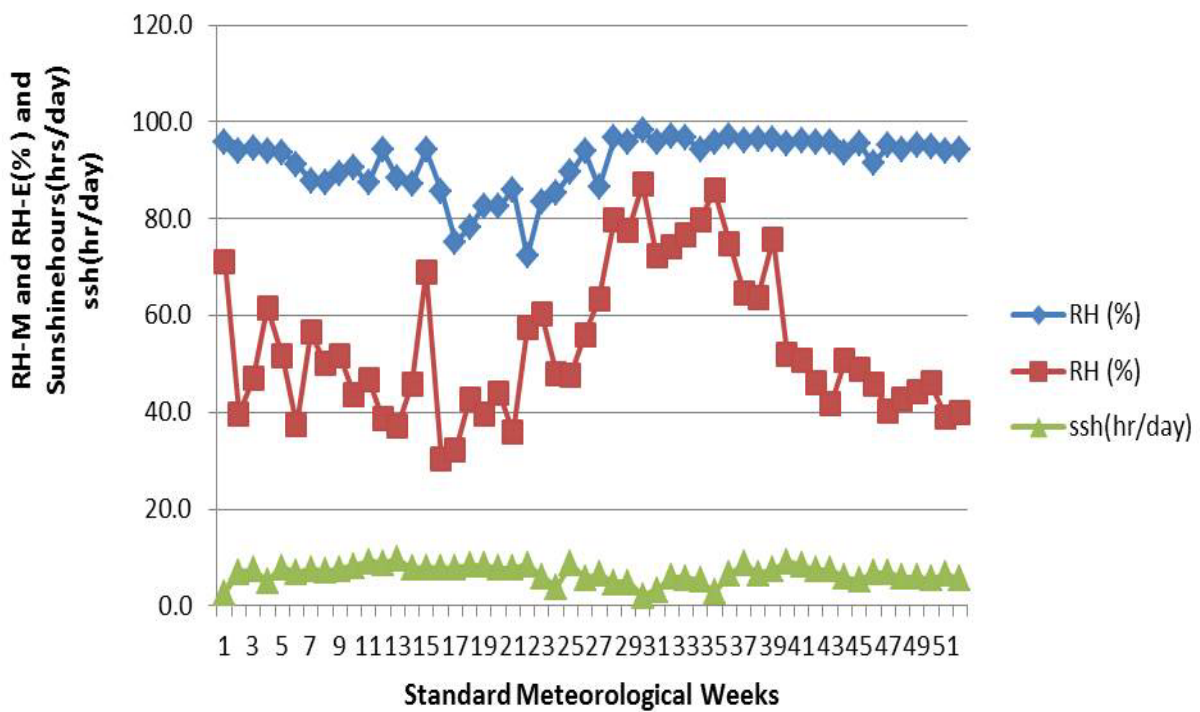


Fig. 2. Weekly RH (morning), RH (evening) and sunshine hours recorded during the year 2018

## RESEARCH ACCOMPLISHMENTS

### Integrated Farming Systems management (IFSM)

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

#### *Crop component*

As per the need of 5 members of Indian family, for which various crops like cereals, pulses, oilseed, vegetables, sugarcane and green fodder were occupied in the various cropping sequences under assured irrigation supply in western plain zone of Uttar Pradesh, on the other hand predominant crops were selected in order to uphold productivity, sustainability and profitability. The productivity of the system as a whole goes up to 100.88 ton/annum when yield of each crop was multiplied with its market price and that was compared with sugarcane market price for bring equivalent yield (ton/annum) (Table1). Whereas, the highest gross and net returns were fetched from sugarcane+cowpea (2:1)-ratoon-wheat cropping system (Rs.106795 and 68295/annum from the 3600m<sup>2</sup>area). While, the benefit: cost ratio was higher in pigeonpea+maize (2:1)-chickpea-okra cropping system (2.94) resulted due to low cost of production.

55.6% of NPK requirement of the crops and fruit plants (Table 2) can be full filled within the system. When, looking towards nutrients supply of various farm based byproducts (crop residues), vermicompost and green manure crop (Dhaincha), out of these dhaincha grown as green manure crop in between rice and wheat crops which had more nutrients (3.5:0.60:1.20% NPK on dry weight basis, respectively) thereafter in vermicompost (2.1:1.5:1.4% NPK). The total N, P and K requirements of crops and fruit plants was 540, 270 and 360kg (Table 2). Nutrient balance indicated that animal and crop based wastes in the IFS model can put aside 49.3% of N, 46.7% of P and 66.3% of K (55.6 % of NPK) otherwise these nutrients will go waste in the environment.

#### *Dairy component*

Dairy component play a vital role in meeting the demand of expenditures, create a sizable amount of organic plant nutrients and fuel in the form of dung cakes .In this model two Murrah buffaloes and one Gir cow along with their calves being kept. Milk production of these animals was stood round 4098 lit./year. Gross and net profits were of Rs 261231 and 139667/annum after

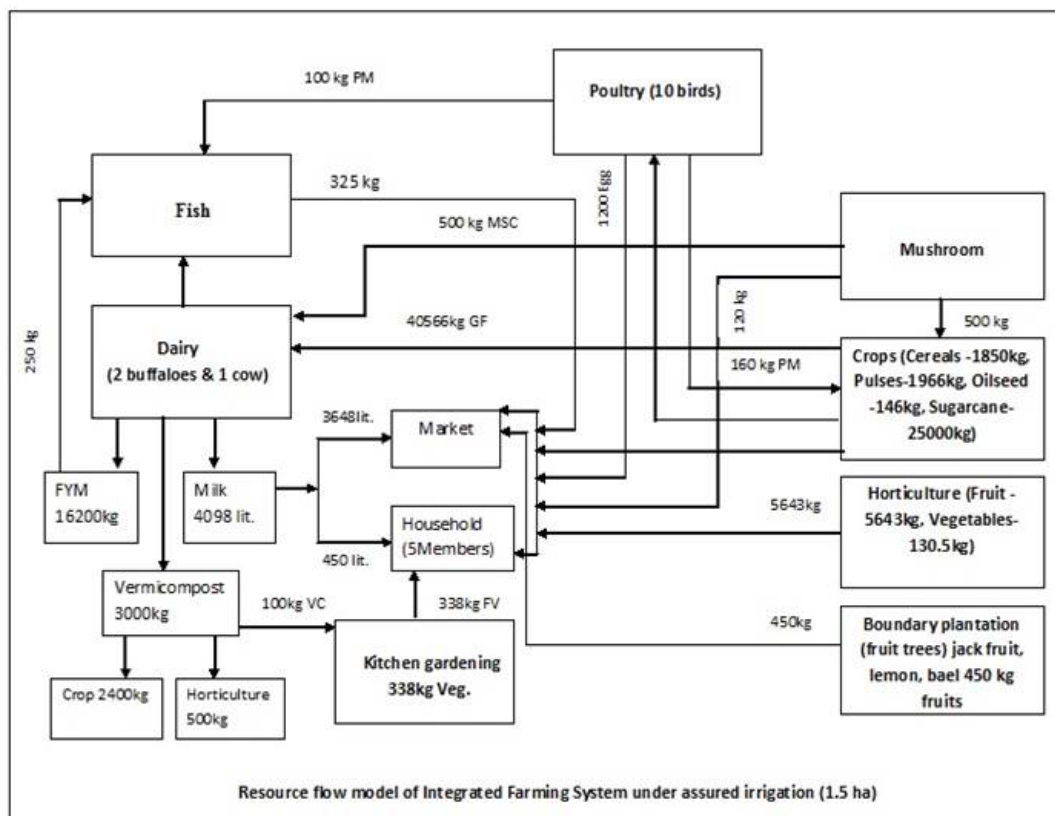


**Fig. 3. : Cropping plan for full filling the needs of house hold and livestock**

**Table 1. Productivity and economics of various cropping sequences in IFS Model**

Cropping sequences	Land allocation under differed cropping sequences (m <sup>2</sup> )	SEY* (ton/annum)	Cost of cultivation (Rs./annum)	Net return (Rs./annum)	Gross return (Rs./annum)	B:C ratio
Sugarcane+ Cowpea (3:1)						
- Ratoon- Wheat	3600	32.68	38500	68295	106795	2.77
Rice-Wheat- Dhaincha (GM)	1800	7.71	8650	16426	25076	2.89
Pigeonpea + Maize (1:2)						
- Gram –Okra	1800	24.87	27500	53328	80828	2.94
Maize- Berseem-Urd bean	1800	16.48	19400	34160	53560	2.76
Sorghum (F) - Mustard -Moong bean	1100	13.20	17600	25300	42900	2.43
Napier+ Cowpea /Napier+ Berseem-Subabool	400	5.94	7550	11755	19305	2.58
Total	-	-	119200	209264	328464	-
SEm±		3.43				
CD(P=0.05)		1.07				

\*SEY: Sugarcane equivalent yield (ton/annum)



**Fig.4. : IFS Model**

**Table 2: Improving 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 produced in IFS Model (kg)
Sugarcane dry leaves (0.4:0.19:1.29)	3360	13.44	6.34	43.34	63.16
Mustard straw (0.42:0.08:0.88)	250	1.05	0.20	2.20	3.45
Chickpea straw (1.19:0.06:1.25)	2400	28.56	1.44	30.00	60.00
Moong bean straw (1.12:0.27:1.00)	320	3.58	0.86	3.20	7.64
Urd bean straw (0.85:0.18:0.53)	217	1.84	0.39	1.15	3.38
Pigeon pea leaves (1.28:0.37:1.62)	781	10.01	2.88	12.65	25.53
Dhaincha (3.50:0.60:1.20)	1172	41.02	7.03	14.06	62.11
Paddy straw (0.36:0.08:0.71)	320	1.15	0.26	2.27	3.68
Tree leaves( 1.20: 0.58: 0.42)	150	1.8	0.9	0.6	3.3
FYM (0.6:0.4:0.5)	4320	25.92	17.28	21.60	64.80
Vermicompost (2.1:1.5:1.4)	5400	113.40	81.00	75.60	270.00
Poultry manure (1.1:0.8:0.5)	260	2.86	2.08	1.30	6.24
Fish pond(1000m <sup>2</sup> ), nutrient supply through water and silt		4.4 9.09	1.9 0.55	5.5 22.30	11.8 31.94
Mushroom compost(spent) ( 0.8:0.3:0.3)	1000	8.0	3.0	3.0	14.0
Total	19950	266.12	126.11	238.77	651.00
Nutrient requirement for crops and fruit plants in IFS Model (kg/annum) and nutrients requirement within the system		540 (49.3%)	270 (46.7%)	360 (66.3%)	1170 (55.6%)

selling of milk, farm yard manure and vermicompost. As well, from the dairy component of IFS model 3.0 ton vermicompost and 16.0 ton FYM/ annum were obtained. From the project one culled buffalo and one calve were sold of Rs. 45300/-.

### Horticulture component

The fruit plant species in horticulture component is comprised of mango (5), guava (35), peach (2), pear (10) and 40 karonda plants as boundary plantation across the garden boundaries. In the IFS model fruit plants at now attain the age of 15 years and they produced just about 5643 kg fresh fruits and 130.5 kg green vegetables as intercropping with fruit plants. The gross and net returns from the horticulture component

were attained of Rs. 125600 and Rs. 67100/ annum through sale on prevailing market prices.

### Fish component

A mix of fish species including rohu, katla, marigal, common carp, silver carps and grass carp were stocked @ 10000 fingerlings/ha in a ratio of 20:20:20:10:20:10 for composite carp culture in IFS pond (0.1 ha) during 2018-19. The pond was fertilized by the excreta out from animal shed (dairy wash) besides periodic fertilization with NPK mixture to maintain the natural fertility of fish pond for optimum plankton production. Fishes were fed with floating pelleted diets having 26% protein content @ 5% of their body weight. During the culture cycle of 11 months 325 kg of fish were harvested

Table 3: Round the year vegetable production for seven family household and space required)

Kharif			Rabi			Summer		
Crop name	Row length (sqm)	Number of plants	Crop name	Row length (sqm)	Number of plants	Crop name	Row length (sqm)	Number of plants
Pumpkin	1.2	20	Peas	1.59	159	Tomato	5.04	68
Cucumber	1.41	24	Broccoli	1.68	38	Onion	1.68	168
Okra	0.21	6	Cauliflower	1.89	42	Radish	1.35	105
Spanish	1.59	53	Carrot	2.1	84	Okra	0.21	6



Fig.5. : Harvesting of fish from Pond



Fig.6. : Button Mushroom and



Oyster Mushroom

from the 0.1 ha of pond. A gross return of Rs. 29250 was realized from sale of 325 kg of fish harvested. The net profit from the module was recorded at Rs.15750.

During the culture period physico-chemical parameter of the fish pond was measured through using

of multi-parameter water quality meter (Hach HQ 40d) and were in the range of water temperature ranging from 19.5- 31.5°C; pH 7.5- 7.8; free carbon dioxide 1.5- 1.8 ppm; total alkalinity 235-380 ppm and TDS (mg/l) 250-450. To prevent eutrophication by excess release of nutrients from dairy unit, diversion of excess urine

and wash were carried out for its application in crop and orchard module through irrigation channels. The gross and net primary productivity were found in the range of 720.1-925.8 mg C/m<sup>3</sup>/hr and 475.1-635.4 mg C/m<sup>3</sup>/hr following light and dark bottle method. The module could recycle the byproducts from dairy unit for its conversion to useful biomass.

### Mushroom production

By utilizing 50% capacity of the crop room, 120 kg yield of mushrooms (80 kg button and 40 kg oyster mushroom) was harvested with additional yield of 500 kg of high quality spent mushroom compost (from button mushroom and 500 kg of animal feed (from spent straws of oyster and milky mushroom). Thus, from this module of Rs. 6800 can be earned as net profit.

**Table 4: Productivity, economic profit and man-days spawned from the different enterprises of integrated farming system**

Component of IFS Model	Land allocation (ha)	Farm produces (per annum)	Total farm produces in kg/ litre/ton/ nos. (SEY (ton/annum))	Variable cost (Rs./ annum)	Gross return (Rs./ annum)	Net return (Rs./ annum)	No. of man days generate/ annum
Crop	1.04	Cereals -1850kg Pulses-1966kg Oilseed -146kg Sugarcane-25000kg Green fodder – 40566kg Dry fodder- 7094kg	100.88	138700	328464	189764	285
Dairy (2 buffaloes and 1 cow), vermicompost unit	0.01 0.01	Milk- 4098 litre FYM-16200kg Vermicompost -3000kg	72.64	121654	261231	139667	160 55
Horticulture	0.26						
Fruit Vegetables		Fruit -5643kg Vegetables-130.5kg	52.80	58500	125600	67100	165
Fishery	0.1	Fish -325kg	9.5	13500	29250	15750	105
Poultry (10 birds)	0.002	Egg-1200 nos. Poultry manure-260kg	2.98	3850	9700	5850	20
Mushroom (Button mushroom and milky mushroom)	0.04	Button mushroom-80kg Milky mushroom -40 kg	3.47	4500	11300	6800	30
Kitchen gardening	0.02	Seasonal vegetable-338.2kg	2.08	3500	7665	3265	18
Boundary plantation	0.02	Fruit Bael(10)-150kg Jackfruit(11)-200 Lemon(37)-80kg Aonla(8)-30kg	3.09	4800	10050	5250	10
Total	1.5ha		247.44	349004	783260	433446	848
Per hectare basis		SEm± CD(P.05)	0.78 2.39	232669	522173	288964	565



## Kitchen garden

It has been observed that during kharif season pumpkin, cucumbers, okra and Spanish can be grown efficiently. Whereas, in rabi and summer seasons vegetables like peas, broccoli, cauliflower, carrot, tomato, onion, radish can be grown for supplying of varying type of vegetables. Further, the row spacing and number of plants of each vegetable crop is shown in the Table for better known. The results of study showed that 0.002 ha of land is sufficient for regular supply of vegetables for 7 members of a family. The yield of vegetables in kitchen garden was 338.2 kg/annum. The economic values in terms of gross and net returns from kitchen garden stood at Rs.7665 and Rs.3265/annum, respectively

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

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 modules.

Plants of 3 varieties of guava (*Psidium guajava*) viz., Allahabad Safeda, Sardar (L-49) and Sweta, 3 varieties of ber (*Ziziphus mauritiana*) viz. Gola, Seb and Umran, 3 varieties of Pomegranate (*Punica granatum*) viz., Bhagwa, Arakta and G-137, were planted. Observations on vegetative growth, flowering, fruiting, yield and quality parameters of fruit crops were recorded and yield of intercrops was also recorded.

Observations on vegetative growth parameters viz. tree height and canopy spread was recorded at regular interval. Among the fruit crops and cultivars, vegetative growth of Ber cv. Gola was recorded significantly higher than other fruit crops and

cultivars. Plant height and canopy spread of ber plant were 3.50 m and 3.50 m. While, the fruit yield was recorded higher in guava crop. Among the guava cultivars, cv. Shweta yielded higher fruit than other crop and cultivars. This variety yielded 47 kg fruit /plant followed by Lucknow Safeda (Sarsar) and Allahabad Safeda (40kg /pl).

Ideal pruning practices were adopted in ber crop during May month of 2018, resulting healthy vegetative growth. Fertilizer management caused excessive growth in fruit crops. All the three cultivars of Pomegranate (Arakta, Bhagwa and G-137) came in bearing. Fruit yield was estimated by counting the number of fruits. Average fruit yield was 16.0 kg, 15.0 kg and 12.50 kg in cultivars Arakta, Bhagwa and G-137 respectively. In control plot of 500 m<sup>2</sup>, where sugarcane (CoSe-01434) was planted and it yield was 25 quintal. Microclimate in plant canopies was modified due to shading, during summers, there was 4.42% reduction of temperature under canopy while during winters, there was 6.22% increase in canopy temperature.

**Intercrops yield:** fruit crops and their cultivars under different modules (vegetable based, cereal based and fodder based) were evaluated. Due to excessive vegetative growth in ber crop, intercropping with ber cultivars was not possible, while in other crops, intercropping modules were evaluated. Care was taken to include legume crops in all components. Year round intercropping modules were vegetable component (Okra-Cowpea-Potato), cereal component (Moong-Rice-Wheat) and fodder component (cowpea-sorghum-berseem). Among the fruit crops least canopy spread was reported in citrus species which resulted in significantly high okra and potato yield in citrus species (Table 6). There was significant difference in yield (REY) of intercropping modules (cereal based, vegetable based and fodder based). Vegetable based intercropping module was found more profitable than other crop modules. Interaction effects between cropping systems, fruit crops and their cultivars is presented in Table 6.

**Table 5: Growth and fruit yield of fruit crops at age of four years**

Fruit crop	Cultivar	Height (m)	Canopy spread (m)	Fruit yield (kg/pl) +
Ber	Gola	3.00	3.50	7.0
	Seb	2.80	3.50	6.0
	Umran	2.80	3.50	6.0
Guava	Shweta	3.0	2.95	47.0
	Allahabad Safeda	2.90	2.85	40.0
	Lucknow -49	2.75	3.00	40.0
Pomegranate	Arakta	2.35	1.65	16.0
	Bhagwa	2.00	1.60	15.0
	G-137	2.10	1.65	12.5
Citrus	Kinnow	2.75	2.00	-
	Mosambi	2.80	2.15	-
	Mandarin	2.75	2.15	-
SEm±		0.28	0.16	1.61
CD(P=0.05)		1.02	0.32	4.74

+ Fruit yield estimated by counting the fruits at calculation by average fruit weight

**Table 6: Yield of intercrops (REY) grown under different cultivars of fruit crops**

Cropping systems	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	5.59	7.75	13.13	8.13	12.92	15.40	10.68	11.92	9.16
Vegetable based	16.72	17.86	19.95	22.60	25.02	24.32	31.40	31.92	23.03
Fodder based	11.72	11.66	12.51	11.58	11.58	11.85	13.16	10.92	11.79
SEm±	0.1955								
CD(P=0.05)	0.424								

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

### Study on suitability of non-traditional high value fruit crops under small farm conditions of Western Uttar Pradesh:

Mango is the major fruit crop in farming system of western Uttar Pradesh but existing old mango cultivars

are suffering from several glitches which caused adverse effect on farmers income. In order to this develop a suitable fruit crop based farming system through introduction of some nontraditional and high value fruit crops to explore the possibility of including these crops in Integrated Farming System. The crops were, low chilling apple (*Malus domestica*) Cv. Anna, Dorsett Golden and Michel, Dragon fruit (*Hylocereus undatus*), Seedless Jamun (*Syzygium cumini*), Assam Lemon and, Khasi mandarin. These fruit crops were grown under recommended package and practices.

**Low Chilling Apple cv Anna:** The main objective of this fruit crop was to find out its suitability for farming system in western Uttar Pradesh. Apple plants are generally reported as deciduous but under western Uttar Pradesh conditions, they shed only 60 % leaves during winter season and remaining (40%) retained.

#### Vegetative Growth Pattern of low chilling cultivars

- Under western UP conditions, plants of Low chilling cultivar Anna behaves like other sub-tropical fruit crops., during report period there was natural defoliation of old leaves (about 50%). Structural pruning for maintenance of plant height and removal of unhealthy growth was done during January 2018 and January 2019. To estimate annual vegetative growth under western UP conditions, observations on vegetative growth parameters were recorded after pruning (January 2018) and before pruning in January 2019. Data is presented in Table 7. Among three cultivars, vegetative growth of Michel was recorded as fastest with 18.51 % annual increase in tree height and 33.33 % increase in canopy spread.

**Flowering, pollination and fruiting** :Four years old plants of low chilling apple cv Anna and two years old plants of Dorsett Golden came to flowering during February 2018. Flowering period of above both cultivars coincided during second week of February 2018. Flowering in these cultivars continued up to first week of April 2018. Another low chilling apple cv Michel does not showed symptoms of flowering during the flowering period. Objective of introducing Dorsett Golden and Michel was to make provision of pollenizer cultivar for Anna. The morphology and flowering time of Dorsett Golden was very similar to Anna and it served the purpose of pollenizer. Floral biology of both

the cultivars was studied. Observations were recorded on time of flower bud emergence, fruit setting and fruit set retention (Table 8)

#### Effect of pollinizer cultivar on fruit setting in Anna apple

- Low chilling apple cv Anna was planted at Institute during March 2014 and it came in flowering during fruiting season of 2015-16, 2016-17, 2017-18 and 2018-19. First two years of bearing were devoid of pollenizer cultivar and there was 5.31 to 7.19 per cent of fruit set retention respectively. From the year 2017-18 onwards, the plants of Dorsett Golden also started 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 afterwards (table 9). During this year, flowering (pink bud stage) to fruit harvesting duration was recorded as 110 days.

**Fruit Quality:** Fruit quality parameters of both the cultivars (Anna and Dorsett Golden) were analyzed and presented in Table 10. Average fruit weight of fruits of Anna cv was 180.0g. While of Dorsett Golden was 150.0g.

**Pest dynamics:** Main pollinator insects observed during this period were Honey bee (*Apis mellifera*), Wasp (*Palaeovespa florissantia*), Hover fly (*Syrphidae spp*) and House fly (*Musca domestica*). Beneficial insect, lady bird beetle (*Coccinella magnifica*) was seen at flowering period, it is reported to prey on harmful aphids. However, there was significant damage to fruits by birds and squirrel and it started from last week of May to end of June 2018. This was the first year when there was no damage by Leaf eating hairy caterpillar during August –September. (Table 11).

Table 7: Vegetative growth pattern of low chilling apple cultivars

Cultivar	Plant height (cm)			Canopy spread (cm)		
	Jan. 2018	Jan. 2019	% increase	Jan. 2018	Jan. 2019	% increase
Anna	210.0	250.0	16.00	150.0	185.0	18.91
Dorsett Golden	180.0	210.0	14.28	45.0	65.0	30.76
Michel	220.0	270.0	18.51	50.0	75.0	33.33

**Table 8: Relationship between time of bud emergence and fruit set in Anna apple at the age of four years**

Time of bud emergence (February - April 2018)	Number of flowers opened	Number of fruit set (April 2018)	Fruit set retention (June 2018)
07-14 February 2018	213	91	28
15-21 February 2018	656	253	55
22-28 February 2018	710	298	118
1-7 March 2018	466	334	91
8-14 March 2018	545	190	73
15-21 March 2018	448	163	64
22-28 March 2018	248	082	46
29 March - 4 April 2018	62	21	-
<b>Total</b>	<b>3348</b>	<b>1432</b>	<b>475</b>

**Pruning time:** In the low chilling apple cv Anna, pruning timings were also evaluated consecutively during second year. Late pruning (mid January) resulted in emergence of significantly higher number of floral buds (8.12/feet shoot length) and less number of vegetative buds (4.6/feet shoot length) as compared to early pruning (mid December) which resulted in more vegetative buds (7.50/feet shoot length) and less number of floral buds (3.34/feet shoot length). On the basis of above results, under farming system of western UP, pruning time in apple can be suggested as mid January.

**Dragon Fruit:** Dragon Fruit (*Hyaloceros undatus*) or Pitaya is a lithophytic or hemiepiphytic fruit from cactus family. 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 South East 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 ICAR-IIIFSRM during August 2014.

**Flowering and fruit quality:** At the age of 45 months, flowering for third bearing (2018-19) started during June 2018. There were two distinct flushes of flowering during this year. First flush of flowering continued from June to August 2018 and second flush came during September-October 2018. It can be 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.

**Table 9: Effect of pollinizer cultivar on fruit set percentage in Anna apple**

Parameter	2015-16	2016-17	2017-18	2018-19
Number of flowers opened	94	612	3970	3348
Number of fruit set	37	171	1540	1432
Fruit set (%)	39.36	27.94	38.79	39.68
Fruit set retention	5	44	541	475
Fruit set retention (%)	5.31	7.189	13.63	14.18

**Table 10. Fruit quality parameters in Anna and Dorsett Golden apple**

Parameters	Anna	Dorsett Golden
Fruit weight (g)	180.0	150.0
Fruit diameter (cm)	7.90	7.00
Fruit length (cm)	8.30	7.15
TSS °brix	16.0	15.0
Storage at room temperature	7	7
Fruit colour	Yellow with red ting on one side	Yellow Golden

While, fruits developed from second flush of flowering (September-October) were heavier in weight with better fruit quality (table 12) 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.

### Fruit quality

Results reveal that fruits developed from the first flush of flowering (during summer months, June to August) were average in size, weight (221.6 g) and quality parameters specially TSS (14.5 brix). While, fruits developed from second flush of flowering (September-October) were heavier in weight (370.0g)

**Table 11. Dynamics of pollinator insects in apple under western UP conditions**

S.No	Pollinaors	Duration of visit
1	Honey bee ( <i>Apis mellifera</i> )	07 February 2018 to first week of April 2018
2	Hover fly ( <i>Syrphidae</i> spp)	07 February 2018 to last week of March 2018
3	Wasp ( <i>Palaeovespa florissantia</i> ,)	mid February 2018 to last week of March 2018
4	House fly ( <i>Muscadomestica</i> )	mid February 2018 to last week of March 2018

along with better fruit quality in terms of high TSS (18.0 °brix) content (Table 12).

### 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), were planted in the field. Plants are under growth phase. Mango cultivars had started flowering during February 2018. Improved mango cultivars were also evaluated for their growth, bearing and pest dynamics under farming system of western UP (Table 13). As per the data of first year growth,

**Table 12: Fruit quality of dragon fruit grown under western Uttar Pradesh**

Parameters	First flush	Second flush	Average
Fruit weight (g)	221.6	370.0	295.8
Fruit length (cm)	7.4	9.0	8.2
Fruit diameter (cm)	6.8	8.1	7.45
Moisture (%)	83	87	85
TSS (°Brix)	14.5	17.5	16
Acidity (%)	0.44	0.48	0.46
Ascorbic Acid (mg/100 g juice)	9.55	12.50	11.35

**Table 13: Growth and fruit yield of fruit crops at age of 2 years (Planting time August 2016)**

Crop	Cultivar	Height (m)	Canopy spread (m)	Trunk circumference(cm)	Fruit yield (kg/pl) July 2018
Mango	Ambika	106.68	85.34	22.0	0.300
	Arunika	099.06	90.0	24.0	2.500
	Amrapali	107.00	73.0	19.0	1.000
bael	CISHB1	121.93	91.0	17.0	0.500
	CISHB2	182.88	108	18.0	-
Jamun	CISHJ37	213.00	182.0	40.0	-
	CISHJ42	213.36	188.0	42.0	-

flowering and fruiting, CISH-Arunika was found best among them in terms of TSS (23.5<sup>o</sup> brix), high pulp (66 %) and late harvesting (August).

**Project Title: Evaluation of sugarcane and wheat varieties for sugarcane – ratoon - wheat cropping system under Organic and Inorganic conditions**

In Western Plain Zone of Uttar Pradesh more than 80% farmers used to plant sugarcane crop in summer season after harvesting of wheat. The yield matrix (NMC and Single cane weight) drastically reduced owing to short span of sun shine and for want of longer photo period. Hence, in order to assess the effect of summer planting on cane yield and other traits, the nine early maturing varieties of sugarcane (first plant and ratoon crops) were evaluated in second cycle of experiment under Inorganic condition. The variety CoPk 05191 recorded highest caneyield (120.12 t/ha) in summer first planting followed by Co 0238 (115.96 t/ha) and CoSe 03234 (115.50 t/ha). While, in case of green top production, the variety CoSe 03234 (21.25t/ha) clinched first spot in first plant, although, CoS 03251 and CoPk 05191 mounted second & third positions, respectively (Table 14). However, brix was found highest in Co 0238 (22.96%) followed by Co 0118 (22.52%). The second cycle experiment of ratoon sugarcane crop revealed that the variety CoPk 05191 (141.68t/ha), CoSe 03234 (137.06t/ha) and Co 0238 (133.98t/ha) stood on first, second and third places, respectively, in terms of cane yield. Whereas,

green top (used as a green fodder) in ratoon crop recorded highest in CoPk 05191 (36.96t/ha) followed by CoSe 03234 (28.02t/ha) and CoLk 013201 (26.94t/ha). Moreover, in ratoon sugarcane crop, the variety Co 118 recorded highest brix (23.06%) followed by Co 098014 (22.48%) (Table 15). The varieties CoPk 05191 & CoSe 03234 shall be substituted of Co 0238 for cane as well as green top yield under Inorganic management particularly in summer planting. The results of this experiment (Table 16) divulged that the variety CoLk 013201 yielded highest cane (95.17 t/ha) under organic management followed by CoSe 03234 (87.18 t/ha) and CoPk 05191 (84.54 t/ha). However, brix was found highest in Co 0238 (21.99%) followed by Co 098014 (21.92%). A significant reduction not only in cane but green top yield was also noticed in all varieties under study. Highest green top was produced by CoPk 05191 (25.56t/ha) followed by CoLk 013201 (22.33t/ha) and Co 0118 (2.09t/ha). This study revealed that CoLk 013201 was the best for dual purpose in organic management. After harvesting ratoon crop of sugarcane, the wheat experiment was conducted on nine late sown



**Fig.7. : A view of CoPk 05191 during growing phase**

**Table 14. Performance of early maturing varieties (first plant) under inorganic conditions during summer planting**

Varieties	Tillering '000'/ha	NMC* '000'/ha	Cane Height (cm)	Single cane weight (kg)	Stem girth (cm)	Brix % (300 days)	Cane yield (t/ha)	Green top yield (t/ha)
Co0238	118.27	93.94	239.33	1.59	2.16	22.96	116.27	13.55
Cose 03234	119.81	108.42	216.55	1.13	2.14	21.14	115.50	21.25
UP05125	153.38	118.43	185.44	0.65	1.82	21.61	64.68	9.86
Cos 03251	123.82	119.04	184.66	0.98	2.14	22.40	101.64	16.48
Co098014	102.10	76.38	246.55	1.00	1.91	22.45	84.70	8.47
Co0118	94.40	74.69	170.44	0.80	2.05	22.53	60.06	8.47
CoLK011201	131.98	129.36	178.89	0.63	1.92	22.44	64.68	11.70
CoLk013201	149.53	124.74	214.64	0.67	1.68	20.26	77.00	15.71
CoPk05191	157.23	144.30	220.22	0.86	1.72	21.25	120.12	16.02
SEm±	7.60	5.61	9.33	0.11	0.06	0.30	2.71	1.07
CD(P=0.05)	22.97	16.96	28.20	0.32	0.19	0.92	8.20	3.22

**Table 15. Performance of early maturing sugarcane varieties (ratoon) under inorganic conditions**

Varieties	Tillering '000'/ha	NMC* '000'/ha	Cane Height (cm)	Single cane weight (kg)	Stem girth (cm)	Brix % (300 days)	Cane yield (t/ha)	Green top yield (t/ha)
Co0238	141.99	127.36	230.88	1.17	2.66	22.03	133.98	25.56
Cose 03234	181.26	153.08	228.11	1.06	2.57	22.29	137.06	28.03
UP05125	141.06	110.73	181.00	1.03	2.44	22.10	59.29	11.24
Cos 03251	136.75	110.26	174.77	0.71	2.45	22.40	68.53	14.32
Co098014	147.22	127.05	252.22	1.03	2.56	22.49	112.42	15.71
Co0118	112.42	99.02	199.66	1.34	2.63	23.33	93.17	19.87
CoLK011201	172.02	142.76	210.66	0.81	2.66	21.61	98.56	22.33
CoLk013201	166.17	140.45	246.55	1.12	2.82	20.71	126.28	26.95
CoPk05191	188.65	173.87	228.12	0.92	2.65	21.51	141.68	36.96
SEm±	10.54	9.30	10.05	0.22	0.12	0.49	6.04	1.87
CD(P=0.05)	31.86	28.12	30.39	NS	NS	NS	18.26	5.66

varieties. The findings revealed that variety WH544 yielded highest grain (56.26q/ha) followed by DBW 16(54.23q/ha) and HD 3059(54.22q/h) while, RAJ 3077 was on first spot producing 91.14 q/ha straw overtaking PBW 89.46 q/ha (Table 17).

### Development of Mustard varieties for organic farming

F<sub>1</sub> population of six crosses (procured from ICAR-DRMR, Bharatpur) had been put in separate six blocks

**Table 16. Performance of early maturing varieties of sugarcane (first) under organic conditions**

Varieties	Tillering '000'/ha	NMC* '000'/ha	Cane Height (cm)	Single cane weight (kg)	Stem girth (cm)	Brix % (300 days)	Cane yield (t/ha)	Green top yield (t/ha)
Co0238	92.86	70.22	197.44	0.98	2.55	22.00	60.37	10.32
CoSe 03234	109.19	84.39	206.66	1.17	2.48	21.17	87.78	19.10
UP05125	142.91	110.42	189.22	0.77	2.27	21.45	68.53	13.55
CoS 03251	114.88	83.47	158.89	0.93	2.80	21.72	63.91	19.87
Co098014	118.89	87.47	231.44	1.00	2.37	21.92	71.61	13.86
Co0118	124.59	84.08	179.44	1.01	2.93	20.80	71.61	20.94
CoLk011201	171.40	115.81	171.22	0.67	2.36	20.66	62.83	19.56
CoLk013201	141.53	121.20	220.00	0.86	2.42	20.21	95.48	22.79
CoPk 05191	161.39	122.43	197.77	0.88	2.27	21.31	84.70	25.41
SEm±	8.65	4.38	8.03	0.06	0.12	0.30	4.41	1.45
CD(P=0.05)	26.17	13.23	24.29	0.18	0.37	0.91	13.35	4.39

**Table 17. Performance of late sown wheat varieties under inorganic conditions**

Varieties	Plant height (cm)	Harvest index %	Straw yield (Q/ha)	Grain yield (Q/ha)
Raj 3077	104.06	33.39	91.14	45.85
Raj 3065	102.90	40.57	75.54	51.49
Raj 3777	100.60	28.69	86.34	34.79
PBW 226	104.80	36.53	89.46	51.56
DBW 90	100.70	31.86	83.09	38.86
DBW 71	102.30	38.81	78.99	50.09
DBW 16	101.90	40.00	81.70	54.23
HD 3059	102.80	38.80	85.38	54.22
WH 544	110.20	40.64	82.27	56.26
SEm±	4.04	1.25	3.23	2.58
CD(P=0.05)	NS	3.78	NS	7.81

with space planting for tapping individual plant having physiological vigor, high seed yield, siliques number, high biomass, oil content and resistance to disease and insects. Near about 257 individual plants selection had been made in first round of selection in F<sub>2</sub> segregating generation on the basis of designed Ideotype. Plants selected in F<sub>2</sub> generation have been advanced in F<sub>3</sub> generation from which 109 individual plants

tapped. Indeed, in F<sub>4</sub> progeny 79 individual plants were selected after rejection of large population (Table 18). A set of six crosses procured from ICAR-DRMR, Bharatpur in 2017, F<sub>2</sub> progeny have been space planted and as many as 104 individual plants were selected, further from F<sub>3</sub> population, a few (04) individual plants were tapped as a result, large population went on rejection. (Table 19).

**Table 18. Selection of individual plants among the crosses in F<sub>2</sub>, F<sub>3</sub> and F<sub>4</sub> progenies**

Parentage	Selected plant (F <sub>2</sub> )	Selected plant (F <sub>3</sub> )	Selected plants (F <sub>4</sub> )
IJ31 × EC597313	54	40	43
MJA38 × MJR-9	77	21	14
MJA25 × MJR3	49	15	—
MJA39-3-2-2 × MJR8	51	12	21
EC597326 × RB50	14	18	01
EC597326 × EC597313	12	03	—
Total selection	257	109	79

**Table 19. Selection of individual plants among the crosses in F<sub>2</sub> and F<sub>3</sub> progenies**

Parentage	Selected plant (F <sub>2</sub> )	Selected plant (F <sub>3</sub> )
MJA 25x MJR-3	31	04
MJA38 xMJR-8	22	—
EC 597326x 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	04

### Performance evaluation of different mustard varieties under organic environment

A total of 15 varieties of mustard were put in replicated trial to evaluate them in organic management with the aim to assess their performance for organic production system. The variety RB 50 was first spotted (Table 20) in terms of seed yield (22.88q/h). However, Varuna and NRC HB 101 both yielded second highest seed (22.05q/h) having equal days to maturity. Trio varieties were found to have above 6.0 gm test weight showing suitability for their production in organic management.

**Table 20. Mean performance Indian mustard strains**

Varieties	Days to maturity	1000 seed weight(g)	Seed yield (kg/plot)	Seed yield (q/ha)
IJ 31	123	5.53	2.285	20.31
NRC HB 101	123	6.64	2.481	22.05
Pusa Agrani	125	5.32	2.317	20.9
Kranti	124	6.52	2.443	21.71
RB 50	126	6.65	2.575	22.88
Varuna	123	5.98	2.481	22.05
Pusa M-27	122	6.34	2.323	20.65
Pusa M-26	123	5.53	2.238	19.89
NRC DR-02	124	4.88	1.985	17.64
DRMR-150-35	125	5.02	2.005	17.82
NRC-DR-601	124	5.64	1.985	17.64
RH-30	124	6.21	2.010	17.86
RH-406	125	6.24	2.023	17.98
RH-749	124	6.60	1.975	17.55
NPJ-112	123	5.71	1.970	17.51
CD (0.05)	N/A	1.062	N/A	N/A
CV %	0.589	5.793	2.708	8.951

## Evaluation of varieties (Basmati Rice) under Organic and Inorganic management

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 (6.56 t/ha) followed by Pusa Sugandha-5 (5.22 t/ha) under organic management (Table 21). However, both the aforesaid varieties also produced dry biological matter stood on

first and second pedestal, respectively. Under Inorganic management the same varieties i.e. Pusa Sugandha-2 recorded highest grain yield (6.495t/ha) followed by Pusa Sugandha-5 (5.86 t/ha). Whereas, again Pusa Sugandha-2 gave rise highest dry biological yield (14.29 t/ha), although Basmati -564 and IR-64 remained on first and third place in straw production. Indeed, some varieties showed marked differences in terms of grain and biological yield under organic and inorganic management.

**Table 21. Performance of different Basmati Rice varieties under Organic and Inorganic management.**

Varieties	Organic management					Inorganic management				
	Days to maturity	No. of grain/spike	Grain yield (t/ha)	Biological yield (t/ha)	HL	Days to maturity	No. of grain / Spike	Grain yield (t/ha)	Biological yield (t/ha)	HL
IR 64	83	127	4.95	9.24	53.50	83	127	5.15	11.53	44.60
PB 1509	77	102	2.74	7.94	34.50	77	102	3.90	7.16	54.50
Pant Sugandha-15	85	220	2.70	5.19	52.00	85	220	3.15	7.93	39.70
Pant Sugandha-17	84	202	4.02	9.56	42.00	84	202	4.58	8.65	53.00
Pusa Sugandha-2	85	232	6.56	13.85	47.40	85	232	6.50	14.29	45.40
Pusa Sugandha-5	84	218	5.22	10.60	49.20	84	218	5.87	10.99	53.40
Tarawadi Bas-1	86	100	2.26	5.68	39.70	86	101	2.71	5.60	48.30
Punjab Bas-2	84	81	2.15	3.90	55.00	84	81	2.73	4.40	62.10
BASCSR-30	86	79	2.08	5.55	37.40	86	79	2.72	6.12	44.40
Basmati -386	85	165	3.78	6.46	58.50	85	165	4.23	8.08	52.40
Basmati-564	85	173	4.25	10.46	40.60	85	173	5.51	11.92	46.20
Imp. Pusa Bas -1	85	177	2.58	5.71	45.10	85	177	3.36	7.72	43.50
Palam Bas P-6-6	77	103	1.94	3.28	59.00	77	103	2.77	5.73	48.30
Basmati-370	81	130	1.84	3.20	57.40	81	130	2.61	5.87	44.40
Haryana Bas-2	83	89	2.48	6.82	36.30	83	89	3.83	9.25	43.10
Pusa Bas-6	84	99	3.71	8.75	42.30	84	99	3.90	7.93	49.20
VB-22	83	76	4.03	7.91	50.90	83	76	5.74	10.87	52.80
VB-23	87	85	2.41	5.38	44.70	87	85	2.66	6.10	43.60
Basmati-Lajawab	78	79	2.91	5.91	49.10	78	79	3.64	8.05	45.20
Super Basmati	84	95	2.08	4.97	40.17	84	95	2.13	4.78	44.60
Basmati-IP-2	84	113	2.24	5.19	43.10	84	113	2.52	7.43	33.80
Kasturi	83	131	2.66	4.16	64.00	83	131	2.15	5.20	41.30
PB-1121	84	77	3.09	6.04	51.10	84	77	3.17	7.78	40.70
Punjab Bas-3	87	56	2.86	4.98	57.30	87	56	3.01	7.05	42.70
CD (0.05)	1.57	7.58	0.68	0.44	1.20	1.63	24.68	0.66	0.77	2.60
CV %	1.10	3.37	12.84	3.98	10.10	1.18	11.92	10.34	5.80	10.25

### 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<sub>1</sub>- rice-wheat; C<sub>2</sub>- maize-wheat; C<sub>3</sub>-rice-barley and C<sub>4</sub>- rice-mustard). The crop residue used as mulching and fertilizer combination treatments (sub-sub-plots) consisted of four M<sub>1</sub> - No mulch + recommended dose of fertilizer (RDF), M<sub>2</sub> - Mulch (6 t/ha) + recommended dose of fertilizer (120:60:40 kg NPK) (RDF), M<sub>3</sub> - Mulch (0) +125% recommended dose of fertilizer (RDF), M<sub>4</sub> - 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<sup>-1</sup> 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. 8). The

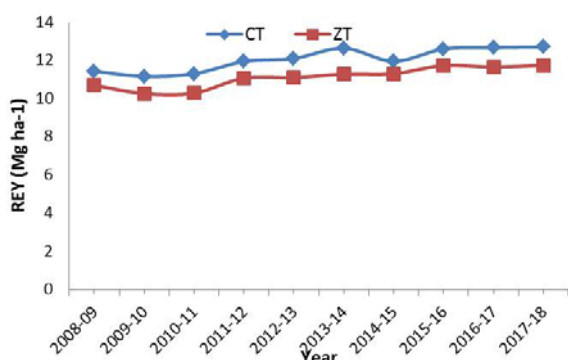


Fig. 8. Rice equivalent yield (REY) on different tillage system

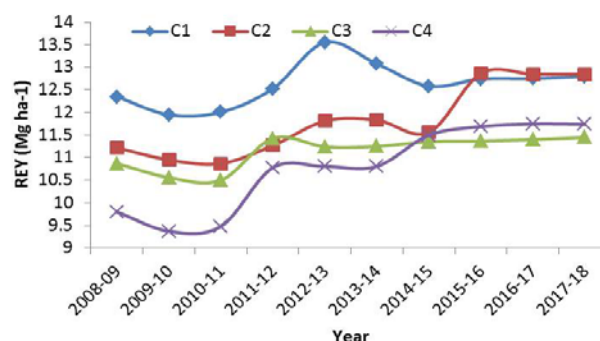


Fig. 9. Rice equivalent yield (REY) on various cropping system

tillage influenced significantly ( $P < 0.05$ ) on REY, whereas, the cropping systems and crop residue 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 treatment of M<sub>4</sub> (6 t/ha mulch + 125% RDF) followed by M<sub>2</sub> (6 t/ha mulch + RDF). The REY in treatment M<sub>4</sub> and M<sub>2</sub> 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. 10). As far as the effect of cropping system (Fig. 9) is concerned, higher REY observed in C<sub>1</sub> (rice-wheat) followed by C<sub>2</sub> (maize-wheat), C<sub>4</sub> (rice-mustard) and C<sub>3</sub> (rice-barley).

