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ANNUAL REPORT

2015-16

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ICAR-Indian Institute of Farming Systems Research

Modipuram, Meerut - 250 110, India

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

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PREFACE

Farming system approach works with two inter-related thrusts. One is to develop and understanding of the household and environment together with identification and second is the testing of potential solutions of constraints being faced by the farming community. To achieve the above objectives, the PDFSR was upgraded to full-fledged institute and renamed as ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram during November 2014. The institute is mandated to find out practical aspects of livelihood options through the development of on and off farm farming system modules. ICAR-IIFSR besides running institutional research activities at its headquarters at Modipuram with four divisions and coordinating one AICRP on Integrated Farming Systems with 25 main, 12 sub, 32 on-farm and 6 voluntary centres and Network Project on Organic Farming with 20 centres in 16 states are also an integral part of the institute in addressing various issues of agriculture.

Looking in to the present and future need, cropping system based institute research projects were re-oriented to farming systems and as a result, various farming systems modules and models are being established. The institute strengthened the farmer participatory research programmes including farming systems characterization at national level which resulted in near to completion of characterization in Jammu, Kerala, Tamil Nadu and West Bengal. Region and resource specific Integrated Farming System models evaluated at various locations provide scope to improve the farmer's income by 2 to 3 times besides better household level food and nutritional supply. Similarly, the integrated organic farming system models evaluated at Umiam (Meghalaya) and Coimbatore (Tamil Nadu) indicates that up to 90 % requirement of seeds, nutrients, bio-pesticides can be met within the farm which in-turn enhances the sustainability of organic farming and reduces the cost of production.

During the year, the institute also organized many training programmes, farmer field schools, 88 demonstrations on farming systems involving oilseeds, group meeting of AICRP on IFS and NPOF. Technical programme of AICRP on IFS was re-oriented to farming systems through a specially organized Technical programme review workshop during May 2015. ICAR-DAC workshop on Organic Farming: Concerns on crop productivity and soil health was organized during January 2016 through which ICAR-IIFSR policy for promotion of organic farming in India was finalized. The events such as International year of soils were celebrated by distributing the soil health card to farmers in Mandora village in Meerut district. Hon'ble Minister of State for Agriculture and Farmers Welfare Dr Sanjeev Kumar Balyanji along with Member of Parliaments and Dr S. Ayyappan, Former Secretary, DARE and Director General, ICAR visited the institute and reviewed the achievements. Four important publications namely, Long term INM in cereal based cropping systems, Farming Systems Research: Success stories (Series 1), Region specific synthesized Integrated Farming System Models for improved production, profitability and nutrition and Farmers Perception on Climate Change and IFS as adaptation measure towards changing climate were brought out during the year. The Vision 2050 of the institute was also published.

Institute Management Committee (IMC) and Research Advisory Committee (RAC) meeting were organized timely and I am thankful to both the committees for providing the valuable suggestions. I express my gratitude to Dr. S. Ayyappan, Former Secretary, DARE and Director General, ICAR, New Delhi and Dr. A. K. Sikka, Former Deputy Director General (NRM), ICAR, New Delhi for their constant guidance, encouragement and support. My appreciation is also due to Dr. B. Mohan Kumar, Former ADG (AAF/CC), ICAR, New Delhi and to other staff members of NRM division for cooperation and support. I am also highly thankful 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 encouragement and support. My appreciation is also due to Dr. S. Bhaskar, ADG (AAF&CC), ICAR, New Delhi. The help of the PME Cell and Editorial Committee in compiling and timely publication of the report is highly appreciated.

(A S Panwar)
Director

CONTENTS

EXECUTIVE SUMMARY

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

2. Budget (2015-16)

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. of Govt. Grant	Exp. Out of revenue generation	Total expenditure (col. 6+7)
1	2	3	4	5	6	7	8
160.0	158.67	1062.0	108.25	1170.25	1039.73	105.06	1144.79

b) External sources (₹ in Lakhs)

Source	**Budget**	**Expenditure**
Pension and other retirement benefits	105.0	101.64
Personal loan and advances	3.00	2.85
Externally funded projects	-	-
Total	108.0	104.49

c) Revenue generated (₹ in Lakhs) during 2014-15

Source	Amount
Farm Produce	34.07
Sale of fish, milk and livestock	0.38
Sale of Publication	0.00
License fee/ water charges	4.33
Cost of tender form	-
Service render	-
Training	-
Miscellaneous	4.25
Interest on loan and advances	2.10
Interest on TDR	9.38
Others (Royalty and Inst. Charges)	-
Total	54.51

3. Staff position (as on 31.03.2016)

Category	Sanction	Position	Vacant
Scientific			
Director	01	01	-
Principal Scientist	07	06	01
Senior Scientist	12	08	04
Scientist	19	16	03
Total	39	31	08
Technical Staff			
Category-III (T-6, 7/8)	2	2	-
Category-II (T-3, T-4 & T-5)	18	18+1#	-
Category-I (T-1 & T-2)	3+1	3	-
Total	23	22	
Administrative Staff			
Sr. Administrative Officer	01	01	-
F & A O	01	01	-
A A O	01	-	01
Assistant	04	04	-
U D C	02	02	-
P S	01	01	-
P A	02	03*	-
Jr. Steno Gr.III	01	02**	-
L D C	03	03	-
Total	16	17* &**	01
Supporting Staff	10	10	-
Temporary Status Casual Labourers	15	15	-
TOTAL	**57**	**55**	**02**

One post of overseer from CSSRI, Karnal had been transferred which are to be returned in future

* &** As per the revised cadre strength after re-structuring of the administrative cadre these are surplus the cadre and as per the direction of the ICAR, they are to continue till further direction of the Council)

3.1 New appointments/joining

Sl. No.	Name	Designation	Date of Joining	From	Remarks
1	Dr. Peyush Punia	Principal Scientist	29.04.2015	ICAR-NBFGR, Lucknow	Transfer
2	Dr. Amrit Lal Meena	Scientist	10.04.2015	-	New Appointment
3	Dr. Lalit Krishan Meena	Scientist	10.04.2015	-	New Appointment
4	Dr. Prakash Chand Ghasal	Scientist	12.10.2015	-	New Appointment

3.2 Promotion/transfer/superannuation

Sl. No.	Name	Designation	Date of Promotion/ Transfer	Promoted to	Remarks
1	Shri D C Mishra	LDC	31.12.2015	ICAR-IISR Lucknow	Transfer
2	Shri Rjender Singh	SSS-2	31-01-2016	-	Superannuated
3	Shri Chet Ram	FS (T-9) CTO	31-0-3-2016	-	Superannuated

4. Research projects

	Numbers
a) Institute based	25
b) Externally funded	17

5. Exploratory study

	Numbers
a) Institute based	01

6. Training programme conducted

Level	No. of Programmes	No. of participants
National	15	370
International	-	-

7. Manpower development

No. of person trained at national level	10
No. of person trained at international level	-

8. Workshop organised

National	10
International	-

9. Infrastructure Development

Procurement of generator	(1 no.)
Farm office construction	
Boundary wall construction	(180 Meters)
Creation of threshing floor	
Construction of boundary wall of Director Residence	

10. Salient Research Achievements

- The use of farm products and byproducts, on-farm recycling of all the farm wastes, crop residues, cow dung, multiple uses of resources and scientific management of land, water and other farm resources make farming more profitable and sustainable through reduced cost and less use of external resources.

- Traditional cropping system along with fodder and maize+ pigeon pea-wheat and two livestock and horticulture unit provided maximum economic benefit (Rs.241037 $h^{-1}ay^{-1}$) for western plain zone of Uttar Pradesh.

- The qualities of banana chips was obtained at slice thickness (4-5 mm) with blanching time of 5-6 min.

- Under the year round forage production module, Stylo-carrot-cowpea crop module gave the highest maize equivalent yield (27.39t/ha/year). However, higher gross returns (Rs. 358000/ha/year), net returns (Rs. 253450/ha/year) and benefit: cost ratio (2.42) was fetched under maize-pea-sorghum crop module. Maximum nutrients of phosphorus, zinc and iron were presented in dry matter of *Clitoria ternatea* and minimum in wheat straw.

- Four farming systems *viz.* crop + dairy, crop + horticulture (mango) + dairy, crop + horticulture (vegetables) + dairy and horticulture + crop + dairy were found to be predominant farming systems in western plain zone of Uttar Pradesh.

- The characterization surveys in two districts of Sikar (Rajasthan) and Sirsa (Harayna) has clearly brought out the dominance of crop+dairy farming systems being practiced by the sample households. The results points towards the potential of diversification in these two districts to enhance farmer's income and employment.

- After seventeen years of rice-wheat cropping, the yield of rice and wheat declined under recommended NPK fertilizer and no-NPK (control) treatment as compared to the initial yields. The magnitude of decline varied from 17 to 30%. On the other hand, productivity of both the crops was increased over the years in all the treatments. Highest increase over initial productivity was noted with organic farming treatment (39% in rice and 24% in wheat). Application of NPK as per soil test crop response had 14 and 2% increase in yield of rice and wheat, respectively. Substitution of 25% of recommended NPK through FYM brought an increase of 5.0% in rice and 10% in wheat yield. Inclusion of fodder legume (berseem and cowpea) as a break crop in place of rice and wheat, respectively in every third rice-wheat cycle also had positive influence on productivity and yield was increased to the tune of 4 to 6%.

- Mustard straw was found as a promising substrate for oyster mushroom with higher yield of fruiting bodies and faster mycelial growth leading to early spawn run completion and fruitbody initiation. This substrate is very much fit to the year round production module of mushroom.

- Sixty farmers from Rasoolpur Jattan village of Shahpur block and Kailawara village of Khatauli block, Muzaffarnagar district were adopted under the project "On-farm Integrated Farming Systems Management" during 2015-16. To narrow down the yield gaps between farmers' practice and improved practice in field crops and horticultural crops in the villages, technological interventions based on identified constraints were introduced through on-farm trials, demonstrations and other extension methods. It can be concluded that through improved technological interventions and extension methods, different crops yield can be increased by 4 to 13 percent in the adopted villages.

- Except recommended NPK and recommended NPK + micronutrient, all the other treatments including farmers package recorded deficient nutrients and minerals (protein, P, K, Zn and Mo) in both grain and straw which in turn suggests that essentiality of supplementation of minerals in human and livestock diet.

- Land utilization index (LUI), biophysical index and most beneficial farm enterprises index can be developed from the spatial and ancillary data for characterization of existing farming systems in India.

- Net income after three years (Rs./year) was in the region specific farming system models was found to be Rs. > 3 lakhs/ha at three locations, between Rs. 2.5-3.0 lakhs at one location and Rs. 2.0-2.5 lakhs in five locations. On-farm diversification of existing cropping systems, livestock and product resulted in improvement of production (24 %), marketable surplus (55 %) and net income (29 %) to the households in the first year of interventions. In the holistic improvement of on-farm farming system experiment, the total cost of interventions across the systems and regions in three years were found to be Rs. 22594 (Rs. 7774 in first year, Rs. 8280 in second year and Rs. 6540 in third year) which resulted in additional return of Rs. 96718 (4.2 times increase).

- Continuous practice of raising the crops organically has good potential to sequester the C (up to 63 %) in the soil to offset the C emissions in the atmosphere. Integrated Organic Farming System (IOFS) promises to meet the 80-90% organic inputs within the system. Scientific Package of Practices for organic production of 42 cropping systems has been prepared. Scientific organic farming practices needs to be promoted in niche crops and areas for having the crop productivity at comparable or higher level.

- The nutrient expert based recommendation out yielded different state recommendation at all the location in different cropping systems. Preliminary results reveals that balanced nutrient prescription through Nutrient Expert may become viable option for sustaining higher productivity of cereals in India.

- The sensitivity of DSSAT-Wheat and APSIM-Wheat to Carbon-Temperature-Water-Temperature was different under the crop management and soil management conditions of Meerut district.

- GCMs projected an increase of annual increase of mean maximum temperature of 3 and 2.4 ^{0}C during 2040-2069 under RCP4.5 and RCP8.5, respectively under hot/dry scenario.

- The potential yield of rainfed sorghum ranged between 4.8 t/ha in climatic buffer zones of Rajasthan to 7.8 t/ha in climatic buffer zones of Maharashtra. Similarly, the water limited yield of sorghum ranged between 1.8 t/ha to 5.4 t/ha in different climatic buffer zones of India

- The initial trend of the simulation in pearl millet suggest that the potential yield ranged between 4.5 t/ha to 6.0 t/ha and the water limited yield ranged between 1.0 t/ha to 5.0 t/ha in different climatic buffer zones of India.

- Primary, secondary and tertiary site specific climate resilient nutrient management practices identified under pearlmillet-wheat cropping system for S.K. Nagar, Junagadh, Hissar and Bichupuri.

- There was 54% reduction in methane flux under aerobic+neem coated urea combination followed by 49% reduction in aerobic+sulphur coated urea compared to conventional puddling+normal urea application in rice. There was 33% reduction in nitrous oxide flux under aerobic+neem coated urea combination and SRI+neem coated urea combination compared to conventional puddling+normal urea combination treatment.

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12- Hkkjr e ektnk df"k i.kkfy;k d o.ku gr LFkkfud ,o lgk;d vkdMk }kjk Hkfe mi;kx lpdkd] to Hkkfrd lpdkd ,o lokf/kd ykHknk;h i{k= m|e lpdkd fodflr fd; tk ldr gA

13- {k= fo'k"k ij fodf'kr fd; x; df"k i.kkyh ekMy l Rkhu o"kk d mijkUr 'k) ykHk yxHkx rhu yk[k :Ik;@o"k@gDV;j ikIr gvkA ,d LFkku ij : 2-5&3-0 yk[k rFkk ikp LFkkuk ij : 2-0 l 2-5 yk[k 'k) ykHk nt fd;k x;kA fdlkuk d [krk ij Ápfyr —f"k i.kkfy;k e fofo/khdj.k d ifj.kkeLo:Ik igy o"k e mRiknu e 24%] fcØh ;kX; vf/k'k"k e 55% rFkk 'k) vk; e 29% dh of) gbA leLr ifjoruk dh dy ykxr : 22594@& jgh ¼iFke o"k

: 7774@&] f}rh; o"k : 8280@& ,o rrh; o"k : 6540@&½ ftll : 96718 ¼4-2 xuk of)½ dh vfrfjDr vk; iklr gbA

14- lk;koj.k ifjoru d v/;;u d vrxr Okkrkoj.k e dkcu mRlTtu e deh ykus d fy, tfod [krh }kjk enk e 63% rd dkcu dk jkdk tk ldrk gA lefUor tfod df"k i.kkyh }kjk 80&90% rd tfod ykxrk dh ifr vkrfjd lLk/kuk }kjk gh dh tk ldrh gA tfod mRiknu gr 42 QLy i.kkfy;k d fy, oKkfud fof/k;k dk idt r;kj fd;k x;k gA tfod QLyk dh mRiknrk dk ikjEifjd QLyk dh mRiknrk d cjkcj ;k mll vf/kd Lrj ij ykus d fy, tfod df"k fof/k;k e OkKkfud rkj&rjhdk dk vkyk QLyk ,o {k=k e ikRlkfgr fd, tku dh vko';drk gA

15- n'k d vyx&vyx jkT;k e fofHkUu QLy i.kkfy;k d fy, lrfyr ik"kd rRo çc/ku gr ik"kd rRo fo'k"kK vk/kkfjr lLrfr;k miyC/k gA ikjfEHkd ifj.kkek d vk/kkj ij dgk tk ldrk g fd Hkkjr e vukt dh fujrj mPp mRiknrk gr ik"kd rRo fo'k"kK fLQkfj'k dk vk/kkj cu ldrk gA

16- ejB fty dh QLy ,o enk ic/ku ifjfLFkfr;k d vUrxr dkcu&rkiØe] ty&rkiØe d fy, Mh-,l-,l-,-Vh-&xg ,o ,-ih-,l-vkb-,Ek-&xg ekMy dh lonu'khyrk fHkUu& fHkUu ikbZ x;h gA

17- of'od tyok; ekMy iktD'ku }kjk xe@'k"d ifjn'; d vUrXkr fjçtVfVo dlV'ku ikFkot ¼vkj-lh-ih-½ 4-5 ,o vkj-lh-ih- 8-5 e 2040&2069 d nkjku vklr vf/kdre rkiØe e vklr okf"kd of) Øe'k% 3-0 ,o 2-4 fMxh lsfYl;l rd gkus dh laHkkouk gS। —

18- Ok"kk flfpr Tokj dh mit jktLFkku ,o egkjk"V d tyok; cQj tku e Øe'k% 4-8 Vu@g- ,o 7-8 Vu@g- ik;h x;hA blh idkj Hkkjr d fofHkUu tyok; cQj {k=k e lhfer ty d vUrxr Tokj dh mit 1-8 &5-4 Vu@g- ik;h x;hA

19- Ckktj e lrr vudj.k d ikjfEHkd :>ku l irk pyk g fd Hkkjr d vyx&vyx tyok; cQj {k=k e mit {kerk dh lhek ¼fofo/krk½ 4-5&6-0 Vu@g- rFkk lhfer ty dh n'kk e mit lhek 1-0&5-0 Vu@g- ik;h x;hA

20- ,l- d- uxj] tukx<] fgekpy ,o fcpijh d fy, ckt jk &xg QLy i.kkyh gr ikjfEHkd] f}rh;d ,o rrh;d LFkku&fo'k"k tyok;&lgu'khy ik"kd rRo ic/ku rduhd dh igpku dh x;h gA

21- /kku e ijEijkxr yok fof/k$;fj;k d lkekU; i;kx dh ryuk e ,;jkfcd$uhe yfir ;fj;k l ehFku iokg e 54% dh fxjkoV nt dh x;h] tcfd ,;jkfcd$x/kd yfir ;fj;k d vUrxr ;gh fxjkoV 49% ik;h x;hA ijEijkxr yok fof/k$lkekU; ;fj;k mipkj dh ryuk e ,;jkfcd$uhe yfir ;fj;k ,o ,l-vkj-vkb-$uhe yfir ;fj;k d vUrxr ukbVl vkDlkbM e 33 çfr'kr dh fxjkoV nt dh x;hA

22- lkf'peh m-i- dh ifjfLFkfr;k e de 'khryu dh vko';drk okyh lc dh itkfr ^vUuk^ d ikjfEHkd ifj.kke mRlkgo/kd jg gA

INTRODUCTION

The Project Directorate for Farming Systems Research (PDFSR) was given the status of full-fledged institute w.e.f. 27th November, 2014 and renamed as "**Indian Institute of Farming Systems Research**" **(IIFSR)** with four 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.

Milestones of the Journey to ICAR-IIFSR

- **1952-53**: "Simple Fertilizer Trials on Cultivator's fields" scheme was started.
- **1956**: Model Agronomic Experiments were added and "All India Coordinated Agronomic Experiments Scheme" was started as an ICAR Project.
- **1968-69**: Scheme was reshaped and sanctioned as "All India Coordinated Agronomic Research Project (AICARP)" with two components *viz*.; 'Model Agronomic Experiments' and 'Simple Fertilizer Trials'.
- **1989**: AICARP was upgraded into the "Project Directorate for Cropping Systems Research (PDCSR)" with "All India Coordinated Research Project on Cropping Systems" at Modipuram (Meerut).
- **2004-05**: New plan scheme of "Network Project on Organic Farming (NPOF)" with 13 co-operating centers was added to the PDCSR.
- **2010**: PDCSR and AICRP-CS scheme were renamed as "Project Directorate for Farming Systems Research" and "AICRP on Integrated Farming Systems", respectively.
- **2014**: PDFSR was upgraded to a full-fledged institute and renamed as "Indian Institute of Farming Systems Research" AICRP on IFS and NPOF as integral part of institute.

Brief History

The genesis of the Cropping Systems Research Project may be traced back to the visit of Dr. A.B. Stewart of Macaulay Institute of Soil Research, Aberdeen, U.K., somewhere in mid- nineteen forties. He was invited by the then 'Imperial Council of Agricultural Research' to review the status in respect of soil fertility investigations, in general, and manuring in particular, and to suggest necessary steps which might be taken to obtain adequate information under different conditions of soil and climate within a very short time so that the agricultural departments could provide relevant instructions to the farmers for increasing the crop yields. His review report, published in 1947, significantly influenced the philosophy and practice of fertilizer experimentation in the county. The importance of conducting simple fertilizer trials on cultivators fields and complex experiments at selected centers was emphasized in the report which promoted the initiation of "Simple Fertilizer Trials on Cultivators Fields" in 1953 under Indo-American Technology Cooperation Agreement through Soil Fertility and Fertilizer Use Project:" with the following objectives:

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

- To demonstrate the role of fertilizer use on crop production before the farmers.

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

Nevertheless, even after green revolution, agricultural research centered on only individual crops in isolation. But for a sustainable development the system approach is a must. This realization might have given an impetus to start cropping systems oriented research and the project was upgraded into a Directorate during 7th five year plan and was established as the '**Project Directorate for Cropping Systems Research (PDCSR**)', which became functional in March,1989 with its headquarters at Modipuram, Meerut, U.P. Further, during 11th five year plan PDCSR has been re-designated as '**Project Directorate for Farming Systems Research (PDFSR**)' during 2009-2010. During 2014 (12th five year plan) PDFSR was upgraded to a full-fledged institute and renamed as "**Indian Institute of Farming Systems Research**" besides AICRP on IFS (In addition to existing 31 centers, ICAR-IASRI was added as new voluntary centre) and NPOF (in addition to existing 13 co-operating centers, 7 new cooperating centers were added) 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
- 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
- Farming/ cropping systems analysis.
- Efficient sources of fertilizers for different crops and soil types
- INM in different farming/cropping systems
- Effect of long term INM and chemical fertilizer use on crop yields and soil fertility
- Options for introducing legumes in cereal-cereal cropping systems
- Resource conservation technologies
- Farm mechanization and crop residue management.
- Climate resilient agriculture
- Organic farming
- Precision farming
- On-farm evaluation and refinement of cropping systems technologies
- Cropping/ farming systems related database management
- Human Resource Development related to Cropping/ Farming Systems Research

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

1. ICAR-IIFSR - Up gradation of PDFSR headquarters at Modipuram to ICAR-IIFSR a full-fledged institute with 4 divisions (Integrated Farming Systems Management, Cropping Systems & Resource Management, Organic Agriculture Systems and Transfer of Technology, Refinement & Human Resource Development).

2. AICRP on Integrated Farming Systems (IFS):

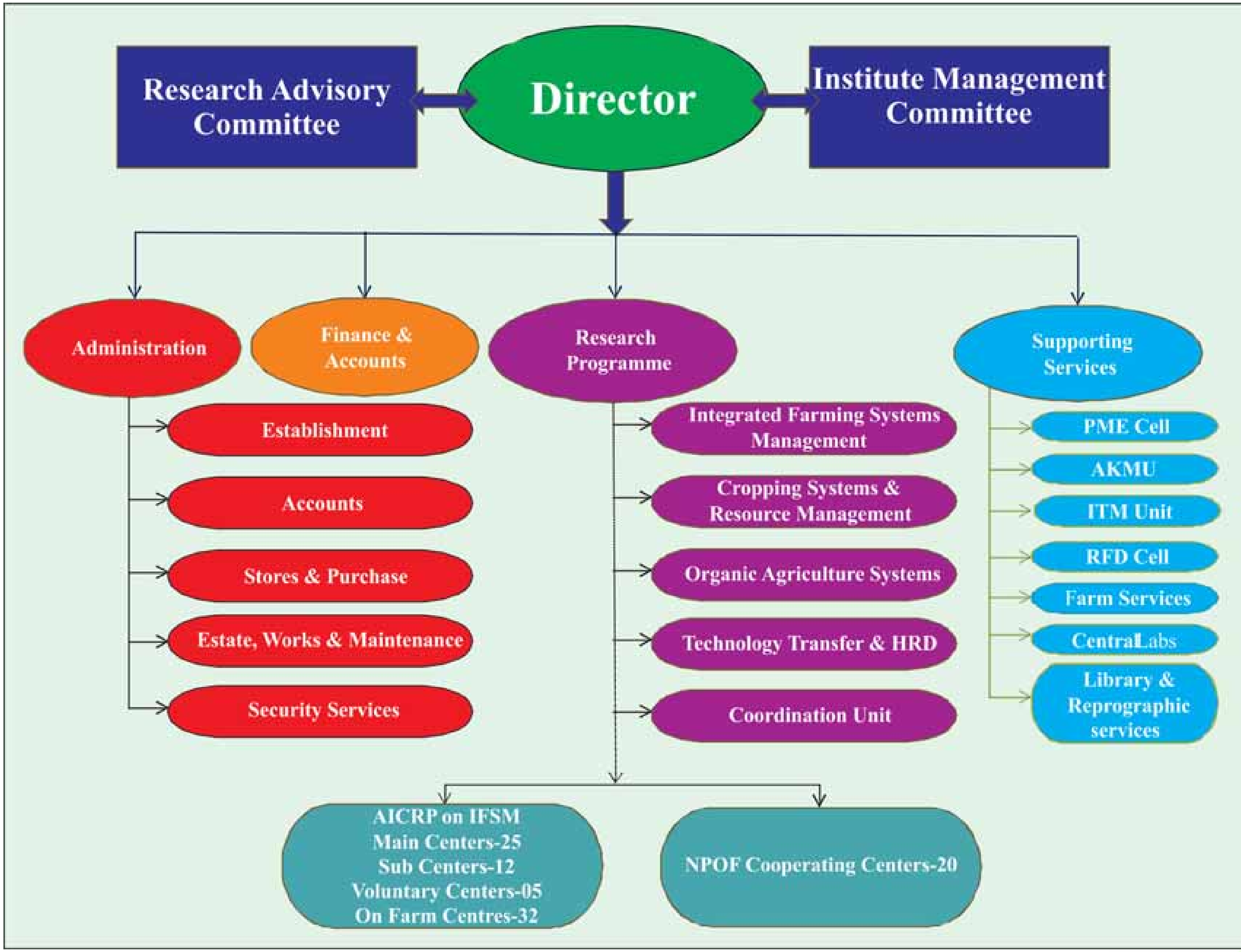
(a) IFS Research Centers: The AICRP-IFS will be headed by a 'Project Coordinator' under administrative control of the Director IIFSR. On-station research was initiated at 31 main centers and 11 sub centers. These centers are engaged in basic and applied research at research stations and are necessarily located at SAUs or their Regional Research Stations or agriculture colleges of those general universities, where strong agricultural research base is available. During XII plan, all existing centers of the scheme will continue. IASRI, New Delhi has been approved as a new voluntary center of AICRP-IFS.

(b) On-Farm Research: On-farm research is going on at 32 centers. These centers are engaged in farmers' participatory research. On-farm research (earlier known as Experiments on Cultivators' Fields) centers are located in different agro climatic zones and cover the entire zone.

3. Network Project on Organic Farming (NPOF) - The project is presently under progress at 13 cooperating centers, located at SAUs/ ICAR Institutes in 12 states. At IIFSR, NPOF is coordinated by a Principal Scientist (as National PI), under administrative control of the Director, ICAR- IIFSR. In addition to existing 13 cooperating centers of NPOF, following seven new cooperating centers have also been approved and included in to the network project.

1) ICAR-RC NEH Regional Centre, Gangtok (Sikkim)
2) MPUAT, Udaipur (Rajasthan)
3) VPKAS, Almora (Uttrakhand)
4) NRC Seed Spices, Ajmer (Rajasthan)
5) SDAU, S.K. Nagar (Gujarat)
6) CTCRI, Thiruvanthapuram (Kerala)
7) RMVU, Narendrapur (West Bengal)

ICAR-IIFSR ORGANOGRAM



LOCATION

The Institute and its research farms are located in the Modipuram suburb of Meerut City, situated on Delhi-Haridwar National Highway no. 58, near Sardar Vallabbhai Patel University of Agriculture and Technology. The distance from Meerut city (Begum Bridge) is about 10 km. Modipuram is situated at an elevation of 230 meters above mean sea level, 29° 4' N latitude and 77° 46' E longitude.

SOIL AND CLIMATE

As per Planning Commission of India this region where ICAR- IIFSR falls is classified as 'Western Plains Sub-Zone' of 'Upper Gangetic Plains'. However, as per National Bureau of Soil Survey and Land Use Planning, Nagpur, the area falls under Agroecological Region number 4, i.e., 'Northern Plain and Central Highland's Hot Semi-Arid Eco-region' with Alluvium derived soils. Soils of IIFSR research farm are representative of the region and are neutral to slightly alkaline in nature and belong to Typic Ustochrept group. The climate of Modipuram is broadly classified as semi-arid sub-tropical characterized by very hot summers and cold winters. The southwest monsoon set in by 21st June in the year 2015, one week earlier than the normal onset. The total annual precipitation received was 710.1 mm. It was slightly less than the normal by 7.5 per cent. The distribution of rainfall over time and intensity in the rainy season was erratic. The monsoon rainfall (June-

Table 1. Monthly meteorological data of Modipuram, Meerut during 2015

Month	Temperature (^{O}C)				Avg. RH (%)	Avg. Sunshine hours (hrs/day)	Total rainfall (mm)		Rainy days	Total Pan evaporation (mm)
	Max.	Normal	Min.	Normal			Observed	Normal		
January	16.2	19.6	7.2	6.4	87	2.8	33.2	16.3	4	36.0
February	24.4	23.9	10.1	9.3	75	5.6	27.6	21.7	1	63.7
March	26.9	29.1	13.4	13.3	78	7.2	99.8	15.2	4	107.6
April	33.4	36.0	19.3	18.8	67	8.4	47.4	17.3	2	190.0
May	39.2	39.1	23.7	23.4	60	9.3	56.8	15.9	3	286.2
June	36.6	38.3	24.5	25.4	73	8.0	82.6	74.8	6	245.1
July	33.4	34.8	25.4	25.8	84	6.4	246.3	196.5	8	172.5
August	33.0	33.7	25.5	25.4	86	5.2	83.3	232.8	8	132.0
September	34.2	34.0	23.7	23.3	77	7.1	26.9	138.2	3	161.0
October	33.2	32.8	18.5	17.5	72	7.6	1.0	25.6	0	139.3
November	27.7	28.1	13.0	11.4	73	5.5	5.2	2.3	1	59.8
December	22.0	22.4	7.1	7.2	74	4.5	0.0	11.3	0	50.8
Annual Avg	30.0	31.0	17.6	17.3	76	6.5	710.1	767.9	40	1644.0

September) was low with 31.6 % and its distribution was also erratic. There was 80.5 and 64.2 % deficit during September and August, respectively. The mean maximum temperature varied from 16.2 °C in January to 39.2.°C in May while the mean minimum temperature varied between 7.1 °C in December to 25.5 °C in August. The average relative humidity and sunshine hrs were 76.0% and 6.5 hrs,/day, respectively. There were 40 rainy days with rainfall more than 2.5 mm. The highest maximum temperature recorded was 43.7 °C on 9th June and the lowest minimum was 1.5 °C on 29th January. The total summary of the monthly meteorological data for the year 2015 is presented in **Table 1.**

The weekly PET reached 50 mm during the 16th week and came down from 25th week onwards (Fig 1 & 2). Highest maximum temperature of 42.6 °C was recorded during the 21st SMW and lowest minimum temperature of 5.5 °C was recorded during the 5th SMW (Fig. 1).

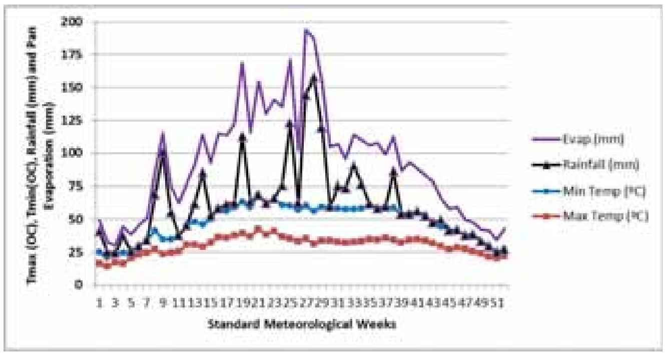


Fig. 1. Weekly meteorological parameters (Evaporation, Rainfall, Min. and Max. temperature) recorded at Agromet Observatory, Modipuram during the year 2015

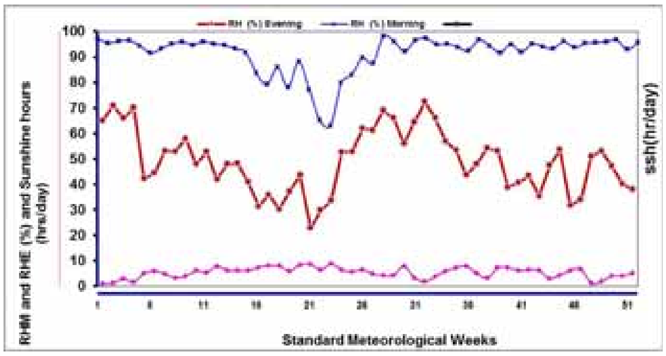


Fig. 2. Weekly meteorological parameters (RHM, RHE and sunshine hours) recorded at Agromet Observatory, Modipuram during the year 2015

RESEARCH ACCOMPLISHMENTS

Integrated Farming Systems Management

Development of cost effective and sustainable Integrated Farming System Models for livelihood improvement of small farm holders

The Farming System model comprised of 4-5 diversified cropping (1.04ha), fruit production (0.12 ha), milch animal unit with 2 murrah buffaloes and 1 H.F. cow, fish pond having a mix of fish culture (0.10 ha), apiary unit with 10 bee boxes, mushroom unit (0.0032 ha), biogas unit (1.5 Cu.m), vermicompost unit (0.01ha), boundary plantation all around the farm boundaries and kitchen gardening in backyard of the house. The data

Table 2. Production and economics of different farm components integrated in to IFS Model (2015-16)

Component/Produce	Area/Numbers	Production	GR(Rs.)	NR (Rs.)
Cropping System (Cereals, pulses, oilseeds, vegetables, sugarcane and green fodders)	0.84 ha	66.50 ton (SEY)	1,91,537	1,59,357
Dairy animals	2 Buffalo + 1 Cow	-	2,36,000	98,650
Milk	2350 liter			
Vermicompost	1 2.0 ton			
FYM	6.0 tons			
Animal sold	5 Nos.			
Horticulture				
Fruits	0.22 ha	3328 kg	55,5,80	33,150
Fishery				
Fish	0.10 ha	347 kg	34,7002,274	19,5002274
Recycled NPK (Through pond water & silt)		(95.4 kg N,2.3 kg P, 29.6 kg K)		
Mushroom (Button, Dhingari, Milky)	12 four tier Racks	1436 kg mushroom + By products (Fodder & Compost)	1,12,16019,200	87,26019,200
Boundary plantations	200 running meter	-	45,680	34,180
Citrus (Nimboo)	1240 kg			
Bel	102 pieces			
Aonla	14 kg			
Karonda	510 kg			
Green fodder	1580 kg			
Fuel	900 kg			
Biogas Unit (Recycled NPK)	5.9 ton slurry	21.3 kg N,12.9 kg P, 9.9 kg K	1166	1166
Total			Rs.698297	Rs.454737(MI) Rs.2,41,037(AI)

Total produce value = Rs.6,98,297; **Cost of production =** Rs.4,57,260 (Market Inputs: Rs.2,43,560 + Family Inputs: Rs.2,13,700) Family Inputs (Recycled Inputs: Rs.1,25,900 + 448 Farm labour: Rs.87,800)
Net returns = Market Inputs only = Rs.6,98,297 – Rs.2,43,560 = Rs.4,54,737; Based on total inputs = Rs. 6,98,297 – Rs.4,57,260 =2,41,037

related to production, productivity and profits of various components presented in Table 2 revealed that gross and net return increased by 293 % and 188 %, respectively over initial year (2005-06) of establishment of the IFS Model (Fig. 3). After deducting cost and family consumption, a net saving of Rs.72, 110/year could be achieved mainly because of economising cost of production through scientific management and recycling of farm wastes, crop residues and cow dung and use of green manure/ leguminous crops etc. Use of chemical fertilizers was minimised by adding plant nutrients 683.8 kg NPK (395.1kg N + 83.0 kg P + 205.7 kg K) valuing Rs.34,207/year through on farm recycling thus making farming more profitable and sustainable. Employment was increased to the tune of 684 man days/year almost double of prevailing farming system.

Fig. 3. Economic viability of diversified farming system during last 10 years - IFS Model at IIFSR

Assessment of climate change impact on integrated farming systems through modeling

This project was started in 2013 for duration of 3 years with the objectives to identify the climate resilient components of IFS under projected climate change scenarios through modeling approach and to develop DSS for identifying the best IFS options for small and marginal farmers of western UP (Fig. 4). During the third year of the project the recording of crop phenology, crop growth, yield and yield attributes for two *kharif* and *rabi* seasons for calibration of the model were completed.

LINGO14.0 was used for optimization of farming system enterprises. The initial results indicated that linking

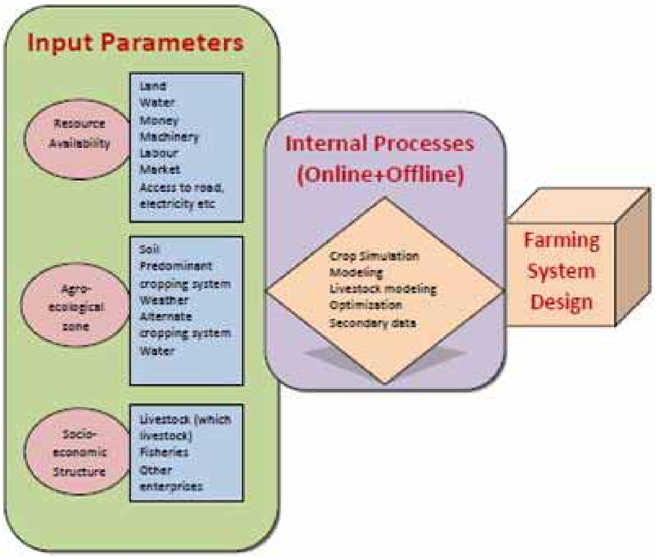


Fig. 4. Methodological framework of FSDST (Farming System Design Support Tool)

of modeling with optimization tool provide an integrated approach to pinpoint the environmentally location specific enterprises of farming system based farmer centric resources. More research and fine tuning of methodology is needed for developing an integrated FSDST (Farming System Decision Support Tool). The preliminary results indicated that the existing combination of farming enterprises meet the nutritional requirement of family, however, traditional cropping system along with fodder and maize+ pigeon pea – wheat and 2 livestock and horticulture unit provided maximum economic benefit as per the agro-ecological scenario of the region.

