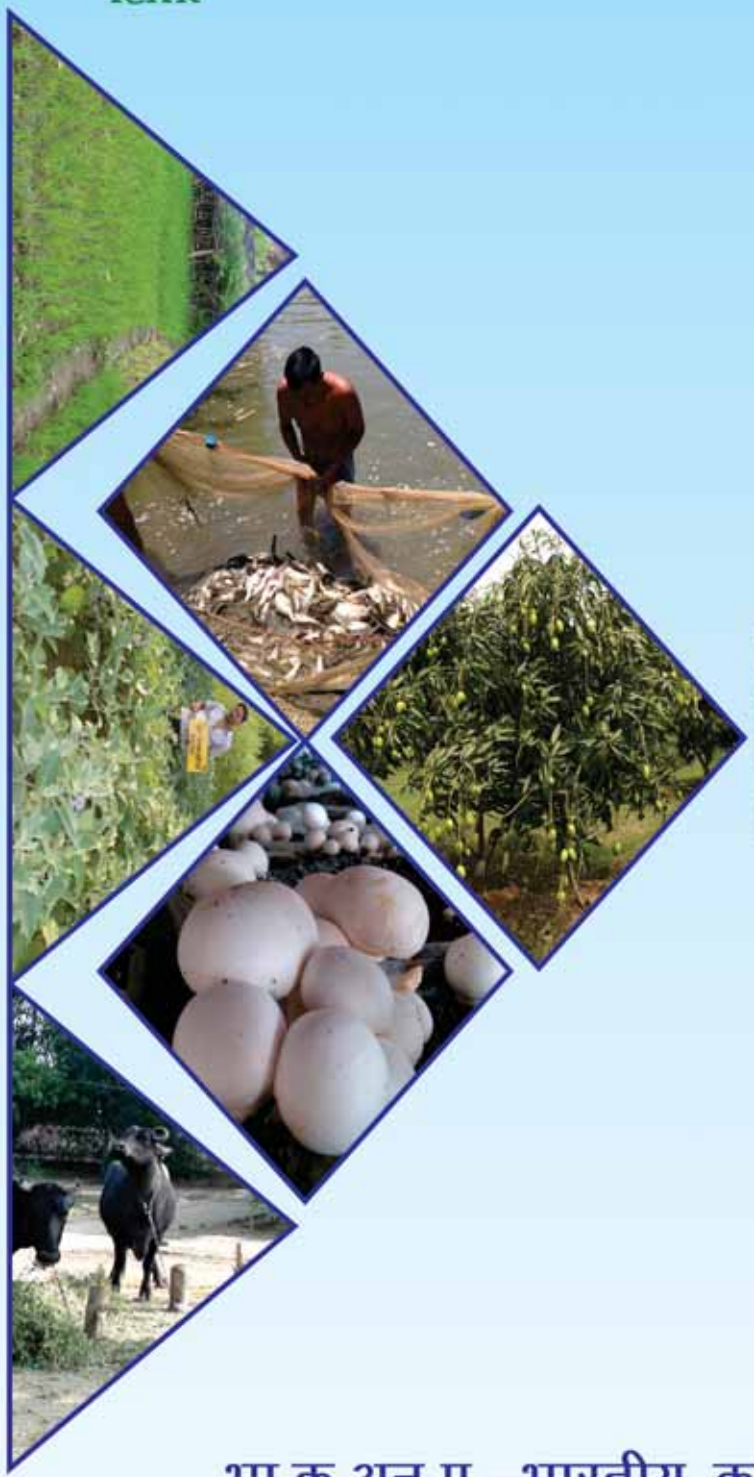
वार्षिक प्रतिवेदन
Annual Report
2014-15



IIFSR

भा.कृ.अनु.प.–भारतीय कृषि प्रणाली अनुसंधान संस्थान
मोदीपुरम, मेरठ–250 110 (यू.पी.)

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

okf"kd izfrosnu

ANNUAL REPORT

2014-15

Hkk-d-vu-i-&Hkkjrh; df"k i.kkyh vuqla/kku laLFkku
eksnhiqje] esjB&250 110] Hkkjr

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

Citation: **ANNUAL REPORT 2014-15**
ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut - 250 110, India

Compilation and Editing: Dr. M. Shamim, Scientist
Dr. A. K. Prusty, Scientist
Dr. N. Ravisankar, Principal Scientist

Hindi Translation: Dr. M. Shamim, Scientist

Cover Page Design: Mr. Shailendra Raj, Research Associate

Published by: **Dr. J.P. Singh**
Director (Acting)
ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut - 250 110 (U.P.), India
Ph. No.: 0121-295 6318
Fax No.: 0121-288 8546
Mobile: 09412234958
E-mail: directorpdfsr@yahoo.com
Website: www.iifsr.res.in

Printed at: Yugantar Prakashan Pvt. Ltd.
WH-23, Mayapuri Industrial Area Phase-I, New Delhi-64
Ph.: 011-28115949, 28116018, 9811349619, 9953134595
E-mail: yugpress01@gmail.com, yugpress@rediffmail.com

PREFACE

I am happy to write a way forward for the first issue of Annual Report after the Directorate has become full-fledged institute with 4 divisions. The number of centres under AICRP on IFS increased from 74 to 75, while NePOF centres also increased from 13 to 20. This shows the importance given to farming systems and organic farming research programme by the government in general and council in particular. Upgradation of Directorate to Indian Institute of Farming Systems Research from 27 November 2014 has been made during the "International Year (2014) of Family Farming" which mainly targets small and marginal holders who manages the farms with their own manpower and depends less on market. Farming systems is the way of life for marginal holders. During the year, the institute achieved many strides as five technologies namely bio-intensive cropping systems, IFS for marginal holders, organic farming of maize-potato-onion system, organic nutrient management packages for cropping systems and conservation agri practices for rice-wheat has been included in the documents brought by ICAR on Agricultural Technologies. Farming system models developed at various locations gives hope for realizing higher returns for farmers from a unit land. I am also happy to reveal that the family farming model of 1 ha developed by on-station centre at Sabour gives decent round the year income (ranging from Rs 13160 to 51950/ month) with more than 3 lakhs as net returns/annum. A new beginning in the AICRP on IFS has also been made with identification and issuing of certificates to best performing centers. This will certainly improve the performance of other centres also in the years to come. Regional workshops for on-station staff and partner institutions resulted in harmonizing the minds, manpower, methods and materials among different AICRPs working within the university. This can be further improved by regular one to one interactions and separate budget allocation for inter-institutional linkages. The on-farm activities in the Muzzafarnagar district of Uttar Pradesh also intensified and regular scientist-farmer interactions and *KisanMelas* are being organized. In the coming years, on-farm research in farmer participatory IFS research and capacity building of stake holders are to be given thrust. During the year, besides publication of research article in national (35) and international (7), a book on farming systems research in India also published.

Modipuram
15 May, 2015

J.P. Singh
Director (Acting)

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 (2014-15)

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
125.0	124.54	104.5	79.5	1125.0	1038.0	37.10	1075.1

b) External sources (₹ In Lakhs)

Source	Budget	Expenditure
Pension and other retirement benefits	100.0	58.25
ICAR	-	-
Personal loan and advances	5.00	4.21
Externally funded projects	46.98	44.35
Total	151.98	106.81

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

Source	Amount
Farm Produce	29.71
Sale of fish, milk and livestock	1.59
Sale of Publication	0.01
License fee/ water b charges	4.56
Cost of tender form	0.07
Service render	-
Training	-
Miscellaneous	0.66
Interest on loan and advances	7.52
Interest on TDR	6.12
Others (Royalty and Inst. Charges)	-
Total	50.24

3. Staff position (as on 31.03.2015)

Category	Sanction	Position	Vacant
		Scientific	
Scientific			
Director	01	-	01
Principal Scientist	07	15	-
Senior Scientist	12	09	03
Scientist	19	13	06
Total	39	38	-
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			
Administrative Staff			
Sr. Administrative Officer	01	00	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	17	16	01
Supporting Staff	10	10	-
Temporary Status Casual Labourers	16	16	-

* 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. Promotion/assessment

Sl. No.	Name	Promoted to	Date of promotion
1.	Sh. Krishan Kumar	Sr. Tech. Officer	22-01-2010
2.	Dr. S.P. Singh	Chief Tech. Officer	02-10-2008

3.2. Retirement

Sl. No.	Name	Retired on
1.	Dr. B. Gangwar	31-01-2015
2.	Dr. S.S. Pal	31-01-2015

3.3. Transfers

Sl. No.	Name	Designation	Date of transfer	To	Remarks
1.	Dr. G.C. Sharma	Principal Scientist	05-07-2014	CSWCR&TI, Dehradun	Transfer
2	Sh. M.P. Tripathi	Driver (T2)	28-02-2015	ICAR-IISR, Lucknow	Transfer

4. Research projects

	Numbers
a) Institute based	24
b) Externally funded	09

5. Salient Research Achievements

- The IFS model developed at IIFSR, Modipuram, in an area of 0.70 ha of land comprise of crops (0.38 ha), agri-horti system (0.30 ha), dairy animals (2 buffaloes + 1 cow), small units of mushroom and biogas (1.5 cubic meter),vermicompost, kitchen gardening and boundary plantations of guava and karonda all along the farm boundaries provide sizable amount (₹ 62,356/year) as saving to meet out other liabilities of the family. This saving is excluding of cost of production (₹ 2, 84,407) and family consumption (₹ 1, 62,810).
- The mushroom module (18'x13') gave the total yield of 457kg with net return of ₹ 26233 in addition to employment generation of about 80 man days.
- The net returns per ha from the vegetable based system was found to be ₹ 150997 followed by crop based system being ₹ 70212 followed by fruit crop based system being ₹ 50231.
- Post harvest losses of around 10-20% were recorded in sugarcane, wheat, paddy, potatoes, vegetables etc. due to poor knowledge on post harvest management and value addition in Western Plain Zone of Uttar Pradesh.
- Women are working actively in farming systems of Meerut district with very less ownership (3.47%) and no control over land.
- Crops+ dairy is the most dominant farming system in the Alipur village and delay in the start of sugarcane crushing by the sugar mills was identified as the most important constraint in the system.
- Cuttings of Anna variety of apple which were 8-9 inch long were recorded 100% survival with profuse vegetative growth without any mortality. The plants successfully passed the severe summer of the region with maximum temperature of 42°C during June 2014.
- Growing of crops in sequence of pigeon pea+black gram-wheat + mustard (ZT)-cowpea (F) was found climate resilient cropping systems it increases the soil temperature by 1.4°C.
- Growing of crops in sequence of maize (c)+veg. cowpea (bb)+sesbania (f)-lentil (bb)+mustard (f)-green gram (mt) was recorded as most profitable cropping systems under the western plain zone Uttar Pradesh.
- Long-term yield sustainability studies revels that the highest rice and wheat sustainable yield index (SYI) (0.85 for rice and 0.90 for wheat crop) was with balanced nutrition plots, whereas recommended NPK plots had lowest SYI.
- The radiation use efficiency of the mustard crop was least among over other crops (maize, wheat and barley) sown in the systems and it was 0.49 (g/MJ) and 0.59 (g/MJ) under zero and conventional methods of crop establishment.
- The highest combined heat use efficiency (Kg/Degree day) on grain yield as well as biomass accumulation basis of rice-wheat cropping system was recorded

under early sowing/transplanting condition of the crops (Rice cv. Saket 4 and wheat cv. PBW 226) which was fertilized with 150 Kg Nitrogen /ha.

- Among the different nutrient management options, integrated plant nutrient supply (IPNS) had highest system productivity followed by soil test based recommendation (STCR), state recommendation (NPKZn: NPK to rice and wheat) had lowest rice wheat system productivity except organic farming treatment.
- The sugarcane varieties viz. Co. 0238, CoSe 03234, Co 0124 and CoSe 01434 appears to be promising over others for Western plain zone.
- Soil organic carbon (SOC), available N, P, K, cationic micronutrients (Zn, Cu, Mn) except, Fe and dehydrogenase activity were recorded higher under conservation agricultural practices than conventional cultivation of rice-wheat sequence.
- Spent mushroom compost (SMC) supported a good growth of *T. harzianum* indicating its potential use for the mass production of this important bioagent.
- Assessment of GHG indicates that highest emission of CO_2 equivalent (CO_2-e) to the extent of 548 kg under cropping and 729 kg under horticulture/ agroforestry was observed at Sabour & Patna IFS models, respectively due to application of inorganic N fertilizer.
- With an additional expenditure of ₹ 2250/- in form of potash, there was an increase in net return of ₹ 13570/- per hectare in improved practice over the farmers' practice in case of sugarcane whereas in case of wheat with additional expenditure of ₹ 1300/ - in form of potash, there was an increase in net return of ₹ 4316/- per ha.
- Major zones for management option covering largest area was under Very Low N_Medium P_Medium K which occupies 48.5% area followed by Very low N_med P_high K (22.18%) and Critical low N_med P_high K (16.5%). The minor zones were identified as Very low N_high P_med K (3.28% area), Very low N_high P_high K (3.44%) and Very low N_med P_low K (5.35% area).
- The single adaptation strategy of advancing of 10-days of sowing in wheat under projected climate scenario in 2050s is likely to result in an increase of 18.6% in mean net farm returns and subsequently the *per capita* income would increase by 11 %.
- During 2009 to 2014, change in irrigated area over bench mark irrigated area (2009) was recorded 7042 ha to 22005 ha in East Yamuna Canal (EYC) command area. Similarly in *Rabi* season, an improvement in irrigated area of was notices which increased from 13834 ha in 2009 to 25476 ha.
- Milk productivity was improved (0.5-1.0 litter), timely heating and health status of milking animals also improved due to de-worming medicines and feed supplement. Introduction of improved variety of wheat gave 20 to 22 % (irrigated condition) and 30 to 40 % (rainfed condition) more yield as compared to conventional varieties in the Koteshwar and Kandysol cluster in New Tehri Dist. Of Uttrakhand.
- Higher (13%) cost of cultivation under organic production system was recorded and it was mainly due to bulky nature of organic manures compared to inorganic production system however 17 % higher net returns (at 20 % premium price) under organic production system compared to inorganic production system was recorded. Status of Soil Organic Carbon 22 % increase under organic production over inorganic in 6 years.

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 Researc**h" (IIFSR) with 4 divisions (Integrated Farming Systems Management, Cropping Systems & Resource Management, Organic Agriculture Systems and Transfer of Technology, Refinement & Human Resource Development) along with AICRP on IFS and NPOF being an integral part of the institute.

Milestones of the Journey to ICAR-IIFSR

- 1952-53: "Simple Fertilizer Trials on Cultivators' 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 (AICRP) 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 centres, ICAR-IASRI was added as new voluntary centre) and NPOF (in addition to existing 13 co-operating centres, 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 system on production technologies for improving productivity and resource use efficiencies.
- To develop efficient, economically viable and environmentally sustainable integrated farming system 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 system.
- 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

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

1. ICAR-IIFSR - Upgradation 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 Centres***:** The AICRP-IFS will be headed by a 'Project Coordinator' under administrative control of the Director IIFSR. On-station research is initiated at 31 main centres and 11 sub centres. These centres 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

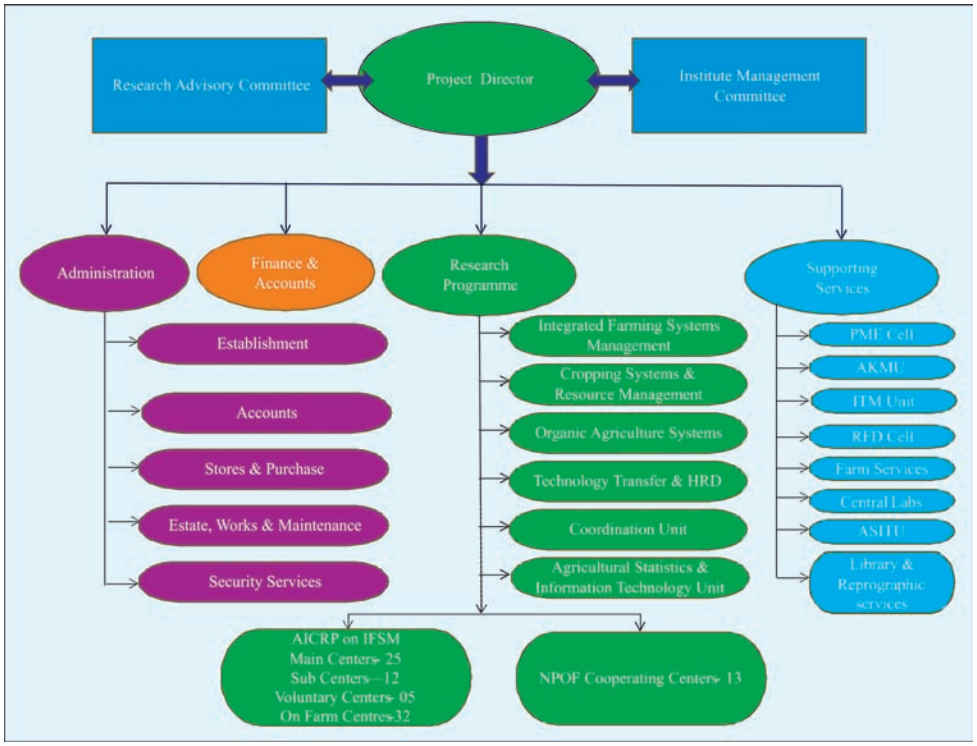
research base is available**.** During XII plan, all existing centers of the scheme will continue. IASRI, New Delhi has been approved as a new voluntary center of AICRP-IFS.

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

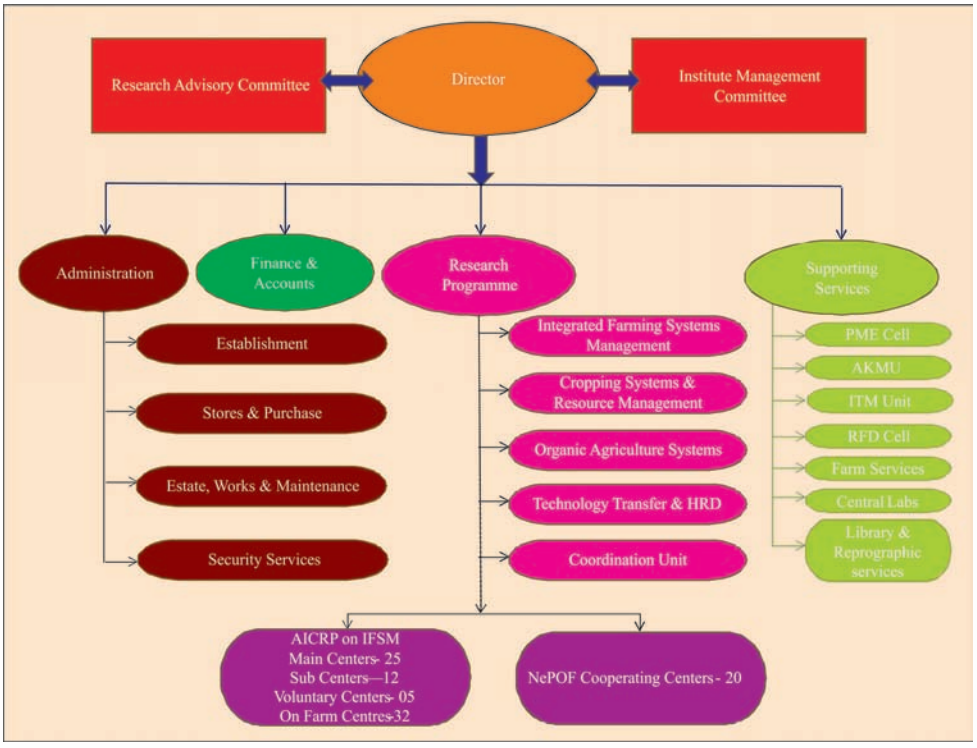
3. Network Project on Organic Farming (NePOF)- The project is presently under progress at 13 cooperating centres, located at SAUs/ ICAR Institutes in 12 states. At IIFSR, NePOF will be coordinated by a Principal Scientist (as National PI), under administrative control of the Director IIFSR. In addition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

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)

PDFSR ORGANOGRAM



ICAR-IIFSR ORGANOGRAM



RESEARCH ACOMPLISMENTS

Integrated Farming Systems Management

Project title	:	Development of cost effective and sustainable Integrated Farming System Models for livelihood improvement of small farm holders
Project code	:	NRMAIIFSRSIL201100200120
Funding Agency	:	Institute based
Duration	:	2010-17
Project Personnel	:	Jag Pal Singh, B. Gangwar, Dushyant Mishra, A.K. Prusty and Vinod Kumar

The experiment was initiated in 2011-12. The IFS model developed at PDFSR, now IIFSR at Modipuram, in an area of 0.70 hectare of land comprise of crops (0.38 ha), agri-horti system (0.30 ha), dairy animals (2 buffaloes + 1 cow), small units of mushroom and biogas (1.5 cubic meter),vermicompost, kitchen gardening and boundary plantations of guava and karonda all along the farm boundaries. Besides crops and dairy, an area of 1800 sq.m. kept under agro-horti system produced 70.35 quintal of kinnow fruits and 585 kg of food grains (rice & wheat) equivalent to ₹ 6,80,583/ha/year. This gave a net returns of ₹ 89,445 from a small area of 1800 sq.m. (4,96,916/ha/year). The results emphasize the importance and need of growing early fruiting and more paying fruit plants along-with cereal crops wheat and rice as intercrops to fulfill family needs of food grains as well as nutritionally rich fruits giving high income compared to other existing systems of farming. Boundary plantations of guava and karonda fruit plants all along the borders/ boundaries of the fruit orchard also gave a sizable income and fruit needs of the family. Other complementary/ supplementary enterprises like mushroom and vermicomposting also add significantly into gross and net income of the IFS Model. Gross and net returns during the year were recorded ₹ 5,09,573 and ₹ 2,25,166, respectively as against ₹ 92,527 and ₹ 64,300 under prevailing system of farming (Crop +Dairy). Recycling of farm wastes and products and by products within the system could save 21.72% expenditure to be incurred on market inputs. In regard to nutrient addition, out of total annual requirement of 350 kg NPK, more than 237 kg NPK could be incorporated by addition/recycling of vermicompost, crop residues, litter fall, weeds and green manuring etc., thus saving more than 53% of total nutrient requirements of the system. The diversified system also generated more employment (369 Man days) as compared to existing system.

Household food and fodder security

The system produced sufficient or rather more than required amount of almost all the food and fodder items needed by the family members and also animals reared by them (Table 1).

Table 1. Demand and production of different farm commodities (2014-15)

Area(ha)		Cereals (kg)	Pulses (kg)	Oil-seeds (kg)	Milk (Litre)	Fruits (kg)	Vegetables (kg)	Mushroom (kg)	Green Fodder (kg)	Dry fodder (kg)
	Demand	1550	200	130	1120	200	900	-	21900	4050
0.70	Production	3565	220	145	3349	9610	918	500	22710	3650

Table 2. Value of farm produce and saving for household

Farm Enterprises	Value (₹) of all the farm commodities produced at farm (A)	Value (₹) of all farm commodities consumed in family (B)	Surplus Farm commodities available for market (A-B) =(C)	Production cost (₹) (D)	Family saving (₹) (C-D) =(E)
Crops	105269	72860	32409	44274	(-) 11865
Dairy	175534	69200	106334	165680	(-) 59346
Horticulture	159795	16850	142945	46743	96202
Others	68975	3900	65075	27710	37365
Total Area(0.70ha)	509573	162810	346763	284407	62356

Economic evaluation of IFS Model

The data given in table-2 below revealed that IFS approach is not only sustain the agriculture under marginal farm conditions but provide sizable amount (₹ 62,356/ year) as saving to meet out other liabilities of the family. This saving is excluding of cost of production (₹ 2,84,407) and family consumption (₹ 1,62,810).

Project title	:	Assessment of Climate Change Impact on Integrated Farming Systems through Modeling
Project code	:	NRMAIIFSRSIL201300300132
Funding Agency	:	Institute based
Duration	:	2013-2016
Project Personnel	:	N. Subash, M. Shamim, J. P. Singh, A.K.Prusty, Chetan Kumar G and S. Malik

This project was started in 2013 for a duration of 3 years with the objectives to identify the climate resilient components of IFS under projected climate change scenarios through modelling approach and to develop DSS for identifying the best IFS options for small and marginal farmers of western UP. During the second year

Table 3. Minimum datasets (a-c) collected for calibration of APSIM model during kharif 2013.

(a) Rice	
Variety	Suganda -5
Sowing	15-06-2013
Transplanting	10-07-2013
Panicle initiation	24-08-2013
Flowering stage	07-09-2013
Milking stage	17-09-2013
Dough stage	25-09-2013
Physiological maturity	05-10-2013
Grains/panicle	60.2
Tillers/m^2	275
Yield	5.28q/1200m^2
1000 grain wt	26.01g
Biomass	
Panicle initiation(2 hill)	66.8g
Flowering stage(2hill)	115.3g
Milking stage(2 hill)	150.4g
Dough stage(2 hill)	155.1g
Maturity	12.28q/1200m^2

(b) Sorghum (fodder)	
Variety	Kanpuri Safed
Sowing	13-05-2013
Harvest	14-08-2013
Yield	9200kg/1600m^2

(c) Maize +Pigeon pea			
Maize		**Pigeon Pea**	
Variety	Ganga safed-2	Variety	T-7
Sowing	01-06-2013	Sowing	01-06-2013
Tesselling	16-07-2013	Flowering stage	05-09-2013
Silking	20-07-2013	Pod formation	15-09-2013
Milking stage	30-07-2013	Grain filling	23-09-2013
Date of harvest	18-08-2013	Dough stage	05-10-2013
Biomass	5000kg/ 1600m^2	Physiological maturity	25-10-2013
Yield	273kgcobs/	Biomass 1600m^2	550kg/1600m^2
		Yield	50kg/1600m^2

Table 4. Minimum datasets (a-d) collected for calibration of APSIM model during rabi 2013-14.