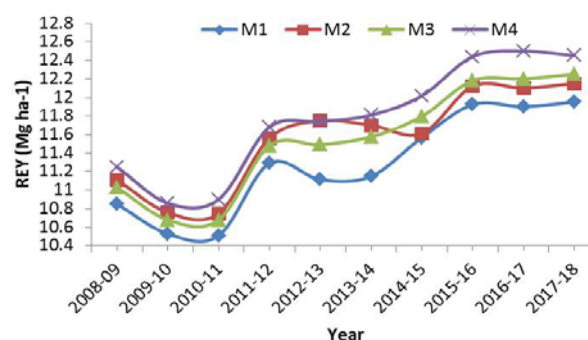
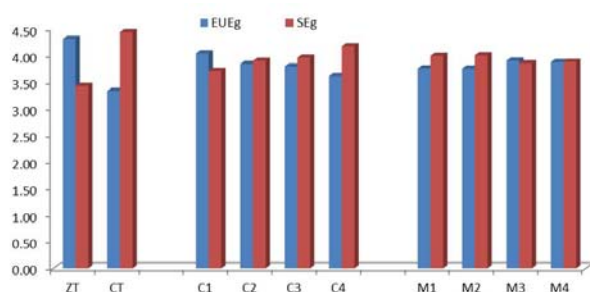


Fig. 10. Rice equivalent yield (REY) on different crop residue management and RDF combination

### Energy budgeting of different tillage and cropping systems with rice residue mulching and fertilizer management practices

Energy budgeting under 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 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 yields of all years were considered for calculating output energy. Energy outputs were calculated by multiplying the grain yields with corresponding energy coefficients. Energy output from grain Grain energy use efficiency ( $EUE_g$ ) and Grain specific energy ( $SE_g$ ) as per treatments (i.e. 2 tillage systems, 4 cropping systems and 4 rice residue and RDF combinations) were estimated and analyzed. Results revealed that grain energy use efficiency ( $EUE_g$ ) was found higher in Zero tillage (4.30) as compared to conventional tillage (3.33), however, grain specific energy ( $SE_g$ ) was observed in CT (4.43) than ZT (3.43). The highest  $EUE_g$  was observed under rice- wheat systems however, highest grain specific energy ( $SE_g$ ) was found in rice-mustard than other cropping system (Fig. 11). It was due to low resource use system has consumed less inputs as compared to other systems and higher productivity. 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.  $EUE_g$  &  $SE_g$ ) however, various cropping systems and mulching and RDF influenced the significantly parameters i.e.  $EUE_g$  and  $SE_g$ .



**Fig. 11. :Energy budgeting (MJ/ha) of different treatment as on various tillage, cropping system and residue management**

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

#### 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<sup>-1</sup> 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 (70%) 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 (0.42 ha/h) followed by HT (0.42 ha/h), RT (0.20 ha/h) and BP (0.30 ha/h), however, highest field efficiency was measured in HT (64%) followed by ZT (59%), BP (54%) and RT (49%).

The effect of planting methods on wheat yield over the years is depicted in Fig. 12. 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 about 1.5 to 2 % (in ZT, HT and RT) than CS.

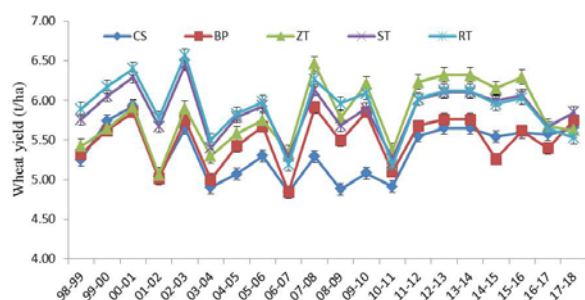


Fig. 12. Effect of different RCT machineries used for wheat crop establishment on yield over the year

The comparative performance of different methods of rice establishment i. e. various transplanting methods, different direct seeded rice i.e. 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. 13. The highest yield was noticed in puddled transplanted rice than direct seeded rice. On average higher yield was observed in puddled transplanted rice than direct seeded rice. The higher net return was noticed in the five direct seeded rice as compared to three puddled transplanted rice and two sprouted rice seeding method. The energy net

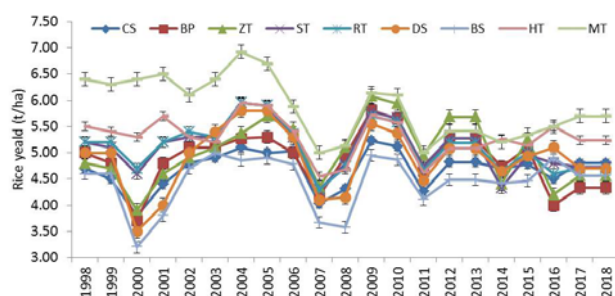


Fig. 13. Effect of planting methods on rice yield over the year

return was 8 to 15% higher in ZT and HTS, as compared to HT. Energy output: input ratio was 18% higher in ZT, 16 to 5% higher in all the methods except DS, CS and BS, where it was 1.5 to 12% lower, compared to HT.

### i) 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 Fig. 14 & 15.

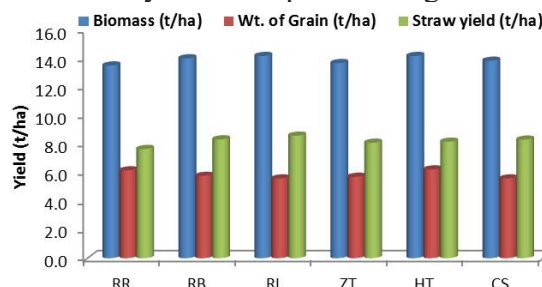
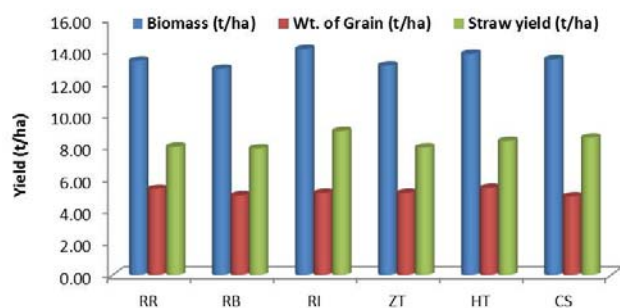


Fig. 14. : Effect of residue management and different machineries on wheat yield

The crop residue recycling was done before planting of both crop seasons (as *khari* and *Rabi*). The residue recycling were done as rice residue (5 to 6 t ha<sup>-1</sup>) as well as wheat straw (7.5 to 8.5 t ha<sup>-1</sup>) and the degree of recycling was 76-81%. The wheat yield varied from (5.41 to 6.41 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.



**Fig. 15. : Effect of residue management and different machineries on rice yield**

In case of kharif crop (rice), the highest yield was observed in residue recycling (5.21 t/ha) (RR) followed residue incorporation (RI) and residue burning (RB). However, highest yield was observed HT (5.3 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.

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

**Optimized a low-calorie jam composition, and method of preparation thereof-a patent filed**

At present most of the peoples/consumers are very much health concerned in nature and they are giving first priority to healthy food during any purchase of ready to use foods from the market. In different Indian market

place a variety of ready to use foods are commercially available, however, most of the foods are not suitable for continuing healthy life style. These readily available ready to used/serve foods are high in calories, low in vitamins, minerals and phytochemicals. Therefore, we have optimized a method for preparing a low-calorie jam composition using aloe vera, tulsi and stevia extract, xanthan gum and lemon juice etc. This method for preparing a low-calorie jam composition was filed under Indian Patent and this patent assigned a number by the Indian Patent Office vide 201911010053 dated 14/03/2019.

**Project Title: Development of protocol for value added products from Organic Sugarcane**

To initiate research work on my newly approved Institute project entitled “Development of protocol for value added products from Organic Sugarcane”, visited few local jaggery production units (Kallu) nearby areas of Muzaffarnagar district. We have identified different problems with local jaggery production units and during this survey, it was recorded that most of the local jaggery units are presently running by unqualified and poor skilled manpower. These units are facing problems during marketing of their produces. The jaggery products are generally not packed properly and no suitable packaging materials are used. Limited jaggery products diversifications are practiced by major jaggery units. Based on the survey and urgent need, we have started initial work on standardization and development of protocol for production of liquid jaggery with different product diversification. The initial results for development of protocol for production of liquid jaggery work was found encouraging and under progress.

## Cropping Systems and Resource Management (CSRM)

### Project Title: Evaluation of different cropping sequences for crop intensification under CA practices

As indicated in table 22 most of the yield attributing characters of rice were of higher order under conventional practices (transplanted rice) as compared to conservational practice (direct seeded rice) and hence plant height (87.47cm), panicle length (24.35cm), grains/ panicle (63.60) as well as grain and straw yield were recorded higher under conventional practices (4.97 t/ha) than conservational practices (4.37 t/ha).

Under maize crop as given in table 23, plant height and number of the plant per m<sup>2</sup> were higher under conventional (CP) practice as compared to conservational (CA) practice; however cob weight was more under CA practices.

Sugarcane yield and yield attributes under sugarcane-ratoon-wheat cropping system, Plant height (332 cm), single cane weight (1.27 kg) were recorded higher under conservational practices, however brix value (21.93%), number of millable canes (273.67 thousands/ha) and cane yield (98.84 t/ha) were higher under conventional practice as compared to conservational practices.(Table 24)

On average basis and across the cropping systems plant height, numbers of tillers/meter square, ear length,

and yields (biological, grain and straw) were recorded more under conventional practice; however number of grains were at par under both the conditions. Conventional practice recorded about 12.7 and 68.3 % higher grain and straw yields as compared to conservational practice (zero till wheat).(Table 25)

Because of better control of secondary weeds in cowpea, green gram and pea higher yields of all the crops were recorded under conventional practices as compared to conservational practices, which were higher to the tune of 108.6, 53.1 and 8.3% (table 26) over the conservational practice.

Maximum wheat equivalent yield (19.39 t/ha) was recorded under sugarcane-ratoon-wheat system followed by maize (cob)-pea (pod)- wheat- cowpea (12.19 t/ha) as per shown in table 06. All the cropping systems showed superiority under conventional practices as compared to conservational practices. However higher B:C ratio was scored under sugarcane-ratoon-wheat and rice-wheat-sesbania system when followed conservational practices, which is mainly because of lower cost of cultivation under conservational practices.

There is little built up of phosphorus, potassium and organic carbon with the adoption of recycling of crops residues like rice and wheat straw; green gram, cowpea and sunhemp residue in various cropping systems. On

**Table 22: Yield and yield attributes of rice as influenced by CA and CP practices**

Cropping Systems		Plant height	Effective tiller/m <sup>2</sup>	Length/ panicle	No. Of grain/ panicle	Grain Yield (t/ha)	Straw Yield (t/ha)
Rice-wheat-green gram	CA	83.73	287	21.57	56	4.14	8.63
Rice-wheat-sesbania		84.93	282	22.80	60	4.60	9.60
Rice-wheat-green gram	CP	88.20	188	24.97	64	4.72	9.87
Rice-wheat-sesbania		86.73	216	23.73	63	5.22	10.88
<b>Average</b>	CA	<b>84.33</b>	<b>284.67</b>	<b>22.18</b>	<b>58.33</b>	<b>4.37</b>	<b>9.11</b>
	CP	<b>87.47</b>	<b>201.83</b>	<b>24.35</b>	<b>63.60</b>	<b>4.97</b>	<b>10.37</b>

Table 23: Yield and yield attributes of maize as influenced by CA and CP practices

Plot No.	Average Plant Height	No. Of plants/m <sup>2</sup>	Cob yield of 5 plant (kg)	per cob wt. (kg)	Cob yield (kg/plot)	Stower yield kg/plot	Cob yield (t/ha)	Stower yield t/ha
CA	211.49	5	1.62	0.32	23.60	41.67	9.83	17.36
CP	223.58	6	1.45	0.29	28.07	51.17	11.69	21.32

Table 24: Yield and yield attributes of sugarcane as influenced by CA and CP practices (Sugarcane-ratoon-Wheat)

Spad	No. of internodes / plant	Plant height (cm)	Single Cane wt. (Kg)	Brix (%)	NMC (Thousand /ha)	Cane Yield (t/ha)	Straw Yield (t/ha)
CA	36.38	17	332.33	1.27	20.33	257.67	92.78
CP	36.03	16	329.11	1.24	21.93	273.67	98.84

Table 25: Yield and yield attributes of wheat as influenced by CA and CP practices

Cropping System		Plant height (cm)	No. of tillers/m <sup>2</sup>	Ear length (cm)	No. of grains/ears	1000 grain wt.(g)	Biological yield (t/ha)	Grain yield (t/ha)	Straw yield (t/ha)
Rice- wheat-green gram	CP	85.27	579	9.13	43	41.78	11.67	5.17	6.50
	CA	83.93	350	8.53	46	41.86	8.48	4.32	4.16
Rice- wheat- sesbania	CP	89.47	493	9.23	48	43.14	10.42	4.27	6.15
	CA	86.73	363	9.57	45	43.63	7.36	3.94	3.42
Maize (cob)- pea (veg)-wheat- cowpea	CP	89.47	521	9.97	55	45.59	14.26	6.15	8.11
	CA	86.80	468	9.27	53	45.54	10.27	5.30	4.96
Sugarcane-ratoon-wheat	CP	91.07	693	9.83	43	44.87	13.68	5.78	7.91
	CA	89.40	552	9.17	49	43.58	9.93	5.43	4.50
Average	CP	88.82	572	9.54	47	43.85	12.51	5.34	7.17
	CA	86.72	433	9.13	48	43.65	9.01	4.75	4.26

an average 16.58 t/ha legume crop residue on dry basis is being recycled under conservational practices, which enhanced the organic carbon content of soil from 0.42 to 0.44.

### Agronomic evaluation of sugarcane varieties under

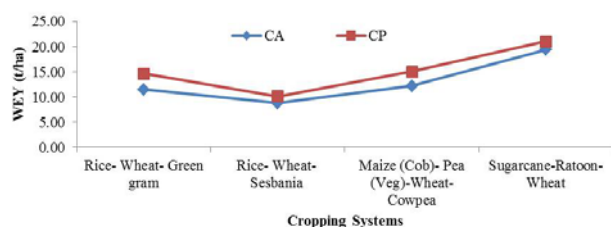


Table 26: Yield and yield attributes of cowpea, green gram and pea as influenced by CA and CP practices

Crop		Green pod yield (t/ha)	Residue		
			SPAD	Fresh wt. (t/ha)	Dry wt. (t/ha)
Cowpea	CP	3.15	55.00	30.45	6.58
	CA	1.51	53.54	28.99	6.38
Green gram	CP	1.24*	51.22	20.54	8.82
	CA	0.81*	52.44	20.42	9.30
Veg. Pea	CA	2.08	-	4.00	1.10
	CP	1.92	-	3.10	0.90

\*Grain yield

**Table 27: WEY, net returns and B:C ratio as influenced by CA and CP practices under different cropping systems**

Cropping System	CA			CP		
	WEY (t/ha)	Net Returns (Lakhs/ha)	B:C (t/ha)	WEY	Net Returns (Lakhs/ha)	B:C
Rice-wheat-green gram	11.46	1.13	2.3	14.63	1.44	2.3
Rice-wheat-sesbania	8.80	0.82	2.1	10.15	0.80	1.8
Maize (cob)-pea (veg)- wheat- cowpea	12.19	1.26	2.5	15.05	1.57	2.5
Sugarcane-ratoon-wheat	19.39	2.46	3.7	21.01	2.49	3.2

### CA and CP practices

Nine varieties of sugarcane viz. Co 0238, CoS 03234, UP 05125, CoS 03251, Co 0118, CoLK 011201, CoLK 013201, CoPK 05191, Co 098014 were evaluated under CA practices. Yield and yield attributes of cane varieties (table 7,8 & 9) are here as under:

Agronomic evaluation of elite lines is extremely important for expression of the traits suitable for practices of conservation agriculture. An experiment on evaluation of sugarcane varieties has been initiated on summer planting of sugarcane in which planting of sugarcane is done after the harvest of wheat crop.

Varieties respond differently and higher number of millable canes (14522 per hectare ) in variety CoPk 05191, cane height (304.11 cm) in variety CoS 098014, single cane weight (2.28 kg/cane) in varieties Co 0238, were recorded under conventional practice (Table 28) Likewise yield attributing characters of sugarcane varieties also varied under conservational practices (Table 29)

As indicated in the table 30, variety Co0238 recorded maximum average yield of 97.60 t/ha followed by CoS03251 (95.40 t/ha) under conventional practice. However Copk05191 and CoS-098014 recorded the respective higher yields of 144.40 and 133.90 t/ha under conservational practices.

**Table 28: Yield and yield attributes of sugarcane varieties under CP condition**

Varieties	Height (cm)	girth (cm)	Single Cane Wt. (kg)	NMC ('000/ha)	Leaf Area index	SPAD	Brix (%)	Yield (t/ha)	Green Top (t/ha)
CoSe 03234	281.78	9.7	1.78	101.85	10.04	44.19	22.53	125.01	24.46
CoLk 013201	253.11	8.9	1.28	110.50	10.97	47.31	20.07	83.19	17.54
Co 098014	304.11	8.0	1.53	120.99	8.38	45.10	21.87	138.13	16.83
CoPk 05191	247.11	7.5	1.48	145.22	10.02	50.10	20.87	141.99	27.61
UP05125	229.33	7.6	1.25	79.64	7.23	39.26	22.17	74.08	11.23
Co 0238	264.44	8.2	2.28	90.59	10.22	46.73	21.65	128.09	19.10
CoLk 011201	210.11	7.4	0.96	84.42	8.21	39.80	20.70	54.02	14.48
Co 0118	245.55	8.0	1.48	79.17	9.10	45.02	22.33	96.46	21.73
CoS 03251	233.33	8.3	1.18	104.79	8.05	45.97	19.93	86.43	23.44

**Table 29: Yield and yield attributes of sugarcane varieties under CA condition**

Varieties	Height (cm)	girth (cm)	Single Cane Wt. (kg)	NMC ('000'/ha)	Leaf Area index	SPAD	Brix (%)	Yield (t/ha)	Green Top (t/ha)
CoS-03234	221.11	7.12	2.47	116	7.4	28.78	20.20	86.08	18.46
CoLk-013201	250.89	7.47	3.71	126	7.5	31.73	20.73	104.39	23.82
CoS-098014	242.44	7.47	2.85	114	9.1	27.82	21.33	94.14	18.02
CoPk-05191	170.83	5.87	2.28	103	5.7	24.44	15.70	85.07	22.92
UP-05125	223.33	7.84	3.03	114	12.0	31.26	19.53	80.77	38.73
Co-238	249.33	8.17	3.34	153	10.9	32.29	20.40	100.99	19.16
CoLk-011201	250.56	7.63	3.16	118	9.4	32.04	19.33	85.23	31.17
Co-0118	252.67	8.04	3.68	116	7.4	37.58	19.73	84.41	23.92
CoS-03251	254.44	7.80	3.33	148	7.3	34.32	18.47	122.69	35.79

**Table 30: Yield of sugarcane varieties under CP and CA conditions (average of two years)**

Varieties	CA Cane yield (t/ha)			CP Cane yield (t/ha)		
	Plant crop	Ratoon	Average	Plant crop	Ratoon	Average
CoS-03234	56.5	86.1	71.3	115.1	125.0	120.1
CoLk-013201	75.2	104.4	89.8	126.2	83.2	104.7
CoS-098014	58.2	94.1	76.2	129.6	138.1	133.9
CoPk-05191	100.2	85.1	92.6	146.8	142.0	144.4
UP-05125	65.4	80.8	73.1	79.0	74.1	76.6
Co-238	94.3	101.0	97.6	104.9	128.1	116.5
CoLk-011201	60.2	85.2	72.7	88.0	54.0	71.0
Co-0118	75.6	84.4	80.0	108.0	96.5	102.3
CoS-03251	68.2	122.7	95.4	71.0	86.4	78.7
Mean	72.6	93.8	83.2	107.6	103.0	105.3

**Project Title: Physiological approaches for improving productivity of promising cropping systems**

Study stated that treatment IAA100 shows the improvement in cane height compare to other treatments in all two DOS. Treatment Waste decomposer shows

the improvement in tillering, cane weight, yield and NMC over the treatments in October sown sugarcane (Table 31). Whereas in February sown sugarcane treatment Waste decomposer shows the improvement in cane height, tillering, yield and NMC over the other treatments in October sown Sugarcane (Table 32).

**Table 31: Growth and yield parameters of October sown first plant of sugarcane (Co238)**

DOS1	Cane Height (cm)	Tillering '000'/ha	NMC '000'/ha	Yield (t/ha)	Cane wt
IAA 100	256.56	167.30	96.77	117.39	1.61
IAA 200	242.22	155.88	95.53	109.96	1.40
GA 20	250.11	149.39	93.68	124.69	1.52
GA 40	254.33	154.95	99.55	108.28	1.46
Jeevamrit	255.33	167.30	104.79	104.62	1.51
Waste decomposer	255.89	167.76	104.79	130.94	1.59
Control	227.00	159.12	103.87	108.73	1.30
SE(m)	14.628	5.598	3.943	5.086	0.122
C.D.	N/A	N/A	N/A	15.846	N/A
C.V.	10.185	6.051	6.839	7.664	14.267

**Table 32: Growth and yield parameters of spring sown first plant of sugarcane (Co238)**

DOS2	Cane Height (cm)	Tillering '000'/ha	NMC '000'/ha	Yield (t/ha)	Cane wt
IAA 100	256.78	170.54	98.16	96.07	1.51
IAA 200	262.56	156.80	95.22	92.38	1.53
GA 20	253.56	169.46	98.00	87.26	1.46
GA 40	259.78	164.67	97.38	78.03	1.52
Jeevamrit	264.67	166.06	97.38	103.67	1.57
Waste decomposer	268.00	181.19	100.63	120.94	1.53
Control	241.89	159.58	96.00	91.87	1.49
SE(m)	5.201	7.389	3.749	9.884	0.083
C.D.	N/A	N/A	N/A	N/A	N/A
C.V.	3.49	7.668	6.658	17.88	9.512

### Project Title: Status of Organic Agriculture in Western Himalayan Region

This study was conducted with the objective to find out the practices, productivity and economics of organic, integrated and inorganic production systems adopted by farmers of hills and plain region of western Himalayas. The study area encompasses the pre-dominant farming systems of Western hills zone of

Jammu Division, India. A survey was conducted in one districts of Western hills zone of Jammu i.e Jammu in the year 2019. The total sample comprises a random sample of 120 households i.e. (1 District x 3 blocks/ district x 1 villages/ block x 20 households) using a stratified sampling frame. A total of 120 households were selected for the study. Data was collected by personal interview method using pre-tested structured questionnaire through face to face interaction with the

men and women farmers. Both the quantitative and qualitative data were used in the study.

From the survey of Jammu districts, it was observed that the farmers who are practicing organic agriculture are using only organic inputs mainly based on cow dung and not using chemical fertilizers. The districts covered in survey follow mainly Rice-Wheat and Maize-Wheat cropping systems along with patches of Rice-Wheat/Pulses-Wheat/pulses-pulses system. Farmers mainly involved in growing rice (basmati (370/1121)/sharbati), maize (Kanchan 517), wheat (2967/1531/412/), berseem (fodder), bajra (fodder), maize (fodder) along with vegetables (mainly for home consumption). Rice and wheat are major cereal crops in the entire districts. The common feature of the region is practicing Dairy and almost all the farmers kept cow or buffalo, bullock. Some farmers are also practicing poultry and goat farming as additional enterprise to enhance household income. This showed a good scope of organic farming system in the state. Some villages in hilly region of the districts are following pulse production with seed and package of practices input by University personnel and mainly growing cowpea, green gram, horsegram, Bengal gram, masoor, pea and other pulses.

From preliminary observation of the survey, it was observed that the farmers outside the organic cluster (3 villages) were found to use inorganic chemical fertilizers and herbicides in cereal crops however, it was observed that farmers are using very less amount of fertilizers (Example: 20-30 kg of Urea and 20-30 kg of DAP per acre). Majority of farmers are not applying fertilizers in either rice or wheat and only one crop is receiving fertilizers. The farmers are not applying insecticides or fungicides due to less incidence of pest and diseases, however, herbicide application is present among all crops. The main feature of region is application of organic input in the farm of compost prepared by open heap method and animal rearing has made farmers to use byproduct of animal waste as organic input and also made berseem as common fodder crop of the region. Dairying is not commercial in the region as most of the farmers use milk for self-consumption and few are following selling of milk but in local market. Cooperatives for milk and cereal market are not present in the region. Since the livestock component is prominent/common practice in region there is very much potential for organic agriculture.

## Organic Agriculture System (OAS)

### Project Title: Network Project on Organic Farming- Modipuram centre

The organic carbon contents in the soil of different cropping systems under organic, inorganic and integrated nutrient management were varied significantly. The soil organic carbon content in the surface soil (0-15 cm) was varied from ~ 0.83 to 0.86 % average across the nutrient management system. The surface soil content maximum amount of organic carbon irrespective of nutrient management and cropping systems. The organic carbon content in the soil under organic management systems were recorded higher average across the depth and the amount organic carbon not varied significantly among the cropping systems. The magnitude of organic carbon distribution in the soil profile depth (60 cm) varies significantly in different cropping systems. The cropping system CS1, Basmati rice – wheat - Sesbania green manure have the higher potentiality to sequestered carbon in soil irrespective of nutrient management systems and the amount of carbon sequestration was maximum (2.77 Mg /ha) under organic nutrient management. The carbon sequestration potential of cropping systems Basmati rice – wheat - Sesbania green manure is statistically at par with the cropping systems Maize – mustard - Sesbania green manure under organic management systems. The carbon sequestration potential of different cropping systems under inorganic systems were always lower in the inorganic nutrient management systems and among the different, Coarse rice – barley – green gram cropping systems have lowest carbon sequestration potential. The carbon sequestration rate under different cropping systems varied 0.213 to 0.208 Mg ha<sup>-1</sup> Yr<sup>-1</sup> under organic nutrient management systems whereas the sequestration rates were lower under inorganic nutrient management systems irrespective of cropping systems. The capacities of inorganic nutrient management to sequestered carbon were varied from 69-79% less as compare to the organic nutrient management systems.

Crop yields are often limited by low P availability in soils, owing mainly to adsorption and precipitation

reactions of both indigenous soil P and applied fertilizer P with iron (Fe), aluminum (Al), or calcium (Ca). Low P uptake efficiency of plants is associated primarily with limited P availability in native soil. Consequently, large amounts of expensive inorganic P fertilizers need to be applied to many agricultural soils to achieve attainable crop yields. Application of organic matter to soil increases P solubility, decreases P fixation, and thus improves P availability to plants. To assess the behaviors of phosphorus in soil, three composite soil samples were collected from surface layer (0-30 cm) during the year 2018 from three production systems viz., organic, inorganic and integrated which are maintained since 2004 under basmati rice-wheat-*Sesbania cropping* system at ICAR-Indian Institute of Farming Systems Research, Modipuram under Network Project on Organic Farming. Fractionation of phosphorus was accomplished by sequential extraction of soil samples. The Al-P fraction in the soil samples was extracted by using NH<sub>4</sub>Cl and NH<sub>4</sub>F followed by washing with saturated NaCl. The extractant was then treated with NaOH to obtain the Fe-P fraction. The soluble P was obtained by treating the solution with Na<sub>3</sub>C<sub>3</sub>H<sub>5</sub>O<sub>7</sub>, NaHCO<sub>3</sub> and Na<sub>2</sub>SO<sub>4</sub> while the Ca-P fraction was obtained by treating the solution with H<sub>2</sub>SO<sub>4</sub>. The relationship between the adsorbed and equilibrium phosphorus concentration in soil was determined by plotting Langmuir and Freundlich adsorption isotherms. The values of the adsorption maxima, which are the measure of the P adsorption capacities of soil, were highest under the organic nutrient management (10.56 µg P g<sup>-1</sup>) practice which was decreased with levels of phosphorus application in soil and were lowest (5.31 µg P g<sup>-1</sup>) under inorganic nutrient management systems. Bonding energy, which is a measure of resistance to P release in soils, varied from 0.415 to 0.601 mL µg<sup>-1</sup> in the soil under three different nutrient management practices. Water soluble P were recorded 8.2, 11.36 and 10.24 mg kg<sup>-1</sup>, respectively in organic, integrated and inorganic nutrient managed soil under rice-wheat cropping system. Long-term balanced fertilization lowers the bonding energy and adsorption capacity for

P in soil and thereby increasing its desorption potential. This process in turn increases P availability to plants and leads to increased P uptake and yield sustainability.

### *Effect of different nutrient management practices on soil biological properties*

- **Carbon sequestration:** Microorganism play significant role in different ecological processes. Mycorrhizal fungi form a mutualistic relation with higher plants. The production of glomalin (glycoprotein) by arbuscular mycorrhizal fungi is directly linked to soil aggregation and positively correlated with soil aggregate stability. It has been also observed that abundance of arbuscular mycorrhizal fungal hyphae and soil aggregation are

also positively correlated with C and N sequestration. The highest amount of glomalin was extracted from the 100% organically managed plot. A significant difference was observed in the total glomalin content in 100% organic and 100% inorganic plots. The results showed that organic agriculture practices are helpful in building the soil carbon ultimately soil health.

### *Population of different microbial groups:*

Maximum population of bacteria, fungi and actinomycetes was observed in 100% organically managed plants. A continuous decrease in the population was observed with increasing percentage of inorganic inputs.

**Table 33. Effect of different nutrient management systems on carbon sequestration in the form of glomalin**

Treatments	Glomalin (mg/kg Soil)			
	CS1 (Basmati rice-wheat- Sesbania)	CS2 (Rice- Barley- Green Gram)	CS3 [Maize (pop corn)- Potato- Okra]	CS4 [Maize (sweet corn)-Mustard-Sesbania Green Manure)
T1 (100%) organic)	513.43±9.01	652.74±7.97	593.30±11.96	513.29±13.21
T2 (75% O+ 25% InO)	357.14±11.57	583.99±10.89	436.20±9.45	479.13±14.21
T3 (50% O+50% InO)	302.89±7.09	481.45±12.52	324.78±11.69	433.20±9.32
T4 (25% O+75% InO)	273.92±8.32	433.83±13.71	263.16±10.49	323.55±9.81
T5 (100% InO)	210.47±9.87	149.66±8.12	143.09±10.76	230.65±9.72
T6 (State Recommendation)	239.45±12.41	208.63±7.89	220.04±13.19	256.12±10.09

**Table 34. Effect of different nutrient management systems on bacterial population**

Treatments	Bacterial population (CFU/g of soil)			
	CS1 (Basmati rice-wheat- Sesbania)	CS2 (Rice- Barley- Green Gram)	CS3 [Maize (pop corn)- Potato- Okra]	CS4 [Maize (sweet corn)-Mustard-Sesbania Green Manure)
T1 (100%) organic)	2.24×10 <sup>7</sup>	2.02×10 <sup>7</sup>	1.87×10 <sup>7</sup>	1.91×10 <sup>7</sup>
T2 (75% O+ 25% InO)	2.13×10 <sup>7</sup>	1.76×10 <sup>7</sup>	1.52×10 <sup>7</sup>	1.78×10 <sup>7</sup>
T3 (50% O+50% InO)	1.76×10 <sup>7</sup>	1.50×10 <sup>7</sup>	1.48×10 <sup>7</sup>	1.78×10 <sup>7</sup>
T4 (25% O+75% InO)	1.76×10 <sup>7</sup>	1.35×10 <sup>7</sup>	1.39×10 <sup>7</sup>	1.76×10 <sup>7</sup>
T5 (100% InO)	1.21×10 <sup>7</sup>	9.7×10 <sup>6</sup>	8.3×10 <sup>6</sup>	9.4×10 <sup>6</sup>
T6 (State Recommendation)	1.35×10 <sup>7</sup>	1.12×10 <sup>7</sup>	1.21×10 <sup>7</sup>	1.19×10 <sup>7</sup>

**Table 35. Effect of different nutrient management systems on fungal population.**

Treatments	Fungal population (CFU/g of soil)			
	CS1 (Basmati rice-wheat- Sesbania)	CS2 (Rice- Barley- Green Gram)	CS3 [Maize (pop corn)- Potato- Okra]	CS4 [Maize (sweet corn)-Mustard-Sesbania Green Manure)
T1 (100%) organic)	6.1×10 <sup>4</sup>	7.2×10 <sup>4</sup>	8.4×10 <sup>4</sup>	7.7×10 <sup>4</sup>
T2 (75% O+ 25% InO)	5.4×10 <sup>4</sup>	6.3×10 <sup>4</sup>	7.8×10 <sup>4</sup>	6.6×10 <sup>4</sup>
T3 (50% O+50% InO)	4.5×10 <sup>4</sup>	4.8×10 <sup>4</sup>	7.0×10 <sup>4</sup>	5.4×10 <sup>4</sup>
T4 (25% O+75% InO)	4.3×10 <sup>4</sup>	4.7×10 <sup>4</sup>	6.0×10 <sup>4</sup>	3.3×10 <sup>4</sup>
T5 (100% InO)	3.0×10 <sup>4</sup>	4.0×10 <sup>4</sup>	4.6×10 <sup>4</sup>	2.3×10 <sup>4</sup>
T6 (State Recommendation)	3.3×10 <sup>4</sup>	4.8×10 <sup>4</sup>	5.7×10 <sup>4</sup>	3.1×10 <sup>4</sup>

**Table 36. Effect of different nutrient management systems actinomycetes population.**

Treatments	Bacterial population (CFU/g of soil)			
	CS1 (Basmati rice-wheat- Sesbania)	CS2 (Rice- Barley- Green Gram)	CS3 [Maize (pop corn)- Potato- Okra]	CS4 [Maize (sweet corn)-Mustard-Sesbania Green Manure)
T1 (100%) organic)	8.8×10 <sup>6</sup>	3.3×10 <sup>6</sup>	6.7×10 <sup>6</sup>	5.9×10 <sup>6</sup>
T2 (75% O+ 25% InO)	7.1×10 <sup>6</sup>	2.2×10 <sup>6</sup>	4.7×10 <sup>6</sup>	5.1×10 <sup>6</sup>
T3 (50% O+50% InO)	4.4×10 <sup>6</sup>	1.9×10 <sup>6</sup>	5.3×10 <sup>6</sup>	3.7×10 <sup>6</sup>
T4 (25% O+75% InO)	4.0×10 <sup>6</sup>	2.0×10 <sup>6</sup>	3.8×10 <sup>6</sup>	2.8×10 <sup>6</sup>
T5 (100% InO)	2.9×10 <sup>6</sup>	1.5×10 <sup>6</sup>	3.0×10 <sup>6</sup>	1.6×10 <sup>6</sup>
T6 (State Recommendation)	3.3×10 <sup>6</sup>	1.9×10 <sup>6</sup>	3.6×10 <sup>6</sup>	2.2×10 <sup>6</sup>

## Conclusion

- Based on the above mentioned results, we conclude that nutrient management with organic inputs helps in building the soil health by improving the soil microflora and amount of carbon

sequestered which is very important for sustainable agriculture.

## Evaluation of weed management practices under organic maize-mustard cropping system

### Treatment details

Treatment	Treatment details (Maize-Mustard system)	
	Maize	Mustard
T1	Hand weeding at 25 and 50 DAS	Hand weeding at 25 and 50 DAS
T2	One mechanical weeding at 25 days after sowing+ One Hand weeding at 50 DAS	One mechanical weeding at 25 days after sowing+ One Hand weeding at 50 DAS
T3	Intercropping with Green gram (1:1)	Intercropping with Chickpea (1:1)

Treatment	Treatment details (Maize-Mustard system)	
	Maize	Mustard
T4	Stale seed bed + reduced spacing (45×20 cm) + mulching with mustard straw + one Hand weeding at 40 DAS	Stale seed bed + reduced spacing (30× 10 cm) + mulching with maize straw + one Hand weeding at 40 DAS
T5	Locally available weed mulch (Water hyacinth 4 t/ha dwb) + one hand pulling at 40 DAS	Locally available weed mulch (Water hyacinth 4 t/ha dwb) + one hand pulling at 40 DAS
T6	Incorporation of mustard seed meal 15 days before sowing @ 5t/ha + one hand weeding at 40 DAS	Incorporation of mustard seed meal 15 days before sowing @ 5t/ha + one hand weeding at 40 DAS
T7	Soil solarization with 25 μ polythene mulch during summer + one hand weeding at 40 DAS	Soil solarization with 8-25 microns polythene mulch during summer (only in kharif) + one hand weeding at 40 DAS
T8	ITK for weed control (mulching with eucalyptus leaves @ 5t/ha dwb) and one hand weeding at 40 DAS	ITK for weed control (mulching with eucalyptus leaves @ 5t/ha dwb) and one hand weeding at 40 DAS

### *Effect of different organic weed management practices on soil biological properties*

The effect of different weed management practices on the population of soil microorganisms was studied

and it was observed that soil solarization leads to slight decrease in the population of different microbial groups (Table 37).

**Table 37. Effect of different weed management practices on microbial population of soil under mustard-maize cropping system.**

Treatments	Population of different microbial groups		
	Bacteria (CFU/g soil)	Fungi (CFU/g soil)	Actinomycetes (CFU/g soil)
T1 (Hand weeding at 25 & 50 DAS)	1.34×10 <sup>7</sup>	6.7×10 <sup>4</sup>	2.9×10 <sup>6</sup>
T2 (Mechanical weeding 25 DAS+ Hand weeding 50 DAS)	1.74×10 <sup>7</sup>	6.1×10 <sup>4</sup>	2.0×10 <sup>6</sup>
T3 (Intercropping with green gram (1:1))	1.57×10 <sup>7</sup>	6.2×10 <sup>4</sup>	1.6×10 <sup>6</sup>
T4 (Stale seed bed+reduced spacing+mulching with same crop residue +Hand Weeding at 40DAS)	1.40×10 <sup>7</sup>	6.3×10 <sup>4</sup>	3.6×10 <sup>6</sup>
T5 (Weed mulch+ Hand pulling at 40 DAS)	1.75×10 <sup>7</sup>	5.9×10 <sup>4</sup>	3.4×10 <sup>6</sup>
T6 (Incorporation of mustard oil cake 15 days before sowing @ 5 t/ha + hand weeding at 40 DAS)	1.56×10 <sup>7</sup>	6.7×10 <sup>4</sup>	3.4×10 <sup>6</sup>
T7 (Soil solarization with 8-25 micron polythene sheet during summer+ Hand weeding at 40 DAS)	1.4×10 <sup>7</sup>	5.4×10 <sup>4</sup>	1.6×10 <sup>6</sup>
T8 ITK (muching with eucalyptus leaves @ 5 t/ha dwb+ hand weeding at 40 DAS)	1.75×10 <sup>7</sup>	5.9×10 <sup>4</sup>	3.5×10 <sup>6</sup>

## Evaluation of zero budget farming involving Beejamrit, Jeevamrit and Ghanjeevamrit in basmati rice –wheat cropping system

### Treatment details:

1. Control
2. NPOF developed package
3. Gurukul package (Beejamrit, Jeevamrit and Ghanjeevamrit) (Product supplied by Gurukul)
4. Locally prepared Gurukul products (Beejamrit, Jeevamrit and Ghanjeevamrit)

5. Location specific improved products (Beejamrit, jeevamrit and Ghanjeevamrit) (Prepared at centre)
6. Integrated crop management (50% organic + 50% inorganic)

**Results:** The highest population of bacteria, fungi and actinomycetes was found in the plots managed by under NPOF package but the differences among the treatment are not significant. This is the first season of experiment which could be a probable reason for this. A slight reduction in the population of all these three groups was found in the samples after rice harvest which may be driven by field conditions (anaerobic/flooded).

**Table 38. Effect of different nutrient management practices on microbial population of soil under mustard-maize cropping system (Season 1 After wheat harvest).**

Treatments	Population of different microbial groups		
	Bacteria (CFU/g soil)	Fungi (CFU/g soil)	Actinomycetes (CFU/g soil)
T1 Control	1.07×10 <sup>7</sup>	5.0×10 <sup>4</sup>	1.9×10 <sup>6</sup>
T2 NPOF developed package	2.36×10 <sup>7</sup>	7.2×10 <sup>4</sup>	2.4×10 <sup>6</sup>
T3 Gurukul package	1.57×10 <sup>7</sup>	6.6×10 <sup>4</sup>	2.11×10 <sup>6</sup>
T4 Locally prepared gurukul products	1.83×10 <sup>7</sup>	5.7×10 <sup>4</sup>	2.5×10 <sup>6</sup>
T5 Location specific improved products	1.80×10 <sup>7</sup>	6.6×10 <sup>4</sup>	2.14×10 <sup>6</sup>
T6 Integrated nutrient management (50% Org.+50% Inorg.)	1.76×10 <sup>7</sup>	5.4×10 <sup>4</sup>	2.12×10 <sup>6</sup>

**Table 39. Effect of different nutrient management practices on microbial population of soil under mustard-maize cropping system (Season 2 After rice harvest).**

Treatments	Population of different microbial groups		
	Bacteria (CFU/g soil)	Fungi (CFU/g soil)	Actinomycetes (CFU/g soil)
T1 Control	8.9×10 <sup>6</sup>	3.3×10 <sup>4</sup>	1.1×10 <sup>6</sup>
T2 NPOF developed package	1.54×10 <sup>7</sup>	3.4×10 <sup>4</sup>	1.95×10 <sup>6</sup>
T3 Gurukul package	1.05×10 <sup>7</sup>	3.07×10 <sup>4</sup>	1.87×10 <sup>6</sup>
T4 Locally prepared gurukul products	1.03×10 <sup>7</sup>	2.3×10 <sup>4</sup>	2.09×10 <sup>6</sup>
T5 Location specific improved products	1.2×10 <sup>7</sup>	3.9×10 <sup>4</sup>	2.47×10 <sup>6</sup>
T6 Integrated nutrient management (50% Org.+50% Inorg.)	9.9×10 <sup>6</sup>	2.76×10 <sup>4</sup>	1.81×10 <sup>6</sup>

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

Organically grown sugarcane crop (cv. Co 0238) of ten month old was selected for raising sugarcane nursery in disposable glasses in March, 2019. The buds were separated from cane by two methods viz. bud chipper and Manual cutting. Separated buds were planted into glasses using filling material soil and

vermicompost in 1:1 ratio. Germination percentage of buds was significantly affected by method of cutting and planting time. Higher germination (93.65%) was recorded in buds harvested with bud chipper machine as compared to manual cutting (80.76%). Germination percentage of buds was reduced with delay in planting. Higher germination (84.0%) was recorded when sets were planted on the same day compared next day of crop harvesting.

**Table 1: Germination percentage of sugarcane buds as affected by method of cutting and planting time.**

Treatment	Buds planted (No.)	Germinated buds (No.)	Non-germinated buds (No.)	Germination (%)
Method of bud cutting				
Bud chipper	315	295	20	93.65
Manual	1107	894	213	80.76
Planting time				
Same day of crop Harvesting	500	420	80	84.00
Next day of crop harvesting	1107	894	213	80.76



**Fig. 11. Bud chip method of sugarcane nursery raising**

## Technology Transfer and Human Resource Development (TT & HRD)

### Project Title: Refinement of horticulture based farming system models for food and nutritional security

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, 0.4 ha), vegetable crops based (CS 2, 0.5 ha), field crop based (CS 3, 0.4 ha) and Pond- dyke system (0.1 ha) were evaluated under this project. (Table 40)

Under fruit crop based system (CS-1), mango, guava and banana 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 respectively. In vegetable based system (CS-2) turmeric, bottlegourd-cauliflower-tomato and brinjal-potato-beans were grown while under crop based system (CS-3), Rice-wheat and sugarcane-ratoon-wheat system and pond-dyke system (0.10 ha) were evaluated. The details of different modules in presented in Table 40. Among the different modules in study highest net returns of Rs. 1,50,266 were recorded from

**Table 40. Enterprise & component of horticulture based farming system**

Enterprise (s) category	Component (s)	Area (ha) or size (numbers)	Details
Primary	Horticulture	0.9	1. Mango (Amrapalli) + intercrops (Onion-okra-Brinjal-Pea) Mango( Dashehri) + intercrops (pumpkin-potato-carrot) 2. Banana + intercrops (Turmeric) 3. Guava + intercrop (Turmeric) 4. Kinnow + intercrops (Onion- okra-lobia-broccoli)
	1. Orchards (With IC)	0.4	
	2. Vegetables	0.5	1. Turmeric (March-April) 2. Okra-brinjal-tomato- cauliflower 3. Beans- Brinjal+ Okra-Potato
Secondary	Crops	0.5	1. Rice-wheat-dhaincha (Green manure) 2. Sugarcane- sugarcane ratoon- wheat
Complimentary	Fisheries	0.10	Pond-Dyke system with Vegetables
Supplementary	Poultry	30 birds	Poultry birds to be integrated in the pond-dyke system

**Table 41: Economics of Horticulture based Farming system Model (2017-18)**

S.No.	System	Gross returns	Net Returns	COC	B:C Ratio
1	Fruit based system(0.4 ha)	2,10,520	1,50,266	60,254	3.49
2	Vegetable based system(0.5 ha)	1,88,550	97,782	90,768	2.07
3	Crop based system(0.5 ha)	1,90,748	125198	65,550	2.90
4	Pond-Dyke system(0.10 ha)	29,200	16,500	12,700	2.29
	<b>Total</b>	<b>6,19018</b>	<b>3,89,746</b>	<b>2,36,272</b>	<b>2.48</b>



**Fig.12. Pond-dyke system (0.10 ha)**

**Table 42. Microbial status of pond dyke soil**

Sample	Bacteria (CFU/gm) gm)	Fungi (CFU/gm)	Actinomycetes (CFU/gm)
T 1 (crop irrigated with pond water having poor growth)	$3.9 \times 10^5$	$3.4 \times 10^3$	$4.2 \times 10^4$
T 2 (crop irrigated with pond water having luxuriant growth)	$4.7 \times 10^5$	$4.2 \times 10^3$	$3.8 \times 10^4$
CONTROL (Crop irrigated with tubewell water)	$2.29 \times 10^7$	$7.3 \times 10^4$	$8.5 \times 10^6$

the module 1 (fruit based system with intercropping of vegetables) followed by Crop based system (Rs 1,25,198/). The least benefit of Rs 97,782/ was recorded from the vegetable based system. This is because of the higher labour, low price of produce fixed at institute for sale of vegetables and high inputs required for raising of vegetables. The highest B:C ratio of 3.49:1 was recorded for module 1. This is because of the intercropping of vegetables in the inter spaces among

the fruit trees resulted in providing higher returns. The B:C ration of crop based system (2.90:1) was also recorded to be higher than module vegetable based system (2.07:1). This is because of the higher cost incurred for cultivation of vegetables as compared to the field crops grown under study as shown in Fig. 12. The pond-dyke system was reported to be highly income generating as it provided net returns worth Rs 12,700 with B: C ratio of 2.29 from 0.10 ha area.