Development of year round production module of mushrooms for small and marginal farmers

Performance of *Pleurotus florida* was evaluated in the month of January-February 2015 on two most commonly available substrates *i.e.* wheat and mustard straw. Observations were taken on spawn run (days), days taken for fruit body initiation, yield of fruiting bodies/ kg dry straw and biological efficiency (%). Mustard straw showed higher fruit body yield (727g/kg dry straw) and biological efficiency (72.79%) as compared to wheat straw. The days taken for spawn run completion and

Oyster mushroom (*Pleurotus florida*)

Table 3. Yield performance of *Pleurotus florida* on different substrates in 2015

Wheat straw				Mustard straw			
Days taken for spawn run	Days taken for fruitbody initiation	Yield (kg/kg dry straw)	Biological efficiency	Days taken for spawn run	Days taken for fruitbody initiation	Yield (kg/kg dry straw)	Biological efficiency
31	38	0.66	66%	28	35	0.73	72.79%

fruit body initiation were only 28 and 35 days as compared to 31 and 38 days in case of wheat straw (Table 3).

Productivity and economic evaluation of horticulture based farming systems

Three modules, *viz.* fruit based (0.3 ha), vegetable crops based (0.22 ha) and field crop based (0.4 ha) were evaluated for improving profitability, enhancing productivity and nutritional security of small and marginal farmers particularly of western plain zone of Uttar Pradesh.

Harvesting cruciferous vegetables from the system

Under fruit crop based model, 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 model turmeric, bottlegourd-cauliflower-tomato and brinjal-potato were grown while under crop based system, rice-wheat and sugarcane-ratoon were evaluated. It was raveled that field crop based models recorded the highest net returns worth Rs. 263912 ha^{-1} followed by fruit based with net returns of Rs. 224928 ha^{-1} (Fig. 5). Among the vegetables based model, the maximum net returns of Rs. 2,02657 ha^{-1} was recorded for cucumber- radish-carrot-onion system

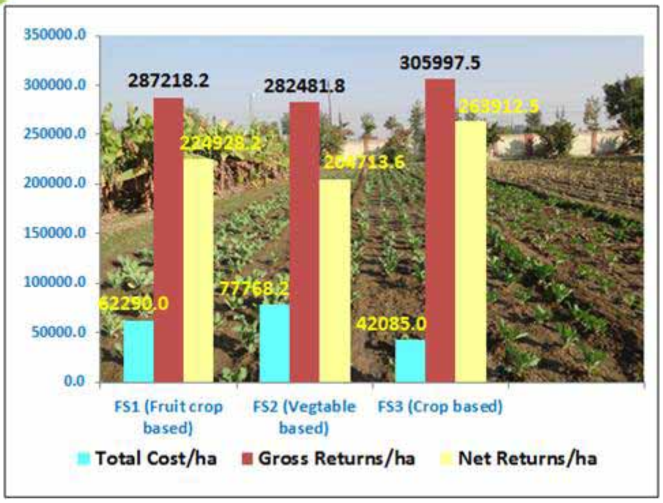


Fig. 5. Economics of different cropping systems under study

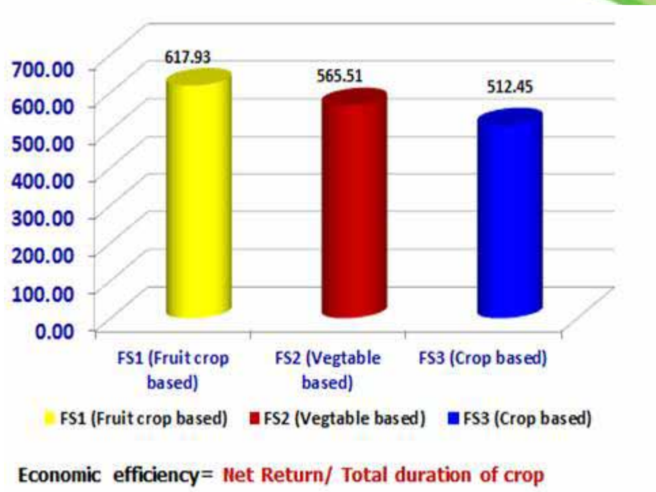


Fig. 6. Economic efficiency of different cropping systems under study

followed by turmeric alone (Rs. 1,47780 ha^{-1}) and brinjal-potato-beans system (Rs. 68035 ha^{-1}) . Amongst the vegetable model highest net return was recorded for radish (Rs. 107781 ha^{-1}) followed by turmeric (Rs. 87014 ha^{-1}), carrot (Rs. 53375 ha^{-1}) and okra (Rs. 42557 ha^{-1}). The highest economic efficiency (Fig. 6) of Rs. 617.93 ha^{-1}day^{-1} was recorded for fruit based model followed by vegetable based (Rs. 565.51 ha^{-1}day^{-1}). Economic efficiency was more for fruit based model than field crop based but the production efficiency was more for crop based than the fruit based and vegetable based, respectively. The methodology for on-farm storage of vegetables (okra) and fruits (mango) in low cost zero energy cool chambers has been standardized for prolonged shelf life and higher quality of produce. A low cost net house has been established at the project site (Siwaya Farm) for raising of vegetable seedlings using soilless media.

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

To optimize the process for production of banana chips using response surface methodology, experiments were conducted on green bananas to develop banana chips with main objectives to extend the shelf life, utilize surplus produce and develop new value added products for creating new entrepreneurship. The process parameters for final banana chip qualities were optimized by numerical and graphical method (Fig. 7a). The numerical optimization methods generated the optimum product qualities in terms of crispness (0.44 kg), texture score (8.2), colour score (7.9), taste score (8.2) and overall acceptability (8.1) were obtained for 4.5 min. blanching time and slice thickness of 4.2 mm with 0.99

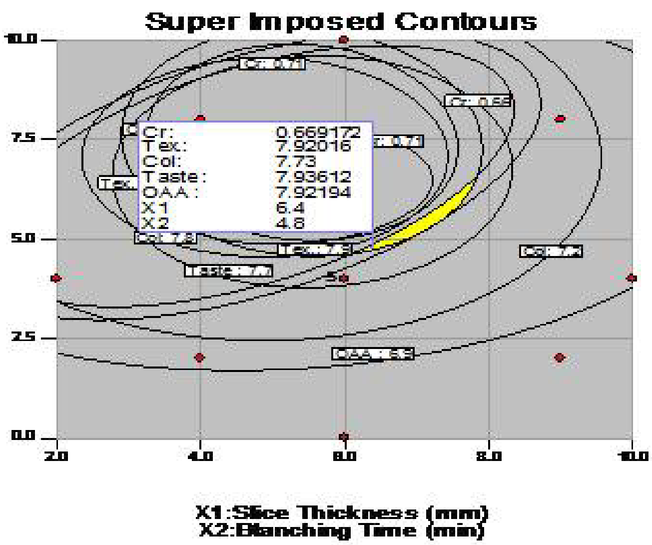


Fig. 7(a). Regions of best combinations of super imposed contours for production of optimized banana chips desirability (Fig. 7b). The study thus suggested that best quality banana chips may be obtained if green bananas were sliced into 4-5 mm thickness and blanched in boiling water for 5-6 minutes followed by drying under sun (1 hour) and frying in edible oil.

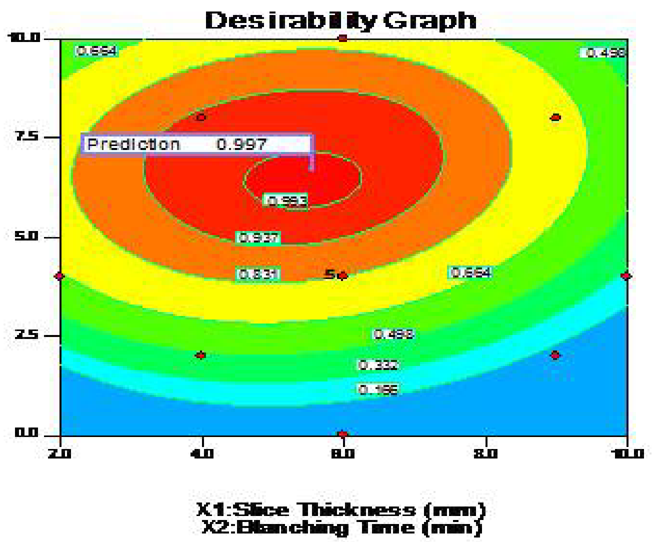


Fig. 7(b). Desirability graph for the effect of slice thickness (mm) and blanching time (min) for the production of banana chips

Round the year forage production in IFS model for marginal farm holders in Western Plain Zone of Uttar Pradesh

The results of the experiment revealed that system productivity in terms of maize equivalent yield (MEY) was higher in stylo-carrot-cowpea crop module (27.39 t ha^{-1}) followed by Clitoria-oat-bajra crop module (25.60 t ha^{-1}), maize-pea-sorghum (24.55 t ha^{-1}) and Dolichos-wheat-Teosinte (19.64 t ha^{-1}) as showed in Fig. 8, whereas, lowest maize equivalent yield was recorded in *Cenchrus* (9.28 t ha^{-1}). Biological yields under various crop modules showed a great variability due to crop combination and yield potential. However, maximum biological yield was recorded (45.84 t ha^{-1}) under stylo-carrot-cowpea crops module (Table 1) and followed by maize-pea-sorghum crops module (32.75 t ha^{-1}). Phosphorus, zinc and iron content was higher in *Clitoria ternatea* and minimum in wheat straw. Maize based crop module gave higher gross returns (Rs.3,58,000 ha^{-1}year^{-1}), net returns (Rs.2,53,450 ha^{-1}year^{-1}) and benefit: cost ratio (2.42) compared to other crop modules.

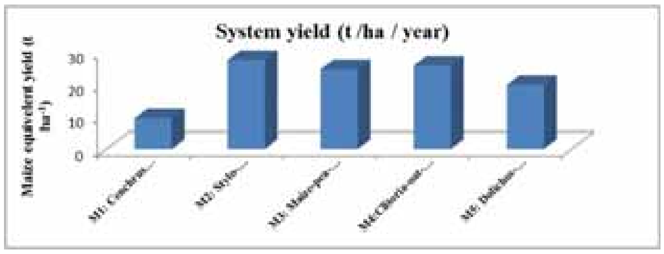


Fig. 8. System productivity of different crop modules

Comparative Study of Role of Women in Predominant Farming Systems of western plain zone of U.P. and hill zone of Uttarakhand

A survey of existing farming system and role of women in agriculture was conducted in two districts of western plain zone (WPZ) of Uttar Pradesh i.e. Meerut and Saharanpur in the year 2014-2015. Around 60 per cent of households were having Crop+ dairy (1C+1-2B) farming system covering 41 per cent of total farming area. (Fig. 9). Around 89 per cent farmers were involved in farming as a major occupation and remaining 11 % were found engaged in farming along with farm labour as major occupation. The farming operations are mainly performed by male (95%). The average landholding size was 2.75 ha (Table 4).Women are doing manual and repetitive tasks with postural disorders e.g. load carrying, paddy transplanting, harvesting, sowing (dibbling/ furrow sowing) weeding, threshing through manual beating, which leads to musculoskeletal disorders. The variation was not observed in terms of technological use except for smokeless stove and power/diesel operated chaff cutting machine, which was found related to their better socio-economic conditions. Women are mainly engaged in farm operations viz; carrying of fodder (10-15%), cowdung/ FYM (15-25%), threshing & winnowing (10-16%), chaff cutting (26-30%), harvesting of field crops (7-33%). They are minimally practicing the improved agricultural technologies while working as co-worker along with their male counterparts (Table 5).

Table 4. Comparative performance of different fodder based crop modules

Treatment	*Kharif*			*Rabi*			Summer		Economics			
	Green fodder yield (t ha^{-1})	Dry matter yield (t ha^{-1})	Grain yield (t ha^{-1})	Green fodder yield (t ha^{-1})	Dry matter yield (t ha^{-1})	Seed / green pod / carrot yield/ (t ha^{-1})	Green fodder yield (t ha^{-1})	Dry matter yield (t ha^{-1})	Total cost (Rs. ha^{-1} $Year^{-1}$)	Gross returns (Rs. ha^{-1} $Year^{-1}$)	Net returns (Rs. ha^{-1} $Year^{-1}$)	Benefit : cost ratio
Cenchrus alone	48.76	14.78	4.02	21.23	5.77	-	16.47	3.21	36320	111480	75160	2.06
Stylo- Carrot-Cowpea	14.70	4.41	-	22.82	7.32	28.60	27.13	5.50	98700	319130	220430	2.33
Maize- Pea-Sorghum	-	8.36	7.14	6.74	2.04	3.58	53.66	11.63	104550	358000	253450	2.42
Clitoria-Oat-Bajra	44.05	13.35	-	22.53	6.78	2.53	44.57	9.70	97200	307315	210115	2.16
Dolichos- Wheat-Teosinte	47.33	14.20	-	-	5.52	4.17	30.37	6.37	98650	292880	194230	1.96

Table 5. Socio-economic profile of farm households of WPZ of Uttar Pradesh

Variables	Crop + Dairy (1C+1-2 B)	Crop + Hort. (Mango)+ Dairy (2C+1-2B)	Crop + Hort. (Veget.) + Dairy (1C +1B)	Hort. + Crop + Dairy (1C+1B)	Mean (Sd)
Household headship (%)					
Male	94.5	100	85	100	94.87 (7.07)
Female	4.5	0	15	0	4.87 (7.07)
Occupation (% of households)					
Farming	87	100	95	75	89.25 (10.9)
Farming + Farm labour	13	0	5	25	10.75 (10.9)
Farm size (ha farm household^{-1})					
Male	1.48	6.85	1.61	1.07	2.75 (2.74)
Female	0.061	0.48	0.24	0	0.19 (0.21)

Fig. 9. Area share of pre-dominant farming systems

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

The experiment was initiated in 2014 with planting of Guava (*Psidium guajava*), Ber (*Ziziphus mauritiana)* and Pomegranate (*Punica granatum*), Sweet orange/ Mosambi (*Citrus sinensis*), Nagpur mandarin (*Citrus reticulata*) and Kinnow (Mandarin X Orange). Growth observations (height and spread) were recorded and are given in Table 6. All the three varieties of ber (Gola, Seb and Umran) came in bloom after one year of planting, during August–September 2015. The flowering behaviour of Ber and Guava show precociousness of crop and varieties over Kinnow, Mosambi and Pomegranate. After one year of field establishment, guava Cv. Shweta showed better in terms of yield and quality (TSS 13.5 ^{0} brix, Beta carotene - 0.0908 mg/100 gm fresh weight).. Fruit setting behavior and fruit development in all crops and varieties were recorded and given Table 7.

Table 6. Vegetative growth of fruit crops under experiment (2015-16)

Crop	Cultivar	Height (m)	Canopy spread (m)
Ber	Gola	312.86	270.9
	Seb	227.3	174.49
	Umran	216.0	146.56
Guava	Shweta	190.93	108.33
	Allahabad Safeda	190.0	90.3
	Lucknow -49	176.33	97.13
Pomegranate	Arakta	196.23	92.9
	Bhagwa	176.1	89.9
	G-137	153.16	80.29
Citrus	Kinnow	128.33	97.3
	Mosambi	180.33	82.0
	Mandarin	145.96	84.7

Table 7. Bearing behaviour of fruit crops under experiment (2015-16)

Crop	Cultivar	Flowering (%)	Fruit set (%)	Fruits reaching maturity / branch
Ber	Gola	100	23.50	31
	Seb	100	19.00	28
	Umran	100	20.44	25
Guava	Shweta	65	64.00	7.3
	Allahabad Safeda	45	55.00	2.44
	Lucknow -49	45	60.22	1.45
Pomegranate	Arakta	25	4.33	0.5
	Bhagwa	30	6.13	0.5
	G-137	15	1.54	—
Citrus	Kinnow	—	—	—
	Mosambi	—	—	—
	Mandarin	—	—	—

Characterization and mapping of farming systems in India

A detailed survey on farming systems characterization of 302 farm households during 2014-15 in Sirsa district (Haryana) representing Trans Gangetic Plain Region showed that the average holding size on sample farms was 2.89 ha, and the average age of respondents was about 45 years with very low formal schooling (5 years). The survey highlighted the dominance of crops + dairy farming system (92%) in the district, and very few farm households (7%) were dependent on crops only as their sole farm enterprise (Table 8). Cotton-wheat and paddy-wheat are the two most important cropping systems covering more than 2/3rd of the gross sown area. Sorghum and berseem (about 4% area) are grown to meet fodder requirement of livestock. High incidence of insects pests and diseases, lack of remunerative and assured prices, and poor quality of fertilizers and pesticides were reported as the major constraints in the existing farming systems.

The characterization study of 300 farms in Sikar district (Western Dry Region) of Rajasthan revealed that average age of respondents was 47 years with low level of formal schooling (8 years). The average farm family of seven persons derived their livelihood from an average holding size of 2.17 ha. While crops+ dairy was the dominant farming system on the majority of the farms (75%), about 21 percent households followed crops+ dairy + vegetables farming system (Table 9). The average livestock holding was about two cows and two buffaloes. Pearlmillet-wheat and clusterbean-wheat were the dominant crops in addition to small area sown to pulses, oilseeds and minor millets. Non-availability of quality seed/ planting material, poor quality of fertilizers and

Table 8. Pre-dominant farming systems in Sirsa (Haryana), 2014-15

Category	Marginal	Small	Medium	Large	Total
Crops	12 (14.1)	5 (5.8)	3 (4.5)	2 (3.1)	22 (7.3)
Crops+ Dairy	73 (85.9)	80 (93.0)	63 (93.4)	61 (93.8)	272 (91.7)
Crops+ Dairy + Vegetables	0 (0)	1 (1.2)	0 (0)	2 (3.1)	3 (1.0)
Sample Size, n (%)	85 (100)	86 (100)	66 (100)	65 (100)	302 (100)

(*Figures in parentheses indicate percentage of total in the respective category.*

Table 9. Pre-dominant farming systems in Sikar (Rajasthan), 2014-15

Category	Marginal	Small	Medium	Large	Total
Crops	5 (10.64)	1 (0.92)	2 (2.11)	1 (2.04)	9 (3)
Crops+ Dairy	30 (63.83)	90 (82.57)	72 (75.79)	35 (71.43)	227 (75.66)
Crops+ Dairy + Vegetables	12 (25.53)	18 (16.51)	21 (22.11)	13 (26.53)	64 (21.33)
Sample Size, n (%)	47 (100)	109 (100)	95 (100)	49 (100)	300 (100)

(Figures in parentheses indicate percentage of total in the respective category)

pesticides (adulteration problems), high incidence of insects-pests and diseases and infertility problems in cattle and buffalo were reported by the sample households as the major constraints in the existing farming system.

Comparative studies of fish and crop based farming systems

Comparative analysis of the information was carried out for different zones to explore the possibility of an alternative fish based farming system model and to synthesize the most efficient combination of fish-crop based systems. Based on the on-station results and characterization studies, synthesis of IFS models were carried out for 18 AICRP-IFS centers having fishery as a component of IFS model viz. Bhubaneswar, Chhata, Jorhat, Kalyani, Ludhiana, Patna, Raipur, Ranchi, Sabour, Faizabad, Varanasi, Jabalpur, Karmana, Kathalger, Sirriguppa, Thanjavur, Umiam and Goa).

Land allocation for fishery component in IFS models across different zones varied between 5 to 26 % of total area lowest being in Umiam to highest being in Odisha (26%) followed by Kalyani (14 %) and Patna (13%) (Table 10). B:C ratio reported for the fisheries component (Table 11) were positive (1.06 to 9.33) for different centres, Highest B: C ratio (9.33) of Port Blair was due

Table 10. IFS model area allocation ratio (fishery to total area)

Center	System GR (Rs.)	System NR (Rs.)	Fisheries GR (Rs.)	Fisheries NR (Rs.)	Fisheries Cost (Rs.)	Productivity (t/ha.)	Fishery GR (%)	Fishery NR (%)	B:C ratio
Bhubaneswar	1.25	0.33	0.264	26.37	8020.00	0.30	6.2	9.4	1.77
Jorhat	1.00	0.1	0.10	10.00	22947.00	3.40	13	10	1.47
Kalyani	0.66	0.09	0.136	13.64	19079.00	1.66	9.8	3	1.15
Patna	0.80	0.10	0.125	12.50	9194.67	3.11	6.1	8.7	3.33
Sabour	1.00	0.08	0.080	8.00	6243.67	2.19	5.6	9.4	3.92
Ranchi	1.00	0.10	0.100	10.00	5053.50	1.58	8.4	8.8	3.67
Chhata	1.50	0.10	0.067	6.67	5956.67	2.20	6.6	11	3.94
Ludhiana	1.00	0.10	0.100	10.00	2875.00	1.39	2.7	4	3.06
Raipur	1.06	0.07	0.066	6.60	3048.33	—	5.2	6.1	2.20
Port Blair	1.00	0.10	0.100	10.00	750.00	—	4.4	6.8	9.33
Varanasi	1.00	0.10	0.100	10.00	18605.33	2.26	4.2	4.3	1.68
Umiam	1.00	0.05	0.050	5.00	3853.00	2.03	4	5.1	2.52

Table 11. Economic analysis of fish based systems and their contribution to system gross and net return

Center	Total area (ha)	Area of fishery component (ha)	Land allocation per ha	% area
Bhubaneswar	1.25	0.33	0.264	26.37
Jorhat	1.00	0.1	0.10	10.00
Kalyani	0.66	0.09	0.136	13.64
Patna	0.80	0.10	0.125	12.50
Sabour	1.00	0.08	0.080	8.00
Ranchi	1.00	0.10	0.100	10.00
Chhata	1.50	0.10	0.067	6.67
Ludhiana	1.00	0.10	0.100	10.00
Raipur	1.06	0.07	0.066	6.60
Port Blair	1.00	0.10	0.100	10.00
Varanasi	1.00	0.10	0.100	10.00
Umiam	1.00	0.05	0.050	5.00

to BBF system and culture of high value fish like magur and singhi in the furrows along with crops and vegetables. Inclusion of fishery component in the IFS model generated employment opportunities (>33 days) besides providing quality protein for nutritional security of household. Synthesis of alternative farming system models for 29 regions covering13 NARP zones was also carried out from the results obtained from on-station studies of AICRP-IFS centres and benchmark studies obtained from characterization surveys and published in the form of a institute technical bulletin.

Development of a web based integrated information system for Indian farming systems research- an exploratory study

Web based integrated information system (Fig. 10 and 11) was developed using three-tier architecture depicted as below; In this three tier architecture, softwares *viz.*, PHP MYSQL, APACHE, HTML, IIS web server were used for development, testing and hosting Information System.

a) *PHP*: *Hypertext Preprocessor,* an open source, server-side, HTML embedded scripting language used to create dynamic Web pages. While PHP originally stood for *Personal Home Page* it now stands for *PHP: Hypertext Preprocessor*, a recursive acronym.

b) The Apache HTTP Server, is also an open source software commonly referred to as Apache is a web server application notable for playing a key role in the initial growth of the World Wide Web.

c) MySQL (also called “My Sequel”) is the world’s most widely used open-source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases, though SQLite probably has more total embedded deployments.

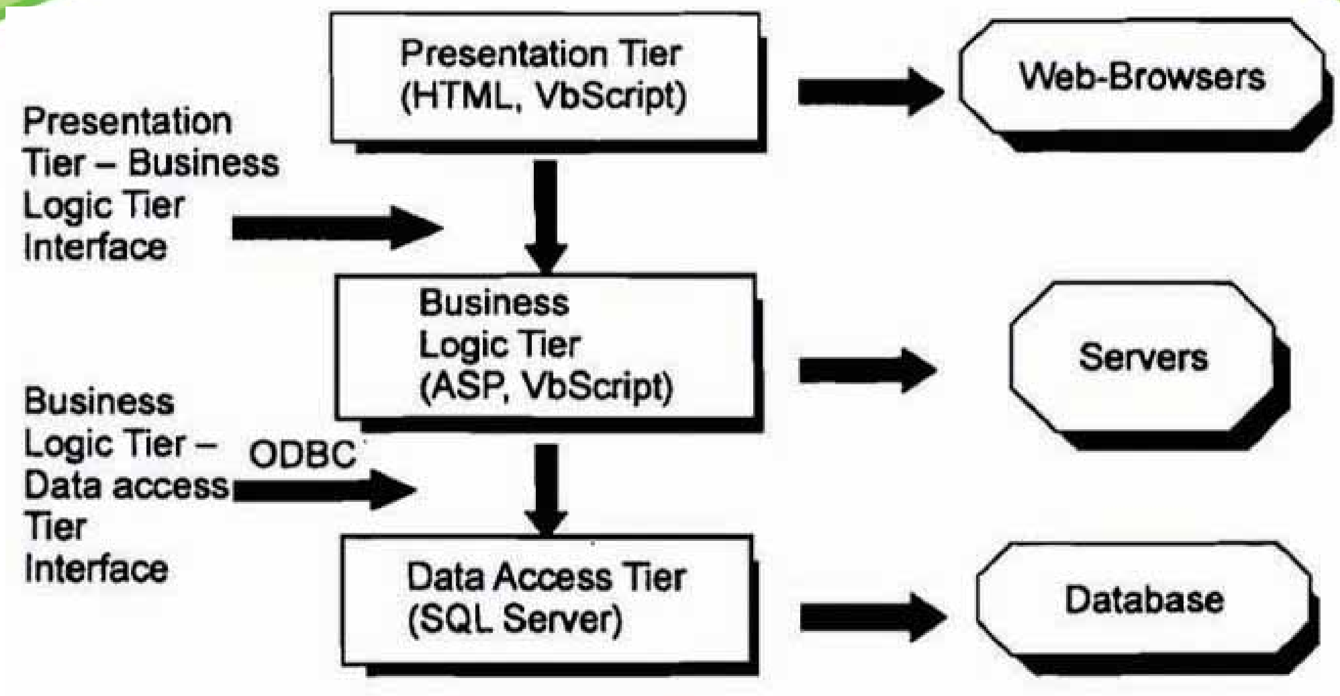


Fig. 10. Web based information system

Fig. 11. Screen view of the web based information system

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

Ten complementary systems were evaluated for higher productivity and profitability (Fig. 12 and 13). The cropping systems evaluated were, T_0: rice-wheat, T_1: hybrid rice-lentil (B)+wheat (F)-cowpea (V+R), T_2: maize (C)+veg. cowpea (BB)+sesbania (F)-lentil (BB)+mustard (F)-green gram (G+R), T_3: maize (G)+black gram (1:1)-mustard (F)+veg. pea (B)-green gram (G+R), T_4:maize (C)+sesbania- toria+ g. sarson (TPT)-green gram (ZT) (G+R), T_5:pigeon pea +black gram (1:1)-wheat+ mustard (6:1) (ZT)-cowpea (f) (ZT), T_6: pigeon pea (1:1)-wheat+ methi (6:1) (ZT)-cowpea (f) (ZT), T_7: sorghum+ cluster bean (f)-maize(C)+black gram (1:1)-methi-cowpea (V+R), T_8: maize+ cowpea (f)-maize (G)+black gram-wheat+ methi (6:1)-green gram (G+R), T_9: sorghum (G)+cowpea (V)-oat (f)-pearl millet (f)+cluster bean (V). Raising of maize for cobs +vegetable cowpea in 1:1 ratio on broad beds (BB) and sesbania in furrow during *kharif* and mustard in furrow and 3 rows of lentil on broad beds in *rabi* while 3 rows of green gram on beds in summer produced highest REY of 26.97 t ha^{-1} with productivity of 73.88 kg $ha^{-1}day^{-1}$ and profitability of Rs. 773 ha^{-1} day^{-1} and was remarkably better than other systems. The complementary effects were reflected in the system as in broad bed and furrows (BBF) system, the furrows served as drainage channels during heavy rains in *kharif* which were utilized for *in-situ* green manuring with 30 t ha^{-1} green foliage incorporated after 35 days of sowing. The timely sown mustard crop in these furrows resulted a good harvest 1.90 t ha^{-1} and a bonus yield of lentil (1.45 t ha^{-1}) could be harvested on one hand and 35% of irrigation water was saved. In the summer season green gram could yield 1.71 t ha^{-1} as grain while incorporation of green gram foliage of about 4.1 t ha^{-1} in the soil further helped the system favourably. Bio-intensive system of raising maize +cowpea (f)-maize (C) +b. gram-wheat+ methi (6:1)- green gram (G+R) was second best which resulted in REY of 24.87 t ha^{-1} with productivity of 68.14 kg grain $ha^{-1}day^{-1}$ and profitability of Rs. 731 ha^{-1} day^{-1}. This system proved to be the second best in the order of merit. The lowest yield (11.19 t/ha) with productivity of 31.65 kg grain ha^{-1} day^{-1} and profitability (Rs. 269 $ha^{-1}day^{-1}$) was obtained under the conventional rice-wheat system.

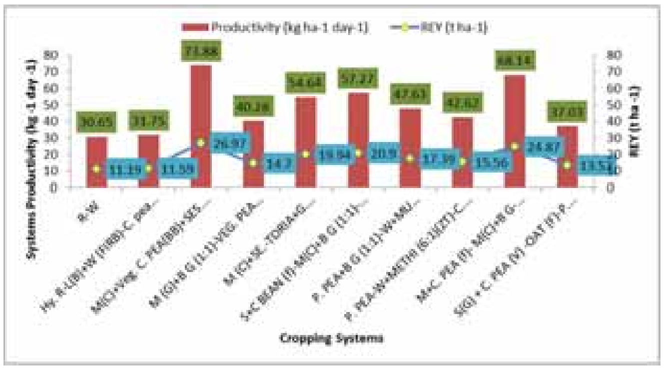


Fig. 12. Effect of bio-intensive complementary cropping systems on rice equivalent yield and productivity

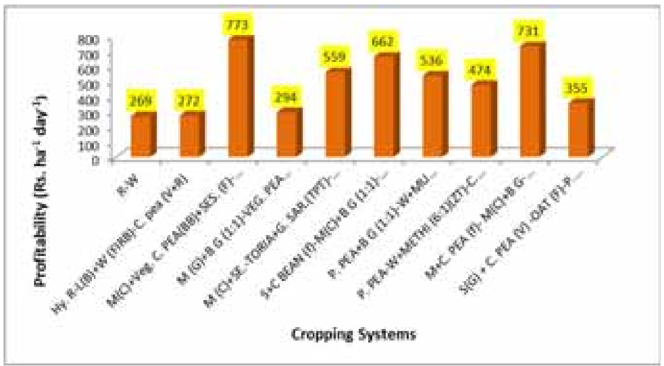


Fig. 13. Effect of bio-intensive complementary cropping systems on profitability

Resource conservation and sustaining high productivity through cropping system management and land configuration

An experiment with twelve treatment combinations of land configuration i.e. Flatbed (FB), furrow irrigated raised bed (FIRB) and broad bed-furrow (BBF) with

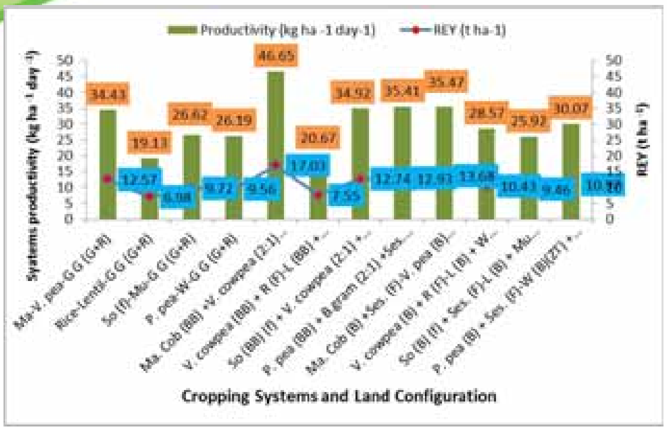


Fig. 14. Effect of cropping systems and land cofigurations on rice equivalent yield and productivity

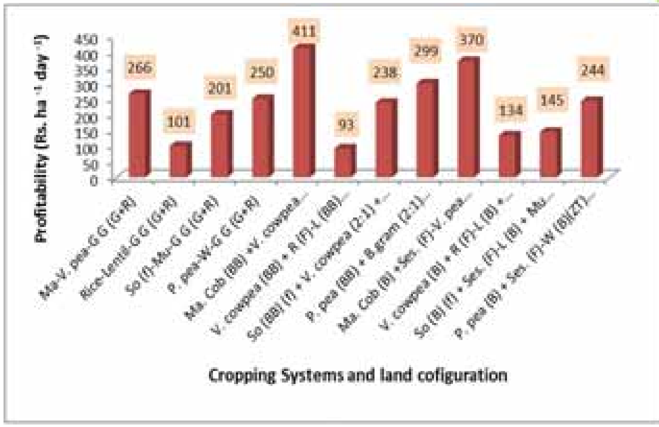


Fig. 15. Effect of cropping systems and land cofigurations on system profitability

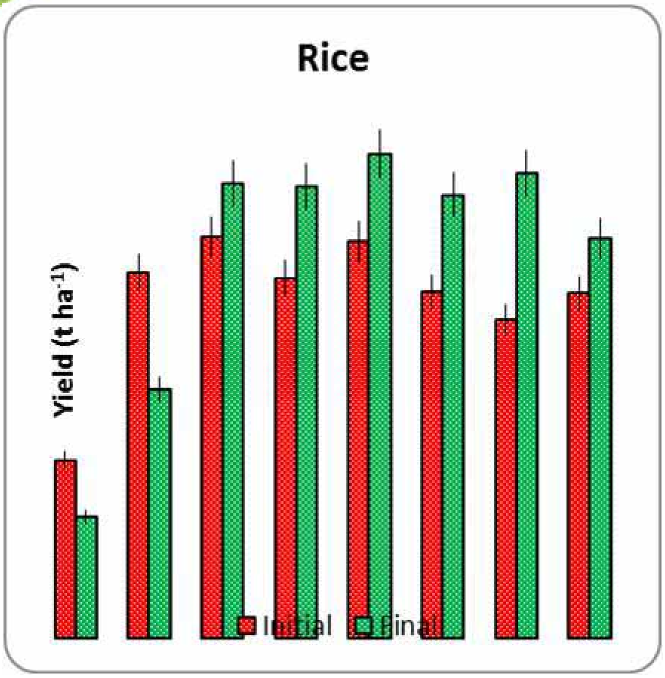
different cropping systems was evaluated in the strip plot design. The effect of land configuration and cropping systems on rice equivalent yield are presented in Fig. 14 and 15. The bio-intensive complementary cropping system Maize (cob) +Vegetable cowpea (2:1) (BB) + Sesbania (F)-Vegetable pea (BB) + W (F)-Green gram (G+R) produced maximum REY of 17.03 t ha^{-1} with productivity of 46.65 kg ha^{-1} day^{-1} and profitability of Rs. 411 ha^{-1} day^{-1}, which was followed by Maize (cob) (RB) +Sesbania (F)-Vegetable pea (RB) + W (F)-Green gram (G+R) system with REY 13.68 t ha^{-1}, productivity of 37.47 kg ha^{-1} day^{-1} and profitability of Rs. 370 ha^{-1} $day^{-}1$ and Pigeon pea + Black gram (2:1) (BB) +Sesbania (F)-Wheat (BB) + Wheat (F)-Fallow system with REY of 12.93 t ha^{-1} , productivity of 35.41 kg ha^{-1} day^{-1} and profitability of Rs. 299 ha^{-1} day^{-1}.

Sustaining rice-wheat productivity through integrated nutrient supply system

In order to study the production sustainability and changes in soil physical- chemical as well as microbial population under integrated use of fertilizers and organic manures, a long-term study initiated in *kharif 1993* on sandy loam (Typic Ustochrept) soil at IIFSR research farms, Modipuram, was continued consecutively for the 22nd year during 2014-15. The initial values for important soil characteristics at onset of the experiment were pH 7.98, EC 0.42 dS/m, organic carbon 0.41 percent, other P 16.4 kg ha^{-1}, available K 96 kg ha^{-1} and available S 14.5 kg ha^{-1}. Thus, the soil was low in OC, available K and S, and medium in available P content. The experiment was conduct in randomized block design with 11 treatments, including different levels of fertilizer nutrients and partial substitution of fertilizer with farmyard manure (FYM), sulphitation press-mud (SPM), green gram residue (GR) or rice/wheat residue (CR). The effect of different nutrient management options on rice-wheat productivity is dpecited in Fig. 16 and Table 12.

Long term application of a fertilizer in conjunction with organic manures induced a significant increase in the organic carbon status of the soil. This was clearly reflected by aggregate properties and stability. However, the relative effect varies with the source (kind) and amount of organic matter. Green manuring in rice followed by farmyard manure addition (25% N substitution) in wheat emerges as the best option in intensive rice-wheat rotation. Addition of crop residue may also be a viable option, since it is always available and disposal elsewhere or burning in situ will be avoided.

The long-term scenario analysis of the RW system using a 17-year climate record indicated some yield penalty when changing from continuous flooding to alternate wetting and drying (AWD) in rice and reduction of the number of irrigations in wheat. Rice irrigation regime of 5 days AWD during rice crop and five irrigations at



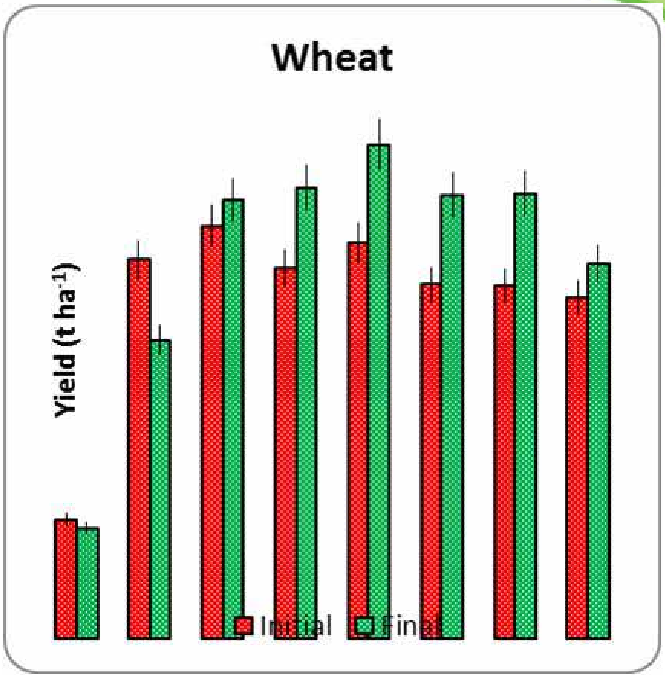


Fig. 16. Change in rice and wheat productivity as influenced by nutrient management options

Table 12. Grain yield, irrigation water requirement, and irrigation water productivity of rice and wheat under different irrigation regimes

Treatments	Grain yield ($Kg\ ha^{-1}$)	Irrigation water requirement (mm)	Irrigation water productivity ($Kg\ ha^{-1}\ mm^{-1}$)
Rice			
CF	6273	1728	3.68
2 AWD	4911	1508	3.29
5 AWD	3838	1122	3.46
8 AWD	3187	835	3.87
Wheat			
2 IR	3131	100	31.3
3 IR	4339	150	28.9
5 IR	5361	250	21.4

different phenophases of wheat crop may be the best option under water limiting situations, as it showed a higher irrigation water productivity with 20.1% yield penalty compared to continuous flooding during the rice season.