(a) Wheat	
Variety	HD-2967
Sowing	05-12-2013
Panicle initiation	21-02-2014
Flowering stage	06-03-2014
Milking stage	15-03-2014
Dough stage	25-03-2014
Physiological maturity	10-04-2014
Grains/panicle	50.3
Tillers/m^2	335
Yield	855kg/1600m^2
1000 grain wt	38.2g
Biomass	
Panicle initiation(2 hill)	133.4g
Flowering stage(2hill)	146.9g
Milking stage(2 hill)	152.7g
Dough stage(2 hill)	170.9g
Maturity	1755kg/1600m^2

(b) Mustard	
Variety	RLC-1
Sowing	11-12-2013
Flowering stage	22-01-2014
Pod formation	02-02-2014
Grainfilling	20-02-2014
dough stage	01-03-2014
Physiological maturity	20-03-2014
Biomass	681kg/1600m2
Yield	101kg/1600m^2

(c) Berseem (fodder)	
Variety	BL-10
Sowing	10-10-2013
harvest	21-03-2014
Yield	2800kg/1600m^2

(d) Maize+B.gram			
B. gram		**Maize**	
Variety	T-9	Variety	Ganga safed-2
Sowing	06-09-2013	sowing	06-09-2013
Yield	Nil	Tesselling	28-10-2013
		Silking	03-11-2013
		Milking stage	13-11-2013
		harvest	23-12-2013
		Biomass	4800kg/1600m2
		Yield	323Cobskg/1600m2

of the project, we have completed the recording of crop phenology, crop growth, yield and yield attributes for one kharif and rabi seasons for calibration of the model. The minimum datasets required for calibration of the model is given in table 3 and 4. The simulation setup of APSIM crop simulation model will be created for crop enterprises based on the soil and phenological data for calibration of crop varieties.

Project Title	**:**	Comparative studies on fish and crop based farming systems
Project Code	**:**	NRMAIIFSRSIL201200200128
Funding Agency	**:**	Institute Based
Duration	**:**	2012-2015
Project Personnel	**:**	A. K. Prusty, J. P. Singh, Poonam Kashyap

Results for different modules (0.4 ha each) were synthesized by taking data from ongoing experiments for crop component and for fisheries component data were upscaled from results of 0.1 ha fish pond of IIFSR. Highest gross and net return was obtained in the module M3 having fish and horticulture component (Table 5). Highest employment generation of 100 days was also observed in M3 module having fish pond and horticulture component on pond dike (Table 6).

Table 6. Employment Generation in different modules (Man days)

Treatments	Employment Generation
M1 Rice-Wheat-Sorghum-Mustard-Sorghum in 0.4 ha	81
M2 Sugarcane-S. Ratoon-Wheat in 0.4 ha	69
M3 Fish + Horticulture on pond dike in 0.4 ha	100
M4 0.2 ha of M1+ 0.2 ha of M3 in 0.4 ha	90
M5 0.2 ha of M2+ 0.2 ha of M3 in 0.4 ha	85

Project title	**:**	Development of year – round production module of mushrooms for small and marginal farmers
Project code	**:**	NRMAIIFSRSIL201300500134
Funding Agency	**:**	Institute based
Duration	**:**	2013-16
Project Personnel	**:**	Chandra Bhanu, J. P. Singh, Amit Nath

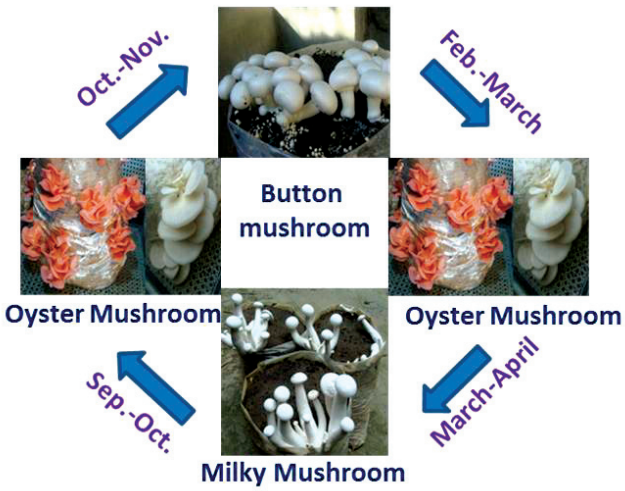
A year round production module of mushroom was developed during 2013-14 to 2014-15 by adjusting the combinations of oyster mushroom (*Pleurotus* spp.), milky mushroom (*Calocybe indica*) and white button mushroom (*Agaricus bisporus*). A crop room of 18' x 13' size with five tier racks was used for the module. Two

Table 5. Comparative performance of fish and crop based modules. (All values in ₹)

Treatments	Market purchase	Farm Labour	Total Cost	Gross Return	Net Return	B:C Ratio
M1 Rice-Wheat-Sorghum-Mustard-Sorghum in 0.4 ha	21768	12150	33918	94060	60142	1.77
M2 Sugarcane-S. Ratoon-Wheat in 0.4 ha	37584	10350	47934	114000	66066	1.37
M3 Fish + Horticulture on pond dike in 0.4 ha	74600	12000	86600	185200	98600	1.13
M4 0.2 ha of M1+ 0.2 ha of M3 in 0.4 ha	48184	12075	60259	139630	79371	1.31
M5 0.2 ha of M2+ 0.2 ha of M3 in 0.4 ha	56092	11175	67267	149600	82333	1.22

crops of button mushroom from October-February with long method of composting, 2 crops of oyster mushroom during October-November and February- March and 2 crops of milky mushroom from March- September were taken in the module.

By utilizing 70% capacity of the crop room, an yield of 457 kg of all the mushrooms (253.39 kg button mushroom, 85.30 kg oyster mushroom and 119 kg milky mushroom) was harvested with additional yield of 2600 kg of high quality organic manure (from button mushroom spent compost) and 962 kg of animal feed (from spent straws of oyster and milky mushroom). The total gross return obtained was ₹ 47233/- with net return of ₹ 26233/-, B:C ratio of 1.25 and employment generation of about 80 man days. The fruiting bodies of mushrooms were available during all the months except for June which was very much unfavourable due to dry hot conditions.



The module ran well during the year and further fine tuning is under progress on profit maximization in farming system mode (Table 7).

Table 7. Economics of the year-round mushroom production module during 2014-15

Mushroom species	Button mushroom (*Agaricus bisporus*)	Oyster mushroom (*Pleurotus* spp.)	Milky mushroom (*Calocybe indica*)
Annual yield of mushroom (kg)	253.39	85.30	119.00
Yield of animal feed/organic manure from spent straw/compost (kg)*	2600	312	650
Income from mushroom (₹)	20271.20	5118.00	9520.00
Income from spent spent straw/compost (₹)	10400	624	1300
Cost of production (₹)	14000	2000	5000
Gross income (₹)	30671.20	5742.00	10820.00
Net income (₹)	16671.20	3742.00	5820.00
B:C ratio	1:19	1:87	1:16
Overall net income from the module (₹)	26233.20		

* Spent straw as animal feed from oyster and milky mushrooms, organic manure from button mushroom

Project title	:	Productivity and economic evaluation of horticulture based farming systems
Project code	:	NRMAIIFSRSIL201100300121
Funding Agency	:	Institute based
Duration	:	2011-2015
Project Personnel	:	Poonam Kashyap, Kamta Prasad and Harbir Singh

Experiments were conducted at IIFSR, Modipuram to develop horticultural crop based model for improving profitability, enhancing productivity and nutritional security of small and marginal farmers particularly of western plain zone of Uttar Pradesh. Three modules, viz. Fruit based (CS 1, 0.3 ha), vegetable crops based (CS 2, 0.22 ha) and field crop based (CS 3, 0.4 ha) were evaluated under this project

Under fruit crop based (CS-1) system mango, guava and banana were grown as main crop and cucumber-radish, carrot and onion as intercrop in mango, brinjal, pea and okra as intercrop in guava and turmeric as intercrop in banana. In vegetable based (CS-2) turmeric, bottlegourd-cauliflower-tomato and brinjal-potato were grown while under crop based (CS-3) system rice-wheat and sugarcane- s. ratoon-wheat were cultivated. Among the modules, vegetable based system has been found most effective in terms of net returns. The net returns per ha from the vegetable based system (CS 2) was found to be ₹ 150997 followed by crop based system (CS 3) being ₹ 70212 followed by fruit crop based system (CS 1) being ₹ 50231. Higher returns from vegetable based system were mainly due to contribution by cash crops.

Project title	:	On-Farm value addition for livelihood improvement of small farm households in Western Plain Zone of Uttar Pradesh
Project code	:	NRMAIIFSRSIL201400100135
Funding Agency	:	Institute based
Duration	:	2014-18
Project Personnel	:	Amit Nath, M. P.Singh, Debashish Dutta, R. P. Mishra, Poonam Kashyap and Nisha Verma

To identify the extent of losses and prevailing value addition practices, a survey was conducted in three blocks of Meerut district. Around 15% of the farmers are using neem leaves along with match stick for preventing insect pest infestation in paddy and wheat grain storage. The farmers are recorded 10-20% post-harvest losses in sugarcane, wheat, paddy, potatoes, vegetables etc. The only 10-15% farmers are doing value addition. In the study district, the most of value addition are mainly carried out by women.

Evaluation of qualities of lemongrass (*Cymbopogan citratus*) essential oil at different drying conditions

An experiment was conducted to explore the oil content, chemical properties and characterizing the lemongrass essential oil under different drying condition. Lemongrass leaves were dried under three different methods of drying viz., sun-drying, shade drying with source of ventilation and oven drying at 45^{0}C for 7hrs and extracted oil using Clevenger-type apparatus by hydro distillation method. Physiochemical properties (oil yield, acid value, saponification value and iodine value) and essential oil components of lemongrass under different drying treatments were analyzed and results are presented in Table 8 & 9 and Fig. 1 & 2. The maximum essential oil (3.06%) recovered in oven drying method while, the minimum saponification value (142.59 mgKOH/g) was recorded in sun drying method, however, the minimum acid value (4.14 mgKOH/g) and iodine value (114.31gI 2/100g) were recorded in shade drying

Table 8. Physiochemical Properties of Lemongrass oil at different drying treatments.

Treatments	Essential oil (%)	Saponification value (mg KOH/g)	Iodine value (gI_2/100g)	Acid Value (mgKOH/g)
Fresh Leaves	0.77±0.41	145.85±0.11	117.11±0.19	4.29±0.24
Sundry Leaves	2.50±0.09	142.59±0.21	115.80±0.12	4.57±0.42
Shade dry Leaves	2.65±0.05	143.61±0.28	114.31±0.14	4.14±0.18
Oven dry Leaves	3.06±0.21	144.60±0.24	116.19±0.12	4.46±0.16

Table 9. Essential oil components of *Cymbopogon citratus* as affected by different drying methods of leaves

No.	Compound	RT (min.)	Fresh(%)	Sun-drying(%)	Shade drying (%)	Oven-drying (%)
1	Myrcene	11.87	12.39±0.16	14.21±0.22	10.23±0.15	12.68±0.41
2	Limonene	11.91	0.38±0.12	0.31±0.08	0.39±0.32	0.38±0.01
3	Citronellal	12.66	1.56±0.16	3.21±0.19	2.89±0.12	3.94±0.21
4	Cis-Carveol	13.12	0.61±0.05	0.91±0.05	0.68±0.02	1.23±0.05
5	Nerol	14.61	0.12±0.09	0.24±0.07	0.20±0.02	1.02±0.08
6	Neral	15.12	42.15±0.35	34.23±0.28	39.35±0.26	35.81±0.24
7	Geraniol	15.64	0.75±0.02	1.21±0.04	1.54±0.11	1.81±0.12
8	Geranial	16.44	35.12±0.21	28.54±0.41	33.26±0.19	31.00±0.31
9	Carveol	20.98	0.23±0.04	0.59±0.04	0.42±0.07	0.35±0.01
10	Geranyl acetate	22.19	0.26±0.08	0.86±0.16	0.54±0.09	1.25±0.21
11	Caryophellene	26.00	0.35±0.01	0.32±0.08	0.31±0.04	0.34±0.02

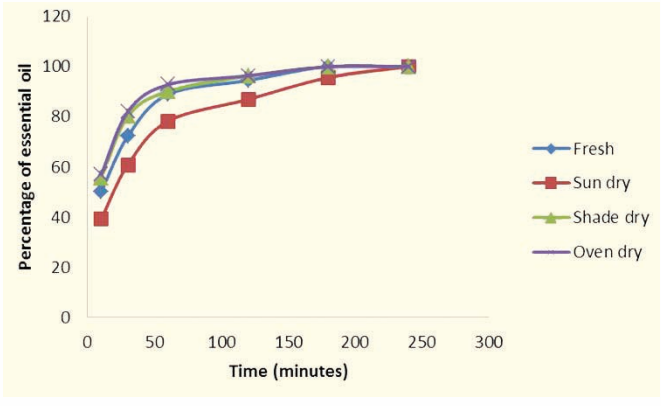


Fig. 1. Effect of drying treatments on Lemongrass Oil extraction

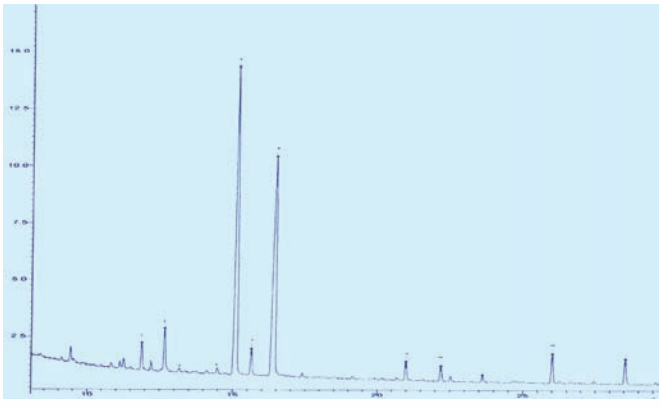


Fig. 2. GCMS chromatogram of Lemongrass (*C. citratus*) oil

method. The essential oils were analyzed by GC/MS instruments and identified eleven different components. Among the components identified, geranial (citral-a), neral (citral-b), caryophellene and limonene were found major components in the lemongrass essential oils.

Development of value added products from different farm produces

Different value added products viz., bael squash, lime pickles, lemon squash, carrot tuity fruity, potato and banana chips were prepared and optimization is under progress. Through value addition in farm produces viz., preparation lemon squash fetches 40-50% more profit than selling from fresh lime, moreover, value addition in carrot by making tuity fruity during peak season, small and marginal farmers could able to store their produce for longer time and also 60% more income from their farm produces.

Drying and dehydration of oyster mushroom

Developed dehydrated oyster mushroom using KMS and citric acid @ 0.5% and 0.1% respectively. The final moisture content of 7.3% and 6.7% respectively recorded under sun drying with 11hours and tray drying (50 ±5°C) with 7hours. Among the different treatments, sun dried products recorded the maximum dehydration ratio of 10.7 whereas the maximum sensory score (8.1) was recorded in tray dried samples (blanching for 5 min. + KMS@ 0.5% + citric acid @ 0.1%). This dehydrated mushroom may be stored under poly propylene (PP) packaging materials for more than three months at ambient storage condition.

Project title	**:**	Comparative study of role of women in predominant farming systems of Western plain zone of UP and Hill zone of Uttarakhand
Project code	**:**	NRMAIIFSRSIL201400400138
Funding Agency	**:**	Institute based
Duration	**:**	2014-16
Project Personnel	**:**	Nisha Verma, M. P. S. Arya, M. P. Singh, Poonam Kashyap and Amit Nath

Survey was conducted to know the gender differences in work participation of pre-dominant farming systems of Meerut district. Ten farm families from each village from each of the three blocks viz. Jani, Kharkhoda and Hastinapur were randomly selected. The information was collected through face to face interaction with the help of interview schedule. The salient findings are given as under:

Land ownership

It was found that maximum land owned by the men, whereas a fraction of land (3.47 %) was owned by women. It was also observed that only (3.3 %) families are female headed families and that is due to death of their husbands. Land taken on lease for cultivation found under men's control (Table 10).

Major farming systems

It was found that sixty three per cent area has been covered by crop + dairy farming system with the annual income ₹ 2,51402 followed by crop + dairy + horticulture system (36%) with the annual income ₹ 3,21,666 (Table 11).

Gender work participation

In many of the crop production activities men found dominating in work participation viz. land preparation, carrying seed for sowing, seed treatment, sowing, manure, pesticide and weedicide application, set treatment, planting and covering, irrigation, earthing up (sugarcane), bringing crop to home and marketing. However, drying and cleaning of seed before sowing, storage and post-harvest management of crops, work participation of women were found dominant. Transplanting of paddy was found to be done by women labours (82.60). Work participation in weeding activity was found joint followed by women labourers independent. More than 50 percent of women were

Table 10. Gender differences in ownership and control over the land

Average cropping area(ha)		Average orchard area (ha)		Total land area(ha)		Leased in Land(ha)	
Men ownership	Women ownership	Men ownership	Women ownership	Men ownership	Women ownership	Men's control	Women 's control
2.00	0.07	0.008	Nil	2.016	0.07	0.16	Nil

Table 11. Pre-dominant farming system and estimated annual income

Prevailing Major Farming Systems with Percent Area Coverage and estimated annual income per hectare					
First Ranking			Second Ranking		
Farming System	Area coverage (%)	Estimated annual income (₹)	Farming System	Area coverage (%)	Estimated returns (₹)
Crop + Dairy	63	2,51,402	Crop + Dairy + Horticulture	36	3,21,666

found participating in sugarcane detopping, detrashing and bundling activities either as cultivators or as labourers. Harvesting (all crops), threshing and winnowing of paddy was found to be done by laboures (both and women). However, work participation in wheat threshing and winnowing was found men independent and was done through mechanical threshers. For some of the activities viz. transportation of manure to the field and set cutting of sugarcane, few amount of women work participation was found.

In livestock, women work participation was found more as compared to their male counterparts. For milking, processing of milk, dung collection and carrying, dung cake preparation, shed cleaning activities, work participation of women were found more whereas for feed preparation, feeding, watering and care of infant animals, joint work participation followed by women-independent work participation was found. Fodder collection was found to be done jointly by the cultivators and women laboures as well. Growing of fodder crop and marketing of milk were the only men dominant activities found.

Project title	**:**	Development of fruit crop based high density farming systems for higher productivity and profitability under small farm conditions
Project code	**:**	NRMAIIFSRSIL201400600140
Funding Agency	**:**	Institute based
Duration	**:**	2014-24
Project Personnel	**:**	D. Mishra, J. P. Singh, Sudhir Kumar, Amit Nath, Chandra Bhanu and M. Shamim

Field planting of experiment was done during July – August 2014. Plants of three varieties of guava (*Psidium guajava*) viz., Allahabad Safeda, Sardar (L-49) and Sweta, three varieties of Ber (*Jujupus jujube) viz.* Gola, Seb, Umran, Two varieties of Pomegranate (*Punica granatum*) viz., Bhagwa,and Arakta, were planted along with plants of Sweet orange/ Mosambi (*Citrus sinensis*) Nagpur mandarin (*Citrus reticulata*) and Kinnow (Mandarin X Orange). Initial growth observations were recorded for all crops and varieties, it was found that among above crops, vegetative growth of ber was very fast and plants attained height of 3.5 feet within 4 month of planting. Flowering and fruit set was also observed in all the three varieties of ber during first week of November but it was non-significant.

Project title	**:**	Characterization and mapping of Farming Systems in India
Project code	**:**	NRMAIIFSRSIL201401000144
Funding Agency	**:**	Institute based
Duration	**:**	2014-16
Project Personnel	**:**	Harbir Singh, Anil Kumar, Vinod Kumar, Raghuveer Singh, Nisha Verma, S. Malik and L. R. Meena

Two blocks–one developed and one under-developed on the basis of 'high' and 'low' productivity–would be selected from a district. Further, three villages would be selected randomly from each selected block of the district, and a sample of 33% farm households would be drawn according to the probability proportional of the farmers in each size group. Different PRA tools were used to elicit village information from the key informants.

The preliminary results of PRA and FGD provides salient picture of an agricultural-based village economy. Alipur village has about 600 households with a population of 6500. The percentage of male, female and children in the population is 34.6%, 32.30% and 33.07%, respectively. The main occupation of the villagers is agriculture and livestock. Tubewells are the main source of irrigation (60%) in addition to canal irrigation. Though agriculture is the main occupation, the villagers derive their livelihood from different sources, such as leather processing, goat and pig rearing, and tiny shops. Crops+ dairy is the most dominant farming system in the village. The main crops grown by the farmers of Alipur village are sugarcane, wheat, jowar and rice. While 2/3rd of the wheat and one-fifth of rice production is used for domestic consumption, 95% of sugarcane production is sold to sugar mill/crushers. Most of the milk produced in the household is sold in the nearby market. The most

Project team interactions with farmers during the PRA & FGD in Alipur village

important constraint in farming was identified as delay in the start of sugarcane crushing by the sugar mills. This has severe adverse impact on the sowing of next crop. The other main constraints in farming were identified as crop losses due to wild animals (pig & blue bull), inadequate supply of electricity, spurious pesticides and insecticides, high input cost (diesel), late payment by sugar mills, delayed in announcement of sugarcane price, and ban on selling wheat and sugarcane outside the state.

Project title	**:**	Study on suitability of non-traditional high value fruit crops under small farm conditions of Western U. P.
Project code	**:**	Exploratory study
Funding Agency	**:**	Institute based
Duration	**:**	2014-15
Project Personnel	**:**	Dushyant Mishra

Under this exploratory trial, some non-traditional but high value fruit crops were planted 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, two types of Dragon fruit (*Hylocereus undatus*) Red fleshed and white fleshed, Apple Ber and Seedless Jamun (*Syzygium cumini*) and strawberry. All the crops were planted in field conditions during the year.

Anna is a low chilling variety of apple developed from Israel with recommendation of growing in warmer areas and subtropical conditions In this experiment, rooted cuttings of two lengths were brought from Horticulture Training and Research Centre, Kotdwar (UK) and were planted during first week of March 2014 under uniform field conditions. All the cultural practiced were followed uniformly. Mulching with banana leaves was done in basins of each plant to conserve moisture and prevent weed growth. Fortnightly basin irrigations were provided in plants from time of planting to July. The cuttings which were 12-14 inch long survived up to mid-May and sprouted new growth but died there after. On the other hand, cuttings which were 8-9 inch long were recorded 100% survival with profuse vegetative growth without any mortality. The plants successfully passed the severe summers of the region with maximum temperature of 42°C during June 2014. The vegetative growths of plants were recorded as 6 feet and 3 feet respectively for height and canopy spread.

Cuttings of Dragon fruit (red fleshed and white fleshed) and saplings of Apple Ber were brought from Ahmadnagar (Maharastra) Dragon fruit plants are trained on cemented pole. Plants growth is satisfactory. All plants passed the severe low temperature of western plain zones of UP without any mortality. Plants of seedless variety of Jamun were brought from CISH, Lucknow and growing well under experimental plot with good vegetative growth.

Project title	**:**	Round the year forage production for rabbit based IFS model for marginal farm holders in Western Plain Zone Uttar Pradesh
Project code	**:**	Exploratory study
Funding Agency	**:**	Institute based
Duration	**:**	2014-15
Project Personnel	**:**	L. R. Meena, Kamta Prasad, N. Ravisankar, R. S. Yadav and G. C. Sharma

Experiment was conducted successfully during kharif season 2014 and succeeding crops (Wheat, oat, carrot and pea are being taken in rabi season 2015

Data revealed that fodder and grain yields of different crops in the cropping sequences were varied due to genetic divergent. However, maximum green fodder production was recorded in Sem (Dolichos lab lab) i.e.

(340.83 q/ha) followed Cenchrus setigerus¼ green fodder and seed yield) i.e. (147.83q/ha and 3.25q/ha), clitoria ternatea (133q/ha) and maize stover and grain yields (69.66 and 71.00q/ha), respectively.

Project title	**:**	Development of a Web Based Integrated Information System for Indian Farming Systems Research
Project code	**:**	Exploratory study
Funding Agency	**:**	Institute based
Duration	**:**	2014-15
Project Personnel	**:**	G. C. Sharma and Vipin Kumar Choudhary

Information system is a relation based processing system that includes storage of data of various parameters of the object. The data is internally related to each other in the system with different parameters of object on the basis of some common fields such as "field ids". The relation-based database in the system helps the user to get the solutions in the form queries to the information system with respect to the given terms and conditions in the query. Information system will be developed using three-tier architecture depicted as follows :-

In three tier architecture , softwares viz., PHP MYSQL ,APACHE , HTML, IIS web server will be used for development , testing and hosting Information System.

a) ***PHP*: *H*ypertext *P*reprocessor**, 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.

Cropping System and Resource Management

Project title	:	Identification of bio-intensive, complementary cropping systems for high productivity and efficient resource use
Project code	:	NRMAPDFSRSIL200800200093
Funding Agency	:	Institute based
Duration	:	2008-2014
Project Personnel	:	B. Gangwar, M.P.S Arya, M. Shamim and Sudhir Kumar

Experiment on bio-intensive complimentary cropping system was initiated during 2008-09 and continued during 2014.

Ten complementary systems were evaluated for higher productivity and profitability. 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).