**Fig. 13. A view of horticulture based farming system model at Institute**

Hence this system has a great potential in providing higher returns to the farmers and hence can be disseminated among them.

### Soil Microbial studies

Soil Microbiological studies were undertaken to judge the quality of soil of pond-dyke system. The details of the study is presented in Table 42. The results showed that The overall microbial population was found significantly lower in the pond soil which may be due to initial establishment phase. A slightly lower microbial load was observed in the poor growth areas. The general soil nutrient status was also recorded for all the modules under study.

### Externally funded Projects

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

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

## Development of Integrated Organic Farming System (IOFS) model for Western Plain Zone

One acre IOFS model comprising of 5 modules such as **food systems** (basmati rice-durum wheat-*sesbania* in 0.15 ha, basmati rice-mustard-green gram in 0.05 ha), **fodder systems** (sorghum + cowpea-maize+cowpea-oat in 0.05 ha and maize + cowpea-sorghum + cowpea-berseem in 0.05 ha), **kitchen system** in 0.040 ha, **pest repellent system** in 0.024 ha and **dairy including bio-input production system** (1 buffalo and 1 cow in 0.05 ha) is being studied. Establishment and evaluation of all the modules except dairy is in progress from 2017. *The dairy including bio-input production module is yet to be integrated due to the delay in shed construction process.* The share in area allocation for different modules is given in Fig 14.

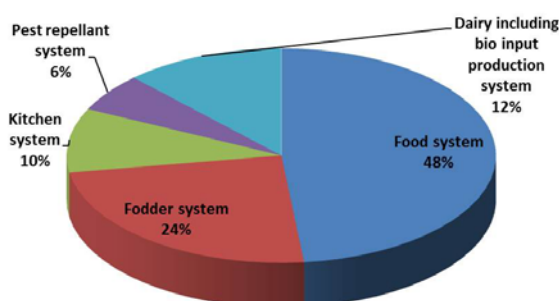


Fig. 14. Share of area in different modules of IOFS model

**Basmati rice-durum wheat-*sesbania*:** In the IOFS model basmati rice-wheat-*sesbania* cropping system was tested in 0.15 ha. In the first year of study, basmati rice variety Pusa Basmati 1 was grown in the system which has recorded the grain and straw yield of 383 and 458 kg from 0.15 ha which works out to productivity of 2550 and 3050 kg/ha respectively (Table 43). Gross and net return of Rs 59,100 and Rs 11,850/ha were recorded with B: C ratio of 1.3. In the second year, basmati rice variety Pusa 1121 was tested which recorded grain and straw yield of 450 and 635 kg respectively from 0.15 ha which works out to 3000 and 4233 kg/ha of productivity with net return of Rs 23,217/ha and B: C ratio of 1.5. In the second year, due to the change in variety and management, 17 % high yield was recorded under organic management. Durum wheat recorded grain and straw yield of 394 kg and 484 kg from 0.15 ha which works out to productivity of 2620 and 3220 kg/ha respectively in the second year. The organically grown crop of durum wheat recorded gross and net returns of Rs 68,597 and Rs 41,317/ha respectively with B: C ratio of 1.5 during 2017-18. The productivity was marginally higher (1 %) in the second year compared to first year. *Sesbania aculeata* green manure was incorporated at 48 days after the sowing which produced 3.60 t of green biomass from 0.15 ha which is about 24,000 kg/ha.

Table 43. Performance of different crops in Basmati rice-durum wheat-*sesbania* in food system module

Year	Grain yield (kg/0.15 ha)	Grain yield (kg/ha)	Straw yield (kg/0.15 ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	B: C ratio	NRPRI
<b>Basmati rice (PB 1 during 2017 &amp; PB 1121 during 2018)</b>								
2017	398	2653	485	3233	59533	14283	0.3	1.3
2018	450	3000	522	3480	66960	28560	0.7	1.7
<b>Durum Wheat (MPO JW 1215)</b>								
2016-17	390	2600	405	2700	65500	34720	1.1	2.1
2017-18	394	2624	484	3223	68597	41317	1.5	2.5
<b><i>Sesbania aculeata</i></b>								
Green biomass	-	-	3600	24000	-	-	-	-

**Basmati rice-mustard-greengram:** The system was evaluated in 0.05 ha and in the first year basmati rice variety (PB-1) recorded grain and straw yield of 128 and 153 kg (Table 44) from 0.05 ha which corresponds to productivity of 2550 and 3050 kg/ha with net returns of Rs 11,850/ha. In the second year to facilitate the timely sowing of the mustard in the sequence, extra short duration basmati rice variety PB 1509 was grown in place of the PB 1. PB 1509 has recorded grain and straw yield of 140 and 171 kg respectively from 0.05 ha with net returns of Rs 17,590/h and B: C ratio of 1.4. The productivity of basmati rice in the second year was higher by 9 %. Mustard registered grain and stover yield of 130 and 376 kg from 0.05 ha with productivity of 2600 kg/ha. It registered net returns of Rs 90, 430/

ha and Rs 1,19, 540/ha in the first and second year respectively. The yield in the second year was increased by 30%. Greengram (variety Pant Mung 5) recorded grain yield of 40 kg from 0.05 ha with 800 kg of residues. The yield is equivalent to productivity of 800 kg/ha. B:C ratio was found to be 2.9 for greengram.

**Basmati rice-durum wheat-sesbania:** During the year, 2 systems namely Maize+ cowpea- sorghum +cowpea-berseem in 0.05 ha and sorghum +cowpea – maize +cowpea- oat in 0.05 ha were evaluated in the fodder system module and their productivity were compared with normal level. In the maize + cowpea – sorghum + cowpea –berseem system, 7790 kg of green fodder/year can be produced from 0.05 ha which will

**Table 47: Performance of basmati rice-mustard-greengram in food system module**

Year	Grain yield (kg/0.15 ha)	Grain yield (kg/ha)	Straw yield (kg/0.15 ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	B: C ratio	NRPRI
<b>Basmati rice (PB 1 in 2017 and PB 1509 in 2018)</b>								
2017	128	2550	153	3050	57100	11850	1.3	0.3
2018	140	2800	171	3420	62840	17590	1.4	0.4
<b>Mustard (RH 749)</b>								
2017-18	100	2000	357	7140	110710	90430	5.5	4.5
2018-19	130	2600	376	7520	138820	119540	7.2	6.2
<b>Green gram (Pant Mung 5)</b>								
2018	40	800	150	1000	60000	39220	2.9	1.9

**Table 45: Performance of crops in the fodder system module**

Crop	Area (m <sup>2</sup> )	Production (kg)	Fodder sufficient for number of days \$	Productivity (t/ha)	Normal Productivity (t/ha)
<b>Maize+ cowpea- sorghum +cowpea-berseem (0.05 ha)</b>					
Maize + Cowpea	500	2780	92	55.6	29.3 ± 5*
Sorghum+ cowpea	500	2860	95	57.2	49 ± 10**
Berseem	500	2150	71	43.0	80 ± 20***
Gross	1500	7790	258	-	-
<b>Sorghum +cowpea – maize +cowpea- oat (0.05 ha)</b>					
Sorghum+ cowpea	500	2765	92	55.3	49 ± 10**
Maize + Cowpea	500	2685	89	53.7	29.3 ± 5*
Oat	500	1550	52	31.0	67 ± 28****
Gross	1500	7000	233	-	-



**Basmati rice var Pusa Basmati 1121**



**Basmati rice var Pusa Basmati 1509**



**Durum wheat var MPO JW 1215**



**Mustard var RH 749**

**Fig. 15. A view of field crops at ICAR-IIFSR**

be sufficient for supply of green fodder to 2 animals for 258 days (Table 45). The productivity of fodder under organic management compared to normal productivity revealed that maize +cowpea and sorghum + cowpea recorded higher productivity while productivity of berseem is lower. Similarly, the other system sorghum +cowpea – maize +cowpea- oat can supply green fodder for 233 days as it has recorded 7000 kg of green fodder from 0.05 ha in a year. The productivity of oat is lesser under organic management than the normal productivity. Hence, it can be inferred that fodder system in 0.10 ha with these 2 systems can supply sufficient green fodder to 2 animals for the organic farming system.

### **Kitchen system**

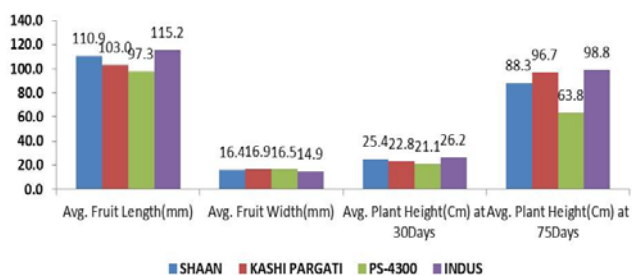
A total of 13 vegetables were evaluated in the kitchen system (Table 46) during the year in an area of 0.026 ha which has resulted in production of 684 kg of vegetables under organic management. This can meet the 5 member family requirement of other vegetables category for 261 days, roots and tuber crops for 331 days and requirement of leafy vegetables for 184 days alone. In addition four varieties of okra were evaluated under organic management with same nutrient source and level (vermicompost @ 10t/ha) for identification of suitable variety. Among the varieties Indus recorded higher yield due to better growth and yield attributing characters (Fig 16 and 17).

**Table 46. Vegetables evaluated in kitchen system**

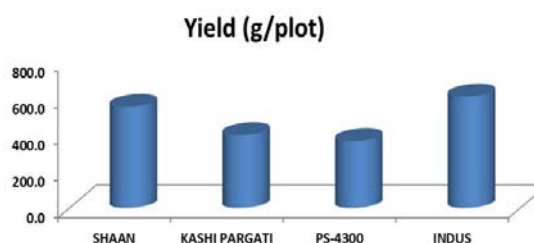
Category **	Name of vegetables	Area (m <sup>2</sup> )	Yield (kg)	Daily requirement (vegetables) for 5 member family (Heavy work)**	No. of days Vegetables requirement can be met for 5 member family
Other Vegetables	Bottle gourd ( <i>K</i> )	100	60	<b>0.02 kg</b> of other vegetables per person per day ( <b>1.0 kg for 5 person/ day</b> )	60
	Brinjal ( <i>K</i> )	50	22		22
	Lobia ( <i>K</i> )	50	18		18
	Beans ( <i>K</i> )	50	12		12
	Chilli ( <i>K</i> )	50	7		7
	Pea ( <i>R</i> )	50	32		32
	Broccoli ( <i>R</i> )	50	30		30
	Cauliflower ( <i>R</i> )	50	68		68
	Fenugreek ( <i>R</i> )	50	12		12
Total			261		261
Roots and Tuber crops	Radish ( <i>R</i> )	50	72	<b>0.02 kg</b> of Roots and Tuber crops per person per day ( <b>1.0 kg for 5 person/ day</b> )	72
	Beetroot ( <i>R</i> )	50	61		61
	Potato ( <i>R</i> )	120*	198		198
Total			331		331
Leafy vegetables	Spinach ( <i>R</i> )	50	80	<b>0.01 kg</b> of Leafy vegetables per person per day ( <b>0.5 kg for 5 person/day</b> )	160
	Coriander ( <i>R</i> )	50	12		24
Total			92		184
<b>Grand Total (Kitchen system)</b>			<b>684</b>		

\* Additional 120 m<sup>2</sup> area was used for potato cultivation; *K*- *Kharif*, *R*- *Rabi*

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



**Fig. 16. Growth and yield parameters of okra varieties under organic management under similar nutrient environment**



**Fig. 17. Yield of okra varieties under organic management under similar nutrient environment**

**Table 47.** Estimated dietary supply from the kitchen system

Nutrient	Estimated supply
Dietary energy (kcal)	11721
Carbohydrates (g)	2348
Dietary fiber (g)	999
Fat (g)	97
Protein (g)	1055
Phosphorus (g)	4708
Potassium (g)	12
Magnesium (mg)	4396
Calcium (mg)	4928
Sodium (mg)	3330
Iron (mg)	206
Zinc (mg)	133
Vitamin A (µg)	2264
Vitamin C (mg)	493
Thiamin (mg)	18
Riboflavin (mg)	39
Folate (µg)	20
Niacin (mg)	300
Vitamin B6 (mg)	14



**Fig. 18.** Vegetable production in kitchen system



**Fig. 19.** Evaluation of okra varieties under organic management in kitchen system

## Pest repellent system

Establishment of pest repellent system in 0.026 ha is in process. *Ipomoea carnea* (besharam) and *Ricinus communis* (castor) were established on bunds. *Datura metal* and *Calotropis gigantea* (aak, Madar) were established in beds and used for preparation of dashparni extract for pest management under organic production system. Pest repellent and pollinator attractant tree and shrub species will be planted in the next year.

## Project Title: Development of Integrated Organic Farming System (IOFS) model for other regions through AI-NPOF

Seven IOFS models are under evaluation in 6 states namely Gujarat, Kerala, Meghalaya, Rajasthan, Tamil Nadu and Uttarakhand. Among the 7 models, at 4 locations namely SK Nagar, Thiruvananthapuram, Udaipur and Almora, dairy component is yet to be integrated. The economic analysis of the system

Table 48. Economic performance of IOFS model at different locations

Components	Area (ha)	Gross returns (Rs)	Cost (Rs)	Net returns (Rs)
<b>Gujarat (SK Nagar)*</b>				
Field crop based system (Groundnut-wheat-green gram; Fodder bajra-fodder maize+oat-fodder bajra; boundary plantation), 3 livestock; vermicompost	0.40	99,915	73,696	46,338
<b>Kerala (Calicut &amp; Thiruvananthapuram)</b>				
<b>Calicut:</b> Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost, 4 cows)	0.40	3,47,980	2,39,570	1,08,410
<b>Thiruvananthapuram*:</b> Cassava + vegetable cowpea, Taro, Maie, Napier grass	0.24	2,45,859	1,08,298	1,35,160
<b>Meghalaya (Umiam)</b>				
Field & horticulture based system (Cereals + pulses + vegetables + fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost	0.43	1,30,738	56,835	73,903
<b>Rajasthan (Udaipur)*</b>				
Field crop based system (Sweet corn + blackgram-wheat; Fodder maize + cowpea-berseem-sesbania; tomato-cowpea; guava, compost unit of NADEP, vermicompost, enriched compost, vermiwash, BD 500, BD 501 & earthworm multiplication)	0.45	97,690	34,622	63,068
<b>Tamil Nadu (Coimbatore)</b>				
Field crop based system (Green manure-okra-maize; greenmanure-cotton-red gram, fodder, pest repellent cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow, 1 heifer & 1 bull calf + vermicompost + boundary plantations ( <i>Gliricidia</i> , <i>coconut</i> ))	0.40	5,34,013	2,16,090	3,17,923
<b>Uttarakhand (Almora)*</b>				
Vegetable based system (Field crops, vegetables, fruits, fodder)	0.43	2,77,646	1,21,445	1,56,201

\*Dairy component not yet integrated

indicates that under organic farming system with livestock component, a net income of Rs 0.73 lakhs (field and horticulture based) to 3.17 lakhs per acre (commercial crops based) (Table 48) can be obtained depending upon the combination of modules adopted. Further, the performance of the system where in livestock component is not integrated, it varied from 0.46 lakhs (field crop based) to 1.56 lakhs (vegetable based) depending upon the crops grown. The nutrient and energy budgeting is in progress.

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

This project was initiated to develop farming system model for profitability and livelihood improvement of different farmers categories and for validation and refinement of on-station technologies at farmers' field. Three villages in three districts were identified namely;

- **Muzaffarnagar** : Badhai Kalan and Sahajpur Kalan
- **Shamli** : Panjokhara and Ramgadi
- **Haridwar** : Mandawali and Narsan Khurd

Basic information and base line survey of Badhai Kalan and Sahajpur Kalan villages from Muzaffarnagar district and Mandawali of Haridwar district has been completed and survey data analysis of one village (Badhai Kalan) completed.

**Table 49. Performance of varieties in Sugarcane - Paddy farming system**

Sr.No.	Crop	Variety	Duration (Days)	Disease & Infestaion	Yield (Kg/ha)
1.	Paddy	PB-1509	75 to 80	Very Less	5375
2.	Paddy	PB-1121	145 to 155	High Infestation	4980

**Farmers Feedback-** Farmers like PB-1509 due to its Short duration , less disease and Pest Infestation and more yield Performance in Sugarcane – Paddy cropping system.

Specific interventions as indicated below were demonstrated in the farmers field and their results are given below

- 1 Introduction of New Varieties of rice
- 2 Introduction of Intercropping
  - a. Sugarcane + Spices
  - b. Sugarcane + Vegetables

**1. Introduction of New Varieties of rice**

**Sugarcane - Paddy farming system**

In this farming system a new variety PB-1121 was supplied by institute and other variety PB-1509 was grown by the farmers in their farmer practice. In this intervention 20 nos. of farmers were included from both villages (Badhai kalan 10 farmers and 10 farmers of Sahajpur kalan).

**2. Introduction of Intercropping**

**a. Inter- cropping Sugarcane+ Spices :**

**Sugarcane+ Spices:** In this intervention total 10 nos of farmers were taken( 5 farmers from Badhai kalan and 5 farmers from Sahajpur kalan). The SEY under sugarcane+ spices farming system to normal cropping system (sole crop)revealed that sugarcane+Fennal recorded higher SEY while sugarcane+coriander is lower(Table 50). Hence it can be inferred that sugarcane+Fennal more beneficial for the farmers.

**Table 50. Yield performance of Sugarcane + Spices inter cropping system**

Crop	Variety	Date of sowing	Duration of inter crop	Yield of inter- crop (kg/ha)	Yield of Sugarcane (qtl/ha)	SEY (qtl/ha)*
Sugarcane(120cm Distance)	Fennal	23-11-17	170-175	1340	1050	1297(17.9%)
Sugarcane(120cm Distance)	Coriander	23-11-17	120-130	680	1050	1155 (5.0%)
Sugarcane(120cm Distance)	Dill	23-11-17	120-130	540	1050	1191 (8%)
Sugarcane(120cm Distance)	Ajwayan	23-11-17	135-140	578	1050	1174 (7%)
Sugarcane(120cm Distance)	kalonji	23-11-17	135-145	413	1050	1241 (13%)

\*Price of Fennal: Rs. 60/kg; Coriander: Rs.50/kg; Dill: Rs. 85/kg; Ajwayan: Rs.70/kg; Kalonji: Rs. 150/kg; Sugarcane: 325/qt. Yield of sole crop of sugarcane: 1100 qt/ha

**Table 51. Inter- cropping Sugarcane + vegetables**

Crop	Variety	Date of sowing	Duration of inter crop	Yield of inter- crop (kg/ha)	Yield of Sugarcane (qtl/ha)	SEY (qtl/ha)*
Sugarcane (120cm Distance)	Onion	11-01-2019	145-160	104	995	1155 (5%)
Sugarcane (120cm Distance)	Garlic	20-11-2018	140-155	75	995	1341 (22%)
Sugarcane (120cm Distance)	Chilli	13-12-2018	130-145	85	995	1256 (14%)

\*Price of Onion: Rs. 500/qtl.; Garlic: Rs.1500/qtl.; Chilli: Rs. 1000/qtl.; Sugarcane: 325/qt. Yield of sole crop of sugarcane: 1100 qt/ha

### b. Sugarcane + vegetables inter cropping system

Under the sugarcane+ vegetable inter cropping system 4 nos. of were taken from each villages i.e. Badhai kalan and Sahajpur kalan and input was applied by farmers by their own sources only technical guidance was given by institute Scientists. The SEY under sugarcane+ vegetables farming system to normal cropping system (sole crop)revealed that sugarcane+Garlic recorded higher SEY while sugarcane+Onion is lower. Hence it can be say that if farmers grows the garlic as inter crop along with sugarcane will be more beneficial for the farmers (Table 51).

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

The project was initiated 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 six villages of 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.

The Comparative performances of different varieties of poultry at farmer’s field were assessed and farming system modules were developed for each variety for

Table 52. Framing system module for marginal farmers.

Names of Intervention: Introduction of improved variety of poultry (Gramapriya).

Improved IFS	Components	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
0.54 ha	Cropping System:			
CS1: 0.40 ha	Sugarcane-Raton-Wheat	116695	62074	54621
CS2: 0.14 ha	Sorghum-Wheat	19559	9049	10510
	Animal Module:			
	Buffalo (01 no.)	52158	37310	14848
	Poultry (20 nos.)	17966	3375	14591
	Kitchen Garden	1540	350	1190
A	Total Returns from system	207918	112158	95760
	<b>B:C Ratio</b>		<b>1.85</b>	
<b>Benchmark</b>	Crop Module			
CS1: 0.40 ha	Sugarcane-Raton-Wheat	116695	62074	54621
CS2: 0.14 ha	Sorghum-Wheat	19559	9049	10510
	Animal Module:			
	01 Buffaloes	52158	37310	14848
B	Total Returns from system	188412	108433	79979
	<b>B:C Ratio</b>		<b>1.74</b>	

Table 53. Framing system module for marginal farmers.

Names of Intervention: Introduction of improved variety of poultry (CARI Dhanraja).

Improved IFS	Components	Gross Returns (Rs)	Cost of cultivation (Rs)	Net Returns (Rs)
0.54 ha	Cropping System:			
CS1: 0.40 ha	Sugarcane-Raton-Wheat	116695	62074	54621
CS2: 0.14 ha	Sorghum-Wheat	19559	9049	10510
	Animal Module:			
	Buffalo (01 no.)	52158	37310	14848
	Poultry (100 nos.)	35346	9574	25772
	Kitchen Garden	1540	350	1190
A	Total Returns from system	225298	118357	106941
	<b>B:C Ratio</b>		<b>1.90</b>	
<b>Benchmark</b>	Crop Module			
CS1: 0.40 ha	Sugarcane-Raton-Wheat	116695	62074	54621
CS2: 0.14 ha	Sorghum-Wheat	19559	9049	10510
	Animal Module:			
	01 Buffaloes	52158	37310	14848
B	Total Returns from system	188412	108433	79979
	<b>B:C Ratio</b>		<b>1.74</b>	



marginal and landless farmers. In both the cases of marginal and landless farmers, CARI Dhanraja (100 nos.) with supplement feeding has shown higher net income as well as B:C ratio. This is also important that for rearing 100 nos. of CARI Dhanraja in backyard system, optimum space /resources is essential. Alternatively, 20 numbers of Gramapriya with supplement feeding is good option for higher net income followed by dual purpose Vanaraja variety for marginal and landless farmers. The farming system module developed for Gramapriya and CARI Dhanraja are presented in table .1 & 2.

The most prominent farming system of Muzaffarnager district is Crop+Dairy (1-2 dairy animals). The existing farming system of crop + dairy was diversified by introduction of 20 Gramapriya birds to improve their livelihood and income. The benchmark net income of the farmers was Rs. 79,979/- before the intervention, but after the improved farming system through integration of poultry (Gramapriya variety) the net income enhanced to Rs. 95,760/- during the period. The B:C ratio improved from 1.74 to 1.85. The net income as well as B:C ration of Gramapriya was higher than CARI Nirbheek.

The existing farming system of crop + dairy was diversified by introduction of 100 CARI Dhanraja birds for the improvement of livelihood and income of the farmers. The benchmark net income of the farmers was Rs. 79,979/- before the intervention, but after the improved farming system through integration of poultry (CARI Dhanraja variety) the net income enhanced to Rs. 1,06,941/- during the period. The B:C ratio improved from 1.74 to 1.90. The net income as well as B:C ration of CARI Dhanraja was higher than all the other varieties of poultry tested at the field level.

**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 Nainital District, Uttarakhand. A

Survey was conducted to know the women's work involvement, access and control over the resources, decision making, drudgery prone activities and livelihood opportunities of women in pre-dominant farming systems of Nainital district. The total sample comprises a random sample of 60 households i.e. (1 District x 3 blocks/district x 2 villages/ block x 10 households) using a stratified sampling frame. Basani, Mitha Avala, Naina, Jauli, Gahna, and Dadim were the villages surveyed under Nainital district. Data was collected by personal interview method using pre-tested structured questionnaire through face to face interaction with the men and women farmers.

**Socio-economic status of farmers in pre-dominant farming systems of Hill Zone of Uttarakhand**

Around  $87.9 \pm 12.6$  per cent households were found under the male headship and remaining  $11.98 \pm 12.59$  per cent was found under the female headship. Amongst them maximum numbers of female headed households was found under FS<sub>1</sub> (30%) whereas FS<sub>3</sub> and FS<sub>5</sub> were found under the male headship. Further study shows that around  $58.8 \pm 29.96$  per cent farmers were involved in farming as a major occupation and remaining  $32.60 \pm 24.29$  % were found engaged in farming along with service as major occupation. The average landholding was found  $0.46 \pm 0.48$  ha per farm household under men ownership and  $0.07 \pm 0.06$  ha per farm household under women ownership. Amongst them FS<sub>5</sub> was having maximum farm size i.e. 1.31 ha per farm household under men ownership, however nil area was found under women ownership. FS<sub>4</sub> exhibiting the least farm size as 0.09 ha per farm household under men ownership and 0.11 ha area per household under women ownership.

The analysed data revealed that around 26.6 per cent of households were having FS<sub>5</sub> : Horticulture (Fruits/Vegetables) + Dairy farming system covering 52.05 per cent total farming area with annual net return of Rs 73,128/- with least share of non-farm income (17.74 %) and was a dominant farming system of Hillzone of Uttarakhand followed by FS<sub>2</sub> : Livestock (Dairy/poultry/goatry) + Crop + Horticulture

**Table 54. Existing farming systems of Hillzone of Uttarakhand**

<i>Existing farming systems</i>								
	FS <sub>1</sub> (n=10)	FS <sub>2</sub> (n=15)	FS <sub>3</sub> (n=7)	FS <sub>4</sub> (n=6)	FS <sub>5</sub> (n=16)	FS <sub>6</sub> (n=2)	FS <sub>7</sub> (n=2)	FS <sub>8</sub> (n=2)
Area share (%)	3.9	23.25	7.5	2.76	52.05	6.34	0.45	4.08
Farmer's distribution (%)	16.6	25.0	11.6	10.15	26.6	3.33	3.33	3.33
Operational Expenditure (Rs)	26,872	28,147	27,133	18,500	58,210	51,818	21,666	40,000
Farm Gross Return (Rs)	40,318	53,651	47,594	34,761	13,1339	1,12569	33,300	10,5845
Farm Net Return (Rs)	13,446	25,504	20,461	16,261	73,128	60,751	11,633	65,845
Non-farm Income (Rs)	98,061	1,05813	1,04285	1,29500	28,333	42,500	42,000	30,000
(%) Share of Non-farm Income	70.86	66.35	68.66	78.83	17.74	27.40	78.83	22.08

\*FS<sub>1</sub>: Horticulture (Vegetable/Spices) + Livestock (Dairy/poultry/goatry) +Crop, FS<sub>2</sub>: Livestock (Dairy/poultry/goatry) + Crop + Horticulture (Vegetables/Spices/Fruits), FS<sub>3</sub>: Crop + Livestock(Dairy/poultry/goatry), FS<sub>4</sub>: Horticulture (vegetables/spices) + Crop, FS<sub>5</sub>: Horticulture (Fruits/Vegetables) + Dairy FS<sub>6</sub>: Horticulture (Fruits/Vegetables), FS<sub>7</sub>:Horticulture(Fruits/Vegetables/Spices)+Crop, FS<sub>8</sub>: Horticulture (Fruits/Vegetables) + Dairy + Crop

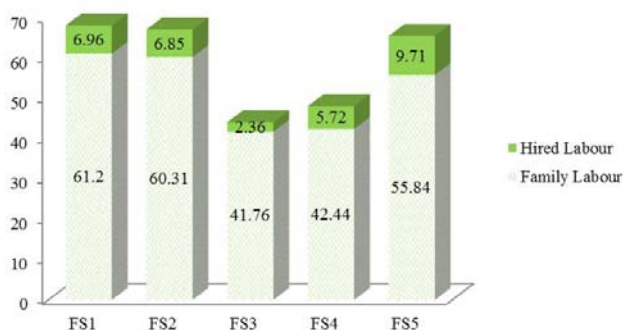
(Vegetables/spices/fruits) exhibiting 25.0 per cent farmers, 23.25 per cent area share and an annual net return of Rs 25,504/-.However the highest share of non-farm income was found in FS<sub>4</sub>:Horticulture (vegetables/spices) + Crop and FS<sub>7</sub>:Horticulture(F/V/S)+Crop (78.83 per cent in each). Farming Systems FS<sub>6</sub>, FS<sub>7</sub> and FS<sub>8</sub> can be eliminated from the further study due to least farmer's distribution percentage for all the cases and least area share percentage in case of FS<sub>7</sub>. (Table 54).

Fruits (apple/plum/appricot/pear/peach)+ vegetables (potato/pea/beans/cualiflower) + maize was the most dominant cropping system found followed by Paddy/soyabean-wheat in hillzone of Uttarakhand. The major crop sown in all the pre-dominant farming system was found wheat followed by paddy covering around 52 % of the gross sown area whereas in case of FS<sub>5</sub> apple followed by potato and plum were found the major crops sown covering around 24 % of the gross sown area (Table 55).

**Table 55. Prevalent cropping systems under the pre-dominant farming systems**

<b>Cropping Systems (CS)</b>			<b>Percentage</b>
FS <sub>1</sub>	CS <sub>1</sub>	Radish/spinach/Fenugreek + Wheat	40
	CS <sub>2</sub>	Paddy/Maize-Wheat + vegetables(ginger/colocasia)	60
FS <sub>2</sub>	CS <sub>1</sub>	Paddy/Maize-Wheat + Horticulture (ginger/colocasia/mango/jackfruit)	40
	CS <sub>2</sub>	Paddy/soyabean-wheat + vegetables (ginger/colocasia)	40
	CS <sub>3</sub>	Paddy-wheat + vegetables (Tomato – okra)	20
FS <sub>3</sub>	CS <sub>1</sub>	Paddy –wheat	42.8
	CS <sub>2</sub>	Paddy/soyabean-wheat	28.6
	CS <sub>3</sub>	Paddy/Maize-Wheat	28.6
FS <sub>4</sub>	CS <sub>1</sub>	Radish/spinach/Fenugreek + Wheat	100
FS <sub>5</sub>	CS <sub>1</sub>	Fruits(apple/plum/appricot/pear/peach)+vegetables(potato/pea/cabbge/cualiflower) + Maize	100

\*FS<sub>1</sub>: Horticulture (Vegetable/Spices) + Livestock (Dairy/poultry/goatry) +Crop, FS<sub>2</sub>: Livestock (Dairy/poultry/goatry) + Crop + Horticulture (Vegetables/Spices/Fruits), FS<sub>3</sub>: Crop + Livestock(Dairy/poultry/goatry), FS<sub>4</sub>: Horticulture (vegetables/spices) + Crop, FS<sub>5</sub>: Horticulture (Fruits/Vegetables) + Dairy FS<sub>6</sub>: Horticulture (Fruits/Vegetables), FS<sub>7</sub>:Horticulture(Fruits/Vegetables/Spices)+Crop, FS<sub>8</sub>: Horticulture (Fruits/Vegetables) + Dairy + Crop



**Fig. 20. Female contribution (%) in pre-dominant farming systems**

Data pertaining to Fig 1 clearly shows that the maximum female contribution was found in FS<sub>1</sub>: Horticulture (V/S) + Livestock (Dairy/poultry/goatry) + Crop followed by FS<sub>2</sub>: Livestock (Dairy/poultry/goatry) + Crop + Horticulture (V/S/F) and FS<sub>5</sub>: Horticulture (Fruits/Vegetables) + Dairy. Further, FS<sub>1</sub> is having maximum number of female headed households (30%). The least female contribution was

observed in FS<sub>3</sub>: Crop + Livestock (Dairy/poultry/goatry) farming system. In various activities/farm operations *viz.* Collection and carrying of wood for fuel through headload, carrying of leaves and grasses, leaf litter through headload collection as well as carrying of dung through headload, milking, furrow making, sowing through dibbling/broadcasting, paddy transplanting, FYM preparation, carrying and its application in field, weeding, harvesting of field crops, preparation of vegetable fields, weeding, picking of vegetables, transportation of vegetables/crops as headload, threshing, winnowing through fan as well as under natural wind, post-harvest management and processing etc. the female contribution was found highest (40-100%).

Carrying of leaf litter found to be the most drudgery prone activity depicted by its highest Load carrying drudgery Index (LCDI) (0.76- and 0.82) followed by carrying of leaves for fodder, grasses for fodder, leaves for compost preparation, fuelwood collection and carrying etc. The maximum LCDI was found in FS<sub>5</sub>:

**Table 56. Load carrying drudgery Index (LCDI) of pre dominant farming systems of Uttarakhand**

Activities of load carrying	Load carrying drudgery Index (LCDI)					Mean	SD
	FS <sub>1</sub>	FS <sub>2</sub>	FS <sub>3</sub>	FS <sub>4</sub>	FS <sub>5</sub>		
Fuelwood collection and carrying	0.57	0.57	0.58	0.60	0.70	0.604	0.055
Water collection and carrying	0.47	0.48	0.48	0.52	0.52	0.494	0.024
Carrying of grasses for fodder	0.71	0.72	0.72	0.72	0.71	0.716	0.0054
Carrying of leaves for fodder	0.72	0.72	0.72	0.72	0.71	0.718	0.0044
Carrying of leaves for compost preparation	0.59	0.68	<b>0.76</b>	<b>0.76</b>	0.72	0.702	0.0708
Carrying of leaf litter	<b>0.76</b>	<b>0.76</b>	<b>0.76</b>	<b>0.76</b>	<b>0.82</b>	0.772	0.0268
Carrying of dung	0.59	0.59	0.59	0.58	0.60	0.59	0.0070
Carrying of manure	0.52	0.52	0.52	0.52	0.52	0.52	0
Carrying of crop to threshing place	0.44	0.44	0.44	0.44	0.44	0.44	6.21E-17
Transport of grains to home	0.35	0.29	0.29	0.29	0.29	0.302	0.026
Carrying of seed (horticultural crops)	0.27	0.27	-	0.33	0.44	0.262	0.162
Transporting of fruits to home	0.44	0.44	-	0.44	0.44	0.352	0.196
Transporting of vegetables to home	0.44	0.44	-	0.44	0.44	0.352	0.196
Mean ± SD	0.52±0.14	0.53±0.16	0.45±0.29	0.54±0.16	<b>0.56±0.15</b>		

Horticulture (Fruits/Vegetables) + Dairy followed by FS<sub>4</sub>: Horticulture (vegetables/spices) + Crop. This may be due to the higher altitude 1500-2400m above sea level in case of FS<sub>5</sub> and 1000-1500 m above sea level in case of FS<sub>4</sub> which is responsible for more exertion and physiological workload during load carrying. The least LCDI was observed in FS<sub>3</sub>: Crop + Livestock (Dairy/poultry/goatry) farming system which may be due to least enterprises (Table 56).

The decision of women in pre-dominant farming systems of hills was considered by the male counterparts but the final decision was taken mostly by men except few activities. When the matter of purchase and sale comes the women's involvement in decision making found limited upto only consultation in 18-25 percent of farm families. Woman belongs to Hill Zone of Uttarakhand are not practicing the improved agricultural technologies. They are doing manual and repetitive tasks with postural problems which leads to musculoskeletal disorders. Study shows that maximum women belonging to FS<sub>4</sub>, FS<sub>5</sub> (100 per cent each) and FS<sub>1</sub> (70 per cent) are using spade/*Kudali* for land preparation and rake and *kutla* as a line maker. In terms of sowing, broadcasting and manual dibbling was found to be practiced in all the farming systems, maximum being found in FS<sub>4</sub> and FS<sub>5</sub> farming systems (100 per cent). Manual transplanting was found to be practiced by women of FS<sub>3</sub> and FS<sub>1</sub> (57 and 30%) respectively. Compost making and manual application of fertilizers in furrow was found to be practiced by women in all the farming systems, maximum being found in FS<sub>4</sub> and FS<sub>5</sub> farming systems (100 per cent). For weeding it was found that weeding through *kutla* as well as hand weeding was found to be practiced by women in all the farming systems, maximum being found in FS<sub>4</sub> and FS<sub>5</sub> farming systems (100 per cent). Harvesting was found to be practiced by cent per cent women in all the farming systems, As far as threshing and winnowing of paddy and wheat through manual beating is concerned, it was found to be done in FS<sub>3</sub>, FS<sub>2</sub> and FS<sub>1</sub> by 57, 53 and 30 per cent women respectively. Maize dehusking was found to be done by women in all the farming systems through hand, maximum being found to be done by women of FS<sub>1</sub> and FS<sub>5</sub> (60 and 50 per cent

respectively). In terms of storage of seeds/grains it was found that women are solely doing storage under jute/plastic bags. In terms of load carrying it was observed that all the women carrying loads only over their heads in hill farming systems. Cent per cent load carrying for various activities viz fruits and vegetable carrying, seed carrying, grasses and leaves for fodder carrying, leaf litter carrying and fuel wood carrying as head load was done by the women of FS<sub>5</sub>.

### Project Title: Cluster based on-farm participatory research in Farming Systems 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 three villages 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. Survey revealed that mean holding size of the households to be 0.52 ha ranging from 0.2-2.83 ha.

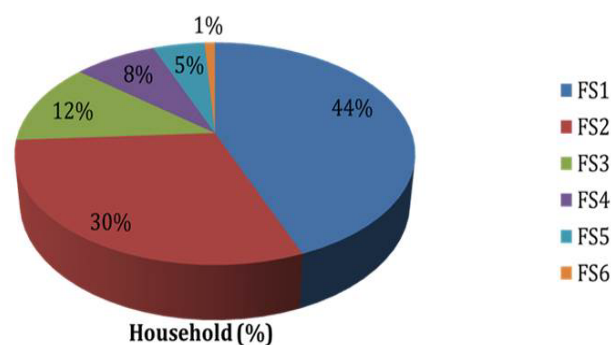


Fig. 21. Existing tribal farming systems

FS<sub>1</sub>: Crop (Paddy-Wheat)

FS<sub>2</sub>: Crop (Paddy-Wheat) + Dairy



- FS<sub>3</sub>: Crop + Horticulture (Vegetables)  
 FS<sub>4</sub>: Crop (P-W) + Dairy + Horticulture (Vegetables/Fruits)  
 FS<sub>5</sub>: Crop (Paddy-Wheat) + Livestock (Cow/Goat)  
 FS<sub>6</sub>: Crop (Paddy-Wheat) + Livestock (Cow/Poultry)+Horticulture (Vegetables)

Crops (paddy-wheat) was the dominant farming system found in around 44 per cent of households followed by Crop (Paddy-Wheat) +Dairy farming system (30%). The total dietary diversity score was (DDS) found  $3.87 \pm 1.45$  amongst 5 food groups, whereas the diet availability was found adequate in case of cereals ( $386 \pm 96$  gm/capita/day) fats and oils ( $31.73 \pm 15.01$  gm/capita/day) and roots and tubers ( $100.83 \pm 43.48$  gm/capita/day). However, the diet availability was found inadequate in terms of pulses ( $27.12 \pm 10.76$ ), milk ( $99.46 \pm 88.57$  gm/capita/day), green leafy vegetables ( $23.53 \pm 13.59$  gm/capita/day), other vegetables ( $93.77 \pm 41.94$  gm/capita/day), fruits ( $42.6 \pm 39.23$  gm/capita/day) and animal foods ( $44.27 \pm 39.69$  gm/capita/day). Gender difference was observed as incidence of undernourished was more among adult female tribes (24%) than adult male tribes (9.67 per cent). Nutritional status of children was evaluated by anthropometric parameters and malnutrition was considered if the Z-scores for the parameters were  $< -2$ . Stunting was found more in male children whereas underweight and wasting was found more in female children which has been depicted by their Z scores. In case of 0-5 years boys, HAZ mean scores was  $-3.25 \pm 0.81$  and WAZ mean score was  $-2.74 \pm 1.34$ , whereas in case of 0-5 year girls the WAZ score was  $-2.54 \pm 1.59$ , BMIZ mean score was  $-3.0 \pm 1.09$  and WHZ mean score was  $-2.38 \pm 1.42$ . However, HAZ mean score was  $-2.06 \pm 1.23$  in case of 11-19 years male. Nutrition education and suitable interventions for improvement of nutritional status has been provided.

### Interventions made:

#### Cropping systems management

- i. Introduction of HYV with high resistance to disease and pests (HD 3086) of timely sown

wheat. Area covered – 5.28 ha, household covered-80 Nos (2017-18). Introduction of zinc (42.0 ppm) and iron (40.0 ppm) biofortified variety of wheat (WB2). Area covered- 1.8 ha, household covered-30 Nos (2018-19).

- ii. Line sowing in wheat. Area covered – 5.28, 1.8 ha household covered-80, 30 Nos respectively for HD 3086 and WB2 varieties.
- iii. Introduction of high HYV, highly prized paddy var. PB 1121. Area covered-5.28 ha, household covered-80 Nos (2018-19).
- iv. Diversification of rice-wheat system by integration of mustard crop (cv. RH 749) (for oilseed and green leaf consumption) Area covered-0.85 ha, household covered-26 Nos (2017-18). Extended to the area 1.8 ha area to 30 household nos (2018-19).
- v. Diversification of rice-wheat system as well as for enrichment of household nutrition and income improved varieties for the pulse crops.

Lentil (Pant lentil 5, rust resistant). Area covered-1.32 ha, household covered -40 Nos for Pant lentil 5 (2017-18). Lentil (Pant lentil 8, rust, wilt and pod resistant variety was introduced in the year (2018-19) and extended to 3.96 ha area by covering 66 households.

Chick pea (pant gram 186, wilt resistant). Area covered-0.33 ha, household covered-10Nos (2017-18).

### Horticulture module

#### i. Promotion of nutritional kitchen gardening.

Brinjal (cv), (Pant Rituraj) and (Pant Samrat), cowpea (pusa komal), okra (Kasi pragati), bottle gourd (pant lauki 3) and ridgegourd (pant torai 1). Area covered-1000 m<sup>2</sup>, household covered -100 Nos (2017-18). Carrot (Pusa Rudhira), Radish (Japanese white), Fenugreek (pant ragini), Spinach (All green),

Corriender (pant haritima). Area covered-1000 m<sup>2</sup>, household covered -100 Nos (2018-19).

## ii Promotion of fruit plants

Lemon (Pant Lemon 1) and mango plants covered in 100 households (2018-19).

### Livestock Module

- Balanced nutrition in milch animals through mineral mixture, Calcium & Vitamin mixture. Animals covered 51 (25 C+ 26 B), household covered – 40 Nos.
- Integration of backyard poultry (CARI Nirbheek) for livelihood security, poultry distributed-690, household covered – 58 Nos.
- Improved nutrition in poultry through introduction of poultry feed, calcium, vitamin mixture etc. poultry covered-690, household covered – 58 Nos.
- Introduction of poultry drinkers for safe water drinking practices for poultry. poultry covered-690, household covered – 58 Nos.

### Drudgery reduction Module

- Demonstration of seed cum fertilizer drill  
Distribution of improved sickle for harvesting of

field crops, fodder crops. Area covered-500 m<sup>2</sup>, household covered -10 Nos.