Long term effect of resource conservation technologies in rice-wheat 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*, the comparative performance of different machines namely; bed planter (BP), zero-till drill (ZT), strip-till drill (ST), 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. The experiments were design in randomized block design with three replications. Both the crops were grown with recommended package of practice. A recommended fertilizer dose of 120-60-40 kg ha^{-1} was applied in rice (saket-4) and wheat (PBW-343).

Evaluation of different drill machines for planting wheat in succeeding rice field

The comparative performance of different RCT machines namely; bed planter (BP), zero-till drill (ZT), happy –turbo seeder (HT), rotary-till drill (RT), and conventional drill (CS), in terms of yield (biomass, straw and grain), benefit: cost ratio (B: C), energy output: input ratio (EE), water use (WU), *Phalaris minor* (PM) and other weeds (OWE) was assessed. The effective field capacities of RT, HT, ZT, BP and CS were 0.45, 0.42, 0.52, 0.38 and 0.45 ha h^{-1}, respectively. The rotary, happy turbo seeder and zero till drilling and bed planting were time saving (70 to 75%), labour saving (68 to 72%), diesel saving (60 to 80%), cost saving (65 to 77%), energy saving (60 to 80%) and also irrigation water saving (15 to 30%) compared to conventional sowing of wheat. Also, there was saving of about 10-15% in seed and fertilizer inputs in bed planting compared to conventional sowing. The yield attributes have no significant difference among the treatments. The highest yield was found in BP (4.58), followed by HT (4.54 t/ha) ZT (4.50), RT (4.44) and CS (4.40) but which are statistically at par (Fig. 17). Happy-turbo seeder, zero, and rotary till drills and bed planter provided higher net returns (10-20%), cost effectiveness (8-13%) and energy efficiency (19-26%); and reduced *Phalaris minor* (57-82%), other weeds (65-82%), compared to conventional sowing of wheat (Fig. 18).

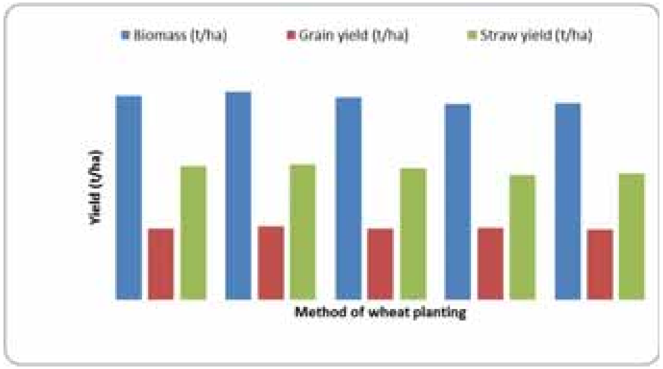


Fig. 17. Effect of different RCT's used for wheat crop establishment on yield (grain, straw and biomass)

The effect of planting methods on whet yield over the years is depicted in Fig. 18. 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.

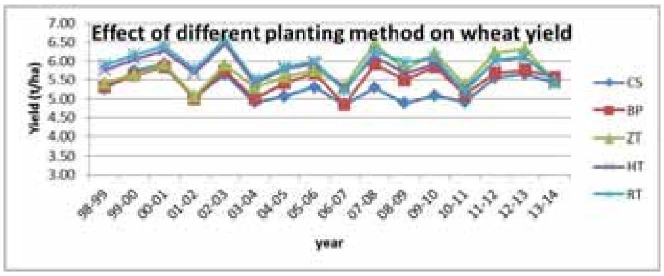


Fig. 18. Effect of different RCT's used for wheat crop establishment on yield over the year

Different resource conservation technologies for planting for rice

The comparative performance of different methods of rice planting, namely; hand transplanting (HT), transplanting by self-propelled transplanter (MT), transplanting by manual transplanter (MaT), bed planting

(BP), zero till drilling (ZT), happy-turbo seeder (HT), rotary till drilling (RT), drum seeding (DS) and sprouted broadcasting (BS), with respect to rice yield (Y), benefit: cost ratio (B: C), energy output: input ratio (EE), water use (WU) was evaluated. The effect of planting methods on rice yield over the year is depicted in Fig. 19. The highest yield was found in MaT followed by MT, HT among the puddled transplanted rice. It was observed that the yield was higher in MaT (5%) and at par with MT with comparison to traditional method. The lower of yield in ZT (14%), HTS (15%), BP (12%) and CS (18%) was observed as compared to traditional HT (5.40 t/ha). The higher net return was noticed in the five direct seeded rice as compared to three puddled transplanted rice (i.e. HT, MT MaT) and two sprouted rice seeding method. The energy net return was 9 to 12% higher in ZT and HTS, as compared to HT. Energy output: input ratio was 20% higher in ZT, 15 to 4% higher in all the methods except DS, CS and BS, where it was 2 to 10% lower, compared to HT (4.73). The water use was 30% lower in BP; 2 to 6 per cent lower in all other methods except CS, DS and BS, where it was 3 to 6% higher, compared to HT (210 ha-cm).

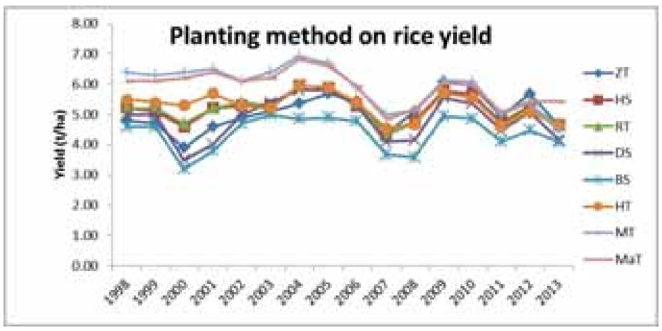


Fig. 19. Effect of planting methods on rice yield over the year

Evaluation of different machines under direct dry seeding of rice

Five machines for direct dry seeding of rice, namely; conventional drill (CS), zero-till drill (ZT), strip-till drill (ST), rotary-till drill (RT) and bed planter (BP) were evaluated using uniform seed (Saket - 4) rate of 30 kg ha^{-1}. Under ZT, ST, RT and BP sowing was done directly without any field preparation but sowing under CS was done after preparing the field with two harrowing, 2 cultivator passes and one planking operations. The row spacing was kept at 180 mm in CS, ZT, ST and RT, and 120 mm in BP. The performance parameters of different rice seeding machines showed that ZT, ST, RT and BP of rice saved time (85 to 80%), labour (86 to 78%), diesel (80 to 60%), cost (80 to 60%), energy (86 to 61%) and also irrigation water (8 to 35%) as compared to conventional sowing. The rice yield, economics and energy use affected by different methods is presented in Fig. 20. The zero till drilling produced higher rice (14 %), net returns (40 %), B: C ratio (21 %) and energy output: input ratio (35 %), compared to conventional sowing. The rotary till drilling produced higher rice (8%), net returns (22%), B: C ratio (11%) and energy output: input ratio (13 %), compared to conventional sowing. The strip till drilling produced higher rice (10 %), net returns (26 %), B: C ratio (14 %) and energy output: input ratio (22 %), compared to conventional sowing. The bed planting produced higher rice (8 %), net returns (20 %), B: C ratio (12 %) and energy output: input ratio (22 %), compared to conventional sowing.

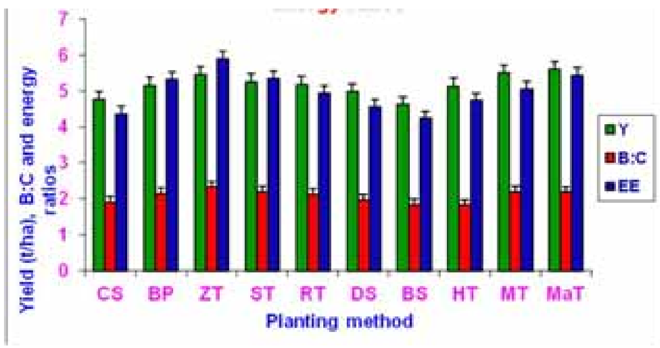


Fig. 20. Effect of planting methods on rice yield (Y), benefit: cost (B:C) and energy ratios (EE)

(CS – Conventional sowing, BP – Bed planting, ZT – Zero till drilling, ST – Strip till drilling, RT – Rotary till drilling, DS – Drum seeding, BS – Sprouted broadcasting, HT – Hand transplanting, MT – Mechanical transplanting, MaT - Transplanting by manual transplanter)

Evaluation of different crop residues management practices 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 yield and economic analysis (*i.e.* input, output cost, benefits) are depicted in Fig. 21.

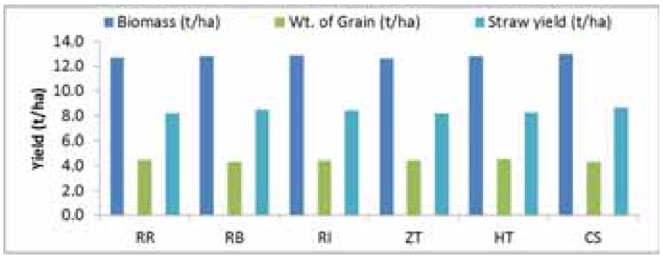


Fig. 21. Effect of residue management and different machineries on wheat yield

The crop residue recycling was done before planting of both crop seasons (as *kharif* and *rabi*). The residue recycling were done as rice residue (5 to 6 t ha^{-1}) as well as wheat straw (8 to 8.6 t ha^{-1}) and the degree of recycling was 76-81%. The wheat yield varied from (4.4 to 4.6 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.

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 (Fig. 22). The weed populations were found less numbers in residue in-corporation.

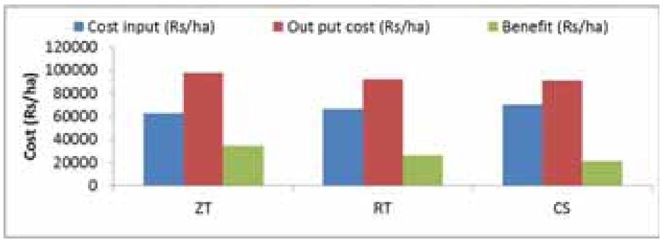


Fig. 22. Effect of residue management and various machineries on cost analysis

The effects of various wheat planting method of resource saving technologies revealed that zero till sown field given about 60 and 80 higher benefit and B: C ratio as compared to conventional sowing, however, rotary till sown produced 22 and 29 % higher benefit and B: C ratio as compared to conventional sowing. The yield and yield attributes has no significance difference among the treatments.

Development of suitable resource conservation modules to mitigate the ill effects of climate change

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

Rice equivalent yield as influenced by tillage, cropping systems and nutrient management over the years (time series)

The tillage influence significantly (P<0.05) on REY, whereas, the cropping systems and crop residue mulching and RDF combination significantly (P<0.01) effect on rice equivalent yield (REY). However, the all interactions were responded non-significant. The REY in treatment M_4 and M_2 had shown at par value in all years. The REY was ranked in order $M_1<M_3<M_4<M_2$ in all years. The yield attributes of wheat (*i.e.* plant height, number of tillers and test weight) were not significantly (P=0.05) affected by the tillage systems and crop residue mulching with combination of recommended dose of fertilizer (RDF), however, the number of spikelets/ear, number of grains/ear were observed significant (P=0.01) of crop residue mulching with combination of recommended dose of fertilizer (RDF) in wheat crop almost similar results were also observed in other cropping systems.

Climate Change: Effects on productivity of rice-wheat cropping system in western plain zones of U.P. and its mitigation by using DSSAT model

A field experiment was started during *kharif* 2010 to calibrate and validate the DSSAT model to find out the effects of climate change on productivity of rice-wheat cropping system and its mitigation strategies by using DSSAT model in western plain zone of Uttar Pradesh. Two wheat genotypes *viz,* PBW 343 and PBW 226 with two levels of Nitrogen (60 kg ha^{-1} and 150 kg ha^{-1}) were sown on three different dates *viz,* D_1 (4th week of October), D_2 (4th week of November) and D_3 (4th week of December) with four replications during *Rabi* 2010-11 to 2014-15. Two rice genotypes *viz,* Pusa Sugandha 4 (PS 4) and Saket 4 with two levels of Nitrogen (60 kg ha^{-1} and 150 kg ha^{-1}) were transplanted on three different dates *viz,* D_1 (3rd week of June), D_2 (1st week of July) and D_3 (3rd week of July) in four replications during *Kharif* 2010 to 2014.

Calibration of CERES-Rice and CERES-Wheat model

Model calibration or parameterization is the adjustment of parameters so that simulated values compared well with observed values. The genetic coefficients that influence the occurrence of developmental stages in the CERES models was derived iteratively, by manipulating the relevant coefficients to achieve the best possible match between the simulated and observed number of days to the phenological events, maximum leaf area index etc. Other coefficients were derived from determinations of non-limited grain weight and number of grains per panicle (rice). Crop data of *Kharif* season 2010 to 2012 and *Rabi* season 2010-11 to 2012-13 were used for calibration of the CERES-Rice and CERES-Wheat model of DSSAT Crop Model.

Validation of the CERES-Rice and CERES- Wheat model with observed data

The DSSAT family of CERES-Rice and CERES Wheat model were employed to simulate grain yield of rice as well as wheat crop for comparison with those respective ones which were observed under field experiments during *Kharif* season 2013 to 2014 and *Rabi* season 2013-14 to 2014-15 with a view to assess the performance of the model in simulating the results of these characters. The results of simulated yields are described below.

The simulated grain yield of the various treatments transplanted on three different dates by the model was in the range of standard deviation of the observed grain yield of the respective treatments as shown in Fig. 23 (a&b). Simulated and observed grain yield was

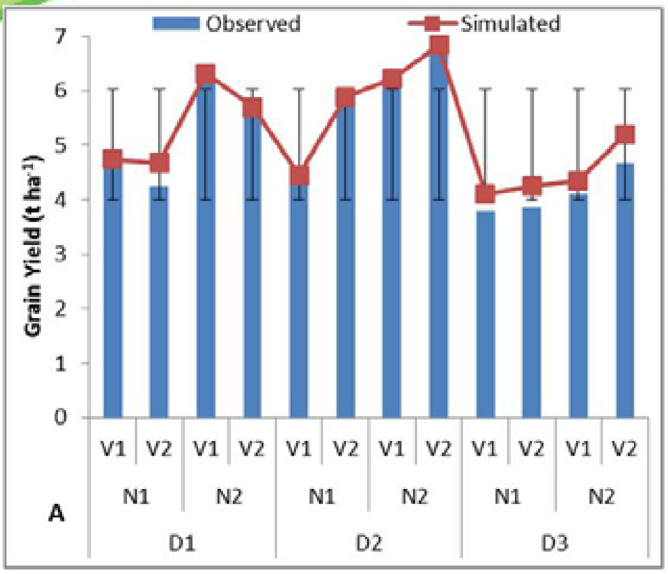


Fig. 23 (a). Treatment wise validation of the CERSE-Rice Model in terms of grain yield with observed data during *Kharif* 2013

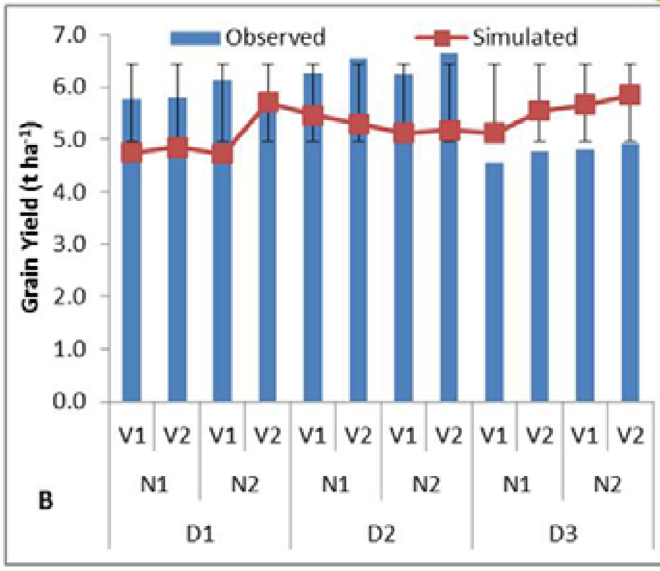


Fig. 23 (b). Treatment wise validation of the CERSE-Rice Model in terms of grain yield with observed data during *Kharif* 2014

significantly associated (P=0.05) and correlation coefficients were 0.29 and 0.57 for kharif season of 2013 and 2014 respectively. Higher Student t test were 0.73 and 0.92 between simulated and obsereved grain yield for kharif 2013 and 2014 respectively showed the strength of the model. Simulation results also revealed model performs well in simulation of grain yield in case of cultivar Saket 4 over the Pusa Sugandha 4.

The simulated grain yield by the model was found quite closer to the observed values of both the wheat cultivars (Fig. 24 a&b). Almost all the test criteria used

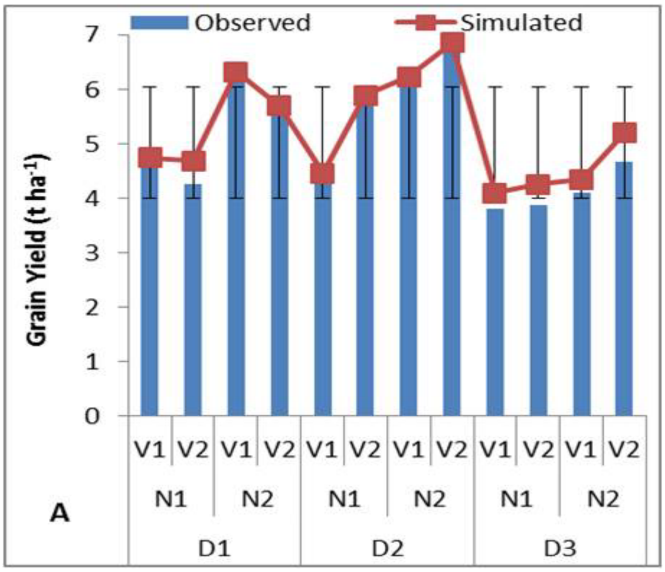


Fig. 24 (a). Treatmentwise validation of the CERSE-Wheat Model in terms of grain yield with observed data during *rabi* 2013-14

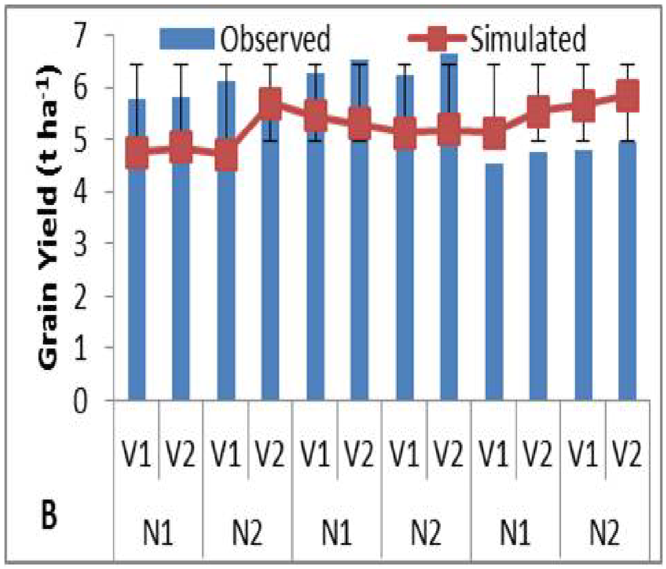


Fig. 24 (b). Treatmentwise validation of the CERSE-Wheat Model in terms of grain yield with observed data during *rabi* 2014-15

for validation of the model was found in the support of the strength of the CERES-wheat model to simulate the grain yield in western plain zone of Uttar Pradesh across the sowing window of the crops.

Development of Sustainable Production Model for Rice-Wheat Cropping System

The filed experiment, initiated in monsoon 1998 at Indian Institute research farm, Modipuram, in order to develop synthesized sustainable production model for rice-wheat system, was continued for 17th consecutive year (2014-15). To address two major non sustainability issues in rice-wheat system viz., declining soil fertility and increasing infestation of noxious weed such as *Echinocloa* spp in rice and *Phalaris minor* in wheat. For this, seven treatments are conducted which are dynamic in nature, and are subject to change in accordance with change in package of practices, fertilizer recommendation or soil-test values. In order to study, well established proven technologies are being compared as per treatment details given below:

T_1= Control i.e., no chemical fertilizer or organic manure

T_2= Recommended fertilizer dose to rice and wheat (SR)

T_3= 75% of recommended NPK as fertilizer+25% N as FYM to rice and complete recommended NPK fertilizer to wheat

T_4= Fertilizer similar to T_3, but substitution of every third wheat crop with berseem

T_5= Fertilizer similar to T_3, but substitution of every third rice crop with forage cowpea

T_6= Soil-test based fertilizer use in rice and wheat (STCR)

T_7= Organic farming

Productivity dynamics

During 2014-15 the rice-wheat productivity remained consistently higher under soil test based, crop nutrient recommendation, which was at par to the integrated nutrient management options. On the other hand, a declining trend was noticed under recommended NPK fertilizer as well as under no-NPK (control) treatment as compared to the initial year yields. Sustainable yield index (SYI) measured for the rice-wheat system using 03 years moving average indicates that STCR had highest SYI (0.92 in rice and 0.94 in wheat crop) followed by IPNS treatment (0.79 in rice and wheat crop) (Fig. 25). On the other hand, lowest SYI was noticed with organic farming treatment. The weed flora counted at 35 DAT in rice revealed the advantage of introduction of a break crop of forage legume (Table 13). The lowest count of 6-11 weed plants m^{-2} in rice was recorded in treatments, where berseem or cowpea was grown to substitute wheat or rice at a definite time interval. Although the noxious weed population was substantially lower under organic farming plot but the other weed population was maximum in this treatment After 17 crop cycle soil organic carbon content was maximum under organic farming plots followed by IPNS and least under chemical fertilized plots (0.68 % and 0.72% respectively). Effect of different nutrient management options studied on soil aggregation reveals maximum aggregation (%) was under organic farming (40.5%) followed by IPNS (39.6%) and least under recommended NPK+Zn applied plots (32.4%). Canopy temperature (^{0}C) studies were made in rice season at 55 days after transplanting (DAT), 60 DAT, 65 DAT and 70 DAT indicates that use of organics had mitigating effect on soil canopy temperature and the lowest canopy (lower and upper canopy) was recorded under organic farming plots (Fig. 26). On the other hand, use of chemical fertilizer *i.e.* recommended NPK had maximum canopy temperature rise at all the rice crop studied stages (Fig. 26). The mean weight diameter (g/cm) was also

Table 13. Effect of nutrient and crop management strategies on weed intensity in rice-wheat system

Treatment	Rice			
	Echinochloa	*Cynodon dactylon*	Others	Total
T_1	8	4	6	18
T_2	7	2	9	18
T_3	5	2	12	19
T_4	2	-	4	6
T_5	3	-	8	11
T_6	7	3	10	20
T_7	4	2	16	22

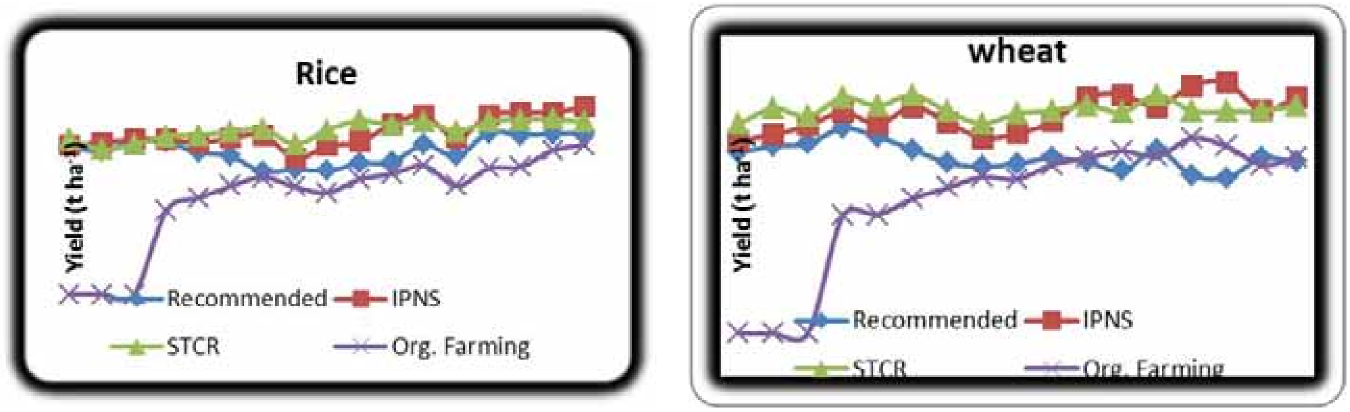


Fig. 25. Yield trend of rice and wheat over the years based on moving average

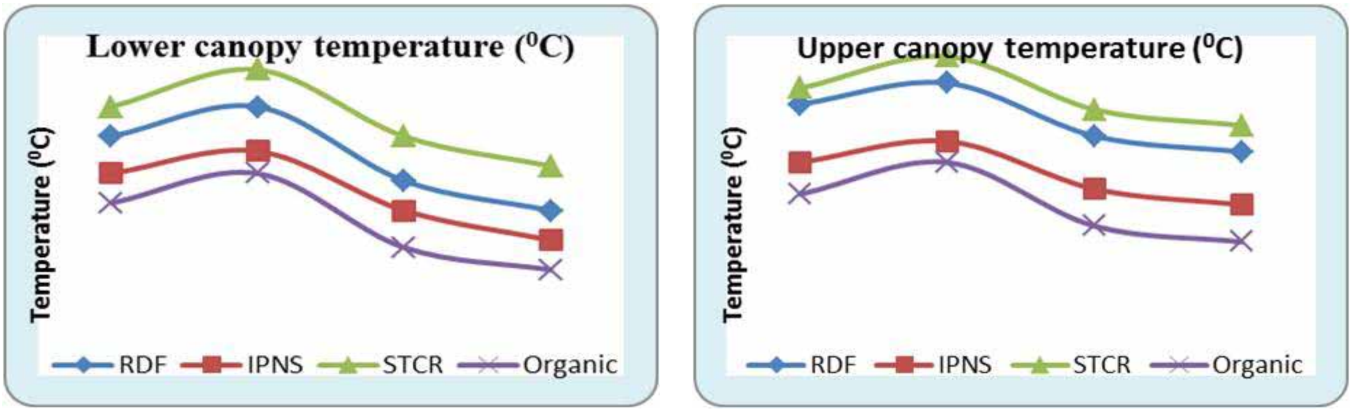


Fig. 26. Effect of nutrient management options on photosynthesis rate in rice crop

highest with organic farming plots (1.78 g/cm) followed by IPNS treatments (1.47g/cm) and the plots having cowpea (1.38g/cm) or barseem (1.24g/cm) as break crop. The lowest mean weight diameter was recorded under control (no-NPK) treatments (0.97g/cm), which was nearer to NPK+ Zn applied (chemical fertilized) ones (1.05g/cm). Soil penetration resistance was increased with increasing profile depth across the treatments. Among the treatments options, plots having cowpea as a substitute crop for rice had lowest penetration resistance up to 60 cm profile depth. Soil penetration resistance in 0-15cm profile depth was smaller under IPNS options like 25% NPK through FYM (IPNS), IPNS+barseem substitution or IPNS+ cowpea substitution. The soil penetration resistance was of increasing order as IPNS >IPNS+barseem >IPNS+cowpea as substitute crop. On the other hand, recommended NPK has maximum penetration resistance. Cumulative infiltration rate (mm) and infiltration rate (mm/hr) measured for 1440 minutes indicates although the infiltration rate of organic farming treatment was maximum (0.287 mm/hr) under Organic farming treatments but the cumulative infiltration rate was highest under IPNS (25% NPK through FYM) plots along with cowpea as break crop at each third rice crop. Soil bulk density declined in 15-30 cm depth by 0.13 g/ cc under plots having cowpea as substitute as break crop as compared to recommended fertilizer plot. Field water use efficiency was recorded maximum in the treatments having IPNS followed by soil test based nutrient recommendation used plots.

Studies on persistence of pesticides residues in the agricultural produce of intensively cultivated farming situations in peri – urban areas of western plain zone of Uttar Pradesh

The small and marginal farmers of this region are using different plant protection chemicals to protect their agricultural produce. Lack of knowledge regarding recommended dose application, waiting periods of pesticides etc. is resulting in agricultural products being contaminated with the hazardous agro chemical that causes detrimental effect on human health besides our environment. Technical knowledge/skills regarding the pesticide application in agricultural field is the need of hour to minimize environmental pollution and health hazard. This project will help the farmers and stake holder to enrich their scientific knowledge for pesticide and also minimize the cost cultivation.

It was found that farmers of these area spend 17.6 % (sugarcane), 2.5% (wheat),10.3% (rice), 19.64% (potato), 8.25% (mustard), 21% (okra), 20-29% (brinjal), 16-18% (tomato), 9.5-20.5% (cabbage and cauliflower) and 23 % (chilli) of the total cost of cultivation for plant protection measures. Among insecticide, Chlorantraniliprole (Coragen) is extensively used as foliar application as well as soil application. Chloripyrifos stands next to the Renoxypyr (Coragen). Among the herbicides Butachlor, Metribuzine, Sulfosulfuron, 2-4D, Atrazine are generally used by the farmers. Mancozeb and Carbendazime are very popular fungicides besides different mixture new fungicides like Fenamidon + Mancozeb, Pyraclostrobin+Polyram, Trifloxystrobin+ Tebuconazole etc.

Degradation of Chlorpyrifos in flooded soil

A pot experiment was conducted in ICAR-IIFSR to study the degradation of Chlorpyrifos in the rhizospheric soil of paddy under flooded condition. Two series of pots (planted and unplanted) containing 5 kg of soil were maintained under flooded condition. An aqueous suspension of Chlorpyrifos was applied at 10µg a.i. per gram of soil in each pot. Twenty one days old rice seedlings (Variety-PB1121) planted in pots represented planted series. Another series of pot was maintained only under flooded condition without rice seedlings. All pots in three replicates were maintained with standing water. Chlorpyrifos was applied after 7 days of flooding. Rhizospheric soil samples were collected on 0,3,7,12,18, and 25 days after Chlorpyrifos application in soil. The soil was quantitatively transfered to the 100 ml Erlenmeyer flask with distilled water and acetone. Soil suspension was prepared and transfered to centrifuge tube for centrifugation at 7000 r.p.m for 10 min, the supernatants were transferred to a separating funnel for portioning with Hexane. The organic solvent fractions were dried over sodium sulphate. The aqueous fraction was partitioned in three times with 30, 20 and 20 ml n Hexane. The pooled solvent fractions were evaporated to dryness at room temperature. The residues were re-dissolved in 10 ml of hexane and then analysed by GCMS (Varian GC Model CP3800 coupled with Varian4000 Ion trap MS). The chlopyrifos was estimated after oven temperature programming in GC. The temperature programing was as follows- initial oven temperature 100^0C withhold time 1 minute, increase temperature 200^0C @ 4^0C per minutes with hold time 2 minute and then the temperature was increase to 260^0C @ 8^0C per minutes with hold time 2 minutes . Total run time was 37.50 minutes and Chlorpyrifos residue was detected and identified by the GCMS at Rt of 30.1 minutes (Fig. 27 and 28). The molecular weight of Chlorpyrifos is 350.59.In the mass fragmentation of the targeted compound, base peak was found at m/z^+ 314.5 and another important mass fragmentation was found at m/z^+ 97 of sampling (Fig. 29). The degradation of chlorpyrifos in soil followed a first order reaction based on the equation $C=C_o e^{kt}$ where C is the concentration of the insecticide remaining in the soil after time t, C_o is the initial concentration and k is the first order kinetic

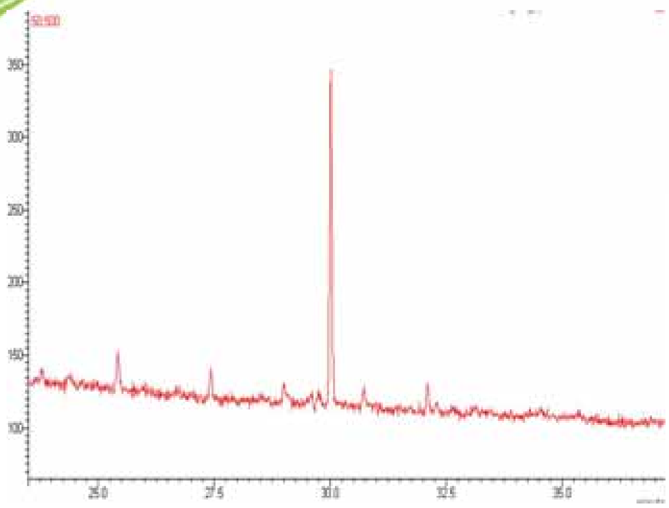


Fig. 27. GCMS Chromatogram of Chlorpyrifos

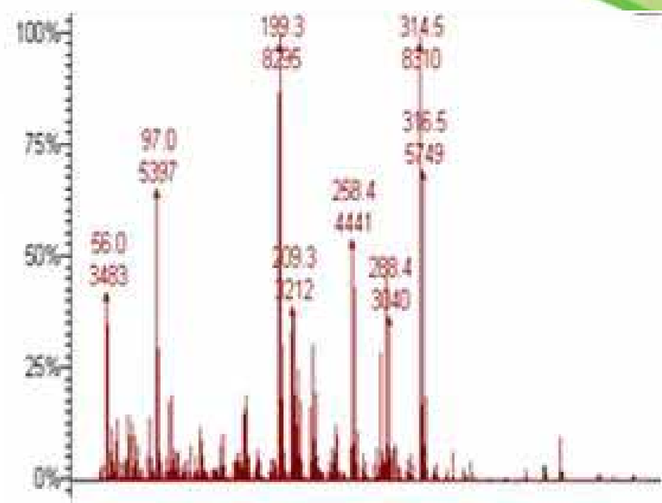


Fig. 28. Mass fragmentation of Chlorpyrifos

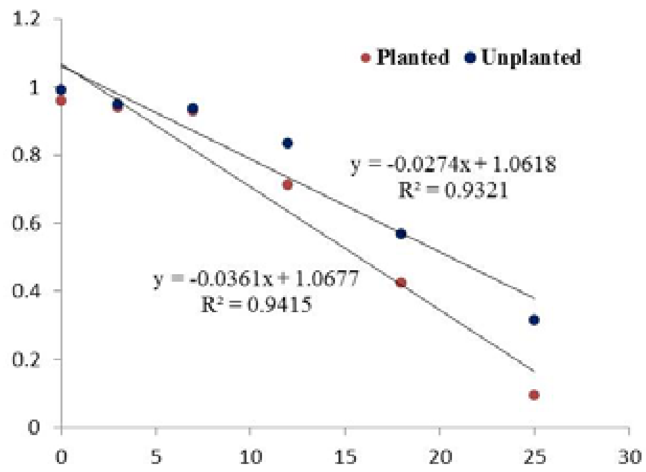


Fig. 29. Degradation pattern of Chlorpyrifos in flooded soil

constant. From the degradation study, it was recorded that initially there was only 2% to 5% degradation of Chlorpyrifos in both types of soil environment. The degradation was 40% faster in the rhizospheric soil of paddy as compare to the normal soil on 12 days after transplanting. During soil sampling, fewer amounts of Chlorpyrifos residues were detected in the rhizospheric soil as compare to the non rhizospheric soil. Chlorpyrifos residues in the paddy rhizospheric soil was detected 9.73 % where as in non rhizospheric soil, the residues was 31.33% of the initial concentration.

The half-life of the Chloropyrifos was calculated from the degradation pattern of Chlorpyfos residue in flooded soil under planted and unplanted condition. The half-life of Chlorpyrifos in plated flood soil was 8 days where as the half-life was 11 days in the unplanted flooded soil. From the above studies it can be concluded that the degradation of Chlorpyrifos is faster under planted flood soil than the unplanted soil. Both the biotic and abiotic factors, which acts in tandem and complement each other in the soil environment, influence the pesticide degradation in soil environment.

Estimation of greenhouse gas emission from IFS modules and models under AICRP-IFS

The project was initiated in April, 2014 onwards with triple objectives *viz*: i) estimation of greenhouse gas (GHG) emissions from different components of IFS, ii) identifying GHG emissions hotspots, and iii) identifying and suggesting GHG mitigation options. During the year, activity data for various components of IFS models under All India Coordinated Research Project on Integrated Farming System (AICRP IFS) On Farm Research centres Paiyur, Tamilnadu and Udaipur, Rajasthan were provided and tabulated for estimating the GHG emission. The assessment of emission of GHG follows the standard Intergovernmental Panel on Climate Change (IPCC) accounting and reporting guidelines with available default and country specific emission coefficients. Estimation of emission of CO_2-e in benchmark cropping module of OFR 2 villages, Paiyur, Tamilnadu reveals that low productive villages emitted mean 517 kg CO_2-e GHG farm household^{-1}, whilst high productive villages emitted mean 781 kg CO_2-e GHG farm household^{-1}. Further, application of N fertilizer in low productive villages contributed 79.7 per cent followed by 11.5 per cent from paddy crop and 8.78 per cent from FYM application. In high productive villages, application of N fertilizer, paddy crop and FYM application contributed 53.0, 42.9 and 4.10 per cent, respectively. Benchmark cropping module in low productive villages in OFR 3 in Udaipur, Rajasthan emitted mean 306 kg CO_2-e GHG farm household^{-1} with 97.7 per cent contribution from fertilizer N application and 2.21 per cent from FYM application, while high productive villages emitted mean 366 kg CO_2-e GHG farm household^{-1} with 90.9 per cent contribution from fertilizer N application and 9.26 per cent from FYM application. Also, during the year 2013, application of fertilizer N, paddy cultivation, consumption of POL and electricity in ICAR-IIFSR resulted into emission of 346 t CO_2-e GHG. Electricity, POL, fertilizer N and paddy cultivation contributed 70.0, 23.0, 6.00 and 1.00 per cent, respectively to the total CO_2-e GHG emission during the year (Fig. 30). This emission can be offset by using slow release fertilizers, solar water pumps and block plantation of trees.