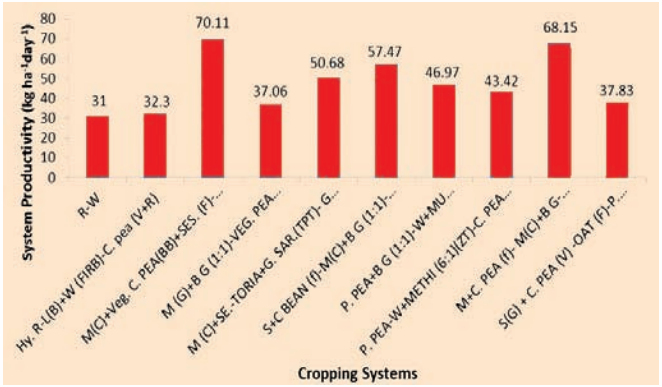


Fig. 4. Effect of bio-intensive complementary cropping systems on productivity

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} with productivity of 70.11 kg ha^{-1}day^{-1} and profitability of ₹

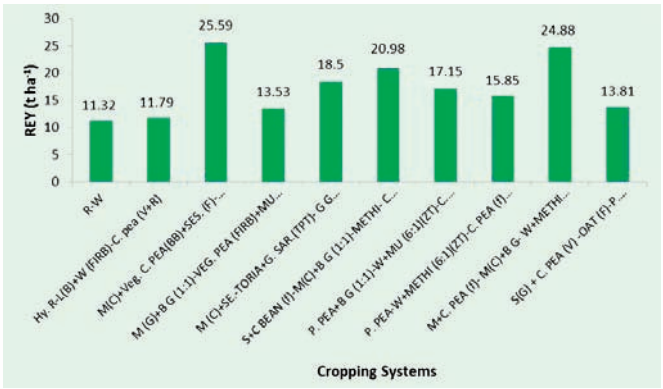


Fig. 3. Effect of bio-intensive complementary cropping systems on rice equivalent yield

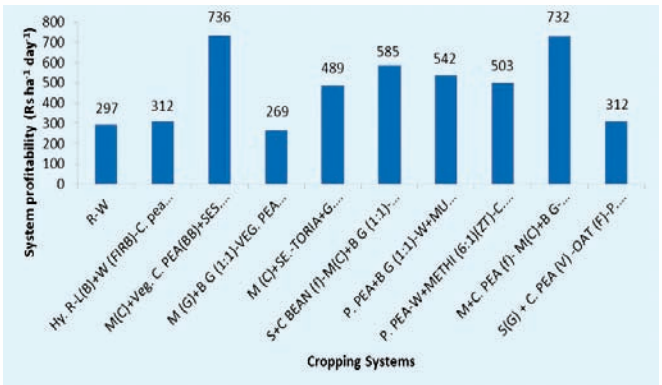


Fig. 5. Effect of bio-intensive complementary cropping systems on profitability

Table 11. Comperative study of biomass and radiation use efficiency of various treatments

Treatments	Biomass (t/ha)	Radiation Use Efficiency (g/Mj)
Rice-Wheat	24.42	1.50
Hy. Rice-Lentil(b)+Wheat (firb)-Cowpea (v+r)	42.26	1.77
Maize(c)+veg. Cowpea(bb)+Sesbania (f)-Lentil(bb)+Mustard(f)-Green gram (mt) (g+r)	50.08	2.01
Maize (g)+Black gram (1:1)-veg. Pea (firb)+Mustard (f)-Green gram (g+r)	24.3	0.98
Maize (c)+Sesbania-toria+ Gobhisarson(tpt)- Greengram (zt) (g+r)	45.55	1.71
Sorghum+Cluster bean (f)-Maize(c)+Black gram (1:1)-Methi- Cowpea (v+r)	106.74	4.19
Pigeonpea+Black gram (1:1)-Wheat+Mustard (6:1)(zt)-Cowpea (f) (zt)	44.98	1.89
Pigeonpea-Wheat+Methi (6:1)(zt)-Cowpea (f) (zt)	45.99	1.93
Maize+Cowpea (f)- Maize(c)+Black gram- Wheat+Methi (6:1)-Green gram(g+r)	108.06	4.26
Sorghum(g) + Cowpea (v) -oat (f)-Pearl millet(f)+Cluster bean (v)	122.95	4.54

736 $ha^{-1}day^{-1}$ 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 32 t ha^{-1} green foliage incorporated after 45 days of sowing. The timely sown mustard crop in these furrows resulted a good harvest 1.49 t/ha and a bonus yield of lentil (1.41 t ha^{-1}) could be harvested on one hand and 35% of irrigation water was saved. In the summer season green gram could yield 1.70 t ha^{-1} as grain while incorporation of green gram foliage of about 4 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 24.88 t ha^{-1} with productivity of 68.45 kg grain $ha^{-1}day^{-1}$ and profitability of ₹ 732 ha^{-1} day^{-1}. This system proved to be the second best in the order of merit. The lowest yield (11.32 t/ha) with productivity of 31.00 kg grain ha^{-1} day^{-1} and profitability (₹ 297 $ha^{-1}day^{-1}$) was obtained under the conventional rice-wheat system.

Radiation use efficiency (RUE) of the crops grown during kharif 2013 to summer 2014. The RUE was calculated on the basis of Photosynthetically Active Radiation (PAR) of the systems as whole. Results revealed that Radiation use efficiency (gMj^{-1}) under treatment$_{10}$Sorghum (g) + Cowpea (v) -Oat (f)-Pearl millet (f) +Cluster bean (v) was highest (4.54 gMj^{-1}). The RUE (0.98) was lowest under treatment$_4$:Maize (g) +Black gram (1:1)-Veg. Pea (firb) +Mustard (f)-Green gram (g+r). The lower RUE was due to inclusion of oilseed crops and vegetable pea with two crops of short statured legume crop. In comparison to rice-wheat cropping system, the RUE of only one treatment viz.,Maize (g)+Black gram (1:1)-Veg. Pea (firb)+Mustard (f)-Green gram (g+r) was very low and it was due to very low biomass accumulation per day. The treatments having C4 crops like Maize and Sorghum were recorded as most efficient treatments in terms of harvest of solar radiation on daily basis. These treatments also produced higher biomass through higher rate of carbon sequestration per day. Comparative analysis of the results related to productivity and radiation harvest of the systems revealed that Sorghum(g) + Cowpea (v) -oat (f)-Pearl millet(f)+Cluster bean (v) is more efficient in terms of harvest of radiation at the marginal cost of the productivity recorded highest under treatment Maize(c)+veg. Cowpea(bb)+Sesbania (f)-

Lentil(bb)+Mustard(f)-Green gram (mt) (g+r) (Table 11).

Project title	**:**	Sustaining rice-wheat productivity through integrated nutrient supply system
Project code	**:**	NRMAIIFSRSIL199300100001
Funding Agency	**:**	Institute based
Duration	**:**	1993-94 (long Term)
Project Personnel	**:**	V.K. Singh, R. P. Mishra, N. Subash, R. S. Yadav

In order to study the production sustainability and changes in soil physic-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 was continued consecutively for the 21th year during 2013-14.

Effect on yield sustainability

Long-term yield sustainability studies revels that the highest rice and wheat sustainable yield index (SYI) (0.85 for rice and 0.90 for wheat crop) was with balanced nutrition plots (T_3), whereas T_2 (*i.e.* Recommended NPK) plots had lowest SYI. The lowest SYI in recommended NPK plots (0.56 for rice and 0.41 for wheat crop) indicates the non-sustainability of state recommendation in rice-wheat system in long-term. Among the organic sources, use of sulphitation press-mud during monsoon season had highest SYI in rice (0.76) which was equal to application farmyard manure use in monsoon season. The SYI for other organic manure integration options were 0.73 for summer green gram green manuring after picking of pods, 0.65 for FYM use in winter season (wheat crop) and 0.72 for sulphitation press-mud applied to wheat crop. In wheat, application of FYM to previous rice crop had maximum SYI (0.84) followed by its application to wheat (winter season) crop (0.82).

Effect on canopy temperature

Studies made at 55 days after transplanting (DAT), 60 DAT, 65 DAT and 70 DAT in rice clearly indicate the significant role of organics integration on canopy temperature reduction and it was least with 25% substitution of FYM, followed by sulphitation press-mud, straw incorporation before the sowing of rice and wheat crop. On the other hand, use of only chemical fertilizers (NPK) did not prevent the canopy temperature rize, which may have adverse effect on stometal regulation and other bio-chemical processes (Figs. 6 & 7).

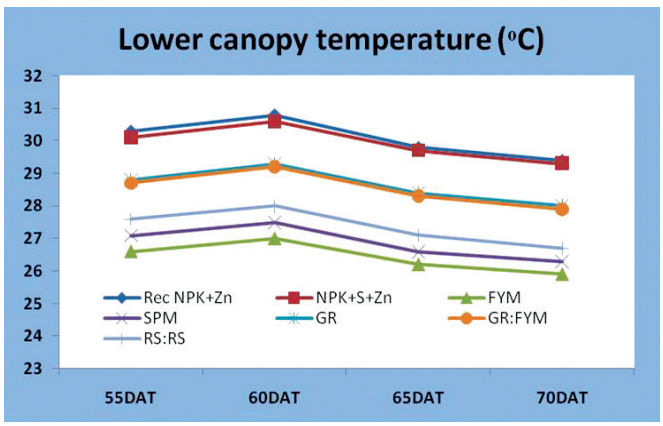


Fig. 6. Effect of nutrient management options on lower canopy temperature

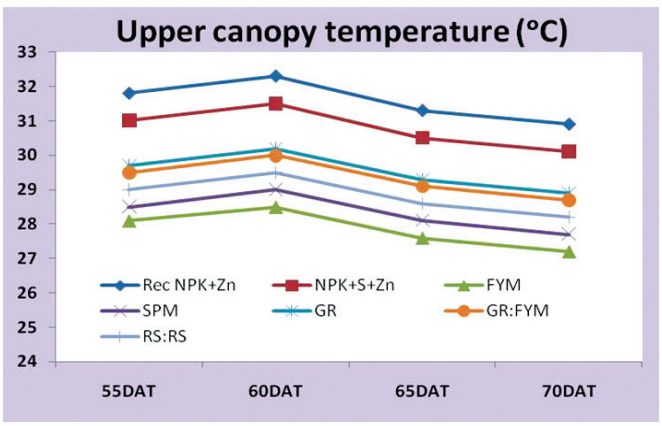


Fig. 7. Effect of nutrient management options on upper canopy temperature

Studies on components of organic carbon inputs to the soil

Different organic carbon inputs like stable biomass C, root biomass C, Rhizodeposition biomass C and external organic C inputs were studied (Table 12) and total C inputs form different resources were estimated. Results revealed that maximum total biomass carbon was recorded with FYM / Sulphitation press-mud/ NPK+S applied plots, whereas, the total biomass C input (In situ + external C input) was highest with plots having rice and wheat straw recycling during both the season. Among the different external inputs, crop residue of rice and wheat had maximum C inputs followed by green gram residue in monsoon season (rice crop) and FYM use in winter (wheat crop) season.

Validation through APSIM model

Parameterization of Agricultural Production Systems Simulator (APSIM) crop growth model was made using 2008-09 and 2009-10 data set. The APSIM model parameterized using crop phenology data showed the comparable rice and wheat yields in simulated as well as in actual yield. APSIM model was also rum for 17 years data set (i.e. 1993-94 to 2009-10) showed yield variability between actual and simulated within threshold limit (Fig. 8 and 9).

Table 12. Components of organic C inputs to soil under rice-wheat system

Treatment	Stubble biomass C		Root biomass C		Rhizodeposition biomass C		Total biomass C		External organic C inputs		Total C inputs
	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat	
Control	0.67	0.33	2.22	1.59	6.63	3.47	9.52	5.39	-	-	14.92
NPK+Zn	1.64	1.07	5.02	6.40	13.53	10.36	20.19	17.83	-	-	38.02
NPKZn+S	2.43	1.53	8.64	10.24	18.18	12.94	29.24	24.71	-	-	53.94
FYM Sub	2.08	1.33	7.71	9.13	16.98	11.82	26.77	22.28	39.06	-	88.11
SPM Sub	2.34	1.56	8.80	10.43	18.12	12.85	29.26	24.84	10.94	-	65.03
GR Sub	1.92	1.29	7.74	8.72	16.29	11.47	25.95	21.48	13.21	-	60.64
GR : FYM	1.93	1.35	7.44	9.07	15.16	11.27	24.53	21.69	13.21	39.06	98.50
RS: WS	1.75	1.17	6.76	8.00	14.38	10.10	22.90	19.26	61.54	47.72	151.42

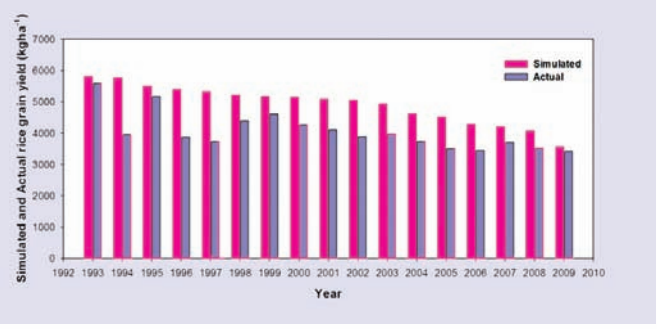


Fig. 8. Comparison of long-term actual and simulated rice yield

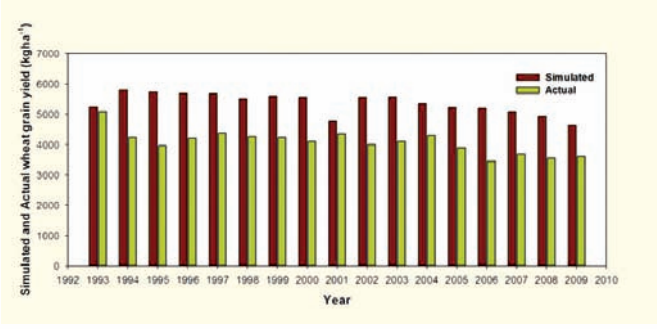


Fig. 9. Comparison of long-term actual and simulated wheat yield

Project title	:	Long term influence of Resource Conservation Technologies in Rice-Wheat system
Project code	:	NRMAIIFSRSIL200400100058
Funding Agency	:	Institute based
Duration	:	2004-2015
Project Personnel	:	V. P. Choudhary and . R. P. Mishra

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).

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), infiltration rate (IR) and weed infestation (We) was evaluated. The effect of planting methods on rice yield is depicted in Fig. 10. 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 (4%) and at par with MT with comparison to traditional method. The lower of yield in ZT (16%), HTS (17%), BP (15%) and CS (20%) was observed as compared to traditional HT (5.52 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). The energy net return was 9 to 10% higher in ZT and HTS, as compared to HT. Energy output: input ratio was 24% higher in ZT, 15 to 4% higher in all the methods except DS, CS and BS, where it was 3 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 5% higher, compared to HT (210 ha-cm). The infiltration rate was maximum in BP (80 mm day^{-1}) and lowest (35 to 43 mm day^{-1}) in the three transplanting methods because of puddling. The weed dry matter was 60 to 200% higher in all the methods but 34 and 38 per cent lower in MaT and MT, compared to HT (60 kg ha^{-1}).

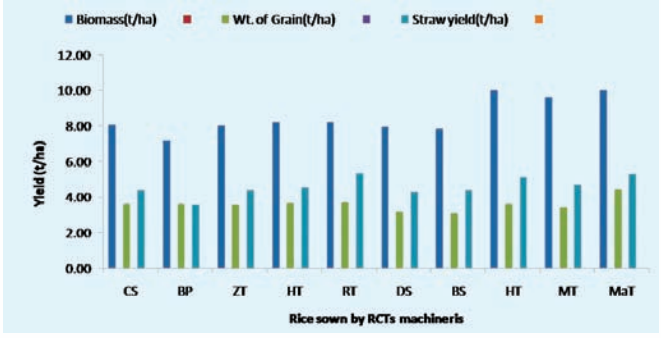


Fig. 10. Effect of yield (biomass, straw and grain) of rice sown by RCTs machineries

Five machines for direct dry seeding of rice, namely; conventional drill (CS), zero-till drill (ZT), happy-turbo seeder (HT), rotary-till drill (RT) and bed planter (BP) were evaluated using uniform seed (Saket - 4) rate of 30 kg ha^{-1}. Under ZT, HT, 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, HT and RT, and 120 mm in BP. The performance parameters of different rice seeding machines showed that ZT, HT, RT and BP of rice saved time (90 to 84%), labour (83 to 81%), diesel (86 to 60%), cost (80 to 63%), energy (80 to 61%) and also irrigation water (5 to 20%) as compared to conventional sowing. The rice yield, economics and energy use affected by different methods is presented. The zero till drilling produced higher rice (12 %), net returns (35 %), B: C ratio (15 %) and energy output: input ratio (30 %), compared to conventional sowing. The rotary till drilling produced higher rice (10%), net returns (25%), B: C ratio (12%) and energy output: input ratio (12 %), compared to conventional sowing. The happy turbo seeder produced higher rice (10 %), net returns (28 %), B: C ratio (12 %) 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.

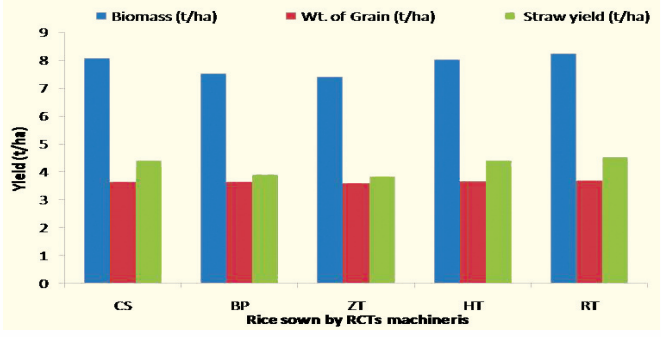


Fig. 11. Effect of yield (biomass, straw and grain) on different direct seeded rice by RCTs machineries

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 78%), labour saving (68 to 70%), diesel saving (60 to 80%), cost saving (67 to 76%), energy saving (62 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. 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. 12).

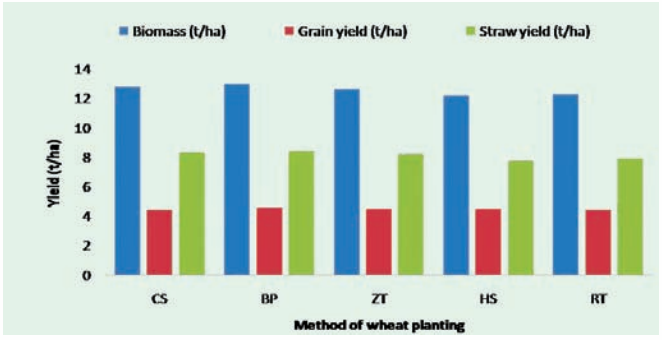


Fig. 12. Effect of different RCT machineries used for wheat crop establishment on yield (grain, straw and biomass)

A field experiment is in progress since 1998 to study the yield and cost of recycling of rice-wheat straw after combine harvesting and to evaluate the performance of subsequent crops in straw recycled fields. Crop residue management and for wheat crop establishment means were separated using least significant difference (LSD) at $P< 0.05$. It was observed that for recycling of 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 (4.3 to 4.5 t/ha) in rice residue

managements viz., RR, RB and RI and crop establishment methods viz., ZT, RT and CS (Fig. 13). The wheat yield has no significant difference among the treatments. There was appearance of yellowing in seedlings at the initial stage but subsequent establishment and growth of crops was found similar to non-straw recycled fields. The recycled wheat straw got decomposed after about 50 to 55 days in rice fields.

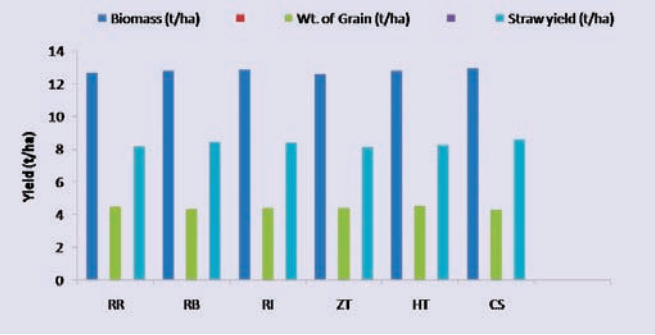


Fig. 13. Effect of residue management and different residue management machineries on wheat yield

Project title	:	Development of suitable resource conservation modules to mitigate the ill effects of climate change
Project code	:	NRMAIIFSRSIL2013004133
Funding Agency	:	Institute based
Duration	:	2013-18
Project Personnel	:	V. P. Choudhary, M. Shamim, Sudhir Kumar and Chandra Bhanu

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- rice-winter maize; 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.

Soil enzyme activity can be used as an indicator of soil quality for assessing the sustainability of agricultural ecosystem. Two tillage systems (no tillage (NT) and conventional tillage (CT), i.e., 4 harrowing +1 tine cultivating and one patella), 4 cropping systems (C_1- rice-wheat, C_2- rice-winter maize, C_3- rice-barley and C_4 – rice –mustard) and 4 treatments of rice residue mulching in combination with chemical fertilizers (M_1 - No mulch + recommended dose of fertilizer, M_2 - Mulch (6 Mg ha^{-1}) + RDF, M_3 - No mulch +125% RDF and M_4 - Mulch (6 Mg ha^{-1}) +125 % RDF) were used as main, sub and sub-sub plots respectively in a split plot design. Available P and Zn significantly ($P<0.01$) affected by tillage system and rice crop residue mulching with combination of RDF. However, cropping system did not influence available Zn at surface layer. SOC (g kg^{-1}), MBC (µg g^{-1}), DHA (µg TPF $g^{-1}24h^{-1}$), AcP and AkP (µg PNF $g^{-1}h^{-1}$) were significantly ($P<0.01$) higher in mulching+125% RDF(6.35, 355, 48.39, 202.5 and 3014.2 respectively) compared to mulching+RDF (5.94, 343, 38.26, 173.98 and 2987.3 respectively) which were significantly higher than without mulching treatments.

The agrometeorological index like radiation use efficiency (RUE) of rice crop were 1.57 (g/MJ/m^2) and 0.95 (g/MJ/m^2) under conventional and zero tillage methods of crop establishment. The mean values of RUE of the wheat under zero tillage and conventional methods

were 1.17 (g/MJ/m2) and 1.50 (g/MJ/m2). The RUE of the maize crop was 0.98 (g/MJ/m2) and 1.36(g/MJ/m2) under zero and conventional methods. The RUE of barley was higher (1.12g/MJ/m2) in zero tillage over the conventional method (0.97g/MJ/m2). The RUE of the mustard crop was least among all the crops sown in the systems and it was 0.49(g/MJ/m2) and 0.59 (g/MJ/m2) under zero and conventional methods of crop establishment methods.Diurnal variations in CO2, temperature and relative humidity under the crop canopy was recorded and analyzed. The diurnal range of CO2, temperature and relative humidity were 468-485 ppm, 16.5-20.2°c and 38-60% respectively.

Project title	**:**	Climate Change: Effects on productivity of Rice-wheat cropping system in western plain zones of U.P. and its mitigation by using DSSAT model
Project code	:	NRMAIIFSRSIL201000800114
Funding Agency	**:**	Institute based
Duration	**:**	2010-2015
Project Personnel	**:**	M. Shamim and Sudhir Kumar

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* 2013-14. 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* 2014.

The highest combined heat use efficiency (Kg/Degree day) on grain yield as well as biomass accumulation basis of rice-wheat cropping system was observed under fist date of sowing/transplanting of the crops (Rice cv. Saket 4 and wheat cv. PBW 226) which was fertilized with 150 Kg Nitrogen /ha. (Fig. 14).

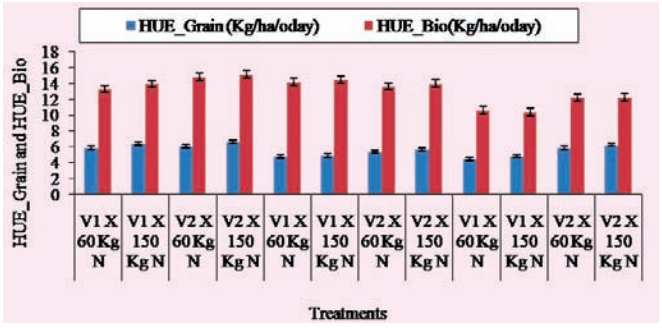


Fig. 14. Combined Heat Use Efficiency (HUE) of rice-wheat cropping systems on grain yield and biomass accumulation basis

The combined radiation use efficiency of the rice – wheat cropping systems was calculated and it was found that the Saket cv. of rice and PBW 226 cv. of the wheat which was fertilized with 150 Kg nitrogen per ha. under the system mode was highest efficient to harvest the radiation over the other treatments (Fig. 15).

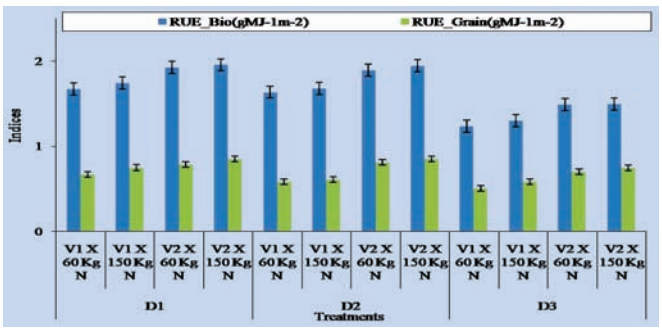


Fig. 15. Combined Radiation Use Efficiency (RUE) of rice-wheat cropping systems on grain yield and biomass accumulation basis

The DSSAT family of CERES-Rice model was used to test the sensitivity of the model under various scenario of the climate change and it was found that Saket 4 transplanted on 3rd week of June fertilized with the 150 Kg Nitrogen per ha. gave the highest yield (Fig. 16).