- Demonstration of protective gloves for harvesting of field crops. Household covered-100
- Demonstration of ring cutter for plucking of okra. Household covered-100

Impact in productivity and profitability: Productivity of paddy-wheat production system in improved practices was observed 5.98 T ha<sup>-1</sup> which was 5.71 T ha<sup>-1</sup> in farmer's practice. Profitability of Rs 30,173.17/ - ha<sup>-1</sup> was noticed in improved production system as compared to farmers practice. The total returns from the improved tribal Integrated farming system Crop (paddy-wheat+ mustard+ lentil +chickpea) + Livestock (1C/1B + poultry) + KG (0.405 ha) was found Rs 1,04,312.76/. The total returns from benchmark farming system (0.405 ha) was found to be Rs 78055.68/-

**Summary:** Diversified Tribal Integrated farming system Crop (paddy-wheat/ mustard/ lentil /chickpea) + Livestock (1C/1B + poultry) + Kitchen Garden for (0.405 ha) with annual Net Returns of Rs 1,04,312.76/ - has been developed at farmers field.

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

Table 57. Economic yield and net returns from the benchmark IFS

Benchmark	Crop Module	Economic yield (Q/unit)	Price (Rs/unit)	Cost of cultivation (Rs/unit)	Net Returns (Rs/unit)
CS_0.405 ha	Paddy-Wheat				
	Paddy	23.34	2055	10809	37587
	Wheat	22.88	1708	10476	28621
	Animal Module:				
	1-2 Cow/1B				
	Milk (Litre/year)	536.6	29.22	8205	7446.2
	Farm yard manure (q/annum)	26.17	206.4	1000	4401.48
	Total Returns from system				78055.68

Table 58. Economic yield and net returns from the improved IFS

Improved IFS	Crop Module	Economic yield (Q/unit)	Price (Rs/unit)	Cost of cultivation (Rs/unit)	Net Returns (Rs/unit)
CS_0.405 ha	<b>Paddy-Wheat/Mustard/Lentil/Chickpea</b>				
0.405 ha	Paddy (Q)	21.05	2748.28	11793.88	45987
	Wheat (Q)	27.43	1540.63	9777	32426
0.033 ha	Mustard (kg)	46.15	46.34	1338.4	800.5
0.033 ha	Lentil (kg)	48.7	61.53	1538	1458
0.033 ha	Chickpea (kg)	46.8	77.5	1110	2517
	<b>Animal Module</b>				
	1-2 Cow/1B				
	Milk (Litre/year)	539.4	32.34	8260	9171.26
	Farm yard manure	26.17	206.4	1000	4401.48
	<b>Nutrition Kitchen Garden</b>				
	Okra (kg, 25.4 m <sup>2</sup> )	24.6	21.13	-	523.98
	Cowpea(kg, 18.8 m <sup>2</sup> )	10.93	22.24	-	243.08
	Bottlegourd (kg, 24.5 m <sup>2</sup> )	21.01	20.56	-	431.9
	Ridgegourd (kg, 28.03 m <sup>2</sup> )	27.85	20.17	-	561.7
	Brinjal (round) (kg, 26.93 m <sup>2</sup> )	24.61	21.12	-	519.76
	Brinjal (long) (kg, 29.19 m <sup>2</sup> )	24.38	23.22	-	566.10
	Total				2846.52
	<b>Backyard Poultry</b>				
	Eggs	210	8.0	500	1680
	Meat	5.5	550	-	3025
					4705/-
	<b>Mushrooms (income awaited)</b>				
	Total Returns from system				1,04,312.76



Fig. 22. Performance of introduced variety of paddy var. PB 1121



Fig. 23. Demonstration of ring cutter for plucking of okra



**Fig. 24. (a), (b) Training programme on Poultry rearing practices cum chick distribution for tribal families**



**Fig. 25. (a), (b) Distribution and demonstration of mango and lemon plants to tribal farmers**

### Drudery reduction module

Identification and pooling of available transferable technologies available with different institutions:

Demonstration kit on gender friendly improved tools on drudgery reduction has been developed. Ergonomically designed improved tools for e.g. improved sickle for harvesting of field crops, fodder

crops and improved khurpi were distributed to 800 farmers (women and men) of Sathedi, Bhayangi bhangela and Sonta villages for improving the working efficiency and comfort during harvesting and weeding operation respectively.

Wheat harvesting using traditional and improved sickle was evaluated at 40 farmers field. It was found that the working capacity of improved sickle was

**Table 59. Evaluation of improved versus traditional sickle in wheat harvesting (n=40)harves**

	Traditional Sickle (Mean)	Improved Sickle (Mean)	t value	p value
Working capacity (hr/ha)	499.31	405.89	3.25*	0.0024
Strain Index	35.53	18.96	4.42*	0.00009

\* = Significant, t-value = Calculated value of t, p= probability value for differences of two sample means assuming equal variances at 5 per cent level of significance



**Fig. 26a. Wheat harvesting through traditional sickle**



**Fig. 26 b. Wheat harvesting through improved (CIAE make) sickle**

**Table 2. Evaluation of improved versus traditional sickle in male and female users**

Parameters	I <sub>M</sub>	T <sub>M</sub>	I <sub>F</sub>	T <sub>F</sub>	F Value	P value
Mean						
Working capacity (h/ha)	389.362	500.5556	438.1313	534.1111	5.836171	0.002212
Strain Index	18.96923	31.51111	17.82727	43.5	16.04738	6.75E-07

I<sub>M</sub> = Improved tool used by male, T<sub>M</sub> = Traditional tool used by male, I<sub>F</sub> = Improved tool used by female, T<sub>F</sub> = Traditional tool used by female\* = Significant, F-value = Calculated value of F, p= probability value for differences of means more than two groups assuming single factor at 5 per cent level of significance

**Post hoc test for all pairwise treatment comparisons for working capacity (h/ha)**

	I <sub>M</sub>	T <sub>M</sub>	I <sub>F</sub>	T <sub>F</sub>
I <sub>M</sub>				
T <sub>M</sub>	0.023375			
I <sub>F</sub>	0.153174	0.206163		
T <sub>F</sub>	6.78E-05	0.47048	0.003462	

**Post hoc test for all pairwise treatment comparisons for strain index**

	I <sub>M</sub>	T <sub>M</sub>	I <sub>F</sub>	T <sub>F</sub>
I <sub>M</sub>				
T <sub>M</sub>	0.021731			
I <sub>F</sub>	0.631928	0.013264		
T <sub>F</sub>	6.42E-07	0.069844	6.6E-08	

405.89 hr/ha which is significantly higher ( $p \leq 0.05$ ) as compared to the traditional sickle (499.31 hr/ha). The harvesting through sickle in bending posture during sunshine hours was found hazardous as the strain index developed by Moore and Garg (1995) was found to be  $> 7$ . However, the mean value for strain index by using improved sickle was found to be 18.96 whereas it was 35.53 by using traditional sickle by the farmers and the difference was found significant ( $p \leq 0.05$ ). Therefore, the improved sickle was found significantly better ( $p \leq 0.05$ ) in terms of working capacity as well as comfort.

Table 60 shows the effect of tools on working capacity and strain index on male and female users. The difference was found significant ( $p \leq 0.05$ ) when improved and traditional sickle was evaluated among male and female users. Further, to know the pairwise comparisons post hoc test has been applied and significant difference ( $p \leq 0.05$ ) was found among traditional and improved tools used by males and females in case of working capacity. Whereas, the

difference was found non-significant when compared traditional tool used by male users and improved tools used by female users. In case of strain index genderwise significant difference ( $p \leq 0.05$ ) was found for both traditional and improved tools.

**Value addition module :** Women Self Help group (*Devanjali Mahila Samuh*) which has been formulated in Sathedi village for the skill enhancement in secondary agriculture activities as a diversified income generating avenue has been trained on packaging and labeling of different processed products. The group has presented potato products developed by them in the Potato Recipe Contest-2019 organized by ICAR-CPRI, Modipuram. Alongwith this they have been exposed to exhibition cum sale of potato/mango products (pickles, french fries etc) in Farmer's fair organised by ICAR-CPRI, Modipuram. The group has initiated earnings through selling their products through different exhibitions and door to door marketing techniques in nearby villages.



**Fig. 27a. Training on packaging and labelling of value added products through value addition and processing**



**Fig. 27b. Exhibition cum sale of potato products developed by Devanjali Mahila Samuh in Farmer's fair organised ICAR-CPRI, Modipuram**

## Coordination Unit (CU)

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

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 progress made during the year is given below.

#### Allocation of area:

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

#### Crop diversity in IFS model

Under IFS model total 23 crops belongs to 9 families are being grown in a year (Fig. 28). Among the different families, crops of *Leguminaceae* family (35%) is being cultivated most followed by *Gamineae* (31%). Other families are *Rutaceae*, *Musaceae*, *Caricaceae*, *Mutaceae*, *Apocynaceae* and *Malvaceae*. As highest

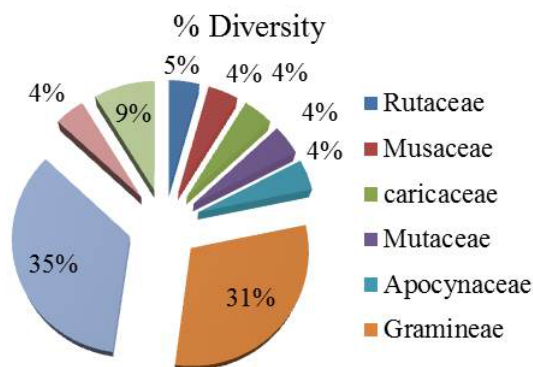


Fig. 28. Crop diversity in IFS model

crops belongs to Legume families and it is well established fact that legume are having significant role in soil health and environmental sustainability which makes IFS model more climate resilient.

#### Performance of different modules

##### 1. Cropping system module (0.38 ha)

Three cropping systems namely basmati rice-wheat + mustard/gram-green manure, Sesbania (seed)-chickpea-green gram and okra-cauliflower-baby corn + cowpea was planned under the module to meet the household demand of food, feed and generate income for the family under changing climate. The results indicate that under family nutrition system, basmati rice (variety PB 1) resulted in 313 kg of grain and wheat 325 kg of grain (Table 61). The straw of rice was recycled as mulch in cauliflower under okra-cauliflower-baby corn + cowpea system. Seed production of Dhaincha could not be taken up and it was incorporated in the soil at 50 DAS for green manuring for timely sowing of next crop. Under Okra-Cauliflower-Baby corn + Cowpea, Okra recorded 1135 kg of green pod yield, 620 kg of baby corn and 105 kg cowpea from 1250 m<sup>2</sup> area. Stalks of okra, cauliflower, baby corn and cowpea were incorporated in-situ to increase soil fertility. Total 4228 kg of rice equivalent yield was recorded from cropping systems module. Total cost of cultivation, gross return and net return of cropping system module was Rs. 29968, Rs. 75170 and Rs. 41290, respectively. Among three tested cropping system, okra-cauliflower-baby corn + cowpea cropping system was found highest profitable.

##### 2. Horti-Pasture Module (0.18 ha)

Five fodder crops *viz.* sorghum, pearl millet, maize, cowpea and maize + cowpea were evaluated during *kharif* 2017 in 5 strips (300 m<sup>2</sup> each) of kinnow plantation. Kinnow recorded 849 kg of fruits from 0.18 ha (27416 kg/ha) (Table 62). Among fodder crops, maize + cowpea recorded higher fodder production



Fig. 29. Overview of cropping system module

Table 63. Productivity and economics of cropping system module in IFS model

Cropping system	Production (kg)	COC (Rs.)	Gross return (Rs.)	Net return (Rs.)
Basmati rice-wheat + mustard/chickpea-GM (0.125 ha)				
Basmati rice	313	5374	7800	2426
Wheat	325	3763	7830	4067
Mustard	6.5	-	260	260
Chickpea	16	-	704	704
Okra-Cauliflower-Baby corn + Cowpea (0.125 ha)				
Okra	1135	3873	22700	18827
Cauliflower*	-	5774	-	-
Baby corn	620	4299	24800	22601
Cowpea	105	-	2100	-
Dhaincha-Chickpea-Green gram (0.125 ha)				
Dhaincha	-	1478	-	-
Chickpea	204	2795	8976	6181
Green gram*	-	2612	-	-
Total CS module	4228 (REY)	29968	75170	41290

(1170 kg from 300 m<sup>2</sup>) followed by maize (1080 kg from 300 m<sup>2</sup>), sorghum (810 kg from 300 m<sup>2</sup>), pearl millet (720 kg from 300 m<sup>2</sup>) and cowpea (450 kg from 300 m<sup>2</sup>) (Table 64). It can be inferred that with the cultivation of maize + cowpea for fodder during *khari* 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 195 days. Intercropping of fodder maize, sorghum, pearl millet 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. Highest fodder yield was found in berseem followed by ryegrass under kinnow plantation. Economics of horti-pasture module is given in Table 65 which indicates net

**Table 64. Performance of different fodder crops under Kinnow plantation**

Component	Yield (kg)	Yield under 1800 m <sup>2</sup> (kg)	Fodder sufficient for number days*
Kinnow	-	849	-
Kharif fodder	(141 days)		
Maize + cowpea	1170	5850	195
Maize	1080	5400	180
Sorghum	810	4050	135
Pearlmillet	720	3600	120
Cowpea	450	2250	75
Rabi fodder	(157 days)		
Berseem	1161	5805	194
Lucerne	1014	5070	169
Ryegrass	1029	5145	172
Oat	846	4230	141
Mustard	648	3240	108

\* 30 kg green fodder/ day for 2 animals

**Table 65. Economics of Horti-pasture module (0.18 ha)**

Component	Cost (Rs)	Gross Returns (Rs)*	Net Returns (Rs)
Kinnow	4245	25470	21225
Kharif fodder			
Maize + cowpea	402	1170	768
Maize	388	1080	692
Sorghum	374	810	436
Pearlmillet	337	720	383
Cowpea	388	900	512
Rabi fodder			
Berseem	523	2322	1799
Lucerne	513	2028	1515
Ryegrass	448	1029	581
Oat	423	846	423
Mustard	309	648	339
Total	8,350	37,023	28,673

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



**Fig. 30. Overview of Horti-pasture module**

return of Rs 28,673 can be obtained through multiple fodder grown in kinnow plantation.

### 3. Boundary Plantations

On the boundary of IFS module guava and karonda hedge is planted for better utilization of different resources. Karonda hedge is also acts as biological fencing because of its spikes and protects crops from stray animals. During the reporting year total 704 kg guava and 206 kg of karonda was harvested and Rs. 23140 net return was earned (Table 66).

**Table 66. Productivity and profitability of boundary plantation module of IFS model**

Fruit plant	Production (kg)	Cost (Rs.)	Gross return (Rs.)*	Net returns (Rs.)
Guava	704	3300	14080	23140
Karonda	206		12360	
Total=	3300	26440	23140	

\* Guava Price: Rs. 20/kg; Karonda price: Rs. 60/kg

### 4. Dairy module (1B +1C)

The dairy unit is having one buffalo (murrh) 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. 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. 1,23,835 and Rs. 44,630 respectively (Table 67). Average daily dung production from dairy unit was found to be 54 kg which works out to 19.7 t/year. Per cent share of feeding cost in dairy is presented in Fig. 32 which indicates 65 % share for concentrates.

### Economics of IFS model

Among the different modules of IFS model, highest cost of cultivation, gross return and net return was found under dairy module followed by cropping system module. Total cost of cultivation of 0.72 ha IFS model was Rs. 1,20,823 with gross return Rs. 2,62,468 and net return Rs. 1,37,733. Benefit to cost ratio of IFS model was found as 2.17 (Table 67). Dairy unit contributed for 32 % share in net income followed by 30 % from cropping system.

### Processing and value addition

Karonda (*Carissa carandas* Linn.) fruits were used for preparation of squash. The fully ripen fruits collected and washed with clean water. Karonda fruits were blanched in boiling water for 5 minutes and made into pulp with the help of laboratory pulper/mixture grinder. Smooth pulps without seeds and skins were obtained by passing through 20mm ISI sieves.



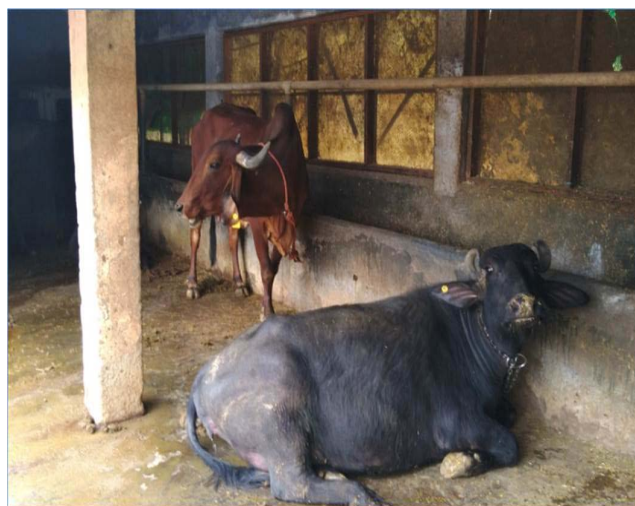
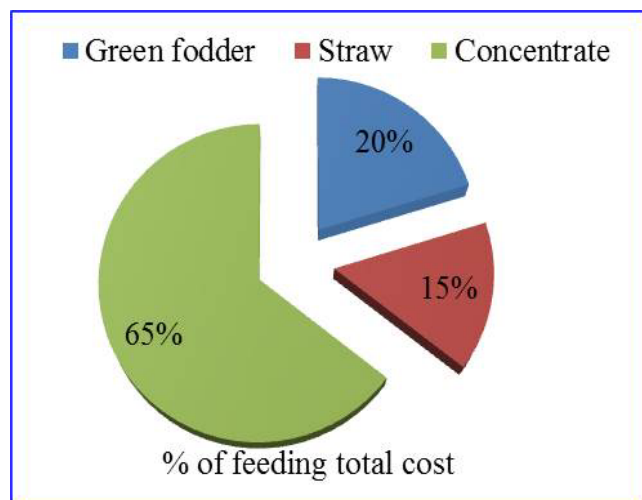
**Fig. 31. Boundary plantation of Guava and Karonda in IFS model**

**Table 67. Production and economics of dairy module in IFS model**

Animal	Milk (lit.)	Dung (t)	Cost (Rs./year)	Gross income (Rs./year)	Net retruns (Rs./year)
1 Buffalo & 1 Cow	2533	19.7	79205	123835	44630

Price of milk: Rs. 45/lit.

Price of dung: Rs. 300/t



**Fig. 32. Percent share of feeding costs in dairy unit**

**Table 68. Cost of cultivation, returns and B:C ratio of IFS model**

Module	Variable Cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C ratio
Cropping system	29968	75170	41290	2.51
Horti-pasture	8350	37023	28673	4.43
Agri-Horti	-	-	-	-
Dairy	79205	123835	44630	1.56
Boundary Plantation	3300	26440	23140	8.01
Total (All modules)	1,20,823	2,62,468	1,37,733	2.17

Recorded pulps initial TSS of 4.1%) and pulp yield of 75.1%. Sugar syrup of 70% was prepared by adding required quantity of sugar in water and mixed with the fresh pulps followed by addition of colour, essence and preservatives (sodium benzoate @300ppm) as per five different treatments (Table 69). The final products were packed in PET bottles (500ml capacity) and sealed with automatic self sealing caps. Labelled the products and stored in dark and cool place for at least three days before use. The final products (Table 70) were analyzed for total soluble solid (TSS), titratable acidity and organoleptic score. Among different treatments, the

karonda squash treated with colour and essence with 50°Brix had recorded the maximum sensory score (8.1) with attractive colour, flavour and taste. Additional revenue of Rs 80/kg of karonda can be obtained by making karonda squash instead of selling raw karonda.

### Household Food Requirement

IFS model is producing sufficient amount of cereals, pulses, milk, vegetables and fruits to fulfill the household food requirement. From this model after meeting family requirement sufficient marketable surplus is also

Table 69. Different treatment combinations for development of Karanda Squash

Sl. No.	Quality parameters	Treatments				
		T1	T2	T3	T4	T5
1	Karonda pulp, ml	300	300	300	300	300
2	Syrup, ml	700	700	700	700	700
	Syrup strength (°Brix)	70	70	70	70	70
3	Citric acid, g	0.0	1.5	1.5	1.5	1.5
4	Sodium Benzoate, g	0.0	0.0	0.3	0.30	0.30
5	Colour, g	0.0	0.0	0.0	0.05	0.05
6	Essence, ml	0.0	0.0	0.0	0.0	1.0

Table 70. Qualities of Karanda Squash with respect to different treatments

Sl. No.	Quality parameters	Treatments				
		T1	T2	T3	T4	T5
1	TSS (%)	50.1	50.1	50.1	50.1	50.1
2	Acidity (%)	1.1	1.12	1.08	1.09	1.1
3	Appearance	6.1	6.1	7.0	8.1	8.2
4	Colour	6.0	6.2	7.1	8.2	8.1
5	Flavour	6.2	5.9	6.0	6.5	8.0
6	Taste	6.8	6.7	6.6	7.3	7.7
7	OAA Sensory	6.1	5.8	6.1	7.6	8.1

Fig. 33. Karonda (*Carissa carandas* Linn.) Squash

**Table 71. Production of different components for household food requirement in IFS model**

Commodity	Net Production (kg/year)	Requirement (kg/year/family)*	Marketable Surplus (kg/year)	Gross income from marketable surplus (Rs.)
Cereals	640	584	56	1047
Pulses	220	116	104	40160
Edible oil	2.14	44	-	-
Milk	2634	438	2196	98820
Vegetables	1860	292	1568	31360
Fruits	1553	146	1407	28140
Total	-	-	-	1,99,527

available and by selling of these marketable surplus Rs. 1,99,527 can be generated as gross income (Table 71).

### Energy budgeting of cropping system module

Highest energy input was reported under vegetable based cropping system followed by cereal based cropping system and least under legume based cropping systems. However, energy use efficiency was reported highest under legume based cropping system followed by cereal based cropping system and lowest under

vegetable based cropping system. Overall energy use efficiency of cropping system module was found 3.58 (Table 72).

### Recycling of waste

To build up fertility of soil residues of different crops were incorporated/added in the IFS model. During the reporting year total 9579 kg of crop residues and farm wastes were recycled within the system (Table 73). Through incorporation these farm wastes 69.09 kg N,

**Table 72. Energetic of cropping system module in IFS model**

Cropping system	Energy Input (MJ)	Energy Output (MJ)	Net Energy (MJ)	Energy use efficiency
Basmati rice-wheat + mustard/chickpea-GM (0.125 ha)				
Basmati rice	2520	10881	8361	4.32
Wheat + Mustard/ chickpea	1830	9403	7573	5.14
Okra-Cauliflower-Baby corn + Cowpea (0.125 ha)				
Okra	1997	4897	2900	2.45
Cauliflower	1945	1066	-879	0.55
Baby corn + Cowpea	1697	4085	2388	2.41
Dhaincha-Chickpea-Green gram (0.125 ha)				
Dhaincha	393	1625	1232	4.14
Chickpea	732	6749	6017	9.23
Green gram	750	3746	2996	4.99
<b>Total CS module</b>	<b>11864</b>	<b>42452</b>	<b>30588</b>	<b>3.58</b>

**Table 73. Recycling of crop residue and farm wastes in IFS model**

Waste/ Residue	Quantity (kg)	Nutrient content (%)			Nutrients added (kg)		
		N	P	K	N	P	K
Rice straw	500	0.87	0.06	1.18	4.35	0.30	5.90
Dhaincha	130	3.53	0.19	1.68	4.59	0.25	2.20
Baby corn	247	1.49	0.20	1.86	3.68	0.49	4.59
Cowpea	48	2.51	0.41	0.88	1.21	0.20	0.42
Okra	274	0.62	0.15	1.31	1.70	0.41	3.59
Cauliflower	98	1.32	0.21	1.24	1.30	0.21	1.22
Green gram	282	3.78	1.01	1.11	10.66	2.85	3.13
FYM	8000	0.52	0.18	0.57	41.60	14.40	45.60
<b>Total</b>	<b>9579</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>69.09</b>	<b>19.11</b>	<b>66.65</b>

Saving of fertilizers: Urea: 150 kg; SSP: 119 kg; MOP: 111 kg

**Fig. 34. Recycling of different crop residue in IFS model**



**Fig. 35. Students and Farmer visitors at IFS model**

19.11 kg  $P_2O_5$  and 66.65 kg K was added in the soil which is equivalent to 150 kg urea, 119 kg SSP and 111 kg MOP fertilizer (Table 73).

**Project Title: AICRP on Integrated Farming Systems (National)**

AICRP on Integrated Farming Systems, a plan scheme initiated from 2010-11 operates currently with 74 centres (25 on-station main, 11 on-station sub, 32 on-farm and 6 ICAR institute based voluntary centres) covering all the 15 agro-climatic regions. The scheme is in operation at 34 SAU's, 1 central university and 6 ICAR institutes and covers 24 states and 1 union territory. 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 taken up at on-station centres while 3 experiments namely on-farm crop response to plant nutrients in predominant cropping systems (768 farm households in 192 villages in 64 blocks of 32 districts in 21 states), Diversification of existing Farming Systems under marginal household conditions (768 farm households in 192 villages in 64 blocks of 32 districts in 21 states) and On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers (384 farm households in 192 villages in 64 blocks of 32 districts in 21 states), On-Farm participatory research in tribal farming systems through cluster approach (11 locations) and FLDs on farming systems

involving oilseeds (179 no's) were undertaken through on-farm research centres.

The salient achievements of the scheme are given below

#### On-station research

- Water and energy efficient cropping systems have been identified for 20 states.
- Suitable and effective modules of IFS were identified and documented for 16 states
- Up-scaling the application of FarmDesign and Farming Systems Typology analysis by capacity building of researchers in collaboration with CIMMYT and Wageningen University of Research, The Netherlands.
- Secretary (DARE) and Director General, ICAR Dr Trilochan Mohapatra presented the IFS models developed by this scheme before the In – session meeting of Consultative Committee of Ministry of Agriculture and Farmers Welfare on “Integrated Farming Systems for livelihood security and enhanced income” on 2 August 2018. The meeting was chaired by Shri Radha Mohan Singh, Hon’ble Union Minister of Agriculture and Farmers Welfare, Government of India and were attended by 13 Members of Parliament including Ministers of State in the Union government. Hon’ble Minister in his opening remarks about the development of 45 scientifically designed and tailor-made integrated farming systems (IFS) for different regions through AICRP on IFS and he said, it is essential for achieving the “Doubling the farmer’s income by 2022” vision of Hon’ble Prime Minister of India. This has been covered in the media at National level.
- Prime Minister of India during his visit to SKUAST, Jammu, he spoke for about 4 minutes on integrated farming system model developed by Jammu centre through AICRP on IFS and need for its popularization among farming communities.

- Shri Nitin Gadkari, Union Minister of Transport and Shipping visited the IFS models at Rauricentre and discussed regarding its popularization.

#### 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 lower application of N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and micronutrients. On-farm system yield gap between recommended dose of N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + micronutrient and farmer’s package were found to be higher in rice-rice, rice-wheat, maize-wheat, soybean-onion and rice-green gram cropping systems. Application of micronutrients based on soil test resulted in additional yield of in rice-rice, rice- wheat, maize-wheat, soybean-onion and rice-green gram systems. In all the NARP zones and systems, application of recommended N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O alone or N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O + 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.

**Farming Systems Typology:** Based on the typology analysis using 39 variables related to determinants of farming systems such as household, crop production, livestock, income and marketing characteristics and principal components analysis, six distinct types of farming systems (Fig. 36) were found at the country level. Their characteristics are described below.

**Cereal based farming system:** Among all the types, cereal based farming system is practiced by 32 % of households with mean holding size of 0.74 ha with minimum total livestock unit of 1.89/household. Rice (48 % of produce is sold) and wheat (39 % are sold) contributes for 78 % of total income of the households. Rice and wheat are also consumed at the household to the extent of 48 and 34 % of the production respectively. Higher wheat intensity of 43.90 % was observed in this farming system which is on par with industrial arid legume and vegetable intensive integrated farms. The productivity of rice (3424 kg/ha) is on par with

diversified crop-based farming system. The yield of wheat was observed to be only 2557 kg/ha. Fodder intensity is very less (2.16 %) which is also contributing for lower income from livestock. Although, other crops such as pulses and oilseeds are also grown, their contribution to income is very less as only 13.29 % are sold. The major area of targeted interventions for this farming system exists in improving the productivity of wheat (current productivity in this farming system is 19.3 % lesser than national average productivity, 3172 kg/ha) by crop management practices, increasing the intensity of fodder cultivation to enhance the income contribution from livestock and also meet the nutrition.

**Other than cereal crops intensive farming system:**

Farming system with other than cereal crops (such as pulses, oilseeds, cotton, jute, sugarcane) intensive is having the significantly higher intensity of 62.10 % of other than cereal crops are being practiced by 22 % of farm households having mean holding size of 1.10 ha with total livestock unit of 1.98/household. Though other than cereal crops are intensively grown in this type, 84 % of total income is from crops mainly by virtue of selling rice (40 % of rice sold) and horticultural crops (55 % selling). The other than cereal crops grown in the farming systems especially pulses and oilseeds are mainly consumed at home (54 % of produces are consumed) and only 14.8 % are only sold. The major constraints are found to be availability of on-farm labour as only 1.34 persons are working in this system. Livestock contribution to total income is found to be only 12 % which is mainly due to low TLU and also very low fodder intensity (2.26 %). Therefore, it implies that interventions for improving the productivity of other than cereal crops with diversification strategies and also improving the fodder intensity is essential for improving the productivity, profitability and nutrition of other than cereal crop intensive farming systems.

**Livestock based integrated farming system:** These constitute 17.7 % of households having mean holding size of 0.86 ha with total livestock unit of 2.74/household which is next best to other cereals and livestock intensive farming system in terms of total livestock unit. The major contributor to income is

livestock (52 %) followed by crop (46 %). Higher contribution of livestock to income can be attributed to significantly higher fodder intensity (25 %) in this farming system compared to all other farming systems except industrial arid legume and vegetable intensive integrated farming systems which is having on par intensity. The 46 % of income from crop is obtained mainly by selling of other cereals (36 % of the total production is sold), while the livestock income is contributed by presence of cow (1.19 /household) and buffalo (1.10 / household). Off farm activities are not remunerative for this type of farms as though 2.35 persons are involved in outside the farm activities, they could contribute only < 1 % of total income. Since, the productivity of livestock is higher among all the farming systems; scope exists to intensify the livestock with further intensifying the fodder crops.

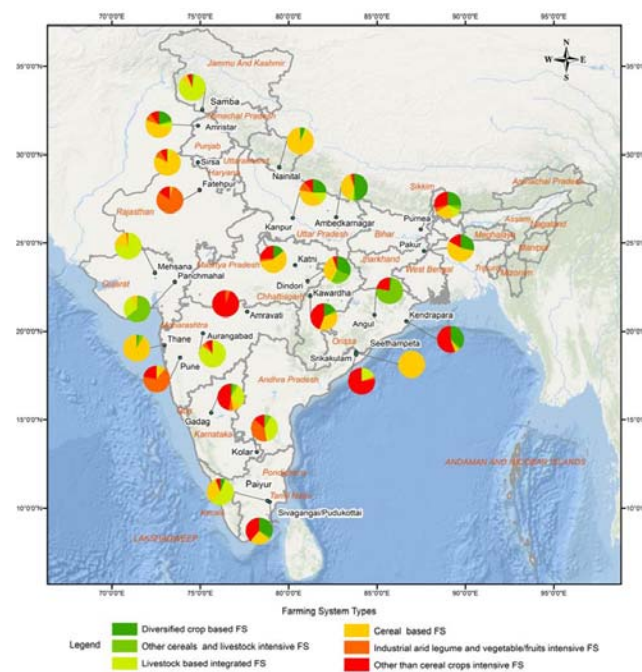
**Diversified crop-based farming system:** Diversified crops such as rice, wheat, other cereals, other than cereals such as pulses, oilseeds and fodder-based farming systems are being practiced by 11.5 % of households with mean holding size of 0.88 ha. Rice intensity is significantly higher (82 %) than other types, however, intensity of wheat cultivation is only 35 % which is on par with cereal based and industrial arid legume and vegetable intensive integrated farming systems. Rice yield (3770 kg/ha) is significantly higher than other types except cereal based integrated farming system. In case of wheat yield also, these farms have registered yield of 1989 kg/ha which is on par with all other types except other than cereal crops intensive farming system. Marketing of rice is higher (48 % of the produce are sold) in this type. Wheat consumption at home is significantly higher (48 %) than other farming systems. It is also observed that 49 % of fodder produced is consumed at the household level which results in only 15 % income from livestock. Apart from rice and wheat, fodder, other than cereal crops and horticulture crops play vital role (30, 41 and 15 % of total production are sold in the market) in generating 75 % of total income from the crop component. The total livestock unit (2.06) is on par with cereal based (1.89) and other than cereal crops intensive (1.98) farming systems and the livestock contributes only 15

% towards income. Off farm activities contributes 6.6 % to income which is on par with all other types of farming systems except other cereals and livestock intensive system. Since, these farms have higher non-vegetarians (3.27 persons / household), mean availability of 905 man days (2.48 persons X 365 days) of family labour who are working outside the farm and also surplus fodder (30 % of fodder are sold), potential exists for improving the intensity of livestock especially cow, buffalo, goat, pig and poultry (these farms presently have only 0.86, 0.41, 1.19, 0.11 and 1.33 / household respectively) for enhancing income and nutrition of these households.

**Industrial arid legume and vegetables/fruits intensive integrated farming system:** Farming system with 61 % intensity of industrial arid legume and vegetable crops are practiced by 9.5 % of households having mean holding size of 0.96 ha with total livestock unit of 2.76 /household. The share of income reveals that industrial arid legume and vegetable crops contributes significantly (56 %) to total income as 91 % of industrial arid legumes and vegetables are marketed. Livestock component contributes for 44 % of income mainly from cow, buffalo and goat. Higher contribution of livestock component to total income in this farming system can be attributed to 22 % fodder intensity in the system. Although other crops like pulses and oilseeds are also grown by these households, but major part of the same is used for home consumption (54.2 %). In this farming system, interventions should focus on diversification of arid legumes crops including seed replacement, processing and cold storage facilities to further enhance the income of households.

**Other cereals and livestock intensive farming system:** Among all the types of farming system classified, these farming systems are practiced by only 8 % of households. These households have higher mean age of head of family (51 years) with significantly higher work force of 3.26 persons / household size of 1.01 ha. Vegetarians are higher in this type of farming system. Among all the crops, the other cereals (maize, pearl millet etc) intensity is higher (73 %) in these households. The rice grown is mostly consumed (60 % of produces

are consumed) at home. Most of the other cereals produced are utilized as fodder for animals as these farms have higher total livestock unit of 5.42 having higher population of cow (1.61/household), goat (2.41/household) and poultry (13.89/household). Crop component contributes 53 % of total income and it is mainly from selling of wheat (39 %), other than cereal crops (25 %) and horticultural crops (27 %) which are grown in lesser intensity (8, 24 and 8 % respectively). The off-farm activities carried out by 2.62 persons / household provides 11.8 % of the total income. Typology analysis clearly reveals that these farms are having the higher intensity of other cereals and livestock, however contribution of other cereals and livestock to the income is not proportionate to their intensity as selling of other cereals and contribution of livestock to the total income are very low compared to other farming systems. Therefore, measures such as introduction of high yielding varieties of other cereals and also management packages with interventions for improving the productivity of livestock are essential in these farms.



**Fig. 36. Spatial distribution of different types of farming systems based on typology analysis**

**Crop frequency in different farming systems:** Particular crop or group of crops grown by number of farmers out of total sample households using Pearson

residuals indicates that rice is strongly associated with cereal based (37.9 % households grow rice), diversified crop based (15.2 %), other cereal and livestock intensive (10.5 %) types of farming systems while association of wheat was found to be in cereal based farming systems only (39.7 %) (Fig. 37). Other cereal crops such as maize, pearl millet, finger millet plays vital role in the other cereals and livestock intensive (12.1 %), livestock based integrated (26.4 %) and industrial arid legume and vegetables/fruits intensive integrated farming systems (18.6 %). Other than cereal crops such as pulses, oilseeds including coconut, cotton, jute etc are having significant present in the other than cereal crops intensive farming system with 27.6 % households practicing the same among all types of farming systems. Fodder crops are strongly associated with livestock based integrated farming systems (36.6 %) compared to other types of farming systems. Industrial arid legume cluster bean and vegetables are having storing association with industrial arid legume and vegetables/fruits intensive integrated farming system as per the pearson analysis.

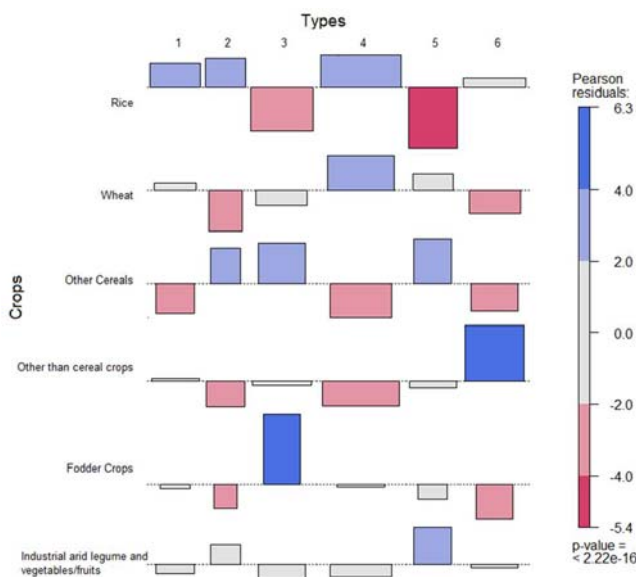


Fig. 37. Crop frequency in different farming systems

**On-Farm participatory research in tribal farming systems through cluster approach:** The programme was undertaken in 12 locations covering 11 states namely Andaman and Nicobar Islands, Andhra

Pradesh, Chhatisgarh, Gujarat, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan, Tamil Nadu, Uttarakhand and West Bengal. The salient interventions and findings at selected locations are highlighted below.

In Kanker (Chhattisgarh), UttarBastar, Kanker district, 84 households were covered in 6 villages of 2 blocks namely Kanker and Durgukondal. Interventions made in crops module were improved varieties/hybrids, balance nutrient management, integrated pest management and suitable cropping system. In livestock module, improved breeds of pigs and poultry, feed management, Azolla production pits were done besides farmers training and exposure visits for skill development. The result revealed that, 22% higher returns were obtained from crops due to interventions of improved varieties/ hybrids of crops and 30-35% higher returns were obtained from livestock due to interventions. It is estimated that around of 7-10 % higher returns were obtained from farming due to training and exposure visits. In Haridwar (Uttarakhand), 2 villages namely Nayagaon and Mohallapuri, in Haridwar district were adopted for tribal farming system development. In Nayagaon, 90 farm families out of 100 belong to vokshatribals. In Mohallapuri, 100 out of 110 farm families belongs some tribal community to tribal. The major farming systems in the villages were found to be crops+ livestock with most families working as contractual labor outside the village. Based on the identified constraints, 13 farming system interventions were formulated for improving the productivity of farming systems. The interventions such as integrated nutrient and pest management in rice and sugarcane kitchen /nutrition garden (kharif); improved varieties of oilseeds (mustard RH 749 and RH 406) and wheat (HD 3086); kitchen/nutrition gardening (rabi) through improved varieties of vegetables seeds and improved community nursery were made. KisanGosthies/training and awareness programme were organized on integrated nutrient and pest management in crops, biological control of insect-pests in rice and sugarcane using Trichocards, seed treatment of rice for disease management and pokahBoengJagrukta Abhiyan for sugarcane in which total of 251 farm families in Nayagaon and 188 farm families in Mohallapuri

benefited. In Nainital (Uttarakhand), high Yielding Variety of wheat (HD 3086) timely sown and basmati rice (PB1121) were introduced in 5.28 ha covered 80 tribal households. Diversification of rice-wheat system with mustard (RH 749) and pulses in 0.85 ha and 1.32 ha area respectively in the cluster resulted in enhancement household nutrition and income. The productivity of rice – wheat system was observed to be 5.99 t/ha compared to farmers practice (5.79 t/ha). Additional return of Rs. 7685/ household/year was noted in Crop + dairy system due to interventions. Nutritional kitchen garden with seasonal vegetables like brinjal, cowpea, okra, bottle gourd and ridge gourd were done in 100 households with total kitchen garden area of 1000 m<sup>2</sup>. Mineral mixture (51 No's milch animals), Calcium & Vitamin mixture (40 households) and integration of backyard poultry for livelihood security with poultry feed, calcium, vitamin mixture and drinkers for safe water drinking practices were done in 58 tribal households having 690 number of poultry birds.

### Other activities

- Based on the impact analysis of on-farm farming systems research, the failed and partially adopted interventions / practices have been communicated to Director of Research of SAU's in 6 states for undertaking further research.
- A total 614 farmers who are connected with the scheme have been linked to market by various means of clustering products etc. Similarly, 491 households have been linked to Bank and also 595 numbers of soil health cards have been issued during the year by the centers.
- A total 179 demonstrations were conducted in 16 different cropping / farming systems involving oilseeds in 4 agro-ecosystems
- Under STC programme, a total of 68 villages were covered and around 1175 family individuals benefitted from the scheme.

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

All India Network Programme on Organic Farming (AI-NPOF), a plan scheme initiated from 2004-05 operates currently with 20 centres covering 10 agro-climatic regions. The scheme is in operation at 11 SAU's, 7 ICAR institutes and 1 special heritage university and covers 16 states. Distribution of locations is given in Fig. 38.



**Fig. 38. Location of Network Project on Organic Farming (NePOF)**

During the year under report, 13 experiments were undertaken. The recommended technologies and policy input in the XIII Annual Group Meeting of the Scheme held at Tamil Nadu Agricultural University, Coimbatore during 27-29 November 2018 for upscaling through the development schemes of Government of India and State are given below.

#### A. Technologies for up-scaling

1. Geo-referenced characterization of organic farmers in all the states indicated existence of wider yield

gap between yield obtained by organic farmers and NPOF experimental yield for many crops. The wider yield gap is mainly due to under dose application of organic manures and adopting only indigenous practices for organic farming. Therefore, popularization of scientific organic farming packages with critical and credible input support must be made.