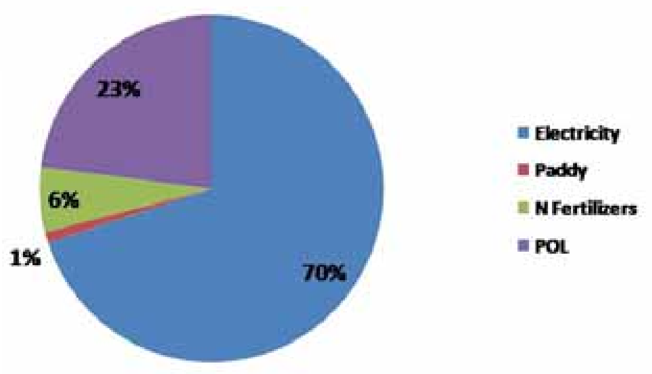


Fig. 30. Contribution of activities to total CO_2 e GHG emission at ICAR-IIFSR in 2013

Evaluation of sugarcane and wheat varieties for sugarcane–ratoon-wheat cropping system under organic and non-organic conditions

Under this project a set of nine (Early) sugarcane varieties has been put in the experiment under inorganic condition on May 8, 2015. However, experiment in organic condition has been laid in 13th May, 2016. Observations *viz*; germination, tillering, NMC, cane

Table 14. Performance of early maturing varieties under non-organic condition during summer planting (mean value)

Varieties	No. of tillers	NMC (6 rows)	Brix percentage at harvest
Co 0238	174.00	156.3	20.27
CoSe 03234	266.67	210.7	18.56
UP 05125	230.67	214.7	13.32
CoS 03251	178.67	159.3	19.07
Co 098014	288.33	216.7	20.12
Co 0118	249.33	193.7	19.44
CoLK 011201	324.67	237	18.85
CoLK 013201	341.67	288.3	19.33
CoPK 05191	419.67	333.7	18.95

weight, cane height and brix % have been recorded and displayed (Table 14). The variety CoPk 05191 produced highest NMC in summer planting followed by CoLk 013201 and CoLk 011201. Highest cane weight was gained by Co 0118 followed by Co 0238, CoSe 03234 and CoPk 05191. While, cane height was recorded highest by varieties Co 098014 followed by Co 0238,Co 0118 and CoPk 05191.However Brix % was found highest in clones Co 0238 followed by Co 098014,Co 0118,CoLk 013201 and CoPk 05191. Initial observations reveal that varieties Co 0238, Co 098014, Co 0118 and CoPk 05191 can perform better in summer planting in terms of cane and sucrose yield.

Evaluation of rapeseed and mustard varieties (under AICRP) in zone II at IIFSR Modipuram, Meerut

This project was awarded to ICAR- IIFSR Modipuram for conducting trials (AICRP) on rapeseed and mustard as a voluntary center. Three trials have been conducted in September and October 2015 on coded entries carrying each trial.

Initial varietal trial (Early) –Indian mustard

Sixteen strains of Indian mustard were tested in randomized block design with three replications. The strain MCN (E) 15-6 recorded highest seed yield (2734. 82 kg ha^{-1}) followed by MCN (E) 15-13(2638.53 kg ha^{-1}), MCN (E) 15-10 (2573.34 kg ha^{-1}) and MCN (E) 15-2(2562.97 kg ha^{-1}). Highest 1000 seed weight was recorded by strain MCN (E) 15-15(7.33 gm) followed by MCN (E) 15-8 (6.42 gm) and MCN (E) 15-2(6.18 gm). Strain MCN(E) 15-15(125.33 days) was found extremely early maturing followed by MCN(E) 15-13(128.33 days) and MCN(E) 15-14(128.07 days) (Table 15).

Table 15. Mean performance of early maturing strains of Indian mustard

S. No	Strain	1000 seed weight (gm)	Seed yield (kg ha^{-1})	Days to maturity
1	MCN (E)15-1	4.94	2440.01	130.67
2	MCN(E) 15-2	6.18	2562.97	129.00
3	15-3	6.05	1800.01	130.00
4	15-4	5.67	2440.01	132.33
5	15-5	4.80	1465.19	135.33
6	15-6	5.58	2734.82	129.67
7	15-7	6.00	2028.16	130.33
8	15-8	6.42	1952.60	130.00
9	15-9	5.43	2020.75	135.67
10	15-10	4.99	2573.34	131.67
11	15-11	5.78	2488.90	129.33
12	15-12	6.01	2414.82	131.00
13	15-13	5.63	2638.53	128.33
14	15-14	5.82	1991.12	128.67
15	15-15	7.33	1368.89	125.33
16	15-16	6.07	2260.75	130.67

Initial varietal trial rapeseed (Toria)

Sixteen strains of rape seed were evaluated in randomized block design with three replications. The strain TCN 15-4 recorded highest seed yield (1451.86 Kg/ha) followed by TCN 15-11(1419.26 Kg/ha) and TCN 15-15(13.98.52 Kg/Ha). Highest 1000 seed weight was recorded in strain TCN 15-10 (4.42 gm) and TCN 15-13(4.22 gm). Whereas strain TCN 15-3 matured in minimum day (110 days) followed by TCN 15-2(111 days) and TCN 15-14(111.33 days) (Table 16). Two strain *viz*; TCN 15-1 and TCN 15-12 did not flower.

Initial varietal trial (Timely sown irrigated) Indian mustard

Thirty strains of timely sown irrigated Indian mustard were tested in Alpha lattice design (Block -6, Plot -5) with three replications during Rabi season 2015-16. The highest seed yield (2942.23 kg ha^{-1}) was recorded by strain MCN 15-9 followed by MCN 15-27A (2642.97 kg ha^{-1}) and MCN 15-8(2577.79 kg ha^{-1}) . Highest 1000 seed weight was recorded under strain MCN 15-4(5.72 gm) followed by MCN 15-22(5.59 gm) and MCN 15-8(5.48 gm). On maturity perspective, the strain MCN 15-13 matured in 135 day followed by MCN 15-6 and MCN 15-20 which matured in 135.67 days (Table 17).

Performance evaluation of high yielding sorghum cultivars in eastern India under staggered planting in the spring season

Field trial consisting of 10 sorghum varieties laid down in the month of February and March, 2015 in split plot design with three replication across three dates of sowing [D_1 (16.2.2015), D_2 (03.03.2015) and D_3 (18.03.2015)] at Siwaya Farm.

Table 16. Mean performance of different strains of rapeseed (Toria)

S. No	Strain	1000 seed weight (gm)	Seed yield (kg ha^{-1})	Days to maturity
1	TCN 15-1	0	0	0
2	TCN15-2	3.34	882.97	111.00
3	15-3	2.90	542.22	110.00
4	15-4	3.51	1451.86	112.67
5	15-5	3.65	1260.75	112.67
6	15-6	3.54	1374.82	114.00
7	15-7	3.98	1318.52	112.67
8	15-8	3.48	1361.49	112.33
9	15-9	3.77	727.41	116.00
10	15-10	4.42	1349.63	113.67
11	15-11	3.99	1419.26	114.33
12	15-12	0	0	0
13	15-13	4.22	1183.71	114.00
14	15-14	3.35	648.89	111.33
15	15-15	3.61	1398.52	114.67
16	15-16A	3.00	580.74	113.00

Table 17. Mean performance of different strains of (Timely sown irrigated) Indian mustard

S. No	Strain	1000 seed weight (gm)	Seed yield (kg ha^{-1})	Days to maturity
1	MCN 15-1	5.33	2005.93	139.33
2	MCN 15-2	5.01	2361.49	136.00
3	MCN 15-3	5.00	2549.64	140.67
4	15-4	5.72	1983.71	138.33
5	15-5	5.17	2179.27	137.00
6	15-6	4.77	1530.38	135.67
7	15-7	5.08	2322.97	136.00
8	15-8	5.48	2577.79	139.33
9	15-9	5.39	2942.23	138.67
10	15-10	5.15	2198.53	140.33
11	15-11	5.11	1945.19	135.33
12	15-12	5.49	2121.49	136.00
13	15-13	5.42	2051.86	135.00
14	15-14	4.87	2420.75	136.33
15	15-15	4.95	2025.19	135.67
16	15-16	5.44	1994.08	138.33
17	15-17	5.45	1967.41	136.00
18	15-18	5.12	2272.60	137.67
19	15-19	5.07	2303.71	137.33
20	15-20	5.14	2122.97	135.67
21	15-21	4.58	2445.93	136.67
22	15-22	5.59	2400.01	138.67
23	15-23	5.36	1922.97	138.33
24	15-24	4.66	1872.60	139.67
25	15-25	4.74	2539.27	136.67
26	15-26	5.60	2114.08	139.00
27	15-27	5.48	2217.79	136.67
28	15-27A	4.88	2642.97	140.00
29	15-28	5.67	2404.45	140.33
30	15-28A	4.85	2096.30	138.33

CSV 24 SS cv. of fodder Sorghum

The field experiment consisting of ten sorghum varieties namely CSH14, CSH16, CSH13R, CSV17, CSV27, Phule Revati, Phule Anuradha, CSV24SS, CSH24MF and CSV21F was conducted at the Research farm of IIFSR, Modipuram (Uttar Pradesh) for their grain and fodder yields during spring season 2015 in split plot design with three replications across three dates of sowing like D1 (16.2.2015), D2 (03.03.2015) and D3 (18.03.2015). It was observed that among all the varieties CSV17 was extremely dwarf coupled with extreme early maturity. It was observed that amongst ten varieties CSV 24 SS, CSH 24 MF and CSV 21 F (Table 18) can be grown only for fodder purpose since they are poor in grain coupled with late maturity.

Table 18. Comparative performance of fodder sorghum varieties under western plain zone of Uttar Pradesh

Variety	Green Fodder yield (t/ha)	Dry fodder yield (t/ha)
CSH 24 MF	157.36	64.52
CSV 24 SS	145.43	59.62
CSV 21 F	144.46	58.67

The varieties CSH 14, CSH 16 and CSH 13R were found at par in term of grain yield and they also recorded considerable yield of green fodder (Table 19). While, the varieties such as CSH 14, CSH 16, CSH 13 R and CSV 27 were found to be dual purpose (Table 20) i.e. they can be grown for both grain and fodder purpose. Indeed, date of sowing D_3 was found suitable for good germination as well as plant stand. Whereas, second date of sowing (D2) had positive impact on growth and yield attributes viz. plant height, number of leaves/plant, grains per head and green fodder yield irrespective of varieties under test. However, second(D2) and third(D3 dates of sowing were found better than first date of sowing in respect to crop growth and development on recently developed new cultivars of sorghum.

CSH 14 grain Sorghum

Table 19. Comparative performance of grain sorghum varieties under western plain zone of Uttar Pradesh

Variety	Green yield (t/ha)	Stover yield (t/ha)
CSH 14	7.96	14.63
CSH 16	7.79	14.54
CSH 13 R	7.66	25.55

Table 20. Comparative performance of dual purpose sorghum varieties western plain zone of Uttar Pradesh

Variety	Green fodder (t/ha)	Grain yield (t/ha)
CSH 13 R	108.46	7.66
CSV 27	103.28	4.41
CSH 16	87.76	7.79
CSH 14	79.61	7.96

Screening of short duration varieties under sugarcane- ratoon- wheat cropping system for N-W plain –an exploratory study

Under this exploratory study 18 sugarcane varieties collected from IISR Lucknow, SBI regional centre, Karnal and UPCSR Regional station, Muzaffar nagar were planted during crop season 2014-15. Some component characters were recorded on the first plant crop and they are depicted in Table 21 and 22.

In early group of sugarcane varieties (Table 21) The variety Co 0118 yielded highest average cane weight followed by Co 0238 ,Co 098014 and CoS 03251.The number of millable cane (NMC) was produced highest by CoPk 05191followed by CoSe 03234, Co 098014,CoLk 011201 and Co 0238. While, on the brix performance the variety CoS 03251 was top performer followed by CoPk 05191, CoLk 011201 and UP 05125.However, cultivar Co 098014 was highest cane

Table 21. Performance of early maturing varieties in spring planting.

Sr. No.	Varieties	Avg. cane weight (kg)	NMC (6 rows)	Yield (ton/ha)	Brix % at harvest
1	Co 0238	1.43	312	106.68	19.8
2	CoSe 03234	0.96	374	95.88	20.14
3	UP 05125	0.88	305	80.51	21.2
4	CoS 03251	1	267	70.34	22.36
5	Co 098014	1.36	354	115.98	19.6
6	Co 0118	1.5	209	99.02	20.7
7	CoLK 011201	0.83	331	78.88	21.8
8	CoLK 013201	0.97	209	55.84	19.14
9	CoPK05191	0.91	382	96.04	21.88

Table 22. Performance of mid-late varieties in spring planting.

Sr. No.	Varieties	Avg. cane weight (kg)	NMC (6 rows)	Yield (ton/ha)	Brix % at harvest
1	Co 05011	1.45	399	125.29	21.84
2	CoPant 97222	0.93	316	78.11	20.52
3	CoS 08279	0.87	297	68.82	20.68
4	LG 04043	0.98	251	64.38	22.36
5	Co 0124	1.52	348	120.54	21.48
6	CoSe 01434	1.08	396	99.11	23.64
7	CoS 07250	0.8	353	65.45	22.48
8	UP 0097	0.84	347	64.33	22.6
9	CoPant 05254	1	387	89.68	22.4

yielder followed by Co 0238,Co 0118 and CoPk 05191. Indeed, Varieties in early group Co 098014, Co 0238, Co 0118 and CoPk 05191 were overall better performer in terms of cane yield and brix performance.

On the other hand, mid-late clones (Table 22) Co 0124 produced highest average cane weight followed by Co 05011, CoSe 01434 and CoPant 05224. Variety Co 05011 was highest NMC producer followed by CoSe 01434, CoPant 05224 and CoS 07250.Highest brix was gained by CoSe 01434 followed by UP 0097, CoS 07250 and CoPant 05224.The top cane yielder variety was Co 05011followed by Co 0124,CoSe 01434 and CoPant 05224. Although, Varieties in Mid-late group Co 05011, CoSe 01434 and Co 0124 may satisfy the expectations of both farmers and sugar factory owners.

System based proven technologies in farming systems perspective under demonstration in technology park

Demonstration of twenty six proven cropping models of Integrated farming system involving vegetable (7), conservation technologies based (6), involving improved varieties (5) ,maize based (4) and sugarcane based (4) was done in the technology park of IIFSR during the year. The demonstrated models were superimposed with the improved technologies i.e. improved verities, direct seeding of rice (DSR), system for rice intensification(SRI), mechanical transplanting of rice, nutrient management (SSNM) rice ,maize ,sugarcane and wheat, green manuring (GM), raise bed planting(RB) ,broad bed furrow system (BBF), zero tillage technology in wheat, crop residue management in wheat, inter cropping in sugarcane and farmers practice for the live on-farm demonstration of the models for the benefit of the farmers of the region was done

From different vegetable based cropping systems under study it was observed that farming systems involving vegetables such as potato, bottle gourd ,okra and brinjal and pulse like mung have provided higher return (REY/ha) as compared to predominant cropping system of Western UP i.e. B. rice –wheat where as other systems recorded lower yield (Table 23).

Table 23. Vegetable based farming systems

Vegetable based	System Income (Rs.)	RYE (t ha^{-1})
Bas. rice- wheat	151181.01	8.89
Bas. rice -otato- mung	317177.70	18.66
Bas. rice - potato- okra	274425.09	16.14
Sorghum—potato - mung	215121.95	12.65
Bas. rice - cauliflower- onion	218257.84	12.84
Brinjal- maize (cabs)	277346.09	16.31
Okra- veg.pea (BB)+ wheat(F) - bottle gourd	346519.16	20.38

Technologies based cropping systems i.e. Bas. rice (MT+ SSNM)- wheat (RM, SSNM)- Ses., Bas. rice (MT,SSNM) - wheat (RM SSNM) - Ses. and Bas. rice (SRI, SSNM) - wheat (ZT, SSNM) – Ses. under study reveled that all of the systems superimposing different proven technologies provided higher yield (REY/ha) as compared to Bas. rice (FP) –wheat (FP) farmer practice (Table 24).

Table 24. System productivity and economics of different proven technologies

Technologies (Cropping Systems)	System Income (Rs.)	RYE (t ha^{-1})
Bas. rice(DSR)- wheat (SSNM) - Sesbania	141637.63	8.33
Bas. rice (SRI ,SSNM) –wheat (ZT,SSNM) -Sesbania	157491.29	9.26
Bas. rice (SSNM) -wheat (RM,SSNM) -Sesbania	171010.45	10.06
Bas. rice (MT,SSNM)–wheat (RFD) -Sesbania	159372.82	9.37
Bas. rice (SSNM) –wheat (RFD) -Sesbania	145156.79	8.54
Bas. rice (FP) –wheat (FP)	135923.34	8.00

Improved varieties based cropping systems ie. Bas. rice(VB-22) –wheat (HD2967), Bas. rice(1509) –wheat (DBW71) and Bas. rice(VB-24) -wheat (HD2894) under study reveledthat all of the systems superimposing different improved varieties provided higher yield (REY/ha) as compared to Bas. rice (FP) –wheat (FP) farmer practice (Table 25).

Other different cropping systems ie maize(F) + pigeon pea (RB) –wheat (SSNM), maize(R&F,SSNM)) –mustard (SSNM) –summer moong, maize(F) + pigeon pea (RB) –wheat (SSNM) and Bas.rice -sugarcane (AP)+potato-ratoon-wheat (LS) -sesbania, rice-sugarcane (SP)+ summer moong-ratoon-wheat (LS)-

Table 25. Improved varieties based farming systems

Improved varieties based cropping systems	System Income (Rs.)	RYE (t ha^{-1})
Bas.rice (1612) -wheat(PBW343)	145644.60	8.57
Bas.rice (VB-22) –wheat (HD2967)	164738.68	9.69
Bas.rice (1509) -wheat(DBW71)	160627.18	9.45
Bas.rice (PB-6) -wheat (HD2967)	137979.09	8.12
Bas.rice (VB-24) -wheat (HD2894)	152334.49	8.96

Sesbania under study reveledthat all of the systems superimposing different proven technologies provided higher yield (REY/ha) due to systems involving of mung been, pigeon pea and intercropping of potato as compared to farmer practice maize and sugarcane based cropping systems . The highest system income was recorded from Bas. rice-sugarcane (AP)+potato-ratoon-wheat (LS) -Sesbania of Rs 278745.87 having a RYE of 16.40, whereas the lowest system income was recorded from maize(FP) -mustard – summer moong (FP) of Rs. 166480.86 having a RYE of 9.79 among different systems evaluated (Table 26).

Table 26. Maize and sugarcane based farming systems

Technologies (Cropping Systems)	System Income (Rs.)	RYE (t ha^{-1})
Maize (FP) -mustard – summer moong (FP)	166480.86	9.79
Maize(FP) –mustard (SSNM) – summer moong	176584.39	10.39
Maize (R&F,SSNM)-wheat (R&F,SSNM)- summer mung	183623.69	10.80
Maize(F) + pigeon pea (RB) – wheat (SSNM)	206968.64	12.17
Maize(F) + pigeon pea (BB) – wheat (SSNM)	196655.05	11.57
Bas.rice-sugarcane (AP)+potato-ratoon-wheat (LS) -Sesbania	278745.87	16.40
Bas.rice- sugarcane (SP)+summer moong-ratoon-wheat (LS)-Sesbania	254634.15	14.98
Sugarcane (Summer)-ratoon - wheat (LS)	210731.71	12.40

Feedback collection through structural schedule from the visitors reveled that different farming systems, Okra-veg.pea+ wheat(F) - bottle gourd , Bas.rice (SRI ,SSNM) –wheat (ZT,SSNM) -Sesbania , Bas. rice(VB-22) -wheat (HD2967, Maize(R&F,SSNM)) –mustard (SSNM) –summer moong, Maize(F) + pigeon pea (RB) –wheat (SSNM) and Bas. rice-s.cane (AP)+potato-ratoon-wheat (LS)-Sesbania were first ranks among the different systems. It has been also observed that. Sorghum—potato – mung, Bas. rice (DSR)- wheat (SSNM) – Sesbania, Rice (1612) -wheat(PBW343) cropping systems obtained the low rank. The analysis of data about the different aspects related to IIFSR, Modipuram i.e. enhancement of knowledge about improved technology (25-30%) , attitude of officials, quality of experiments, arrangement of visit and usefulness of technology park revealed that majority (80 -95%) of the visitor had opinion of good to very good rating given to the all aspects. Only 8.33 percent visitors had expressed their opinion as something good.

On-Farm Integrated Farming Systems Management

On-farm trials on intercropping of maize for fodder in sugarcane

Fifty five farmers were selected randomly from Rasoolpur Jattan village of Shahpur block, Muzaffarnagar district for conducting on-farm trials (OFTs) on intercrop green gram variety SML-668 (Synchronized variety) with sugarcane during 2015-16. Two treatments were taken under each OFT and each treatment was laid on an area of 1000 sq. m. The comparison of improved practice (farmers' practice + intercrop of green gram) and farmers' practice (mono crop of sugarcane) was made. The results revealed that increase in yield of sugarcane of improved practice over the farmers' practice was 13.4%. It was also revealed that with an additional expenditure of Rs. 6000/- in form of seeds and other cultural practices, there was an increase in net return of Rs 17240/- per hectare in improved practice over the farmers' practice. Benefit cost ratio was higher 1.82 in improved practice as compared to 1.70 in farmers practice.

On-farm trials on intercropping of fodder Maize

Sixty farmers were selected randomly from Rasoolpur Jattan village of Shahpur block, Muzaffarnagar district for conducting on-farm trials (OFTs) on intercrop of maize (fodder) variety African tall with sugarcane during 2015-16. Two treatments were taken under each OFT and each treatment was laid on an area of 1000 sq. m. The comparison of improved practice (farmers' practice + intercrop of maize for fodder) and farmers' practice (sole sugarcane) was made. The results revealed that increase in yield under sugarcane of improved practice was 7.8%. over the farmers' practice Cost of cultivation of both improved practice and farmers' practice was worked out. It was also revealed that with an additional expenditure of Rs. 5000/- in form of seeds and other cultural practices, there was an increase in net return of Rs 8580/- per hectare in improved practice over the farmers' practice. As regards benefit cost ratio was 1.75 in improved practice as compared to 1.70 in farmers practice.

Demonstrations on recommended seed rate and use of quality seed in rice

Forty farmers were selected randomly from Rasoolpur Jattan village of Sahpur block, Muzaffarnagar district for conducting on-farm trials (OFTs) on recommended seed rate and quality ssed of rice varieties PB-1 and Pusa sugandha-1121 during 2015-16. Two treatments were taken under each OFT and each treatment was laid on an area of 1000 sq. m. The comparison of improved practice (recommended seed rate and quality seed) and farmers' practice was made. The results revealed that increase in yield of rice varieties PB-1 and Pusa sugandha-1121 under the improved practice over the farmers' practice was 4.2% and 5.4% respectively. Cost of cultivation of both improved practice and farmers' practice of rice was worked out. The results revealed that with an additional expenditure of Rs. 100/- made for purchase of improved seed, there was an increase in net return of Rs 4530/- per hectare in improved practice over the farmers' practice. Benefit cost ratio was 1.55 in improved practice as compared to 1.48 in farmers practice.

Diversification of existing farming systems through integration of poultry for improving livelihood of marginal and landless farmers

During the period of 350 nos. day old chicks of CARI Nirbheek and 1080 no. day old chicks of CARI Dhanraja were procured from Central Avian Research Institute, Izatnagar. 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 four villages viz. Rasoolpur Jatan and Chandpur villages of the Shahpur block and Manfoda and Majra Tsang (Naya gaon) villages of Jansath block of Muzaffar Nagar district. In each village 240 chicks of 4 weeks old CARI Dhanraja (100 chicks to 2 farmers and 20 chicks to 2 farmers) and 80 chicks of CARI Nirbheek (25 chicks to 2 farmers and 15 chicks to 2 farmers) distributed to the farmers. Therefore, a total of 1280 chicks distributed in the four villages.

Dsitricution of chicks in Muzaffaranagar

The mean body weights of CARI Dhanraja at 12 weeks of age were: 1.496 ± 0.013, 1.341± 0.010 and 1.421 ± 0.009 kg., respectively, for male, female and overall mean, whereas at corresponding weight in CARI Nirbheek were: 0.847 ± 0.010, 0.763 ± 0.009 and 0.804 ± 0.007 kg. at the farmers field. The mean body weights at 20 weeks of age were: 2.795 ± 0.040, 2.411 ± 0.017 and 2.503 ± 0.023 kg., respectively in male, female and overall mean in CARI Dhanraja, however the corresponding body weight in CARI Nirbheek at the farmer's field were: 1.633 ± 0.013, 1.497 ± 0.010 and 1.552 ± 0.10 kg., respectively. The higher body weights in CARI Dhanraja from CARI Nirbheek might be due to CARI Dhanraja being broiler variety continuously selected for higher body weight.

Coordination Unit

On-farm crop response to plant nutrients in rice-wheat cropping system (RWCS) and their impact on crop-livestock-human chain

The study aims to bring out a sufficiency and deficiency level of various nutrients in grain (human consumption) and straw (livestock consumption) with farmer nutrient management and improved management practices and to suggest a need based interventions for improving the deficiency level in both grains and straws. Under, AICRP on Integrated Farming Systems, study on nutrient response of crops and cropping systems is being undertaken at 32 locations in 21 states in farmer participatory mode. During the year, in order to find out the sufficiency and deficiency level in rice-wheat system, 3 districts (Jeolikote, Amritsar and Samba in Uttarakhand, Punjab and Jammu & Kashmir respectively) were selected. Macro and micro nutrient status in grains and residues of identified treatments were collected. Collection of blood plasma sample of animal (cow and buffalo) and its profiling from different OFR centers were done in collaboration with ICAR-Central Institute for Research on Cattle, Meerut. Comparison of the nutrients available in grain and straw in various treatments with the standard quality of rice and wheat grain and straw were carried out. The details of samples collected from centers are given below (Table 27).

Data received from the different centers on nutrient contents of grain and straw were compared for bringing out the nutrient sufficiency or deficiency (Table 28).

In case of grains for human consumption, it was found that nitrogen and phosphorus content in rice grain were deficient by 13 and 14 % respectively in farmers practice. However under improved practice of application of NPK + micronutrient, the deficiency of nitrogen in grains has been reduced to 9 % and phosphorus reaching to sufficiency level. In case of potassium, it was found that, deficiency in control while all other treatments recorded sufficiency. Zn was found to be in sufficient level in all the treatments. In case of wheat grain, farmer practice had deficient P and K while N and Zn were at sufficient level. Both, P and K reached

Table 27. No. of samples collected from different centres

OFR centre	Soil sample	Concentrate sample	Fodder sample	Roughage sample	Livestock blood sample (Cow + buffalo)
Jeolikote (Uttarakhand)	20	20	20	6	6 (4+2)
Amritasr (Punjab)	7	7	7	10	31 (16+15)
Samba (Jammu & Kashmir)	15	15	2	15	21 (11+10)
Total	42	42	29	31	58 (31+27)

Table 28. Status of nutrient in grain and straws at Kanpur (UP) centre

Kanpur (UP)	Nutrient element	Control	N+P+K	N+P+K+ Deficient micronutrient	Farmer practice	Standard level
Rice grain	N%	1.14	1.29	1.31	1.25	1.44
	P%	0.15	0.28	0.30	0.24	0.28
	K%	0.20	0.299	0.31	0.28	0.25
	Zn ppm	31.16	35.08	36.58	32	24.46
Wheat grain	N%	2.07	2.24	2.27	2.17	2.10
	P%	0.27	0.40	0.41	0.34	0.39
	K%	0.31	0.46	0.48	0.36	0.50
	Zn ppm	38.29	45.25	46.5	41.04	40.00
Rice Straw	N%	0.28	0.44	0.45	0.38	0.49
	P%	0.04	0.08	0.09	0.05	0.08
	K%	1.23	1.31	1.33	1.23	1.20
	Zn ppm	19.42	35.08	36.6	19.9	18.8
Wheat Straw	N%	0.30	0.46	0.48	0.39	0.48
	P%	0.04	0.09	0.10	0.06	0.10
	K%	1.29	1.41	1.43	1.33	1.52
	Zn ppm	17.65	26.40	27.40	20.80	28.00

Collection of blood samples for analysis from Jeolikote (Uttarakhand) to sufficiency level with improved nutrient application of NPK + micro nutrient. Similar trend was also observed in straw of both the crops indicating, whatever feeding sources available at farmer field are not sufficient to full fill the phosphorus requirement of animal and maintain their productivity level and if farmer not applying balanced fertilizer to their soil, it will further widen the gap between daily requirement and availability for livestock. The study conclusively reveals that supplementation of area and nutrient specific mineral mixture for livestock is essential.

Exploratory study

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

Some non-traditional but high value fruit crops were studied to see their performance under western UP conditions and to explore the possibility of including above crops in Integrated Farming System. The crops were, low chilling apple (*Malus domestica*) Cv. Anna, Dorsett Golden and Michel, two types of Dragon fruit (*Hylocereus undatus*) Red fleshed and white fleshed, Apple Ber and Seedless Jamun (*Syzygium cumini*) and Valencia orange, Khasi mandarin, and Assam Lemon. All the crops are growing well under field conditions.

Fruit setting stage

Flowering in apple

Fruit development stage

Low chilling Apple - In order to identify some non-traditional and high value fruit crops for integration in farming systems, we introduced Low chilling apple Cv Anna, which produced good vegetative growth under Meerut conditions and it attained the height of 1.80 m and canopy spread of 1.35 m during February 2015 (at the age of 11 months).

Colour development stage

These plants started flowering from 18th February and continued up to end of March 2015. Floral biology was studied and fruit set was reported under Meerut conditions (Table 29 and 30). Since there was no availability of pollen grain of any other apple variety in region, and fruit set was reported therefore we inferred that "Anna" is a self-fruitful variety. Fruit development continued during warm climate of western plains of UP. (Max. temp 45.5 ^{o}C during June 2015). The first bud, which emerged on 18th February 2015 turned in to mature fruit of apple on 10th June 2015 and last bud which was noticed on 20th March 2015, turned in to mature fruit on 10th July 2015. It showed that from flower bud emergence to fruit maturity and harvest, it takes 112 days under western plain zones of UP and fruit availability period ranged from first fortnight of June to first fortnight of July. Fruit dimensions were 2.5 inch diameter, 2.4

Table 29. Time of emergence of flower and fruit set relationship

Time of bud emergence (Feb- March)	Number of flowers opened (March - April 2015)	Number of fruit set (April 2015)	Fruit set retention (June 2015)
20-28 Febrary 2015	19	08	2
1-7 March	24	11	1
8-14 March	28	09	-
15-21 March	17	08	2
22-28 March	06	01	-
Total	**94**	**37**	**5**

Table 30. Description of floral morphology of apple Cv. Anna under western Uttar Pradesh conditions

Character	Range
Breeding type	Bisexual
Flower type	Perfect,
Flower colour, Bud Colour	Pinkish white, Pink
Inflorescence	Terminal and axillary cymose cluster
Number of flowers per bunch	5-6
Flower diameter (mm)	30-45
Length of stamen (mm)	22-31
Number of stamens	19-32

Character	Range
Anther size (mm)	1.0
Pollen shape	Ellipsoidal and circular
Pollen size (µm)	35
Pollen viability (%)	73.0
Length of style (mm)	18-22
Width of gyonecium (mm)	2-3
Number of ovaries and one stigma	Five, each with two ovules
Pollinators	Bees, Black wasp (*Sphex pensylvanicus*)

inch length, fruit weight 82 gram. Total soluble solids (TSS) was observed 17.0 ^{0}B. No insect or disease was observed during fruits development period.

Insect dynamics were studied and given in Table 31, 32 and 33. After fruit maturity and harvesting, plant again started vegetative growth and attained the height of 2.7 m and canopy spread of 1.8 m during December 2015., In order to evaluate some other low chilling apple varieties and keep provision of pollinizer variety for better fruit set in apple, we planted 5 plants of low chilling Cv Dorsett Golden and 10 plants of Cv Michel on 9th January 2016 at our experimental plot. At time of planting, average height of Dorsett Golden and Michel plants were 110.74 m and 112.4 m respectively. Survival percentage of all new plants is 100 per cent. Among these varieties, Dorset Golden sprouted first and produced the flower buds. It produced pink bud stage on 14th February 2016. Other variety, Michel showed delayed sprouting and they sprouted on 24th February 2016. SPAD value of old leaves of "Anna" who retained after leaf fall and one weak old young leaves of "Dorsett Golden" were recorded and it was reported as 56.26 and 49.19 respectively.

Table 31. Insect dynamics in apple under western Uttar Pradesh conditions

S. No.	Pollinaors	Duration of visit
1	Honey bee	24 February 2015 to 2 April 2015
2	Black wasp	28 February 2015 to first week of April 2015
3	Hover fly	24 February 2015 to first week of April 2015
4	House fly	Last February 2015 to March 2015

Table 32. Other beneficial insects identified on apple during flowering period

S. No.	Beneficial	Duration of visit insects
1	Lady bird beetle	Flowering time (28 February to first week of April)
2	Black ant-	Flowering time (28 February to mid April)

Table 33. Non beneficial insects noticed on apple tree during the year

S. No.	Pollinaors	Duration of visit
1	Leaf eating insect, hairy caterpillar	14-24 August 2015
2	Mealy bug	20 March 2015 to 12 April 2015

Apple Ber - Ber (*Ziziphus mauritiana* L.) is considered as a multipurpose tree due to its nutritious fruits, seeds, fodder, timber, medicines and industrial components in it. Leaves of ber are recommended as fodder for animals and pruned wood as fuel wood. It is a hardy tree species because it has a very strong tap root system which helps in withstanding high temperature and water stress during the summers. All above characteristics of this crop suggests its suitability for integration in IFS. Numbers of varieties of Ber are commercially grown in different part of country with small to medium fruit size.

One year old Apple ber plant in full bearing

Apple Ber or Taiwan Apple is a new introduced variety of ber which is spreading very fast due to its high production potential, bigger sized fruits and better shelf life. In order to test feasibility of this variety in western plains of Uttar Pradesh, planting of this variety was done at ICAR-IIFSR experimental plot. After one year of growth, the height of plant was recorded as 1.90 m with canopy spread of 1.81 m. Trunk circumference at the height of 10 cm, from ground was 14.0 cms and plant produced 2 primary branches and 14 secondary branches, no disease was observed on this variety while other varieties such as Gola, Seb and Umran which were grown under similar conditions were severely infested by powdery mildew 20 days after fruit set. Few leaves (15 - 20 %) of this variety were damaged by **Leaf webber (*Synclera univocolis* Walker)** during July – August months which was under control.

At the age of one year, all the secondary branches came in bloom. Flowering started from last week of August and continued up to September, it prolonged for about 40 days. From this much canopy spread, 343 number of fruits were recorded which shows production potential of this variety. Few fruits attained exceptionally bigger size and weight of 82.0 gram but average fruit weight was recorded 55.45 grams with TSS of 15.5 ^{0} Brix. The pulp stone ratio was also very high with 92.82 percentage of pulp and only 7.18 percentages of stone. Fruits developed and attained marketable size and quality during last week of December and continued up to end of February.

Individual fruit of Apple ber

This variety of ber produced 18.87 kg fruit at the age of 18 months and proved its high production potential. In order to maintain its productivity in long term, nutrient management practices based on nutrient removal studies through fruit and pruned wood are under taken. Storage of fruits at room temperature showed that Physiological loss in weight (PLW) was very slow and it reached 8.84 % after 8th day of storage SPAD values of leaves were recorded at full bearing stage and it was found in the range of 42.0 to 55.3 with average value of 47.16.

The thorn less canopy, precociousness, freedom from major pests and diseases, attractive bigger appearance of fruits, and a pleasant flavour of fruits during consumption make it more acceptable than existing varieties. The first year data of this variety is very much encouraging which needs further investigation.

Dragon Fruit – Dragon fruit is a perennial climbing vine cactus. Cuttings of Dragon fruit (red fleshed and white fleshed) were planted during August 2014 and are growing under open field conditions, both type of cuttings developed fleshy and many branched segments. Each segment has three wavy ribs with corneous margins with spines. These are trained on cemented pole. Aerial roots are developing and plants are creeping on pole Plants growth is satisfactory. All plants passed the severe low temperature of western plain zones of UP without any mortality.

Jamun plants of seedless variety are growing well and are under vegetative phase. Jamun plants have attained the height of 150 cm and canopy spread of 148 cm at the age of 18 months. Similarly plants of Khasi mandarin, Valencia orange and Assam lemon are growing well under field conditions.

Success Story

Family Flower Farming system: A money spinner

Mrs L. Velumani, the farm women because of her son who has desire for profitable farming took the highest risk of complete diversification. After the sudden demise of her husband, she became the family head and took to full time farming. Though she worked in farm, direct involvement in decision making was not there earlier. Her son and daughter in law started giving a helping hand in farming as a full timer. On-Farm Research (OFR) programme under AICRP-IFS located at Regional Research Station, Paiyur (Tamil Nadu) under Tamil Nadu Agricultural University selected Mrs L. Velumani having 1.14 ha in Baisuhalli village in Karimanagalam block of Dharmapuri district in Tamil Nadu for the experiment of "On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers". The predominant farming system practiced by her was field crops+ dairy. Due to water scarcity, she grew mainly green gram, groundnut and fodder sorghum. With the available water, she had crops over an area of 1.08 ha and 3 HF cows. She realized a net income of only Rs.55, 208 with the investment of Rs.51892 during the bench mark year (2011-12).

Mrs L. Velumani in the flower field

Through OFR team, her family laid drip irrigation system in 0.70 ha with the help of National Horticulture Mission subsidy of Rs.60, 000 so as to use the available water judiciously. The tuber rose variety 'Prajwal' from ICAR-IIHR was recommended and from sourcing of tubers, planting and maintenance, the family adopted the AICRP on IFS team recommendations. All three

Family maintained tube rose crop

Weeding by daughter in law of Mrs L. Velumani members of family involved in forming broad beds and furrows, planting, weeding, earthing up, pest management and plucking. Early morning all the three were there in the field for doing regular field operations and plucking flowers. By 7.00 am, Mr. Suresh, her son drops the fresh flowers to the local transporters to deliver the flowers at Bangalore before 9.30 am. Around 6144 kg of tuberose flowers were harvested in a 7 month period earning Rs.1, 57,694 as the net income. She also raised cowpea (Co 6) in an area of 0.20 ha and received a net return of Rs.8583. She also planted fodder grass in 0.04 ha with $CNCO_4$ to feed her animals. From dairy, she got Rs. 24105 as net return. In total, interventions made in farming systems perspective resulted in additional net return of Rs 1, 35,174 $year^{-1}$ which is 2.5 times higher than the benchmark income.

Externally Funded Projects

Integrated farming system model for marginal farm holders of western plain zone of U.P. – AICRP-IFS project

Scientific management of existing farming system and subsequent diversification with integration of complementary/supplementary farm enterprises like Agri- horti system with early fruiting tree species mandarin Kinnow & Banana etc and low cost & cost effective enterprises requiring less land area and also limited external inputs such as mushroom, vermicomposting, biogass etc. ensure household food security, improve nutritional status alongwith income enhancement and bring stability in production and profits under small farm conditions. Intermittent use of farm products and by products, on-farm recycling of all the farm wastes, crop residues, cowdung, multiple use of resources and scientific management of land, water and other farm resources make farming more profitable and sustainable through reduced cost and less use of chemicals. More employment rather than existing one is also beauty of the farming system approach.