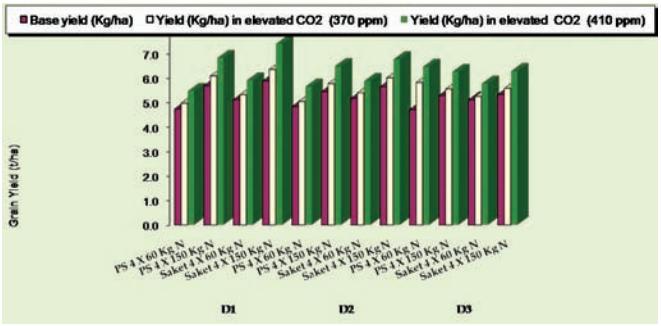


Fig. 16. Sensitivity of the model under various scenario of the climate change

Project title	**:**	Development of sustainable production model for rice-wheat cropping system
Project code	**:**	NRMAIIFSRSIL199800100006
Funding Agency	**:**	Institute based
Duration	**:**	1998 (Long Term)
Project Personnel	**:**	R. P. Mishra and V. K. Singh

The field experiment conducted to develop synthesized sustainable production model for rice-wheat system, was continued for 16th consecutive year (2013-14). To address two major non sustainability issues in rice-wheat system viz., declining soil fertility and increasing infestation of noxious weeds such as *Echinocloa spp* in rice and *Phalaris minor* in wheat, 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

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 forage 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

T_7 = organic farming

All the treatments are dynamic in nature, and are subject to change in accordance with change in package of practices, fertiliser recommendation or soil-test values

Among the different nutrient management options, integrated plant nutrient supply (IPNS) had highest system productivity followed by soil test based recommendation (STCR), state recommendation (NPKZn: NPK to rice and wheat) had lowest rice wheat system productivity except organic farming treatment.

Sustainable yield index (SYI) measured for the rice-wheat system using 03 years moving average indicates that STCR had highest SYI (0.88 in rice and 0.90 in wheat crop) followed by IPNS treatment (0.80 in rice and wheat crop) (Fig. 17). On the other hand, lowest SYI was noticed with organic farming treatment.

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. 18). On the other hand, use of chemical fertilizer *i.e.* Recommended NPK had maximum canopy temperature rise at all the rice crop studied stages.

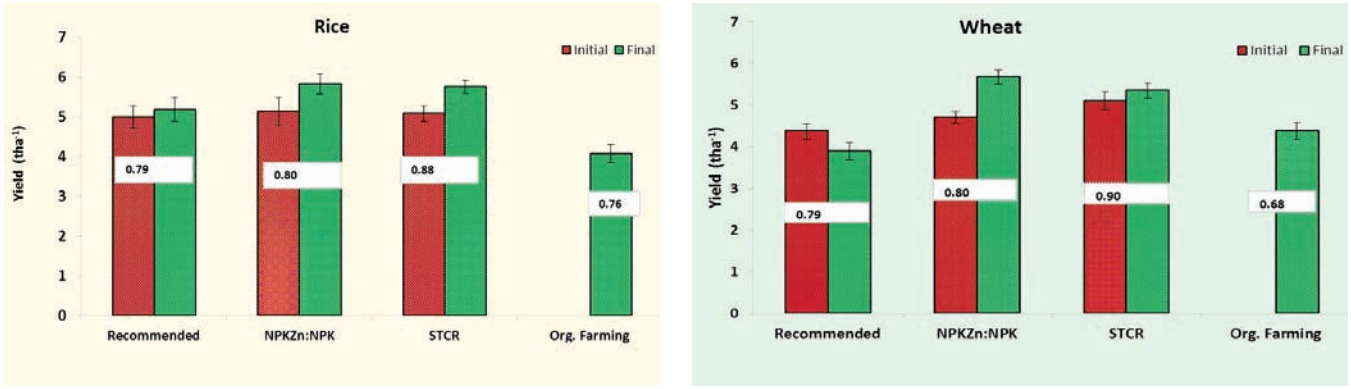


Fig. 17. Effect of nutrient management options on crop productivity and sustainable yield index

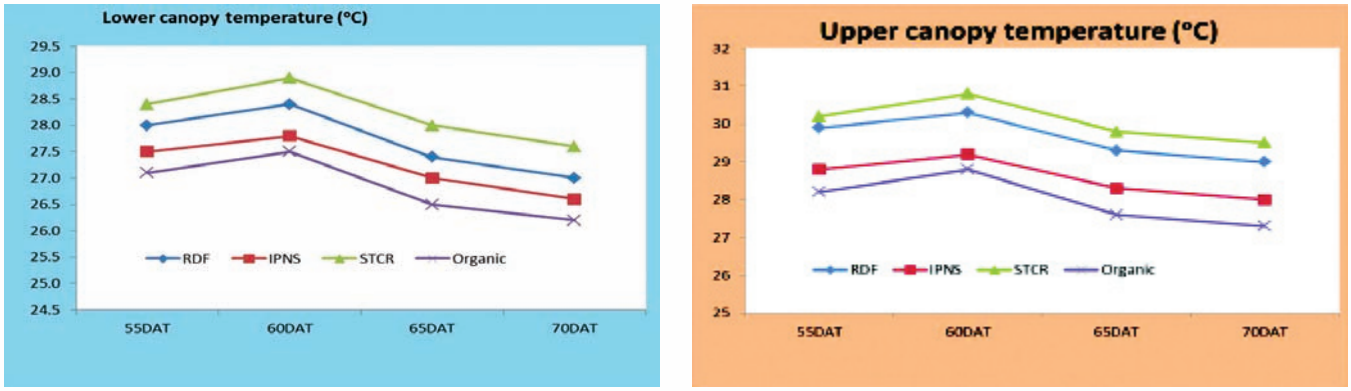


Fig. 18. Effect of IPNS options on canopy temperature in rice

Rice crop photosynthesis rate studies in 2013-14 indicates that organic farming plots had maximum photosynthesis rate (µ mol/m^2/sec) followed by IPNS + berseem plots and STCR plots. The lowest photosynthesis rate was recorded under control plot where no fertilization was made since inception of the study.

Project title	**:**	Screening of short duration varieties in sugarcane-wheat cropping system
Project code	**:**	Exploratory study
Funding Agency	**:**	Institute based
Duration	**:**	2014-15
Project Personnel	**:**	Devendra Kumar, Sudhir Kumar, Sanjeev Kumar, Chethan Kumar G.

In western plain zone sugar cane – wheat cropping system is pre-dominantly adopted since a long back because, this system not only sustain the livelihood of small and marginal farmers but land less labor also. Sugarcane planting in this zone is generally done after harvesting of wheat in the month of May similarly wheat crop is also sown very late after harvesting of cane ratoon in the month of December of January. Late planting of sugarcane not only affect cane yield and juice quality in the region but sugar recovery gets depleted due to immature cane crushing. On the other hand, wheat yield owing to late sowing in western plain zone is on lower pedestal against national average. In order to sustain this intensive cropping system of sugarcane and wheat needs to evaluate short duration and high yielding Varieties which could benefit farmers of this zone.

However, we have initiated the work by brining the 17 sugar cane clones from SBI, Regional Centre, Karnal, IISR, Lucknow and UPCSR, Regional centre, Muzaffarnagar. The seed of all clones is being multiplied in field No – D-8 at Siwaya farmwith the aim to conduct the experiment in the month of April, 2015.

The observations have been recorded on germination %, Tillers 000'/hac., cane girth, HR Brix.

Eighteen Varieties had been planted six row each aiming at multiplying their planting material for conducting trial/Experiment to find out their genetic potential under late planting (in the month of April/May).

However, initial observations reveal that Varieties viz. Co. 0238, CoSe 03234, Co 0124 and CoSe 01434 appear to be promising

Sl. No.	Entries	Germin-ation %	Tiller 000/hac.	Cane girth (cm)	HR Brix %
1.	Co.05011	20.63	82.81	2.10	16.54
2.	Co. 0238	24.36	132.87	2.48	16.64
3.	Co Pant 97222	37.54	162.53	1.86	14.24
4.	Cos 08279	43.47	169.33	2.12	16.12
5.	CoSe 03234	33.78	147.08	2.20	15.36
6.	CoS 03251	32.91	93.32	2.12	16.24
7.	CoLK 11201	40.54	125.45	2.10	14.64
8.	LG 04043	17.36	45.73	1.94	16.12
9.	Co 0124	47.63	173.65	2.14	15.3
10.	Co 0118	30.09	69.83	2.46	15.8
11.	Co 98014	36.54	127.93	2.42	16.52
12.	CoSe 01434	37.96	132.87	2.50	15.12
13.	CoS 07250	40.27	124.22	2.18	19.68
14.	UP 05125	51.38	120.51	2.04	16.44
15.	UP 0097	39.81	87.75	2.52	14.44
16.	Co Pant 05254	17.59	45.73	2.26	17.48
17.	CoPK 05191	32.40	156.35	1.94	16.48
18.	CoLK 13201	32.87	79.73	1.70	15.32

Organic Agriculture Systems

Project title	:	Conservation agriculture based weed management practices in rice-wheat cropping system
Project code	:	NRMAIIFSRSIL201200300129
Funding Agency	:	Institute based
Duration	:	2012-15
Project Personnel	:	N. K. Jat, R. S. Yadav and Sudhir Kumar

The experiment was carried out in split plot design with three replications with four crop establishment techniques *viz.*, rice-wheat (conventional), rice (DSR-ZT) - wheat (ZT), rice (DSR-ZT) - wheat (ZT) + rice residue and rice (DSR-ZT) - wheat (ZT) + rice residue+ summer mungbean in main plots and five weed management practices as W_1 (weedy check), W_2 (Bispyribac15-25 DAS @ 25 g a.i./ha), W_3 (Pendimethalin @ 1.2 kg a.i./ha+ Bispyribac 15-25 DAS @ 25 g a.i./ha), W_4 (Glyphosate @ 1.0-1.5 kg a.i./ha + Pendimethalin @ 1.2 kg a.i./h) + Bispyribac15-25 DAS @ 25 g a.i./ha) and W_5 (weed free) applied to rice in sub-plots. In wheat, weed management was done by applying W_1 (weedy check), W_2 (Sulfosulfuron+Metsulfuron 30-35 DAS @ 25+2 g a.i./ha), W_3 (Pendimethalin @ 1.2 kg a.i./ha) + PoE (Cladinofop 30-35 DAS @ 60 g a.i./ha), W_4 (Glyphosate @ 1.0-1.5 kg a.i./ha) + (Pendimethalin @ 1.2 kg a.i./ha) + (Carfentrazone30-35 DAS @ 20 g a.i./ha) and W_5 (weed free) in sub-plots and replicated thrice.

In rice, significantly highest grain yield (7.6%) and significantly lower weed density and weed dry weight was recorded under puddled transplanted rice than direct seeded zero tilled rice (DSR-ZT). Among weed management practices, glyphosate+pendimethalin+ bispyribac application registered the significantly highest grain yield (40.2%) and significantly lowest weed density and weed dry weight over weedy check. In wheat, the significantly highest grain yield (6.64 t/ha) and significantly lower weed density and weed dry weight was recorded in conventional cultivation than zero tilled wheat. However, zero tilled wheat mulched with rice residues recorded the higher grain yield (6.28 t/ha) and lesser weed density (40.6%) over zero tilled wheat without mulching. Among weed management practices, the significantly highest grain yield (66.1%) and significantly lowest weed density (69.3%) and weed dry weight were recorded with sulfosulfuron + metsulfuron application over weedy check.

After two years of experimentation, soil organic carbon (SOC), available N, P, K, cationic micronutrients (Zn, Cu, Mn) except, Fe and dehydrogenase activity were recorded higher under conservation agricultural practices than conventional cultivation of rice-wheat sequence. Among conservation agricultural practices, the highest values of SOC, available N, P, K, Zn, Fe, Mn and dehydrogenase enzyme was recorded under DSR (ZT) - wheat (ZT)+ rice residue mulch – greengram system. However, highest value of Cu was recorded under DSR (ZT) - wheat (ZT) system. Moreover, the system of DSR (ZT) - wheat (ZT) + rice residue mulch - greengram recorded 25.2, 12.7, 14.6, 6.0, 38.8, 31.8 and 11.2% higher SOC, available N, P, K, Zn, Mn and dehydrogenase activity, respectively over conventional cultivation.

Project title	:	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
Project code	:	NRMAIIFSRSIL201400200136

Funding Agency	:	Institute Based
Duration	:	2014-18
Project Personnel	:	Debashish Dutta Dr. Prem Singh, Amit Nath, D. Mishra and Nisha Verma

To study the pesticide use pattern of the farmers during the production of agricultural produce in their field a survey was conducted in the peri-urban area of Meerut district. The farmers are using pesticides as per recommendation of the pesticides dealer very unscientifically. The farmers of Meerut district region are commonly using different pesticides *viz*., chlorpyriphos, monocrotophos, imidacloprid, acetamiprid, chlorantraniliprole (Coragen), butachlor, Pendimethalin, Metribuzin, 2-4-D, Mancozeb, Carbendazim, *dimethomorph etc*. Among all, butachlor, a herbicides is intensively used by the farmers in their paddy field to control the different herbs.

The degradation processes of herbicides, butachlor in aqueous solution under natural sunlight were investigated after standardization of the method and temperature programming in the GCMS. Varian Gas Chromatography Model CP3800 coupled with Varian 4000 Ion Trap MS was conditioned with injector temperature 250^{0}C, initial oven temperature 100^{O}C hold time 2 minutes and increase the temperature up to 280^{0}C @7^{0}C withhold time 2 minutes. Mass spectroscopic detector was operated in electron impact ionization mode with an ionizing energy of 70 eV, scanning from m/z 50 to 550 at 0.5 s per scan. The ionsource temperature was 200^{0}C and the MS transfer temperature 280^{0}C. The electron multiplier voltage (EM voltage) was maintained at 1000 V, and the solvent delay of 5.0 min was employed.

Total run time was 29.71minutes and retention time (Rt) of butachlor was 17.751 minutes (Fig. 19). Butachlor was identified by its mass fragmentation with molecular weight (m/z) 311. The concentrations of

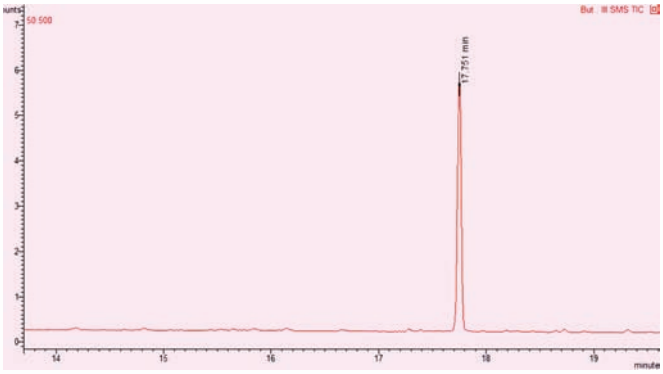


Fig. 19. GCMS Chromatogram of Butachlor

butachlor during consecutive 72 hours after herbicide application under natural sunlight are shown in Fig. 20. The half-life ($t_{1/2}$) during 72 hours after herbicide treatment was determined using first-order kinetics. The $t_{1/2}$ was obtained as the slope of natural logarithm of pesticide concentrations (ìg/L), ln(concentration), versus the exposure period (hour, hr).

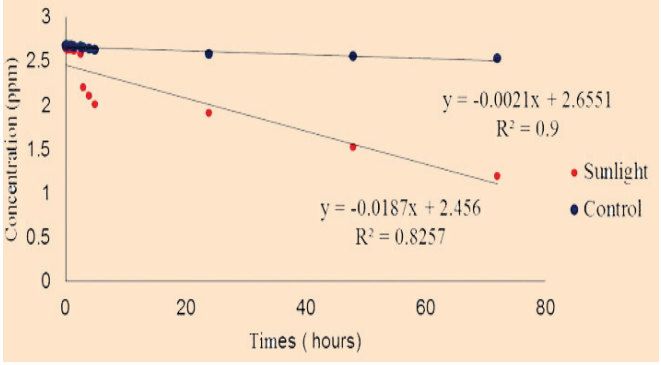


Fig. 20. Degradation pattern of Butachlor

Project title	:	Development of microbial consortia for crop disease suppression, growth promotion and yield enhancement under organic farming system
Project code	:	NRMAIIFSRSIL201400800142
Funding Agency	:	Institute Based
Duration	:	2014-18
Project Personnel	:	Chandra Bhanu, N. K. Jat and S. S. Pal

A local isolate of *Trichoderma harzianum* (designated as PDFSRTh1) was isolated from the rhizospheric soil of rice crop and its growth promotion potential was tested on Kinnow variety of Mandarin. The powdered formulation of *T. harzianum* was mixed in SMC to obtain an initial inoculum (0 day)of 10^4c.f.u. per gram of the substrate. Colony forming units (c.f.u.) of *T. harzianum* were estimated in the laboratory following serial dilution technique. One month old Trichoderma enriched SMC (TESMC) was applied in root zone of Kinnow@25 kg/plant in the month of April (flowering/ fruiting stage).

In Kinnow, the average leaf area in treated plants was 24.40 cm^2 against 14.23 cm^2 in control. The SPAD and NDVI values were also significantly higher in treated plants. The number of fruits/plant (395), average fruit circumference (22.87cm) and fruit weight (148.57g) were significantly higher in treated plants as compared to control.

Project title	**:**	Estimation of greenhouse gas emission from IFS modules and models under AICRP-IFS
Project code	**:**	NRMAPDFSRSIL201400900143
Funding Agency	**:**	Institute Based
Duration	**:**	2014-17
Project Personnel	**:**	R. S. Yadav, L. R. Meena, J. P. Singh, Vinod Kumar and Dushyant Mishra

The project was initiated in April, 2014 onwards with triple objectives *viz*: i) estimation of 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) Modipuram for the year 2012 -13, Patna for the year 2011 -12, Sabour for the year 2011 -12, Rahuri for the year 2012 – 13 & S.K. Nagar for the year 2011 – 12 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. Assessment of GHG indicates that highest emission of CO_2 equivalent (CO_2-e) to the extent of 548 kg under cropping and 729 kg under horticulture/ agroforestry was observed at Sabour & Patna IFS models, respectively due to application of inorganic N fertilizer (Table 13). It is further observed that highest CO_2-e GHG emission due to enteric fermentation and manure management system by livestock was found to be 3720 kg in Modipuram IFS model with lowest of 1167 kg in Patna IFS model. The total CO_2-e GHG emission due to livestock and application of inorganic N fertilizer in different IFS models was in the order: Modipuram (4292 kg) > S.K. Nagar (3737 kg) > Sabour (2960 kg) > Patna (2332 kg) > Rahuri (2268 kg). CO_2-e GHG emission due to farm operations, organic fertilizers, crop residue etc. and C sequestration due to perennial vegetation is under progress.

Table 13. CH_4, N_2O and CO_2-e emission (kg) from livestock and application of inorganic N fertilizer in different IFS models under AICRP IFS

AICRP IFS	Cropping		Horticulture/agroforestry		Livestock			Total
	N_2O	CO_2-e	N_2O	CO_2-e	CH_4	N_2O	CO_2-e	CO_2-e
Modipuram	1.02	316	0.825	256	156	1.46	3720	4292
S.K. Nagar	1.16	359	0.464	144	128	1.73	3234	3737
Patna	1.41	436	2.35	729	46.8	0.593	1167	2332
Rahuri	0.999	310	0.000	0.00	73.2	1.36	1958	2268
Sabour	1.77	548	0.255	79.0	95.8	1.19	2333	2960

Technology Transfer & HRD

Project title	:	System based proven technologies in farming system perspective under demonstration in Technology park
Project code	:	NRMAIIFSRSIL20140050013
Funding Agency	:	Institute based
Duration	:	2014-18
Project Personnel	:	M. P. Singh, Prem Singh and R. P. Mishra

Different proven technologies based cropping systems (28 nos.) *viz*. vegetable based (8 nos.), cereal based (12 nos.), and Other cropping systems (8 nos.) were demonstrated in the technology park. All of the systems comprised of different proven improved technologies (improved varieties, system for rice intensification (SRI), mechanical transplanting of rice, nutrient management, relay cropping , inter cropping in sugarcane , green manuring (GM), August sown maize (BB), raise bed planting (RB), broad bed furrow system (BBF), zero tillage technology in wheat, mustard and lentil, crop residue management in wheat) superimposed with each other. Farmers practice was also demonstrated to compare the technologies. To evaluate the above cropping systems rice equivalent yield (REY t ha^{-1}) and net returns per day ha^{-1} were calculated by considering the cost of cultivation and income and feedback from visitor were also collected and synthesis.

From different vegetable based cropping systems ie. rice - potato - g. gram (FB), rice- potato – g. gram (BB) + ses. (F) , rice - potato – b. gram (FB), rice-potato –b. gram (BB) + ses. (F), rice - veg. pea (RB) +wheat (F) – okra (relay), rice - veg. pea (BB) + wheat (F) – ses. (F) , rice - veg. pea (F) - moong(FB) and h. rice - c. flower – moong (FB)under study it was observed that all of the systems superimposing different proven technologies provided higher yield (REY/ha) as compared to farmer practice. The opinion of the farmers and visitors during the period 72 to 97% are agreed about all vegetable based cropping systems

Cereal based cropping systems ie. Rice (MT+ SSNM)- wheat (RM, SSNM)- ses , rice (SRI + SSNM) - wheat (ZT ,SSNM) - ses., rice (MT+ RDF) - wheat (RM +RDF) - ses., rice (DS+ SSNM) - wheat (SSNM) + mustard - ses ,rice (SRI + RDF) - wheat (ZT ,RFD) - ses and rice (DS + RDF) - barley (BB) + mustard (F) - ses. under study it was found that all of the systems superimposing different proven technologies provided higher yield (REY/ha) as compared to farmer practice. The opinion of the farmers and visitors during the period 58 to 81% are agreed about these cereal based cropping systems .

Other different cropping systems ie s.cane (SP) + g.gram (BB) + termeric – ratoon ,b. guard (BB) – wheat(PBW502), redish (BB) + brinjal (SF), maize + b.gram (FB) 1:1 – Wheat (PBW343)- ses., maize (BB) + cowpea(2:1) + ses. (F) – wheat (502)– ses. and maize (FB) – wheat(DBW 16)-ses. under study it was found that all of the systems superimposing different proven technologies provided higher yield (REY/ha) as compared to farmer practice. The opinion of the farmers and visitors during the period 69 to 85% are agreed about these cereal based cropping systems.

Project title	:	On-Farm Integrated Farming Systems Management
Project code	:	NRMAIIFSRSIL201100700125
Funding Agency	:	Institute based
Duration	:	2011-16
Project Personnel	:	B. K. Sharma, Anil Kumar and A. K. Prusty

Fifty farmers from Alipur and Madarpur villages of Sardhana block, Meerut district were adopted in the villages under the project "On-farm Integrated Farming Systems Management" during 2013-14. To narrow down the yield gaps between farmers' practice and the achievable yields of different field crops, horticultural crops and milch animals 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 crop yields can be increased by 5 to 11 percent and farming system profitability (crop-dairy) can be increased by 13 to 14 percent in the adopted villages.

Thirteen farmers were selected randomly from the above mentioned two villages for conducting on-farm trials (OFTs) on sugarcane ratoon crop during 2013-14. Three treatments were taken under each OFT and each of these treatments was laid on an area of 800 sq. m. The results revealed that increase in yields over the farmers' practice of the varieties Co-0238 and CoS-767 through recommended NPK were 7.7% and 8.5%, respectively. The application of recommended NPK in combination with Zinc sulphate in the varieties Co-0238 and CoS-767 contributed 10.3% and 11.1% increase in yield over the farmers' practice, respectively. Cost of cultivation of both improved practice (IP) and farmers' practice (FP) of sugarcane was worked out. The results revealed that with an additional expenditure of Rs. 2250/- in form of potash there was an increase in net return of Rs 13570/- per hectare in improved practice over the farmers' practice. As regards benefit cost ratio, it was 2.1 in IP as compared to 1.98 in FP. In case of application of potash in combination with zinc, the results revealed that with an additional expenditure of Rs. 3250/- in form of potash and zinc, there was an increase in net return of Rs 17610/- per hectare in improved practice over the farmers' practice. As regards benefit cost ratio, it was 2.12 in IP as compared to 1.98 in FP.

Twenty two demonstrations on balanced use of fertilizers in wheat were laid in above mentioned villages during *rabi,* 2013-14. The comparison of improved practice (farmers' practice + recommended K) and farmers' practice was made. The results revealed that the improved practice resulted in increase in yield of varieties PBW-550 and PBW-226 by 7.3% and 7.0 % over the farmers' practice. Cost of cultivation of both improved practice (IP) and farmers' practice (FP) of wheat was worked out. The results revealed that with an additional expenditure of Rs. 1300/- in form of potash, there was an increase in net return of Rs 4316/- per hectare in improved practice over the farmers' practice. As regards benefit cost ratio, it was 1.72 in IP as compared to 1.65 in FP.

Nineteen farmers were selected randomly from the two villages for conducting on-farm trials (OFTs) on two varieties of rice Pusa Basmati-1121 and Pusa Basmati-1509 during *kharif* 2014. Three treatments were taken under each OFT and each of these treatments was laid on an area of 500 sq. m. The results revealed that increase in yields over the farmers' practice of the varieties Pusa Basmati-1121 and Pusa Basmati-1509 through recommended NPK were 6.8% and 7.5%, respectively. Increase in yields over the farmers' practice of the varieties varieties Pusa Basmati -1121 and Pusa Basmati -1509 through recommended NPK+Zinc were 10.0% and 10.5%, respectively. Cost of cultivation of both improved practice (IP) and farmers' practice (FP) of rice was worked out. The results revealed that with an additional expenditure of Rs. 1250/- in form of potash, there was an increase in net return of Rs 7128/- per hectare in improved practice over the farmers' practice. As regards benefit cost ratio, it was 2.23 in IP as compared to 2.13 in FP. In case of application of recommended NPK combination with zinc, the results revealed that with an additional expenditure of Rs. 2200/- in form of potash and zinc, there was an increase in net return of Rs 9777/- per hectare in IP over FP. As regards benefit cost ratio, it was 2.26 in IP as compared to 2.13 in FP.

It can be concluded that through improved technological interventions crops yield can be increased by 5 to 11 percent and system profitability (crop- dairy) can be increased by 13 to 14 percent.