2. Application 75 % nutrients only through combination of organics such as FYM, vermicompost, Non edible oil cakes and other locally available sources + 2 innovative inputs such as cow urine, panchagavya, PGPR with complete organic management for following locations and cropping systems

State	Crop/Cropping System
Chhatisgarh	Soybean-pea, soybean-chilli
Himachal Pradesh	Kharif and summer tomato
Jharkhand	Rice (Basmati type)-wheat
Karnataka	Groundnut and Safflower
Madhya Pradesh	Soybean-wheat, soybean-mustard, soybean-chickpea, soybean-linseed
Punjab	GM-basmati rice-greengram

3. Application 100 % nutrients through combination of organics such as FYM, vermicompost, Non edible oil cakes with complete organic management for following locations and cropping systems

State	Crop/Cropping System
Himachal Pradesh	Frenchbean and summer squash
Jharkhand	Rice (Basmati type)-potato, Rice (Basmati type)-linseed
Kerala	Turmeric
Maharashtra	Field bean
Meghalaya	Rice in sunken beds and French bean, carrot, potato, broccoli and tomato in raised beds
Punjab	GM-basmati rice-wheat
Uttarakhand	GM-basmati rice-chickpea / vegetable pea and Potato

4. Towards organic approach with 75 % organic + 25 % inorganic package and 50 % organic + 50 % inorganic package for the following cropping systems and states

State	Crop/Cropping System
Himachal Pradesh	Frenchbean, summer squash
Tamil Nadu	Maize, chilli, beetroot and sunflower

5. Promotion of identified varieties of crops for organic farming in different seasons and states

State	Season	Crop	Recommended varieties
Chhattisgarh	<i>Kharif</i>	Scented Rice	CR Sugandhadhan 907 C.G. SugandhitBhog
	<i>Rabi</i>	Chickpea	JG-130 Vaibhav
Himachal Pradesh	Kharif	Okra	Chameli 015 Indranil
		Cauliflower	US 178 Chandramukhi
	Summer	Pea	Ten Plus Nirali
		Tomato	RK-123 Heem Sohna
Jharkhand	<i>Kharif</i>	Rice	MTU-1010 Lalat

State	Season	Crop	Recommended varieties
Karnataka	<i>Rabi</i>	Wheat	K-0307 Raj-4229
	<i>Rabi</i>	Chickpea	A1 JAKI 9218
Kerala	<i>Kharif</i>	Wheat	UAS 347(BW) DWR2006(DW)
		Turmeric	Pragati Suguna
Madhya Pradesh	<i>Kharif</i>	Soybean	RVS-2002-4 JS-9752
	<i>Rabi</i>	Maize	Kanchan Proagro 4412
Wheat		GW-366 HI-8498	
Maharashtra	<i>Kharif</i>	Chickpea	JG-130 JG-63
		Rice	<i>Sahyadri 5 (hybrid)</i> <i>Sahyadri 3 (hybrid)</i> Karjat 5 (Straight variety)
Meghalaya	<i>Rabi</i>	Groundnut	<i>Jaya (Straight variety)</i> JL 26 Konkan Gaurav
	<i>Kharif</i>	Maize	DA-61A RCM-75
Punjab	<i>Kharif</i>	French bean	<i>Naga local</i> , RCM-FB-18
	<i>Summer</i>	Tomato	MT 2 0-17
	<i>Kharif</i>	Basmati Rice	<i>Pb Basmati 4</i> Pusa Basmati 1509
Tamil Nadu	<i>Rabi</i>	Wheat	<i>PBW1 Zn</i> Unnat PBW 550
		Rice	Mappillai samba Kitchidi samba CO(R)48 Red kavuni
Uttar Pradesh	<i>Kharif</i>	Maize	<i>Vivek QPM 9</i> PMH 1
	<i>Rabi</i>	Mustard	<i>RGN 48</i> Urvashi
Uttarakhand	<i>Kharif</i>	Basmati rice	<i>Pant Sugandha dhan-17</i> Pant Basmati-1
	<i>Rabi</i>	Wheat	<i>HD-2967</i> UP-2565

#### 6. Resource conservation practices for organic farming

Cropping System	Land configuration
<b>Karnataka</b>	
Soybean-Wheat	Conventional FB with crop residues
Groundnut + Cotton (2:1)	Conventional FB with crop residues
Greengram-Sorghum	Conventional FB with crop residues
Soybean + Pigeonpea (2:1)	Conventional FB with crop residues
<b>Uttarakhand</b>	
Direct seeded rice + soybean –vegetable pea +mustard	FIRB system
Direct seeded rice– chickpea-moong	Road bed and furrow system
<b>Meghalaya</b>	
Carrot- Okra	Raised bed
Rice (VD-82) -Pea	Sunken bed

#### 7. Promotion of Integrated Organic Farming System (IOFS) models to reduced the market input cost

##### Components

##### Calicut (Kerala)

Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost, 4 cows)

##### Coimbatore (Tamil Nadu)

Field crop based system (Green manure-okra-maize; greenmanure-cotton-red gram, fodder, pest repellent cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow, 1 heifer & 1bull calf + vermicompost + boundary plantations (*Gliricidia*, *coconut*))

##### Umiam (Meghalaya)

Field &horticulture based system (Cereals + pulses + vegetables + fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost

#### 8. Pest management package for seed spices

- Garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit for aphids and thrips management in Coriander and Fennel

#### B. Policy (based on brainstorming session)

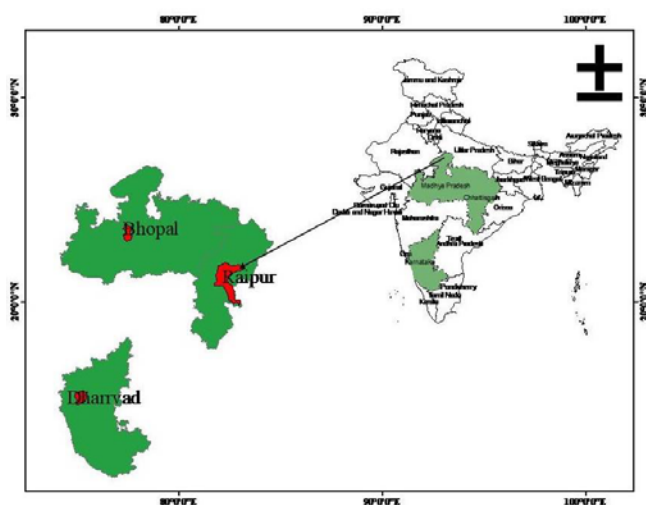
- Integrated organic farming systems having the components of science based inputs and also components of natural farming such as Jeevamrit and Ghanjeevamrit should be promoted for better sustainability in organic agriculture.
- Availability of critical and credible inputs in time for practicing organic farming in cropping systems perspective should be ensured.
- 5P (Plan, Produce, Process, Package and Promote) model of organic farming should be encouraged through government schemes.

#### Project Title: Identification of climate resilient production system for different ecology

Using the data of 11 years (2004-05 to 2014-15) of field experimentation on vertisols (Bhopal, Madhya Pradesh) of Sub—arid tropics (Fig. 39), deep black soil of Raipur, Chhattishgarh (2004-05 to 2014-15) of sub humid agro ecosystem and Vertic inceptisoles of Dharwad, Karnataka (2004-05 to 2012-13) of Arid Agro-ecosystems having three management practices viz., organic (supply of 100% nutrients through organic sources and complete organic management as per NPOP standards), towards organic (supply of nutrients through 50% organic + 50% inorganic with complete organic management) and 100% inorganic management. The evaluation of production systems in terms of Soybean grain yield was performed using the long term rainfall data (1951 to 2015). To know the discrete differences among the production systems, standard error of mean of grain yield was calculated. Climate resilient production systems were identified by working out % gain (+/-) in yield over inorganic management during normal, high and deficit rainfall years.

**Agro-ecosystems undertaken**

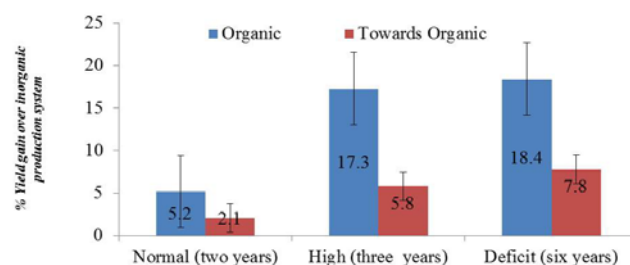
Locations	Bhopal	Raipur	Dharwad
State	M.P	Chhattisgarh	Karnataka
Agro-ecosystem	Semi-arid	Sub-humid	Semi-arid
Latitude (N)	23°18'	21°16'	15°26'
Longitude (E)	77°24'	81°36'	75°07'
Rainfall (mm)	1146.7	1203.2	851.4



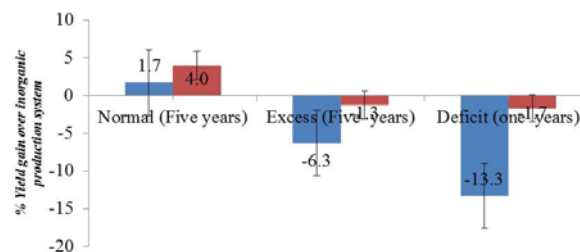
**Fig. 39. Agro ecosystems undertaken for identification of climate resilient production systems for soybean**

Soybean grown under organic production systems gained 17.3% and 18.4% yield over inorganic production systems under Excess and deficit rainfall respectively in Vertisols (OC 0.53%) of semi-arid tropics (Central India) of sub-arid Agro-Ecosystem (Fig. 40).

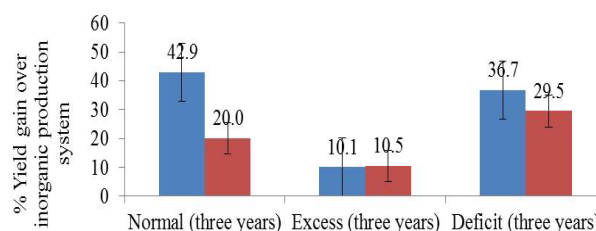
Under deficit rainfall, soybean yield grown in organic production system under performed statistically over inorganic and integrated crop management (ICM) or towards organic production system in deep black soil (OC 0.64%) under sub-humid Agro-Ecosystem (Fig. 41). However, under deficit rainfall situations, organic production system performed better over inorganic and integrated crop management production system with 36.7% higher yield in comparison to inorganic under arid climate with 885 mm rainfall (Fig. 42).



**Fig. 40. Comparative study of % Yield gain over inorganic production system for soybean at Bhopal**



**Fig. 41. Comparative study of % Yield gain over inorganic production system for soybean at Raipur**



**Fig. 42. Comparative study of % Yield gain over inorganic production system for soybean at Dharwad**

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

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

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

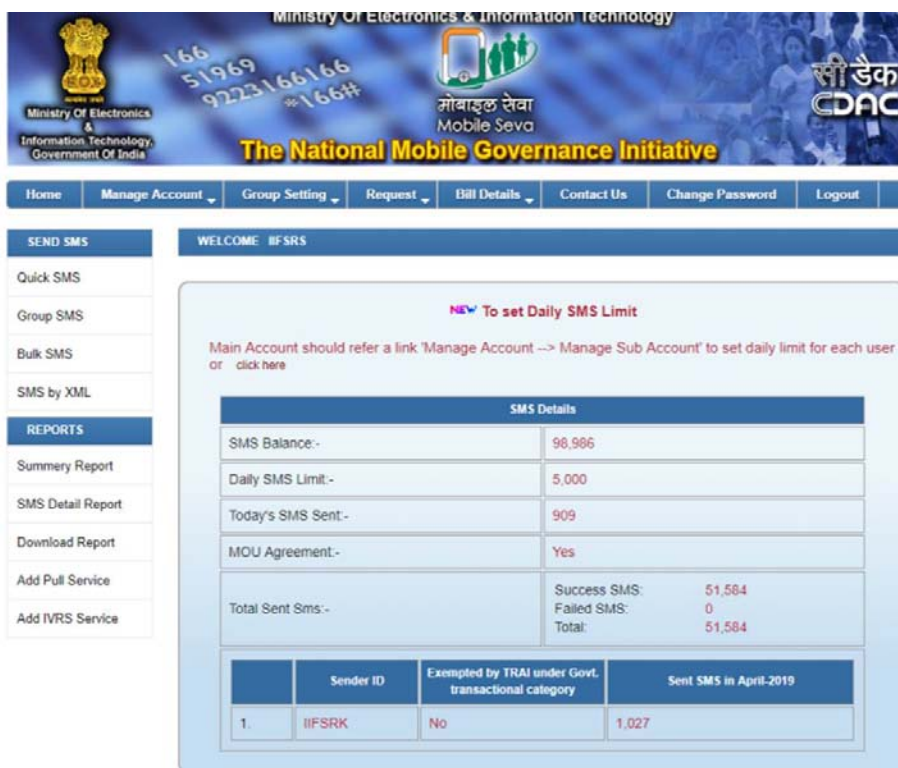


Fig. 43. Snapshot of agro-advisories disseminated to the farmers

## Externally Funded Project (EFP)

**Project Title: Adaptation and mitigation potential through Cropping System/Farming System approach (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 and modeling studies with farming systems and relating it to GCMs to assess the adaptation potential of IFS to climate change. During the year 2018-19, we have completed the following tasks,

*GHG measurement under rice-wheat cropping system under different strata of soil organic carbon*

A field experiment was started in 2017-18 at Modipuram under irrigated conditions to assess the quantum of greenhouse gases emission from rice-wheat system under different organic strata (Medium and High) under different establishment methods (puddled transplanted rice and direct seeded rice in rice; zero tillage and conventional tillage in wheat) and different source of nitrogen (control, neem coated urea, vermi compost and Application of DMPP/DCD nitrification

**Table 74. Effects of treatments on methane nitrous oxide emission & GWP under high and medium carbon soil conditions**

High Carbon	Treatments	Methane Emission (Kg/ha)	Nitrous Oxide Emission (Kg/ha)	GWP of rice systems (Kg CO <sub>2</sub> /ha)
Direct	Control (no fertilizer)	27.46	0.55	747.16
	Application of Neem coated urea	30.46	0.71	859.76
	Application of DMPP/DCD nitrification inhibitor	30.83	0.61	836.53
	Organic N management (through vermin-compost)	36.23	0.59	943.73
Transplanted	Control (no fertilizer)	29.94	0.50	783.74
	Application of Neem coated urea	37.36	0.69	998.46
	Application of DMPP/DCD nitrification inhibitor	37.06	0.67	985.96
	Organic N management (through vermin-compost)	39.40	0.61	1016.5
Medium Carbon	Treatments	Methane Emission (Kg/ha)	Nitrous Oxide Emission (Kg/ha)	GWP of rice systems (Kg CO <sub>2</sub> /ha)
Direct	Control (no fertilizer)	24.87	0.56	694.79
	Application of Neem coated urea	33.07	0.69	908.35
	Application of DMPP/DCD nitrification inhibitor	30.10	0.65	832.94
	Organic N management (through vermin-compost)	34.76	0.61	919.42
Transplanted	Control (no fertilizer)	25.76	0.52	942.03
	Application of Neem coated urea	35.46	0.67	748.82
	Application of DMPP/DCD nitrification inhibitor	35.18	0.63	934.36
	Organic N management (through vermin-compost)	37.15	0.60	932.05

inhibitor). The preliminary study indicated that GWP reduced in direct seeded rice by 13.9 per cent compared to transplanted rice under high carbon soil strata, while it reduced by 4.6 per cent under medium carbon soil strata. The application of DCDA nitrification inhibitor reduced the GWP in direct seeded rice by 15.2 per cent compared to transplanted rice under high carbon soil strata, while it reduced by 10.8 per cent under medium carbon soil strata. CH<sub>4</sub> emission reduced in direct seeded rice compared to transplanted rice by 18.5 and 6.7 per cent under high carbon and medium carbon soil strata, respectively.

### Soil organic carbon under different nutrient management practices- NPOF experiment

Application of organic manures to raise the crops organically is one of the management practices to enhance carbon buildup keeping other management practices constant. Assessment of soil C sequestration potential was made after 10 years of continuous organic cultivation of different crops at ICAR-IIFSR, Modipuram. Four cropping systems (CS1- Basmati rice – durum wheat – GM (Sesbania); CS2- Coarse rice – barley (malt) – green gram; CS3- Maize (pop corn) – potato – Okra+Sesbania and CS4- Maize (sweet corn)- mustard – GM (Sesbania)) were evaluated under organic, integrated and chemical fertilizer nutrient management practices. Higher carbon buildup of 74 Mg/ha noticed under CS4 in organic management compared to 40.9 Mg/ha under CS1 in chemical management. Maize(sweet corn)-mustard-GM(Sesbania) cropping system under organic

cultivation sequestered more carbon compared to all other cropping system as well as integrated and chemical treatments.

Maize (sweet corn)-mustard-GM (Sesbania) cropping system under organic cultivation sequestered more carbon compared to all other cropping system as well as integrated and chemical treatments.

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

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 2018-19, the following research activities done,

**Table 75. Soil C Sequestration Potential of Different Cropping Systems under Organic Cultivation in the Western Plain Zone - IIFSR, Modipuram, Meerut, Uttar Pradesh**

Cropping system	Soil C Stock (Mg/ha) (0-105 cm depth)			Total C sequestered (Mg/ha) (0-105 cm depth)			C sequestration rate (Mg/ha/year)		
	Org	Integ.	Chem	Org	Integ.	Chem	Org	Integ.	Chem
CS1	63.4	57.6	40.9	28.9	23.1	6.4	2.89	2.31	0.64
CS2	58.4	55.6	53.4	24.0	21.2	19.0	2.40	2.12	1.90
CS3	51.3	54.6	52.7	16.8	20.2	18.3	1.68	2.02	1.83
CS4	74.0	64.3	58.9	39.5	29.8	24.5	3.95	2.98	2.45

### Are the vulnerability of small farms of Indo-Genetic Plains solely depends on socio-economic conditions?

The socio-economic situation is highly variable across IGP. This study tried to link the climate-crop-socio economic models for integrated assessment of climate change impact on agricultural productivity using AgMIP-protocol in two study districts of IGP viz., Meerut and Karnal districts. Rice-wheat is the predominated cropping system in these study area. The survey data of each study districts showed that there is lot of variability between the districts, in terms of household size, income (both off- farm and on-farm, livestock population etc). It is noticed that there is lot

of difference in projected net farm income in these two districts in 2050s, even though there is not that much different in rice-wheat yields. There will be small reduction in mean net farm income of the order of -0.8 % in Meerut district, while 13.5 % increase in Karnal district. This may be due to higher contribution of livestock component in future production system. It is found that 52 % of the farms will be vulnerable in Meerut while 35 % of the farms vulnerable in Karnal district under sustainable green road pathways (moderate emission) in 2050s. The study underlined the need for such integrated assessment throughout India because of diverse farming system exists under 127 agro-climatological zones of the country.

### Vulnerability

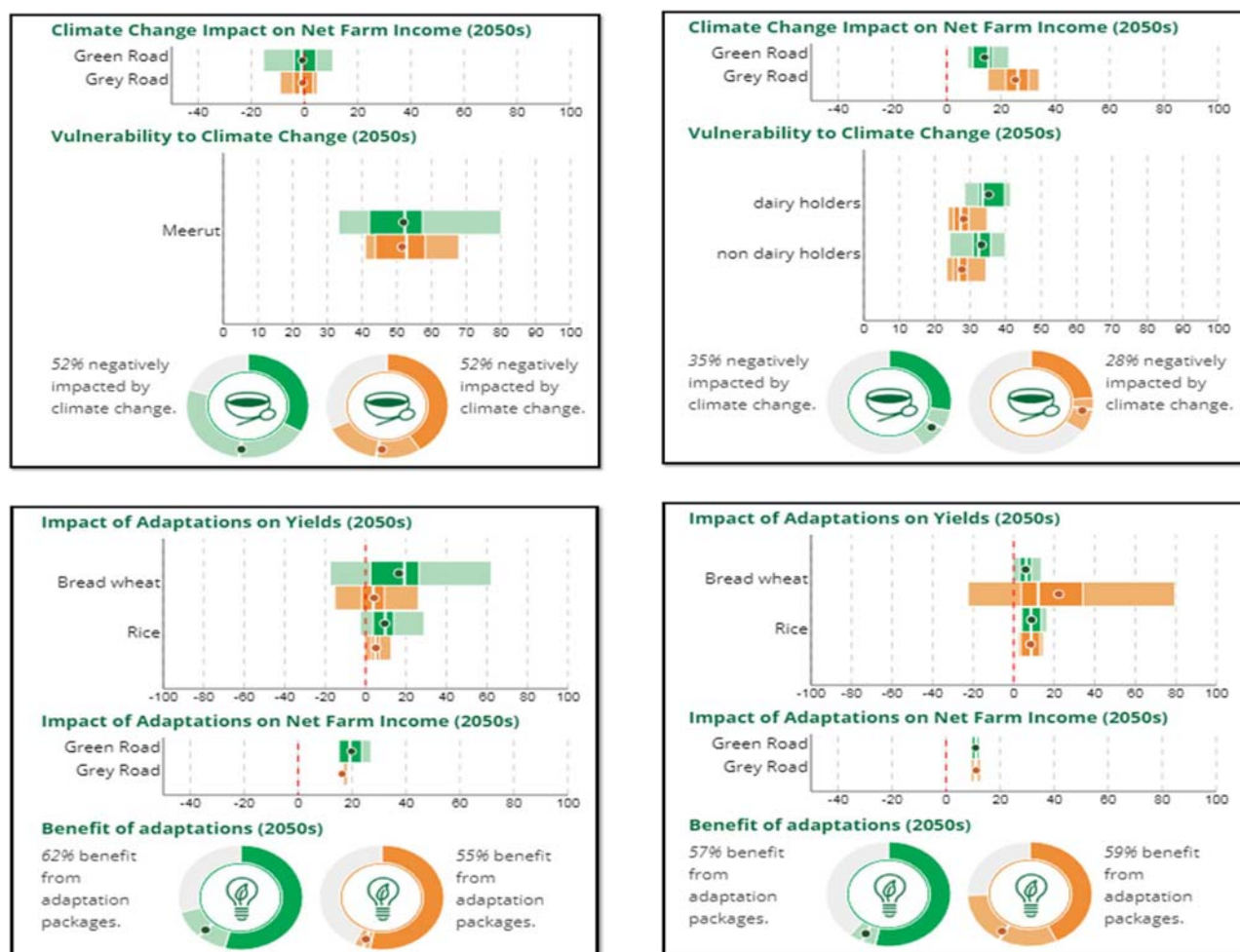


Fig. 44. Impact of climate change on various parameters

There will be 57 % and 62 % of the farms, respectively pertaining to Meerut and Karnal would benefit by adopting the adaptation package in response to climate change under Green pathways.

### Future Irrigation Requirement of Rice Under Irrigated Area - Uncertainty through GCMs and Crop Models

Analysed the climate change impact on farm level productivity of rice at Meerut District, Uttar Pradesh using 29 GCMs under RCP4.5 and RCP8.5 during mid-century period 2041-2070. Two crop simulation models DSSAT4.6 and APSIM7.7 were used for impact study. There is lot of uncertainty in yield level by different GCMs and crop models. Under RCP4.5, APSIM showed a declining yield upto 14.5 % while DSSAT showed a declining yield level of 6.5 % only compared to the baseline (1980-2010). However, out of 29 GCMs, 15 GCMs showed negative impact and 14 showed positive impact under APSIM while it showed 21 and 8 GCMs, respectively in the case of DSSAT. DSSAT and APSIM simulated irrigation water requirement in future of the order of  $645 \pm 75$  mm and  $730 \pm 107$  mm, respectively under RCP4.5. However, the same will be of the order of  $626 \pm 99$  mm and  $749 \pm 147$  mm, respectively under RCP8.5. Projected irrigation water productivity showed a range of 4.87-12.15  $\text{kg ha}^{-1} \text{mm}^{-1}$  and 6.77-12.63  $\text{kg ha}^{-1} \text{mm}^{-1}$  through APSIM and DSSAT, respectively under RCP4.5,

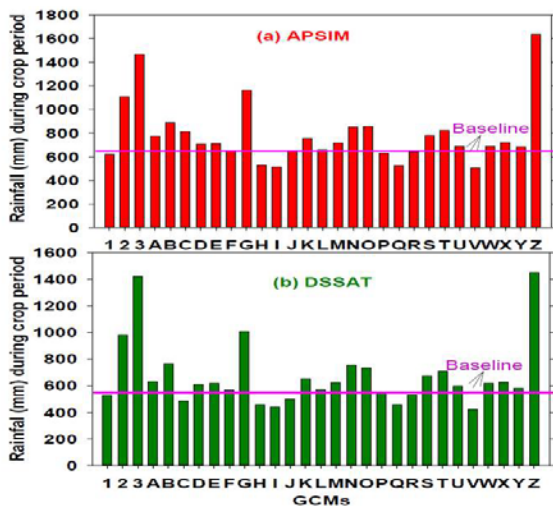


Fig. 45. Uncertainty in projected total rainfall (mm) during rice growing season by different GCMs under RCP4.5

which stands an average of 7.81 and 8.53  $\text{kg ha}^{-1} \text{mm}^{-1}$  during the baseline period. It reduced to 4.22-10.64 and 6.37-12.56  $\text{kg ha}^{-1} \text{mm}^{-1}$  through APSIM and DSSAT, respectively under RCP8.5. This showed the uncertainty of GCMs as well as the Crop models for future projection. A multi-model approach with optimistic and pessimistic projections should be used for scenario analysis and policy planning in future rather than single model projections for impact analysis.

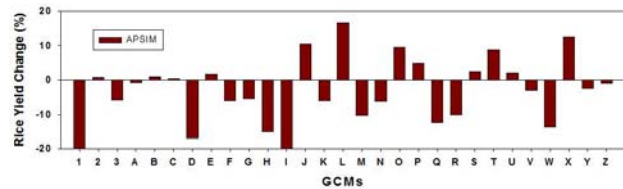


Fig. 46. Relation between GCM's and rice yield change

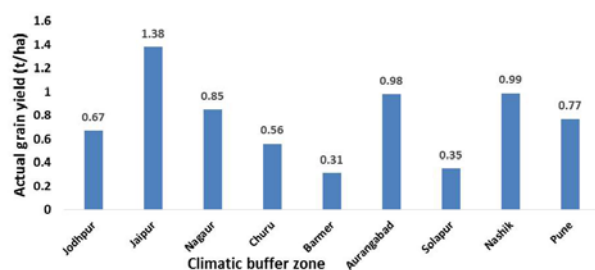
Projected rice yield deviations from baseline (1980-2010) by APSIM and DSSAT using different GCMs under RCP8.5

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

The main aim of this project is to assess the yield potential ( $Y_p$ ) or water-limited yield potential ( $Y_w$ ), yield gap ( $Y_g$ ) 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. 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 revised actual yield of rice, wheat, maize, sorghum and pearl millet has been estimated using latest data of Government of India for different climatic buffer zones of India. The mean yield data for ten-year period from 2007-08 to 2016-17 was considered for estimation of actual yields of these five crops. The actual yield of rice for Raipur climatic buffer zone of Chattisgarh, Mayurbhanj climatic buffer zone of Odisha and Kurnool climatic buffer zone of Andhra Pradesh was found to be 1.59 t/ha, 1.65 t/ha and 3.53 t/ha respectively. The actual yield of wheat for Pune climatic buffer zone of Maharashtra, and Jaipur climatic buffer zone of Rajasthan was found to be 1.91 t/ha, and 3.13 t/ha respectively. The actual yield of maize for Gulbarga and Tumkur districts of Karnataka was found to be 2.03 t/ha and 2.26 t/ha respectively. The actual yield of maize for Bhilwara and Udaipur districts of Rajasthan was found to be 1.60 t/ha and 1.49 t/ha respectively. Similarly, the actual yield of maize for Aurangabad, Jalgaon and Nashik climatic buffer zones of Maharashtra was found to be 2.72 t/ha, 2.86 t/ha and 3.1 t/ha respectively. The actual yield of sorghum for Aurangabad, Solapur and Pune districts of Maharashtra was found to be 1.38 t/ha, 0.51 t/ha and 0.81 t/ha respectively. Similarly, the actual yield of sorghum for Jodhpur and Nagaur climatic buffer zones of Rajasthan was found to be 0.48 t/ha and 0.68 t/ha respectively. The actual yield of pearl millet for Aurangabad, Solapur, Nashik and Pune districts of Maharashtra was found to be 0.98 t/ha, 0.35 t/ha, 0.99 t/ha and 0.77 t/ha respectively. (Fig. 46) Similarly, the actual yield of pearl millet for Jodhpur, Jaipur, Nagaur, Churu and Barmer climatic buffer zones of Rajasthan was found



**Fig. 47. Mean actual grain of pearl millet in different climatic buffer zones of India**

to be 0.67 t/ha, 1.38 t/ha, 0.85 t/ha, 0.56 t/ha and 0.31 t/ha respectively.

### **Project Title: Developing and targeting climate smart agriculture practices portfolios for diversity of farming systems**

ICAR-IFFSR has developed IFS prototypes for different agro-ecological zones in India. At these prototype research centres, sustainable intensification options are investigated, and prototype farms with innovative new cropping patterns and livestock combinations for farmers are being developed. To create resilient farming systems, the innovations at the prototype farms focus on climate-smart agricultural practices (CSA). Climate-smart agriculture as a global development goal was introduced to guide the transformation of agricultural systems by integrating adaptation, mitigation and food security. To support bridge the Think-Do-Gap, and move from on-station prototype research towards adoption in farmers' fields, this study used a whole-farm modelling approach to assesses the impact of on-station prototype cropping patterns for different farm types. A whole-farm modelling approach has been selected as farming system studies taking the biophysical environments into consideration are complicated, expensive and time-consuming.

The cropping patterns researched here served as interventions in the model. Table 75 Shows the components of the three selected IFS prototypes.

### **Analysis of current performance of the farmers Modipuram, Uttar Pradesh using FarmDESIGN**

The FarmDESIGN model was used to analyse the performance of the IFS prototypes and local farms. Moreover, the impact of adopting cropping patterns from the prototype farms was assessed. Majority of farmers grow sugarcane as a cash crop and cereals for feed and food purposes, milk is produced for home consumption. The economic condition of the farmers is highly dependent on sugarcane production. 3 major

**Table 75. Components of IFS prototype Modipuram**

Components prototype farm Modipuram	Area (ha) or No.
Agri-Horti system: Banana+ soybean - vegetable pea	0.12
Horti-pasture system: Kinnow + Berseem – cowpea – Lucerne – Maize – pearl millet – mustard – oats – ryegrass – Sorghum.	0.18
CP1 Basmati Rice – Wheat + Mustard / Green Gram	0.125
CP2 Sesbania – Chick Pea – Green Gram	0.125
CP3 Okra – Cauliflower – Baby corn + Cow pea	0.125
<b>Total area</b>	0.675
Buffalo	3

farm types were identified using typology viz. Marginal poor, Marginal mechanized and medium well endowed farmers.

### Alternative practices derived from IFS based on Farmers' objective for exploration

There best performing cropping systems were identified from on-station IFS model based on margin per ha, Effective organic matter (EOM), dietary energy yield and pesticide use (kg active ingredient/ha) for its upscaling at farmers field using exploration options in the FarmDesign Model.

The results obtained from the exploration study revealed there is still scope for improvement in existing farming systems of the farm types as well as IFS on-station model based on the objectives of increased

operating profit, increased organic matter balance, increased dietary energy yield and reduced pesticide use.

Results suggested that for both MPF and MWF improving dietary energy, is not possible in the current farm configuration. Only wheat is contributing NSYE to household consumption. The population of alternative farming systems generated for MWF are arranged in a linear relationship or as one dot, and not in a cloud. There are no alternative solutions that can be found below the Pareto frontier. From this, it can be concluded that in the current farming system the solution space is limited. The model results showed that reconfiguration of cropping components with added alternative systems of prototype farms could lead to improvements on all objectives. The alternative systems with higher crop diversity resulted in an increased

Abbreviation	Description	Land use (Ha.)	Household (no.)	TLU (No.)
Mo-MaPoor	Marginal, poorly-endowed farmers	0.59	5.43	1.47
Mo-MaMech	Marginal, mechanised farmers	0.77	7.92	2.84
Mo-MeWell	Medium, well-endowed farmers	2.68	9.68	3.80

### The best performing cropping systems identified from on-station IFS model

Cropping pattern	Margin p/ha INR	EOM	Dietary yield	Pesticides kg A./Ha
Agri-Horti system: Banana + Soybean(k) – Vegetable pea (r)	184560	567	15.7	0
CP1 Basmati Rice (K) -Wheat+Mustard+sesbania(r)	106400	2099	24.4	0.035
CP2 Sesbania(K) - Chick Pea+Green Gram(r)	98960	1144	9.1	2.73

solution space compared to the original situation. For all types an increase in OM balance is possible compared to the original configuration, solution space for soil OM balances improved in all systems under this exploration. Due to increased green manure applied to the soil when alternative cropping systems are included. However, for all farms, an increase in OM balance would result in farm configurations with lower operating profit. The model could provide insight into alternative scenario building of farming systems of different farm types based on the objectives and constraints

**Title of the project: Ensuring Food and Nutritional Security through Integrated Farming System in Western Plain Zone of U.P. ( FARMER FIRST SCHEME).**

### Characterization of farming systems

Farm households of all the three adopted villages namely Saunta, Sathedi and Bhangela have been categorized based on land holding size. The results

**Table 76. Households under different categories of farmers**

Category	Farmers (nos.)	Saunta	Sathedi	Bhangela	Total (%)	Cumulative (%)
Landless	376	33.4	49	19.7	36.29	36.29
Marginal (<1 ha)	346	30.91	28.3	46	33.40	69.69
Small (1-2 ha)	184	23.61	12.2	17.2	17.76	87.45
Semi-Medium (2-4 ha)	108	10.32	7.3	16.2	10.42	97.87
Medium (4-10ha)	22	1.76	3.2	0.9	2.12	100
Total	1036	100(398)	100(400)	100(238)	100	

**Table 77. Existing productivity and cost of cultivation of major crops**

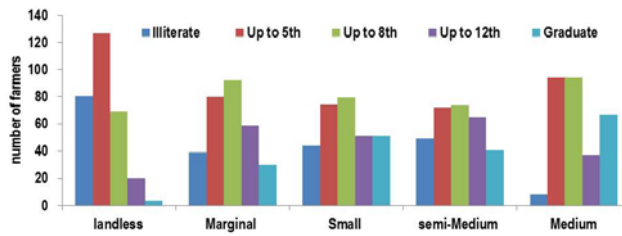
Crops	Yield q/ha	Production cost per ha (Rs.)
Sugarcane plant crop	600	110600
Wheat	36	37500
Rice	31	42600
Black gram	5.5	12500
Green gram	6.2	14500
Berseem (green fodder)	155	15000
Sorghum (green fodder)	375	16700
Oat (multi-cut green fodder)	325	18250

revealed that out of total 1036 farmers, landless farmers were 36.29% while marginal farmers were 33.40% constituting 87.45% of total sample size (Table 76). Highest number of landless farmers were found in Sathedi village (49%) followed by Sounta (33.4%) and Bhangela (19.7). Highest percentage of marginal farmers were present in Bhangela village. The medium farmers were very less i.e. 2.1% while large farmers were absent in the adopted villages.

Land holding classification and productivity of major crops are being grown in the locality and their cost of production (Table 77) were also recorded for analysis of yield gap between existing productivity and potential productivity which could give an insight into potential areas of technological intervention.

### 1. Education level

Educational level of the household head plays significant role in adoption of new technologies and its successful implementation and influences the farmers



desire to adopt given interventions. Accordingly the educational level of the household head were enumerated and presented in figure 1 which revealed maximum percentage of households had education level of to 8<sup>th</sup> class among the marginal to medium categories of farmers while 42.4% household heads of landless category are illiterate.

### 2. Chronic energy deficiency (CED) status of households

Body mass index (BMI) of household members were calculated based on which chronic energy deficiency status of the members were estimated which is presented in Table 76. Results showed that 85.10 % of the male population and 65.5 % of female population are normal while 75.30% of total population was normal in terms of CED. There was no obese in the case of male was reported however 3.57% of the female populations were found under obese category.

### 3. Typology description of Sathedi village

A typology was constructed to understand the diversity of farming systems in one village out of three to select representative farms for the assessment. This was done using survey data for households. From this survey a dataset with 20 variables was created.

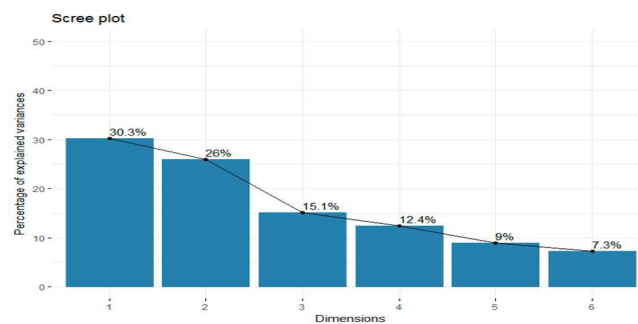
**Table 78. Chronic Energy Deficiency (CED) status based on BMI**

S. No.	CED	Male (%)	Female (%)	Average
1	Severely	2.14	3.40	02.77
2	Mild to moderate	8.51	24.13	16.32
3	Normal	85.10	65.5	75.30
4	Over weight	04.25	03.40	03.83
5	Obese	-	03.57	01.79

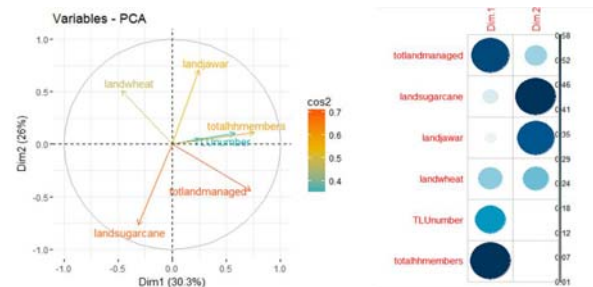
**Note:** If BMI < 16.0 (Severe), 16 – 18.4 (Mild to moderate), 18.5 – 24.9 (Normal), 25 – 30 (Over weight), > 30 (Obese)

### Principal component analysis and hierarchical clustering

Results from the initial 20 variables six final principal components (PC) having Eigen value > 1.0 were selected (Table 79). These variables were related to land use (area, cropping practice and herd size) and household (total household members). Analysis was done with two PC's explaining ~55% of the variability (Fig. 48). Fig. 49 and 50 show the sum of the cos<sup>2</sup> as measure of representation of the variables in the two dimensions (cos<sup>2</sup>=1 means fully represented in one plane).



**Fig. 48. number of principal components is determined with the Scree Plot, which orders the eigenvalues from largest to smallest**



**Figs. 49 & 50. Variables projected on PC's. Colour code gives cos<sup>2</sup> as means of representation (closer to 1 is more represented)**

#### 4. Technological interventions Implemented in different modules

Farming systems module wise planned interventions based on constraints identified during the reporting period and were implemented which are presented in Table 6. The technological interventions included primary and secondary modules as well as skill enhancement through capacity building trainings besides agro-advisory services.



**Fig. 51. Intercropping of sugarcane with Lady finger (30 Farmers)**

#### 5.1. Crop Module

**Line sowing of wheat:** On-farm trials of sowing of wheat with ferti-seed drill along with weed management and nutrient management was demonstrated at 203 farmers' fields. Improved varieties of wheat viz. Unnat PBW 550, PBW 658 DBW 90 were promoted in the region through on-farm demonstration for higher productivity and better climate resilience.



**Fig. 52. Intercropping of sugarcane with Mustard+Trench method of sugarcane planting**

**Table 79. Module wise technological interventions**

Modules	Interventions
Crop	<ul style="list-style-type: none"> <li>• Cropping intensification and diversification.</li> <li>• Use of improved production technology, HYV, Intercropping, INM, IPM and IWM.</li> <li>• Emphasis on oilseeds and pulses.</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>• Fertility and nutrition management in milch animals.</li> <li>• Livestock health care/vaccination/deworming/calcium supplementation.</li> <li>• Introduction of improved breeds of poultry, goat and swine.</li> <li>• Feed and fodder management through cropping systems diversification</li> </ul>
Horticulture	<ul style="list-style-type: none"> <li>• Demonstration of improved package of practices in vegetable crop production.</li> <li>• Exotic vegetable cultivation for higher income.</li> <li>• Multi-tier cropping of vegetables and Promotion of Nutritional kitchen garden.</li> <li>• Low cost nursery for off season vegetable production/Low cost poly house</li> </ul>
Secondary Agriculture	<ul style="list-style-type: none"> <li>• Composting and vermi-composting.</li> <li>• Improved small farm tools for reduction in drudgery of farm-women.</li> <li>• Value addition of farm produce (pickle/jam/Jaggery making) and SHG formation for marketing</li> <li>• Water chest nut (Singhada) culture in ponds</li> </ul>
Capacity building	<ul style="list-style-type: none"> <li>• Skill enhancement training (Compost/vermicompost preparation/nursery raising/on-farm processing/mushroom production/pruning/good agricultural practices etc training)</li> <li>• Exposure visits to Agri-fair/Krishi unnati mela/ awareness programmes/kiasn gosthi etc.</li> <li>• Literature distribution in local languages and agro-advisory services for risk management</li> </ul>

Sowing of wheat with ferti-seed- drill and comparison of standing crops sown using ferti-seed-drill with farmers practices

**Intercropping of sugarcane with Lady finger (30 Farmers) Intercropping of sugarcane with Mustard+Trench method of sugarcane planting**

*Diversification of sugarcane based cropping systems through intercropping:*

Results from intercropping of sugarcane revealed 6.5, 7.15, 13.26, 14.53 and 14.87 % decrease in cane yield respectively for sugarcane intercropped with greengram, black gram, okra, cucumber and bottle gourd 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 80).

**5.2. Horticultural Module**

Improved package of practice has been provided to the farmers for successful cultivation of the exotic vegetables through introduction of exotic vegetables viz., broccoli, chinese cabbage, Kale and lettuce in vegetables module for enhancing profitability was demonstrated at 50 farmers field. Demonstration of improved package of practices in vegetable crop production was carried out at 250 farmer’s field. Low cost poly tunnels were demonstrated for off season nursery raising of vegetable seedlings. A three tier horticulture based vertical farming system for space utilisation was executed at one farmer’s field.

**5.3. Livestock Module**

For addressing the problem of infertility, artificial insemination with quality semen was carried out. Supplementation of mineral mixture along with balanced nutrition was carried out for enhancing milk production

**Table 80. 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	86.7
Sugarcane + Okra	75.2	9.3	103.5
Sugarcane + Cucumber	74.1	12.0	128.6
Sugarcane + Bottle gourd	73.8	10.2	104.8
Sugarcane + Greengram	81.0	0.4	89.1
Sugarcane + Black gram	80.5	0.4	87.0



**Fig. 53. Demonstration of improved package of practices in vegetable crop production**



**Fig. 54. Vaccination, Piggery for livelihood security among landless farmers and Artificial insemination (AI) and health management in milch animals**

in mulch animals, promotion and improvement of indigenous breed of cattle, deworming, disease management etc. were carried out under livestock module. Besides, animal health camp were organized regularly for vaccination and health management of animals which are an integral part farming systems of this region and an important source of livelihood.

For ensuring the livelihood security of marginal, landless farmer's livestock based intervention given to 600 farm families viz. Piggery, backyard poultry, milch animals and farming system based etc. Nutritional chart for different livestock and poultry birds were prepared and displayed for day to day management which could result in enhanced milk and meat production due to better management practice.

#### 5.4. Secondary Agriculture Module

Under this module for women self help group named Devanjali Mahila Samuh was formed and were given training on preparation of different value added products using their on-farm produce viz. Pickle, Jagery

cubes etc. Technology of blended squash (guava+orange) and (guava + pineapple + pomegranate), Mixed jam (guava+apple+aonla +orange+ ramphal) and (guava+pineapple + pomegranate + apple), Ginger paste and labelling, branding and marketing on developed products through exhibitions and door to door marketing techniques for skill enhancement and income alternate income generation from value addition module were also carried out during the reporting period.

#### 5.5. Capacity building

Capacity building programmes, public awareness campaigns on improved package of practices of different crops was carried out during the reporting period. Farmers were also exposed to new age technologies through exposure visits to Krishimelas, exhibitions etc. World soil health day was celebrated for increased awareness about maintaining soil health for sustainable production. On this occasion soil health card were distributed to 150 villagers. Keeping in mind the important role played by the farm women in livestock



as well as cropping operations like harvesting and intercultural operations, a mahila krishak diwas was organized in Sathedi village where about 700 farm women attended the awareness programme.

#### **5.6. Risk management through SMS based agro-advisory services:**

A SMS based agro-advisory service vide Indian Institute of Farming Systems Kisan (IIFSRK) was

started using C-DAC platform under which 1036 farmers of all the three villages were registered. Farmers are being given information about anticipated weather particularly rainfall predictions as well as advisory for curtailing the inputs (e.g. upholding of irrigations and applications of agrochemicals) for enhancing the farm profitability. And also for saving the crops from aberrant weather besides giving emphasis on improved practices and crop specific disease and pest management..

## RESEARCH COORDINATION AND MANAGEMENT

### 31<sup>st</sup> Meeting of Institute Research Committee

The 31<sup>st</sup> meeting of institute research committee (IRC) of institute was held during 4<sup>th</sup> August, 2018 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 30<sup>th</sup> IRC meeting; results of on-going research projects as well as exploratory studies were discussed. Dr. Peyush Punia, Member Secretary, 30<sup>th</sup> IRC meeting, welcomed the Chairman, ADG and all the members of the IRC. Dr A. S. Panwar, Director and Chairman, 31<sup>st</sup> IRC welcomed ADG, Dr. S. Bhaskar and all the member scientists. He suggested that the project proposals should aim towards achieving the larger goal of doubling farmers income in terms of productivity, profitability and nutrition. Besides highlighting on need for working on IFS for rainfed systems.. Dr. S. Bhaskar suggested that, individual scientist (PI and Co-PI) must contribute significantly to enhance the output of the project. He emphasized to merge all small-small experiments to form a result oriented project so that, meaningful results can be drawn. He suggested for consolidation of projects and suggested that the projects at present should be formulated without effecting the mandate of the institute. Dr. A. K. Prusty presented the action taken report of the 30<sup>th</sup> 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 and their objectives.

The second meeting of the 8<sup>th</sup> Research Advisory Committee of ICAR-Indian Institute of Farming Systems Research, Modipuram was held on 3-4 May, 2018. 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, special invitee Dr M L Jat and Dr Y Saharawat 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

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 during the reporting period for economic empowerment and livelihood improvement of small farming communities in the country.



In his opening remarks, Prof. A K Singh, Chairman appreciated the efforts and achievements of the institute in the farming system mode and pointed out that the main aim of farming systems research is to address the farmers problems for sustained income throughout the year as well as more focus should be on farmers field. The need of the hour is to refine the IFS system by

interventions, input requirements with focus on small and marginal farmers. Dr S Bhaskar welcomed the RAC committee and requested the RAC members to guide the research of the institute for years to come in tune with Government of India expectations. He emphasized on undertaking research in the institute in mission mode rather than development of models and bring research component in experiments of farming system mode. Dr N Sarangi appreciated the transformation of the institute from cropping system to farming system, highlighted the importance of research components such as energy budgeting, nutrient management and economics in the models so that concrete results can be obtained. He also mentioned importance of floriculture, fish seed production unit and backyard ornamental fish modules for enhancing the income of farmers. Dr H Ravishankar complimented the scientists of the institute for undertaking excellent work in farming system for the benefit of the farmers of the country. He emphasized on the need to have correlation between horticulture based farming system to the type of soil for establishment new orchards. Dr. Praduman Kumar highlighted the importance of socio economics in the farming system perspective by which a regular income flow should be seen in all developed models. He emphasized on completing the total productivity analysis on all developed models. Mr R. K. Garg in his remarks wanted the excellent output of the institute to be more visible and the proven technologies to be disseminated to the farmers. Dr. N. Devakumar felt the need to establish workable models of IFS in all centers which should include organic blocks and to develop indicators for the assessment of developed models. He also felt the need to popularize bio-inoculants in the organic farming system. Shri Naresh Sirohi felt the need for undertaking extension activities for the dissemination of technologies/models developed by IIFSR for better visibility of the institute.

He explained about the challenges for small and marginal farmers in agriculture sector. Special invitee Dr M L Jat felt the need of adoption of developed models by the local farms of the region and models should be adapted according to the local needs. He further emphasized on the validation of economic viability of the developed models. Special invitee Dr Y. Saharawat highlighted the importance of bottom up approach required for transformation from cropping system mode to farming system mode and the need of research on precision farming.