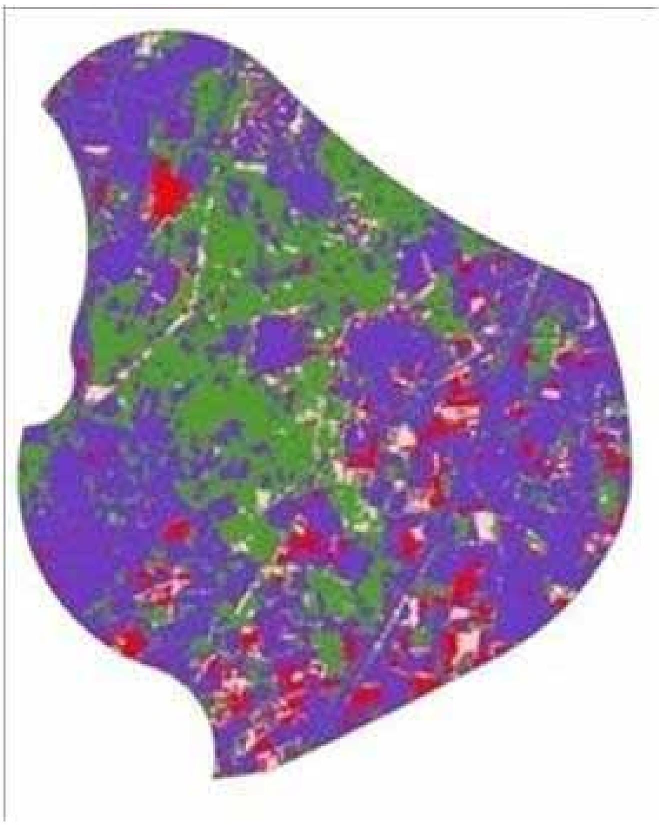
In an irrigated cultivated field area of 0.70 hectare, prevailing farming system Crop +Dairy (opted by more than 84% of the total farm families) was diversified with integration of i) fruit crops (0.30ha) having Mandarin kinnow and Banana var.G-9 under Agro – horti system, ii) round the year production of mushroom , value addition in cowdung by scientific composting and vermicomposting (0.01ha), biogas unit of one cubic meter and backyard poultry with 15 birds alongwith boundary plantations of guava and karonda. Initial four years results (2011-12 to 2014-15) revealed that a small area of 3800 sq.m. is sufficient to meet the household annual food, fuel and fodders demand of a six member family and their animals and rest of the farm area can be utilized for growing/raising high value crops/enterprises. In fourth year (2014-15) of the study total farm production (REY) was 36.26 tha^{-1} with gross and net returns of Rs.5, 58,380 and Rs.2, 67,447, respectively.

Net returns were three times higher than prevailing system (Rs.68, 000). The percent contribution in gross and net returns of different farm enterprises crops, dairy, horticulture and others was 23%,28%,39%,10% and 25%, 2.3%, 61%,11% respectively. Less contribution from dairy was because of casualty in animals and higher profits in horticulture because of significantly higher yield and net returns from Kinnow& Banana plantations under Agri-hortisystem.The total cost of production of different farm components/enterprises under IFS approach was Rs. 2, 90, 933. Out of total cost of production farmer has to invest only 42.56% as market inputs and rest of the expenditure was met from farm inputs (farm labour 24.62% & recycled inputs 32.82%) , thus economizing the production cost to a great extent . Considering plant nutrient as a major input, about 336 kg of NPK in available form could be added in to soil and a sum of rupees eleven thousand two hundred sixty three (Rs.11263 $year^{-1}$) was saved which otherwise to be spent on chemical fertilizers could be saved. Diversification also provided more employment opportunity 358 man days as compared to 215 Man Days in prevailing system of farming.

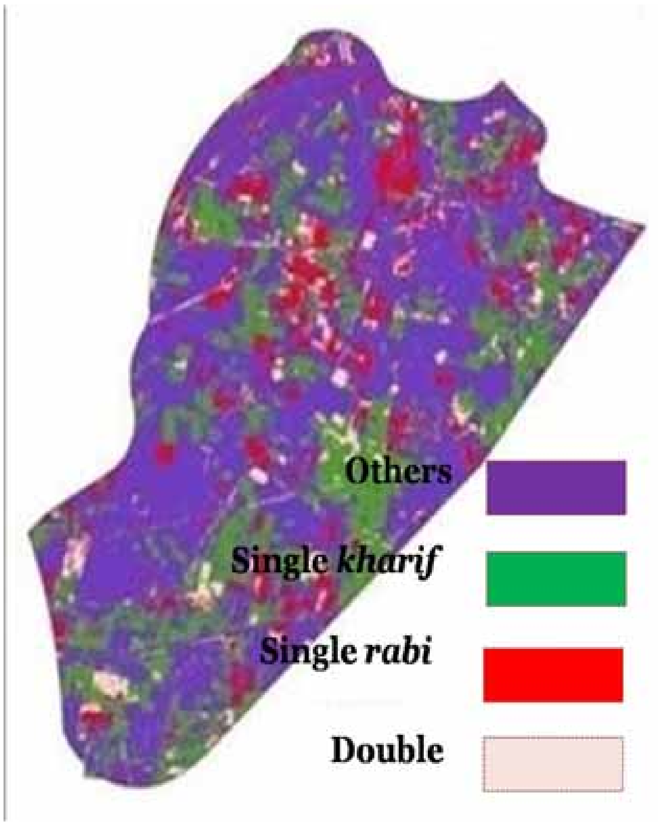
Integrated spatial farming systems analysis techniques with remote sensing and ancillary data (INFARM)

The study visualizes mapping the farming systems of India using primary, secondary, spatial and other ancillary data and identifying the ideal or alternate efficient farming system at village level using remote sensing data along with other thematic and socio-economic information in a GIS environment. The major objectives include delineation of major farming systems of India using remote sensing and ancillary data, characterization of resource base of identified farming systems and evaluation and designing alternate/ideal farming system at village level. The selected districts for study are Mehsana (Gujarat), Kendrapara (Odisha), Dharmpuri/ Krishnagiri (Tamil Nadu), Udaipur (Rajasthan), Pune and Amravati (Maharashtra), 24 Pargnas (West Bengal), Kanpur Dehat (Uttar Pradesh) and Pathinamthitta (Kerala).

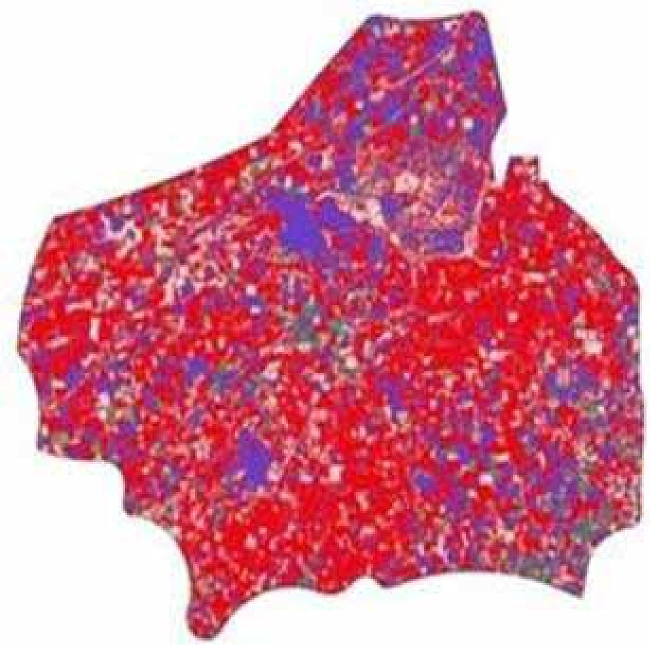
Using the primary data collected from benchmark information of on-farm research farm households, existing farming systems for each of the identified district has been prepared with basic details of farm and family size, contribution of components to income and total gross returns. Component wise datasets of existing farming systems have been compiled for 8 blocks falling in various states *viz,* Gujarat, Uttar Pradesh, Maharashtra, Odisha, West Bengal and Karnataka. Polynomial interpolation and maximum likely hood image classification have been performed to develop land utilization index (LUI), biophysical index and most beneficial farm enterprises index for characterization of existing farming system in the study area. Agricultural intensity classification of villages in Udaipur district in Rajasthan is presented in Fig. 31 (a,b,c,d).



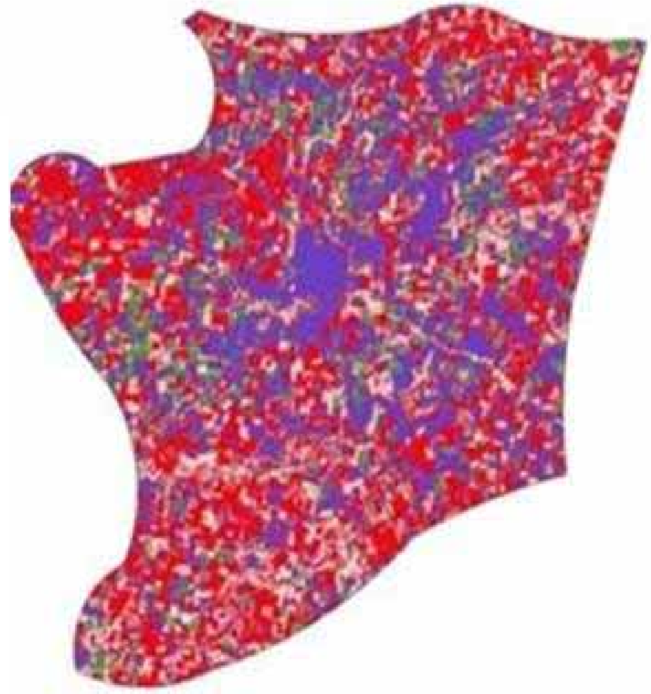
(a) Ambilyara village



(b) Borisana village



(c) Ganeshpora village



(d) Ravapora

Fig. 31. Classification of agricultural intensity in villages of Udaipur district using spatial and ancillary data

Integrated organic farming systems project (consultancy mode with UCOB)

Keeping in view of typical topography, low land holding, less scope of modern agriculture, low pesticides consumption and best options for organic agriculture, Uttarakhand Organic Commodity Board was established as a nodal agency for promotion of organic farming in the state. The agency is facilitating the farmers by certification, marketing and technical support. Uttarakhand Organic Commodity Board also set up a separate Research and Development Cell in the year 2013 at State Training and Research Center for Organic Farming, Majkhali. The cell is collaborated by ICAR-Indian Institute of Farming System Research (IIFSR) Modipurum, Meerut. The main objectives of the R&D Cell is to develop the Integrated Organic Farming System (IOFS) model for Mid hill organic farmers with the adoption of indigenous technical knowledge, maximum uses of on farm inputs, local strains of bio agents and best composting methods. Majkhali is situated at 1620 m above MSL. IOFS model is being developed in 0.74 ha area. The amount of annual average rainfall in this region is between 1240.2 mm and snowfall of 67.5 mm also occurs. The average humidity and sunshine of this area are 66.0 % and 6.7 h/day, respectively.

The technical programme was prepared by ICAR-IIFSR for implementation by UOCB, Dehradun. All the field experiments and farming system component were carried out at the State Training and Research Center for organic farming, Majkhali. The Integrated Organic Farming System model occupied 0.74ha and it comprises of crops (0.50 ha), dairy (0.01 ha), kitchen

Soybean

Amaranthus

Finger millet

Kidney bean

French bean

Horsegram

Apiary

Mushroom

Kuroiler

Glimpses of Integrated Organic Farming System Model at Uttarakhand

garden (0.005 ha), mushroom production (0.005), fishery (0.01 ha), Dairy (0.01), Poultry (0.005), and miscellaneous (0.065) which was used for animal shed, threshing floor , composting unit (Vermi, CPP compost, Agnihotra, Pancha-gavya, Amrit-pani, NADEP, BD composting etc.) and stores. Crop component comprised of 9 cropping systems namely finger millet -vegetable pea -greenmanure (Dhaincha), barnyard millet-lentil -greenmanure (Dhaincha), amaranthus-field pea – cucurbits, maize (dual purpose) -green leafy Vegetable, kidney bean –wheat, lobia (cow pea) -coriander -green manure, chilli-wheat, cabbage -mustard -green manure and soya bean -mustard –cucurbits to meet the household demand of cereals, pulses, oilseeds, vegetables etc. Further, Organic bee keeping unit (Apis cerana indica sp.) component of IOFS has been successfully installed. The foraging ranged between 0.8 and 1.0 km. Flowers of large number of plants species are visited by honey bees for nectar and pollen. In this farm area major sources of pollen and nectar are maize, vegetable flowers, rajma, cucurbits etc. Bee hives management against bee enemies (Wax moth larvae, Ant etc.) with the help of cow urine and some botanicals has been done. Recognising the crucial role that low cost beekeeping could play in increasing agricultural yields for the small and landless farmer. Initially 2 kg of honey was produced. Besides apiary, organic horticulture (25 each of Lemon, Malta and Oranges), organic mushroom, organic kitchen garden (French bean, Okra, Cucurbits, Chilli, Cabbage and Radish), organic poultry (20 numbers of kuroiler) and organic floriculture unit also established. The experiments are in progress and continuously monitored for various parameters.

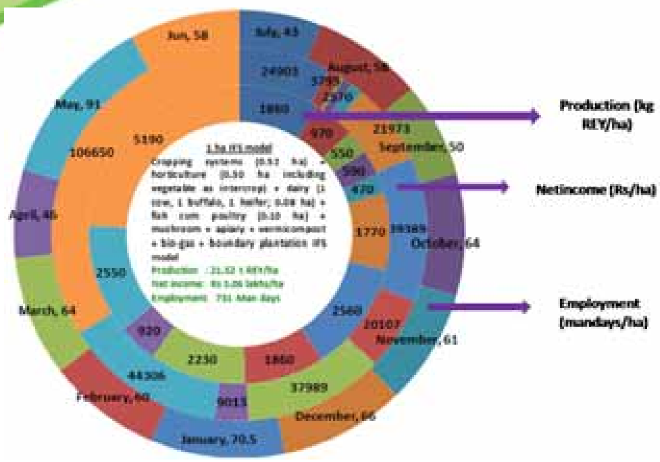
AICRP on Integrated Farming Systems

AICRP on Integrated Farming Systems is a plan scheme carried out in partnership mode with SAU's and ICAR institutes covering 23 states and 2 Union territories. The scheme involves on-station (25 main centers, 12 sub centers, 6 voluntary centers) and on-farm (32 on-farm centers) research. During 2015-16, eight experiments namely Development of region specific on-station IFS research models for small and marginal farmers (32 locations), Identification of need-based cropping systems for different agro-ecosystems (37 locations), Development of organic farming package in system-based high value crops (8 locations) and Permanent plot experiment on integrated nutrient management in cereal-based cropping systems (13 locations) were undertaken at on-station while three on-farm experiments namely On-farm crop response to plant nutrients in pre-dominant cropping systems and their impact on crop-livestock-human chain (32 locations), Diversification of existing farming systems under marginal household conditions (32 locations) and On-Farm Evaluation of Farming System Modules for improving profitability and livelihood of small and marginal farmers (32 locations) were undertaken besides FLD's on cropping systems involving oilseeds (88 no's) and On-Farm participatory research in tribal farming systems through Cluster approach (13 locations) were conducted in the scheme.

Region specific evaluation of farming system models are under evaluation for small/ marginal farmers, assuming a family size of 5-7 members. Farm size has been kept at1.00-1.50 and 0.4 ha, for small and marginal farmers, respectively. Field crops (need-based 3-4 diversified cropping systems), horticulture crops (orchard units/ boundary plantation), dairy animals (cow/ buffalo) are common and form major component at majority of the centers. Other region-specific components integrated are; fish culture (17 centers), poultry (13 centers), apiary (4 centers), goat, (9 centers), pigs (2 centers), mushroom (6 centers) and agro-forestry (3 centers). Effective recycling of farm wastes was done through secondary components of vermi-composting, biogas unit etc. Net income after 3 years (Rs. $year^{-1}$) was found to be Rs. > 3 lakhs/ha at 3 locations, between Rs. 2.5-3.0 lakhs at 1 location and Rs. 2.0-2.5 lakhs in 5 locations.

Integrated Farming System model for round the year production, profit, profession and nutrition

One ha integrated Farming System (IFS) model comprising of cropping systems (rice-wheat-greengram, rice-potato-blackgram, rice-mustard-greengram and berseem+oat-maize+sorghum with hybrid napier on bund) in 0.52 ha + horticulture (Guava as main crop, Lemon and mango (Amarpali) as boundry crop and brocolii, Knol Khol, Cabbage, Cauliflower, Radish, okra as intercrops) in 0.32 ha + dairy (1 cow, 1 buffalo, 1 heifer) including bio-gas and vermicompost unit in 0.08 ha + fish cum poultry in 0.1 ha) + mushroom (dhingri & button) developed for the mid to high altitude plain zone (JK-1) in Western Himalayas provides round the year production (21.52 t REY $year^{-1}$), profit (Rs. 3.06 lakhs $year^{-1}$) and employment (731 man days $year^{-1}$). The maximum production and profit was realized in June (Fig. 32) while employment was in May month signifying the work even during lean period. The model also meets around 85 % of inputs required for different enterprises within the farm besides providing all the commodities (cereals, pulses, oilseeds, vegetables, fruits, mushroom, milk, egg, and fish) required for the farm family (Fig. 33).



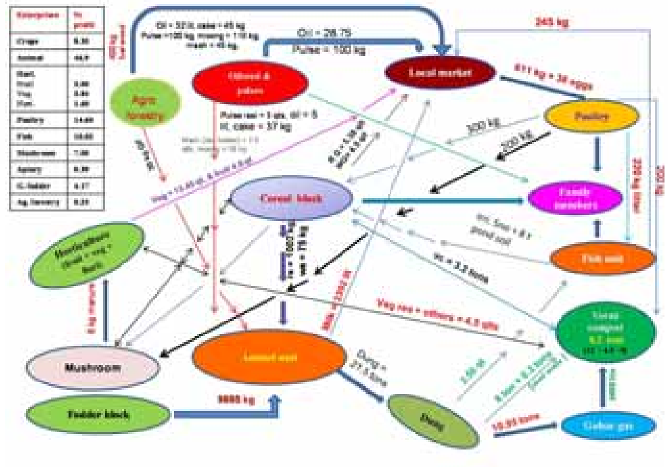


Fig. 32. Integrated Farming System model for round the year production (kg REY/ha), profit (Rs./ha) and employment (man days/ha) of the farm family at Jammu (Jammu and Kashmir)

Fig. 33. Recycling of inputs and output in the IFS model developed at Jammu (Jammu & Kashmir)

Salient findings from other experiments

In the need based cropping systems experiment, alternative systems identified to rice-wheat promises 22 (rice-onion-green gram at Jabalpur) to 241 % (rice-brocoli-black gram at Jammu) increase in net monetary returns. Alternative systems to rice-rice promises 6 (rice-maize at Rudrur) to 180 % (rice-maize-green gram at Siruguppa) increase in net returns. Soybean-maize (Rajendranagar) and maize + asparagas bean-radish-onion (Palampur) recorded 88 & 159 % increase in net returns over maize-wheat. Substitution of 25-50% N with FYM or green manure in rice-wheat system was found to increase the productivity by 4%, which is estimated to save chemical fertilizers worth Rs. 7.0 crores. It also helped in increase of soil organic carbon by 55.9%. In rice-rice system, green manuring increased the yield by 3.6%. The similar trend was observed in other predominant cropping systems in various agro-ecological zones.Under organic farming experiment, sustainable yield index of rice based system was > 0.7 under organic management at Kalyani, Chiplima, Maruteru, Navsari and Bhubaneswar during kharif; > 0.8 at Chiplima and Bhubaneswar during rabi and > 0.7 at Jorhat, Chiplima, Sabour, Kalyani, Navsari and Bhubaneswar during summer. Increase in crop yields under organic treatments over conventional chemical farming ranged from 2.3% (recommended N through organic manures; FYM + VC + NEOC +inter/trap cropping) to 62.3% (recommended N through FYM, VC & NEOC + Azatobacter/Phosphobacteria).On-farm nutrient management study revealed that application of micronutrients based on soil test resulted in additional yield of 812, 530 & 325 kg ha^{-1} in rice – rice, rice-wheat and maize- wheat systems respectively. On-farm diversification of existing cropping systems, livestock and product resulted in improvement of production (24 %), marketable surplus (55 %) and net income (29 %) to the households in the first year of interventions. In the holistic improvement of on-farm farming system experiment, the total cost of interventions across the systems and regions in 3 years were found to be Rs 22594 (Rs 7774 in first year, Rs 8280 in second year and Rs 6540 in third year) which resulted in additional return of Rs 96718 (4.2 times increase).

Network Project on Organic Farming

Network Project on Organic Farming (NPOF) is a plan scheme carried out in partnership mode with SAU's and ICAR institutes covering 16 states. The scheme involves 20 centres. During 2015-16, experiments/on-farm study Evaluation of organic, inorganic and integrated production systems (All 20 locations), evaluation of response of different varieties of major crops for organic farming (All 20 locations), evaluation of bio-intensive complimentary cropping systems under organic production systems (Pantnagar, Dharwad and Umiam), development of Integrated Organic Farming System models (Coimbatore, Umiam, Calicut, Dharwad, Almora, Thiruvananthapuram, Udaipur, SK Nagar), evaluation of Farm waste recycling techniques for organic farming (Modipuram, Dharwad, Almora), cluster based demonstration of Organic Farming Package under TSP (Umiam and Dharwad) and geo-referenced characterization of organic clusters (all 20 locations) were carried out.

Identification of niche areas for organic farming

Scientific organic farming practices needs to be promoted in the niche areas for increasing the production in the default organic areas where in fertilizer and pesticide usage are less. There are many states where nutrient and pesticide consumption are much lesser than national average (128.7 kg ha^{-1} and 0.30 kg a.i. ha^{-1} respectively). The states have been grouped in to nine categories based on consumption of nutrients and pesticides (Fig. 34). Arunachal Pradesh, Nagaland, Meghalaya, Mizorum, Assam, Rajasthan, Madhya Pradesh, Odisha, Bihar, Jharkhand, Gujarat, Karnataka, Himachal Pradesh, Jammu & Kashmir and Uttarakhand are very much suitable for promotion of organic farming based on its usage of inputs. Further, towards organic approach having non-pesticide but with chemical fertilizers can be promoted in Tamil Nadu, Kerala, Andhra Pradesh, West Bengal, Uttar Pradesh, Punjab and Haryana states. Package of practices for organic production of crops in cropping systems perspective has been developed for 42 cropping systems suitable to 12 states under Network Project on Organic Farming.

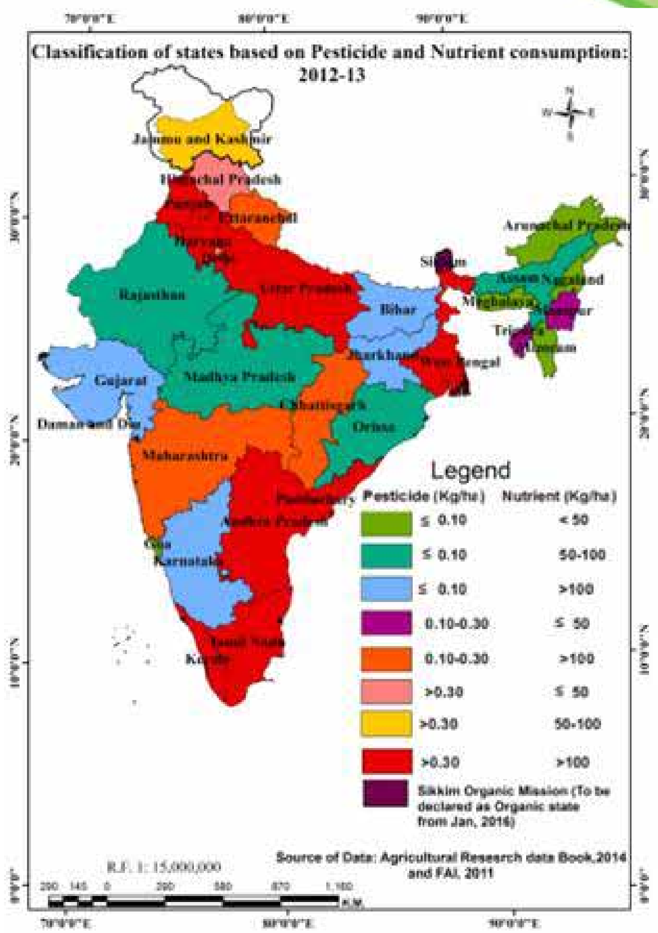


Fig. 34. Classification of states based nutrient (kg/ha) and pesticide consumption (kg a.i./ha)

One acre integrated organic farming system model

Integrated organic farming system model consisting of cropping systems in 0.34 ha + dairy (2 cows, 1 calf) + vermicompost + boundary plantation was developed in 0.43 ha at Coimbatore for western zone of Southern Plateau and Hills region. The cropping systems consists of okra + coriander (leaf)-maize + cowpea (fodder) in 0.12 ha, green manure (sunhemp)-cotton-fodder sorghum in 0.12 ha and Cumbu napier fodder & *Desmanthus sp* in 0.1 ha. In the boundary, desmanthus, *Gliricidia* and banana were grown. The integrated organic farming system approach resulted in net return of Rs. 74,316 $acre^{-1}$ with B:C ratio of 1.80. The contribution of cropping systems and livestock to net return was found to be 87 & 11 % respectively. The system also generates 84 % of the organic inputs required for one acre integrated organic farming system model.

Integrated organic Farming system model at Coimbatore

Carbon sequestration study

Assessment of soil C sequestration potential was made after 10 years of continuous organic cultivation of different crops at HAREC, CSK HPKVV, Bajaura (Himachal Pradesh) under Network Project on Organic Farming in collaboration with NICRA programme. Averaged across different cropping systems, Walkley-Black C stock at 0 – 60 cm soil depth was found 66.3, 51.7 and 40.7 t ha^{-1} under organic, integrated and chemical management of soil nutrients, respectively. Under the organic system, this buildup of Walkley-Black C stock was higher by 28.2 and 63.1 per cent than to integrated and chemical application of nutrients, respectively. Further, Walkley – Black soil C sequestration rate in 0 – 60 cm soil depth under organic cultivation of crops was 1.46 and 2.57 t ha^{-1} yr^{-1} as compared to integrated and chemical application of soil nutrients, respectively. This study explicitly shows that continuous practice of raising the crops organically has good potential to sequester the C in the soil to offset the C emissions in the atmosphere.

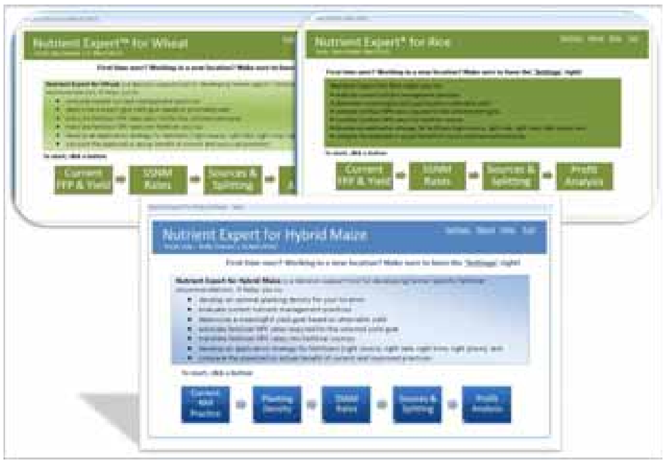
On-Farm Precision Nutrient Prescription under Pre-dominant Cereal-Cereal System using Nutrient Expert®

Cereal-cereal systems of India in under stress and nutrient as removals for exceeds than the replacement through fertilizers. Inadequate and unbalanced fertilizer application to these systems not only reduces farm profits but also led to multi-nutrient deficiency in soil and other environmental hazards. Some scattered studies conducted in India indicated that site-specific nutrient management (SSNM) for a particular cropping system may have a vital role on improving yield and profits. In order to wider applicability of SSNM, computer based decision support tools- Nutrient Expert® (rice, wheat and maize) which is based on SSNM principal was evaluated under rice-wheat system (RWS) at 05 locations, rice-rice system (RRS) at 04 locations, rice-maize (RMS) at 01 location and maize-wheat system (MWS) at 03 locations of All India Coordinate Research Project on Integrated Farming System (AICRP-IFS) spread over 11 states of India.

At each location 10 on-farm trials were initiated during monsoon 2014. Results reveals that on average, farmers apply 64 to 230 kg N ha^{-1}, 46 to 69 kg P_2O_5 ha^{-1} and 0 to 45 kg K_2O ha^{-1} to rice crop under RWS, 9 to 195 kg N ha^{-1}, 45 to 58 kg P_2O_5 ha^{-1} and 0-75 kg K_2O ha^{-1} monsoon rice under RRS, 73 to 138 kg N ha^{-1}, 29 to 58 kg P_2O_5 ha^{-1} and 19 to 90 kg K_2O ha^{-1} to rice under RMS and 28 to 189 kg N ha^{-1}, 0-115 kg P_2O_5 ha^{-1} and 0-75 kg K_2O ha^{-1} to maize under MWS depending upon the cultivars grown at different locations. Using Nutrient Expert prescription economized fertilizer use ranging from 30 to 89 kg N ha^{-1}, 9 to 49 kg P_2O_5 ha^{-1} in rice under RWS, 29 to 77 kg N ha^{-1} and 16 to 30 kg P_2O_5 ha^{-1} in RRS, 26 kg P_2O_5 ha^{-1} in rice under RMS, 14 kg N ha^{-1} in maize under MWS at various location over farmer fertilizer practice (FFP). Whereas, Nutrient Expert prescribed additional K use ranging from 14 to 72 kg K_2O ha^{-1} to rice and maize crop in different cropping systems at various locations. With Nutrient Expert prescription grain yield of rice ranged between

Table 34. Productivity of different component crops of the system evaluated for various nutrient management options

AICRP-IFS center	Grain yield (t ha^{-1})					
	Rice-wheat system					
	NE		SR		FFP	
	Rice-wheat system					
	Rice	Wheat	Rice	Wheat	Rice	Wheat
Modipuram	4.7	4.8	4.4	4.27	4.1	4.12
Jeolikote	5.6	5	5.2	4.8	4.4	4.6
Amritsar	7.2	3.55	7.1	3.45	7.3	3.42
Kanpur Dehat	5.8	3.37	5.1	2.91	4.6	2.5
	Rice-rice system					
	Rice (*kharif*)	Rice (*rabi*)	Rice (*kharif*)	Rice (*rabi*)	Rice (*kharif*)	Rice (*rabi*)
Thiruvalla	8.2	7.4	7.0	6.6	6.2	6
Seethampeta	3.8	3.40	3.6	3.13	3.2	2.97
Warangal	4	6.2	3.5	6	3.8	5.7
Chettinand	3.93	4.51	3.9	4.45	3.9	4.02
	Maize-wheat system					
	Maize	Wheat	Maize	Wheat	Maize	Wheat
Udaipur	3.2	4.0	3.0	3.8	1.05	2.5
Kangra	4.4	3.67	3.6	3.3	1.8	1.9
Jammu	2.9	2.87	2.8	2.79	2.2	2.24
	Rice based other cropping system					
Purnia	Rice	Maize	Rice	Maize	Rice	Maize
	4.6	8.5	4.2	7.4	3.7	6.5
Kawardha	Rice	Chickpea	Rice	Chickpea	Rice	Chickpea
	2.0	1.63	1.9	1.56	1.8	1.4



Screen shot of Nutrinet expert® software for nutrient management

4.24 to 5.77 t ha^{-1} in RWS and 5.19 to 8.17 t ha^{-1} in RRS which was 14 to 45% higher as compared to FFP. Similar yield gain in maize was to the tune of 153 to 217% over FFP (Table 34).

Strengthening simulation approaches for understanding, projecting and managing climate risks in stress-prone environments across the Central and Eastern Indo-Gangetic basin

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

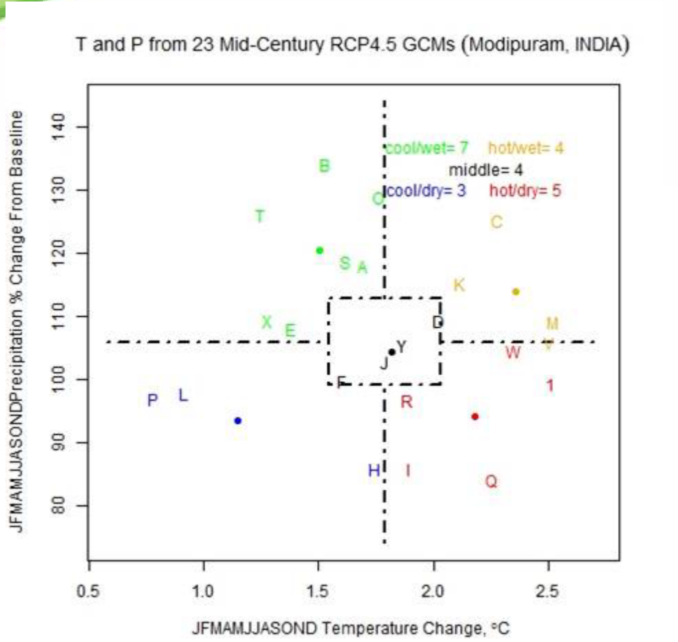


Fig. 35 (a). Models Selected: C,T,P,Q,A

(BNU-ESM, MIROC5, MIROC-ESM, MPI-ESM-LR, ACCESS1-0)

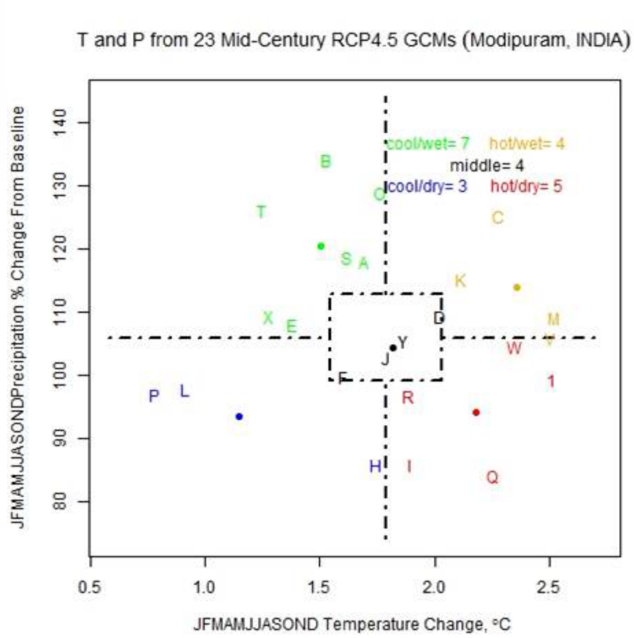


Fig. 35 (b). Models Selected: C,T,P,Q,A

(BNU-ESM, MIROC5, MIROC-ESM, MPI-ESM-LR, ACCESS1-0)

Table 35. Comparison of projected mean maximum and minimum temperature and change in rainfall (%) during 2014-2069 under RCP4.5 & RCP8.5 pertaining to different GCMs during annual, rice and wheat seasons.

GCMs and RCPs	Type	Mean Maximum temperature (°C)			Mean Minimum temperature (°C)			Change in rainfall compared to baseline (%)		
		Rice	Wheat	Annual	Rice	Wheat	Annual	Rice	Wheat	Annual
Baseline		34.8	26.1	31.1	23.6	10.9	17.4	——	——	——
RCP-4.5 : IPSL-CM5A-LR	hot/wet	37.1	28.8	33.6	26.2	13.2	19.8	10.8	3.8	8.3
RCP-4.5 : MRI-CGCM3	cool/wet	35.9	28.1	32.6	25.1	12.8	19.1	18.9	8.9	19.1
RCP-4.5 : inmcm4	cool/dry	35.6	28.0	32.3	25.0	10.8	18.0	2.5	-36.2	-1.4
RCP-4.5 : MPI-ESM-LR	hot/dry	37.1	28.7	33.5	25.8	13.1	19.5	-19.4	14.2	-17.2
RCP-4.5 : HadGEM2-AO	Middle	36.3	28.3	32.9	25.7	12.6	19.3	6.0	-3.8	5.3
RCP-4.5 : BNU-ESM	hot/wet	36.6	29.6	33.7	26.4	14.4	20.5	30.7	5.8	28.4
RCP-8.5 : MIROC5	cool/wet	35.9	28.8	33.0	25.1	13.1	19.3	27.6	-21.7	23.7
RCP-8.5 : MIROC-ESM	cool/dry	36.3	28.8	33.2	25.8	13.7	19.8	-1.9	5.2	-0.8
RCP-8.5 : MPI-ESM-LR	hot/dry	37.6	29.5	34.1	26.5	13.9	20.3	-17.1	-25.3	-15.9
RCP-8.5 : ACCESS1-0	Middle	36.5	28.9	33.3	26.3	13.0	19.8	18.8	-9.6	15.4

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 2015-16, analysed 29 GCMs for Meerut District during mid-term century (2040-2069) for RCP4.5 and RCP8.5. Out of 29 GCMs, 6 GCMs (CSIRO-MK3-6.0, IPSL-CM5A-MR, FGOALS-g2, IPSL-CM5B-LR, GISS-E2-R & GISS-E2-H) found biased which projected >200 % annual rainfall (Table 35). The scatter plotter diagram of 23 GCMs used to identify the GCMs under hot/wet, cool/wet, cool/dry, hot/dry and median quadrants (Fig. 35 a&b). The GCMs close to mean value were chosen for further analysis.

CTWN Sensitivity analysis for wheat - APSIM & DSSAT

One set of farm data (crop management and soil data) were selected for CTWN analysis. CO_2 - 360, 450, 540,630, 720 ppm (run for high and low N), Tmax/ Tmin- -2, 0, +2,+4,+6, +8 OC, Rainfall - 25 %, 50 %, 75 %, 100 %, 125 %, 150 %, 175 % and 200 %, Fertilizer N - 0,30,60, 90, 120, 150, 180, 210 kg ha^{-1} - a total of 32 simulations were created and compared the sensitivity of each parameters in DSSAT and APSIM. The sensitivity of APSIM and DSSAT is different for CO2, temperature and fertilizers, even though both are showing the same trend (Fig. 36 and 37).

Hence, it has been concluded that there is a need to find out the cause of difference between the DSSAT and APSIM pertaining to responses.