Coordination Unit

Project title	:	On-farm crop response to plant nutrients in rice-wheat cropping system (RWCS) and their impact on crop-livestock-human continuum
Project code	:	NRMAIIFSRSIL201400300132
Funding Agency	:	Institute based
Duration	:	2014-16
Project Personnel	:	Raghuveer Singh, N Ravisankar, Sanjeev Kumar Verma (ICAR-CIRC)

Total 20 samples were collected under this project from the Ranibagh, Bhandari Shamili, Ginti and Nauda village. Mineral content (Macro and micro nutritional status) of concentrates (on dry matter basis) and roughages (straw on dry matter basis) were compiled from secondary sources to further use to compare the nutrients available in the grain and straw in various treatments with the standard quality for animal feeding. Deficiency of vitamin D were noticed in the animals. The analysis of collected blood samples for its mineral content is under progress. Data pertaining to result of mineral content of concentrates and roughages (on dry matter basis) is given in Tables 14 & 15.

Table 14. Mineral content of concentrates (on dry matter basis)

Ingredient	N (%)	Ca (%)	P (%)	Mg (%)	K (%)	Na (%)	Cl (%)	S (%)	Co (ppm)	Cu (ppm)	I (ppm)	Fe (ppm)	Mn (ppm)	Se (ppm)	Zn (ppm)	Mo (%)
Grain and Seeds																
Maize	1.44	0.02	0.35	0.12	0.42	0.02	0.08	0.10	-	1.0	-	59	7	0.07	21	0.7
Sorghum	1.4	0.03	0.25	0.17	0.47	0.01	0.06	0.11	-	10.0	-	284	44	-	34	2.3
Wheat	1.76	0.03	0.28	0.15	0.50	0.01	0.01	0.15	-	5.0	-	72	42	0.28	40	1.3
Barely	1.92	0.05	0.38	0.14	0.56	0.02	0.13	0.12	0.35	6.0	-	70	22	0.11	38	1.1
Oats	1.76	0.07	0.30	0.16	0.52	0.03	-	0.19	0.06	8.0	-	106	43	0.48	41	1.7
Rice	1.44	0.02	0.28	0.1	0.25	0.01	-	0.1	0.13	13.79	-	655.8	39.45	0.07	24.46	0.41
Rye	-	0.07	0.37	0.14	0.52	0.03	0.03	0.17	0	8.0	-	69.0	66.0	0.44	36.0	-
Bajra	1.92	0.08	0.38	0.59	0.97	0.10	-	0.19	0.31	6.07	-	234.7	33.35	0.19	28.78	0.54

Table 15. Mineral content of roughages (straw on dry matter basis)

Ingredient	N (%)	Ca (%)	P (%)	Mg (%)	K (%)	Na (%)	Cl (%)	S (%)	Co (ppm)	Cu (ppm)	I (ppm)	Fe (ppm)	Mn (ppm)	Se (ppm)	Zn (ppm)	Mo (%)
Oat straw	0.54	0.24	0.06	0.18	2.57	0.42	0.78	0.23	-	10.0	-	175.0	37.0	-	6.0	-
Barely straw	0.64	0.30	0.30	0.23	2.37	0.14	0.67	0.17	0.07	5.0	-	201.0	17.0	-	7.0	-
Mung straw	-	0.81	0.13	0.09	0.3	-	0.07	0.7	3.01	-	117.9	10.42	0.38	20.4	0.39	-
Wheat straw	0.48	0.30	0.10	0.15	1.23	0.04	-	0.14	0.45	3.96	-	812.03	63.24	0.15	11.89	-
Rice straw	0.49	0.14	0.05	0.06	-	-	-	-	-	4.3	-	289.5	-	-	-	-
Maize hay	0.57	0.42	0.14	0.37	1.13	0.01	-	0.13	0.38	9.35	-	616.56	53.41	0.08	39.55	0.35
Sorghum hay	1.12	0.83	0.75	0.28	0.97	0.01	-	0.09	0.19	5.96	-	472.19	30.54	0.08	33.77	0.39

AICRP on Integrated Farming Systems

J.P. Singh, Kamta Prasad and N. Ravisankar

All India Coordinated Research Project on Integrated farming Systems (AICRP-IFS) is an integral part of ICAR-IIFSR with 31 on-station IFSR centres, 11 on-station CSR centres and 32 on-farm research centres spread throughout the country in all the agro-climatic regions to develop location specific farming system technologies. During the year, a voluntary centre of ICAR-IASRI was added to cater the needs to statistical computation in farming systems research. Under the aegis of AICRP-IFS, the experiments of Identification of need based cropping systems for different agro-ecosystems, Tillage and planting management in different cropping systems, Long range effect of continuous cropping and manuring on soil fertility and yield stability, Development of organic farming packages for system-based high value crops, and development of region specific integrated farming system models were taken up in on-station while 3 experiments viz., On-Farm crop response to plant nutrients in predominant cropping systems and their impact on crop-livestock-human chain (OFR1), Diversification of existing Farming Systems under marginal household conditions (OFR 2) and On- Farm evaluation of farming system modules for Improving profitability and livelihood of Small and Marginal Farmers (OFR 3) were taken up under on-farm research besides conducting of 100 FLD's on cropping systems involving oilseeds.

The salient findings from on-farm experiments are given below.

OFR1: Across the various NARP zones and cropping systems, farmer's package resulted in lower yield compared to recommended package owing to the 28, 21, 68 and 98 % lower application of N, P_2O_5, K_2O and micronutrients. On-farm system yield gap between recommended dose of N , P_2O_5, K_2O + micronutrient and farmer's package was found to be 1437, 1816, 4042, 1332 and 1622 kg ha^{-1} in rice- rice, rice- wheat, maize- wheat, pearlmillet – wheat and rice-greengram respectively. Application of micronutrients based on soil test resulted in additional yield of 787, 438, 767, 260 and 416 kg ha^{-1} in rice – rice, rice- wheat, maize- wheat, pearlmillet – wheat and rice -green gram systems respectively. In all the NARP zones and systems, application of recommended N P_2O_5 K_2O alone or N P_2O_5 K_2O + micronutrient resulted in higher yield and use efficiency of nutrients. Suboptimal application in terms of number and quantity resulted in significantly lower yield and use efficiency of nutrients especially nitrogen.

OFR 2: 744 marginal households in 31 districts in 21 states were covered. 38 types of farming systems are found and diversification of cropping systems, livestock and product are being undertaken apart from capacity building. Analysis benchmark data of 732 households reveals that 59 % of marginal households are having the farming system with 2 or less components only (crop alone, dairy alone, crop + dairy, crop + goat etc). Their net income is Rs 0.57 lakhs from 0.82 ha with family size of 5 no's. The mean net income of remaining 41 % marginal households having the components of >2 (e.g. crop+dairy+goat; crop+dairy+goat+poultry; crop+dairy+goat+poultry+fish etc.) was found to be Rs 1.61 lakhs from 0.84 ha with family size of 5 [2 times

higher income than households with 2 or less components). Diversification of cropping systems, livestock and product resulted in improvement of net income to the households to the tune of 2 to 6 times in the first year.

OFR 3: 372 small holders in 31 districts in 21 states have been covered. 33 types of farming systems are found and interventions in crop, livestock, processing and optional module are being undertaken. Mean holding and family size of experimental household was 1.05 ha and 5 no's. Mean benchmark net income across the systems and regions were found to be Rs 81,046. Major farming systems were crop + dairy (43 % households) and crop + dairy + goat (9 % households). Mean cost of interventions across the systems and regions in 2 years were found to be Rs 16054 (Rs 7774 in first year and 8280 in second year) which resulted in additional return of Rs 83,480.

Tribal Sub Plan: 7 OFR centres exclusively works with tribal households. Programme covers 1055 farm households in 41 villages in 13 districts covering 13 states. Improvement in income ranging from Rs 18000 to as high as 97000/household/year at Srikakulam (AP). Yield increase in crops was observed to be 22 to 36%. Additional return of Rs. 24,000/ha/household could be realized due to introduction of vegetable bean with its scientific package (seed+ nutrients+ bio-control) costing only Rs 8500/ha at Coimbatore. Homestead farming at Nicobar (A&N Islands): Rs 8750/household as net return. Production of 375, 100, 250, 300 kg of vegetables, greens, fruits, tuber respectively and 1800 numbers of egg /household/year was ensured. Goat rearing improved the income by Rs 8500 to16100 / household in 6-8 months. Replacement of non-descriptive pig breed with improved native breed 'Ghoongru' resulted in additional gain of Rs 4,750/ household in 6 months due to higher gain in body weight. The cost of intervention was only Rs 1200/household. Doubling the production of maize, fingermillet, cowpea, dolichos, redgram and grain amaranth of Soliga tribals in Karnataka. In Gujarat, fennel quality was improved which resulted in 10-30 % higher marketability and price.

Chaff c utter with training on chaff cutting resulted in 30% reduction in fodder wastage in the tribal cluster of Amirgadh taluk in Gujarat. Nutritional security for the family has been ensured by promotion of kitchen garden and fruit trees. Tribal households were very happy to get the guava fruits within 2 years. Physical assets of semi-permanent nature were created in 3 states *viz.*, Andaman and Nicobar Islands, Andhra Pradesh and Chhattisgarh (20 number of low cost poultry shelter at Nicobar Island in A&N Islands + 2 units of Drip irrigation system and Azolla unit at Kanker in Chhattisgarh + 150 numbers of hand operated Knapsack sprayers and 75 number of cotton tarpaulins in Seethempeta block of Andhra Pradesh) resulted in backup for longterm income.

ICAR-Network Project on Organic Farming

National PI: N. Ravisankar

ICAR-Indian Institute of Farming Systems Research (ICAR-IIFSR), Modipuram is operating a Network Project on Organic Farming (NPOF) from 2004-05 with 13 co-operating centres representing 9 agro-climatic regions, 13 NARP zones and 12 states. Seven new centres have been added to the programme from November 2014. List of centres are given in Fig. 21. The highlights of results are given below.

- Yield advantage (after 8th cycle across the locations): Basmati rice, soybean, garlic, groundnut, cauliflower, tomato (4-6 %) & greengram, onion, chilli, cabbage, turmeric (7-14 %). Trend in yield basmati rice over 10 years is given in Fig. 22.

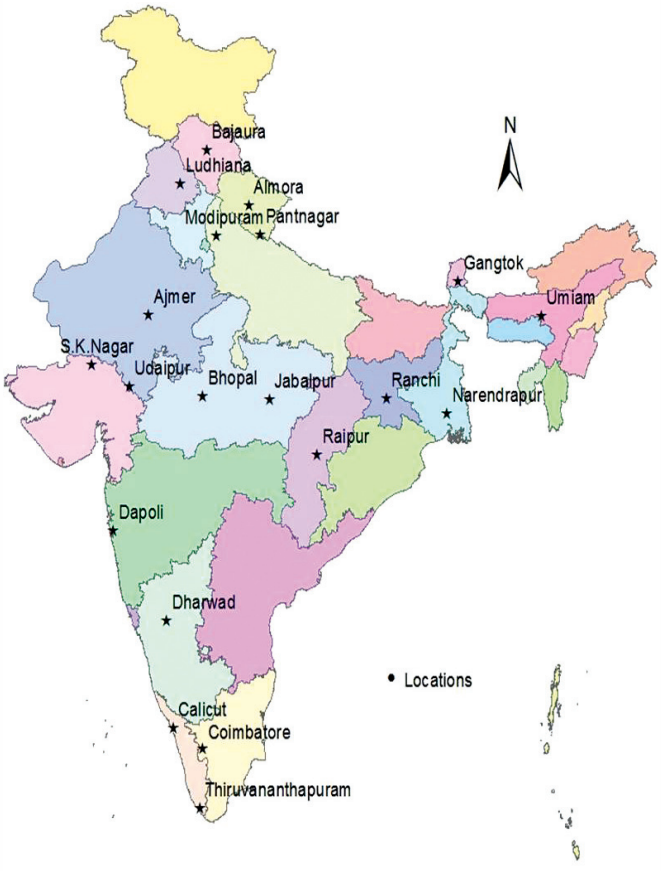


Fig. 21. Location of Network Project on Organic Farming (NPOF)

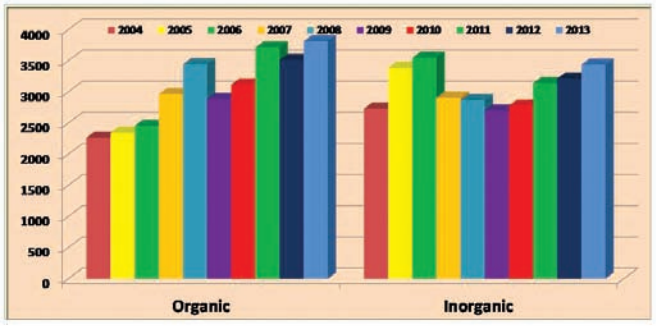


Fig. 22. Trend in yield of basmati rice over 10 years including conversion period under organic and inorganic crop management

- Yield reduction (after 8th cycle across the locations): Wheat, mustard, lentil, potato, French bean (5-8 %)
- Cost of cultivation: 13 % higher under organic production system mainly due to bulky nature of organic manures compared to inorganic production system
- Net returns (at 20 % premium price): 17 % higher under organic production system compared to inorganic production system
- Status of Soil Organic Carbon(SOC): 22 % increase under organic production over inorganic in 6 years

Under NPOF, development of integrated organic farming system models are in progress at Umiam (Meghalaya) and Coimbatore (Tamil Nadu) which promises 3-7 times higher net returns than existing systems (Table 16).

Out-reach activities

12 trainings on various aspects of "Organic production of crops" in 5 states (Chhattisgarh, Jharkhand,

Meghalaya, Maharashtra and Tamil Nadu). 355 tribals benefitted from training. From the trained persons, Manar Vanadesa Organic Farmers Group registered at Coimbatore. 25 vermicompost units and 20 azolla units created in Kanker district of Chhattisgarh.

Table 16. Performance of Integrated Organic Farming System (IOFS) models at Coimbatore and Umiam

Components	Area (ha)	Total cost (Rs/year)	Net returns (Rs/year)				
			Crop	Livestock	Others	Total	Existing system
Coimbatore (Tamil Nadu) Crop (Okra, cotton, desmanthus) + dairy (1 milch animal, 1 heifer & 1 bull calf) + vermicompost+ Boundary plantation	0.40	1,10,109	64,500 (87 %)	8,216 (11 %)	1,600 (2 %)	74,316	27,200*
Umiam (Meghalaya) Crops (Cereals + pulses + vegetables +fruits + fodder) + Dairy (1 cow + 1 calf) + Fishery + vermicompost	0.43	68,255	33,531 (57 %)	13,252 (22 %)	11,538 (21 %)	58,321	8,618**

IOFS model at Umiam (Meghalaya)

IOFS model at Coimbatore

Externally Funded Projects

Project title	:	Precision nutrient management using GIS-based spatial variability mapping under Upper and Middle Gangetic Plain Zones of India
Project code	:	NRMAIIFSRSOL201100500123
Funding Agency	:	ICAR National Fellow Scheme
Duration	:	2011-16
Project Personnel	:	V.K. Singh (PI)

The work on assessment of spatial variability in soil fertility status in the Central Plain Zone (CPZ) was taken up during 2013-14. As per plan, second and third predominant cropping systems in all the districts of Central Plain Zone wase identified, and soil, plant and irrigation water samples, representing these cropping systems were collected following 'Proportionate area method. Information on socio-economic and demographic, input use, productivity level, disposal of crop residues etc was also collected simultaneously using a pre-designed questionnaire. A wide variations in fertilizer use in different cropping system of surveyed districts was observed, which was in general, skewed in favour of N, whereas use of K, S and micronutrients was generally neglected. Such imbalanced crop nutrition led to varying degree of nutrient deficiencies. Soil samples analysed for macro and micronutrients revealed marked variability across the districts and cropping systems. Such variability in soil fertility status was mapped using Ordinary Exponential Kriging with the help of Arc-GIS 10.1. In order to develop precision nutrient prescription, homogeneous fertility management zones were prepared for CPZ. In order to ensure real time N management as per crop demand, calibration of Green Seeker based NDVI was made and correlated with SPAD and leaf color chart values in monsoon maize crop.

Homogenous fertility management zones

Based on predicted NPK status in CPZ, homogenous fertility management zones were prepared for efficient nutrient management and to identify the region where the deficiency of particular nutrients of N, P and K is prevalent. In CPZ, 03 major and 03 minor Zones were identified. Major zones for management option covering largest area was under Very Low N_Medium P_Medium K which occupies 48.5% area followed by Very low N_med P_high K (22.18%) and Critical low N_med P_high K (16.5%). The minor zones were

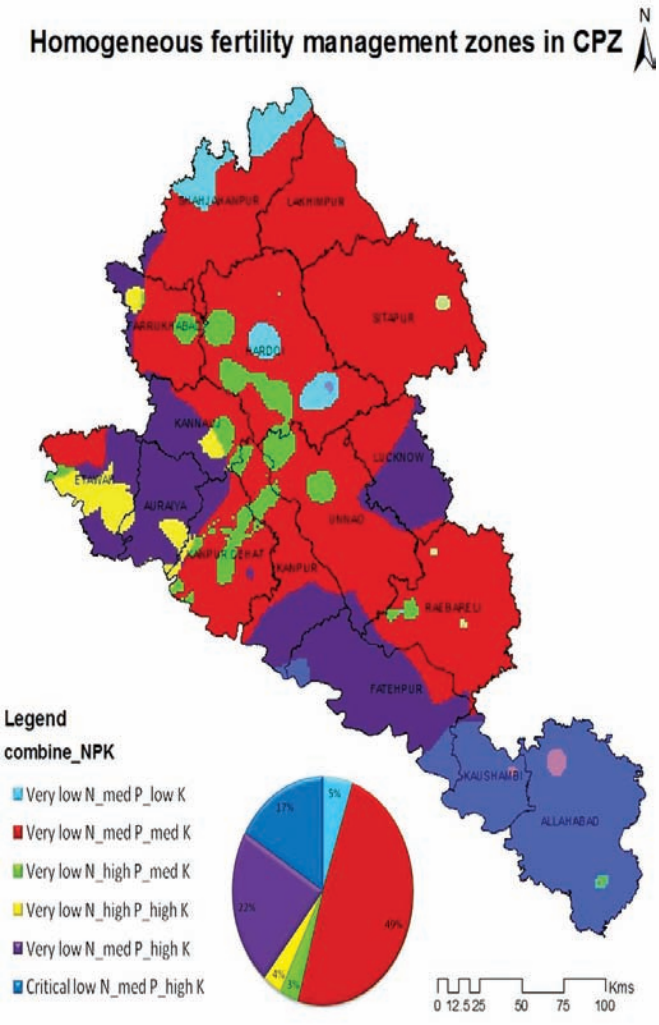


Fig. 23. Homogenous fertility management zones for CPZ

identified as Very low N_high P_med K (3.28% area), Very low N_high P_high K (3.44%) and Very low N_med P_low K (5.35% area) (Fig. 23).

LCC, SPAD, NDVI values at different days after sowing (DAS) and maize yield

The coefficient of determination (R^2) of SPAD meter, LCC and NDVI values at different DAS in relation to seed cotton yield is presented in Fig. 24 . Data reveals that NDVI values at different DAS were significant at p = 0.05 level of significance and maximum (R^2) value were noted at 32 DAS (R^2 = 0.819) followed by 51 DAS (R^2 = 0.816) (Fig. 24). Alike NDVI, correlation between grain yield and LCC or SPAD meter reading were significant at different observation dates, however the highest R^2 values were noted at 18 DAS (R^2 = 0.789) and 51 DAS (R^2 = 0.776) with SPAD and 18 DAS (R^2 = 0.859), 32 DAS (R^2 = 0.859) and 51 DAS (R^2 = 0.856) with LCC. The coefficient of determination obtained with NDVI values at early growth stages (0–17 DAS) were not better indicator of maize yield (data

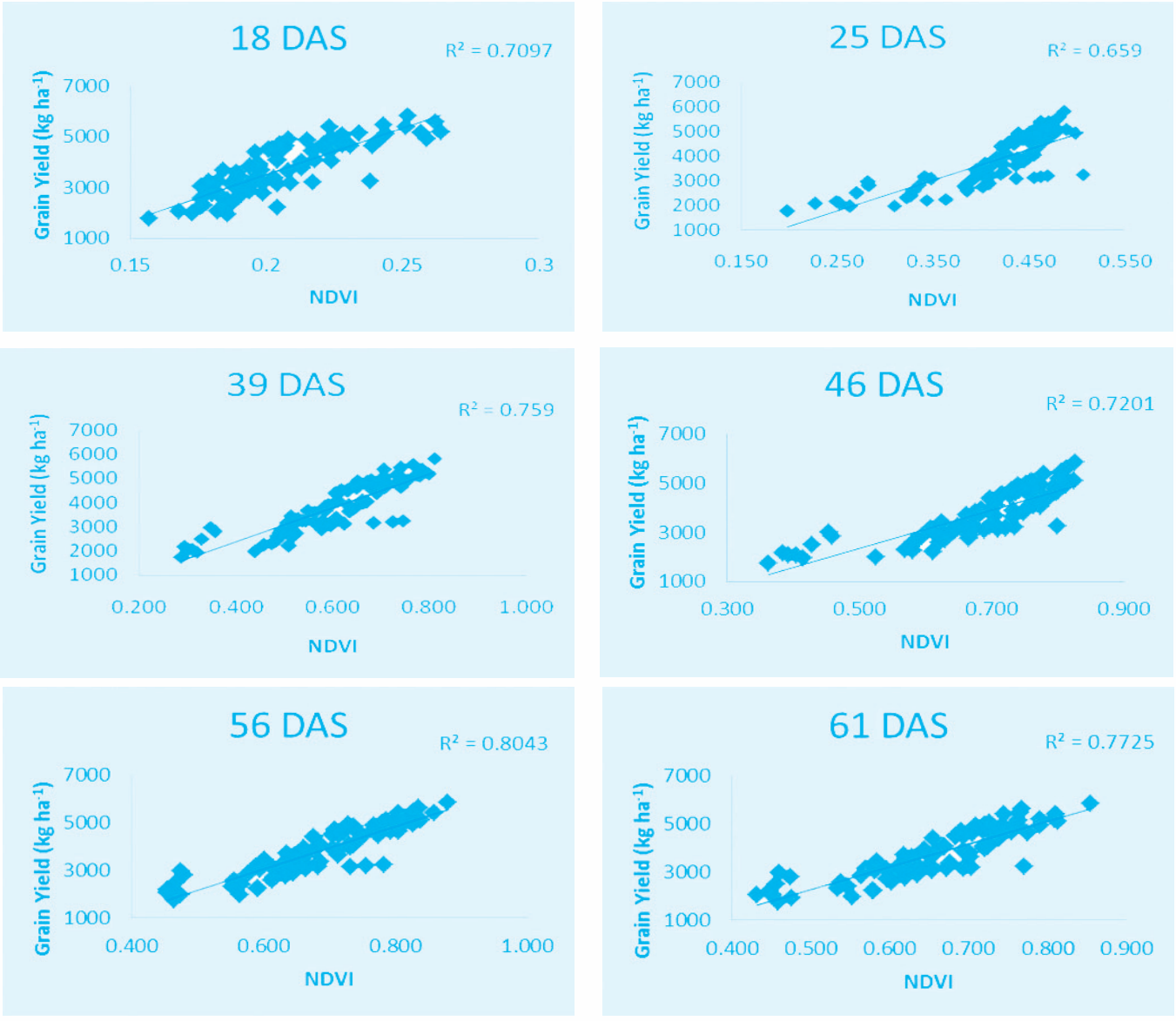


Fig. 24. NDVI (green seeker)-grain yield relationship for maize at 18, 25, 39, 46, 56, 61 Days after sowing stage for Upper Gangetic Plains of India

not shown). The possible reasons for error in prediction in early stage was that the soil remain uncovered during early stages of maize crop growth. The data further revealed that SPAD meter, LCC and NDVI may help to guide for predict yield and manage fertilizer N as per need of the plant from 18 DAS to 61 DAS, however, better prescription can be made if observations are recorded at 32 DAS and 51 DAS using any of these tools during monsoon season maize crop.

Project title	**:**	Strengthening Simulation Approaches for Understanding, Projecting and Managing Climate Risks in Stress-prone Environments Across the Central and Eastern Indo-Gangetic Basin
Project code	**:**	318/NRM/PDFSR/Model/9/11/12
Funding Agency	**:**	AgMIP through ICRISAT
Duration	**:**	2015-17
Project Personnel	**:**	N. Subash and Harbir Singh

This AgMIP-ICAR collaborative international project apply simulation tools in the major production ecologies of the central and eastern Indo-Gangetic Basin (India, Nepal, Bangladesh) in order to understand the integrated assessment of climate change impact on agricultural productivity. It will also assess the value of adaptation strategies under current and projected climatology by considering whether simulation tools and approaches and adequately capture the potential of different strategies for building resilience. The effort aims to fortify an existing network for agricultural simulation modeling while broadening it to include stronger linkages to climate and socioeconomic scientists. During the year 2014-15, three core questions answered pertaining to Meerut District as per the AgMIP methodological framework. To assess the integrated impact of climate change on rice-wheat farms under projected climate change scenario during 2040-2069 under RCP8.5, 5 GCMs (CCSM4, GFDL-ESM2M, HadGEM2-ES, MIROC5 and MPI-ESM-MR) and 2 crop models (DSSAT & APSIM) were used. The output of the crop models were then linked with TOA-MD economic model for integrated assessment.

Overall, the mean net farm returns are likely to decline by 12% to 16% percent under APSIM and 4% to 8% under DSSAT under the five climate scenarios. Similarly, the *per capita* income would decline approximately by 8% to 10% and 2% to 6% as per APSIM and DSSAT estimates, respectively, under five climate scenarios. As a result of decline in mean net farm returns and *per capita* income, the population poverty rates would increase by about 1–3% under climate change. The decline in mean net farm returns is not large enough to have significant adverse impact on population poverty rate. Though it looks that population poverty rate increases only marginally (1–3%), it has wider implications as there is a large proportion of adversely affected farms (53–79% losers) under climate change.