A special presentation was made on Integrated Farming System Research: Progressive steps taken in data analysis and synthesis (Farm design and Farming System Typology) by Dr N Ravishanker and Dr Ashisa Prusty. The Programme Facilitators and Heads of different sections presented the highlights of research achievements of the respective sections. The Chairman and the members of the RAC expressed their critical views during the presentations made by the concerned scientists/team and given their valuable inputs and directions for the improvement of IFS research and IIFSR in the future. The RAC committee then visited farm of the institute and experiments being conducted in the farmers field and gave critical inputs for improvement of the experiments.



## PUBLICATIONS

### Research Papers (National/International)

- A. Patidar, S.S. Walia and Mohammad Shamim (2018). LAI and PAR interception in maize as influenced by fertilizer management in Punjab. *Journal of Agrometeorology*, 20(4) 338-339.
- A. S. Panwar, M. Shamim, S. Babu, N. Ravisankar, A.K. Prusty, N. M. Alam, D. K. Singh, J. S. Bindhu, J. Kaur, L. N. Dashora, M. D. Latheef Pasha, Soumitra Chatterjee, M. T. Sanjay and L. J. Desai (2019). Enhancement in Productivity, Nutrients Use Efficiency, and Economics of Rice-Wheat Cropping Systems in India through Farmer's Participatory Approach, *Sustainability*, 11 (122): 1-26
- A. L. Meena, R.N. Pandey, D. Kumar, V.K. Sharma, S.P. Dutta, and G. Singh, (2019). Relative impacts of long-term nutrient management practices on nitrogen dynamics in rice (*Oryza sativa*)-based organic cropping systems of Indo-Gangatic Plains. *Indian Journal of Agricultural Sciences* 89(1): 79-86.
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- V P Chaudhary and Nisha Verma (2018) Comparative Study of Brush Cutter and Improve Sickle for harvesting of both wheat and paddy crop for small landholders In National Extension Education Congress on Climate Smart Agricultural Technologies: Innovations and Interventions, held at ICAR-National Research Centre for Orchids, Pakyong, Sikkim pp 57.
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P. C.Ghasal, N.Ravisankar, D.Dutta, A.Nath, S.Malik, A.K Prusty, and A.S Panwar (2018) Performance evaluation of different fodder crops under hortipasture system. Proceedings of the XXI Biennial National Symposium on Doubling Farmers Income through Agronomic Interventions under Changing Scenario held at Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan from 24-26 Oct., 2018.

### Bulletins/ Compendium/ Manual

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N Verma, V P Chaudhary, Amit Nath, M Shamim, Dushyant Mishra organized Published by A.S. Panwar. Compendium of Empowerment of Small and Marginal Women Farmers through Agri-entrepreneurship during 06- 15-July, 2018 at ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut - 250 110, India. 4

V P Chaudhary, M Shamim, Nisha Verma, Amit Nath, Dr Dushyant Mishra Published by Dr. A S Panwar. Training Manual on 'Package and Practices for Small farm Mechanization' Model Training Course from 4th to 11th September, 2018 at Indian Institute of Farming Systems Research, Modipuram, Meerut - 250 110, India.

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### Pamphlets

डा. फूल चंद जाट, डा. एम.पी. सिंह, डा. पूनम कश्यप, डा. आजाद सिंह पँवार. पशु आवास प्रबंधन का महत्व. भारतीय कृषि प्रणाली अनुसंधान, मोदीपुरम (उत्तर प्रदेश). पृष्ठ संख्य-1

समस्या एवं समाधान. डा. फूल चंद जाट, डा. एम.पी. सिंह, डा. पूनम कश्यप, डा. आजाद सिंह पँवार. पशु आहार प्रबंधन: भारतीय कृषि प्रणाली अनुसंधान, मोदीपुरम (उत्तर प्रदेश). पृष्ठ संख्य-1

डा. फूल चंद जाट, डा. एम.पी. सिंह, डा. पूनम कश्यप, डा. आजाद सिंह पँवार. कम दूध उत्पादन के प्रमुख

कारण एवं उनका निवारण. भारतीय कृषि प्रणाली अनुसंधान, मोदीपुरम (उत्तर प्रदेश). पृष्ठ संख्य-1

### Annual Reports

N. Ravisankar, Prem Singh, R.P. Mishra, A.K. Prusty, Mohammad Shamim, Raghuveer Singh, D. Tripathi and Brij Mohan Garg. 2017. Annual Report 2016-17, AICRP on Integrated Farming Systems, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut p.1-258

N. Ravisankar, Vipin Kumar and M. Shamim. 2017. Annual Report 2016-17, Network Project on Organic Farming, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut p.1-248

Peyush Punia, A. K. Prusty, Poonam Kashyap and Sunil Kumar (2018). Annual Report 2017-18, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut p.1-189

P. C. Jat, Poonam Kashyap, Sunil Kumar, Chandra Bhanu, A. K. Prusty and R. B. Tiwary (2018). कृषि प्रणाली आलोक (चतुर्थ अंक –2017). ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut Publication, p. 1-186,

Suresh Malik, Poonam Kashyap, Sunil Kumar and Nisha Verma. (2018). Annual Report 2017-18, Farmer FIRST Programme., ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut p.1-31.

### IT based -database, software etc.

IFS – GHG emission Estimation Tool (B-version) software (N. Subash, Debashis Dutta, N. Ravisankar S. Sridevi, M. Shamin, A.S. Panwar & S. Bhaskar), ICAR-Indian Institute of Farming Systems Research, Modipuram

On-line data submission and analysis for AICRP on Integrated Farming Systems On-Farm Farming Systems research (Cini Varghese, Sukanta Dash, Arpan Bhowmik, N. Ravisankar, Dr. A.S. Panwar, A.K. Prusty and M. Shamim), ICAR-Indian Agricultural Statistics Research Institute, New Delhi.

IFS Simulator (IFSS) ver.1.1 model: A computer based crop model IFSS (Integrated Farming Systems Simulators) was developed to simulate the growth, development and yield of seven field by taking into account the effects of weather, parameters and management practices. (Sunil Kumar, M. Shamim, Mamta Bansal and RP Aggarwal)



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

Title	Period	Venue	Name of Participants
All India seminar on hi-tech cultivation of vegetable & flowers	10-11 March,2018	The Institutions of Engineers (India) Derhadun.	Dr. V.P. Chaudhary
National conference “Identification, convergence, implementation & extension of researchable issues for sustainable development (ICIESSD-(2019))	20-21 <sup>st</sup> April, 2019	Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut	Dr. L.R. Meena
National conference on Identification, convergence, implementation and extension of Science-Tech-Research for sustainable Development (ICIESSD-(2019))	20-21 <sup>st</sup> April, 2019	SVPUAT, Meerut.	Dr Nisha Verma
Creating awareness about cleanliness & sanitation, ascertaining animal health related problem	27 <sup>th</sup> April, 2018 & 11 <sup>th</sup> June, 2018	Wajeedpur, District, Baghpat.	Dr. D. Kumar
Swacchta Bharat Abhiyan, ascertaining animal health related problem	27 <sup>th</sup> April, 2018 & 11 <sup>th</sup> June, 2018	Lohoda, District Baghpat	Dr. D. Kumar
Identification of villages and meeting with pradhans and farmers regarding initiation of MGMG activities, advisory to the farmers to adopt intercropping, organic farming and diversification of crops	27 <sup>th</sup> April, 2018 & 11 <sup>th</sup> June, 2018	Jonmana (Baghpat)	Dr. D. Kumar
Farmers’ constraints in agriculture, animal husbandry and horticulture. Main constraints bull menace, payment of sugarcane, brick kilns smoke, repeat breeding in cow and buffaloes, cancer emergence in human population.	27 <sup>th</sup> April, 2018 & 11 <sup>th</sup> June, 2018	Dhikana (Baghpat)	Dr. D. Kumar
GIS approach in soil, water and plant health management	14-18 <sup>th</sup> May, 2018.	NIPHM, Hyderabad	M. Shamim
National Seminar on “Innovative technologies and management strategies for doubling farmers income” and delivered lecture on “Enhancement of income and employment through IFS” and also delivering lecture in the CAFT on Organic Farming at MPUAT, Udaipur	9 <sup>th</sup> June, 2018	MPUAT, Udaipur	N. Ravisankar
Brain storming session on “Holistic strategy for assessment of Soil health” at NASC, New Delhi”	26 <sup>th</sup> June,2018	NASC, New Delhi	N. Ravisankar
Training on “GHG emission/carbon sequestration estimation using $\beta$ version of excel tool”	26-28 <sup>th</sup> June, 2018	ICAR-IIFSR, Modipuram	Dr. L. K. Meena, Dr. Amit Kumar
Training on “GHG emission/carbon sequestration estimation using $\beta$ version of excel tool”	26-28 <sup>th</sup> June, 2018	ICAR-IIFSR, Modipuram	Kamlesh Kumar
Training on “4R Nutrient stewardship: Concepts, principles and application”	29 <sup>th</sup> June, 2018	ICAR-IIFSR, Modipuram	Dr. L. K. Meena Dr. Amit Kumar

Title	Period	Venue	Name of Participants
Training on “4R Nutrient stewardship: Concepts, principles and application”	29 <sup>th</sup> June, 2018	ICAR-IIFSR, Modipuram	Kamlesh Kumar
Training on “4R Nutrient stewardship: Concepts, principles and application”	29 <sup>th</sup> June, 2018	ICAR-IIFSR, Modipuram	Dr. L. K. Meena Dr. Amit Kumar
Organized Course co-coordinator Short course on “Empowerment of Small and Marginal Women farmers through Agri Entrepreneurship”	6-15 <sup>th</sup> July, 2018	ICAR-IIFSR, Modipuram	Dr VP Chaudhary
ICAR sponsored short course	06-15 <sup>th</sup> July, 2018	ICAR- IIFSR, Modipuram, Meerut - 250 110, India	Dr. Amit Nath
Conferences/ Meetings		ICAR-IIFSR, Modipuram	Dr. L.R. Meena
1. 4 <sup>th</sup> IRC Meeting	4 <sup>th</sup> August, 2018	Modipuram	
2. QRT meeting			
3. Workshop on crop plan	6 <sup>th</sup> September, 2018		
4. Capacity building and skill up gradation program on Farm Management during 6-10 March, (2018).			
lecture on parthenium control in crop field’s road sides and cities	21 <sup>st</sup> August, 2018	ICAR-IIFSR, Modipuram	Dr. L.R. Meena
Package and practices for small farm mechanization sponsored by Directorate of Extension, Ministry of Agriculture and Farmers Welfare, New Delhi	4-11 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Dr. Chethan Kumar G, Dr. Amit Kumar
Package and practices for small farm mechanization	4-11 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	A.L. Meena
Organized as Course Director A Model Training Course on “Package and practices for small farm mechanization”	4-11 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Dr VP Chaudhary
Model Training Course (MTC)	4-11 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram, Meerut, U.P.	Dr. Amit Nath
Package and practices for small farm mechanization sponsored by Directorate of Extension, Ministry of Agriculture and Farmers Welfare, New Delhi	4-11 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Dr. Chethan Kumar G, Dr. Amit Kumar
Cropping System based soil Indicators	8 <sup>th</sup> September, 2018	NASC complex, New Delhi	Debashis Dutta
Farm management	14-20 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Mr. Kamlesh Kumar
Fitting tribute on the first monthly death anniversary of Bharat Ratna Late Sri Atal Bihari Vajpayee ji	16 <sup>th</sup> September, 2018.	ICAR IIFSR Modipuram, Meerut	Dr. Dushyant Mishra
काव्य संध्या कार्यक्रम, हिंदी पखवाड़ा	16 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Kamlesh Kumar



Title	Period	Venue	Name of Participants
काव्य संध्या कार्यक्रम, हिंदी पखवाड़ा	16 <sup>th</sup> September, 2018	ICAR-IIFSR, Modipuram	Dr. Prem Singh, Dr. Chethan Kumar G, Dr Sunil Kumar, Dr. L. K. Meena, Dr. Amit Kumar
Attended a 4 days workshop on “Quantitative farming system typologies applications with the R statistical computing.	17-21 <sup>st</sup> September, 2018	ICAR-IIFSR, Modipuram, Meerut	Dr. Poonam Kashyap Dr. Sunil Kumar
Workshop on preparation of manual and strategy Document on Crop plan	18 <sup>th</sup> September, 2018	NASC complex, New Delhi	Debashis Dutta Dr Nisha Verma
Swachh Bharat Pakhwada	25 <sup>th</sup> September, 2018	Jamalpur, Daurala (Meerut)	Dr. L.R. Meena
Swachh Bharat Pakhwada	28 <sup>th</sup> September, 2018	Shuk Tirth (Muzaffarnagar )	Dr. L.R. Meena
Swachh Bharat Pakhwada	01 <sup>st</sup> October, 2018	Panwarsa, Daurala (Meerut)	Dr. L.R. Meena
Training cum exposure visit on Low chilling apple cultivation for Karnataka farmers	1 <sup>st</sup> October, 2018.	ICAR-IIFSR, Modipuram	Dr. Dushyant Mishra
All India Farmers fair and animal exhibition as krishidham expo -(2018)	12-14 <sup>th</sup> October, 2018	SVPUAT, Meerut	Dr Sunil Kumar, Dr. Chethan Kumar G, Dr. L. K. Meena, Dr. Amit Kumar
2nd International Conference Advances in Agricultural, Biological and Applied Sciences for Sustainable Future (ABAS-(2018)).	20-22 <sup>nd</sup> October, 2018	Sardar Patel Auditorium, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh	Dr. L.R. Meena Dr P. Kashyap and Dr Sunil Kumar
Computational modeling and analysis of varietal effects on growth and yield of Pigeonpea using IFSS version Model. 2nd International conference on Advances in agricultural, biological and applied sciences for sustainable future	20-22 <sup>nd</sup> October, 2018	CCS University, Meerut	S Kumar, M Shamim, AS Panwar, P. Kashyap and AK.Prusty
Horticulture based farming systems for doubling farmer’s income. 2 <sup>nd</sup> International conference on Advances in agricultural, biological and applied sciences for sustainable future	20-22 <sup>nd</sup> October, 2018	Swami Vivekanand Subharti University, Meerut, UP	Panwar AS, Kashyap Poonam, Ravisankar N, Prusty AK, Kumar S, Meena AL and Choudhary J.
ICAR sponsored short course on “Phenomics, the next generation phenotyping (NGP), the trait dissection and crop improvement”	22-31 <sup>th</sup> October, 2018	ICAR-IARI, New Delhi	Dr. L. K. Meena

Title	Period	Venue	Name of Participants
ICAR sponsored short course on “Phenomics, the next generation phenotyping (NGP), the trait dissection and crop improvement”	22-31 <sup>th</sup> October, 2018	ICAR-IARI, New Delhi	Dr. L. K. Meena
Kissan Diwas	23 <sup>rd</sup> December, 2018	Rashoolpur jatan, Muzaffarnagar	Dr. L.R. Meena
One day training cum exposure visit on Low chilling apple cultivation on for farmers of Punjab.	23 <sup>rd</sup> October, 2018	ICAR-IIFSR, Modipuram	Dr. Dushyant Mishra
Ergonomical Design guidelines for Agricultural tools and equipment	23-25 <sup>th</sup> October, 2018	ICAR-CIAE, Bhopal	Dr. Nisha Verma
XXI Biennial National Symposium of Indian Society of Agronomy	24–26 <sup>th</sup> October, 2018	MPUAT, Udaipur, Rajasthan	R.P. Mishra, Debashis Dutta, P.C. Ghasal
XXI biennial National Symposium of Indian Society of Agronomy on “Doubling farmers income through Agronomic Interventions Under Changing Scenario”	24-26 <sup>th</sup> October, 2018	MPUAT, Udaipur	N. Ravisankar M. Shamim
Attended XXI Biennial National Symposium on “Doubling Farmer’s Income through Agronomic Interventions under Changing Scenario”,	24-26 <sup>th</sup> October, 2018	Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan.	Dr. P.C. Jat
International Conference Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-(2018))	28-30 <sup>th</sup> October, 2018	Durgapura, Jaipur, Rajasthan	Raghuveer Singh
Training workshop for vigilance officers of ICAR institutes	31 <sup>st</sup> October to 01 <sup>st</sup> November 2018	ICAR-NAARM, Hyderabad	N. Ravisankar
International Symposium and IPNI Cooperators’ meet on Advancement in Soil, Water and Plant Nutrition Research	2-3 <sup>rd</sup> November, 2018	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Nagpur, Maharashtra	Debashis Dutta
प्रथम प्राकृतिक चिकित्सा दिवस, जैविक खाद्य उत्पाद सेमिनार	12 <sup>th</sup> November, 2018	ICAR-IIFSR, Modipuram	Kamlesh Kumar
प्रथम प्राकृतिक चिकित्सा दिवस, जैविक खाद्य उत्पाद सेमिनार	12 <sup>th</sup> November, 2018	ICAR-IIFSR, Modipuram	Dr. Prem Singh, Dr. Chethan Kumar G, Dr Sunil Kumar, Dr. L. K. Meena, Dr. Amit Kumar, R.P. Mishra, Debashis Dutta, Chandra Bhanu, A.L. Meena, P.C. Ghasal, A.K. Pursty
9th National Extension Education Congress-(2018), organized by Society of Extension Education, Agra on “Climate Smart Agricultural Technologies: Innovations and Interventions	15-17 <sup>th</sup> November, 2018	CAPHET, Ranipool, SikkimCAU, Imphal, Manipur.	Dr. V.P. Chaudhary



Title	Period	Venue	Name of Participants
9 <sup>th</sup> NEEC,(2018) on Climate Smart Agricultural Technologies: Innovations and Interventions	15-17 <sup>th</sup> November, 2018	CAEPHT, CAU, Ranipool, Sikkim	Dr.P.C. Jat
9 <sup>th</sup> National Extension Education Congress-(2018)	15-17 <sup>th</sup> November, 2018	CAEPHT, Ranipool, Sikkim (CAU), Imphal, Manipur	Debashis Dutta
ISWS Golden Jubilee International Conference on “Weeds and Society: Challenges and Opportunities	21-24 <sup>th</sup> November, 2018	ICAR-DWR, ICAR- Jabalpur	Raghuveer Singh
Attended 4 days training programme on ‘Impact Assessment of Agricultural Research and Technologies’	4-7 <sup>th</sup> December, 2018.	ICAR-NAARM, Hyderabad	Dr VP Chaudhary
Fertilizer Association of India (FAI) Annual Seminar (2018)	5 <sup>th</sup> December,2018	Pullmann hotel, New Delhi	N. Ravisankar
Advances in experimental Designs and Analysis	06-26 <sup>th</sup> December, 2018	ICAR-IASRI, New Delhi	Dr Sunil Kumar
National symposium on “Forage and livestock based technological innovations for doubling farmers’ income”	13-14 <sup>th</sup> December , 2018	UAS, Dharwad, Karnataka	Dr. L.R. Meena
Swachh Bharat Pakhwada	19 <sup>th</sup> December, 2018	Manphoda, Jansath (Muzaffarnagar)	Dr. L.R. Meena
Swachh Bharat Pakhwada	20 <sup>th</sup> December, 2018	Pamnavali (Muzaffarnagar)	Dr. L.R. Meena
V(XXXIII) Biennial workshop of AICRP on integrated Farming systems.	20-23 <sup>rd</sup> December, 2018	University of Agricultural Sciences Bengaluru( Karnataka)	Dr. L.R. Meena
V (XXXIII of project) Biennial Workshop of AICRP on Integrated Farming Systems	20-23 <sup>rd</sup> December, 2018	UAS, Bengaluru	R.P. Mishra Debashis Dutta Chandra Bhanu P.C. Ghasal
Biennial Workshop on AICRP on Integrated Farming Systems	20-23 <sup>rd</sup> December, 2018	UAS, GKVK, Bengaluru	Dr.Nisha Verma
V Biennial Workshop of AICRP on IFS	20-22 <sup>th</sup> December, 2018	GKVK, UAS, Bengaluru	Dr. Amit Nath
Swachh Bharat Pakhwada	21st December, 2018	Bhangela, Khatauli (Muzaffarnagar)	Dr. L.R. Meena
Swachh Bharat Pakhwada	23 <sup>rd</sup> December, 2018	Rasulpur Jatan	Dr. L.R. Meena
National Symposium on IFS for 3Es during 20-24 December (2018)	23-24 <sup>th</sup> December, 2018	University of Agricultural Sciences, Bengaluru	N. Ravisankar A.K. Prusty M. Shamim
National Symposium on IFS for 3Es during 20-24 December (2018)	23-24 <sup>th</sup> December, 2018	University of Agricultural Sciences, Bengaluru	Poonam Kashyap

Title	Period	Venue	Name of Participants
National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity).	23-24 <sup>th</sup> December, 2018	UAS, GKVK, Bengaluru	Dr. Nisha Verma
National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity)	23-24 <sup>th</sup> December, 2018	University of Agricultural Sciences, GKVK, Bengaluru (Karnataka)	Dr. L.R. Meena
Swachh Bharat Pakhwada	24 <sup>th</sup> December, 2018	Siwaya	Dr. L.R. Meena
Swachh Bharat Pakhwada	25 <sup>th</sup> December, 2018	Sardhana block of Meerut district	Dr. L.R. Meena
National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity)	23-24 <sup>th</sup> December, 2018	UAS, Bengaluru	R.P. Mishra Debashis Dutta Chandra Bhanu P.C. Ghasal
National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity)	23-24 <sup>th</sup> December, 2018	UAS, Bengaluru GKVK, UAS, Bengaluru	Dr. Amit Nath
National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity).	23-24 <sup>th</sup> December, 2018	UAS, GKVK, Bengaluru	Dr. Nisha Verma
Swachh Bharat Pakhwada	27 <sup>th</sup> December, 2018	Primary and middle schools of Daurala	Dr. L.R. Meena
Swachh Bharat Pakhwada	30 <sup>th</sup> December, 2018	Vill-Tisang	Dr. L.R. Meena
Experimental Designs and Statistical data analysis	03-16 <sup>th</sup> January, 2019	ICAR-IASRI, New Delhi	Dr. Nisha Verma
One day training cum exposure visit on Low chilling apple cultivation on for farmers of Chhatisgarh.	7 <sup>th</sup> January, 2019	ICAR-IIFSR, Modipuram	Dr. Dushyant Mishra
Brainstorming Workshop on “Elevated temperature and its impact on fragrance of basmati rice and strategies for mitigation”	2 <sup>nd</sup> February, 2019	College of Biotechnology, SVPUAT, Meerut	Dr. Chethan Kumar G Dr. L. K. Meena
Brainstorming Workshop on Elevated temperature and its impact on fragrance of Basmati rice and Strategies for Mitigation	02 <sup>nd</sup> February, (2019)	SVBPUAT, Meerut	Debashis Dutta P.C. Ghasal
Brainstorming Workshop on “Elevated temperature and its impact on fragrance of basmati rice and strategies for mitigation”	2 <sup>nd</sup> February, 2019	College of Biotechnology, SVPUAT, Meerut	Dr. Chethan Kumar G Dr. L. K. Meena
Brain storming session on Elevated temperature and its impact on fragrance of basmati rice and strategies of mitigation	02 <sup>nd</sup> February, 2019	SVP University & Technology, Meerut	M Shamim
Brainstorming Workshop on Elevated temperature and its impact on fragrance of Basmati rice and Strategies for Mitigation	02 <sup>nd</sup> February, 2019	SVBPUAT, Meerut	Debashis Dutta



Title	Period	Venue	Name of Participants
Training on “Apple cultivation in plain zones of north India”	04 <sup>th</sup> February, 2019	ICAR-IIFSR, Modipuram	Dr. Dushyant Mishra
Training cum workshop on NHB-ICAR, Horticulture	05-06 <sup>th</sup> February, 2019	NASC Complex, New Delhi, India	Dr. Sunil Kumar
NHB-ICAR Horti. Institutions, SAU/SHU/CAU and Horticulture Training Institute conference	5-6 <sup>th</sup> February, 2019	NASE Complex, New Delhi	Dr. L.R. Meena
National Conference on Women Empowerment Through Agro-Entrepreneurship for Livelihood Security.	7-8 <sup>th</sup> February, 2019	SKUAST, Jammu	Dr. Nisha Verma
Workshop on Technical Collaboration on Agribusiness between India and Argentina	15 <sup>th</sup> February, 2019	NASC, New Delhi	N. Ravisankar
One day training programme for women farmers under Self Help group (Devanjali Mahila Samuh), village: Satheri, Dist: Muzaffarnagar	15 <sup>th</sup> February, 2019	IIFSR-Modipuram, Meerut, U.P.	Dr. Amit Nath
Workshop on Technical Collaboration on Agribusiness between India and Argentina	15 <sup>th</sup> February, 2019	NASC, New Delhi	N. Ravisankar
XIV Agricultural Science Congress Innovations for Agricultural Transformation	20 <sup>th</sup> -23 <sup>rd</sup> February, 2019	NASC Complex, New Delhi	Dr. V.P. Chaudhary
One day Tribal Farmers Fair and Agri-Tech-Exhibition	21 <sup>st</sup> February, 2019	Gandikhata, Haridwar	Dr. Amit Nath
Training cum exposure visit on low chilling apple cultivation in plain zones	23 <sup>rd</sup> February, 2019	ICAR-IIFSR, Modipuram	Dr. Dushyant Mishra
Pilot survey of the villages, Farming system characterization, selection of beneficiaries	26 <sup>th</sup> February, 2019	Paldi, Ram Nagar and Balwa	Dr. D. Kumar
Attended the Interactive meeting-cum-workshop of Scientist in IT/ Computer Application with Secretary, DARE & DG, ICAR	6 <sup>th</sup> March 2019	NASC Complex, New Delhi	Vipin Kumar Choudhary
2 <sup>nd</sup> International Training Workshop on Precision Nitrogen Nutrition in wheat	07-12 <sup>th</sup> March, 2019	BISA-CIMMYT, Ludhiana	P.C. Ghasal
National conference on Identification, convergence, implementation and extension of Science-Tech-Research for sustainable Development (ICIESSD-(2019))	20-21 <sup>st</sup> April, 2019	SVPUAT, Meerut.	Dr. Nisha Verma
National conference “Identification, convergence, implementation & extension of researchable issues for sustainable development (ICIESSD-(2019))	20-21 <sup>st</sup> April, 2019	Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut	Dr. L.R. Meena

## TRAININGS/ WORKSHOPS ORGANISED AND ATTENDED

### Trainings /Worshop Organised

Title	Venue	Date	Participants
Meeting with ADG (AAFCC) and Secretary (DARE) & DG (ICAR) regarding closing of Agra Centre	Office of Secretary (DARE) & DG, ICAR	4 <sup>th</sup> April 2018	N. Ravisankar M. Shamim
Meeting with Department of Agriculture, Panjim, Goa and NBSSLU&P, Nagpur for finalization of Model Crop Plans for Goa State	Department of Agriculture, Panjim, Goa	17-18 <sup>th</sup> April, 2018	M. Shamim
Review meeting of agricultural schemes and programmes implemented in Uttar Pradesh chaired by Smt. Krishna Raj, Minister of State for Agriculture and Farmers Welfare (MoSA), GoI, New Delhi	ICAR-IISR, Lucknow	17 <sup>th</sup> April, 2018	N. Ravisankar
Review meeting of agricultural schemes and programmes implemented in Uttar Pradesh chaired by Smt. Krishna Raj, Minister of State for Agriculture and Farmers Welfare (MoSA), GoI, New Delhi	ICAR-IISR, Lucknow	17 <sup>th</sup> April, 2018	N Ravisankar A.K.Prusty
ICAR committee on Develop syllabus/course curriculum for PG degree in Organic farming at NASC, New Delhi (Letter F.No. Edn.5/36/2017-EQR dated 10 April (2018))	NASC, New Delhi	20 <sup>th</sup> April, 2018	N. Ravisankar
Mid-term review meeting of XXIII regional committee No. III	ICAR-RC-NEH, Umiam	11 <sup>th</sup> May, 2018	N. Ravisankar
Meeting of DDG (NRM), ADG (AAFCC) and Director, ICAR-IIFSR with QRT Chairman for finalizing the Members of the committee	NRM division, ICAR, New Delhi	14 <sup>th</sup> May, 2018	N. Ravisankar
SMD level 6 monthly Review meeting of Foreign aided Projects	KAB II, PUSA, New Delhi	04 July (2018)	A.K.Prusty
ICAR constituted committee to study the problem encountered by farmers of Sikkim and suggest suitable strategies for Sustainable Agriculture (Ref: F.No. NRM/7-3/2016-AFC dated 12/07/(2018))	ICAR-RC-NEH, Regional Centre, Gangtok	23-25 <sup>th</sup> July, 2018	N Ravisankar A.K.Prusty
National Consultation on Leveraging Agriculture for Nutrition.	MS Swaminathan Research, Chennai	29 <sup>th</sup> July, 2018	A.K.Prusty
Refinement of OFR 2 and 3 datasheet of AICRP on IFS	ICAR-IIFSR, Modipuram	10-17 <sup>th</sup> August, 2018	N. Ravisankar A.K. Prusty M. Shamim
Foundation day and award ceremony of ICAR.	NASC, New Delhi	16 <sup>th</sup> July, 2018	N. Ravisankar
Cadre strength review planning meeting	NRM division, ICAR, New Delhi	17 <sup>th</sup> July, 2018	N. Ravisankar
Cadre strength review meeting chaired by Dr Trilochan Mohapatra, Secretary (DARE) & DG (ICAR)	NASC, New Delhi	18 <sup>th</sup> July, 2018	N. Ravisankar



Title	Venue	Date	Participants
In-Session meeting of Parliament Consultative committee of Ministry of Agriculture and Farmers Welfare on Integrated Farming Systems for livelihood security and enhanced income	Parliament house annexe, New Delhi	02 <sup>nd</sup> August, 2018	N. Ravisankar
Preliminary planning meeting of QRT (2012-17)	NRM division, ICAR, New Delhi	06 <sup>th</sup> August, 2018	N. Ravisankar A.K.Prusty M. Shamim
Meeting convened by DDG (NRM) to discuss about Revised Cost Estimate (RCE) of Sub Scheme 4 on Sustainable Cropping and Farming Systems Research	NRM division, ICAR, New Delhi	27 <sup>th</sup> August, 2018	N. Ravisankar
Second meeting of QRT of ICAR-IIFSR including AICRP on IFS and NPOF	Rajasthan Agricultural Research Institute, Durgapura, Jaipur (Rajasthan)	10-11 <sup>th</sup> October, 2018	N. Ravisankar A.K.Prusty
Meeting to discuss the proposals of RE (2018)-19 and BE (2019)-2020	NRM division, ICAR, New Delhi	20 <sup>th</sup> November, 2018	N. Ravisankar
Third meeting of QRT of ICAR-IIFSR including AICRP on IFS and NPOF at Sher-E-Kashmir University of Agricultural Sciences & Technology (SKUAST), Chatha, Jammu, Jammu & Kashmir	SKUAST, Jammu	22-23 <sup>rd</sup> November, 2018	N. Ravisankar A.K. Prusty
13th Annual Group Meeting of All India Network Programme on Organic Farming	TNAU, Coimbatore	27-29 <sup>th</sup> November, 2018	N. Ravisankar A.K.Prusty M.Shamim
Meeting on Zero budget natural farming chaired by Mr Sanjay Agarwal, Secretary, DAC&FW along with Dr S. Bhaskar, ADG (AAFCC). The meeting was attended by Additional Secretary, Joint Secretary (INM) and also selected Scientists of AI-NPOF centres.	Krishi Bhawan, New Delhi	11 <sup>th</sup> December, 2018	N. Ravisankar
Fourth meeting of QRT of ICAR-IIFSR (including AICRP on IFS and NPOF)	ICAR-RC-NEH, Umiam	12-13 <sup>th</sup> December, 2018	N. Ravisankar A.K.Prusty
V Biennial Workshop (XXXIII of project) of AICRP on Integrated Farming Systems	University of Agricultural Sciences, Bengaluru	20-23 <sup>rd</sup> December, 2018	N. Ravisankar A.K. Prusty M. Shamim
SMD level 6 monthly Review meeting of Foreign aided Projects	NASC Complex, New Delhi	24 <sup>th</sup> January, 2019	
V meeting of QRT of ICAR-IIFSR including AICRP on IFS and AI-NPOF	Hotel Horizon, Thiruvananthapuram	10-12 <sup>th</sup> January, 2019	N. Ravisankar A.K.Prusty
Seventh meeting of QRT of ICAR-IIFSR (including AICRP on IFS and AI-NPOF)	ICAR-CIARI, Port Blair	04-06 February (2019)	N. Ravisankar A.K.Prusty
Write lab meeting of AICRP on IFS to prepare the publications related to FarmDesign and Farming Systems Typology from AICRP on IFS along with selected centres and experts from CIMMYT, India and also Wageningen University of Research, The Netherlands.	PAU, Ludhiana	26 <sup>th</sup> February - 01 <sup>st</sup> March, 2019	N. Ravisankar A.K.Prusty
Meeting convened by Hon'ble Union Minister of Agriculture and Farmers Welfare with Agricultural Experts for discussion on policies	NASC, New Delhi	6 <sup>th</sup> March, 2019	N. Ravisankar

Title	Venue	Date	Participants
Displayed IFS technologies in 3 days Pusa Krishi Vigyan mela at IARI, New Delhi-	IARI, New Delhi	5-7 <sup>th</sup> March, 2019	Poonam Kashyap
Participated and Displayed IFS technologies in National Potato day	CRPS Modipuram	15 <sup>th</sup> February, 2019	Dr. Poonam Kashyap
Horticulture based farming systems for doubling farmers income (Theme 1. Recent trends in Agricultural Sciences and Technologies) In 2 <sup>nd</sup> International conference on Advances Agricultural, Biological and Applied Sciences for Sustainable future (ABAS-(2018))	Swami Vivekanand Subharti University, Meerut, Uttar Pradesh	20-22 <sup>nd</sup> October, 2018	Panwar, A.S., Poonam Kashyap, N. Ravisankar, A.K. Prusty, Sunil Kumar, Amrit Lal Meena and Jairam Choudhury

### Trainings /Worshops/Schools Organised

Programme	Venue	Period	Name of the Scientist	Role
IIFSR-ILRI-FAO interface meeting	ICAR-IIFSR, Modipuram	21 April (2018)	A.K.Prusty	Programme Coordinator
Training on “GHG emission/carbon sequestration estimation using $\beta$ version of excel tool”	ICAR-IIFSR, Modipuram	26-28 <sup>th</sup> June, (2018)	Dr. L. K. Meena, Dr. Amit Kumar	Participant
Training on “GHG emission/carbon sequestration estimation using $\bullet$ version of excel tool” for on-station and on-farm centres of AICRP on Integrated Farming Systems at ICAR-IIFSR, Modipuram	ICAR-IIFSR, Modipuram	26-28 June (2018)	N. Ravisankar	Programme Facilitator (CU)
Training on “4R Nutrient stewardship: Concepts, principles and application”	ICAR-IIFSR, Modipuram	29 <sup>th</sup> June, (2018)	Dr. L. K. Meena, Dr. Amit Kumar	Participant
IPNI sponsored training on “4R nutrient management strategy”	ICAR-IIFSR, Modipuram	29 June (2018)	N. Ravisankar	Programme Facilitator (CU)
ICAR sponsored short course on “Empowerment of Small and Marginal Women farmers through Agri-Entrepreneurship”	ICAR-IIFSR, Modipuram	06-07-(2018) to 15-07-(2018)	Dr Nisha Verma, Dr Amit Nath, Dr V P Chadhary, Dr M Shamim and Dr Dushyant Mishra	Course Coordinator
ICAR-IIFSR- CIMMYT Joint TRAINING WORKSHOP SERIES on “Quantitative farming systems typologies applications with the R statistical computing software for OFR centres of AICRP on IFS organized with International experts	AU, Kota TNAU, Coimbatore ICAR-IIFSR, Modipuram ICAR-RC-ER, Patna	3-7 September (2018) 10-14 September (2018) 17-21 September (2018) 24-28 September (2018)	N. Ravisankar	Programme Facilitator (CU)



Programme	Venue	Period	Name of the Scientist	Role
ICAR-IIFSR- CIMMYT Joint TRAINING WORKSHOP SERIES on “Quantitative farming systems typologies applications with the R statistical computing software for OFR centres of AICRP on IFS organized with International experts	AU, Kota	3-7 September (2018)	A.K. Prushty	Programme Coordinator
	TNAU, Coimbatore	10-14 September (2018)		
	ICAR-IIFSR, Modipuram	17-21 September (2018)		
	ICAR-RC-ER, Patna	24-28 September (2018)		
Model Training Course sponsored by Directorate of Extension, Ministry of Agriculture and Farmer Welfare New Delhi “Package and practice for small farm mechanization” at ICAR-IIFSR, Modipuram	ICAR-IIFSR, Modipuram	4-11 <sup>th</sup> September, (2018)	Dr VP Chaudhary, Course Dr Amit Nath, Dr Dushyant Mishra, Dr M Shamim and Dr Nisha Verma.	Coordinator
Package and practices for small farm mechanization sponsored by Directorate of Extension, Ministry of Agriculture and Farmers Welfare, New Delhi	ICAR-IIFSR, Modipuram	4-11 <sup>th</sup> September, (2018)	Dr. Chethan Kumar G, Dr. Amit Kumar	Participant
काव्य संध्या कार्यक्रम, हिंदी पखवाड़ा	ICAR-IIFSR, Modipuram	16 <sup>th</sup> September, (2018)	Dr. Prem Singh, Dr Poonam Kashyap, Dr A. K. Pursty, Dr. Chethan Kumar G, Dr Sunil Kumar, Dr. L. K. Meena, Dr. Amit Kumar	Participant
“Quantitative farming system typologies applications with the R statistical computing	ICAR-IIFSR, Modipuram	17-21 <sup>th</sup> September, (2018)	Dr Sunil Kumar	Participant
Hindi Karyashala	ICAR-IIFSR, Modipuram	25-09-(2018)	A.K.Prusty	Programme Coordinator
Certified Farm Advisor (CFA) on Organic Farming (Module-II) sponsored by National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Telangana	ICAR-IIFSR, Modipuram	4-18 October (2018)	N. Ravisankar	Programme Coordinator
			M Shamim	Programme Co-Coordinator
			Poonam Kashyap	Programme Co-Coordinator
All India Farmers fair and animal exhibition as krishi dham expo -(2018)	SVPUAT, Meerut	12-14 <sup>th</sup> October, (2018)	Dr P.C. Jat, Dr Poonam Kashyap, Dr Sunil Kumar, Dr Nisha Verma Dr. Chethan Kumar G, Dr. L. K. Meena, Dr. Amit Kumar	Participant
Organized Mahila Krishak Diwas	ICAR-IIFSR, Modipuram	15 <sup>th</sup> October, (2018).	Poonam Kashyap	Programme Co-Coordinator
ICAR sponsored short course on “Phenomics, the next generation phenotyping (NGP), the trait dissection and crop improvement”	ICAR-IARI, New Delhi	22-31 <sup>th</sup> October, (2018)	Dr. L. K. Meena	Participant
Vigilance Awareness Week-(2018) “Eradicate Corruption-Build a New India” (अष्टाचार मिटाओ-नया भारत बनाओ)	ICAR-IIFSR, Modipuram	29 October to 03 November (2018)	N. Ravisankar	Vigilance Officer

Programme	Venue	Period	Name of the Scientist	Role
Vigilance Awareness Week-(2018)"Eradicate Corruption-Build a New India" (अष्टाचार मिटाओ-नया भारत बनाओ)	ICAR-IIFSR, Modipuram	29 October to 03 November (2018)	A.K.Prusty	Coordinator
प्रथम प्राकृतिक चिकित्सा दिवस, जैविक खाद्य उत्पाद सेमिनार	ICAR-IIFSR, Modipuram	12 <sup>th</sup> November, (2018)	Dr. Prem Singh, Dr Poonam Kashyap, Dr A. K. Pursty, Dr. Chethan Kumar G, Dr Sunil Kumar, Dr. L. K. Meena, Dr. Amit Kumar	Participant
Training on Integrated Farming Systems and Conservation Agriculture for officials of National Rainfed Area Authority (NRAA) sponsored by NRAA, GoI, New Delhi	ICAR-IIFSR, Modipuram	19-23 November (2018)	Poonam Kashyap	Programme Co-Coordinator
XIII Annual Group Meeting of All India Network Programme on Organic Farming	Tamil Nadu Agricultural University, Coimbatore	27-29 November (2018)	N. Ravisankar A.K.Prusty M. Shamim	National PI & Organizing Secretary Memeber, Coordination Unit Associate Scientist, AINPOF
Brain storming session on Indigenous organic practices including zero budget natural farming (ZBNF) vs Scientific organic farming involving ZBNF practicing farmers	Tamil Nadu Agricultural University, Coimbatore	28 November (2018)	N. Ravisankar A.K.Prusty	National PI & Organizing Secretary Member, Coordination Unit
Advances in experimental Designs and Analysis	ICAR-IASRI, New Delhi	06-26 <sup>th</sup> December (2018)	Dr Sunil Kumar	Participant
World Soil Day at Gaidikhata, Haridwar Haridwar	Gaidikhata, Haridwar	30-12-18	Poonam Kashyap	Member stage management committee
V Biennial Workshop (XXXIII of project) of AICRP on Integrated Farming Systems	University of Agricultural Sciences, Bengaluru	20-23 December (2018)	N. Ravisankar	Programme Facilitator & Organizing Secretary
National Symposium on IFS for 3Es	University of Agricultural Sciences, Bengaluru	23-24 December (2018)	N. Ravisankar	Co-Convener
Skill development training on scientific goat farming	Jayapur, Nagepur and Sewo in Varanasi	03 January, (2019)	M Shamim	Programme Coordinator



Programme	Venue	Period	Name of the Scientist	Role
8th Indian Horticulture Congress (2018)	Indira Gandhi Krishi Vishwa-vidyalaya, Raipur, Chattisgarh	17-21 January, (2019)	M. Shamim	Participants
Brainstorming Workshop on “Elevated temperature and its impact on fragrance of basmati rice and strategies for mitigation”	College of Biotechnology, SVPUAT, Meerut	2 <sup>nd</sup> February, (2019)	Dr. Dr. Chethan Kumar G, Dr. L. K. Meena	Participant
Training cum workshop on NHB-ICAR, Horticulture	NASC Complex, New Delhi	05-06 <sup>th</sup> February, (2019)	Dr Sunil Kumar	Participant
International Symposium on Advances in Agrometeorology for Managing Climatic Risks of Farmers (INAGMET-(2019)).	JNU, New Delhi	11-13 February, (2019)	M. Shamim	Participants
Training on packaging and labelling of value added products to Women’s Self help Group	ICAR-IIFSR, Modipuram	15-02-(2019)	Dr Nisha Verma, Dr Amit Nath and Dr Poonam Kashyap	Course Coordinator
Discussion meet on the sidelines of International workshop on technical cooperation in agribusiness between India and Argentina (15-17 Feb. (2019)	ICAR-IIFSR, Modipuram, Meerut.	17 February, (2019)	N. Ravisankar M. Shamim A K Prusty Raghuveer Singh	Programme Facilitator Programme Coordinator Programme Co-coordinator Programme Co-coordinator
Discussion meet on side lines of International workshop on Technical cooperation in Agri-business between India and Argentina	ICAR-IIFSR, Modipuram	17 February (2019)	Poonam Kashyap	Programme Co-Coordinator
Training cum exposure visit on Organic farming for farmers of Nilgiri districts, Tamil Nadu	ICAR-IIFSR, Modipuram, Meerut	21-23 February, (2019)	N. Ravisankar M. Shamim A K Prusty Raghuveer Singh	Programme Facilitator Programme Coordinator Programme Co-coordinators Programme Co-coordinators
Writing Lab for identified centres of AICRP on IFS	Punjab Agricultural University, Ludhiana	25 February to 01 March (2019)	N. Ravisankar A.K.Prusty	Programme Facilitator (CU) PI, CIMMYT Project
New technologies and developments in oilseeds cultivation for changing climate	ICAR-IIFSR, Modipuram, Meerut	18-19 March, (2019)	N. Ravisankar M. Shamim A K Prusty Raghuveer Singh	Programme Facilitator Course Director Course Coordinator Course Coordinator

## TRAINING/ REFRESHER COURSE/ SUMMER/ WINTER INSTITUTE /SEMINARS/ CONFERENCES/ WORKSHOP ATTENDED WITHIN INDIA AND ON DEPUTATION ABROAD

Event	Period/ Duration	Venue	Achieved
Aaloo Divas”	15 <sup>th</sup> February (2018)	CPRI, Regional station Moipuram, Meerut	Dr Poonam, Dr P.C. Jat, Dr Sunil Kumar, Dr Nisha Verma, Dr Khushal Singh Participated and coordinated for stall exhibition in the Mela
Krishi Unnati Mela (2018)	16-19 March, 2017	IARI, New Delhi	Dr Poonam, Dr P.C. Jat, Dr Sunil Kumar, Dr Nisha Verma, Dr Khushal Singh Participated and coordinated for stall exhibition in the Mela
International Conference organized by IPNI	28-29 August, 2017	NASC, New Delhi	Dr Prem Singh, Dr L.K. Meena, Dr Chethen Kumar G, Dr Sunil Kumar, Dr Nisha Verma, Attended and coordinated as assigned by the competent authority
All India Farmers’ Fair and Agro-Industry Exhibition	7-10-2017 to 9-10-2017	Sardar Vallabh Bhai Patel University of Agriculture & Technology, Modipuram Meerut.	Dr Poonam, Dr P.C. Jat, Dr Sunil Kumar, Dr Nisha Verma, Dr Khushal Singh Attended and coordinated as assigned by the competent authority
77 <sup>th</sup> Annual National Conference of Indian Society of Agricultural Economics	October, 12-14, 2017	CPGS, CAU, Barapani, Meghalaya	Attended and coordinated as assigned by the competent authority
Participated the Advance Training programme on Conservation Agriculture- Asia	23 <sup>rd</sup> Oct., 2017 to 6 <sup>th</sup> Nov., 2017	Ludhiana & Karnal	Dr Poonam, Dr P.C. Jat, Dr Sunil Kumar, Dr Nisha Verma, Dr Khushal Singh Attended and coordinated different sessions of the workshop as assigned by the competent authority

## AWARDS/HONOURS AND RECOGNITIONS

### Awards/Honours and recognitions received

Awards/fellowships received(National; International; Institutional/ Professional Societies, Best paper/poster/honours received Any other—please specify)	Awarding institute/ association	Name of the awardee
Fellow 2015, Indian Society of Agronomy	Awarded by Indian Society of Agronomy during (2018)	N. Ravisankar
Best Paper Presentation Award in the IX National Extension Education Congress-(2018)	Awarded by Society of Extension Education during (2018)	A.K.Prusty
Dhiru Moraji Memorial Award for best article (First Prize) in Agricultural Sciences, 2017-18	Awarded by Fertilizer Association of India during (2018)	A.S.Panwar, N. Ravisankar and M. Shamim
Best Poster (second) award in the XXI National Symposium of Indian Society of Agronomy, (2018)	Awarded by Indian Society of Agronomy during (2018)	N. Ravisankar
Best Paper Presentation Award in the IX National Extension Education Congress-(2018)	Awarded by Society of Extension Education during (2018)	N. Ravisankar
Best Poster Award on the paper of “Sustainable development of Integrated Farming system approach for sustainable production, nutritional security and resource conservation in Western plain zone of Uttar Pradesh.	Indian society of Agronomy Bengaluru chapter, UAS(B), International Maize and Wheat improvement center (CIMMYT) New Delhi, UAS, GKVK, Bengaluru during 23-24 December, (2018).	L.R.Meena, Suresh Malik, Amit Nath, Dushyant Mishra, Devendra Kumar, Chandrabhanu, A.K.Prusty and A.L.Meena
Best Oral Presentation Award in the IX National Extension Education Congress-(2018)	Awarded by Society of Extension Education during (2018)	Poonam Kashyap
Received 2 <sup>nd</sup> prize in displaying IFS technologies in All India Farmers Fair Krishidham EXPO (2018) organised by ICAR-CPRI RS Modipuram from 12th – 14 <sup>th</sup> October, (2018) held in Sardar Vallabhabhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh.	Awarded by ICAR-CPRI RS Modipuram, Meerut.	P.C. Jat, Poonam Kashyap, Sunil Kumar, Nisha Verma
शोध-पत्र पोस्टर प्रदर्शन प्रतियोगिता में द्वितीय स्थान प्राप्त किया। दिनांक 26.09.(2018) 14-28 सितम्बर, (2018) को हिन्दी पखवाड़ा का आयोजन भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ (उ.प्र.) द्वारा किया गया। शीर्षक: “भारतीय कृषि में मोबाईल ऐपस का महत्व”, सुनील कुमार, पूनम कश्यप और आशीष कुमार प्रूष्ठी एवं पीयूश पूनिया	भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ (उ.प्र.)	Sunil Kumar, Poonam Kashyap

Awards/fellowships received(National; International; Institutional/ Professional Societies, Best paper/poster/honours received Any other—please specify)	Awarding institute/ association	Name of the awardee
Received Best Poster Award on paper “Integrated farming System Approaches for Sustainable Production, Nutritional security and Resource Conservation in western plain zone of UP” during National Symposium on Integrated Farming Systems for 3Es at UAS, GKVK Bengaluru during 23-24 <sup>th</sup> December (2018)	GKVK Bengaluru	D. Mishra
Received Young Scientist Award from New Age Mobilization Society, New Delhi on the occasion of National Conference on Identification, Convergence, Implementation and Extension of Science-Tech-Research for Sustainable Development (ICIESSD-(2019))during 20-21 April, (2019). Implementation and Extension of Science-Tech-Research for Sustainable Development	New Delhi	Nisha Verma
हिंदी पखवाड़ा के अंतर्गत 26/09/;2018-19 को आयोजित शोध पत्र पोस्टर प्रदर्शन प्रतियोगिता में प्रथम स्थान प्राप्त किया	हिंदी पखवाड़ा, भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ	अमृत लाल मीना, बी एस द्विवेदी, देबाशीष दत्ता, एल के मीना, अमित कुमार, चेतन कुमार जी, जयराम चौधरी, प्रकाश चंद घासल, कमलेश कुमार, सुनील कुमार एवं आर पी मिश्रा

### Radio/Television talk

1. Dr Nisha Verma, Delivered radio talk on “Malila Krishakon ke kathin shram ka unnat takneekon dvaara nuneekaran” Live telecasted on 13<sup>th</sup> March, (2019) w.e.f. 11: 15 -12:15 hrs from villager Meerapur Dalpat, Dist. Mujaffarnagar.
2. Dr Suresh Malik, Topic: “Vaizaganik takniki dwara murgi palan” delivered on 16 March, (2019) at village Badhai Kala, District Muzaffarnager, U.P.
3. Delivered Invited Talk on “Advances in Fruit Production Technologies” in “Students mentoring Program on Nutritional crops” organized under Centre for advanced Agricultural Science and Technology on Nutritional crops” (CAAST-NC) financed by ICAR at Department of Horticulture, C S Azad University of Agriculture and Technology, Kanpur on 30<sup>th</sup> March (2019).