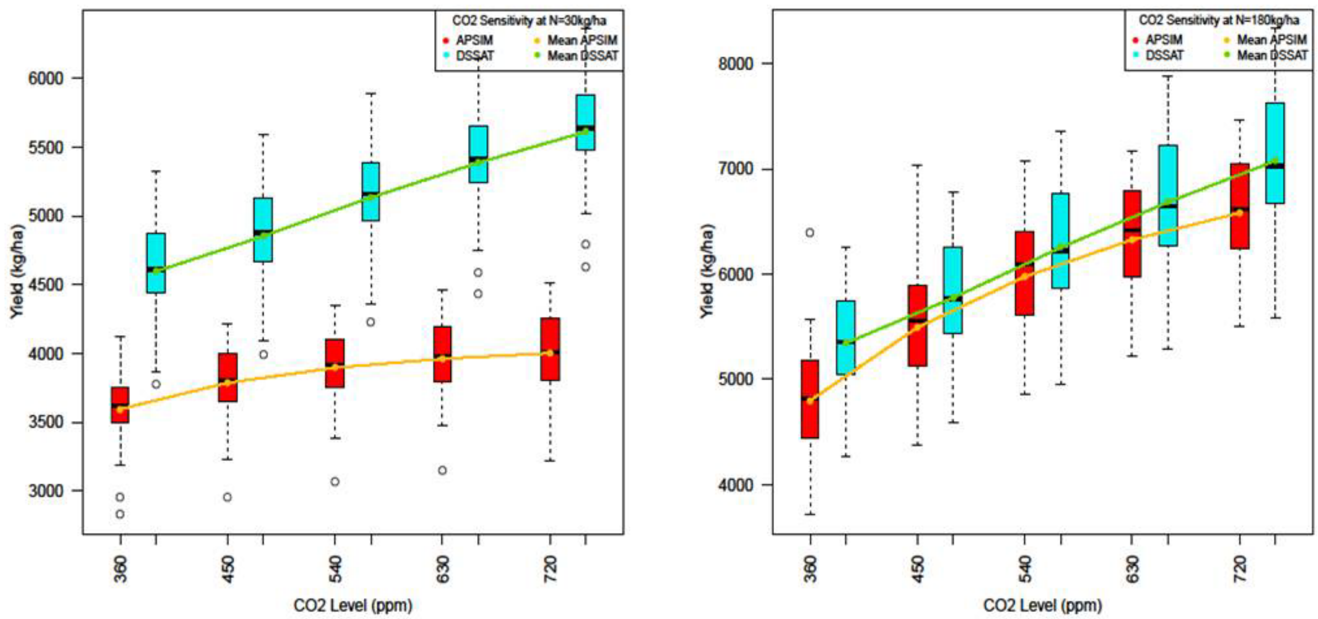


Fig. 36. CO_2 sensitivity at N=30 kg ha^{-1} and N=180 kg ha^{-1}

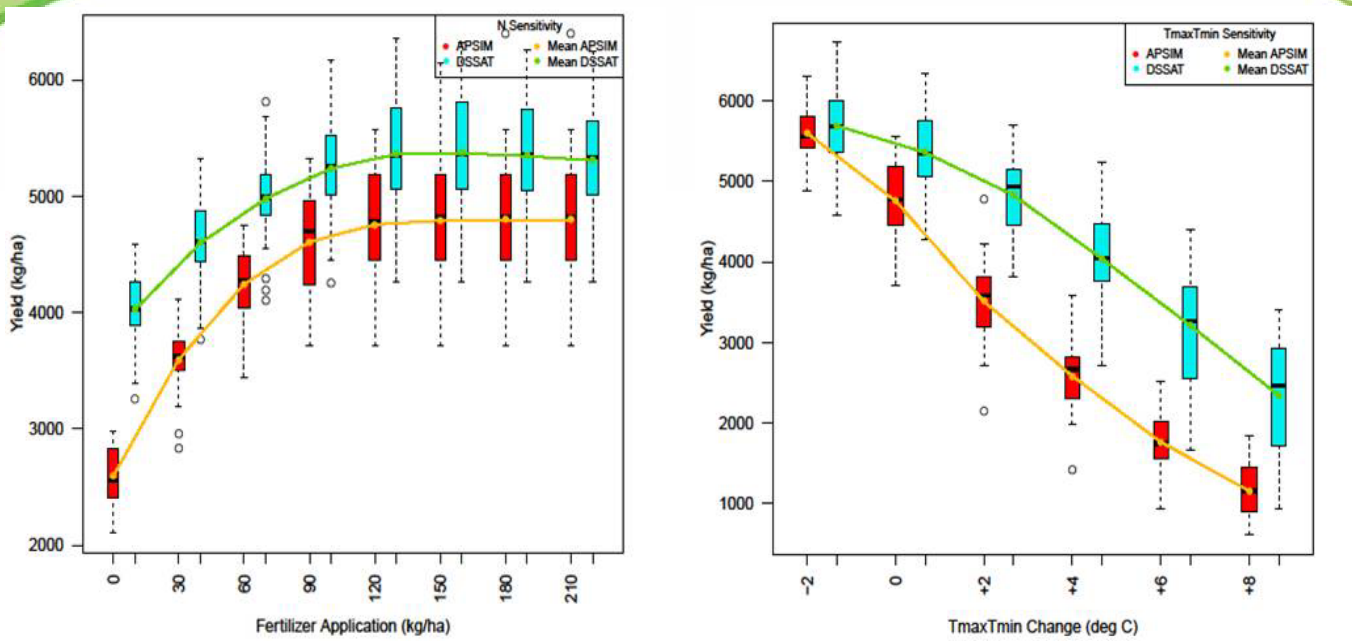


Fig. 37. Comparison of sensitivity of DSSAT-wheat and APSIM-wheat models to fertilizer response and temperature response

Global yield gap and water productivity atlas (GYGA)

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

The mean actual yields of maize, sorghum and pearl millet for ten year period (2001-02 to 2010-11) and the segregated yields of the three year period (2008-09, 2009-10 and 2010-11) were estimated for all the climatic buffer zones. The highest mean yield of maize (3.92 t ha^{-1}) was recorded with Nizamabad buffer zone of Telangana. Similarly, the highest mean yields of sorghum and pearl millet were corded with Kurnool buffer zone of Andhra Pradesh (2.9 t ha^{-1}) and Hisar buffer zone of Haryana (1.7 t ha^{-1}) respectively. WOFOST model was used for simulation of potential yield of sorghum and pearl millet in India. Simulations were performed separately for each crop system and soil type, in each RWS buffer, and aggregated based on their relative contribution to the crop harvested area within the RWS buffer. A dynamic sowing rule was used based upon on the reported sowing windows for each RWS and the onset of rains. Soil water content at sowing was simulated for each year by initializing the simulation by harvest time

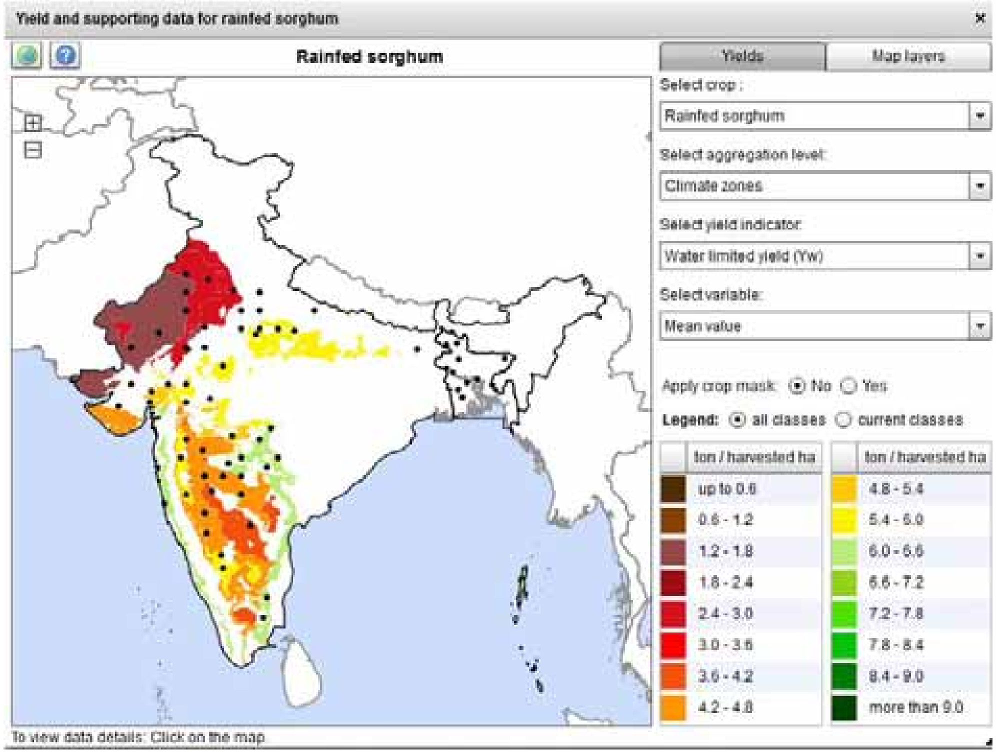


Fig. 38. Potential yield of rainfed sorghum in India

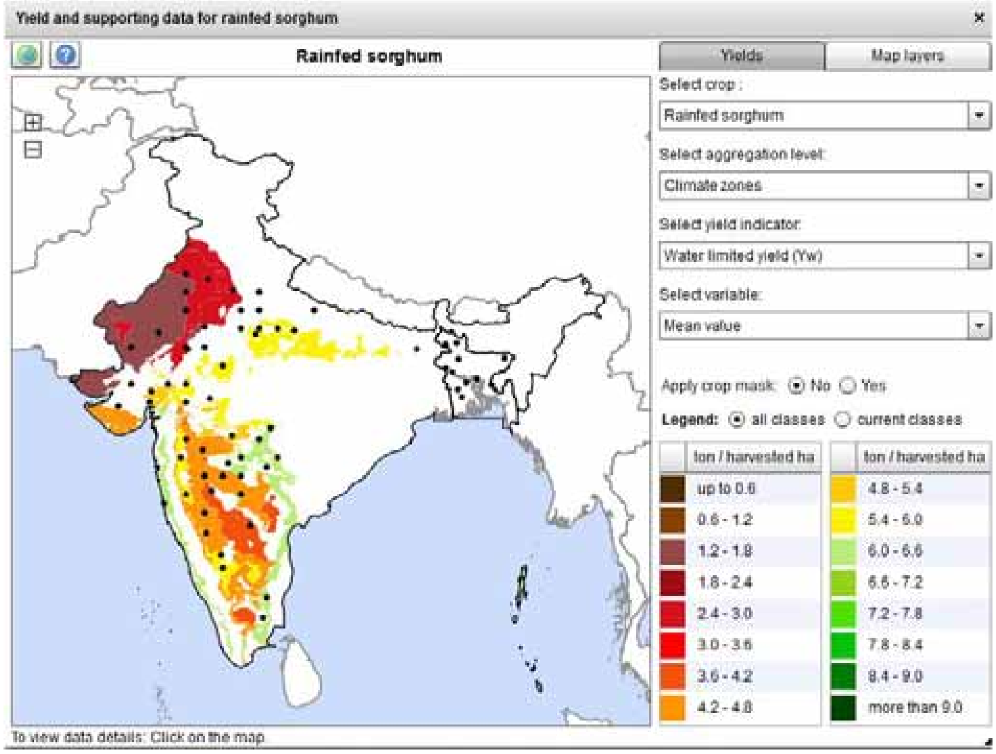


Fig. 39. Potential yield of rainfed pearlmillet in India

of previous crop. Generic parameters were used, but phenology-related parameters were adjusted to reproduce the average data of flowering and maturity reported in literature.

The initial trend of the simulation suggest that the potential yield of rainfed sorghum ranged between 4.8 ha^{-1} in climatic buffer zones of Rajasthan to 7.8 ha^{-1}in climatic buffer zones of Maharashtra. Similarly, the water limited yield of sorghum ranged between 1.8 $ha^{-1}$to 5.4 ha^{-1}in different climatic buffer zones of India (Fig. 38). The initial trend of the simulation in pearl millet suggest that the potential yield ranged between 4.5 ha^{-1} to 6.0 ha^{-1} and the water limited yield ranged between 1.0 $ha^{-1}$to 5.0 ha^{-1} in different climatic buffer zones of India (Fig. 39). The results of the project were presented in the Workshop of GYGA project held on 11th December 2015 at New Delhi.

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

Under NICRA Project, there are three objectives identified for IIFSR viz., Study of carbon sequestration in different cropping systems in the on- going long- term experiments of AICRP-IFS, Study of GHG emissions in rice-wheat and other prevalent cropping systems in IIFSR network in at least two treatments (farmers' practice vs. the best practice) throughout the season at periodical intervals and modeling studies with farming systems experimental data and relating it to GCMs to assess the adaptation potential of IFS to climate change. During the year 2015-16, we have completed the following task.

Identification climate resilient management practices in pearlmillet-wheat cropping systems under different nutrient management options

Yield datasets of long-term experiments on integrated nutrient management in Pearlmillet-wheat cropping systems at four sites (S.K. Nagar, Junagadh, Hissar and Bichupuri) were used to investigate the relationship of variability in rainfall, temperature, and integrated nutrient management (INM) practices in pearlmillet-wheat cropping system in different agroecological regions of India. Twelve treatments with different combinations of inorganic (chemical fertilizer) and organic (farmyard manure, green manure, and paddy straw) were compared with farmers conventional practice (Table 36). The intraseasonal variations in pearlmillet yields are largely driven by rainfall during kharif and by temperature during wheat. Half of the standard deviation from the average monthly as well as seasonal rainfall during *kharif* and 1 °C increase or decrease from the average maximum and minimum temperature during *rabi* has been taken as the classification of yield groups.

At S.K. Nagar, the application of 50% recommended NPK through chemical fertilizers and 50% N through FYM resulted in an overall average higher increase of 6.7 % in system productivity under both excess and deficit rainfall years and also during the years

Table 36. Site specific primary, secondary and tertiary climate resilient integrated nutrient management practices and system productivity deviation (%) in extreme climate situation

Site	Primary	Secondary	Tertiary
S.K. Nagar	50 % NPK (C)+50 % (FYM) (6.7)	75 % NPK (C)+25 % (FYM) (3.5)	50 % NPK (C)+50 % (GM) (2.8)
Junagarh	50 % NPK (C)+50 % (FYM) (-2.6)	75 % NPK (C)+25 % (FYM) (-5.2)	RDF (-6.3)
Hissar	50% NPK (C)+50 % (GM) (13.3)	50 % NPK (C)+50 % (Straw) (10.0)	Farmers Practice(9.1)
Bichupuri	50 % NPK (C)+50 % (Straw) (9.6)	50 % NPK (C)+50 % (FYM) (8.2)	50 % NPK (C)+25 % (FYM) (7.0)

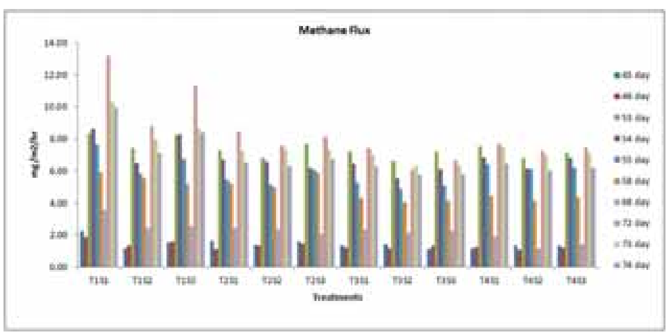
C: Chemical fertilizers, FYM: Farm Yard Manure, GM: Green manure, Straw: Crop residue *(Figures in parenthesis indicate the yield deviation compared to normal years)* having seasonal mean maximum temperature 35.1 °C. However, at Hissar, the application of 50% recommended NPK through chemical fertilizers and 50% N through GM resulted in an overall average higher increase of 13.3% in system productivity, while at Bichupuri, the application of 50 % NPK through chemical fertilizers and 50% N through straw resulted in an overall average higher increase of 9.6% in system productivity. The identified information on primary, secondary and tertiary site specific climate resilient nutrient management practices at the study site provide an opportunity for different stakeholders to choose different combination of fertilizers under extreme climate conditions.

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

Experiments were conducted for GHG measurement under different crop establishment methods and different sources of nitrogen under rice-wheat system. During the first year of experimentation 2014-15 under rice, maximum methane flux noticed under the treatment of transplanted puddled and normal urea application combination compared to all other treatment combinations at different stages of the rice crop. The highest methane flux occurred in 72 days after sowing in all the treatment combinations. There is 54 % reduction in methane flux under T_3S_2 (aerobic+neem coated urea) followed by 49 % reduction in T_3S_3 (aerobic+sulphur coated urea) compared to conventional puddling+normal urea application. The highest nitrous oxide flux occurred in 53 days after sowing in all the treatment combinations, except T_4S_2. There is 33 % reduction in nitrous oxide flux under T_3S_2 (aerobic+neem coated urea) and T_4S_2 (SRI+neem coated urea) compared to conventional puddling+normal urea combination treatment (Fig. 40).

Soil C Sequestration Potential of Different Cropping Systems under Organic Cultivation in the Western Himalaya Region

Application of organic manures to raise the crops organically is one of the management practices to enhance net C sequestration keeping other management practices constant. Assessment of soil C sequestration potential was made after 10 years of continuous organic cultivation of different crops at HAREC, CSK HPKVV, Bajaura (H.P.). Averaged across different cropping systems, Walkley-Black C stock at 0 – 60 cm soil depth was found 66.3, 51.7 and 40.7 t ha^{-1} under organic, integrated and chemical management of soil nutrients, respectively (Table 37). Under the organic system, this build up of Walkley-Black C stock was higher by 28.2 and 63.1 per cent than to integrated and chemical application of nutrients, respectively. Further, Walkley – Black soil C sequestration rate in 0 – 60 cm soil depth under organic cultivation of crops was higher by 1.46 and 2.57 t ha^{-1} yr^{-1} as compared to integrated and chemical application of soil nutrients, respectively. This study explicitly shows that continuous practice of raising the crops organically has good potential to sequester the C in the soil to offset



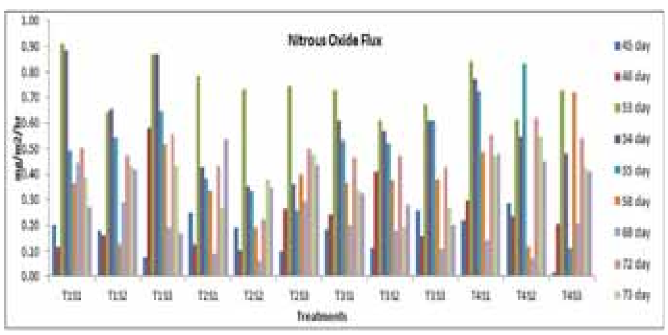


Fig. 40. Methane and nitrous oxide flux ($mg/m^2/h$) recorded under different establishment methods Vs source of nitrogen in rice

Table 37. Walkley & Black C & C stock under different management practices and “ C stock & C seq rate under organics over to integrated & chemical nutrient management at Bajaura, HP

Nutrient management	Soil depth (cm) 0-15	15-30	30-45	45-60	Cropping systems (0-60 cm depth) CS1	CS2	CS3	CS4	Mean
Walkley & Black C (g kg^{-1} soil)									
Organic	12.2	9.09	5.01	4.20	9.03	7.38	7.00	7.06	**0.763**
Integrated	10.0	6.43	4.10	3.18	6.88	5.93	5.50	5.41	**0.593**
Chemical	5.94	4.56	3.78	3.16	4.44	4.54	4.60	3.86	**0.436**
C stock (t ha^{-1})									
Organic	25.8	19.7	11.2	9.61	78.2	64.3	61.1	61.7	**66.3**
Integrated	21.1	14.0	9.17	7.46	60.0	51.9	47.9	47.2	**51.8**
Chemical	13.4	10.6	8.97	7.69	41.2	42.4	42.8	36.1	**40.7**
“ C stock (t ha^{-1}) over to									
Integrated	4.67	5.72	2.02	2.16	18.2	12.5	13.2	14.4	**14.6**
Chemical	12.4	9.16	2.22	1.93	37.0	21.6	18.3	25.6	**25.7**
C seq rate (kg ha^{-1} yr^{-1}) over to									
Integrated	467	572	202	216	1.82	1.25	1.32	1.44	**1.46**
Chemical	1236	916	222	193	3.70	2.19	1.83	2.56	**2.57**

the C emissions in the atmosphere. Further, averaged across the nutrient management practices, Walkley-Black soil C stock (t ha^{-1}) under different cropping systems was found in the order: tomato – cauliflower – French bean, CS_1 (59.8) > tomato – cauliflower, CS_2 (52.9) > black gram – cauliflower – summer squash, CS_3 (50.6) > okra – pea, CS_4 (48.3). Similarly, change in Walkley-Black soil C stock (t ha^{-1}) and C sequestration rate (t ha^{-1} yr^{-1}) due to organic cultivation than to mean of integrated and chemical cultivation of crops was in the order: CS_1 (27.6) > CS_4 (20.0) > CS_2 (17.1) > CS_3 (15.8) and CS_1 (2.76) > CS_4 (2.00) > CS_2 (1.72) > CS_3 (1.58), respectively. From the results, it may be unequivocally concluded that while making and applying soil C sequestration as one of the options to mitigate the climate change, selection of crops in the cropping systems under organic cultivation may also be taken into consideration.

Integrated Farming System for improvement of nutrition and livelihood of farm women under different agro eco system

Project started in two villages *Mandaura* and *Jamalpur Goma* of Sardhana block in Meerut District with objectives following (1)To assess farm resources under different farming systems (2)To implement integrated farming system models for nutritional and livelihood security (3) To assess impact of climate change on the livelihood security of farm women

Under this project 15 famers –Scientist interaction meetings were organized and 85 farming families were surveyed (Crop based farm families 69.44 % and Livestock based farm families 30.50 %) (Table 38). Majority of farmers (80.55 %) have cemented house, only 8.33 % farmers have thatched house and 11.11 %

Table 38. Body Mass Index (BMI of selected farmers)

BMI	Underweight	Normal	Over weight	Obese
Female %	11.11	50.00	16.66	22.00
Male %	10.71	50.00	32.14	07.14

Participation of farm women in different agricultural activities

farmers have half cemented and half thatched house. Dietary pattern is mainly based on wheat. Small farmers also include milk, pulses and vegetables but marginal farmers consume mainly chapatti, tea, potato, chutney etc.

Farm produce and utilization pattern shows that major crop of this area is sugarcane which is used for both commercial sale as well as fodder for domestic animals. Sale Price for sugarcane is Rs. 250-280 quintals^{-1}. Second major crop is wheat which is sown followed by sugarcane ratoon and primarily used for domestic consumption and its straw is used as dry fodder for animals during lean period. Livestock based farmers retain only 10-15 % milk with them for family utilization and sell 90 % produce @ 28 - 30Rs. litre^{-1}. They also sell 40 - 50 % of FYM/compost @ 40 Rs. quintal^{-1} and rest use at own farm. Access and control over family assets. All farm womens have access to farm resources but only 6 % womens (female headed families) have control over assets.

TECHNOLOGY TRANSFER, TRAININGS, WORKSHOPS AND FARMERS MEETS

Technology/ products assessed and transferred to client

Technology generated	Name of the Scientist/s
Protocols standardized for development of Instant anola candy and murabba	Dr. A. Nath and Dr. D. Dutta
Protocols standardized for development of Instant pickles from mushroom	Dr. A. Nath and Dr. Chandra Bhanu
Optimized process technology for production of RTS and jamfrom aloevera	Dr. A. Nath and Dr. D. Dutta
Protocols standardized for development of beetroot tuity fruity and jam	Dr. A. Nath, Dr. D. Dutta and Dr. N. Verma
Integrated nutrient management in wheat at Kailawara village, Muzaffarnagar	Dr. B K Sharma, Dr. Chandra Bhanu, Dr. Dushyant Mishra and Dr. Anil Kumar
Integrated nutrient management in mustard at at Kailawara village, Muzaffarnagar	Dr. B K Sharma, Dr. Chandra Bhanu, Dr. Dushyant Mishra and Dr. Anil Kumar
Integrated pest management in pulses at Chandsamand village, Muzaffarnagar	Dr. Chandra Bhanu
Seed production technology of wheat and mustard at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu
Integrated pest management in oilseeds at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu
Production technology of mushrooms for farmers of Meeru, Hapur, Sardhana etc.	Dr. Chandra Bhanu
Integrated nutrient and pest management in chilli for farmers of Alipur and Madarpur	Dr. Chandra Bhanu
Integrated pest management in rice for farmers of Meerut and Alipur	Dr. Chandra Bhanu
Integrated disease management in jaickfruit at Bhurana, Muzaffarnagar	Dr. Chandra Bhanu and Dr. Dushyant Mishra
Integrated pest management in mango for farmers of Arnawali, Sarurpur, Rohta Road, Mawana, Sardhana, (Meerut), Kharad, Bhurana, Kailawara (Muzaffarnagar), Jhabrera (Haridwar)	Dr. Chandra Bhanu, Dr. Dushyant Mishra Dr. B K Sharma and Dr. Anil Kumar
Integrated pest management in wheat at Meerut and at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu, Dr. Dushyant Mishra, Dr. B K Sharma and Dr. Anil Kumar
Integrated pest management in mustard at Meerut and at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu, Dr. Dushyant Mishra, Dr. B K Sharma and Dr. Anil Kumar

Technology generated	Name of the Scientist/s
Integrated nutrient management in sugarcane at Meerut and at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu, Dr. M P S Arya, Dr. Anil Kumar, Dr. Sanjeev Kumar, Dr. Dushyant Mishra and Dr. B K Sharma
Integrated pest management in sugarcane at Meerut and at Kailawara village, Muzaffarnagar	Dr. Chandra Bhanu, Dr. M P S Arya, Dr. Anil Kumar, Dr. Sanjeev Kumar, Dr. Dushyant Mishra and Dr. B K Sharma
Safe ripening of Bael fruits by alternate methods at Masuri {Bijnor district}	Dr. Dushyant Mishra, Dr. A. Nath and Dr. D. Dutta
Integrated Nutrient Management in mango for farmers of Arnawali, Sarurpur, Rohta Road, Mawana, Sardhana, (Meerut), Kharad, Bhurana, Kailawara (Muzaffarnagar), Jhabrera (Haridwar)	Dr. Dushyant Mishra, Dr. Chandra Bhanu, Dr. B K Sharma and Dr. Anil Kumar
Production Technology of ber Cv Apple ber at Kila Parikshitgarg and Meerapur, Hastinapur {Meerut}, Saharanpur	Dr. Dushyant Mishra, Dr. J P. Singh and Dr. Chandra Bhanu
Production Technology for guava Cv Shweta at Budhana, Hastinapur, Sardhana	Dr. Dushyant Mishra, Dr. J. P. Singh and Dr. Chandra Bhanu
Raising of maize for cobs +vegetable cowpea in 1:1 ratio on broad beds (BB) and *sesbania* in furrow during *kharif* and mustard in furrow and 3 rows of lentil on broad beds in *rabi* while 3 rows of green gram on beds in summer produced highest REY of 25.59 t ha^{-1} and was remarkably better over other systems	Dr. M. Shamim, Dr. B. Gangwar, Dr. M.P.S. Arya, Dr. Sudhir Kumar and Dr. O.K. Tomar
Farmers perception and adaptation practices towards changing climate under Integrated Farming Systems is documented and released in the group meeting of ICAR-AICRP on Integrated Farming Systems organized during 16-18 December, 2015 at Assam Agricultural University, Jorhat	Dr. M. Shamim, Dr. N. Ravisankar, Dr. B. Gangwar and Dr. Kamta Prasad
Adaptation index (AI) developed based on degree of adaptation of a particular adaptive measures to grow an important enterprise of the Integrated Farming Systems under changing climate and higher AI identified for 25 centres of On Farm Research (OFR) representing a particular NARP zone of the country	Dr. M. Shamim, Dr. N. Ravisankar, Dr. B. Gangwar and Dr. Kamta Prasad
Farming Systems Research: Success stories (series 1) was compiled from the adopted farmers of AICRP on IFS and submitted to DD Kisan for dissemination.	Dr. N. Ravisankar
Policy input for promotion of organic farming in India was prepared based on the results of NPOF scheme and submitted to DAC&FW	Dr. N. Ravisankar
On-farm storage of fruits and vegetables in low cost zero energy cool chamber for extended shelf life and quality	Dr. Poonam Kashyap and Dr. Nisha Verma

Technology generated	Name of the Scientist/s
Biofencing for additional income and protection against wild animals.	Dr. Poonam Kashyap and Mr. Avinash Kansal
Off season production of vegetables in low cost poly tunnels using soilless media	Dr. Poonam Kashyap and Mr. Avinash Kansal
Vegetable based farming system model for year round production	Dr. Poonam Kashyap, Dr Kamta Prasad and Mr. Avinash Kansal
Five vegetables based cropping systems viz., Brinjal-Potato-Beans, Bottle Gourd-Cauliflower-Tomato, Brinjal-Pea-Okra, Cucumber-Radish-Carrot-Onion and Turmeric have been developed for small and marginal farmers of western Uttar Pradesh.	Dr. Poonam Kashyap, Dr. Kamta Prasad and Mr. Avinash Kansal
Provided full technology package for rural poultry production to the farmers in which distributed 1280 chicks of improved varieties (CARI Nirbheek and CARI Dhanraja) of poultry, improved feeding practices and preventive measures for reducing mortality included in the package	Dr. Suresh Malik

Training Attended

Title of training	Period	Venue	Name of participant
Orientation Training	10.04.2015-23.05.2015	ICAR-IIFSR, Modipuram	Dr. A.L.Meena
Professional Institutional Attachment Training	25.05.2015-29.08.2015	ICAR-IISS, Bhopal	Dr. A.L.Meena
Farming Systems for the future: Approaches and applications	20.01.2016-09.02.2016	TNAU, Coimbatore	Dr. A.L.Meena
Training program on MDP on Leadership Development (a pre-RMP Program)	30.11.2015-11.12.2015	NAARM, Hyderabad, India	Dr. Amit Nath
Training program on "IPR in Agriculture".	12.08.2015-01.09.2015	ICAR-IARI, New Delhi.	Dr. Amit Nath
Training program on Smart Agro-input Delivery Approaches Based on Hydrogels and Other Polymeric Carriers for Improved Crop Health and Productivity	21.07.2015-30.07.2015	Division of Agriculture Chemicals, ICAR-IARI, New Delhi	Dr. Debashis Dutta
DST Sponsored training programme on Agrometeoro-logical techniques for risk assessment and management of extreme	01.08.2015-21.09.2015	ICAR-CRIDA, Hyderabad	Dr. M. Shamim
Ergonomics methodologies for designing and assessing women friendly agriculture tools and technologies.	17.11.2016-26.11.2016	MPUAT, Udaipur.	Dr. NishaVerma
Training programme on Science and Technology for rural societies for women scientists and technologists	24.08.2015-28.08.2015	Indian Institute of Public Administration (IIPA), New Delhi	Dr. Poonam Kashyap Dr. NishaVerma
Climate Smart Agriculture: Lessen learnt, Technological Advances made and Research Priority in SAT	16.11.2015-06.12.2015	UAS Raichur	Dr. Sanjeev Kumar
Molecular approaches for augmenting reproductive efficiency in Cattle	08.12.2015-21.12.2015	ICAR-CIRC, Meerut	Dr. Suresh Malik
Conservation Agriculture for enhancing resource use efficiency and arresting land degradation	17.08.2015-10.09.2015	ICAR-Research Complex for NEH Region, Umiam	Mr. Raghuveer Singh Shri Vipin Kumar

Seminar/Symposia/Workshop/ Conference/ Kishan Gosthi Attended

Title of seminar/symposia/workshop	Period	Venue	Name of participant
Consultation meeting of the stakeholders on concept Note “Crop Loss Assessment Due to Extreme Weather Events by Remote Sensing”	01.09.2015	Krishi Bhawan, New Delhi	Dr. J.P. Singh
National Conference on Sustainable Agriculture and Farmers Welfare	17-18.01.2015	Gangtok, Sikkim	Dr.N. Ravisankar
International Extension Education Conference on Education, Research and Services	27-30.01.2015	Banaras Hindu University, Varanasi	Dr. NishaVerma
International conference organized by Indian society for animal production and management	28-31.01.2015	Hyderabad	Dr. Sanjiv Kumar Kochwade
Kisan Mahotsav organized by Dainik Jagran	31.03.2015-02.04.2015	Sardhana, Meerut	Dr. Dushyant Mishra
International Conference on Technological Intervention in Agricultural Sciences for Enhanced Productivity, Nutritional Quality and Value Addition	17-19.02.2015	Central Institute of Horticulture (CIH), Medziphema, Nagaland	Dr. Amit Nath
Launching and planning workshop of CCAFS Flagship of projects (FPs) on Climate Smart Agriculture Practices Portfolios, Institutions and policies	24-25.02.2015	New Delhi	Dr. J.P. Singh
IFA-FAI National seminar on Sustainable Fertilizer Management for Soil Health	16.03.2015	New Delhi	Dr. J.P. Singh
Kisan mela and Zaid gosthi on Strengthening Agriculture information system(AIS) and farmer awareness programme	24-25.03.2015	Meerut city	Dr. L.R.Meena
Workshop on Measurement of Greenhouse Gas Emissions for development of Inventory form Agriculture	03-04.12.2015	ICAR-IARI, New Delhi.	Dr. Debashis Dutta
Roadmap for Agricultural development in Upper Gangetic Plain Region	04.12.2015	ICAR-IIFSR Modipuram	Dr. Dushyant Mishra
First Nodal Officers Workshop of KRISHI	04-05.08.2015	NASC Complex, New Delhi	Dr. N. Subash
AgMIP-ICAR Collaborative Project Stakeholder consultation meeting	05.12.2015	NDUA&T, Faizabad	Dr. N. Subash
Annual Conference of VC(s)/ Director(s) at NASC Complex.	15-16.05.2015	New Delhi	Dr. J.P. Singh
Approaches for Integrated Analysis of Agricultural Systems in South Asia: field, to farm, to landscape scale	18-20.05.2015	ICAR-CSSRI, Karnal	Dr. Dushyant Mishra
IPIW- Internal partners intensive workshop of ICAR-Ag MIP Collaborative Project	20-24.05.2015	ICRISAT, Hyderabad	Dr. N. Subash
AgMIP-IGB Team Internal Partners Intensive Workshop	20-24.05.2015	ICRISAT, Patancheru	Dr. Harbir Singh
22nd Regional Committee Meeting, Zone III	22-25.05.2015	Agartala	Dr. J.P. Singh
ICAR-DAC Interface Meeting with Department of Agriculture, Govt. of Uttar Pradesh for coping with various likely scenarios of aberrant rainfall as involved in Districts Contingency Plans Development in U.P., Punjab and Haryana	29.05.2015	Krishi Bhavan, Hazratganj, Luknow	Dr. M. Shamim

Title of seminar/symposia/workshop	Period	Venue	Name of participant
Group meeting of OFR agronomist and economists	28-30.05.2015	ICAR- IIFSR, Modipuram	Dr. L.R.Meena
National Seminar on climate change and smart agriculture technology	13-14.06.2015	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalay, Gwalior, M.P	Dr. M. Shamim
RAC meeting of ICAR-NBSS&LUP at Nagpur	25-27.06.2015	Nagpur	Dr. J.P. Singh
AgMIP Phase II Fundamentals workshop	24-30.06.2015	A'Zambezi River Lodge, Victoria Falls, Zimbabwe	Dr. Harbir Singh Dr. N. Subash
XVII Annual Workshop of All India Coordinated Research Project on Mushroom	29-30.06.2015	ICAR-DMR, Solan	Dr. Chandra Bhanu
International symposium on " Next Generations Approaches for Sustainable Development of Hill and Upland Horticulture"	05-07.11.2015	Sikkim University	Dr. Dushyant Mishra
Pradhan Mantri Krishi Sinchai Yojna (PMKSY)	13.07.2015	New Delhi	Dr. J.P. Singh
87th ICAR Foundation Day and Award Ceremony and National Conference of KVKs	24-27.07.2015	Patna, Bihar	Dr. J.P. Singh
Half yearly foreign aided projects review meeting	08.08.2015	KAB-II, ICAR,New Delhi	Dr. N. Subash
4th Annual workshop of NICRA	13-14.08.2015	ICAR-IARI, New Delhi.	Dr. N. Subash Dr. Debashis Dutta
X Annual Group Meeting of NPOF	19-21.08.2015	MPUAT, Udaipur	Dr.J.P.Singh Dr. M.P.S Arya Dr. N. Ravisankar
Expert consultation on status and future prospect of organic agriculture for safe food security in SAARC countries	26-27.08.2015	Rochogpel Hotel, Thimphu, Bhutan	Dr. N. Ravisankar
Meeting on Agricultural Systems and Management Sectional Committee	26-28.08.2015	NASC, New Delhi.	Dr. J.P. Singh
Mid-term Review meeting of the action (s) taken on the recommendations of XXII meeting of ICAR Regional Committee-II	18-20.09.2015	CIFRI, Kolkatta, Barrackpore	Dr. J.P. Singh
5th International Symposium for Farming Systems Design – "Multi- functional farming systems in a changing world"	07-10.09.2015	Le Corum, Montpellier, France	Dr. N. Subash
National Seminar on Soil health management & food security: role of Soil Science Research & Education.	07-10.10.2015	Regional Centre-ICAR-NBSSLUP, Kolkata	Dr. Debashis Dutta
25th Asia Pacific Weed Science Society Conference (APWSSC)	13-16.10.2015	PJT State Agriculture University, Hyderabad	Dr. Chandra Bhanu
Sitting of parliament Standing Committee on Agriculture for examining the subject "Comprehensive Agriculture Research based on Geographical Conditions and impact of climatic changes to ensure food security in the country"	19.10.2015	Parliament House, New Delhi.	Dr. J.P. Singh
Meeting pertaining to discuss issues on modification in operational guidelines of Paramparagat Krishi Vikas Yojana (PKVY)	30.10.2015	Krishi Bhawan, New Delhi	Dr. J.P. Singh
Organic Farming for better soil quality	31.10.2015	SVPUA&T, Modipuram	Dr. A.L.Meena