Using RAP parameters and other estimates of productivity and price trends from a global model (IMPACT model) for rice and wheat, the TOA-MD analysis shows interesting results for climate change impacts. The losses in mean net farm return (23.4–25.4%) are higher than gains (18.5–21.3%) under APSIM, but DSSAT shows that gains in mean net farm return (23.8–28.6%) are little higher than losses (21–22%). Thus, under climate change, mean net farm return is likely to decline by about 3–9% (APSIM) whereas, DSSAT shows a little increase in mean net farm returns (2– 8%) under five GCMs. The comparison between gains, losses, and net impacts under current agricultural production system and future agricultural production system (Q1 and Q2) by different climate scenarios and crop models as shown in Fig. 25. As expected, *per capita* income declines by 2–6% under APSIM but

shows some increase under DSSAT (1–5%). It interesting to note that even though yields decline substantially (under APSIM), there is only a small difference in the percentage of population (1–3%) without and with climate change. This is logical because growth in prices offsets to a large extent the percentage decline in yields. Still, a large proportion of the population (39–64%) is vulnerable to climate change. So, what type of adaptation measures can be helpful to sustain farm incomes under climate change? In other words, what are the benefits of climate change adaptation?

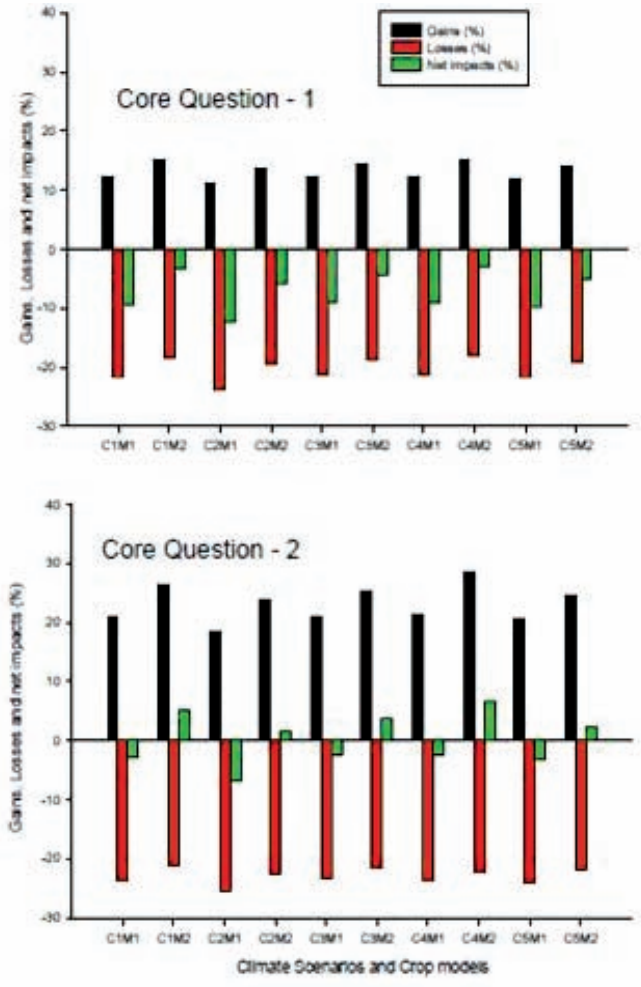


Fig. 25. Comparison between gains, losses, and net impacts under current agricultural production system and future agricultural production system (Q1 and Q2) by different climate scenarios and crop models. C1–C5 = climate models, C1 = CCSM4, C2 = GFDL-ESM2M, C3 = HadGEM2-ES, C4 = MIROC5, C5 = MPI-ESM-MR; M1 = crop model (APSIM), M2 = crop model (DSSAT).

The adaptation strategy is likely to result in an increase of 15.5–18.6% in mean net farm returns for APSIM but the magnitude of increase would be lower (10–11%) for DSSAT. The *per capita* income would increase by 10–11% and 6–7% for APSIM and DSSAT, respectively. Consequently, the poverty rate would decline by 3–5% for the population as a whole. The adoption rates for the adaptation strategy ranges from 59–64% for APSIM but less than 50% (46–49%) for DSSAT under five GCMs. Overall, the adaptation strategy results in an increase in mean net farm returns for the population as a whole. However, 36–41% of the population still remains vulnerable to climate change. It may be noted that the adaptation is tested for one crop (wheat) only and the yield increases are not substantially higher due to which a substantial proportion of farm population do not adopt the adaptation strategy. Therefore, different adaptation packages and a set of elaborate RAPs visualizing 23 more realistic features of the future agricultural production systems need to be tested to formulate an effective strategy under climate change and for ensuring economic viability and livelihood security of smallholders in the region.

Project title	:	Global Yield Gap and Water Productivity Atlas (GYGA)
Project code	:	COP201300100130
Funding Agency	:	Bill & Melinda Gates foundation through ICRISAT
Duration	:	2013-15
Project Personnel	:	N. Subash

The main aim of this project is to assess the yield potential (Yp) or water-limited yield potential (Yw), yield gap (Yg) and water productivity (WP) using a bottom-up approach based on actual data and robust crop simulation models. GYGA aspires for global coverage of yield gaps for all major food crops and countries that produce them, focuses on maize, rice, wheat, sorghum

and millet in 20 countries spread over all the continents. In southAsia, during the first phase India and Bangladesh are participating in this project. During the year 2014, based on the area of five major crops, reference weather stations (RWS) were identified over India. Revised methodology was worked out for selection of higher number of reference weather stations for rice, wheat, maize, sorghum and bajra for achieving higher accuracy in estimation of potential yields. Pulses like greengram and blackgram under rice based cropping systems will also be included under yield gap study. Soil and crop related basic data was collected for these weather stations. 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

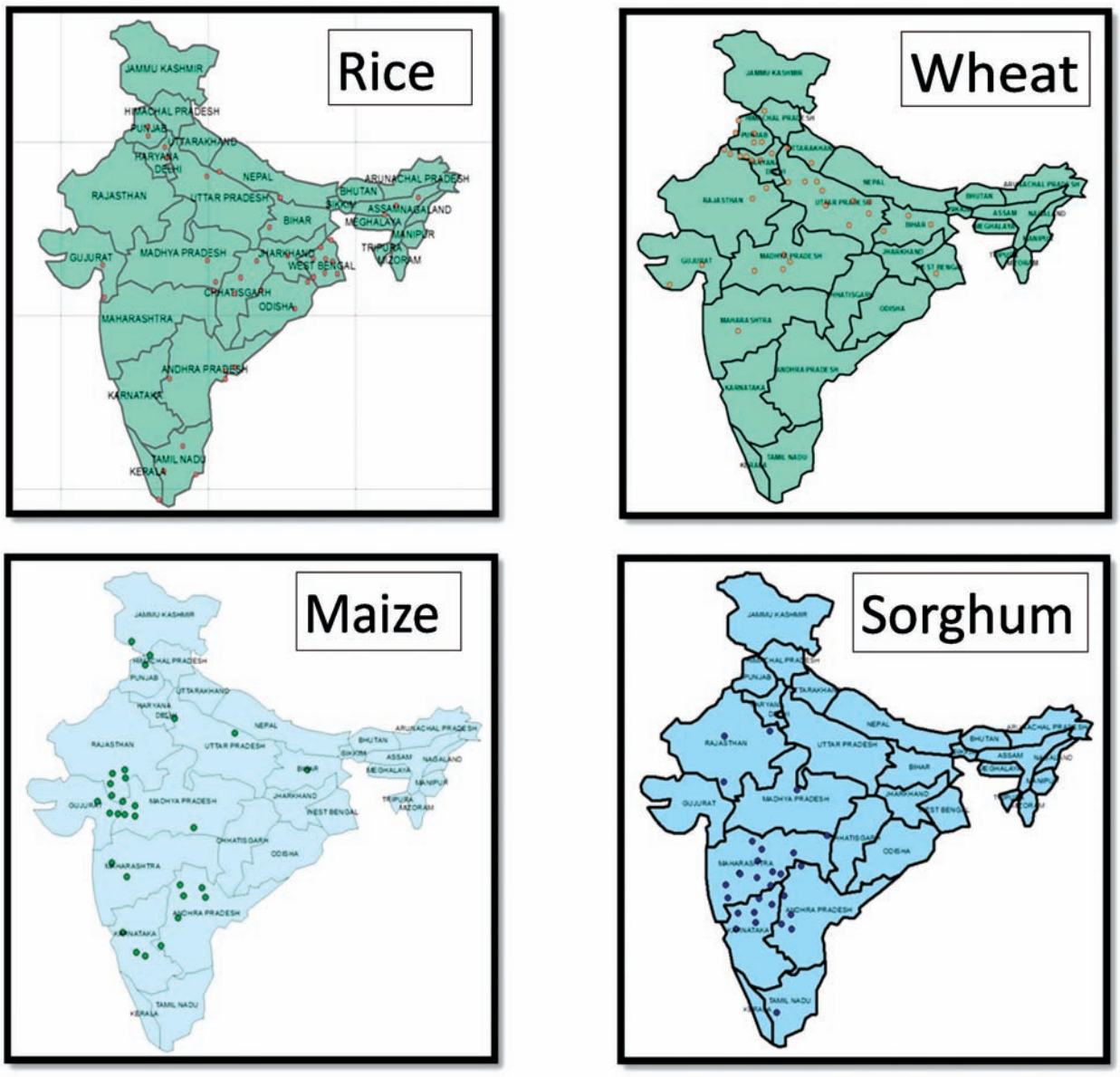


Fig. 26. Selected RWS - reference weather stations for rice, wheat, maize, sorghum and pearl millet over India.

identified in different agro-climatic zones of India. Actual crop yields for 10 years were estimated for thirty climatic buffer zones taking the respective district and surrounding district weighted mean of major crops with in 100km radius.

Project title	:	Adaptation and mitigation potential through conservation agriculture and IFS modules
Project code	:	NRMAIIFSRSOL201100600124
Funding Agency	:	ICAR
Duration	:	2012-17
Project Personnel	:	N. Subash, M.P.S. Arya, R.S. Yadav, Sanjeev Kumar, Debasis Datta and V.P. Chaudhary.

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 PDFSR 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 2014-15, we have completed the following tasks,

Yield datasets of long-term experiments on integrated nutrient management in rice-rice cropping systems at three sites (Bhubaneshwar, Jorhat and Rajendranagar) were used to investigate the relationship of variability in rainfall, temperature, and integrated nutrient management (INM) practices in rice-rice cropping system in three 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. The intraseasonal variations in rice yields are largely driven by rainfall during kharif rice and by temperature during rabi rice. Half of the standard deviation from the average monthly as well as seasonal rainfall during kharif rice and 1 °C increase or decrease from the average maximum and minimum temperature during rabi rice has been taken as the classification of yield groups.

Different integrated nutrient management practices responded differently to the excess/ deficit quantity of monsoon rainfall at different study sites (Table 17). At Bhubaneshwar, all the treatments performed well when rainfall >1,464 mm with a maximum yield increase of 15.6 % compared to normal with the application of 50 % of RDF during kharif. The threshold maximum temperature varies with the study sites due to different kinds of ecosystems that exist in these places. At Bhubaneshwar,

Table 17. Average yield deviation (%) pertaining to years with extreme rainfall years (mean ± ½ standard deviation) compared to normal years under different nutrient management treatments during *kharif*-rice

Treat-ments	Study sites					
	Bhubaneshwar		*Jorhat*		*Rajendranagar*	
	>1464	<1154	>1364	<1168	>792	<621
T1	1.5	-16.1	-3.5	-10.9	-16.8	-20.2
T2	10.2	-8.4	-10.2	0.4	7.6	-4.2
T3	10.5	-11.2	-8.0	0.7	5.3	-5.4
T4	11.1	-6.5	-9.6	0.8	3.9	-1.6
T5	6.4	-6.4	-6.4	2	6.4	0.2
T6	14.9	-7.3	-3.2	6.7	5.5	-1.6
T7	10	-2.8	-6.6	6.4	4.9	-2.8
T8	13	-7.9	-4.5	10.6	6.9	-4.4
T9	9.1	-5.0	-5.6	7.1	6.4	2.6
T10	15.3	-5.2	-1.5	5.3	11.2	6.1
T11	7.9	-3.7	-2.1	8.9	11.0	8.3
T12	8.5	-7.3	-11.5	-4.7	6.3	4.5

when the mean crop season maximum temperature >35 °C, all the treatments, except farmers'conventional practice and 50%NPK through chemical during kharif and 100% during rabi, produced higher yield (Table 18).

Table 18. Average yield deviation (%) from normal years when the maximum temperature during the rabi-rice period increases to mean+1^{0}C under different nutrient management treatments over different study sites

Treatments	Average yield deviation from normal (%) when maximum temperature (^{0}C)		
	Bhubaneshwar ≥35	Jorhat ≥ 27.4	Rajendranagar ≥35.9
T1	3.1	1.0	-27.2
T2	2.3	5.0	-40.9
T3	-0.6	4.1	-21.6
T4	5.5	5.7	-20.4
T5	1.2	9.7	-14.0
T6	5.9	13.2	-28.3
T7	5.0	14.5	-24.6
T8	5.0	16.1	-11.8
T9	1.4	15.7	-13.2
T10	5.9	10.2	4.9
T11	2.0	6.2	6.9
T12	-10.8	19.2	-5.4

At Bhubaneshwar, the application of 50 % recommended NPK through chemical fertilizers and 50 % N through green manure resulted in an overall average higher increase of 5.1% in system productivity under both excess and deficit rainfall years and also during the years having seasonal mean maximum temperature e"35 °C (Table 19). However, at Jorhat, the application of 50 % recommended NPK through chemical fertilizers and 50 % N through straw resulted in an overall average higher increase of 7.4 % in system productivity, while at Rajendranagar, the application of 75 % NPK through chemical fertilizers and 25 % N through green manure resulted in an overall average higher increase of 8.8 % 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. This study highlights the adaptive capacity of different integrated nutrient management practices to rainfall and temperature variability under a rice-rice cropping system in humid, subhumid, and semiarid ecosystems.

The carbon stocks and sequestration rate under different integrated nutrient management practices were computed under the 2(a) experiment of AICRP-IFS centers viz., Bhubaneshwar, Chiplima and Maruteru. It is found that highest carbon stocks of 35.85 t/ha, 63.18 t/ha and 80.79 t/ha, respectively at Bhubaneshwar, Chiplima and Maruteru under incorporation of 50 % FYM along with 50 % inorganic N application (Fig. 27).

Table 19. Site specific primary, secondary and tertiary climate resilient integrated nutrient management practices and system productivity deviation (%) in extreme climate situation

Site	Primary	Secondary	Tertiary
Bhubaneshwar	50 % NPK (C)+50 % (GM) (5.1)	50 % NPK (C)+50 % (FYM) (4.5)	75 % NPK (C)+25 % (FYM) (4.1)
Jorhat	50 % NPK (C)+50 % (Straw) (7.4)	75 % NPK (C)+25 % (Straw) (5.7)	50 % NPK (C)+50 % (FYM) (5.6)
Rajendranagar	75 % NPK (C)+25 % (GM) (8.8)	50 % NPK (C)+50 % (GM) (7.3)	50 % NPK (C)+50 % (FYM) (1.8)

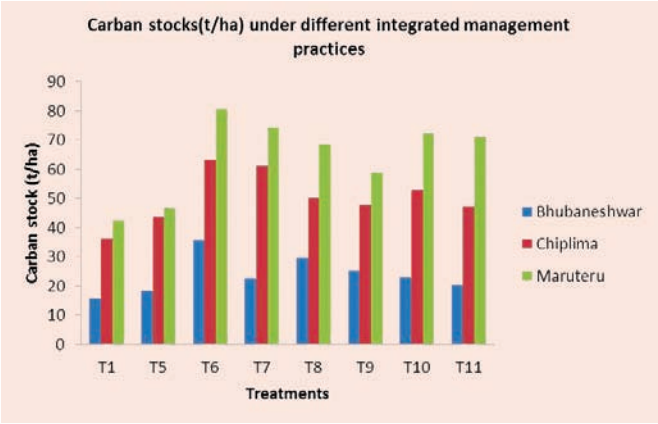


Fig. 27. Carbon Stocks (t/ha) under different integrated nutrient management practices (T1- Control; T5-Recommended dose of fertilizer; T6-50 % FYM; T7-25 % FYM; T8-50 % Crop Residue (CR); T9-25 % CR; T10- 50 % Green manure (GM); T11- 25 % GM)

It is also found that the highest carbon sequestration rate of 835.64 kg/ha/yr, 938.99 kg/ha/yr and 1622.40 ka/ha/yr, respectively at Bhubaneshwar, Chiplima and Maruteru under incorporation of 50 % FYM along with 50 % inorganic N application over 100 % recommended inorganic fertilizer application (Table 20).

Data presented in Table 21 reveals that application of organic source of nutrients for cultivation of crops enhanced the buildup of organic carbon in the soil at both Pantnagar and Modipuram locations. At 0-90 cm soil depth, practice of organic cultivation of crops increased the organic carbon in the soil to the extent of 16.5 and 24.0 per cent over to integrated and chemical application of nutrient, respectively at Pantnagar with corresponding

Table 20. Comparison of carbon sequestration rate over control and recommended dose of fertilizers by different integrated nutrient management practices

Treatments	Carbon sequestration rate (kg/ha/year) Over control (T1)			Carbon sequestration rate (kg/ha/year) over recommended dose of fertilizers (T5)		
	Bhubaneshwar	Chiplima	Maruteru	Bhubaneshwar	Chiplima	Maruteru
T5	115.00	336.65	208.12	-	-	-
T6	950.64	1275.65	1830.52	835.64	938.99	1622.40
T7	321.01	1179.22	1527.39	206.01	842.57	1319.27
T8	657.70	653.40	1246.10	542.70	316.75	1037.98
T9	452.63	546.16	786.59	337.63	209.50	578.47
T10	341.82	787.69	1423.69	226.82	451.03	1215.57
T11	212.08	525.85	1371.11	97.08	189.20	1163.00

T5-Recommended dose of fertilizer; T6-50 % FYM; T7-25 % FYM; T8-50 % Crop Residue (CR); T9-25 % CR; T10- 50 % Green manure (GM); T11- 25 % GM

Table 21. Soil organic carbon (g kg^{-1} soil) under application of organic, integrated and chemical nutrients averaged across different cropping systems at Pantnagar and Modipuram after 10 years of crop cycle.

Soil Depth (cm)	Pantnagar			Modipuram		
	Organic	Integrated	Chemical	Organic	Integrated	Chemical
0-15	9.39	8.38	6.43	8.60	6.85	5.28
15-30	4.86	4.48	4.48	5.60	4.63	4.15
30-45	3.17	2.49	2.64	3.88	3.77	3.35
45-60	1.93	1.78	1.74	3.15	3.35	2.48
60-75	1.56	1.07	1.44	2.80	2.83	2.33
75-90	1.11	0.69	1.03	2.15	2.20	2.00
90-105	-	-	-	1.75	1.55	1.50
Mean	3.67	3.15	2.96	4.20	3.60	3.01

increase of 10.8 and 32.6 per cent at 0-105 cm soil depth at Modipuram.

Project title	**:**	Study of crop pattern and increase in agricultural produce due to release of water from *Tehri* Reservoir for irrigation purpose
Funding Agency	**:**	SEWA, THDC, Rishikesh
Duration	**:**	
Project Personnel	**:**	V.K Singh, M.P. Singh and R.P. Mishra

Present study was under taken to characterize the existing farming situation in different canal command area where *Tehri* Hydro- Development Corporation of India Limited (THDCIL) has released the additional/ supplemental irrigation water in East Ganga Canal command and East Yamuna Canal command (1100 cusec to each canal command) and evaluate its impact on crops and cropping system dynamics, yield, economics and change in water aquifer. Studies were undertaken in EYC command covers District Muzaffar Nagar, Baghpat and partially Ghaziabad whereas EGC command irrigate the crops of Haridwar, Bijnor and partially J.P. Nagar District of western Uttar Pradesh.

Salient outcome of the study are given here as under:

During *Kharif* (monsoon) season of 2009, the total irrigated area through EYC was 22005 ha which increase upto 42055 ha in 2013. During the study period (2009 to 2014) change in irrigated area over bench mark irrigated area (2009) was recorded 7042 ha to 22005 ha. Similarly in *Rabi* season, an improvement in irrigated area of East Yamuna Canal (EYC) command was notices which increased from 13834 ha in 2009 to 25476 ha. in 2013 with an additional area gain of 5481 ha during the five years period. Such results clearly demonstrate that additional irrigation water availability through *Tehri* reservoir had direct influence on irrigated cropped area under EYC in both *Kharif* and *Rabi* season.

The total irrigated area in EGC through canal command were increased from 33794 ha in 2009 to 46746 ha in 2013. The change in irrigated cropped area over 2009 was 12953 ha during 2013. In all the canal commands Divisions of EGC not had irrigation availability in *Rabi* season during 2009, But with availability of irrigation water total irrigated cropped area under these canal command increased continuously which was maximum (16383 ha) during 2013.

The change in productivity (t/ha) and total production (t) over initial bench mark (2008-09) due to additional water release was made during 2014. Results reveals that the rice, wheat, sugarcane, potato, sorghum (fodder) and pulse production varied from with a mean value of 3.6, 3.8, 61.5, 21.5, 17.5 and 0.9 t/ha, respectively before release of supplemental irrigation water in EGC command. With availability of irrigation water, productivity of these crops ranged from with a mean value of 4.0, 4.3, 67.2, 23.8, 18.5 and 1.0 t/ha, respectively in EGC command.

The crops production in EYC command was in the range of 3.6 to 4.1 t/ha for rice, 3.7 to 4.3 t/ha for wheat, 60.0 to 69.4 t/ha for sugarcane, 18.0 to 25.2 t/ha for potato, 16.5 to 20.2 t/ha for sorghum (fodder) and 0.8 to 1.09 t/ha for pulses before the release of additional irrigation water through *Tehri* reservoir. The average increase in yield of these crops were 11.05% in rice, 11.86% in wheat, 9.20% in sugarcane, 10.73% in potato 5.85% in sorghum (fodder) and 1.6% in pulses under EYC command. In general crop productivity in EGC command was lower as compared to EYC.

Among various enterprises maximum gain of ₹ 573 cr./annum in EGC and ₹ 778 cr./ annum in EYC was noted with agriculture enterprises. Contribution of other enterprises viz. horticulture, vegetables and live-stock were ₹11 cr./annum, ₹ 15 cr./annum and ₹ 51 cr./annum in EGC and ₹ 18 cr./annum, ₹ 19 cr./annum and ₹ 40

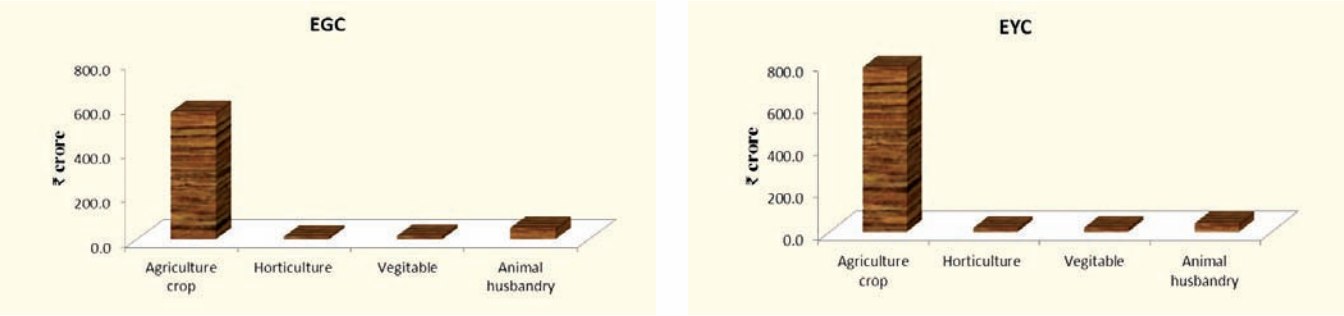


Fig. 28. Estimated revenue (' crore) through different enterprises in EGC and EYC

cr./annum in EYC. Summing all these enterprise revenue gain, a sum of ' 1506 cr./annum additional benefit was estimated from both the canal commands (Fig. 28).

The differential water aquifer during the study period clearly indicates a positive effect of irrigation water supply and improvement in water aquifer was noted at all the benchmark location of EGC and EYC command in different crop season with a gain of 33% in EGC and 10% in EYC in water depth. After release of supplemental irrigation water these canal command had reverse trend and canal irrigation area increased by 43% in EGC and 37% in EYC command.

Project title	**:**	Ensuring livelihood security through farming system approach in Tehri district of Uttarakhand
Project code	**:**	NRMAIIFSRSCL201100400122
Funding Agency	**:**	SEWA, THDC, Rishikesh
Duration	**:**	2011-2015
Project Personnel	**:**	B. Gangwar, M. P. Singh, V. K. Singh, V. P. Choudhary, R. P. Mishra, Poonam Kashyap and A. K. Prusty

Under the THDC sponsored Project, studies were undertaken in randomly selected villages forming clusters in Tehri districts of Uttarakhand using stratified random sampling. Two clusters namely Koteshwar and Kandi Soud consisting of 10 villages each were selected after an extensive survey through Tehri district by a multidisciplinary team of in consultation with THDC authorities.

Field trials (403) of improved varieties of wheat (VL Gehun 804 and 907) were conducted at farmer's field, covering 20 villages in both cluster (Koteshwar and Kandisoud). The increase in yield at irrigated condition about 20 to 22% and rainfed condition about 30 to 40% over the local variety was noticed.

Demonstrations of weed management in wheat were carried out in ninety one (91 nos.) farmers field in Koteshwar and Kandisour cluster. Each farmer was supplied with weedicide (N Double Mix) as input material for demonstration trial. 10-15 % more yield was recorded.