## LECTURES DELIVERED

Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Improving productivity of fruit crops	“Improving productivity of fruit crops” under MGMG scheme	Villages of Kithor area (Jhidio, Naval Surajpur, Govindpur), Meerut	24 <sup>th</sup> April (2018)	Dr. Dushyant Mishra
Pest management opportunities and challenges in Organic Farming	Pest management opportunities and challenges in Organic Farming	PKVY Scheme at BHU, Varanasi	06.June.(2018)	Dr. Chandra Bhanu
Recent research advances of organic farming in India	CAFT on Innovative approaches and strategies for higher profitability and sustainability in organic production system	MPUAT, Udaipur	9 <sup>th</sup> June,2018	N. Ravisankar
Future of organic farming in India	CAFT on Innovative approaches and strategies for higher profitability and sustainability in organic production system	MPUAT, Udaipur	10 <sup>th</sup> June, 2018	N. Ravisankar
Advances in Mango Production	“Advances in Mango Production” during 27 <sup>th</sup> Mango Mela-cum-Seminar	Centre for Subtropical Fruits (CSTF), Ladwa, Kurukshetra (Haryana)	06 July (2018).	Dr. Dushyant Mishra
Off farm Entrepreneurship activities for landless, small and marginal women farmers	ICAR sponsored short course entitled “Empowerment of Small and Marginal Women farmers through Agri-Entrepreneurship		06-15 July, (2018)	Dr Nisha Verma
Processing and value addition for developing women entrepreneurs	ICAR Short Course on Empowerment of Small and Marginal Women Farmers through Agri-entrepreneurship	ICAR-IIFSR, Modipuram	06-15 July, (2018)	Dr. Amit Nath
Minimal processing of fruits and vegetables	ICAR Short Course on Empowerment of Small and Marginal Women Farmers through Agri-entrepreneurship	ICAR-IIFSR, Modipuram	06-15 July, (2018)	Dr. Amit Nath
Entrepreneurship options in Organic Farming	ICAR short course on Empowerment of small and marginal women farmers through Agri-Entrepreneurship	ICAR-IIFSR, Modipuram	9 <sup>th</sup> July, 2018	N. Ravisankar
Ornamental Fish farming for entrepreneurship development	ICAR short course on Empowerment of small and marginal women farmers through Agri-Entrepreneurship	ICAR-IIFSR, Modipuram	9 <sup>th</sup> July, 2018	Peyush Punia
Empowerment of Small and Marginal Women farmers through Agri Entrepreneurship	Evaluation of nutrients (Proximate composition) of different food products.	ICAR-IIFSR, Modipuram Meerut (U.P.)	10 <sup>th</sup> July, (2018)	Dr D. Dutta

Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Small tools and machinery for post-harvest handling, harvesting and processing	Small tools and machinery for post- harvest handling, harvesting and processing	ICAR-IIFSR, Modipuram	July 11, (2018)	Dr. V.P. Choudhary
Demonstration of tools and implements for post-harvest handling	Demonstration of tools and implements for post-harvest handling	ICAR-IIFSR, Modipuram	July 11, (2018)	Dr. V.P. Choudhary
Food Processing Industry	Food Processing Industry visit	ICAR-IIFSR, Modipuram	July 13, (2018)	Dr. V.P. Choudhary
Entrepreneurship development through scientific nursery management in ICAR approved short course on Empowerment of small and marginal women farmers through agri-entrepreneurship	Entrepreneurship development through scientific nursery management	ICAR-IIFSR, Modipuram	14 July (2018)	Dr. Poonam Kashyap
Quality mango production in western UP	“Quality mango production in western UP and Uttarakhand for International markets” during Mango festival (2018)	Department of Horticulture, Uttarakhand Government Dehradun (UK)	16-17 July (2018)	Dr. Dushyant Mishra
IFS and organic farming system models	Farmer workshops concurrently with International agriculture and horticulture and world organic expo (As per office order of ICAR vide letter no. Nil dated 10 July (2018) from ADG (TC)	Pragati Maidan, New Delhi	29 <sup>th</sup> July, 2018	N. Ravisankar
Parthenium Awareness Week	On Menace and integrated management of Parthenium hysterophorus	ICAR-IIFSR	16-22 August, (2018)	Dr. Chandra Bhanu
Overview of small farm Mechanization	Farm Mechanization	ICAR-IIFSR, Modipuram	4 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Status and Scope of mechanization in Indian agriculture scenario	Mechanization in Indian agriculture scenario	ICAR-IIFSR, Modipuram	4 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Importance and role of gender friendly tools and equipments for reducing drudgery	Model Training Course on “ Package and Practices for small farm Mechanization	ICAR-IIFSR, Modipuram	04-11 September, (2018)	Dr Nisha Verma
Importance of small tools in horticultural operations for small farm holders	“Importance of small tools in horticultural operations for small farm holders” in Model Training Course entitled “Package and Practices for Small farm Mechanization”	Directorate of Extension, Ministry of Agriculture and Farmers Welfare, New Delhi. Held at ICAR-IIFSR, Modipuram Meerut	5 <sup>th</sup> September (2018)	Dr. Dushyant Mishra



Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Farm units and discussed the experimental plans for small land holders	Visit of Farm units and discussed the experimental plans for small land holders	ICAR-IIFSR, Modipuram	6 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Conservation agricultural	Long term conservation agricultural practices and its impact on natural resource management soil	ICAR-IIFSR, Modipuram	11 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Organic Farming	Crop Pest and Disease management under Organic Farming during Farmers Fair organized by Agriculture Department	Fatehpur (U.P.)	7-11 September, (2018)	Dr. Chandra Bhanu
Demonstration on farmers friendly small tools for reducing drudgery	Small tools for reducing drudgery	ICAR-IIFSR, Modipuram	11 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Farm Management	Data analysis techniques of field crops in “capacity building and skill up gradation programme on “Farm Management”	ICAR-IIFSR, Modipuram	14-20 September, (2018)	Dr. Sunil Kumar
Management of farm products by value addition	Capacity Building and Skill Upgradation Programme for Technical Staffs on “Farm Management	ICAR-IIFSR, Modipuram	14-20 Sept., (2018)	Dr. Amit Nath
Farm implements and gender sensitive farm tools	Farm implements and gender sensitive farm tools	ICAR-IIFSR, Modipuram	15 <sup>th</sup> September, (2018)	Dr. V.P. Choudhary
Modern techniques of Orchard management in ICAR sponsored training on Farm Management	Modern techniques of Orchard management	ICAR-IIFSR, Modipuram	18 Sept (2018)	Dr. Poonam Kashyap
Quality seed production of field crops	“Quality seed production of field crops” in Capacity building and skill up gradation programme on Farm Management	ICAR-IIFSR, Modipuram Meerut (U.P.)	19 <sup>th</sup> September (2018)	Dr. D. Kumar
Trainers Training Programme on Entrepreneurship Development in Farming System through Round the Year Mushroom Production Technology	Practical aspects of nutrient analysis in organically managed soils and different organic manures	ICAR-IIFSR, Modipuram Meerut	04-18 October, (2018)	Dr. A. L. Meena
Training programme on Certified Farm Advisor on organic Farming	Talk on Tools and Techniques for nutrient management under organic production system	ICAR-IIFSR, Meerut	04.October (2018)	Dr. P.C. Ghasal
Training programme on Certified Farm Advisor on organic Farming	Talk on Identification of green manures and its utilization in organic production system	ICAR-IIFSR, Meerut	05 October (2018)	Dr. P.C. Ghasal

Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Training programme on Certified Farm Advisor on organic Farming	Talk on Identification of different weeds and management	ICAR-IIFSR, Meerut	05 October (2018)	Dr. P.C. Ghasal
Diversification in Agriculture through Fruit crops	“Diversification in Agriculture through Fruit crops” During National Conference on “Advances in Agricultural and Natural Sciences for Sustainable Development”	School of Agricultural Sciences, Quantum University, Roorkee (UK)	13 <sup>th</sup> October 2018	Dr. Dushyant Mishra
Horticulture based farming systems for food and nutritional security	Horticulture based farming systems	Swami Vivekanand Subharti University, Meerut (U.P.)	20-22 October, (2018)	Dr. Poonam Kashyap
Sharing experiences from ICAR Network project on Organic Farming	Organic Animal Husbandry	ICAR- Indian Veterinary Research Institute, Izatnagar	24-31 <sup>st</sup> October, 2018	N. Ravisankar
Agricultural Residues and techniques for waste recycling	Skill training on Organic Farming organized by Patanjali Research Institute, Haridwar	ICAR-IIFSR, Modipuram	15 <sup>th</sup> November, 2018	N. Ravisankar
Fish Farming	Training cum orientation programme on Integrated Farming Systems and Conservation Agriculture	ICAR-IIFSR, Modipuram	19-23 <sup>rd</sup> November, 2018	A.K. Prusty
Fish Farm Management	Training cum orientation programme on Integrated Farming Systems and Conservation Agriculture	ICAR-IIFSR, Modipuram	19-23 <sup>rd</sup> November, 2018	Peyush Punia
Fruit Crop based farming System Models	“Fruit Crop based farming System Models” in Training cum orientation program on Integrated farming System and Conservation Agriculture	ICAR-IIFSR Modipuram	19-23 November (2018)	Dr. Dushyant Mishra
Livestock module	Livestock module for integrated farming systems for small and marginal farmers	ICAR-IIFSR, Modipuram	19-23 Nov., (2018) (delivered on 21 Nov., (2018))	Dr. S. Malik
Vegetable modules for horticulture based farming systems in Training cum orientation programme on Integrated Farming systems and Conservation agriculture	Vegetable modules for horticulture	ICAR-IIFSR, Modipuram	19-23 <sup>rd</sup> November, (2018)	Dr. Poonam Kashyap
Off farm activities/interventions in different farming systems for income enhancement	Training cum orientation programme on “Integrated farming systems and Conservation agriculture” during, (2018) for officials of National Rainfed Area Authority	GOI, New Delhi.	19-23 November	Dr Nisha Verma



Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Apple Production:	Half day training to farmers from Karnataka on Apple Production	ICAR-IIFSR, Modipuram Meerut (U.P.)	20 November, (2018)	Dr. Chethan Kumar G
Conservation agriculture:	Conservation agriculture: Principle, Practices and Prospects (Lecture and field visits)	(NRAA), GOI, New Delhi	21 <sup>st</sup> November, (2018)	Dr. V.P. Choudhary
Small scale processing technologies suitable for Integrated Farming Systems	Training on New technologies and developments in oilseeds cultivation for changing climate	ICAR-IIFSR Modipuram	21 <sup>st</sup> Nov., (2018)	Dr. Amit Nath
Improving Yield and Quality of Litchi in Western UP	“Problems and prospects of Litchi in western UP” During Field day on “ was organized in association with ICAR-NRC Litchi and ICAR-CRPS, Modipuram	Litchi garden, Shahpur, Muzaffarnagar	30 <sup>th</sup> November, 2018	Dr. Dushyant Mishra
Good agricultural practices for doubling farmers income and enhanced	Role of physiology in IFS research” during the visit of trainees of Division of Agronomy, ICAR-IARI winter school on “resource use efficiency”	ICAR-IIFSR, Modipuram Meerut (U.P.)	19 <sup>th</sup> December, (2018)	Dr. L.K. Meena
Environmental cleaning through fruit planting	“Environmental cleaning through fruit planting” under <i>Swacchata program</i> in <i>swacchata pakhwara</i> program	Janta Higher Secondary School at Naval Surajpur (MGMG village)	20 <sup>th</sup> December (2018)	Dr. Dushyant Mishra
Orchard Management	“Orchard Management” during Viraat Kisan Mela	Samrat Prithviraj Chauhan Degree College, Bagpat	21-22 December (2018)	Dr. Dushyant Mishra
Characterization of gender sensitive farming systems in low, mid and high hills of Uttarakhand”	National Symposium on 21. Integrated Farming Systems for 3 E’s	ICAR- Bengaluru	23-24 December, (2018).	Dr Nisha Verma
Integrated Farming Systems for 3Es” (Ecological sustainability, Enhanced productivity and Economic prosperity) sustainable food production	“C status and budgeting of prototype IFS models developed for different agro-climatic regions”	GKVK campus, Bengaluru	24 <sup>th</sup> December (2018)	Dr D. Dutta
	Decomposition and utilization of waste straw from mushroom production	ICAR-IIFSR, Modipuram Meerut	15-22 January, (2019)	Dr. A. L. Meena
Nutritional and Medicinal values of mushroom	Model Training course entitled Trainers Training programme on Entrepreneurship development in Farming System through round the year mushroom production technology	ICAR-IIFSR, Modipuram	15-22 January, (2019)	Dr Nisha Verma

Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Lecture on Preparation of vermicompost from spent mushroom substrate in farming system a training	“Trainers Training Programme on Entrepreneurship Development in Farming System through Round the Year Mushroom Production Technology	ICAR-IIFSR, Modipuram	15-22 January, (2019)	Dr. Jairam Choudhary
Processing and value addition of mushroom: A practical demonstration for production of instant mushroom pickles”	Model Training Course on “Trainers Training Program on Entrepreneurship Development in Farming Systems through Round the Year Mushroom Production Technology	ICAR-IIFSR, Modipuram	15-22 January, (2019)	Dr. Amit Nath
Low chilling apple cultivation	“Experiences of Institute on low chilling apple cultivars” during training on low chilling apple cultivation	ICAR-Indian Institute of farming Systems Research, Modipuram Meerut	04 February (2019)	Dr. Dushyant Mishra
Execution of value addition module through SHG formulation: An income generation avenue for rural	National Conference on Women Empowerment through Agro-Entrepreneurships for Livelihood Security (WE (2019)	ICAR-IIFSR, Modipuram	07-08 February (2019).	Dr Nisha Verma
Synthesis of location specific farming systems	Capacity building and skill upgradation programme for Technical Staffs on Farm Management	ICAR-IIFSR, Modipuram	13-19 <sup>th</sup> February, 2019	A.K. Prusty
Fish Farm Mangement	Capacity building and skill upgradation programme for Technical Staffs on Farm Management	ICAR-IIFSR, Modipuram	13-19 <sup>th</sup> February, 2019	Peyush Punia
Farm Management	“Soil Quality/Soil Health Management” during training on Farm Management	ICAR-IIFSR, Modipuram Meerut (U.P.)	13 <sup>th</sup> to 19 <sup>th</sup> February, (2019)	Dr. Chethan Kumar G
Farm Management	Scope of ICTs for entrepreneurship in agriculture in “capacity building and skill up gradation programme on “Farm Management”	ICAR-IIFSR, Modipuram	13 <sup>th</sup> to 19 <sup>th</sup> February, (2019)	Dr. Sunil Kumar
Profits from orchards under western UP conditions	“How to get profits from orchards under western UP conditions”. during Krishidham Expo – (2019)	ICAR-CPRS, Modipuram	17 <sup>th</sup> February (2019)	Dr. Dushyant Mishra
Post harvest	Post harvest management and value addition in oilseeds”	ICAR-IIOR, Hyderabad.	18-19 March, (2019)	Dr. Amit Nath
Principles of Selection of Enterprises for Multi-enterprise Farm	Capacity Building and Skill Upgradation Programme for Technical Staffs on Farm Management	ICAR-IIFSR, Modipuram	19 <sup>th</sup> February, 2019	N. Ravisankar



Title of lecture	Name of training	Venue	Date of lecture	Name of the Scientist
Organic Crop Production	“Organic Crop Production” during training to Farmers of Nilgiri District, Tamil Nadu on Organic Farming for 3 days 21.02.(2019)to 23.02.(2019)	ICAR-IIFSR, Modipuram Meerut (U.P.)	21 <sup>st</sup> to 23 <sup>rd</sup> February, (2019)	Dr. Chethan Kumar G
Training cum exposure visit on Organic Farming for Farmers	Pest and disease management under organic production system	Tamil Nadu by ICAR-IIFSR	21-23 February, (2019)	Dr. Chandra Bhanu
Diversified use of sugarcane to cater to the need arising in future.	Krishi gayan mela	Krishak Gosthi at Meerut	06 <sup>th</sup> March, (2019)	Dr. D. Kumar
Selection of early varieties for higher cane yield.	Selection of early varieties for higher cane yield.	Nazibabad Radio	07 <sup>th</sup> March, (2019)	Dr. D. Kumar
Improving productivity of fruit orchards	“Improving productivity of fruit orchards” in HRD training program for KVK scientists	Directorate of Extension, ATIC, Sardar Vallabh Bhai University of Agriculture and Technology, Modipuram, Meerut	12 <sup>th</sup> March (2019)	Dr. Dushyant Mishra
Improved package and practice for oilseeds cultivation with special reference to mustard	New technologies and developments in oilseeds cultivation for changing climate	ICAR-IIFSR, Modipuram	19 <sup>th</sup> March, 2019	Raghuveer Singh
Advances in Fruit Production Technologies	“Advances in Fruit Production Technologies” in “Students mentoring Program on Nutritional crops”	Centre for advanced Agricultural Science and Technology on Nutritional crops” (CAAST-NC) at Department of Horticulture, C S Azad University of Agriculture and Technology, Kanpur	30 <sup>th</sup> March (2019).	Dr. Dushyant Mishra
Apple Production	Apple Production: Package and Practices during “Half day training to 12 farmers from Karnataka on Apple Production”	ICAR-IIFSR, Modipuram Meerut (U.P.)		Dr. Chethan Kumar G
Mushroom Cultivation	Half day training to Army personnel on Mushroom Cultivation in Meerut Cant (assisted Dr. Chandra Bhanu, Chief, Mushroom production unit)	Army Cant., Meerut		Dr. Chethan Kumar G

## OTHER PROGRAMMES ORGANIZED FOR FARMERS

Name/ of events	No. of participants	Title of Training	Venue	Period and date	Contributors
Demonstration	10	Demonstration on pruning in apple ber	Paswara Village, Kila Parikshitgarh, Meerut	24 <sup>th</sup> April, 2018	Dr. D. Mishra
Scientist Farmer interface	40	Improving productivity of crops	Jhidio, Naval Surajpur, Govindpur, Kithor, Meerut	24 <sup>th</sup> April, 2018	Dr. D. Mishra
Scientist Farmer interface	65	Kisan Gosthi Interaction with farmers, village head.	Bhandaura, Hiranwara and GogwanpurJalalpur in Shamli district	26 <sup>th</sup> April, 2018	Dr. Prem Singh, Dr. Sunil Kumar, Dr. L.K. Meena
Kisan Kalyan Abhiyan	616	Farmers Aspirational	District Haridwar	01-30 <sup>th</sup> June, 2018	Dr. M. P. Singh, Dr. R.P. Mishra, Dr. P.C. Jat, Dr. Khushyal Singh, Dr. Chandra Bhanu, Dr. Devendra Kumar, Dr. S.P. Singh
Online Lecture of Prime Minsters	100	Interaction of Honourable Minister with farmers televised programme	ICAR-IIFSR, Modipuram	20 <sup>th</sup> June, 2018	Dr N. Subash Dr Sunil Kumar
Pokkah Boeng Jagrukta Abhiyan	313	Farmers/pesticide dealers	Western U.P. and Uttarakhand	July-August, 2018	Dr. R.P. Mishra Dr. Chandra Bhanu Dr. P.C. Ghasal Mr. Kamlesh Kumar Dr. M. P. Singh Dr. Khushyal Singh
Parthenium Awareness week	40	Parthenium Awareness week	ICAR-IIFSR	16-22 <sup>nd</sup> August 2018	Dr. Prem Singh, Dr. N. Subash, Dr. C. Bhanu Dr. Chethan Kumar G, Dr. L.K. Meena, Dr. Amit Kumar Dr. Sunil Kumar
Mahila Krishak Diwas	100	Mahila Krishak Diwas	ICAR-IIFSR, Modipuram	15 <sup>th</sup> October, 2018	Dr Poonam Kashyap, Dr Sunil Kumar, Dr Nisha Verma



Name/ of events	No. of participants	Title of Training	Venue	Period and date	Contributors
Krishak Goshthi	80	On improved package of practices on cultivation of wheat, mustard, lentil, package of nutritional kitchen gardening of vegetables cultivation with Tribal farmers	Thari, Veerpur Tara and Mallapuri villages of Block Ramnagar, District Nanital	02-03 <sup>rd</sup> November, 2018	Dr. N.Verma, Dr. Amit Kumar Dr. Alka Verma
Farmers Visits	40	Scientist-Farmer interaction meet	Kanchikovil village in Erode district of Tamil Nadu	26 <sup>th</sup> November, 2018	N. Ravisankar
Demonstration	70	Canopy management for improving fruit quality in Litchi	Saini Litchi Garden, Shahpur, Muzaffarnagar	30 <sup>th</sup> November, 2018	Dr D. Mishra
World Soil day	600	Farmers/Institutions	Village -Satedi (Muzaffarnagar)	5 <sup>th</sup> December, 2018	Dr. R. P. Mishra Dr. D. Dutta Dr Chandra Bhanu Dr. P.C. Ghasal Dr. Jairam Choudhary
Kisan Gosthi	382	Animal Health camp on World Soil Health Day	Village -Satedi (Muzaffarnagar)	05 <sup>th</sup> December, 2018	Dr. S. Malik Dr. M. P. Singh Dr Poonam Kashyap Dr. Sunil Kumar
Farm Management	26	Capacity building and skill up gradation programme	ICAR-IIFSR, Modipuram	13-19 <sup>th</sup> February, 2019	Dr Suresh Malik, Dr Sunil Kumar, Dr PC Ghashal Dr Chethan Kumar G
Tribal Farmers Fair and Agri-Tech Exhibition	1500	Farmers/NGOs/ input dealers/Institutions	Gaindikhata (Haridwar)	23 <sup>rd</sup> February, 2019	Dr. R. P. Mishra Dr. D. Dutta Dr. Chandra Bhanu Dr. P.C. Ghasal Dr. Jairam Choudhary Sh. R. B. tewari
Demonstration of IFS Models during Pusa Krishi Vigyan Mela	Mass level programme	Farmers, and other stakeholders	ICAR-IARI, New Delhi	5-7 <sup>th</sup> March, 2019	Dr. A.L. Meena Dr. J. Choudhary
International Women day	100	Farm women	ICAR-IIFSR	8 <sup>th</sup> March, 2019	Dr. D. Dutta Dr Nisha

## EVENTS ORGANIZED

### ICAR-IIFSR organized *Kisan Kalyan Abhiyan* from 01-30 June, 2018

Institute organized “**Kisan Kalyan Abhiyan**” from **01-30 June, 2018** in the aspirational District Haridwar of Uttarakhand State. During the programme, various activities like seed mini-kit distribution of improved Basmati rice and vegetables, awareness programmes on improved nursery management and rice growing

technology, demonstration on seed treatment, integrated nutrient and pest management in sugarcane, field visits and advisory for pest and disease management in sugarcane etc. were undertaken.

During the programme, a total of 12.35 quintals of certified seeds of Basmati rice var. PB 1121 was distributed to 230 needy farmers. Vegetable seed mini-kits (189Nos.) were distributed to farmers for kitchen/



Seed Mini-kit Distribution at Gujjar Basti Village (Haridwar)



Seed Mini-kit Distribution at Nayagaon Village (Haridwar)



Seed Mini-kit Distribution at Mohallapuri Village (Haridwar)



Seed Mini-kit Distribution at Rasoolpur Bada Village (Haridwar)



Seed Mini-kit Distribution at Mohammadpur Jatt Village (Haridwar)



Seed Mini-kit Distribution at Mandawali Village (Haridwar)



Field visit with farmers for pest and disease identification and management of sugarcane at Mannakheri Village (Haridwar)



Kisan Gosthi at Meethi-Beri Village (Haridwar)

**Seed mini-kit Distribution and various activities organized by ICAR-IIFR during Kisan Kalyan Abhiyan from 01-30 June 2018 in inspirational District Haridwar**

nutrition gardening. Total farmers covered under the programme were 616 from three different blocks i.e. Bahadrabad, Bhagwanpur and Narson of the Haridwar district. Besides, awareness programme on identification and management of pests and diseases of sugarcane were conducted through mass-media.

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भारतीय कृषि प्रणाली अनुसंधान संस्थान मोदीपुरम मेरठ में दिनांक 20.06.2018 को माननीय प्रधानमंत्री श्री

नरेंद्र मोदी व देश के किसानों के बीच परिचर्चा के सीधे प्रसारण को दिखाया गया। कार्यक्रम में संस्थान के वैज्ञानिकों, अधिकारियों, कर्मचारियों व किसानों सहित कुल 150 लोगों ने भाग लिया। माननीय प्रधानमंत्री जी ने अपने संबोधन में किसानों की आय दोगुना करने हेतु सरकार द्वारा चलाई जा रही विभिन्न योजनाओं जैसे— प्रधानमंत्री फसल बीमा योजना, राष्ट्रीय कृषि बाजार योजना, प्रधानमंत्री कृषि सिंचाई योजना, प्रधानमंत्री मृदा स्वास्थ्य कार्ड योजना, व अन्य योजनाओं व उनके लाभ के बारे में किसानों को अवगत कराया। परिचर्चा के दौरान माननीय प्रधानमंत्री जी ने देश के 9 राज्यों के किसानों से वीडियो कॉन्फ्रेंसिंग के जरिए सीधा संवाद किया। इसी दौरान उन्होंने कृषि प्रणाली संस्थान के छत्तीसगढ़ स्थित कांकर केंद्र द्वारा अंगीकृत किसान श्री आसाराम जी से समेकित कृषि प्रणाली के माध्यम से अपनी आय दोगुना करने वाली सफलता की गाथा सुनी व कृषक की संपन्नता पर हर्ष व्यक्त किया। कई प्रगतिशील किसानों ने कड़कनाथ प्रजाति के मुर्गीपालन के माध्यम से अपनी सफलता की गाथा भी प्रधानमंत्री जी को सुनायी जिसका देश के कई भागों में औषधीय महत्व भी है। कृषि प्रणाली संस्थान, मेरठ द्वारा देश के कई राज्यों में कड़कनाथ प्रजाति के मुर्गी को किसानों में वितरित कर इसके अधिकाधिक उत्पादन की संभावनाओं पर अध्ययन किया जा रहा है।

कृषि प्रणाली संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने सभी वैज्ञानिकों से किसानों से सीधे जुड़ने व समेकित कृषि प्रणाली के माध्यम से उनकी आजीविका सुदृढ़ करने की अपील की। माननीय प्रधानमंत्री व किसानों के बीच सीधे संवाद में कृषि प्रणाली विविधीकरण, समेकित कृषि प्रणाली, संरक्षण कृषि तरीकों जैसे— स्प्रिंकलर व टपक सिंचाई, कृषि मशीनीकरण, स्वयं सहायता समूह के माध्यम से सामूहिक खेती, पशुपालन, मुर्गीपालन, मछलीपालन, परंपरागत व जैविक कृषि, मृदा परीक्षण व मृदा स्वास्थ्य कार्ड के माध्यम से पोषण प्रबंधन, ट्रेंच विधि से गन्ने की बुवाई व गन्ने के

साथ सहफसली खेती, समुद्री खरपतवार की खेती इत्यादि मुख्य आकर्षण रहे। कार्यक्रम का संचालन डॉक्टर एन. सुभाष जी ने किया।



**I ΔFkku ea pvrjkZVh; ; ksx fnol p , oa p; ksx I kekuk f'kfoj p dk vk; kst u**

संस्थान द्वारा दिनांक 21 जून 2018 को चौथे **pvrjkZVh; ; ksx fnol p** का आयोजन किया गया जिसमें संस्थान के अधिकारियों, कर्मचारियों व उनके परिवार के सदस्यों तथा आस-पास के आवासीय कालोनियों के लोगों ने बढ़-चढ़कर भाग लिया। इसी के साथ-साथ संस्थान में 18 से 21 जून के दौरान **p; ksx I kekuk f'kfoj p** का भी आयोजन किया गया। कार्यक्रम का शुभारंभ करते हुए संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने सभी अतिथियों व प्रतिभागियों का स्वागत किया। उन्होंने अपने संबोधन में योग को स्वस्थ जीवन की कुंजी बताया तथा सभी से अपने कार्यालयीन कार्यों व निजी जीवन में सकारात्मक सोच के साथ काम करने की सलाह दी। दिनांक 18 से 21 जून, 2018 तक चलने वाले योग साधना शिविर का आयोजन योगगुरु डॉ. एस. डी. धीमान के मार्गदर्शन में किया गया, जिसमें संस्थान के कर्मचारियों ने प्रत्येक दिन सुबह 5:00 से 6:00 बजे के बीच बढ़-चढ़कर भाग लिया। योग साधना शिविर के दौरान डॉ. धीमान जी ने महर्षि पतंजलि के अष्टांग योग दर्शन अर्थात् यम, नियम, आसन, प्राणायाम, प्रत्याहार, धारणा, समाधि

एवं मोक्ष के बारे में विस्तार से बताया एवं संस्थान कर्मियों को चारों दिन विभिन्न प्रकार के आसन एवं प्राणायाम का अभ्यास करवाया। इसी दौरान वरिष्ठ आमंत्रित योग गुरु श्री विनोद पँवार जी ने संस्थान कर्मियों को शरीर को स्वस्थ एवं खुश रखने वाले विभिन्न प्रकार के आसन और मुद्राओं का अभ्यास

करवाया। योगाचार्य डॉ. मनोज राणा जी ने आचार-रसायन के माध्यम से स्वस्थ जीवन जीने के बारे में विस्तार से बताया। आयुर्वेदाचार्य डॉ. संजय यादव जी ने स्वस्थ जीवन हेतु स्वस्थ भोजन के प्रकारों व उसके ग्रहण करने के तौर तरीकों के बारे में विस्तार से बताया।

### Summarized Report of International Yoga Day organized at ICAR-IIFSR, Meerut on 21.06.2018

Name of the Institute	Activity organized	Duration	No. of participants
ICAR-Indian Institute of Farming Systems Research, Modipuram Meerut	1. International Yoga Day	21.06.2018	108
	2. Yog Sadhana Shivir	18-21.06.2018	210



International Yoga Day at ICAR-IIFSR, Meerut on 21.06.2018



Inauguration of International Yoga Day at ICAR-IIFSR, Meerut on 21.06.2018

### Institute organized “Pokkah Boeng Jagrukta Abhiyan” during July-August 2018

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut organized “**Pokkah Boeng Jagrukta Abhiyan**” during July-August, 2018 with an objective to create the awareness among sugarcane farmers about the fungal disease ‘*Pokkah Boeng*’ which is getting the status of epidemic and threatening sugarcane crops in the sugar bowl of Uttar Pradesh and Uttarakhand. With increase in the cultivated area of the wonder sugarcane variety Co 0238 (highly susceptible to *Pokkah Boeng* disease), this fungal disease caused by *Fusarium moniliforme* has increased tremendously and creating havoc to sugarcane production in many areas of Uttar Pradesh and Uttarakhand. The main aim of the programme was to reduce the excessive and unwanted use of pesticides in sugarcane by correct identification of different insect-pests and diseases and thereby reducing the cost of cultivation and environmental pollution. Location specific integrated nutrient management technique and training and demonstrations on biological control of insect-pests were also given to farmers with the aim to reduce excessive use of nitrogenous fertilizers especially urea and also the unwanted applications of insecticides.

### Pokkah Boeng Jagrukta Saptah organized from 19-26 July, 2018

A team of scientists from ICAR-IIFSR visited 12 villages from four districts of Uttar Pradesh and Uttarakhand including Haridwar, Bijnor, Muzaffarnagar and Meerut. Kisan Gosthies were organized in the villages on identification and management of insect-pests and diseases of sugarcane with special reference to

Pokkah Boeng disease. Field visits were performed with farmers, rural youths, ladies and childrens to show the correct identification of Pokkah Boeng disease in the field and differentiate it from infection/infestation of other pests and diseases of sugarcane. Lectures and demonstrations on biological control of Top Borer and other borer insects by using parasitoid *Trichogramma* were also given to farmers during Gosthi and field visits as well. Supporting literatures on integrated pest and disease management and leaflets on location specific integrated nutrient management for sugarcane were also distributed to farmers via hard copies and/or Whatsapp messaging.



### One day “Ganna Jagrukta Diwas” organized on 02.08.2018 at Hariyakheda village of Distt. Baghpat (U.P.)

Institute organized one day *Ganna Jagrukta Diwas* in Hariyakheda village of District Baghpat (U.P.) on 02.08.2018. A field visit was organized along with farmers of the village to identify the insect-pest and diseases of sugarcane and rice. All the four symptoms of pokkah boeng disease were shown to farmers in their fields. A Kisan Goshthi was organized in the village and lectures were delivered by the expert scientists on

### Summary of Pokkah Boeng Jagrukta Abhiyan organized during July-August 2018

No. of states covered	No. of Districts covered	No. of villages covered	No. of farmers covered	Remarks
02 (U.P. and Uttarakhand)	05 (Meerut, Muzaffarnagar, Bijnor, Haridwar, Baghpat)	34 (MGMG villages, AICRP on IFS TSP, state govt. adopted, NGO adopted and Independent villages)	313	20 farmers covered via phone calls and personal visit to IIFSR



Field visit with farmers of Nayagoan village



Training of framers for the release of trichocards in sugarcane



Distribution of Trichocards to farmers for biological management of insect-pest in sugarcane



Organization of various activities of field visit during Pokkah Boeng Jagrukta Saptah at Nayagoan village of Distt. Haridwar (U.K.) on 19.07.2018



Organization of various activities during Pokkah Boeng Jagrukta Saptah at junior high school Dhanayan village of Distt. Muzaffarnagar (U.P.) on 25.07.2018



Organization of various activities during Ganna Jagrukta Diwas at Hariyakheda village of Distt. Baghpat (U.P.) on 02.08.2018

diversification of the sugarcane based farming system, identification of insect-pest and diseases of sugarcane, demonstration on the release of parasitoid *Trichogramma* sp. (tricho-card) for biological management of sugarcane borers, diversification of farming system with goatary. A Total of 29 farmers participated in the programme.

### One day “Pokkah Boeng Jagrukta Diwas” organized on 14.08.2018 at Chhur village of Distt. Meerut (U.P.)

Institute organized one day *Pokkah Boeng Jagrukta Diwas* in Chhur village of Saroorpur Block, District Meerut (U.P) on 14.08.2018. A Kisan Goshthi was organized in the village and lectures were delivered by the expert scientists on diversification of the sugarcane based farming system, integrated nutrient management, identification of insect-pest and diseases of sugarcane, demonstration of four stages of Pokkah Boeng disease, demonstration for the release of parasitoid *Trichogramma* sp. (tricho-card) for biological management of borers in sugarcane and ways to reduce the pesticide application for health and environmental security. A field visit was organized along with farmers to identify the insect-pest and diseases of sugarcane. The sugarcane in this area was found to be heavily infected with Pokkah Boeng disease. All the four symptoms of pokkah boeng disease were shown to farmers in their fields. A Total of 33 farmers were participated in the programme.



7209 Lorærk fnol dk vk; kst u

### One day visit of farmers organized on 15.08.2018

A group of 36 farmers from 20 different villages of Distt. Pilibhit (U.P.) visited ICAR-IIFSR Modipuram, Meerut on 15.08.2018 under ATMA programme through Pahal Grameen Sewa Samiti, Saidpur, Pilibhit (U.P.). A field visit was organized for farmers to introduce them about integrated farming systems for food, nutrition, livelihood and environment security. Crop, dairy, orchard, mushroom, fishery and waste recycling components of the IFS Model of the Institute for higher profitability were shown to farmers. A lecture and demonstration was also given to farmers on identification of insect-pest and diseases of sugarcane and their management with special reference to pokkah boeng disease.