Title of seminar/symposia/workshop	Period	Venue	Name of participant
Organic Farming for better soil quality	31.10.2015	SVPUA&T, Modipuram	Dr. P.C. Ghasal
Inception workshop of Collaborative research project on IFS research for improvement of nutrition and livelihood of farm women under different agro-eco systems	11.06.2015	ICAR-CIWA, Bhubaneswar	Dr. Dushyant Mishra
GYGA India Workshop	11.12.2015	New Delhi	Dr. N. Subash
Meeting of "Existing and Traditional Cropping Pattern in India for Optimal Utilization of water resources under PMKSY" under the Chairmanship of Hon'ble Dr. A.K. SIKKA, DDG (NRM) at ICAR, KAB-II, New Delhi.	14.11.2015	New Delhi	Dr. J.P. Singh
Inception Workshop of Collaborative Research Project on Integrated Farming System Research for Improvement of Nutrition and Livelihood of Farmwomen under Different Ago-ecosystems	17-18.11.2015	ICAR-CIWA, Bhubaneswar	Dr. M.P.S Arya
XXXII Annual Conference and National Symposium of Indian Poultry Science Association	19-21.11.2015	Kerala Veterinary and Animal Sciences University, Thiruvazhamkunnu, Palakkad, Kerala	Dr.Suresh Malik
Meeting on "Indian Grain Storage Working Group"	21.11.2015	NASC Complex, New Delhi.	Dr. J.P. Singh
One day workshop on Discussion and finalization of statistical analysis methodology for on-station and on-farm IFS experiments of AICRP on IFS	24.11.2015	IASR, New Delhi	Dr. A. K. Prusty
Joint Workshop of ICAR-IASRI and ICAR- IIFSR under AICRP-IFS for finalizing the on-station and on-farm IFS data analysis methodology	24.11.2015	ICAR-IASRI, New Delhi	Dr. N. Ravisankar Dr. Harbir Singh Dr. N. Subash Mr. Raghuveer Singh
Brain storming session on importance of soil in sustaining life system on earth	23-24.11.2015	NASC Complex, DPS Marg, New Delhi	Dr. J.P.Singh Dr. L.R. Meena Dr. Dushyant Mishra Dr. Debashis Dutta Dr. Chandra Bhanu Dr. M. Shamim Dr. A.L.Meena Dr. L.K.Meena
Meeting on scope of IFS in Indian scenario in seminar on IFS	12-14.12.2015	NAARM, Hyderabad	Dr Peyush Punia
4th Institute Management Committee Meeting of ICAR-ATARI Zone VII, Jabalpur	14.12.2015	Jabalpur	Dr. M.P.S Arya
Group Meeting of AICRP on Integrated Farming Systems	16-18.12.2015	AAU, Jorhat	Dr. J.P.Singh Dr. N. Ravisankar Dr. Harbir Singh Dr. L.R. Meena Dr. Dushyant Mishra Dr. A. K. Prusty Mr. Raghuveer Singh

Title of seminar/symposia/workshop	Period	Venue	Name of participant
Field day/kisan gosthi	20.12.2015	Kakda village of Saharanpur block, Muzaffarnagar	Dr. Sanjiv Kochwad
IJTA 2nd International conference on Agriculture, Horticulture and Plant Sciences	26-27.12.2015	Hotel Landmark, Shimla	Dr. Poonam Kashyap, Dr. A. K. Prusty
Workshop on Organic farming: Concern about crop productivity and soil health sponsored by DAC&FW	07.01.2016	ICAR-IIFSR, Modipuram	All scientists of the Institute
Annual Conference of VCs/ICAR Directors	22-24.01.2016	NASC, New Delhi	Dr. J.P. Singh
SAC Meeting of SVBPUA&T - KVK, Hastinapur	27.01.2016	Hastinapur	Dr. J.P. Singh
Meeting at Agronomy Department, IARI, New Delhi for establishing IFS unit at IARI Campus	25.02 2016	IARI, New Delhi	Dr. Dushyant Mishra
National Seminar on Problems of Indian Agriculture, Causes and Remedial Measures	13.02.2016	New Delhi	Dr. J.P. Singh
Scientific Advisory Committee Meeting of KVK	16.02.2016	Noida, Gautambudh Nagar, U.P.	Dr. J.P. Singh
Brainstorming on IPM in major crops	16-17.02.2016	NASC Complex, New Delhi	Dr. Chandra Bhanu
Kisan mela organized by Department of Agriculture, Government of UP and interacted with fruit growers on recent techniques on Orchard Management	26.02.2016	Delhi Road, Meerut	Dr. Dushyant Mishra
6th International Conference on "Plant Pathogens and people"	23-26.02.2016	NASC Complex, New Delhi.	Dr. Chandra Bhanu
AgMIP Phase II Integration workshop	22-29.02.2016	Dakar, Senegal	Dr. Harbir Singh Dr. N.Subash
Workshop on Farmer centric initiatives	06.01.2016	Krishi Bhavan, New Delhi	Dr. N. Ravisankar
Inaugurated one day training programme on Increased Employment Opportunities and Enhanced Income through On-Farm Processing and Value Addition in Farm Produces	01.03.2016	Dinkarpur Block Sahpur, Muzaffar Nagar, U.P.	Dr. J.P. Singh
Scientist and farmers interaction meet and interacted with the farmers queries related with dairy farming	15.03.2016	Kutbe village of Muzaffarnagar	Dr. Sanjiv Kumar Kochwad
Workshop cum meeting of ITMU unit under NRM Division	16-17.3.2016	ICAR Comples, Umaim, Meghalaya	Dr Peyush Punia
Application of Farmdesign Software in farming systems perspective	20-24.03.2016	BISA, CIMMYT, Pusa	Dr. A.K.Prusty
Brain storming meeting of scientists from CIMMYT and IIFSR on implementation of CCAFS	06.03.2016	ICAR-IIFSR, Modipuram	Dr. Chandra Bhanu Dr. M. Shamim
Half yearly foreign aided projects review meeting	09.02.2016	KAB-II, ICAR,New Delhi	Dr. N. Subash

Training, Seminar/Symposia/Workshop/ Conference/Field Day/ Kisan Goshthi Organised

Name of events	Number of participants	Title	Venue	Period	Name of Organizer
fgnh i[kokMk	140	—	IIFSR, Modipuram	14.09.2015-28.09.2015	Dr. M.P. S. Arya, Dr. Chandra Bhanu
Workshop of AICRP on IFS	150	Annual Group Meeting of AICRP on Integrated Farming Systems	AAU, Jorhat	16.12.2015-18.12.2015	Dr. N. Ravisankar
Boundary plantation of for live fencing	15	Awareness drive	Bubakpur, Meerut	03.08.2015	Dr. A.K. Prusty Karonda
Field Day	20	Scope and importance of Boundary Plantation and live fences (Karonda)	Bubakpur, Meerut	03.08.2015	Dr. Poonam Kashyap
Kisan Gosthi	100	Pashchimi uttar Pradesh main phalon ki utpadakta badhane hetu krishak vaigyanik paricharcha	Budhana, Muzaffarnagar	23.12.2015	Dr. M. P. Singh, Dr. Dushyant Mishra and Dr. Chandra Bhanu
Field Day	20	Demonstration on scientific raising of tomato seedlings and planting in fields	Chindora, Khatauli	22.02.2016	Dr. Poonam Kashyap
Field day	15	Horticulture and its benefits to small and marginal farmers	Chindora, Muzaffarnagar	22.02.2016	Dr. A.K. Prusty
One day training programme	70	Value addition of farm produces (tomato and orange viz. tomato ketch up, orange squash respectively) for Entrepreneurship Development	Dinkarpur village of Muzaffarnagar	01.03. 2016	Dr. Amit Nath, Dr. L.R. Meena, Dr. Debashis Dutta, Dr. Poonam Kashyap and Dr. Nisha Verma
Exposure visit of women farmers	24	Exposure visit of women farmers to Krishi Unnati Mela, IARI, New Delhi.	Exhibition ground, PUSA, New Delhi	20.03.2016	Dr. Nisha Verma, Dr. Dusyant Mishra and Sh. P.P. Mishra
Field visit of B. Tech. students from SVPUAT, Modipuram	30	-	ICAR- IIFSR, Modipuram	30.12.2015	Dr. A.K. Prusty
Two days training	26	Oilseeds in Farming Systems	ICAR-IIFSR, Modipuram	29.03.2016-30.03.2016	Dr. Anil Kumar, Dr. Chandra Bhanu and Dr. Poonam Kashyap

Name of events	Number of participants	Title	Venue	Period	Name of Organizer
Coordinated 3-months Professional Attachment Training of two ARS probationer scientists from ICAR Research Complex for Eastern Region, Patna Training w.e.f. 10-11-2015 to 09-02-2016.	02	Professional Attachment Training	ICAR-IIFSR, Modipuram	10.11.2015-09.02.2016	Dr. Anil Kumar, Dr. R.S. Yadav, Dr. A.K. Prusty
Conducted Professional Attachment training as Co-ordinator	01	-	ICAR-IIFSR, Modipuram	10.11.2015-09.02.2016	Dr. A.K. Prusty
Workshop of AICRP on IFS	40	Technical Programme review workshop for on-station experiments of AICRP on IFS	ICAR-IIFSR, Modipuram	18.05.2015-19.05.2015	Dr. Kamta Prasad
Visit to Agrommet Observatory to the B.V. Sc. & AH, Students of College of Vetenary & Animal Sciences SVBPAU&T, Modipuram	30	Exposure of Agromet Observatory and various meteorological instruments	ICAR-IIFSR, Modipuram	18.03.2016	Dr. M. Shamim
Training programme for Technical Staff of Soil Testing Laboratories of Meerut zone	20	Soil Health Card Scheme	ICAR-IIFSR, Modipuram	19.01.2016-23.01.2016	Dr. RS Yadav, Dr. Anil Kumar, Sh. RB Tiwari
Soil health card distribution	250	Soil Testing and Ferti-lizer Recommendation	ICAR-IIFSR, Modipuram	19.01.2016-23.01.2016	Dr. R.S.Yadav
21-days training of 101 FOCARS batch scientists from NAARM, Hyderabad	06	Field Experience Training (FET)	ICAR-IIFSR, Modipuram	19.02.2015-11.03.2015	Dr. MPS Arya Dr. Anil Kumar
Jai Kisan Jai Vigyan week	55	Jai Kisan Jai Vigyan	ICAR-IIFSR, Modipuram	23.12.2015-29.12.2015	
Workshop of AICRP on IFS	55	Formulation of technical programme for New centers of NPOF-	ICAR-IIFSR, Modipuram	24.04.2015-25.04.2015	Dr. N. Ravisankar
Training	31	Group Meeting of OFR Agronomists and Economists	ICAR-IIFSR, Modipuram	28.05.2015-30.05.2015	Dr. Harbir Singh

Name of events	Number of participants	Title	Venue	Period	Name of Organizer
One day traning Jai Kisan Jai Vigyan Saptah to farmers of Kailawada, Muzaffarnagar	17	Seed production in wheat and mustard"	ICAR-IIFSR, Modipuram	28.12.2015	Dr. Chandra Bhanu Mr. Raghuveer Singh
2-days training programme under the scheme of "FLD on oilseeds for the activities of cropping/farming systems involving oilseeds other than groundnut"	26	Oilseeds for Farming Systems	ICAR-IIFSR, Modipuram	29.03.2016-30.03.2016	Dr. Anil Kumar, Dr. Chandra Bhanu, Dr. Poonam Kashyap, Dr. Sanjeev Kumar
Farmers' training	45	Farming system components & their management	ICAR-IIFSR, Modipuram	29.09.2015-30.09.2015	Dr. Anil Kumar, Dr. BK Sharma, Dr. Sanjeev Kumar
Farmers' training	30	Integrated farming systems management	ICAR-IIFSR, Modipuram	30.06.2015	Dr. Anil Kumar, Dr. BK Sharma, Dr. Sanjeev Kumar
Workshop of Organic Farming	60	Workshop on Organic Farming: Concerns about crop productivity and soil health	ICAR-IIFSR, Modipuram	07.01.2016	Dr. N. Ravisankar
One day Workshop	200	Dairy farming for livelihood and rural employment	ICAR-IIFSR, Modipuram	08.03.2016	Dr. Vinod Kumar, Dr. Suresh Malik, Dr. Anil Kumar, Dr. Sanjeev Kochewad, Dr. Vipin Kumar
Organized 3 workshops on Hindi	150	-	ICAR-IIFSR, Modipuram	9.06.2015, 22.09.2015 and 29.12. 2015	Dr. M.P. S. Arya, Dr. Chandra Bhanu
Kisan Gosthi	55	Integrated farming system and its benefits	Masuri	06.06.2015	Dr. Anil Kumar, Dr. Chandra Bhanu
National level agricultural technology exhibition	500	IIFS Technology Display	Motihari, Bihar	20.08.2015-21.08.2015	Dr. A.K. Prusty
Under Swachh Bharat Mission conducted awareness cum cleaning programme	50	Swatch Bharat and its benefits to soceity	Muzaffarnagar	05.10.2015	Dr. A.K. Prusty
One day training programme	16	Value addition of farm produce for livelihood improvement.	Post Harvest Technology Lab, IIFSR-Modipuram, Meerut, U.P.	18.03.2016	Dr. Nisha Verma, Dr. Amit Nath, Dr. Debashis Dutta, Dr. Dushyant Mishra
Kisan Gosthi	50	Inter Cropping in Sugarcane	Rasoolpur Jattan, Muzaffarnagar		Dr. B. K. Sharma
One day demonstration cum training programme	50	Use of improved small farm implements for reduction of drudgery of farm women	Siwaya Farm, ICAR-IIFSR	29.12.2015	Dr. Poonam Kashyap Dr. NishaVerma

HUMAN RESOURCE DEVELOPMENT

Training/Workshop Organised

Sl. No.	Title	Venue	Date	Number of Beneficiaries	Coordinators
1.	Field Experience Training (FET) of 101 FOCARS batch scientists from NAARM, Hyderabad	ICAR-IIFSR, Modipuram	19th February to 11th March, 2015	06	Dr. MPS Arya Dr. Anil Kumar
2.	Farmers' training on Integrated farming systems management	ICAR-IIFSR, Modipuram	30th June, 2015	30	Dr. Anil Kumar, Dr. BK Sharma, Dr. Sanjeev Kumar
3.	Farmers' training on Farming system components & their management	ICAR-IIFSR, Modipuram	29-30 Sept., 2015	45	Dr. Anil Kumar, Dr. BK Sharma, Dr. Sanjeev Kumar
4.	Training programme for Technical Staff of Soil Testing Laboratories of Meerut zone under Soil Health Card Scheme	ICAR-IIFSR, Modipuram	19-23 January, 2016	20	Dr. RS Yadav, Dr. Anil Kumar, Sh. RB Tiwari
5.	Workshop on Dairy farming for livelihood and rural employment	ICAR-IIFSR, Modipuram	8 March, 2016	200	Dr. Vinod Kumar, Dr. Anil Kumar, Dr. Sanjeev Kochewad, Dr. Vipin Kumar
6.	Extension training on Oilseeds for Farming Systems under the scheme of FLD on oilseeds	ICAR-IIFSR, Modipuram	29-30 March, 2016	26	Dr. Anil Kumar, Dr. Chandra Bhanu, Dr. Poonam Kashyap, Dr. Sanjeev Kumar
7.	Professional Attachment Training of ARS probationer scientists from ICAR Research Complex for Eastern Region, Patna	ICAR-IIFSR, Modipuram	10th Nov. to 9th Feb., 2016	02	Dr. Anil Kumar, Dr. RS Yadav, Dr. A.K. Prusty

Lectures delivered/Resource persons

Lectures delivered/Resource Person	Delivered by
An interactive talk on Orchard Management organized by Agriculture, Government of UP at Delhi Road, Meerut on 26th February 2016	Dr. Dushyant Mishra
An interactive talk on Orchard Management organized by Agriculture, Government of UP at Delhi Road, Meerut on 26th February 2016	Dr. Dushyant Mishra
Aquaculture in Farming systems: Farming system components and their management during 03-04 October, 2015 at ICAR-IIFSR Modipuram	Dr. A.K.Prusty
Attended *Kharif Kisan Sammelan*-2015 as resource person on fruit crops nd interacted with farmers, It was organized by KVK Muzaffarnagar on 27th June 2015	Dr. Dushyant Mishra

Lectures delivered/Resource Person	Delivered by
Cultivation of cabbage, cauliflower and peas on September 23, 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Poonam Kashyap
Delivered an interactive talk on “crop managemen in mango” during Kisan Gosthee organized at *Budhana* on 23rd December 2015	Dr. Dushyant Mishra
Delivered lecture on ‘Extension approaches and ethics in oilseeds production’ on 30 March, 2016 in the training programme on “Oilseeds for Farming Systems” during 29-30 March, 2016 organised at IIFSR, Modipuram	Dr. Anil Kumar
Delivered lecture on ‘Reliable sources of information for farmers’ on September 30, 2015 in the training programme on ‘Potato seed production & marketing’ organized by CPRIC, Modipuram during 26-30 September, 2015	Dr. Anil Kumar
Delivered lecture on ‘Reliable sources of information for farmers’ on October 14, 2015 in the training programme on ‘Integrated pest & nutrient management in potato’ organized by CPRIC, Modipuram during 12-16 October, 2015	Dr. Anil Kumar
Delivered lecture on “Orchard Management” in Kisan Gosthee organized by ICAR-IIFSR on 17th April 2015 at Rasoolpur, Muzaffarnagar	Dr. Dushyant Mishra
Delivered lecture on integrated pest and disease management in crops in Kisan Gosthi at Masuri on 6th June, 2015	Dr. Chandra Bhanu
Diagnosis and management of crop diseases on 17 March, 2016 at Gochar Mahavidyalaya, Rampur Maniharan, Saharanpur	Dr. Chandra Bhanu
Exposure lecture on Integrated Farming Systems as an adaptive measures under changing climate to participants of HAMETI, Jind , Haryana on 19.03.2016	Dr. M. Shamim
Exposure lecture on various meteorological instruments and their applications to the B.V. Sc. & A.H Students of college of Vetenary and Animal Scccences, SVBPAU&T, Modipuram	Dr. M. Shamim
Imparted training on Canopy Management and Rejuvenation of Senile Mango Orchards at Krishi Vigyan Kendra, Mundra, Kuchchh Gujarat during 20-22nd June 2015.	Dr. Dushyant Mishra
Imparted training on Canopy Management and Rejuvenation of Senile Mango Orchards at Krishi Vigyan Kendra, Mundra, Kuchchh Gujarat during 20-22nd June 2015.	Dr. Dushyant Mishra
Imparted training on Canopy management in mango during 9th to 11th December 2015 at ICAR – Central Coastal Agricultural Research Institute, Goa.	Dr. Dushyant Mishra
Invited as Judge during 24th National Mango Mela organized by Department of Horticulture, Haryana in collaboration with Haryana Tourism Development Corporation at Yadvindra Garden, Pinjor, Chandigarh on 4-5th July 2015	Dr. Dushyant Mishra
Invited as resource person in *Vishal Aam Gosthee evam Pradarshani* organized by Mango Growers Association of India at Malihabad, Lucknow on 3rd June 2015	Dr. Dushyant Mishra
Kisan Gosthee organized by ICAR-IIFSR on 17th April 2015 at Rasoolpur, Muzaffarnagar	Dr. Dushyant Mishra
Livestock based Integrated Fish Farming in India: A prospective way of productivity enhancement, Lecture note for ICAR sponsored short course on Recent Advances in Livestock Fish Integrated Farming System, September 2015, ICAR-Research Complex for Eastern Region, Patna (Bihar)	Dr. Ravisankar, N.
Management of mango and other fruit orchards during training of farmers from Meerut and Muzaffarnagar on 22nd September 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Dushyant Mishra
Management of mango and other fruit orchards during training of farmers from Meerut and Muzaffarnagar on 22nd September 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Dushyant Mishra

Lectures delivered/Resource Person	Delivered by
Management of mango orchards in training of farmers from Meerut and Muzaffarnagar on 30th June 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Dushyant Mishra
Management of mango orchards in training of farmers from Meerut and Muzaffarnagar on 30th June 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Dushyant Mishra
Modern techniques of vegetable production on June 30, 2015 at ICAR-IIFSR, Modipuram, Meerut	Dr. Poonam Kashyap
Organic Farming: Scope and Strategy for A&N Islands, Model Training course on Integrated Farming Systems conducted by ICAR-CIARI, Port Blair during February 2016	Dr. Ravisankar, N. and Dr. B. Gangwar
Participated in *Kisan gosthee* at village Chand Samand, Khatauli, Muzaffarnagar. And interacted with farmers on "Improving productivity of existing orchards and Prospects of new fruits in region" organized by IFFCO on 27th March 2016	Dr. Dushyant Mishra
Poultry based integrated farming system. Presented on 20th March, 2016 in Krishi Unnati Mela-2016 held in IARI, Pusa, New Delhi from 19-21 March, 2016.Small ruminants and backyard Piggery based integrated farming system. Presented on 20th March, 2016 in Krishi Unnati Mela-2016 held in IARI, Pusa, New Delhi from 19-21 March, 2016.	Dr. Suresh Malik

Radio/Television talk

Topic	Date	Broadcasted/ telecasted in	Name of speaker
Paschimi Uttar Pradesh hetu upyukt phalo ke kheti	18th Dec.,2015	E TV Uttar Pradesh	Dr. Dushyant Mishra
Aam ke bago ka prabandhan	12th Feb., 2016	Krishidarshan, Lucknow Doordarshan	Dr. Dushyant Mishra
Low chilling apple cultivation in western UP and Guava cultivation for western UP	Broadcasted on 14th March 2016	Krishi darshan program of D D Kisan channel.	Dr. Dushyant Mishra
Prospects of low chilling apple cultivation in western UP and Prospects of improved guava cultivars for western UP	Broadcasted on 25th March and 17th April 2016	*Mausam Khabar* program of D D Kisan channel	Dr. Dushyant Mishra
Paschimi Uttar Pradesh hetu upyukt phalo ke kheti	18th Dec.,2015	E TV Uttar Pradesh	Dr. Dushyant Mishra
Aam ke bago ka prabandhan	12th Feb., 2016	Krishidarshan, Lucknow Doordarshan	Dr. Dushyant Mishra
Vaad Sanvad	15th April, 2015	DD – Kisan (National)	Dr. J.P. Singh
Live interview on Farmer's Expert	11th June, 2015	DD – Kisan (National)	Dr. J.P. Singh
Hellow Kisan on Farming System and Earning	9th Sept., 2015	DD – Kisan (National)	Dr. J.P. Singh
Mausam ki Khabar	25th March, 2015	DD Kisan (National)	Dr. M. Shamim
Panel discussion on Jaivik aur rasainik kheti kaun bheter	4th Nov., 2015	DD Kisan (National)	Dr. N. Ravisankar
Scope of Floating Gardens	18 March, 2016	DD Kisan (National)	Dr. Poonam Kashyap
Cultivation of Banana in western Plain Zones of Uttar Pradesh	21 March, 2016	DD Kisan (National)	Dr. Poonam Kashyap
Delivered TV Talk on DD Kisan regarding role of Fisheries in IFS Model	27th March, 2016	DD Kisan (National)	Dr Peyush Punia

AWARDS AND RECOGNITIONS

Awards

Awards	Conferred to
Best Publication of the year award for the year 2014-15 as Co-author by ICAR-CIFE, Mumbai for the publication, Beneficial effects of dietary probiotics mixture on haemato-immunology and cell apoptosis of *Labeo rohita* fingerlings reared in higher temperatures	Dr. A. K. Prusty
Best Young Scientist Award 2015 at 2nd IJTA Intentional Conference on Agriculture, Horticulture and Plant Science held at Shimla during 26-27 December, 2015	Dr. A. K. Prusty
Kunwar Saxena Bahadur SRDA Award-2014 by the Society for Recent Development in Agriculture for his outstanding contribution in the field of Agriculture	Dr. Amit Nath
Best Poster Award as Co-authored in the poster entitled "Design and development of low-cost portable biomass fired dryer and its performance evaluation for drying of large cardamom" during XII Agricultural Science Congress-2015 at ICAR-National Dairy Research Institute, Karnal during 3-6 Feb., 2015	Dr. Amit Nath
Award of certificate and 2nd prize by ARCC Karnal 2014-15 for the research publication entitled "Value Addition of horticultural crops: A source of nutritional security and income generation for rural women of Odisha" published in Bhartiya Krishi Anusandhan Patrika 29 (4) 194-200 by Verma N, Shukla A K, Sarkar A.Nath A, Dutta D, Kumar P and Gangwar B (2014).	Dr. Nisha Verma
Mahima Young Scientist Award	Dr. Sanjeev Kumar
Young Scientist associate award 2015 at IJTA 2nd International conference on Agriculture, Horticulture and Plant Sciences held at Shimla (H.P.) from 26-27 December, 2015 organized by Serial Publications Ltd, New Delhi.	Dr. Poonam Kashyap
First prize in Antakshri and Second Prize in Hindi debate competition organized at ICAR-IIFSR on the occasion of Hindi Pakhwada from September 14 to Sept 28, 2015.	Dr. Poonam Kashyap
The best poster presentation award (Ist position) for the paper "Evaluation of various residue management machineries for wheat sowing under different rice residue management practices" in the International Conference on "Technological Interventions in Agricultural Sciences for enhanced Productivity, Nutritional Quality and value addition (TIAS-2014) held on February 17-19, 2015 at Central Institute of Horticultural Medziphema, Dhimapur (Nagaland)	Dr. V. P. Chaudhary
The best Oral presentation (Ist position) for "Comparative study of various mechanization options for sowing of wheat under different conservation techniques". *In Proc*. National Seminar on "Technology and management of Micro Irrigation in Floriculture" held during 19-20 March 2015 at SKUAST, Jammu (J&K), India	Dr. V. P. Chaudhary

Recognitions

Recognitions	Received By
Acted as rapporteur for 3 sessions during the group meeting of AICRP on IFS held at AAU, Jorhat during 16-18 December, 2015	Dr. A. K. Prusty
Acted as reviewer of national and international peer reviewed journals	Dr. A. K. Prusty
Invited speaker in UGC Sponsored National Seminar entitled on Innovative Approaches for Sustainable Agriculture, Livelihood and Environment Security on November 07, 2015 at Gochar Mahavidyalaya, Rampur Maniharan, Saharanpur	Dr. Chandra Bhanu
Invited speaker in Vishal Aam Gosthee evam Pradarshani organized by Mango Growers Association of India at Malihabad, Lucknow on 3rd June 2015	Dr. Dushyant Mishra
Invited as speaker on training program for mango June 20-22, 2015 at KVK Kuchchh (Gujarat)	Dr. Dushyant Mishra
Invited as Judge during 24th Nationaml Mango Mela organized by Haryana Government at Yadvindra Garden during July 4-5, 2015	Dr. Dushyant Mishra
Conducted viva voce exam of M.Sc Horticulture student at Department of Horticulture, SVPUAT, Modipuram on 18th December, 2015	Dr. Dushyant Mishra
Nominated as member in selection committee for selection of Young Professional 1 at ICAR-IIFSR on 30th April, 2015	Dr. Dushyant Mishra
Evaluated the thesis of of M.Sc (Ag) Horticulture thesis of Navsari Agricultural University, Navsari on 9th June, 2015	Dr. Dushyant Mishra
Invited as Judge during 24th National Mango Mela organized by Department of Horticulture, Haryana in collaboration with Haryana Tourism Development Corporation at Yadvindra Garden, Pinjor, Chandigarh on 4th July, 2015	Dr. Dushyant Mishra
Conducted viva voce exam of M.Sc (Ag) Horticulture thesis of Sardar Vallab Bhai Patel University of Agriculture and Technology on 29th July, 2015	Dr. Dushyant Mishra
Conducted viva voce exam of Ph D (Horticulture) thesis of Sardar Vallab Bhai Patel University of Agriculture and Technology on 10TH November, 2015	Dr. Dushyant Mishra
Received certificate of appreciation by organizers by Dainik Jagran at Sardhana, Meerut in Kisan Mahotsav organized during 31st March to 2nd April, 2015	Dr. Dushyant Mishra
Recognition as Expert on Horticulture for Uttar Pradesh by Ministry of Agriculture and Farmers welfare, Government of India under Kisaan Knowledge Management System	Dr. Dushyant Mishra
Served as Referee for research journals of OMICS group	Dr. Dushyant Mishra
Participated in *Kisan Mahotsav* organized by Dainik Jagran at Sardhana, Meerut during 31st March to 2nd April 2015 and received certificate of appreciation by organizers	Dr. Dushyant Mishra and Dr. Chandra Bhanu
Co-chaired two sessions on 'Review of progress of farming systems characterization' and 'Review of on-station research' during the Group Meeting held at AAU, Jorhat	Dr. Harbir Singh
Served as Referee for two research journals viz., Indian Journal of Agricultural Research and Agricultural Economics Research Review	Dr. Harbir Singh
Co-chaired the technical session II on "Climate change aimpact on Madhya Pradesh Agriculture in National Seminar on climate change and smart agriculture technology organized by Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalay Gwalior (M.P), June 13-14, 2015	Dr. M. Shamim

Recognitions	Received By
Reviwed research article sent by editors of national and international research journals	Dr. M. Shamim
Invited to present lecture in National Seminar on climate change and smart agriculture technology organized by Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalay Gwalior (M.P), June 13-14, 2015	Dr. M. Shamim
External Examiner for Ph.D thesis viva and thesis evaluation to Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. During the year, conducted 1 Ph.D viva voce and evaluated 3 Ph.D and 1 M.Sc thesis for award of respective degrees	Dr. N. Ravisankar
Focal point expert for the regional consultation meeting on "Status and future prospect of organic agriculture for safe food security in SAARC countries" organized by SAARC Agriculture Centre, Dhaka, Bangladesh	Dr. N. Ravisankar
Resource person in the National Conference on Sustainable Agriculture and Farmers Welfare organized by Ministry of Agriculture and Farmers Welfare held at Gangtok, Sikkim during 17-18 January, 2016. Plenary session of the conference was chaired by Hon'ble Prime Minister of India	Dr. N. Ravisankar
Invited to present status paper on organic farming before Task force on Organic Farming and Non chemical farming in NASC complex, New Delhi.	Dr. N. Ravisankar
Convened one technical session at International Extension Education Conference on Education, Research and Services organised by Department of Extension Education, Institute of Agricultural Sciences, BHU, Varanasi (U.P).	Dr. Nisha Verma
Served as Referee for two research journals viz., *Journal of Human Ecology (JHE)* and Journal of Food Processing & Technology	Dr. Nisha Verma
Evaluated M.Sc.Thesis of Ms. Samapika Dalai, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut.	Dr. Poonam Kashyap
Acted as member in viva- voce of Ms. Samapika Dalai, for the award of M.Sc. Degree on July 15, 2015 at College of Horticulture, Sardar Vallabhbhai Patel University of agriculture and Technology, Modipuram, Meerut.	Dr. Poonam Kashyap
Acted as reviewer of national and international peer reviewed journals	Dr. Poonam Kashyap
Reviwed research article of Indian Journal of Animal Science and Tropical Animal Health and Production	Dr. Suresh Malik

RESEARCH COORDINATION AND MANAGEMENT

Research Advisory Committee

The second meeting of the 7th Research Advisory Committee of ICAR-Indian Institute of Farming Systems Research, Modipuram constituted vide NRM/17-16/2013-IA.II dated 6th September 2013, was held on October, 28-29, 2015 at Modipuram. The meeting was started with ICAR song. Thereafter, Member Secretary explained that the meeting is significant as it is the first meeting of RAC after Directorate become institute from November 2014 and for the first time Chief Agronomist/Agronomist/Principal Investigators from selected centres of AICRP on IFS and NPOF are invited for discussion. Dr J.P. Singh, Director (Acting), ICAR-IIFSR welcomed the Chairman and Members of RAC and briefed on the activities undertaken between last RAC and the present meeting. The significant achievements highlighted were preparation of 29 region specific IFS models using on-station, on-farm and secondary data, compilation of farmer success stories (80 no's) from on-farm farming systems research, preparation of country status report and base paper on organic farming and year round capacity building activities for institute scientists/AICRP centres and farmers. In his opening remarks, Chairman pointed out that the basic aim of farming systems research should be how a farmer thinks in managing his resources. Dr V.S. Korikanthimath pointed out that farming system models should be promoted as better economic proposition among small and marginal farmers and should aim to attract farmers towards agriculture on the lines of Skill India and Smart India. Dr Arun Varma, opinioned that yield gaps needs to be fixed to get maximum profit from agriculture. Mr Naresh Sirohi pointed out that IFS project has contributed for the betterment of farmers and it is the only approach by which farmer's profitability can be enhanced. Further, he informed that the success stories should be published in regional languages and can be disseminated through DD Kisan by respective universities. The Chairman and the members of the RAC expressed their critical views during the presentations made by the concerned scientists/team. On second day, Dr N. Ravisankar, Member Secretary presented the action taken report on the recommendations of last RAC meeting and in over all, the Committee was satisfied with the action taken report. Dr N. Ravisankar also made a brief presentation of technical programme of On-Farm Research for getting the inputs/suggestions from RAC. The committee members were satisfied with IFS approach of implementing the on-farm programme and suggested to involve KVK's in the district for more reach.

Further, the Committee deliberated on the on-going research programmes vis-à-vis the mandate of the Institute. The Committee also took a note of QRT (2007-12) recommendations. The Committee recognizes that the Directorate was changed to Institute from 2014 and clear cut differences are to be worked out between IIFSR and AICRP on IFS. The Institute should increasingly adopt an agro-ecology based approach to farming systems research. There was also an urgent need to integrate the activities of the Institute based programmes and those of the network centres. The AICRP on IFS / NPOF should aim for intentional integration and evaluation of components for higher profitability, resource recycling, reducing market/ external inputs etc. In this context, the existing programmes were reviewed and the following broad recommendations are made.

Recommendations

1. IFS approach should be farmer centric and participatory with region specific components. The institute programmes must aim at better understanding of the existing farming systems with a view to refine and test opportunities to enhance the system.

2. Farming systems approach should increasingly use the agro-ecological approaches to study the interactions among farming system components. This should be done by the institute by training the Scientists of the institute/centres. AICRP on IFS

centres should workout the IFS components with purposive intentional integration using bio-physical characterization.

3. Identify the issues and practical constraints of Geo-referenced farmers in all the 11 locations and technical interventions be documented to improve the already characterized organic growers. Site specific technical interventions may be implemented using farmer participatory approach.

4. Capacity building including international exposure of Scientists and research managers is essential as the mandate has been completely shifted from cropping to farming system approaches.

5. National and International exposure to NPOF Scientists for better understanding with global trends in organic farming research should be given priority. NPOF may seek association with organizers of organic world congress 2017 at New Delhi.

Group Meeting of ICAR-AICRP on Integrated Farming Systems

The group meeting of ICAR-AICRP on Integrated Farming Systems was organized during 16-18 December, 2015 at Assam Agricultural University, Coimbatore in which review of on-going research programmes of on-station and on-farm centres including Tribal Sub Plan, discussion on formulation of new experiments and special lectures on identified topics were undertaken. The inaugural programme of the group meeting started with *Saraswathi Vandana* performed by AAU staff. Dr.Ajit Baishya, Chief Agronomist welcomed the guests and delegates. He briefly informed that the cropping intensity in the region increased from 131 to 142 %. Dr G.N. Hazarika, Director of Research informed that contribution of university is immense in the region and farming system is native to these lands. Dr. K. M. Bujarbaruah, Vice Chancellor, AAU inaugurated the programme as chief guest. Dr. J.P. Singh, Director (Acting), ICAR-IIFSR gave brief history of ICAR-IIFSR. He appraised about the changed mandate of the institute, vision, mission and schemes, additional responsibilities and future functioning of different programmes of the institute. A brief note of the progress made by ICAR-IIFSR and AICRP on IFS during 2014-15 was also explained by him. Dr N.P. Singh, Director, ICAR-CCARI in his address, made it that carbon sequestration and microbial studies should be undertaken in farming system models being developed at various regions. The following publications brought out by the ICAR-IIFSR and AICRP on IFS centres were released by the Chief Guest.

1. Annual Report, 2013-14 of AICRP on IFS

2. Long term Integrated Nutrient Management in cereal based cropping systems (B. Gangwar, Kamta Prasad, N. Ravisankar & JP Singh)

3. Farming Systems Research: Success Stories (Series 1) (N. Ravisankar, B. Gangwar, Kamta Prasad, Raghuveer Singh and Rajbir Singh)

4. Farmer perception on climate change and Integrated Farming System as adaptation measure towards changing climate (M. Shamim, N. Ravisankar, B. Gangwar and Kamta Prasad)

5. CD on "TSP interventions in Bali Island" (AICRP on IFS centre, BCKV, Kalyani)

Dr. K.M. Bujarbaruah, Vice Chancellor and Chief Guest, pointed out that systematic farming system research was initiated in 1975 at ICAR Research complex in Umiam (Meghalaya) and said that filing of data and information on machinery, parameters, weather and output filing needs to be created. He wished that at the end of delibrations, some useful recommendations will come which can be utilized in the development schemes. Dr N. Ravisankar, PF (CU) proposed the vote of thanks in the inaugural programme. The results of experiments conducted at on-station, on-farm and tribal sub plan were reviewed critically and following recommendations were made in the workshop.

Recommendations

On-station Research

- All the centres should ensure compliance of recommendations made in Technical Programme Review workshop held in 18-19 May 2015 at ICAR-IIFSR, Modipuram. Accordingly action needs to be taken to conclude the cropping system experiments and prepare the new experiments in farming systems perspective for discussion in the 32nd Biennial workshop.

- As per decision of technical programme review workshop, organic farming study to be continued at identified 8 centres only with modified technical programme. Formulation of study on weed management under organic condition to be made in consultation with DWR/AICRP on WM.

- On-station centres should transfer the best treatments from concluded experiments to farmer's field through OFR programme of AICRP on IFS for farmer participatory evaluation. Publications/technical bulletins should also be brought out from the concluded experiments.

- Responses / feedback of visiting farmers/stake holders to IFS models should be recorded and considered for improving the components of farming systems. Resource recycling flow chart should be prepared and presented by all centres.

- IFS models for different regions and resources should be synthesized using the standard methodology finalized during on-station regional workshops. In view of shortage of funds provided by council in the scheme, upscale the IFS models using Central Government schemes/other funding sources/state plan schemes/university extension programmes. It will be one of performance indicator for judging the centre.

- Preparation of bankable project on IFS for different regions is essential. Using the on-station & on-farm data, bankable project on IFS for each on-station IFS model should be prepared by Agricultural Economists in the scheme. Each scientist may be assigned the responsibility for 2-3 on-station/sub centres for preparation of bankable project.

- Farming Systems Characterization work is joint responsibility of main, sub and OFR centres. Agricultural Economists in the scheme should be made responsible for survey, analysis and preparation of report. Each Agricultural Economist may be assigned 2 states for farming systems characterization work.

- In the existing IFS model, carbon sequestration and greenhouse gas emissions estimation needs to be made by Soil Scientists in the project. To ensure uniform methodology, training for Soil Scientists be arranged at ICAR-IIFSR.

- IFS model for marginal farmer should be established by all sub centres. Initially keep low cost livestock components. Later on dairy and other infrastructure can be added provided additional funds are received from council.

On-Farm Research

- OFR farming systems data should be synthesized in terms of production (on equivalent basis), marketable surplus (on equivalent basis), total cost of the system, total net income, savings after meeting all house hold demand, resource recycling and its impact on saving of nutrients/water/market inputs. All the above parameters should be used for comparing the various farming systems in the district.