Two hundred and fifty five no (255 no.) of demonstrations of cultivation of improved varieties of gram (Abrodhi) was carried out in farmers field covering 20 villages in study clusters. An average yield enhancement of 15 to 20 % was recorded in pulse crops from the trials conducted. Two hundred ninety five (295 no.) of demonstrations of lentil (VL 406) was carried out in farmers field covering 20 villages in study clusters. An average yield enhancement of 16 to 22 % was recorded in pulse crops from the trials conducted. Two hundred fifty five (255 no.) of demonstrations of barley (VL barley 54) was carried out in farmers field covering 20 villages in study clusters. An average yield enhancement of 17 to 21 % was recorded in barley crops from the trials conducted.

For kitchen gardening improved seeds of vegetables e.g. palak, raddish, coariander, veg pea, cauliflower, cabbage, board bean and rai were distributed to 476 farmers in the both cluster. The distributed vegetables seeds helped in rendering the availability of the green vegetables and hence also helped in improving the nutritional requirement of the family through vegetables and also strengthened the livelihood on financial terms.

Sowing of improved varieties of following crops was done for Kharif season among adopted farm families in both the clusters. Rice (Vivek dhan 154, Vivek dhan 62 and VL dhan 209), Maize (Vivek sankul Makka 31), Jhangoora (VL 207), Ramdana (PRA 3), Madua (VL Mandua 324), Gahat (VLG 19), Arhar (VL Arhar 1), Urd (PO-35) and Rajmash were distributed in both Kandisour and Koteshwar cluster among 214 farmers, 244 farmers, 95 farmers, 87 farmers, 125 farmers, 45 farmers, 97 farmers, 86 farmers and 116 farmers respectively. Demonstrations of weed management in Rice were carried out in four (04 nos.) farmers field in Koteshwar. Each farmer was supplied with weedicide (Nomini gold) as input material for demonstration trial. INM and IPM practiced in Khariff crops intervention was done. In INM practiced, DAP MOP and Urea and in IPM practiced Radomil, Imidacloprid, Nuvan, Cloro+Cyper, Prorate and Neem oil was distributed among Koteshwar and Kandisour cluster farmers. Significantly yield increased of farmer practice to improved cultivation of Rice (20-22%), Jhangora (18-20%), Mandua (20-23%), Maize (24-25%), Arhar (21-24%), Ramdan (24-28%), Rajma (23-24%), Gahat (25-27%) and Urd (21-23%) yield growth in percentage was noticed in all the distributed crops through recommended package of practice.

In both the study clusters (Koteshwar and Kandi soud) for control of insect pest and disease in kitchen garden and fruit plants like mango, banana, guava, citrus etc. fungicide/pesticide namely Imidachloprid, cypermethrin, Nuvan, Neem oil, Kudarat, Carbendazyme and Radomil etc. were distributed to farmers along with information on their application and proper dosage. Inorganic insecticide viz. CYPERMETHRIN and organic NEEM OIL were applied on fruit and vegetable plants. Khariff season vegetable Kit was provided 760 farmers of Koteshwar and Kandisour cluster for fresh vegetables daily need. Vegetable kit had contained improved seeds of Okra, Cucumber, Bitter guard, Bottle guard, Snake guard and Shimala mirch. The INM was used for fresh and much production of vegetables in kitchen garden and fruits in both studies cluster. In the Khariff season kitchen garden and fruit plants were sprayed of Humic fort, Sujala N.P.K., Anmol Amrit, Micro-nutrient and vegmor among 170 farmers of Koteshwar and Kandisour cluster. For livelihood improvement and nutritional security of the farmer's fruit plants such as Mango (Dashahari and Amrapali 375 plants), Guava (Allahabadi Safeda 250 plants), Jack fruit (250 plants) and Lemon (Kagaji 250 plants) were provided among 273 farmers at Kandisour and 560 farmers at Koteshwar site. In demand of THDC, Mango 500 plants, Guava 300 plants, Pomegranate 150 plants, Lemon 350 plants, Litchi 300 plants and Jack fruit 200 plants were distributed among 74 farmers Chopra, 65 farmers Devari, 60 farmers Pingola, 25 farmers Lasi Sukheth, 20 farmers Asana, 15 farmers Sain Kandogi, 4 farmers Swadi Gadaliya, 4 farmers Swadi, 1 farmer Kudi Gadaliya, 160 Uppu village, THDC Engineering collage B. puram and THDC Rishikesh office. Average survival of the supplied fruit plants was approximately 65 % at both the clusters.

Vermicomposting trials (7 nos.) were carried out for value addition of animal dung which yielded very good response among farmers. About 19 village level skill enhancement training were conducted for value addition of agricultural produce which benefitted 800 farmers in the Kandisour and Koteshwar cluster. Under capacity building programme, trainings were conducted regarding value addition of agricultural produce such as , preparation of pickles, tomato sauce, lemon squash etc, propagation methods of fruit plant for multiplication of fruit plant population, vermi-composting and local problem and solution on crops, animals, fruit plants and kitchen garden related.

Project title	:	Integrated Spatial Farming Systems Analysis Techniques with Remote Sensing and Ancillary data (INFARM)
Project code	:	NRMAIIFSRCOP201300200131
Funding Agency	:	SAC, Ahmedabad
Duration	:	3 years
Project Personnel	:	N. Ravishankar, M. Shamim and Brij Mohan Garg

The current study visualizes farming systems of India and evaluating the selected 9 districts covering 8 states for 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 selected study districts are Mehsana (Gujarat), Kendrapara (Odisha), Dharmpuri/ Krishnagiri (Tamil Nadu), Udaipur (Rajasthan), Pune and Amravati (Maharashtra), 24 Pargnas (West Bengal) and Kanpur (Uttar Pradesh). During 2014-15, one additional district of Thiruvalla (Kerala) has been added. Image analysis of LISS IV data, 2014-15, Kharif season, was done at SAC, Ahmedabad and also submitted all the scanned cadastral maps of Dharmapuri and Krishnagiri districts (Tamil Nadu), Kanpur Dehat (Akbarpur Block and Maitha Block) and Udaipur (Salumber and Sarada Block) to SAC, Ahmedabad.

Using the primary data collected from benchmark information of OFR farm households, farming systems for each 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 farming system existing in the study area. Map will be developed of existing farming systems on the basis of developed indices. The Spatial Variability of Integrated Farming Systems maps of 8 study areas are developed for Rabi season. The map of Krishnagiri district is given in Figs. 29 and 30.

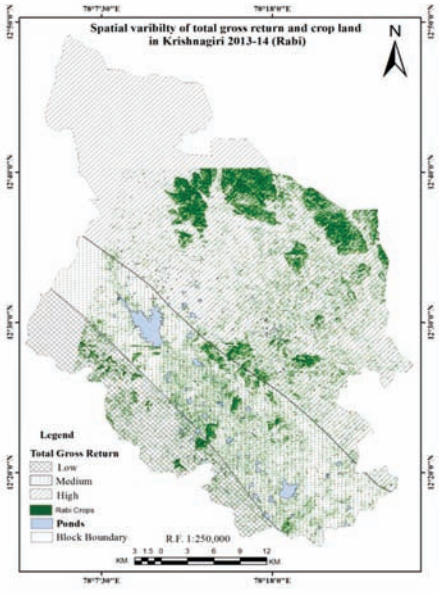


Fig. 29. Spatial Variability of Integrated Farming Systems of Krishnagiri |(Tamil Nadu) during *rabi* season

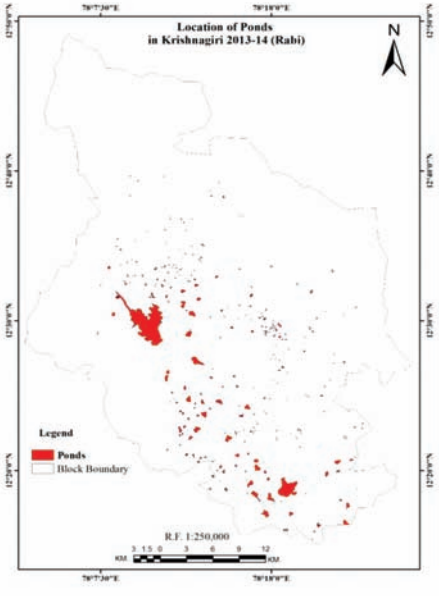


Fig. 30. Available ponds for fisheries in Krishnagiri (Tamil Nadu)

TECHNOLOGY TRANSFER, WORKSHOPS, TRAININGS AND FARMERS MEETS

Sl. No.	Seminar/Symposia/Training Programme Organized	Duration
1	Training cum Kisan Goshthi involving THDC staff and farmers at Mehrampura,Khekra, district Baghpat.	24 April, 2014
2	Kisan Goshthi at Koteshwar of New Tehri district.	18 May, 2014
3	Ninth Annual Group Meeting of NePOF at Bajaura, Kullu.	19-20 May, 2014
4	Kisan Goshthi at Kandisour of New Tehri district.	20 May, 2014
5	Regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on Integrated Farming System" at Jorhat.	26-27 May, 2014
6	Brain storming session on IFS modeling at IIFSR, Modipuram	June 3, 2014
7	Regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on IFS" at Patna.	9-11 June, 2014
8	Sensitization Workshop on Nutrient Expert® Decision support Tool for Cereals organized at IIFSR, Modipuram ,Meerut, Uttar Pradesh	15-16 June 2014
9	Regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on IFS" at Hyderabad.	9-11 July, 2014
10	Regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on IFS" at Hissar.	11-13 August, 2014
11	Agri Education Day at IIFSR, Modipuram	23 August, 2014
12	Regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on IFS" at S.K. Nagar.	28-30 August, 2014
13	Training cum Kisan Goshthi involving THDC staff and farmers at Pratapnagar Block, Tehri.	07 November, 2014
14	Training cum Kisan Goshthi involving THDC staff and farmers at Bhelangana Block, Tehri.	08 November, 2014
15	Farmers' awareness program on impact of climate change in agriculture" under NICRA Project at Dulhera Village, Modipuram.	17 November, 2014
16	Agronomist Meet: farmers perception on Climate change and Farming system and success stories organised at IIFSR,Modipuram, Meerut, Uttar Pradesh	21-22 November 2014
17	Kisan Goshthi at Rasulpur Jatan village of Muzzaffarnagar district.	13th December 2014
18	Kisan Goshthi at Barwala village of Muzzaffarnagar district.	14th December 2014.
19	ICAR-NCIP, New Delhi and ZPD-IV collaborated training on 'Orientation Course on Integrated Pest Management for ZPD-IV' at IIFSR, Modipuram, Meerut.	9-11 December, 2014
20	XXXI biennial workshop on Integrated Farmimg System at Coimbatore	22-24 December, 2014

fgUnh dk;Z'kkyk

निदेशालय में दिनांक 06.06.2014 को पूर्वाह्न 11.00 बजे मुख्य सभागार में एक दिवसीय हिन्दी कार्यशाला का आयोजन किया गया जो कि हिंदी भाशा की दशा एवं दिशा के बारे में जानकारी तथा कार्यालय कार्यों में हिंदी भाशा को बढ़ावा देने पर आधारित थी। इस कार्यशाला में डा0 दीपक भार्मा, प्रोफेसर (संस्कृत) श्री वेंकटेशवरा विश्वविद्यालय द्वारा मुख्य प्रवक्ता के रूप में दैनिक कार्यो में हिंदी के प्रयोग से संबंधित विभिन्न महत्वपूर्ण जानकारियां दी गई, जिसके लिए डा0 कामता प्रसाद, प्रधान वैज्ञानिक/(कार्यकारी परियोजना निदेशक) ने भी हार्दिक सराहना की। उपस्थित सभी अधिकारियों एवं कर्मचारियों ने हिंदी के प्रयोग के प्रशिक्षण/जानकारी को ग्रहण कर हिंदी के दैनिक कार्यों में अधिक से अधिक प्रयोग करने का संकल्प लिया। कार्यशाला में निदेशालय के अधिकारियों एवं कर्मचारियों के अलावा मेरठ में स्थित केन्द्र सरकार के अन्य कार्यालयों से पधारे कई अधिकारियों ने भी अपनी उपस्थिति दर्ज की तथा अपने विचार रखे। कार्यक्रम का संचालन श्री सुशील कुमार सिंह, वरिश्ठ प्रशासनिक अधिकारी द्वारा किया गया।

दिनांक 17.12.2014 को अपराह्न 2.30 बजे एक हिन्दी कार्यशाला, संस्थान के बड़े सभागार में आयोजित की गई। इस कार्यशाला में श्री प्रमोद कुमार त्यागी, सदस्य सचिव, न.रा.का.स., मेरठ को आमंत्रित किया गया था। उनके द्वारा "देवनागरी लिपि एवं मानक वर्तनी" के प्रयोग व नियम संबंधी विभिन्न जानकारियां दी गई, जिसके लिए डा0 कामता प्रसाद, प्रधान वैज्ञानिक/प्रभारी निदेशक ने हार्दिक सराहना की। उपस्थित सभी अधिकारियों एवं कर्मचारियों ने हिंदी के प्रयोग के प्रशिक्षण/जानकारी को ग्रहण कर हिंदी के दैनिक कार्यों में "देवनागरी लिपि एवं मानक वर्तनी" के प्रयोग करने का संकल्प लिया।

Ñf"k f'k{kk fnol

संस्थान में दिनांक 28, अगस्त 2014 को कृषि शिक्षा दिवस मनाया गया। इस अवसर पर डा0 अरविन्द कुमार, उपमहानिदेशक (कृषि शिक्षा), भारतीय कृषि अनुसंधान परिषद नई दिल्ली मुख्य अतिथि के तौर पर उपस्थित रहे। कार्यक्रम में डा. वृहमप्रकाश, निदेशक, केन्द्रीय गौवंश अनुसंधान संस्थान मेरठ व डा0 हरिशंकर गौड, कुलपति, सरदार वल्लभ भाई पटेल कृषि एंव प्रो़द्योगिकी विश्वविद्यालय मेरठ भी विशिष्ठ अतिथि के रुप में उपस्थित रहे। मेरठ के विभिन्न विद्यालयों के अध्यापक एंव छात्र–छात्राओं ने भी कार्यक्रम में हिस्सा लिया। कार्यक्रम का शुभारम्भ डा0 प्रेम सिंह के स्वागत भाषण से हुआ। परियोजना निदेशक, डा0 बाबूजी गंगवार ने सभी आगन्तुको का स्वागत करते हुए हमारे देश की वर्तमान में कृषि समबन्धी चुनौतीयों पर प्रकाश डालते हुए सीमान्त एंव छोटे कृषकों हेतू समनवित कृषि प्रणाली की उपयोगिता के बारे में बताया। डा0 बृहमप्रकाश ने कृषि शिक्षा में अतिरिक्त दक्षता के विकास पर जोर दिया। डा0 हरिशंकर गौड ने भारत के सम्पूर्ण विकास में आजादी के उपरान्त कृषि शिक्षा के योगदान पर विस्तृत प्रकाश डाला। मुख्य अतिथि डा0 अरविन्द कुमार ने बताया कि कृषि केवल आजीविका का साधन ही नही वरन् आज एक व्यवसाय भी है। आज सुदृढ़ आर्थिक व्यवस्था का मुख्य आधार हमारी कृषि है जिसके फसलस्वरुप विश्वव्यापी मन्दी के दौरान भी हमारा प्रदर्शन लगभग स्थिर रहा है। उन्होनें बताया कि कृषि शिक्षा का उद्देश्य सामान्य जनमानस, विशेषकर नवयुवकों में कृषि ज्ञान के प्रति रुचि बढ़ाना है जिससे उन्हें अपने परिवेश में ही स्वरोजगार एंव अन्य अवसर प्रदान किये जा सकें। कार्यक्रम के दूसरे सत्र में कृषि शिक्षा सम्बंधी दो प्रतियोगिताओं का आयोजन किया गया। पहली, वाद–विवाद प्रतियोगिता "भारत को जैविक कृषि की तरफ बढ़ना चाहिये" नामक शीर्षक पर एंव दूसरी, चित्रकला प्रतियोगिता "भारतीय कृषि एंव

महिलाऐं"शीर्षक पर आयोजित की गयी। दोनेा प्रतियोगिताओं के प्रतिभागियों को कुल 12 पुरुस्कारों के अतिरिक्त सान्तवना पुरुस्कार भी प्रदान किये गये। वाद–विवाद प्रतियोगिता में कुमारी निवेदा सिंह, शोभित विश्वविद्यालय ने प्रथम तथा आकाश गुप्ता ने द्वितीय पुरुस्कार प्राप्त किया। पेंटिंग प्रतियोगिता में कुमारी मीनल सिंह ने प्रथम एंव कुमारी मीनाक्षी ने द्वितीय पुरुस्कार प्राप्त किया। पुरुस्कार वितरण के बाद कार्यक्रम का समापन डा0 बाबूजी गंगवार के धन्यवाद प्रस्ताव द्वारा किया गया।

fgUnh pkSd i[kokMk

निदेशालय के दैनिक कार्यो में हिंदी के अधिकारिक उपयोग को बढ़ावा देने एवं सभी कर्मियों में राजभाशा के प्रति अभिरूचि पैदा करने के उद्देश्य से वर्श 2014 में 14–28 सितम्बर तक हिंदी पखवाड़े का आयोजन किया गया। पखवाड़े को सफलीभूत करने के उद्देश्य से इस दौरान हिंदी उपयोग को बढ़ावा देने संबंधी विविध कार्यक्रम जैसे– कविता पाठ, हिंदी सामान्य ज्ञान प्रश्नोत्तरी एवं अंत्याक्षरी की टोली प्रतियोगिताएं, हिंदी एवं अन्य भाशा–भाशी हेतु पृथक–पृथक वाद–विवाद एवं निबंध प्रतियोगिता, टिप्पणी एवं प्रारूप लेखन प्रतियोगिताएं कराई गयी जिसमें सभी संवर्ग के अधिकारियों एवं कर्मचारियों ने बढ़–चढ़कर भाग लिया। हिंदी पखवाड़े के दौरान संस्थान में दिनांक 17.09.2014 को अपराह्न

2.30 बजे मुख्य सभागार में हिन्दी कार्यशाला का आयोजन किया गया जो कि हिंदी भाषा की दशा और दिशा के बारे में जानकारी तथा कार्यालय कार्यों में हिंदी को बढ़ावा देने पर आधारित थी। इस कार्यशाला में डा0 रविकान्त सरल, प्राचार्य, ए. एस. कालिज आफ एजूकेशन एण्ड टेक्नोलोजी, हापुड़ रोड़, मेरठ को मुख्य प्रवक्ता के रूप आमंत्रित किया गया था। उनके द्वारा दी गई हिंदी भाशा की जानकारियों के लिए परियोजना निदेशक महोदय ने हार्दिक सराहना की। उपस्थित सभी अधिकारियों एवं कर्मचारियों ने हिंदी के प्रयोग के प्रशिक्षण/जानकारी को ग्रहण कर हिंदी के दैनिक कार्यों में अधिक से अधिक प्रयोग करने का संकल्प लिया।

REGIONAL WORKSHOP

Regional Workshop for North-Eastern Region, Jorhat

Two days regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on Integrated Farming System" was held at Jorhat on 26-27 May, 2014 in joint collaboration of PDFSR, Modipuram and AAU, Jorhat. Dr K.M. Bujarbaruah, Hon'ble Vice Chancellor, AAU, Jorhat (Assam) presided over the inaugural session of the workshop. In his chairman's remarks, Dr. Bujarbaruah stressed on harvesting the solar energy by setting the inter-related activities for well being of the small

and marginal farmers of the country. The first beneficiary of the IFS is the environment, second is farmers, third beneficiaries are scientists and ultimately the biosphere- he opined. The Chairman urged upon the Scientists for refining the refined models and also to evaluate the B:C ratio plus criteria in IFS. Hon'ble Vice Chancellor also urged upon the house to work for development of a systematic farming system for *Char* areas or IFS model without paddy crop.

Dr B. Gangwar, Project Director PDFSR, Modipuram in his inaugural address opined that IFS has been focused frequently in country level is particularly designed for small and marginal farmers. So far as environmental quality is concerned, integration of different enterprises is very important as the waste materials produced in the system has been utilized within the system itself- he quoted. In his lecture, Dr. A.K. Gogoi, ZPD, ICAR Zone-III stressed on using bio-mulch (using weeds), GPS/remote sensing technologies and commodity based farming system approach.

Regional Workshop for Eastern Region, Patna

A three days regional workshop on "Strengthening Partnerships and Refined Methodology for On-station Experiments on AICRP on IFS" under AICRP-IFS was held at Patna on 9-11 June, 2014 in joint collaboration with PDFSR, Modipuram and ICAR-RCER, Patna. Nodal officers, Scientists from state universities/ICAR institutes from five states (Bihar, Jharkhand, Chhattisgarh, Orissa and Madhya Pradesh) and Project Co-ordinators of different KVKs of Bihar and Jharkhand participated in the workshop. The workshop was inaugurated by Hon'ble Agricultural Minister, Sh Narendra Singh, Government of Bihar. In his inaugural speech the minister emphasized the need of developing ideal IFS models for small and marginal farmers of Bihar with technologies of efficient water management in agriculture. He called upon scientists to develop skill of state level officers for effective implementation and management of IFS, so that income of farmers may be enhanced.

Annual Group Meeting of NePOF

The Directorate is operating a Network Project on Organic Farming (NePOF) from 2004 with 13 co-operating centers representing 9 agro-climatic regions, 13 NARP zones and 12 states. The 9th Annual Group Meeting of NePOF was organized during 19-20 May 2014 at Hill Agricultural Research and Extension Centre (HAREC), Bajaura, Kullu (HP). The group meeting was inaugurated by Dr K.K. Katoch, Hon'ble Vice Chancellor, CSKHPKV by lighting of lamp followed by *Saraswati Vandana* by students and release of publications brought up by PDFSR.

Dr K. K. Katoch, emphasized that farmers should adopt organic farming as a way of life as the impact of climate change can be minimized through organic farming. Dr B. Gangwar, Project Director, PDFSR while delivering the Project Director's report, highlighted the

Address by Dr K.K. Katoch, Hon'ble VC, CSKHPKV

achievements of NePOF. He said, with the increasing awareness about the safety and quality of foods, long term sustainability of the agricultural system and accumulating evidences of being equally productive, the organic farming has emerged as an alternative system of farming which not only addresses the quality and sustainability concerns, but also ensures a profitable livelihood option. Dr S.P. Sharma, Director Research, CSKHPKV by giving a brief account of history of organic farming in India stressed that organic farming has emerged as off-shoot of ill effects of green revolution technologies and diminishing natural resources.

Biennial Workshop of AICRP on IFS

XXXI biennial workshop of AICRP on Integrated Farming Systems was organized by ICAR-IIFSR, Modipuram in collaboration with Tamil Nadu Agricultural University at Coimbatore during 22-24 December 2014.

The workshop was inaugurated by Dr K. Ramasami, Vice Chancellor as Chief guest and presided over by Dr B. Gangwar, Director, ICAR-IIFSR.

Dr K. Ramasami, in inaugural address highlighted that the achievements of agricultural research is very important for development of the nation and called for transformation of agricultural scientists to specialists in agri-business. He also informed that one cow-one acre system will prevail but we need to make them profitable by way of integrating tradition and science. He also asked the 'AICRP on IFS' group to develop tools and techniques for agricultural disaster management as IFS gives scope for flexible management of resources within the farm.

Dr B. Gangwar, Director, IIFSR in his opening remarks highlighted achievements of the project during last one year including the strengthening of inter-institutional linkages and progress on on-station and on-farm IFS model development at various locations which could result in 82 success stories within the period of two years. He said, as our on-farm research reveals, 59% of marginal households are having two or less components for integration in their system; they need to be diversified for augmenting the income. Further, though we have achieved net income up to Rs. 3.75 lakhs/ha/annum, but we should target for Rs. 6 lakhs/annum in the coming years by appropriately mixing the profitable activities such as protected cultivation of high value crops, boundary plantations etc.

Address of Dr B. Gangwar, Director, IIFSR, Modipuram

Agronomist Meet

In order to comply with the recommendation of Research Advisory Committee (RAC) a meeting on "Farmers Perception on Climate Change & Farming System Success Stories" involving Agronomists of On-Farm Research Centers was organized during 21-22, November 2014 at ICAR-IIFSR, Modipuram. The recommendation of RAC was intended to have a quick survey with the farmers involved in the On-Farm Research, synthesize the results and compile the findings after thorough discussion with all the Agronomists. In this regard, a proforma has been devised which needs to be filled after discussing with OFR adopted farmers. Further, the success stories generated from the farming system or nutrient response experiments of OFR were also discussed and finalize during the meeting. It was also focused that each center is expected to bring at least 3 to 4 success stories which will be discussed and finalized for documentation.

Brainstorming on IFS Modeling

A brainstorming session on IFS modeling was held on 3rd June, 2014 under the chairmanship of Dr. A.K. Sikka, DDG (NRM). In his address, he emphasized the importance of IFS modeling and also informed that there is a need to work closely with international organizations to learn more about modeling tools. Dr Santiago Lopez-Ridaura, CIMMYT, Kenya delivered a seminar on "Modeling Approached for Farming Systems Research" and highlighted the importance of system approach in farming system modeling.