### 1 2Fku }jkk 7209 Lorærk fnol dk /kæ/kke I s vk; kst u

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में 15 अगस्त, 2018 को राष्ट्र के 72 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 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। निदेशक महोदय ने यह भी बताया कि संस्थान द्वारा देश भर के अपने विभिन्न शोध केन्द्रों द्वारा विकसित समेकित कृषि प्रणाली मॉडल को भारत सरकार द्वारा सराहा गया है तथा इन कृषि प्रणाली मॉडल के माध्यम से किसानों की आय बढ़ाने में हम तेजी से आगे बढ़ रहे हैं। उन्होंने वैज्ञानिकों से देश की खाद्य एवं पोषण 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। निदेशक महोदय ने क्षेत्र के किसानों के लिए संस्थान द्वारा खेती के खर्च घटाने, पर्यावरण सुरक्षा एवं समेकित कृषि प्रणाली के माध्यम से किसानों की आय बढ़ाने पर किये जा रहे कार्यों की भी सराहना की।

### 1 rdrk tkx: drk l lrgk dk v; kstu

संस्थान में दिनांक 29 अक्टूबर से 03 नवम्बर, 2018 तक सतर्कता जागरूकता सप्ताह का आयोजन किया गया। कार्यक्रम का भुभारम्भ 29 अक्टूबर, 2018 को किया गया जिसमें संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी कार्यालय कर्मियों को सतर्कता एवं ईमानदारी की भाषण दिलायी। निदेशक महोदय ने अपने संबोधन में सभी कार्यालय कर्मियों को हर स्तर पर ईमानदारी बरतने की सलाह दी एवं संस्थान के अधिदेश के अनुसार निष्ठापूर्वक कार्य करने का आग्रह किया। सप्ताह के दौरान दिनांक 30/10/2018 को मुजफ्फरजगर के शाहपुर ब्लाक में किसान गोष्ठी का आयोजन किया गया जिस दौरान किसानों व समान्य जनमानश को सतर्कता की शपथ दिलाई गयी। दिनांक 01/11/2018 एवं 2/11/2018 को शामली जिले के दो गाँवों व बुलन्द शहर जिले के एक गाँव में क्रमशः किसानों एवं स्कूल छात्रों को सतर्कता एवं ईमानदारी की शपथ दिलाई गयी। सप्ताह के दौरान दिनांक 31/10/2018 को संस्थान में "नया भारत

बनाने हेतु भ्रष्टाचार उन्मूलन" विषय पर एक व्याख्यान प्रतियोगिता कराई गयी जिसमें संस्थान कर्मियों के अलावा आस-पास के विद्यालयों के छात्रों व अध्यापकों ने भी बढ़ चढ़कर भाग लिया। दिनांक 03/11/2018 को संस्थान में विभिन्न विद्यालयों के छात्रों हेतु भ्रष्टाचार उन्मूलन पर पेंटिंग प्रतियोगिता का आयोजन किया गया जिसमें लगभग 100 छात्रों व अध्यापकों ने भाग लिया। कार्यक्रम समन्वयक व मुख्य सतर्कता अधिकारी डा. एन. रविशंकर ने संस्थानों से भ्रष्टाचार उन्मूलन विषय पर एक व्याख्यान भी दिया।



कार्यक्रम का समापन दिनांक 03/11/2018 को किया गया जिसमें प्रभारी निदेशक डा. एम. पी. सिंह द्वारा विभिन्न प्रतियोगिताओं के विजेता कार्यालय-कर्मियों, छात्रों व अध्यापकों को पुरस्कार देकर सम्मानित किया गया। कार्यक्रम का संचालन डा. पूनम कश्यप एवं डा. आशीष कुमार प्रुशिट ने किया।

### —f'k izkkyh l lFku ea ipo"kh; l eh{k Vhe dh nks fnol h; cBd dk vk; kstu

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 6 सितंबर, 2018 को संस्थान की प्रथम पंचवर्षीय समीक्षा टीम की बैठक का शुभारम्भ किया गया। बैठक की अध्यक्षता प्रख्यात कृषि वैज्ञानिक व जबलपुर कृषि विश्वविद्यालय के पूर्व कुलपति डॉ. डी. पी. सिंह जी ने किया। अध्यक्ष महोदय ने अपने संबोधन में बताया कि हरित क्रांति के उपरान्त देश की

कृषि उत्पादकता में एक ठहराव सा आ गया है; खेती का खर्च बढ़ रहा है और किसानों की प्रति इकाई क्षेत्रफल से आय घटती जा रही है। इन परिस्थितियों में समेकित कृषि प्रणाली एक उपयुक्त विकल्प हो सकता है जिसके विभिन्न अवयवों जैसे फल व सब्जी उत्पादन, उन्नत दुग्ध उत्पादन व पशुपालन, मुर्गीपालन, मछली पालन, मशरूम उत्पादन, उत्पाद मूल्यवर्धन, संसाधन पुनर्चक्रण इत्यादि के माध्यम से हम किसानों की खाद्य, पोषण एवं आय के साथ-साथ पर्यावरण सुरक्षा सुनिश्चित कर सकते हैं। समिति के सदस्य डॉ. पी. के. महापात्रा, डॉ. एस. दम. राय, डॉ. सी. जयन्ती व डॉ. ए. सुब्बाराव जी ने अपने-अपने विचार रखे और समेकित कृषि प्रणाली अनुंधान को आगे बढ़ाने की दिशा व दशा पर गहन चर्चा की। कृषि प्रणाली संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने सभी अतिथियों का स्वागत करते हुए संस्थान द्वारा किये जा रहे शोध कार्यों की संक्षिप्त प्रगति रिपोर्ट प्रस्तुत की। विभिन्न विभागों जैसे समेकित कृषि प्रणाली प्रबंधन, फसल प्रणाली एवं संसाधन प्रबंधन, जैविक कृषि प्रणाली, तकनीकी विस्तार एवं समन्वयन के विभागाध्यक्षों के अपने-अपने विभागों की विस्तृत प्रगति रिपोर्ट प्रस्तुत की। अपराहन में समिति ने संस्थान के सभी कर्मियों के साथ बैठक की एवं उनकी परेशानियों एवं आवश्यकताओं के बारे में भी चर्चा की। प्रस्तुत बैठक 6-7 सितंबर (दो दिनों) तक चली जिसमें समिति संस्थान की पिछले पाँच साल की उपलब्धियों



के आधार पर समेकित कृषि प्रणाली पर शोध कार्यों की दशा व दिशा पर अपनी संस्तुति दी।

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संस्थान में दिनांक 15/09/2018 को स्वच्छता अभियान के अन्तर्गत सेवा दिवस का आयोजन किया गया जिसमें कार्यालय कर्मियों के अतिरिक्त किसानों एवं जन प्रतिनिधियों ने भी बढ़-चढ़कर भाग लिया। कार्यक्रम के मुख्य अतिथि दौराला के पूर्व ब्लाक प्रमुख श्री राहुल देव जी रहे। पल्लवपुरम से सभासद श्री



विक्रम ढांका जी विशिष्ट अतिथि रहे। मुख्य अतिथि ने सभी अतिथियों एवं कार्यालय कर्मियों को स्वच्छता की सपथ दिलाई। अपने सम्बोधन में यह बताया कि स्वच्छता जागरूकता अभियान केवल घर तक सीमित न होकर अपने आस-पास भी होना चाहिए इसके साथ-साथ सभी को कूड़े के उचित निस्तारण पर भी ध्यान देना चाहिए। विशिष्ट अतिथि श्री विक्रम ढांका जी ने सभी से आग्रह किया कि वे अपने आस-पास की सड़कों पर कूड़ा न फेंकें तथा स्वच्छता अभियान में बढ़-चढ़कर सहयोग करें। संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी अतिथियों का स्वागत करते हुए यह बताया कि हम अपने कार्यालय और घर पर छोटे-छोटे प्रयासों से स्वच्छता अभियान में बहुत बड़ा सहयोग दे सकते हैं। उन्होंने यह भी बताया कि कृषि प्रणाली संस्थान फसल अवशेषों व घरेलू कचरा प्रबंधन पर वैज्ञानिक शोध के माध्यम से स्वच्छता अभियान में



तकनीकी सहयोग प्रदान कर रहा है। उन्होंने किसानों को संस्थान द्वारा खेती में स्वच्छता के प्रति जागरूक करने के प्रयासों के बारे में भी जानकारी दी। संस्थान द्वारा आयोजित किया जाने वाला स्वच्छता अभियान 15 सितम्बर से 2 अक्टूबर 2018 तक मनाया गया। इस दौरान संस्थान के अतिरिक्त आवासीय परिसर, विद्यालयों व गांवों में स्वच्छता सम्बन्धी विभिन्न कार्यक्रम आयोजित किये गये।

## i fke i kÑfrd fpdfRI k fnol ij fopkj xkSBh dk vk; kst u

प्राकृतिक चिकित्सा दिवस के उपलक्ष में प्रथम प्राकृतिक चिकित्सा दिवस एवं जैविक खाद्य उत्पाद पर आधारित विचार गोष्ठी दिनांक 12 नवम्बर 2018 को भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, में अंतरराष्ट्रीय प्राकृतिक चिकित्सा संगठन, मेरठ के साथ मिलकर आयोजित किया गया। कार्यक्रम के मुख्य अतिथि डा. एच.सी. शर्मा ने अपने अभिभाषण के वर्तमान में प्राकृतिक चिकित्सा की महत्वता बताई। इससे पहले के वक्ता डा. संजीव गोयल, प्रसिडेन्ट INO की प्राकृतिक चिकित्सा दिवस के इतिहास के बारे में बताया व जल, मिट्टी, अग्नि, आकाश व वायु का प्राकृतिक चिकित्सा में महत्व को समझाया। इसके बाद डा. मनोज INO Secretary ने इस तरह के कार्यक्रम को आयोजन को सरहाया। डा. चन्द्रभानु के अपनी प्रस्तुति में छतवाणी के माध्यम से कीटनाशी रहित जैविक सब्जियों के अपने घर की छत पर उत्पादन करने की तकनीकों को बताया।

डा. एस.डी. धीमान, कार्यक्रम समन्वयक से अपने भाषण में सफल जीवन के लिए प्राकृतिक चिकित्सा की अलग-अलग विधियां बताई। डा. प्रेम सिंह जैविक खेती की तकनीकीयों के बारे में विस्तृत विवरण किया। अतः डा. आजाद सिंह पंवार ने प्राकृतिक चिकित्सा के पीछे का विज्ञान समझाया। तथ सात्विक भोजन ग्रहण

करने पर जोर दिया। गोष्ठी का समापन डा. धीमान के धन्यवाद ज्ञापन के साथ हुआ।

## okf"kd fnol dk jakjx vk; kst u

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 27/11/2018 को संस्थान के वार्षिकोत्सव का आयोजन किया गया। कार्यक्रम का शुभारम्भ माननीय महापौर व मुख्य अतिथि श्रीमती सुनीता वर्मा जी ने किया। पूर्व विधायक श्री योगेश वर्मा, केन्द्रीय आलू अनुसंधान संस्थान के संयुक्त निदेशक डा. मनोज कुमार व संस्थान के पूर्व प्रधान वैज्ञानिक डा. सेवाराम जी विशिष्ट अतिथि रहे। मुख्य अतिथि ने अपने संबोधन में कृषि प्रणाली संस्थान द्वारा देश की खाद्य, आजीविका और पर्यावरण सुरक्षा पर किये जा रहे उत्कृष्ट शोध कार्यों पर हर्ष व्यक्त किया। उन्होंने कृषि प्रणाली संस्थान द्वारा अपने परिसर तथा गांवों में स्वच्छता के ऊपर कराये जा रहे कार्यक्रमों की भूरि-भूरि प्रशंसा की तथा मेरठ शहर की अन्य संस्थाओं से भी यहाँ से सीख लेने की सलाह दी। पूर्व विधायक श्री योगेश वर्माजी ने किसानों की आय बढ़ाने हेतु संस्थान द्वारा समेकित कृषि प्रणाली पर किये जा रहे उत्कृष्ट शोध कार्यों की सराहना की तथा यह भी बताया कि जब वैज्ञानिक शोधों के माध्यम से हमारे किसान सुखी रहेंगे तभी पूरा देश सुखी रह सकता है। कृषि प्रणाली संस्थान के प्रभारी निदेशक डा. प्रेम सिंह ने सभी अतिथियों का स्वागत करते हुए संस्थान द्वारा देश के किसानों के लिए किये जा रहे शोध कार्यों की संक्षिप्त जानकारी दी। विशिष्ट अतिथि व केन्द्रीय आलू अनुसंधान संस्थान के संयुक्त निदेशक डा. मनोज कुमार जी ने संस्थान के वार्षिकोत्सव के अवसर पर सभी को बधाई दी तथा कृषकों की आजीविका सुरक्षा व प्रगति के लिए संस्थान के शोध कार्यों को रीढ़ की हड्डी बताया। विशिष्ट अतिथि डा. सेवाराम जी ने अपने विचार रखे। कार्यक्रम समन्वयक डा. लक्ष्मण राम मीणा जी ने सन 1952 से साधारण उर्वरक प्रयोगों से

शुरू होकर कृषि प्रणाली संस्थान के राष्ट्रीय स्तर का संस्थान बनने तक की पूरी गाथा का विस्तृत विवरण पेश किया। इस दौरान मेरठ स्थित भारतीय कृषि अनुसंधान परिषद के तीनों संस्थानों, कृषि प्रणाली संस्थान, केन्द्रीय आलू अनुसंधान संस्थान व केन्द्रीय गोपशु अनुसंधान संस्थान के खिलाड़ियों, टीमों व परिवारजनों के मध्य खेल प्रतियोगिताओं वालीवाल, रस्साकसी व म्यूजिकल चेयर का आयोजन भी किया गया। वालीवाल प्रतियोगिता में केन्द्रीय आलू अनुसंधान संस्थान की टीम विजयी रही। रस्साकसी में कृषि प्रणाली संस्थान का प्रथम स्थान रहा। म्यूजिकल चेयर में श्रीमती सचिता जी का प्रथम स्थान रहा।

अपराहन में सांस्कृतिक कार्यक्रम का आयोजन किया गया जिसमें तीनों संस्थानों के कर्मचारियों के बच्चों व परिवारजनों ने बढ़-चढ़कर भाग लिया। कार्यक्रम के अन्त में विभिन्न प्रतियोगिताओं के प्रतिभागियों को निदेशक महोदय द्वारा पुरस्कार देकर सम्मानित भी किया गया। संस्थान के सेवानिवृत्त वैज्ञानिकों व कर्मचारियों को भी निदेशक महोदय द्वारा स्मृति चिन्ह भेंटकर सम्मानित किया गया। पल्लवपुरम स्थित विभिन्न समाचार पत्रों के सम्पादकों एवं कर्मचारियों को भी निदेशक महोदय द्वारा सम्मानित किया गया। कार्यक्रम का संचालन डा. निशा वर्मा ने किया। डा. कमलेश कुमार ने धन्यवाद ज्ञापन दिया।

**I 1FkkU }kjk 'fo'o enk fnol ^ ,oa 'lk'kqku LokLF; f'kfoj^ dk vk; kstu**

संस्थान द्वारा दिनांक 5/12/2018 को मुजफ्फरनगर जिले के सटेड़ी गांव में **fo'o enk fnol** का आयोजन किया गया। कार्यक्रम के मुख्य अतिथि माननीय सांसद व पूर्व केन्द्रीय कृषि राज्य मंत्री डा. संजीव कुमार बालियान जी रहे। मुख्य अतिथि ने अपने संबोधन में बताया कि धरती हमारी माता है और इसके स्वास्थ्य को बनाये रखना हम सभी का दायित्व है। पूर्व मंत्री महोदय ने किसानों से मृदा स्वास्थ्य कार्ड

के प्रयोग एवं संस्तुतियों के अनुसार ही खाद एवं उर्वरकों के प्रयोग की सलाह दी। उन्होंने कृषि प्रणाली संस्थान द्वारा अधिकाधिक मात्रा में मृदा स्वास्थ्य कार्ड वितरण एवं कृषि प्रणाली की अन्य समस्याओं के समाधान हेतु किये जा रहे प्रयासों के लिए संस्थान के निदेशक डा. आजाद सिंह पँवार एवं उनकी टीम की भूरि-भूरि प्रशंसा की और इसके लिए धन्यवाद भी दिया। माननीय सांसद द्वारा 50 किसानों के लिए कृषि प्रणाली संस्थान द्वारा तैयार किये गये मृदा स्वास्थ्य कार्ड एवं लघु कृषि यंत्र भी वितरित किये गये।

कृषि प्रणाली संस्थान के निदेशक डा. आजाद सिंह पँवार ने सभी अतिथियों एवं किसान भाईयों का स्वागत करते हुए संस्थान द्वारा क्षेत्र की कृषि प्रणाली के मुख्य आधार मृदा के स्वास्थ्य को बनाये रखने एवं प्रदूषण मुक्त रखने के लिए किये जा रहे प्रयासों की संक्षिप्त जानकारी दी। कार्यक्रम में उपस्थित विशिष्ट अतिथियों एवं जन-प्रतिनिधियों श्री मनोज कुमार, श्री सुधीर सैनी, श्री सतेन्द्र पाल, श्री धर्म सिंह, श्री राजबीर सिंह वर्मा, श्री विरेन्द्र सिंह वर्मा एवं श्री दुश्यंत जी ने मृदा स्वास्थ्य के बारे में अपने-अपने विचार रखे। इस दौरान डा. अमृत लाल मीणा, वैज्ञानिक, मृदा विज्ञान ने किसानों के समक्ष विश्व मृदा दिवस मनाने के उद्देश्यों, मृदा प्रदूषण की रोकथाम एवं मृदा स्वास्थ्य कार्ड की महत्ता एवं उपयोग के विभिन्न पहलुओं पर प्रकाश डाला। डा. चन्द्रभानु, वरिष्ठ वैज्ञानिक, पादप रोग विज्ञान ने कृषि प्रणाली में फसलों की विभिन्न रोगों एवं कीटों के समेकित एवं जैविक प्रबंधन के माध्यम से मृदा स्वास्थ्य बनाये रखने की विस्तृत जानकारी दी। डा. एस. के. धूप सिंह, प्रधान वैज्ञानिक ने कृषकों को कृषि में पशुपालन के लाभ एवं पशुधन की विभिन्न स्वास्थ्य संबंधी समस्याओं जैसे बांझपन, अंतः परजीवी व अन्य बीमारियों के समाधान की विस्तृत जानकारी दी।

कार्यक्रम के दौरान आयोजित किसान गोष्ठी में सटेड़ी गांव सहित 10 गांवों के 690 किसानों सहित

कुल 760 लोगों ने भाग लिया। इसी दौरान कृषि प्रणाली संस्थान, मेरठ एवं केन्द्रीय गोवंश अनुसंधान संस्थान, मेरठ द्वारा संयुक्त रूप से पशुधन स्वास्थ्य शिविर का आयोजन किया गया जिसमें गांव के किसानों ने अपने-अपने पशुओं को वैज्ञानिकों द्वारा निरीक्षण करवाकर उनके स्वास्थ्य संबंधित समस्याओं के उचित समाधान प्राप्त किये। कार्यक्रम का संचालन डा. प्रेम

सिंह, एवं डा. पूनम कश्यप ने किया। डा. एम.पी. सिंह, डा. आर. पी. मिश्रा, डा. देवाशीष दत्ता कार्यक्रम के समन्वयक रहे। कार्यक्रम के अन्त में डा. एम.पी. सिंह जी ने धन्यवाद ज्ञापन दिया। इस दौरान डा. सुरेश मलिक, डा. निशा वर्मा, डा. एल. के. मीणा, डा. प्रकाश चन्द घासल, डा अमित कुमार व डा कमलेश कुमार आदि मौजूद रहे।

### Brief Report of World Soil Day Celebration

S.N.	Name of the Institute	No. of Participants attended		No. of Soil Health Cards distributed to Farmers	No. of VIPs attended	Name of Prominent VIPs (M.P./M.L.A. etc.) attended
		Total Participants	Farmers attended			
1.	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut	760	690	50	9	Dr. Sanjeev Kumar Baliyan, M.P., Muzaffarnagar (U.P.)  Sh. Manoj Kumar, Jila Panchayat Sadashya, Muzaffarnagar (U.P.)



### —f'k iz kkyh jfM; ks i kB' kkyk dk vk; kst u

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ और आकाशवाणी केन्द्र नजीबाबाद, उत्तर प्रदेश द्वारा "Okej QLVZ' परियोजना के अंतर्गत 26 कड़ियों की '—f'k iz kkyh jfM; ks i kB' kkyk' का आयोजन दिनांक 27 फरवरी 2015 से 16 मार्च, 2019 तक

किया गया। कृषि प्रणाली रेडियो पाठशाला का उद्देश्य संस्थान की समेकित कृषि प्रणाली एवं जैविक खेती तकनीकों को सजीव व रिकार्डेड प्रसारण के माध्यम से देश के अधिकतम किसानों तक पहुँचाने हेतु fdl ku c<sn\$ k c<‡ नारे के साथ किया गया। कार्यक्रम का शुभारम्भ दिनांक 27/2/2019 को मुजफ्फरनगर जिले के सठेड़ी गाँव में किया गया। संस्थान के निदेशक डॉ.

आजाद सिंह पँवार ने सभी किसानों एवं अतिथियों का स्वागत किया। उपरोक्त सजीव प्रसारण एवं रिकॉर्डिंग की 26 कड़ियों के अंतर्गत ही विभिन्न रेडियो पाठशालाओं

के दौरान विभिन्न वैज्ञानिकों द्वारा समेकित कृषि प्रणाली के विभिन्न विषयों पर रिकॉर्डिंग भी की गयी जिनके प्रसारण का विवरण निम्न प्रकार है:

क्र.सं.	दिनांक	कड़ियाँ	वैज्ञानिक	विषय
1	4	28/2/2019	डॉ. आजाद सिंह पँवार, निदेशक	गन्ने में फसल विविधीकरण
2	5	01/03/2019	डॉ. चन्द्रभानु, वरिष्ठ वैज्ञानिक	पश्चिमी उ.प्र. एवं उत्तराखण्ड के मैदानी क्षेत्रों में वर्ष भर मशरूम उत्पादन
3	5	02/03/2019	डॉ. अतर सिंह, निदेशक, अटारी कानपुर	किसानों की आय दोगुनी करने के प्रयास
4	7	03/03/2019	डॉ. पी.सी.जाट	मृदा स्वास्थ्य कार्ड योजना
5	8	04/03/2019	डॉ. आर.पी. मिश्र, प्रधान वैज्ञानिक	जैविक कृषि भविष्य की कृषि
6	9	05/03/2019	डॉ. चन्द्रभानु, वरिष्ठ वैज्ञानिक	समेकित कीट प्रबंधन
7	10	06/03/2019	डॉ. देवन्द्र कुमार, प्रधान वैज्ञानिक	पश्चिमी उत्तर प्रदेश में गन्ने की अधिक पैदावार कैसे लें?
8	11	07/03/2019	डॉ. देबाशीष दत्ता, प्रधान वैज्ञानिक	मिट्टी की जाँच क्यों व कैसे?
9	15	09/03/2019	डॉ. दुष्यन्त मिश्र, प्रधान वैज्ञानिक	आम के बागों का समेकित प्रबंधन
10	16	10/03/2019	डॉ. चन्द्र भानु, वरिष्ठ वैज्ञानिक	गन्ने में कीटों का जैविक नियंत्रण
11	17	11/03/2019	डॉ. चन्द्र भानु, वरिष्ठ वैज्ञानिक	गर्मियों में दूधिया मशरूम की खेती
12	18	12/03/2019	डॉ. आर. पी. मिश्र, प्रधान वैज्ञानिक	जैविक उत्पादों का उचित विपणन प्रबंधन
13	22	14/03/2019	डॉ. पी.सी.जाट वरिष्ठ, वैज्ञानिक	मक्का की उन्नत खेती
14	23	15/03/2019	डॉ. दुष्यन्त मिश्र, प्रधान वैज्ञानिक	नये बाग लगाते समय ध्यान देने योग्य बातें
15	12 कड़ियाँ	—	—	प्रसारण संख्या (4X3=12) कड़ी संख्या 1,2,3, / 12,13,14 / 19,20,21 और 24,25,26

कुल 26 दिनों में



कृषि प्रणाली रेडियो पाठशाला का समापन दिनांक 16 मार्च, 2019 को ग्राम बधाई कलाँ मुजफ्फरनगर में अंतिम सीधे प्रसारण के साथ किया गया। उपरोक्त रेडियो पाठशालाओं के दौरान विभिन्न गाँवों (सटेडी, कैलावड़ा कलाँ, मीरापुर दलपत और बधाई कलाँ) के लगभग 200 किसानों ने भाग लिया। इस रेडियो पाठशाला के सीधे व रिकॉर्डेड प्रसारण से देश भर के लाखों किसान लाभान्वित हुए। कार्यक्रम के प्रसारण में आकाशवाणी केन्द्र नजीबाबाद की ओर से श्रीमती मंदीप कौर चड्ढा (कार्यक्रम निदेशक), श्रीमती मंजुला नेगी (कार्यक्रम अधिकारी), श्री विक्रान्त चौधरी (प्रसारण अधिकारी) एवं श्री नरेश पाल सिंह, सुबेन्द्र सिंह और श्री आलोक कुमार (कृषि समनुदेशिनी) ने सीधे प्रसारण एवं रिकार्डिंग कार्यक्रम में भाग लिया। कार्यक्रम को सफलतापूर्वक सम्पन्न कराने हेतु संस्थान के कार्यकारी निदेशक डा. प्रेम सिंह ने सभी को धन्यवाद दिया।

## 1. Fkk Jkj Nf'k eyk o Nf'k rduhdh i n'kUh dk vk; kst u

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम (मेरठ) एवं सुरभि फाउंडेशन, गैण्डी खाता द्वारा संयुक्त रूप से दिनांक 23.02.2019 हरिद्वार जिले के गैण्डी खाता गाँव में एक विशाल कृषि मेले का आयोजन किया गया। क्षेत्र के आदिवासी एवं अनुसूचित श्रेणी के किसानों की समेकित कृषि प्रणाली तकनीकों के माध्यम से कृषि उत्पादकता बढ़ाने, आजीविका एवं पर्यावरण सुरक्षा के उद्देश्यों पर आधारित इस किसान मेले में लगभग 1500 किसानों ने भाग लिया, मेले का उद्घाटन हरिद्वार ग्रामीण क्षेत्र से माननीय विधायक एवं मुख्य अतिथि स्वामी यतीस्वरानन्द जी ने किया। मुख्य अतिथि ने अपने संबोधन में उत्तराखण्ड के अनुसूचित जाति एवं जनजातियों तथा अन्य किसानों के कल्याण हेतु चलाई जा रही समेकित कृषि प्रणाली जनजातिय उपयोगना एवं मेरा गाँव मेरा गौरव के संचालन हेतु भारतीय कृषि प्रणाली अनुसंधान संस्थान के निदेशक डॉ. आजाद सिंह पँवार एवं उनके साथी वैज्ञानिकों की भूरि-भूरि प्रशंसा की एवं इसके लिए उन्हें धन्यवाद भी दिया। भारतीय कृषि प्रणाली अनुसंधान संस्थान, मेरठ

के निदेशक डॉ. आजाद सिंह पँवार ने सभी अतिथियों एवं किसानों का स्वागत किया तथा क्षेत्र के किसानों एवं अनुसूचित जनजातियों के खाद्य एवं आजीविका सुरक्षा हेतु संस्थान द्वारा चलाई जा रही विभिन्न परियोजनाओं की विस्तृत जानकारी दी। उन्होंने यह भी बताया कि किसानों की खेती की उत्पादकता एवं आय में वृद्धि एवं पर्यावरण सुरक्षा हेतु कृषि प्रणाली संस्थान फसलों की उन्नतशील प्रजातियों से लेकर किचन गार्डन/पोषण वाटिका, फसलों एवं पशुओं में समेकित पोषण एवं नाशीजीव प्रबंधन, पर्यावरण सुरक्षा हेतु जैविक कीटनियंत्रकों के प्रयोग एवं मृदा स्वास्थ्य प्रबंधन आदि विषयों पर तकनीकी समावेश कर रहा है।

कार्यक्रम के विशिष्ट अतिथि एवं भारतीय कृषि अनुसंधान परिषद, नई दिल्ली की संचालन समिति के सदस्य तथा सुरभि फाउंडेशन के अध्यक्ष श्री आलोक गुप्ता जी ने क्षेत्र में समेकित कृषि प्रणाली की नवीनतम तकनीकों के प्रचार-प्रसार एवं परियोजना संचालन हेतु भारतीय कृषि प्रणाली अनुसंधान संस्थान के निदेशक एवं वैज्ञानिकों के कार्य की सराहना की। उन्होंने क्षेत्र के किसानों के चहुमुखी विकास हेतु सुरभि फाउंडेशन, गैण्डी खाता द्वारा चलाई जा रही विभिन्न योजनाओं की जानकारी भी दी। कार्यक्रम में विशिष्ट अतिथि, केंद्रीय आलू अनुसंधान संस्थान के संयुक्त निदेशक डॉ. मनोज कुमार जी, श्री ब्रजमोहन जी एवं अन्य विशिष्ट अतिथियों ने अपने-अपने विचार रखे। इसी दौरान क्षेत्र के जाने-माने प्रगतिशील किसानों, स्वयं सहायता समूह एवं लघु उद्यमियों को कृषि प्रणाली संस्थान एवं सुरभि फाउंडेशन द्वारा पुरस्कार देकर सम्मानित किया गया। इस भव्य किसान मेले के दौरान कृषि प्रणाली संस्थान मेरठ, केंद्रीय आलू अनुसंधान संस्थान मेरठ, कृषि विज्ञान केंद्र धनौरी (हरिद्वार) एवं स्वयं सहायता समूह एवं अन्य उद्यमियों द्वारा नवीनतम तकनीकों पर आधारित कृषि प्रदर्शनी का आयोजन भी किया गया। किसान मेले के दौरान देश के विभिन्न संस्थानों के जाने-माने वैज्ञानिकों एवं किसानों के मध्य परिचर्चा एवं किसान गोष्ठी का आयोजन भी किया गया, जिसमें किसानों को समसामयिक समस्याओं के समाधान हेतु नवीनतम कृषि तकनीकों की जानकारी दी गयी। सभी किसानों को

जायद मौसम में उगाने वाली सब्जियों हेतु पोषण वाटिका बीज किट, पशुओं हेतु मिनरल मिक्चर, मशरूम बैग एवं समेकित कृषि प्रणाली की विभिन्न तकनीकों पर पत्रक एवं पाठन सामग्री का वितरण भी किया गया। कार्यक्रम का संचालन प्रधान वैज्ञानिक डॉ. प्रेमसिंह ने किया। डॉ. चन्द्रभानु ने धन्यवाद ज्ञापन प्रस्तुत किया।

egRoI wK 0; fDr; ka dk nkjk

I LFku ea vrjkZh; oKkfud ny dk Hke.k

भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ में दिनांक 21.04.2018 को संयुक्त राष्ट्र के अंतर्राष्ट्रीय खाद्य एवं कृषि संगठन एवं अंतर्राष्ट्रीय पशुधन अनुसंधान संस्थान नई दिल्ली शाखा के वैज्ञानिकों के दल ने भ्रमण किया। अंतर्राष्ट्रीय पशुधन अनुसंधान संस्थान, दिल्ली के प्रभारी डॉक्टर यस. रहमान एवं अंतर्राष्ट्रीय खाद्य एवं कृषि संगठन से डॉक्टर कोडा रेड्डी (कार्यक्रम विशेषक), डॉक्टर कुंदन सिंह (अर्थशास्त्री), डॉ राजेश दुबे (परिचालन अधिकारी) मुख्य वैज्ञानिक गड़ रहे। कृषि प्रणाली संस्थान के निदेशक डॉ आजाद सिंह पँवार ने वैज्ञानिक को क्षेत्र एवं देश के लिए समेकित कृषि प्रणाली पर चल रहे कार्यक्रमों के बारे में विस्तार से बताया। इसके उपरांत वैज्ञानिक दल ने भायंगी भंगेला एवं सटेरी गांवों में अंगीकृत किसानों के प्रक्षेत्र सब्जी आधारित, फसल आधारित एवं पशुपालन आधारित समेकित कृषि प्रणाली इकाईयों का भ्रमण किया। तत्पश्चात अंतर्राष्ट्रीय वैज्ञानिकों ने समेकित कृषि में फसलोत्पादन, पशुपालन एवं मृदा स्वास्थ्य संबंधित समस्याओं एवं उनके सुधार की संभावनाओं



पर किसानों के साथ गहन चर्चा की। बाद में वैज्ञानिकगण ने कृषि प्रणाली संस्थान के शोध प्रक्षेत्र पर स्थित कृषि प्रणाली मॉडल, जैविक कृषि व जैविक लागत इकाई का भ्रमण भी किया। भ्रमण कर रहे वैज्ञानिकगण ने कृषि प्रणाली संस्थान द्वारा समेकित कृषि प्रणाली पर किए जा रहे उत्कृष्ट शोध व विकास कार्यों की सराहना की।

o'k 2018 dh jktHK'k l cdk xrfof/k; k;

fgnh i [kokMs dk vk; kst u

संस्थान में राजभाषा हिंदी के अधिकाधिक प्रयोग को बढ़ावा देने एवं समस्त कार्यालय कर्मियों में राजभाषा हिंदी के प्रति अभिरुचि पैदा करने के उद्देश्य से 14-18 सितंबर, 2018 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, अन्त्याक्षरी आदि का आयोजन किया गया। सभी प्रतियोगिताओं के विजयी प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं प्रोत्साहन पुरस्कार देकर सम्मानित किया गया। इसके अतिरिक्त वर्ष 2017-18 के दौरान हिंदी में सर्वाधिक कार्य करने वाले कर्मियों को भी पुरस्कृत किया गया। उक्त प्रतियोगिताओं में सभी संवर्ग के अधिकारियों एवं कर्मचारियों ने बढ़-चढ़ कर प्रतिभागन किया। 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 कृषि प्रणाली से संबंधित शोध कार्यों को परिषद द्वारा प्रकाशित हिंदी पत्रिकाओं में लोकप्रिय लेखों के माध्यम से किसानों तक पहुँचाकर उनकी

आमदनी बढ़ाने एवं कृषि संबंधी समस्याओं का समाधान करने का आग्रह किया।

### fgnh dk; / kkykvka dk vk; kstu

Ø-l a	dk; Øe dk uke	fnukal	ifrHkxh
1	हिंदी कार्यशाला	एक दिवसीय / 09.03.2018	कार्यालय कर्मी एवं आमंत्रित अतिथि
2	हिंदी कार्यशाला	एक दिवसीय / 20.06.2018	कार्यालय कर्मी एवं आमंत्रित अतिथि
3	हिंदी कार्यशाला	एक दिवसीय / 25.09.2018	कार्यालय कर्मी एवं आमंत्रित अतिथि
4	हिंदी कार्यशाला	एक दिवसीय / 26.12.2018	कार्यालय कर्मी एवं आमंत्रित अतिथि

### jktHkk"kk dk; kll; u l febr dh =ekfl d cBdk dk vk; kstu

vof/k	fnukal
जनवरी – मार्च	07 मार्च 2018
अप्रैल – जून	20 जून 2018
जुलाई – सितंबर	04 सितंबर 2018
अक्टूबर – दिसंबर	18 दिसंबर 2018



### dk0; l d; k dk vk; kstu

संस्थान के सभागार में दिनांक 16 सितंबर, 2018 को दिवंगत प्रधानमंत्री माननीय श्री अटल बिहारी वाजपेयी जी को उनकी प्रथम मासिक पुण्यतिथि पर श्रद्धांजलि अर्पित करने के लिए काव्य संस्था का आयोजन किया गया। कार्यक्रम में संस्थान के सभी कर्मियों ने सपरिवार भाग लिया तथा वाजपेयी जी की प्रेरणादायक कविताओं का पाठ किया। इसके अतिरिक्त वक्ताओं ने वाजपेयी जी के उच्च मानदण्ड वाले राजनैतिक एवं सामाजिक कृत्यों का बखान किया। इस अवसर पर संस्थान के निदेशक डॉ. आजाद सिंह पँवार ने अपने संबोधन में वाजपेयी जी के विराट व्यक्तित्व एवं कृतित्व पर प्रकाश डाला। कार्यक्रम के आयोजन में संस्थान के वैज्ञानिकों डॉ. दुष्यंत मिश्रा, डॉ. चन्द्रभानु एवं डॉ. निशा वर्मा का विशेष योगदान रहा।

### l d nh; l febr }kjk fujh{k.k

संस्थान के कामकाज में राजभाषा हिंदी के प्रगामी प्रयोग में हुई प्रगति का निरीक्षण संसदीय राजभाषा समिति की दूसरी उपसमिति द्वारा दिनांक 09 अक्टूबर, 2018 को नई दिल्ली में किया गया। निरीक्षण के दौरान समिति के माननीय अध्यक्ष एवं सदस्यों द्वारा संस्थान के निदेशक एवं वरिष्ठ प्रशासनिक अधिकारी से हिंदी के प्रगामी प्रयोग से संबंधित विस्तारपूर्वक चर्चा की गई। समिति ने संस्थान में राजभाषा हिंदी के प्रगामी प्रयोग में हुई प्रगति पर संतोष व्यक्त किया तथा यह विश्वास जताया कि संस्थान द्वारा राजभाषा विभाग द्वारा निर्देशित वार्षिक कार्यक्रम के सभी शेष लक्ष्यों को शीघ्र पूरा किया जायेगा।

# ICAR-IIFSR IN MEDIA



## LIST OF ON-GOING PROJECTS DURING 2018-19 AS PER 30<sup>th</sup> IRC PROCEEDING#

S.No	Project Title and Code	PI	Co PI's	Date of start	Likely date of completion
<b>I. Integrated Farming Systems Management (Livelihood security through integrated farming system approach)</b>					
1.	Development of sustainable IFS Model for Western Plain Zone of Uttar Pradesh.	Dr. L.R. Meena	Dr. S. Malik, Dr. Amit Nath, Dr. D. Kumar, Dr. D. Mishra, Dr. C. Bhanu, Dr. A.K. Prusty, Dr. A.L. Meena	2017	2022
2.	Development of fruit crop based farming systems for higher productivity and profitability	Dr. Dushyant Mishra	Dr. L.R. Meena, Dr. S. Malik Dr. Amit Nath	Jan-18	Dec-23
3.	Crop improvement for organic production system.	Dr. Devendra Kumar	Dr. L.K. Meena, Dr. L.R. Meena, Dr. Kamlesh Kumar, Dr. K.H. Singh (DRMR Bharatpur),	2018	2022
4.	Development of Protocol for value added Products from organic sugarcane	Dr. Amit Nath	Dr. D. Kumar, Dr. Kamlesh Kumar	2018	2022
5.	Evaluation and Identification of Farm Implements under Different Farming systems	Dr. V.P. Chaudhary	Dr. Nisha Verma, Dr. Dushyant Mishra, Dr. L.R. Meena	Oct-18	Sep-24
6.	Development of climate resilient agro-horti-pastoral model for sustainable production and livelihood under rainfed condition (New Proposal)	Dr. L.R. Meena	Dr. D. Mishra, Dr. Amit Nath Dr. Chetan Kumar Dr. L.K. Meena	2019	2024
7.	Development of mobile based organic farming Advisory Service.	Dr. Vipin Kumar	Dr. N. Ravisankar Dr. Dushyant Mishra, Dr. N. Subash, Dr. L.R. Meena	Dec-18	Dec-21
<b>II. CSRM (identification of climate resilient alternative efficient cropping systems)</b>					
1.	Status of organic agriculture in Jammu division of Western Himalayan regions	Dr. Sunil Kumar	Dr. A.L. Meena Dr. L.K. Meena, Dr. Chetan Kumar	Aug-18	Aug-23
2.	Physiological approaches for improving productivity of promising cropping system.	Dr. L.K. Meena	Dr. D. Kumar, Dr. P.C. Ghasal, Dr. A.L. Meena, Dr. Sunil Kumar	Oct-17	Dec-23

S.No	Project Title and Code	PI	Co PI's	Date of start	Likely date of completion
3.	Identification of cropping system module for different farming system.	Dr. Amit Kumar	Dr. Prem Singh, Dr. D. Dutta, Dr. P.C. Ghasal, Dr. Sunil Kumar, Dr. Jairam Chaudhary Dr. Chetan Kumar	Nov-18	Nov-23
4.	Measurement and Estimation of GHG emission and carbon footprint in sustainable IFS Models of western plain zone of Uttar Pradesh.	Dr. N. Subash	Dr. Debashi Dutta Dr. S. Malik, Dr. L.R. Meena Dr. A.L. Meena Dr. A.K. Prusty Dr. Poonam Kashyap Dr. D. Mishra	2018	2022
5.	Long term influence of resource Conservation Technologies	Dr. V.P. Chaudhary	Dr. R. P. Mishra	2004*	Extended up to March 2019
<b>III. OAS (Evolving sustainable organic farming systems practices)</b>					
1.	Development of viable and sustainable management options for integrated organic farming system (OAS 1) Sub Project: Development of pest and disease management package for organic farming system	Programme leader Dr. R.P. Mishra (OAS)  PI- Dr. Chandrabhanu	Dr. D. Dutta, Dr. P.C. Ghasal, Dr. Jairam Chaudhary, Dr. A.L. Meena	Sep-18	Jun-22
2.	Nutrient Mangement in different cropping systems under organic production systems	Dr. P.C. Ghasal	Dr. P.C Jat, Dr. D. Dutta, and Dr. Chetan Kumar Dr. Amit Kumar	Oct-18	Dec-23
3.	Development and validation of microbial consortia for crop residue recycling under organic farming system	Dr. Debashis Dutta	Dr. R.P Mishra, Dr. Chandra Bhanu, Dr. A.L. Meena, Dr. Jairam Chaudhary, Dr. Amit Kumar	Nov-18	Nov-21
<b>IV. TTR and HRD (Farming systems, demonstrations, transfer of technology and capacity building)</b>					
1.	Refinement of Horticulture Based Farming System Models for Food and Nutritional Security	Dr. Poonam Kashyap	Dr. A.K. Prusty, Dr. A.L. Meena, Dr. P.C. Jat, Dr. Sunil Kumar, Dr. Jairam Chaudhary, Dr. Peyush Punia, Dr. M.P. Singh	Jan-18	Dec-22
2.	On-Farm demonstration and refinement of improved IFS technologies for livelihood security	Dr. P.C. Jat	Dr. M.P. Singh , Dr. P. Kashyap, Dr. Peyush Punia, and Dr. Sunil Kumar	Jan-18	Mar-22



S.No	Project Title and Code	PI	Co PI's	Date of start	Likely date of completion
3.	Characterization of existing farming systems in Uttarakhand.	Dr. Nisha Verma	Dr. Khushyal Singh, Dr. V.P. Chaudhary, Dr. Vipin Kumar Chaudhary, Dr. Amit Nath.	Jan-18	Dec-22
4.	Study of pesticide residues in Fish grown in different integrated farming systems	Dr. Peyush Punia	Dr. A.K. Prusty, Dr. Sunil Kumar, Dr. Debashis Dutta	Oct-18	Oct-21
5.	Diversification of existing farming systems of Western Plain zone.	Dr. Khusyal Singh	Dr. M.P. Singh, Dr. Peyush Punia, Dr. L.R. Meena, Dr. D. Mishra, Dr. D. Kumar, Dr. Nisha Verma		
<b>V. Co-ordinate Unit ( Coordination and monitoring of IFS and organic farming research in the country)</b>					
1.	Development of Integrated Organic Farming System models for different regions of India	Dr. N. Ravishankar	Dr.Amit Kumar, Dr. P.C. Jat, Dr. M. Shamim, Dr. D.Dutta, Dr.Suresh Malik, Dr. Poonam Kashyap, Dr. C. Bhanu	Nov-18	Oct-20
2.	Identification of climate resilient production system for different ecology (IXX13036)	Dr. M. Shamim	Dr. N. Ravisankar		

## STAFF LIST AS ON 31.03.2019

S. No.	Name of the Scientist	Designation	Discipline
RMP	Dr. A.S. Panwar	Director	
<b>Principal Scientist</b>			
1.	Dr. M.P. Singh	Pr. Scientist	Agril. Extension
2.	Dr. Prem Singh	Pr. Scientist	Agronomy
3.	Dr. Peyush Punia	Pr. Scientist	Fisheries Resource Management
4.	Dr. L. R. Meena	Pr. Scientist	Agronomy
5.	Dr. N. Ravisankar	Pr. Scientist	Agronomy
6.	Dr. Suresh Malik	Pr. Scientist	Poultry Science
7.	Dr. Amith Nath	Pr. Scientist	Food Technology
8.	Dr. R.P.Mishra	Pr. Scientist	Agronomy
9.	Dr. N.Subhash	Pr. Scientist	Agri-Meteorology
10.	Dr.V.P.Chaudhary	Pr. Scientist	FMP
11.	Dr.Dushyant Mishra	Pr. Scientist	Fruit Science
12.	Dr. Debasish Dutta	Pr. Scientist	Agril. Chemicals
13.	Dr. Devendra Kumar	Pr. Scientist	Plant Breeding
<b>Sr. Scientist</b>			
14.	Dr. Khushyal Singh	Sr. Scientist	(Agril. Extension)
15.	Dr. P C Jat	Sr. Scientist	Agronomy
16.	Dr. Chander Bhanu	Sr. Scientist	Plant Pathology
17.	Dr. Poonam Kashyap	Sr. Scientist	Horticulture
18.	Dr. A. K. Prusty	Sr. Scientist	Aquaculture
<b>Scientist</b>			
19.	Shri Vipin Kumar Chaudhary	Scientist	Computer Application
20.	Dr. M. Shamim	Scientist	Agri-Meteorology
21.	Dr. Sunil Kumar	Scientist	Computer Application & Agril. Economics
22.	Dr. Nisha Verma	Scientist	Home Science
23.	Dr. Raghuvveer Singh	Scientist	Agronomy
24.	Dr. Lalit Kumar Meena	Scientist	Plant Physiology
25.	Dr. Amrit Lal Meena	Scientist	Soil Science
26.	Dr. Amit Kumar	Scientist	Agronomy
27.	Dr. P.C. Ghasal	Scientist	Agronomy
28.	Dr. Jairam Choudhary	Scientist	(Soil Microbiology),
29.	Shri kamlesh Kumar	Scientist	Agronomy
30.	Dr. Chetan Kumar G.	Scientist	Soil Microbiology
S. No.	Name of the Officers	Designation	
<b>Technical Staff</b>			
31.	Dr. Yogendra Singh	CTO	
32.	Shri D. Tripathi	CTO	
33.	Dr. Vipin Kumar	CTO	
34.	Dr. Brij Mohan	ACTO	
35.	Dr. Om Kumar Tomar	ACTO	
36.	Shri Naval Singh	ACTO	



S. No.	Name of the Officers	Designation
37.	Shri P. P. Mishra	ACTO
38.	Dr. S. P. Singh	ACTO
39.	Shri S. K. Duhoon	STO
40.	Shri R. B. Tewari	STO
41.	Dr. Vinod Kumar	STO
42.	Shri D. P. Singh	STO
43.	Shri A. P. Dwivedi	T O
44.	Shri D. K. Pandey	TO
45.	Shri Krishan Kumar	TO
46.	Shri Uma Shankar Pandey	STA
47.	Shri Ashok Kumar	STA
48.	Smt. Anju Verma	Sr. Technician
49.	Shri Raj Kumar Meena	Sr. Technician

S. No.	Name of the Officers	Designation	
<b>Administrative</b>			
50.	Shri Ravinder Singh	Senior Admn. Officer	
51.	Shri T. C. Sharma	F & A O	
52.	Shri Surya Kant	P S	
53.	Shri Attar Singh	P.A.	
54.	Shri Rai Bahadur	P.A.	
55.	Smt. Jailata Sharma	P.A.	
56.	Smt. Alka Jain	Assistant	
57.	Shri Sanjay Kumar Gupta	Assistant	
58.	Shri S. K. Bansal	P. A.	
59.	Shri Rajesh Kumar	P. A.	
60.	Shri Brij Beer singh	P. A.	
61.	Smt. Sheela Devi	Assistant	
62.	Shri Ravi Kant	U.D.C.	Promoted to Asst on 9.2.2018
63.	Shir Prem Singh	U.D.C.	
64.	Sh. Rajender Kumar	L.D.C.	Promoted to UDC on 9.2.2018
65.	Sh. Permanand	L.D.C.	
66.	Sh. Prasant Panwar	L.D.C.	

S. No.	Name of the Officers	Designation
<b>Supporting Staff</b>		
67.	Shri Anand Singh	SSS
68.	Shri Prem Kumar	SSS
69.	Shri Rakesh Kumar	SSS
70.	Shri Kripa Shankar Pandey	SSS
71.	Shri Ayodhya Prasad Dubey	SSS
72.	Shri Prem Singh	SSS
73.	Shri Mahavir Singh	SSS
74.	Shri Siddh Kumar	SSS
75.	Shri Harshnath Singh	SSS
76.	Shri Sada Ram	SSS
77.	Shri Gajendra Kumar	SSS







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