- Farming system wise resource recycling flow chart should be prepared by all OFR centres.

- Impact study of interventions made in OFR 2 & 3 experiments should be taken up during 2016-17. Clear recording of reasons for adoption/partial adoption/rejection of farming system interventions to be noted. Schedule for impact study to be prepared by ICAR-IIFSR and sent to all centres by May 2016.

- Under TSP, seed bank can be developed for better performing variety. Use of chemical fertilizers and pesticides should be avoided because tribal area comes under natural de-facto organic production systems.

Administrative

- Delegation of financial power equivalent to the HoD's/Principal Investigators (as per ICAR guidelines) of external funded projects should be given to Chief Agronomists/Agronomists/Principal Investigators of the AICRP-IFS centres. This will facilitate for the round the year management of activities related to livestock, fisheries and other important components of the IFS model which requires timely attention.

- A separate meeting of identified centres for undertaking weed management in organic farming experiment along with Scientists from Directorate of Weed Research, Jabalpur and AICRP on Weed Management centres should be organized during April/May 2016 for formulating the technical programme.

- Each fund receiving university/institute should submit the scheme annual report containing the details of *staff, technical progress, collaborative studies under inter-institutional linkage, TSP activities, publication details, extension activities, financial statement including revenue generation, infrastructure development (NRC items), ATR on the discussion in the workshop/group meeting and ATR on monitoring visits*. Five hard copies of report and a soft copy (in editable mode to pcifs.iifsr@rediffmail.com) should be submitted to ICAR-IIFSR by 31 January.

- Best centre in each category (main, sub and OFR centres) may be identified based on overall performance including up-scaling of IFS models and additional contingencies along with certificate may be given in the Biennial workshops.

Group Meeting of OFR Agronomists & Economists

A Group Meeting of the on-farm research (OFR) Agronomists & Economists was organized by ICAR-IIFSR at Modipuram during 28–30 May 2015. In his welcome address, Dr J.P. Singh, Director, remarked that characterization is one of the main mandates of the institute and top priority should be given to farming system characterization. The inaugural session was chaired by Dr S.K. Sharma, former Project Director, PDCSR. He underscored the need for study of the whole farm surroundings for the success of on-station and on-farm research. Dr B. Mohan Kumar, ADG (Agronomy, Agro-forestry & Climate Change), ICAR, New Delhi was the Chief Guest during the concluding session on 30 May 2015. He observed that farming system approach has not received due emphasis in the past, and there is need to undertake recurrent surveys to assess farming system scenario in the country. In all, 24 OFR agronomists and 7 economists working on the on-farm research (OFR) centers of AICRP on IFS participated in this meeting. The major recommendations of the Group Meeting were:

- All the OFR centers must target detailed characterization of farming systems in at least one district every year, and send final report (soft and hard copy) alongwith dataset (soft and hard copy) to the ICAR-IIFSR.

- At many centers vacant post are not being filled up for a considerable long period. The concerned Chief Agronomist/ OFR Agronomists should strongly pursue the matter with higher authorities of University under intimation to ICAR-IIFSR.

ICAR-IIFSR should approach ICAR authorities for enhancement of budget allocation to meet all the financial requirements of farming systems characterization work, which require extensive travelling and additional manpower.

Workshop on "Organic Farming: Concerns about crop productivity and soil health"

Workshop on Organic Farming: Concerns about crop productivity and soil health sponsored by Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW) under the Ministry of Agriculture and Farmers Welfare was organized by ICAR-Indian Institute of Farming Systems Research, Modipuram on 7 January 2016. Members of Task Force on Organic Farming and Non-chemical farming, Principal Investigators of Network Project on Organic Farming (NPOF), officials from DAC&FW, National Centre of Organic Farming and Scientists of ICAR-IIFSR participated in the workshop and deliberated on policy for promotion for organic farming in the country without compromising the crop productivity and soil health.

Dr A.K. Sikka, DDG (NRM) informed that organic farming has advantages over chemical management in agriculture, but considering the food requirement in terms of quantity and quality, proper policy needs to be designed for organic farming after taking in to consideration of crop productivity in different regions.

Shri Ashok Dalwai, Additional Secretary (INM) and Dr A.K. Sikka, DDG (NRM) interacting with the participants

Discussion and formulation of policy and recommendations on organic farming

Shri Ashok Dalwai, Additional Secretary (INM) in his opening remarks informed that organic farming in the country is being promoted through Paramparaghat Krishi Vikas Yojana with a target of creating 10,000 clusters. Crop productivity under organic farming is a major a concern and considering the food security issue, proper policy of promoting organic farming in the country is essential.

Dr J.P. Singh, Director (Acting), ICAR-IIFSR welcomed the participants while Dr N. Ravisankar, Principal Scientist & National PI, NPOF presented an overview of results of NPOF especially on crop productivity and soil health along with policy input. The workshop was organized as a pre-cursor to “National Conference on Sustainable Agriculture and Farmers Welfare” to be held during 17-18 January 2016 at Gangtok, Sikkim.

After the detailed deliberations, recommendations for promotion of organic farming were finalized besides identification of researchable issues

Recommendations

1. Organic farming should be promoted in phased manner by identifying niche areas and crops. “Certified organic farming” with combination of tradition, innovation and scientific organic packages should be promoted in the de-facto organic areas (hills) and rainfed/ dryland regions for safe food security and climate resilience, besides increased income of farm households.

2. Accelerated adoption of “towards organic” (integrated crop management) approach for intensive agricultural areas (food hubs) will positively contribute to the cause of soil, human, livestock and eco-system health, the basic objective of organic agriculture.

3. Low volume high value crops should be given impetus for promotion under organic farming especially for export economy.

4. Based on research studies in scientific organic management under ICAR-Network Project on Organic Farming, 18 crops responded positively to yield on par or higher under organic systems after the conversion period (2-3 years). Organic management of basmati rice, rice, maize, green gram, chickpea, soybean, cotton, garlic, cauliflower, tomato resulted in yield advantage to the tune of 4 to 14 % over inorganic management. The scientific Package of Practices PoP’s for organic production of crops should be adopted for keeping the crop productivity at comparable or higher level and should be advocated through development schemes.

5. Yield reduction (after 8th cycle across the locations) of 5-8 % was observed in wheat, radish, potato etc. In wheat, 7 % reduction in yield was noticed over the years. Hence, organic farming should not be initiated with exhaustive crops especially in winter in the input intensive areas. However under rainfed conditions, wheat yield was comparable. Therefore, if wheat is taken in cropping systems for organic farming, it is better to take durum wheat. Reason for reduction in yield was found to be non-synchronization of nutrient release and critical stage of crop demand.

6. Area specific best cropping systems suitable for organic farming should be mapped for up scaling.

7. Cost of production per unit area is comparable or less under organic agriculture than inorganic management when on-farm organic inputs are used. However, if organic inputs from outside the farm are purchased and utilized, the cost of production increases by about 13 %. Therefore, organic agriculture should naturally depend on on-farm generation of inputs including mixed cropping, crop rotation, residue recycling, composting etc.

8. Integrated Organic Farming System (IOFS) models promises to meet 70-80 % of organic inputs within the farm and should be given impetus for promotion.

9. High volumes of organic materials are required to meet the nutrient demand for organic production. Through combination of sources, the nutrient demand can be met instead of single source and cropping system approach involving green manures and leguminous crops must be adopted. Combination of vermicompost, FYM and neem cake was found to be better compared to application of single source.

10. Decentralization/community based organic input production at local level should be promoted and need to be linked with Swacch Bharat, SHG's etc which will lead to development of micro enterprises and self-employment for youths.

11. Continuous practice of raising the crops organically has good potential to sequester the C (up to 63 % higher C stock in 10 years), higher soil organic carbon (22 % increase in 6 years), reduction in energy requirement (by about 10-15 %) and increase in water holding capacity (by 15-20 %), thereby promoting climate resilience farming.

12. Considering the advantages of organic farming, suitable market and premium price for organic produce needs to be ensured.

Research and Development

1. Although techniques of cultural and mechanical options are available for weed management, present technologies of weed management are labour intensive. Hence, weed management study should be further strengthened in collaboration with ICAR-Directorate of Weed Research, Jabalpur.

2. Regional level consultation meet with successful organic growers should be organized and their good practices need to be documented and validated.

3. Staggered N management involving split application of organic manures should be studied at selected locations to match the nutrient release and crop demand.

4. Farm mechanization techniques especially for small organic farm holders needs to be developed.

5. Region specific Integrated Organic Farming System (IOFS) models with zero external cost need to be developed for large scale promotion.

6. Sensitization of SAU's Scientists on organic farming is required by organizing a National level dialogue by DAC&FW in collaboration with ICAR.

7. Capacity building of researchers involved in organic farming especially at international level needs to be looked into.

X Annual Group Meeting of Network Project on Organic Farming organized at MPUAT, Udaipur

The X Annual Group Meeting of Network Project on Organic Farming (NPOF) was organized at Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur during 19-21 August 2015. Shri Chandra Singh Kothari, Mayor of Udaipur Corporation inaugurated the group meeting as Chief Guest. Shri Kothari expressed concern about the ill effects of indiscriminate use of chemicals especially pesticides and called for growing safe food for all on the principles of organic farming combining the tradition, modern science and farmers innovation. Professor P.K. Dashora, Vice Chancellor, MPUAT who chaired the inaugural session lauded the efforts of agricultural scientists and farmers along with policy makers for making self-sufficient India in terms of food production in the post-independence period. Further, he said that today's need is to go near to our nature as consumers have started to look for safer and better controlled foods produced in environment friendly way. Dr J.P. Singh, Director, ICAR-IIFSR said that, considering the importance of organic farming in the country and to provide technological backstopping, the number of centres have been increased to 20 from 13. He also informed that all the 7 new centres have been made functional from 2015-16 and during the year, geo-

Professor P.K. Dashora, Vice Chancellor addressing in the inaugural session

Interface meeting of researchers-farmers-development departments-NGOs-certification agencies

Release of publications by dignitaries in the inaugural session

Field visit to NPOF experiments at MPUAT, Udaipur

referenced characterization of 453 organic growers have been done to understand the dynamics of organic farming. Dignitaries also released nine publications brought out by IIFSR and cooperating centres. Dr G.S. Ameta, Director of Research, MPUAT welcomed the participants while Dr S.K. Sharma, PI, MPUAT proposed the vote of thanks in the inaugural session.

In the first two days, review of on-going programmes and re-orientation/finalization of technical programme was taken up. Besides, special lecture on third party/GGC/PGS certification by Dr A.K. Yadav, Ex-Director, NCOF & Member, RAC of IIFSR was also organized. On 21 August 2015, interface meeting of researchers-farmers-development departments-NGOs-certification agencies was organized to take stock of research requirements of all the stake holders. All the stakeholders expressed that scientific package of practices for organic production, identification of suitable varieties for organic farming and reducing the external organic inputs as requirement for successful organic farming. Dr J.P. Singh, Director, ICAR-IIFSR informed that location specific organic package of practices for 42 cropping systems have been prepared from the scheme which will be finalized and published in multiple-languages shortly. Experiments for identification of varieties and reducing the external organic input costs through integrated organic farming system models are being undertaken through the scheme.

Based on the overall performance, Pantnagar (GBPUAT) centre of NPOF was selected as best centre and a certificate were issued in the plenary session. The group meeting ended with vote of thanks proposed by Dr N. Ravisankar, National PI, ICAR-IIFSR. The consolidated recommendations of the group meeting is given below

A. Research

- Geo-referenced characterization of organic farmers is mandatory activity for all the centres. Data from minimum of 30 organic farmers per year per centre should be collected in the prescribed proforma and synthesized. The activity should be reflected in the Annual Report.
- Allelopathic kind of weed management needs to be considered in organic farming. Collaborative study on organic weed management with AICRP on weed management should consider this aspect.
- Quality of milk obtained under organic management of dairy should also be observed in the Integrated Organic Farming System (IOFS) models experiment.
- Long term analysis of yield, economics, soil physical, chemical and microbial properties in the experiment on evaluation of organic, inorganic and integrated production systems should be done and presented briefly (only 2 slides) in all future group meetings before presenting the current year results.
- Economics should be calculated with premium and without premium for organic management. This should be compared with other management practices such as integrated and inorganic which are to be calculated without any premium price. Net return per rupee invested (NRPRI) should be used as measuring parameter instead of B:C ratio.
- Yield transition period (number of years taken to obtain statistically at par yield with chemical management) for all the cropping systems under organic management should be worked out using system equivalent yield.
- New centres should initiate all the approved experiments as per the technical programme discussed and finalized. Long term experiment of evaluation of organic, inorganic and integrated production systems should be laid out as per the plan provided which includes alley strips with perennials and buffer channels.

B. Others

- Detailed Package of Practices (PoP) for organic production of crops in cropping systems perspective should be published in English and Hindi. English version should be published by December 2015 and Hindi version by March 2016. It should also be translated in to regional languages especially Tamil, Gujarati, Malayalam and Kannada. Regional translation and publication should be done by centres. For regional publication, relevant crops and packages from other locations can also added.
- All the centres should document techniques used for management of weed, pest and disease under organic management in the experiment on evaluation of organic, inorganic and integrated production systems.
- All the centres should improve the publications from the scheme especially research papers and popular articles.

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OTHER INFORMATION

Dr M.P.S Arya monitored the AICRP IFS programmes of Odisha centres at Bhubaneswar, Chiplima, Angul and Kendrpada on 21-26 Sept. 2015.

Dr Poonam Kashyap attended visitors from SAUs, Schools, College students, Forest and other state Dept. officers and explained them about the IFS.

Dr. Anil Kumar, Principal Scientist and his approved team organised IIFSR Annual Day on 27 November, 2015, which consisted of events like Annual Day Lecture, Friendly sports, indoor competitions, and prize distribution.

Dr. Devendra Kumar maintained Germplasm and put as varietal demonstration (Co 0118, Co 0238, Co 05011, Co 098014, CoSe 03234 and CoSe 01434) in D Block for farmers visit.

Dr. Devendra Kumar participated in an Exhibitions organized at Kakra village, Muzaffarnagar on 20/12/2015.

Dr. Devendra Kumar produced 1500 Quintal breeder seed of CoSe 01434 during crop season 2014-2015 under a MoU between ICAR-IIFSR and UPCSR. More than 1000 Quintal breeder seed was distributed to state stake holders allotted by UPCSR and Cane Commissioner of U.P. (See pic 3). By selling of the sugarcane breeder seed and other remaining sugarcane crop a total of around Rs. 5.5 lakh revenue was generated.

Dr. Dushyant Mishra acted as resource person in training for mango growers of Kuchchh, organized by KVK Kuchchh (Gujarat) and imparted practical training on canopy management and rejuvenation of senile mango orchards on 20th June 2015.

Dr. Dushyant Mishra attended a meeting at Agronomy Department, IARI, New Delhi for establishing IFS unit at IARI Campus on 25th February 2016.

Dr. Dushyant Mishra attended *Kharif Kisan Sammelan*-2015 and interacted with farmers, It was organized by KVK Muzaffarnagar on 27th June 2015

Dr. Dushyant Mishra Conducted many meetings of FPPFC for fixing price of farm produce at Institute level.

Dr. Dushyant Mishra Evaluated a proposal submitted under RKVY and submitted report to DDG (Horticulture) Cell at ICAR Head quarter, New Delhi.

Dr. Dushyant Mishra facilitated the visit of Ethiopian delegation at Integrated Farming System Unit of Institute on 28th April 2015.

Dr. Dushyant Mishra facilitated visit of team of Ph. D students from G B Pant University of Agriculture and Technology, Pantnagar and explained them about development of fruit crop based farming system on 9th May 2015.

Dr. Dushyant Mishra interacted with Delhi Doordarshan team on fruit crop based Integrated farming system at ICAR-IIFSR, Meerut on 7th April 2015.

Dr. Dushyant Mishra was invited as resource person to interact with mango growers of Haryana during 24th National Mango Mela organized by Department of Horticulture, Haryana in collaboration with Haryana Tourism Development Corporation at Yadvindra Garden, Pinjor, Chandigarh on 5th July 2015.

Dr. Dushyant Mishra was invited as speaker to deliver a lecture on "Mango orchard management by improved methods" during Vishal *Aam gosthee evam pradarshini* organized by Mango Growers Association of India (MGAI) on 3rd June 2015 at Malihabad, Lucknow.

Dr. R.S.Yadav monitored the AICRP IFS on Station experiments at Akola, Parbhani and Rahuri and OFR experiments at Amravati, Pune and Aurangabad.

Dr. R.S.Yadav organized celebration of 'World Soil Day on Dec. 05, 2016' and distributed about 300 soil health cards to the farmers of Mandora village, Sardhana block, Meerut.Dr. Chandra Bhanu catered need based advisory to farmers contacting the Institute in the field of IPM, mushroom cultivation and IFS.

Dr. RS Yadav and Dr. Anil Kumar organised World Soil Day function at IIFSR on December 5, 2015 to create awareness about healthy soils among the farmers. Soil health cards were also distributed to 300 farmers by the Institute on this occasion.

PERSONNEL (As on 31.03.2016)

Name of the Institute: ICAR-Indian Institute of Farming Systems Research, Modipuram,Meerut.

Director: Dr. A.S. Panwar

S. No.	Name of the Personnel	Designation	Discipline
(A)	**Scientific cadre**		
1	Dr. J. P. Singh	Principal Scientist	Agronomy
2	Dr. M.P. S. Arya	Principal Scientist	Agronomy
3	Dr. M. P. Singh	Principal Scientist	Agricultural Extension
4	Dr. Vinod Kumar	Principal Scientist	Animal Nutrition
5	Dr. Peyush Punia	Principal Scientist	Fish Resource Management
6	Dr. Prem Singh	Principal Scientist	Agronomy
7	Dr. S. P. Singh,	Principal Scientist(on Deputation)	Agricultural Economics
8	Dr. Anil Kumar,	Principal Scientist	Agricultural Extension
9	Dr. L. R. Meena	Principal Scientist	Agronomy
10	Dr. N. Ravisankar	Principal Scientist	Agronomy
11	Dr. Harbir Singh	Principal Scientist	Agricultural Economics
12	Dr. R. S. Yadav	Principal Scientist	
13	Dr. Amith Nath	Principal Scientist	Food Technology
14	Dr. Suresh Malik	Principal Scientist	Poultry Science
15	Dr. B. K. Sharma	Senior Scientist	Agricultural Extension
16	Dr. R. P. Mishra	Senior Scientist	Agronomy
17	Dr. N. Subash	Senior Scientist	Agrometeorology
18	Dr. T. Ram	Senior Scientist	Agronomy
19	Dr. V. P. Chaudhary	Senior Scientist	Farm Machinery and Power
20	Dr. Dushyant Mishra	Senior Scientist	Horticulture-Pomology
21	Dr. Debasish Dutta	Senior Scientist	Agriculture Chemicals
22	Dr. Devender Kumar	Senior Scientist	Plant Breeding
23	Shri Vipin K. Chaudhary	Scientist	Computer Applications
24	Dr. Chandra Bhanu	Scientist	Plant Pathology
25	Dr. Poonam Kashyap	Scientist	Horticulture-Pomology
26	Dr. A. K. Prusty	Scientist	Aquaculture
27	Dr. M. Shamim	Scientist	Agricultural Meteorology

S. No.	Name of the Personnel	Designation	Discipline
28	Shri Sanjeev K. Kochewad	Scientist	Livestock Production and Management
29	Shri Sunil Kumar	Scientist	Agricultural Statistics
30	Dr. Sanjeev Kumar	Scientist	Agronomy
31	Dr. Nisha Verma	Scientist	Family Resource Management
32	Shri Raghuveer Singh	Scientist(On Study leave)	Agronomy
33	Shri Amrit K. Meena	Scientist	Soil Science
34	Shri Lalit K. Meena	Scientist	Plant Physiology
35	Shri Prakash C. Ghasal	Scientist	Agronomy
(B)	**Technical Staff**		
1	Shri J P Singh	Chief Tech. Officer	
2	Shri Krishanpal	Chief Tech. Officer	
3	Dr. Yogendra Singh	Chief Tech. Officer	
4	Shri D. Tripathi	Chief Tech. Officer	
5	Dr. Vipin Kumar	Chief Tech. Officer	
6	Shri K. V. Anand	Asstt. Chief Tech. Officer	
7	Shri Naval Singh	Asstt. Chief Tech. Officer	
8	Dr. Brij Mohan	Asstt. Chief Tech. Officer	
9	Shri P P Mishra	Asstt. Chief Tech. Officer	
10	Dr. O K Tomar	Asstt. Chief Tech. Officer	
11	Dr. S P Singh	Asstt. Chief Tech. Officer	
12	Shri S. K Duhoon	Sr. Tech. Officer	
13	Dr. Vinod Kumar	Sr. Tech. Officer	
14	Shri R B Tiwari	Sr. Tech. Officer	
15	Shri D P Singh	Sr. Tech. Officer	
16	Shri Brijesh Sharma	Sr. Tech. Officer	
17	Shri Krishan Kumar	Sr. Tech. Officer	
18	Shri D K Pandey	Technical Officer	
19	Shri A P Dwivedi	Technical Officer	
20	Shri Uma Shankar Pandey	Sr. Technical Assistant	
21	Shri Ashok Kumar	Sr. Technical Assistant	
22	Smt. Anju Verma	Sr. Technician	
23	Shri Raj Kumar Meena	Sr. Technician	

S. No.	Name of the Personnel	Designation	Discipline
(c)	**Administrative staff**		
1	Sh. Ravinder Singh	Sr. Administrative Officer	
2	Sh. T.C. Sharma	Finance &Account Officer	
3	Sh. Attar Singh	PS to Director	
4	Sh.S.K.Gupta	Asisstanat	
5	Smt. Sheela Devi	Asisstanat	
6	Smt. Alka Jain	Asisstanat	
7	Sh. Jata kant	Asisstanat	
8	Smt. Jai Lata Sharma	Personal Asisstanat	
9	Sh. Rai Bahadur	Personal Asisstanat	
10	Sh. S.K. Bansal	Stenographer	
11	Sh. Brij Bir singh	Stenographer	
12	Sh. Rajesh Kumar	Stenographer	
13	Sh. Ravi Kant	Sr. Clerk	
14	Sh. Prem Singh	Sr. Clerk	
15	Sh. Rajender Kumar	Jr. Clerk	
16	Sh.Permanand	Jr. Clerk	
17	Sh. D.C. Mishra	Jr. Clerk	
(D)	**Supporting Staff**		
1	Sh. Anand Singh	Supporting	
2	Sh. Prem Kumar	Supporting	
3	Sh. Rakesh Kumar	Supporting	
4	Sh. Rajender Singh	Supporting	
5	Sh. Prem Shanker	Supporting	
6	Sh. Mahabir Singh	Supporting	
7	Sh. Mahabir Singh	Supporting	
8	Sh. Kripa Shanker Pandey	Supporting	
9	Sh. A.P. Dubey	Supporting	
10	Sh. Harsh Nath	Supporting	
11	Sh. Sada Ram	SSS Grade-I	

LIST OF ON-GOING PROJECTS (IN-HOUSE)

Sl. No.	Project Title and Code	PI	Co PI's	Duration
I.	**Cropping Systems and Resource Management (CSRM)**			
1.	Weed utilization evaluation for supplementary farming system productivity	Dr. T. Ram Dr. V. P. Choudhary	Dr. Prem Singh	Kharif 2015 to Kharif 2018
2.	Evaluation of sugarcane – wheat varieties under sugarcane-ratoon-wheat cropping system	Dr. Devendra Kumar	Dr. Sanjeev Kumar Mr. Lalit K. Meena Mr. Amrit Lal Meena	May 2015 to April 2017
	Exploratory study			
3.	Screening of short duration varieties in sugarcane-wheat cropping system	Dr. Devendra Kumar	Dr. Lalit K. Meena Dr. Sanjeev Kumar Dr. Amrit Lal Meena	Extended till 2015-16 (one year)
II.	**Integrated Farming Systems Management**			
4.	Development of cost effective and sustainable Integrated Farming System Models for livelihood improvement of small farm holders.	Dr. J. P. Singh	Dr. Dusyant Mishra Dr. A. K. Prusty Dr. S. Malik	2010-2017
5.	Assessment of climate change impact on Integrated Farming Systems through Modelling	Dr. N. Subash	Dr. M. Shamim Dr. J. P. Singh Dr. A.K.Prusty Dr. S. Malik	2013-2016
6.	Development of year–round production module of mushrooms for small and marginal farmers	Dr. Chandra Bhanu	Dr. J. P. Singh Dr. Amit Nath	2013-2016
7.	Productivity and economic evaluation of horticulture based farming systems	Dr. Poonam Kashyap	Dr. Harbir Singh Dr. R. S. Yadav	2011-2020
8.	On-Farm value addition for livelihood improvement of small farm households in Western Plain Zone of Uttar Pradesh	Dr. Amit Nath	Dr. M. P.Singh Dr. D. Dutta Dr. R. P. Mishra Dr. Poonam Kashyap Dr. Nisha Verma	Nov 2013 – October 2018
9.	Identification of potential herbal plant species for integration in existing farming systems	Dr. Amit Nath	Dr. D Mishra Dr. D Dutta Dr. L. R. Meena	2015-2019
10.	Synthesis and validation of secondary agriculture module for different agro climatic zones through AICRP-IFS	Dr. Amit Nath	Dr. Peyush Punia Dr. Nisha Verma	July 2015 to July 2018
11.	Development of an IFS model for sustained production and livelihood improvement under marginal farm condition	Dr. L. R. Meena	Dr. R. S. Yadav Dr. Sanjeev Kumar Dr. Lalit K. Meena	July 2015 to July 2018
12.	Round the year forage production in IFS model for marginal farm holders in Western Plain Zone of Uttar Pradesh	Dr. L. R. Meena	Dr. N. Ravisankar Dr. R. S. Yadav Dr. Sanjeev Kumar	2015-2016

Sl. No.	Project Title and Code	PI	Co PI's	Duration
13.	Development of fish based farming system model for marginal farmers	Dr. A. K. Prusty	Dr. J. P. Singh Dr. S. Malik Dr. Amit Nath Dr. Poonam Kashyap Dr. Peyush Punia Dr. M. Shamim	November 2015 to October 2020
14.	Comparative study of role of women in predominant farming systems of Western plain zone of UP and Hill zone of Uttarakhand	Dr. Nisha Verma	Dr. M. P. S. Arya Dr. M. P. Singh Dr. Poonam Kashyap Dr. Amit Nath	Dec 2013-Nov2016
15.	Development of fruit crop based high density farming systems for higher productivity and profitability under small farm conditions <u>Sub Project:</u> Study on suitability of non-traditional high value fruit crops under small farm conditions of Western U. P.	Dr. Dushyant Mishra	Dr. Sudhir Kumar Dr. J. P. Singh Dr. M. Shamim Dr. Amit Nath Dr. Chandra Bhanu Dr. L.K.Meena	Feb 2014 to Jan 2024
16.	Characterization and mapping of Farming Systems in India	Dr. Harbir Singh	Dr. Vinod Kumar Mr. Raghuveer Singh Dr. Nisha Verma Dr. S. Malik Dr. L. R. Meena	April 2014 – March 2016
III. Organic Agriculture Systems				
17.	Studies on Persistence of Pesticides Residues in the agricultural produce of intensively cultivated farming situations in peri–urban areas of Western Plain Zone of Uttar Pradesh	Dr. Debashish Dutta	Dr. Prem Singh Dr. Amit Nath Dr. D. Mishra Dr. Nisha Verma	Nov 2013 to Oct 2018
18.	Development of microbial consortia for crop disease suppression, growth promotion and yield enhancement under organic farming system	Dr. Chandra Bhanu		July 2014-June 2018
19.	Estimation of greenhouse gas emission from IFS modules and models under AICRP-IFS	Dr. R. S. Yadav	Dr. L. R. Meena Dr. J. P. Singh Dr. Vinod Kumar Dr. Dushyant Mishra	April 2014 to March 2017
20.	Effect of RCT and Potassium application on soil health, productivity and quality of produce in Integrated Farming system	Dr. Sanjeev Kumar	Dr. L. R. Meena Dr. Vinod Kumar Dr. V.P. Choudhary Dr. A. L. Meena	July 2015 to June 2020
IV.	**Technology Transfer and HRD**			
21.	System based proven technologies in farming system perspective under demonstration in Technology park	Dr. M. P. Singh	Dr. Prem Singh Dr. R. P. Mishra	2014-2018

Sl. No.	Project Title and Code	PI	Co PI's	Duration
22.	On-farm validation of ICAR-IIFSR developed IFS modules for marginal and small farm house holds	Dr. M. P. Singh	Dr. Sanjeev Kumar Dr. Vinod Kumar Dr. A. K. Prusty Dr. Poonam Kashyap Dr. Chander Bhanu Dr. Peyush Punia	June 2015 to May 2020
23.	On farm integrated farming system management	Dr. B. K. Sharma	Dr Anil Kumar Dr. Chandra Bhanu Dr D. Mishra Dr. Prem Singh	June 2015 to June 2018
24.	Development of web based integrated information system for Indian farming systems research	Mr. Vipin Kumar		2015-2017
25.	Diversification of existing farming systems through integration of poultry for improving livelihood of marginal and landless farmers	Dr. S. Malik	Dr. Vinod Kumar Dr. A. K. Prusty	March 2014 – February 2018
VI.	**Coordination Unit**			
26.	On-farm crop response to plant nutrients in rice-wheat cropping system (RWCS) and their impact on crop-livestock-human continuum	Sh. Raghuveer Singh	Dr. N Ravisankar Dr. Pramod Singh	March 2014 to February 2016

LIST OF ON-GOING PROJECTS (EXTERNALLY FUNDED)

Sl. No.	Project Title and Code	PI	Co PI's	Duration	Funding agency
I.	**Externally Funded Projects**				
1.	Network Project on Organic Farming (NPOF) Modipuram Centre	Dr. M. P. S. Arya	Dr. Chandra Bhanu Dr. Amit Nath Dr. Debashis Dutta	2005-2017	ICAR-NPOF
2.	AICRP on Integrated Farming Systems (On-station, Modipuram)	Dr. J. P. Singh	Dr. D. Mishra Dr. S. Malik Dr. Chandra Bhanu	2010-2017	ICAR-AICRP
3.	AICRP on Integrated Farming Systems (OFR- Modipuram)	Dr. L. R. Meena		2014-17	ICAR-AICRP
4.	Precision nutrient management using GIS based Spatial variability mapping under upper and middle Gangetic Plain Zones of India.	Dr. V. K. Singh		2011-2016	ICAR
5.	On-farm precision nutrient prescription under pre-dominant cereal-cereal cropping system using Nutrient Expert ®. IPNI Project	Dr. V. K. Singh	Dr. R. P. Mishra	2014-2016	IPNI
6.	Adaptation and mitigationpotential through conservation agriculture andIFS modules (NICRA).	Dr. N. Subhash	Dr. M. P. S. Arya Dr. V. P. Choudhary Dr. R. S. Yadav Dr. Debashis Dutta Dr. Sanjeev Kumar	2011-2017	ICAR-NICRA
7.	Integrated spatial farming systems analysis techniques with remote sensing and ancillary data (INFARM)	Dr. N. Ravisankar	Dr. M. Shamim	2013-2016	SAC, Ahmedabad
8.	Integrated organic farming systems project (consultancy mode with UCOB)	Dr. B. Gangwar	Dr. Kamta Prashad Dr. N Ravisankar Dr. Anil Kumar	2014-16	
9.	Agri-CRP project on Conservation Agriculture	Dr. M. P. S. Arya	Dr. Mohd. Shamim Dr. A. L. Meena Dr. Sanjeev Kumar	2015-17	ICAR-IISS Bhopal
10.	Efficient ground water management for enhancing adaptive capacity to climate change in sugarcane farming system	Dr. Prem Singh	Dr. V. P. Choudhary Dr. N. Subash	2015-2017	ICAR-IIWM, Bhuba-neswar
11.	Integrated farming system for improvement of nutrition and livelihood of farm women under different agro-ecosystems	Dr. Dushyant Mishra	Dr. Nisha Verma Dr. Sanjeev Kumar	2015-2018	ICAR-CIWA, Bhuba-neswar
12.	Crop growth monitoring, yield prediction and early warning system NFBSFARA, Nation Agricultural Science Fund (NASF)	Dr. N. Subash	Dr. Sudhir Kumar	2015-18	NASF

Sl. No.	Project Title and Code	PI	Co PI's	Duration	Funding agency
13.	AICRP on IFS (ALL India)	Dr. N. Ravisankar (Co-ordinator)			ICAR
14.	NPOF (All India)	Dr. N. Ravisankar (Co-ordinator)			ICAR
II.	**Foreign Aided Projects**				
15.	Global Yield Gap and Water Productivity	Dr. N. Subash		2013-16	ICAR-UNL Collaborative Project
16.	Strengthening Simulation Approaches for Understanding, Projecting and Managing Climate Risks in Stress-prone Environments Across the Central and Eastern Indo Gangetic Basin	Dr. N. Subash	Harbir Singh	2015-2017 (Phase II)	DFID through AgMIP, ICRISAT
17.	Developing and defining climate smart agriculture practices portfolios in South Asia	Dr. N. Subash		September 2015-19	ICAR-CIMMYT

ICAR-IIFSR: AN APPROACH TOWARDS "FARMERS FIRST"

Farmers visited to ICAR-NDRI, Karnal on 15.02.2015

Farmers visited to ICAR-CSSRI, Karnal on 15.02.2015

Farmers visited to ICAR-SBIC, Karnal on 19.02.2015

Farmers visited to IIWBR on 15.02.2015

Farmers visited to PAU, Ludhiana on 19.02.2015

Farmers visited to BISA farm on 19.02.2015

Training to the farm women on importance of small farm tools for drudgery reduction

Kisan Gosthi and field training

Demonstration on raising of tomato seedlings in soil less media and under low cost poly tunnels

Field day on scientific raising of tomato seedlings in soil less media and planting of raised seedlings in fields

Field day on the scope and importance of Boundary Plantation and live fences (Karonda)

KisanGosthi and training on "Dairy Farming for Livelihood and Rural Employment" 08-03-2016

Kisanmela at Navala (Muzaffarnagar)

Dr. Sanjeev Balyan, Union State Minister of Agriculture, Cooperation and Farmer Welfare sowing sugarcane using sugarcane transplanter at farmers field in Nawla Village

Kisan Mela at Meerapur Dalpat (Muzaffarnagar) 8000 Farmers attended

DISTINGUISHED VISITORS

Dr. Sanjeev Balyan, Union State Minister of Agriculture, Cooperation and Farmer Welfare

Dr. S. Ayapan, Former Secretary to GOI and DG, ICAR, New Delhi (22/08/2015)

Brainstorming session on collaborative project with CIMMYT Scientists

Dr. Tesfaye Feyisu, Team Leader with Ethiopian Delegation

Dr. S. Bhaskar Assistant Director General (Agronomy Agro-Forestry & climate Change)) visited the Institute on March 08,2016

Dr. Gaya Prasad, VC (SVPAU&T) visited the Institute on March 17, 2016

FARMERS FIELD DEMONSTRATIONS

Demonstrations conducted during 2015 -16 at Rasoolpur Jattan village in Muzaffar nagar district.

Crops	No. of OFTs	Yield q ha^{-1}		% increased in yield of T-2 over T-1
		T-1	T-2	
1. Sugarcane+Greengram	55	620	703	13.4
2. Sugarcane+Maize (Fodder)	60	620	668.5	7.8
3. Rice	40	40.8	42.75	4.8

T-1: Framers' practice, T-2 Improved practice

Framers' practice

Improved practice

On-farm trials conducted on nutrient management in wheat and mustard at Kailawara village in Muzaffar nagar district.

Crop	No. of OFTs	Average yield (t ha^{-1})			% increased in yield of T-2 over T-1	% increased in yield of T-3 over T-1
		T-1	T-2	T-3		
Wheat	36	41.24	43.56	44.48	5.65	7.87
Mustard	10	17.83	19.13	19.73	7.29	10.66

T1 – Farmers' practice (FP), T2- Improved Practice (FP+potash), T3- IP (FP+ potash+Sulphur)

Framers' practice

Improved practice

ICAR-IIFSR IN MEDIA


शोध को प्रयोगशाला से खेतों तक ले जाएं वैज्ञानिक


मेरठ ने ओढ़ी धुंध की चादर


प्रकृति की मदद लेकर खुद को मजबूत बनाएं किसान


कमजोर मानसून के दावे बेदम


मानसून पर छाए संकट के बादल


मौसम

बारिश की गोद में आई ठंड

- अधिकतम तापमान ने 7.2 डिग्री का लगाया गोता


गेहूं और आलू की फसल को भारी नुकसान


आसमां में लग गई है आग


तेज हवाओं और बूंदाबांदी से गुलाबी ठंड

- देर शाम तेज हवाओं के साथ पड़ी फुहारें

मोदीपुरम : देर शाम रिमझिम फुहारों ने वातावरण में गुलाबी ठंडक घोल दी। मौसम वैज्ञानिकों ने बताया कि अगले 24 घंटे में एक बार फिर बारिश हो सकती है। माना जा रहा है कि बुधवार को बदला मौसम आने वाले दिनों में तापमान में परिवर्तन लाएगा। पारा धीरे-धीरे और नीचे जाएगा। खासकर रात के समय ठंड की दस्तक देगी।

पिछले एक-दो दिनों में तापमान में बढ़ोतरी दर्ज की गई थी। इसके साथ आर्द्रता का प्रतिशत भी बढ़ गया था। बुधवार को शाम से ही ठंडी हवाएं चलने लगीं। बादलों की गड़गड़ाहट और बिजली की चमक के साथ हुई बूंदा-बांदी ने माहौल में हल्की ठंड पैदा कर दी। कई दिनों से तापमान में हुई बढ़ोतरी भी नीचे आई जबकि आर्द्रता में इजाफा हो गया। आने-जाने वाले लोगों तथा बाजार हाट में मार्केटिंग करने, घूमने-फिरने निकले लोग अचानक हुई बारिश से बचते नजर आए। आइआइएफएसआर के मौसम कृषि वैज्ञानिक डा. एन. सुभाष ने बताया कि गुरुवार को भी बारिश के आसार है। वहीं चौधरी चरण सिंह विश्वविद्यालय के मौसम विभाग के प्रभारी अशोक गुप्ता ने बताया मानसून सीजन के जाते-जाते इस प्रकार की बारिश होती है। इससे आने वाले दिनों में तापमान में गिरावट होगी। बुधवार को अधिकतम तापमान 32.3 डिग्री सेल्सियस व न्यूनतम तापमान 21.8 डिग्री रहा। आर्द्रता का अधिकतम प्रतिशत 82 और न्यूनतम प्रतिशत 55 रहा।


पसीने से भी तर होंगे और बारिश से भी


समय पर आएगा, लेकिन कमजोर रहेगा मानसून

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