- In order to make aware about improved farming and enhanced livelihood of the farmers, a *Kisan Gosthi* was organized at Koteshwar cluster of New Tehri District on 18th May, 2014.
- To create farmer's awareness on IFS approaches for improving livelihood, a Kisan Gosthi was organized at Kandisoud village of New Tehri district on 20th May, 2014.
- A *Kisan Gosti* on "Farmers' Awareness Program on Impact of Climate Change in Agriculture" under NICRA Project was organized at Village Dulhera, Modipuram on 17th November, 2014. Around 75-80 farmers participated in this event. This event was organized under the NICRA objective of "Farmers' participation in integrated farming system modelling to assess risk management in climate change and climatic variability scenarios".
- संस्थान द्वारा दिनांक 13 दिसम्बर, 2014 को मुजफ्फरनगर जिले के रसूलपुर–जाटान गांव में किसान मेले का आयोजन किया गया। मेले में भारतीय कृषि अनुसंधान परिषद के 11 भोध संस्थानों, कृषि विज्ञान केन्द्र बघरा, अन्तर्राश्टीय मक्का एवं गेंहू अनुसंधान केन्द्र मेक्सिको सहित कुल 17 सरकारी व निजी संस्थाओं ने अपने अपने उत्कृष्ट शोध कार्यो एवं उत्पादों की प्रदर्शनी लगाई।
- रसूलपुर–जाटान गांव में मेले का उदघाटन भारतीय कृषि अनुसंधान परिशद के उपमहानिदेशक एवं मुख्य अतिथि डा0 आलोक कुमार सिक्का ने किया। उन्होंने कृषि एवं पशुपालन के लिए आधारभूत संसाधन जैसे भूमि एवं जल के संरक्षण पर विशेष प्रकाश डाला। गंगा एवं जमुना जैसी पवित्र नदियों के दोआब क्षेत्र में होने के बावजूद भी क्षेत्र के कुछ ब्लाकों में गिरते

भूजल स्तर के कारण ßMkdh tkuhमें चले जाने पर चिंता जताई।

- संस्थान द्वारा दिनांक 14 दिसम्बर 2014 को मुजफ्फरनगर जिले के बरवाला गांव में किसान मेले का आयोजन किया गया। बरवाला गांव में आयोजित किसान मेले का उदघाटन डा. आलोक कुमार सिक्का,एवं डा0 ए0के0सिंह, उपमहानिदेशक भारतीय कृषि अनुसंधान परिशद के कर कमलों द्वारा किया गया। डा0 संजीव कुमार बालियान, केन्द्रीय कृषि राज्य मंत्री, भारत सरकार, मेले के मुख्य अतिथि थे। गॉव के किसानों ने बड़ी गर्मजोशी से डा0 संजीव कुमार बालियान का स्वागत किया एवं क्षेत्र के विकास के लिए उनके द्वारा किये जा रहे कार्यो को सराहा। माननीय मंत्री जी ने अपने अभिभाशण में क्षेत्र के किसानों द्वारा आवश्यकता से अधिक जल एवं यूरिया के उपयोग पर चिंता जताते हुए जल संरक्षण एवं उचित पोशक तत्व प्रबंधन की सलाह दी। उन्होनें कृषकों से फसल एवं कृषि विविधीकरण द्वारा अधिक लाभ कमाने की सलाह दी। मंत्री जी ने किसानों को þenk LokLFk; dkMþ भी वितरित किये।

- मेले के दौरान एक भव्य कृषि प्रदर्शनी एवं किसान गोष्ठी का आयोजन किया गया जिसमें क्षेत्र के गिरते भूजल स्तर की परिस्थितियों में उन्नत कृषि तकनीकों तथा कृषि एवं फसल विविधीकरण द्वारा कृषकों की आय बढाने, जल संरक्षण एवं उनके संपूर्ण विकास पर चर्चा की गई। डा0 बी0 गंगवार ने सभी अतिथियों का स्वागत करते हुए कृषकों से कृषि विविधिकरण को अपनाकर अधिक लाभ कमाने की सलाह दी। डा0 ब्रहम प्रकाश ने उचित पोशण प्रबन्धन व संक्रमण नियंत्रण करके पशुओं के बॉझपन की समस्या के निदान व अच्छी नस्ल के गोपशुओं के वीर्य की उपलब्धता के बारे में विस्तार से जानकारी दी। डा0 चन्द्रभानु ने गेहूँ व धान में बीमारियों की रोकथाम व पश्चिमी उत्तर प्रदेश में वर्ष भर मशरूम उत्पादन की जानकारी दी। डा0 सुरेश मलिक ने उन्नत मुर्गीपालन व अत्याधिक अण्ड़ा उत्पादन हेतु उचित प्रबन्धन की जानकारी दी एवं क्षेत्र में मुर्गीपालन की संभावनाओं के बारे में बताया।

- डा0 ए0के0 सिंह, उपमहानिदेशक भा0कृ0अनु0प0, ने देश के कृषि विज्ञान केन्द्रों द्वारा नई–नई कृषि तकनीकों के प्रसार की विस्तृत जानकारी दी। उन्होनें गन्ने में उचित पोशण व सहफसली खेती की तकनीकों व कम जल उपयोग करते हुए अधिक उत्पादकता लेने के बारे में जानकारी दी। डा0 ए0के0 सिक्का, उपमहानिदेशक भा0कृ0अनु0प0 ने क्षेत्र के घटते भूगर्भ जल स्तर व कई ब्लाकों के डार्क जोन में जाने पर चिंता जताई। उन्होंने किसानों से उचित

जल संरक्षण व उपयोग की तकनीकों को अपनाने की सलाह दी। फसल व कृषि विविधीकरण करके उत्पादकता व जल संरक्षण के तौर–तरीकों को भी बताया। कुलपति डा0 एच0एच0 गौड़, ने पानी के संसाधनों के सदउपयोग, उचित पोशण प्रबन्धन, पशुधन प्रबन्धन व पशु चिकित्सा सुविधाओं आदि के बारे में जानकारी दी तथा कृषि विश्वविद्यालय से हर सम्भव सहायता का आश्वासन दिया।

Technology/ products assessed and transferred to client

Technology generated	Name of Scientist
Process technology for banana chips	A. Nath D. Dutta N. Verma
Potato flakes and potato chips	A. Nath D. Dutta N. Verma
Protocols for carrot tuity fruity	A. Nath
Growing of crops in sequence of Pigeon pea+Bengal gram-W + MTD (ZT)-cowpea (F) climate resilient cropping systems under Bio-intensification	M. Shamim B. Gangwar M. P.S Arya
The IFS model developed in area of 0.70 ha of land comprise of crops (0.38 ha), agri-horti system (0.30 ha), dairy animals (2 buffaloes + 1 cow), small units of mushroom and biogas (1.5 cubic meter), vermicompost, kitchen gardening and boundary plantations provide sizable amount (₹ 62,356/year) as saving to meet out other liabilities of the family.	J.P. Singh

TV Talks/ Lectures delivered/Resource persons

TV Talks/ Lectures delivered/Resource Person	Delivered by
Two lectures on "Rejuvenation of senile fruit orchards "and "Canopy management in fruit crops" during training program for officers of Haryana state held at Horticulture Training Institute (HTI) Uchani, Karnal on 8th July 2014	Dushyant Mishra
Presented a Lead lecture on "Canopy Management and Rejuvenation in mango orchards" during "National Conference on Mango Production, Improvement, Post-Harvest Management and Trade" held at Bihar Agricultural University, Sabour, Bhagalpur, Bihar (June 09-11, 2014)	Dushyant Mishra
Presented a invited lecture on "Cultural Practices for Mango Cultivation" during 23rd National Seminar on Mango at Panchkula, Chandigarh, Haryana "on 6th July 2014	Dushyant Mishra
Resource person for field visit of progressive farmers of Haryana farmers from Palwal district and two officers from HTI Uchani who visited IIFSR on 18th July 2014.	Dushyant Mishra
TV talk for ***Krishidarshan*** program of Lucknow Doordarshan on 26th September 2014. The topic of interaction was *"Aam ke bagwani se adhik laabh kaise le "*.	Dushyant Mishra
TV talk on IFS models for small farm holders for ***Krishidarshan*** program - Recorded and broadcasted by Delhi Doordarshan on 06 October, 2014.	J. P. Singh

TV Talks/ Lectures delivered/Resource Person	Delivered by
TV talk on Composite carp culture for ***Krishidarshan*** program - Recorded and broadcasted by Delhi Doordarshan on 06 October, 2014.	A. K. Prusty
Delivered lecture on 'Clean Development Mechanism: Concepts, Methodologies and Opportunities' on 21/06/2014 at PDFSR, Modipuram under monthly technical seminar programme.	R. S. Yadav
Acted as internal auditor ISO-9001 (2008) certification of ICAR-IIFSR, Modipuram on 16-01-2015.	Poonam Kashyap M. Shamim
Delivered lecture at CIRC, Meerut on the Agriculture Education Day on May 1, 2014	Harbir Singh
Delivered talk to farmers on integration of aquaculture in farming system on 24th April, 2014 at Mehrampur, Baghpat under THDC sponsored project.	A. K. Prusty
Delivered lectures to 30 fish retailers at FFDA, Meerut on topic entitled, "Hygienic handling of fish" on 15-10-2014 under NFDB sponsored training.	A. K. Prusty
Delivered lectures to 30 fish retailers at FFDA, Meerut on topic entitled, "Hygienic handling of fish" on 16-10-2014 under NFDB sponsored training.	A. K. Prusty
Delivered training to 30 fish farmers at ADF (Fisheries) office, Bijnore as resource person on topic entitled, "Culture of Pangassius fish" on 25-02-2015 under NFDB sponsored training.	A. K. Prusty
Delivered Training on entering information related to training and deputations into ICAR ERP (MIS-FMS) system. On 13 January, 2015 for scientists and technical officers of ICAR-IIFSR.	A. K. Prusty

AWARDS AND RECOGNITIONS

Awards

Awards	Received by
2nd Prize for Best Stall at Exhibition of PDFSR technologies at All India Farmers Fair and Agro-Industrial Exhibition held at SVPUAT, Modipuram during 16-18 October, 2014.	Team PDFSR
IPNI-FAI Award for Best Research on Management and Balanced Use of Input (2014) of International Plant Nutrition Institute and The Fertiliser Association of India, New Delhi.	V. K. Singh
ISA Fellow (2014) of Indian Society of Agronomy, New Delhi	V. K. Singh
Appreciation certificate in recognition to develop and promote scientific information about the responsible use of plant nutrients for the benefit of the human family (2014). International Plant Nutrition Institute, Canada.	V. K. Singh
Appreciation Letter from Chief General Manager (Social and Environment), THDCIL (2014). Tehri Hydro- Development Corporation India Limited, Rishikesh	B. Gangwar V. K. Singh M. P. Singh and other Project Team
Best Oral paper presentation award: Evaluation of horticulture based IFS models for providing livelihood security to small and marginal farmers of western plain zone of Uttar Pradesh at International Horticultural Congress a Kalimpong Darjeeling (2014).	Poonam Kashyap Kamta Prasad Harbir Singh Avinash Kansal A. K. Prusty Nisha Verma
Best Poster paper presentation award: Potential of Horticultural crops for livelihood security and profitability in western plain Zone of Uttar Pradesh at 2nd International conference on bio-resource and stress management Hyderabad, India held during January 07-10, 2015	Poonam Kashyap Avinash Kansal B. Gangwar A. K. Prusty
Best Poster paper award: Best poster award in the XII Agricultural Science Congress held at NDRI, Karnal (Haryana) during 3–6 February 2015	Harbir Singh

Awards	Received by
Best Poster paper award: Effects of microenvironment on productivity of rice under irrigated condition of western plain zone of Uttar Pradesh at TIAS (2014) held during 17-19 February 2015 at Dimapur, Nagaland.	M. Shamim B. Gangwar S. P. Mazumdar Sunil Kumar
Honoured with prestigious **Dr. J S Pruthi Award** for 2013 for his significant contribution to the development of Fruit and Vegetable Industry in India at XXIII Indian Convention of Food Scientists and Technologists (ICFOST) during December, 13-14, 2014 at NIFTEM Campus, Kundli, Haryana.	Amit Nath
Best Oral paper presentation award: Effect of different concentration of KMnO4 as ethylene absorbent for shelf life extension of tomato fruits during ambient storage at International Horticultural Congress a Kalimpong Darjeeling (2014).	Amit Nath
Young Scientist Associate Award: Society for Recent development In Agriculture (SRDA) conferred prestigious Young Scientist Associate award for outstanding contribution in the field of Horticultural science on the occasion of TIAS (2014).	Poonam Kashayp
Best Poster paper award: Crop + Cattle + Carp system for enhancing productivity for livelihood security of small and marginal farmers of western plain zone of U.P. presented at TIAS (2014) held during 17-19 February 2015 at Dimapur, Nagaland.	A. K. Prusty J. P. Singh Poonam Kashyap S. P. Singh

Awards	Received by
Best Poster paper award: Evaluation of various residue management machineries for wheat sowing under different rice residue management practices presented at TIAS (2014) held during 17-19 February 2015 at Dimapur, Nagaland.	V. P. Choudhary
Best Oral presentation award: Comparative study of various mechanization options for sowing of wheat under different conservation techniques presented at National Seminar on "Technology and management of Micro Irrigation in Floriculture" held during 19-20 March 2015 at SKUAST, Jammu (J& K), India.	V. P. Choudhary
NAAS Fellowship award on 06 May, 2014	B. Gangwar

Recognitions

Recognitions Received	Received By
Judge for the debate competition organized by ICAR-CIRC, Meerut on May 1, 2014.	Harbir Singh
Expert for evaluation of FET Village seminar by ARS trainee scientists at ICAR-CIRC, Meerut on 10-March-2015.	Harbir Singh
External examiner for evaluation of M.Sc (Ag) Horticulture thesis of SVP University of Agriculture and Technology, Meerut on 18th July 2014	Dushyant Mishra
Acted as Judge for Mango show and best mango grower awards in 23rd Mango Mela held at Yadvindra Garden, Pinjor, Panchkula on 5th July 2014	Dushyant Mishra
Acted as Judge in Fruit Show competition during Kisan Mela at Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram Meerut held on 16-18 October 2014	Dushyant Mishra
Selected as "APSIM Expert" to impart training to 40 Scientists working under GKMS and FASAL projects of IMD during 7-18 October, 2014 at Agro Climate Research Centre, Rajendranagar, Hyderabad organized by PJTSAU in collaboration with IMD.	N. Subash
Acted as internal auditor ISO-9001 (2008) certification of ICAR-IIFSR, Modipuram on 16-01-2015.	Poonam Kashyap M. Shamim
Member in Organizing Committee of "2nd International Conference on Bio-resource and Stress Management 7-10th January 2015 PJTSAU and ANGRAU, Hyderabad, India	Debashish Dutta
Nominated as member in editorial board of Journal of Food Product Development and Packaging.	Debashish Dutta
Nominated as member in editorial board of Research Journal of Agriculture and Environment Science, an International Peer Reviewed open access Journal.	Debashish Dutta
Rapporteur for the session II on "Review of Results" in the 9h Annual Group Meeting of Network Project on Organic Farming (NPOF) at CSKHPKV HAREC, Bajaura, HP during May 19-20, 2014.	R. S. Yadav
Co-chairman for the session IV on "Review of Results of TSP Programme" in the 9h Annual Group Meeting of Network Project on Organic Farming (NPOF) at CSKHPKV HAREC, Bajaura, HP during May 19-20, 2014.	R. S. Yadav
Nominated as technical editor for International Journal of Agriculture Environment and Biotechnology.	Debashish Dutta
Co-Chairman in technical Session in the National Conference on Bioactive Compounds and Functional Foods in Health and Diseases Management (BFHDM-2013) at NIFTEM, Kundli, India.	Amit Nath
Co-Chairman in technical Session in the International Conference on Horticulture for Nutritional, livelihood and environmental Security in Hills: Opportunity and Challenges held on 22-24 May, 2014 at Kalimpong, Darjeeling, India.	Amit Nath
Nominated as member in editorial board of Journal of Food Research and Technology, JAKRAYA, An academic and scientific publisher, Pune.	Amit Nath

RESEARCH COORDINATION AND MANAGEMENT

Research Advisory Committee

The meeting of the 7th Research Advisory Committee of the Project Directorate for Farming Systems Research (PDFSR), Modipuram constituted vide NRM/17-16/ 2013-IA.II dated 6th September 2013, held on April, 15-16 2014 at Modipuram. The meeting started with welcome to Chairman and members of RAC by Dr B Gangwar, Project Director, PDFSR. Few publications brought out by the Directorate were released by the Chairman and Members of RAC. Thereafter, Project Director presented a brief account of major research achievements of the Directorate including AICRP on IFS and NPOF in different fields, during past one year. 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.

The Chairman and the members of the RAC expressed their critical views during the presentations of research progress by the concerned scientists/ programme facilitators.

Further, the Committee deliberated on the on-going research programmes vis-à-vis the mandate of the Directorate. The Committee also took in to the note of QRT (2007-12) recommendations. The Committee recognizes that the Mandate of the Directorate was changed from cropping systems based research to farming systems based research in the year 2010. The Committee further recognizes that, this change in mandate involves a basic shift in the conceptual framework of how research agenda needs to be defined, prioritized and addressed. This major change would involve a basic change in the thinking of the scientific personnel and achieving a conceptual clarity on the Farming Systems Research will be very basic to this change. The Committee is of the view that understanding of the farming system i.e the farmer and the environment in which he/ she operates and takes decisions are fundamental to defining technological and other interventions which will contribute to the family livelihood opportunities. In this context, the existing programmes were reviewed and the following suggestions and broad recommendations are made.

The overall guiding factors for PDFSR will be i) Systematic characterization of existing farming systems in various agro-climatic regions, ii) Identification of Farming constraints, iii) Collective, compatible and convenient farm interventions iv) Convergence of resources for making a self- reliant farm, v) Auditing of input-output vi) Assessing the impact of interventions on employment generation, productivity enhancement, sustainability of natural resources and vi) Capacity building and demonstrations of farming systems in participatory mode. In light of above, the current research projects need to be reviewed. The following recommendations are made.

1. Considering the new mandate, requirements and suggestions of the Committee, the Directorate should review the existing manpower and specialization. A suitable proposal for approving the flexi disciplines may be made to the Council. Further, mobility of scientists is essential to understand the farming systems practiced by farmers for which sufficient funds under travel is required. To achieve the objectives assigned, it is also extremely important to have 3 more Agricultural Economist in the Directorate.

2. A sample characterization of a village in respect of bio-physical and socio-economic indicators in Meerut district should be made using diagnostic tools such as remote sensing, GIS, door to door survey and farmer group meets. This should be done within six months. Subsequently, guidelines needs to be prepared and all the on-farm research centres of AICRP on IFS should be trained for characterization of a village. Each centre should complete

characterization of at least one village in their mandated district. Documentation of dominant farming systems in different agro-ecological situation is to be brought out through quick Participatory Rural Appraisal, small farmer group meets and secondary data.

Priority Setting, Monitoring and Evaluation (PME) cell

The PME works as nodal point for priority setting, monitoring and evaluation of the projects of the institute. Altogether, 24 on-going research projects and 4 exploratory studies were monitored by the cell. Documents of the Directorate *viz.*, Annual Report, News Letter, preparation of reports to the council like Quarterly target/performance review, Half yearly target/ performance review, DARE report, report for result-frame work document (RFD) and performance indicator were prepared during the period. It has coordinated and processed the publishing of research articles, technical bulletins, folders, abstracts submitted by Scientists. Also processed the proposals of Memorandum of Understanding received from various organizations. During the year, the on-going experiments at ICAR-IIFSR experimental farm and on-farm research projects were monitored and evaluated effectively by constituting committees. The report submitted by the committees was discussed and follow up action were taken.

Result Frame-work Document (RFD)

The RFD Committee and Resource Centre of the institute functions with the following team.

1. Dr B. Gangwar, Director and Chairman, RFD (upto 31-01-2015) Dr. J.P. Singh, Director (Acting) and Chairman, RFD from (01-02-2015)
2. Dr Kamta Prasad, Pr. Scientist & Nodal Officer, RFD
3. Dr N. Ravisankar, Pr. Scientist & Co-Nodal Officer, RFD Committee
4. Dr N. Subash, Sr Scientist & Member Resource Centre
5. Dr Brij Mohan, Technical Officer & Member Resource Centre

The RFD committee prepares the annual action plan, monitors the progress and reports achievements to the headquarters. The approved annual total composite score of the directorate for the last two years are given below.

Year	Approved Annual Total Composite Score	Approved Rating
2011-2012	96.00	Excellent
2012-2013	96.73	Excellent
2013-2014	93.65	Very Good

Monitoring of on-going programmes under AICRP-IFS & NePOF

Centers visited/monitored	Scientist visited
On-station- Hyderabad, SK nagar, Palampur, Jabalpur, Bhubaneswar, Ludhiana, Coimbatore, Kanpur	Dr B. Gangwar **OFR**- Anand
On-station- SKnagar **TSP**- Banaskantha	Dr Kamta Prasad and Dr J. P. Singh
On-station- Kalyani **TSP**-Bali Island **OFR**- Kakdwip, Sirsa	Dr N. Ravisankar
On-station- Maruteru, Hisar, Kumarganj **OFR**-Ambedkarnagar, Warangal, Rudrur, S.K. Nagar	Dr J.P. Singh

Statement of Understanding (SOU)

As a follow up action on the recommendation of interaction meeting held with Director's of all the division during 15 & 17 July 2013 at NASC, New Delhi, during the year ICAR-IIFSR developed Statement of Understanding (SoU) with 3 ICAR institutes and 3 AICRP's for partnership in knowledge, technology, material and resource sharing for Integrated Farming Systems Research which is being carried out across the country through 75 centres (on-station and on-farm) under the aegis of AICRP on IFS. The gist of the SoU developed during the year with various institutes are briefly given below. The best available technologies/ material will be shared by the above institutes and the same will be tested in farming system mode through AICRP on IFS network of ICAR-IIFSR.

	Institutes	Date of signing SoU/MoU
1.	DPR, Hyderbad (Including AICRP on poultry)	24 April, 2014
2.	IIOR, Hyderabad (Including AICRP on oilseeds)	25 April, 2014
3.	Uttrakhand Organic Commodity Board, Dehradun for Integrated Organic Farming Systems Model	4 September, 2014
4.	ICAR-Central Institute for Research on Cattle, Meerut	24 September, 2014

SOU with DPR, Hyderbad (Including AICRP on poultry)

SOU with ICAR-CIRC, Meerut

HUMAN RESOURCE DEVELOPMENT

Seminar/Symposia/Workshops/Training Programme attended	Duration	Attended by
Agriculture Education Day at CIRC, Meerut	May 1, 2014	Harbir Singh Prem Singh Vinod Kumar Anil Kumar A. K. Prusty
9h Annual Group Meeting of Network Project on Organic Farming (NPOF) at CSKHPKV HAREC, Bajaura, HP	May 19-20, 2014	R. S. Yadav
International Conference on Horticulture for Nutritional, livelihood and environmental Security in Hills: Opportunity and Challenges at Kalimpong Darjeeling, West Bengal organized by UBKVV, IARI R.S. Kalimpong and NRC orchids.	May 22-24, 2014	B. Gangwar Amit Nath Debashish Dutta Poonam Kashyap Nisha Verma
Regional workshop under AICRP-IFS cum training programme at AAU, Jorhat, Assam	May 25-30, 2014	J. P. Singh B. Gangwar S.S. Pal Kamta Prasad N. Ravishankar
Priority Setting, Monitoring and Evaluation in National Agricultural Research System: Status, Experiences and Way forward organized at NASC Complex, New Delhi	May 27, 2014	A. K. Prusty
Brain storming session on IFS modeling at IIFSR, Modipuram	June 3, 2014	N. Subash Poonam Kashyap A. K. Prusty
Regional workshop under AICRP-IFS cum training programme at ICAR- RCER,Patna, Bihar. J. P. Singh		June 8-12, 2014 B. Gangwar N. Ravishankar
20th World Congress on Soil Science at ICC, Jeju, South Korea.	June 8-13, 2014	V. K. Singh
2nd U.P. Agriculture Science Congress on 'Technological and governance strategies for advancement of agricultural education, research and extension in Uttar Pradesh at ICAR-	June 14-16, 2014 IISR, Lucknow	Chandra Bhanu
3rd Annual workshop of NICRA organized at NASC Complex, New Delhi	July 3-5, 2014	N. Subash
Regional workshop under AICRP-IFS cum training programme at ANGRAU, Rajendernagar, Hydearabad, A.P.	July 8-12, 2014	J. P. Singh B. Gangwar Kamta Prasad M.P.S. Arya N. Ravishankar
National Conference on Pre-/post-harvest Losses & value addition in vegetables" organized at IIVR, Varanasi, India	July 12-13, 2014	Amit Nath

Seminar/Symposia/Workshops/Training Programme attended	Duration	Attended by
Refresher Course on Agriculture Research Management" at ICAR-NAARM, Rajendranagar, Hyderabad (Talengana).	July 14-26, 2014.	T. Ram
Management Development Programme (MDP)- a pre RMP programme at NAARM, Hyderabad	July 15-26, 2014	J. P. Singh M. P. Singh
Half yearly foreign aided projects review meeting organized at NRM Division, ICAR,	August 6, 2014 KAB-II, New Delhi	N. Subash
Regional workshop under AICRP-IFS cum training programme at CCHAU, Hisar,	August 10-13, 2014 Haryana.	J. P. Singh B. Gangwar Kamta Prasad N. Ravishankar
Regional workshop under AICRP-IFS cum training programme at S. K. Nagar,	August 26-30, 2014 Dantewada, Gujarat	J. P. Singh B. Gangwar Kamta Prasad N. Ravishankar
Training on "Geospatial knowledge management for sustainable agriculture using open source GIS" organized by National Academy of Agricultural Research management, Hyderabad.	September 2-12, 2014	V. K. Singh
Training on "Conservation Agriculture: Developing Resilient Systems" at CSSRI, Karnal (Haryana) organized under the flagship of CSISA Project funded by USAID and Bill Gates Foundation (BMGF)	September 27 – 04 October, 2014	M. Shamim
Regional training and awareness program on J-Gate@CeRA organised at NASC Complex	September 29, 2014	N. Subash
International symposium on new dimensions in agrometeorology for sustainable agriculture at G.B. Pant University of Agriculture & Technology, Pantnagar	October 16-18, 2014	N. Subash M. Shamim
Workshop on "Open Access to Agricultural Knowledge for Inclusive Growth and Development" at ICAR-NAARM, Rajendranagar, Hyderabad (Talengana)	October 29-30, 2014	N. K. Jat
12th Asian Maize Conference and Expert Consultation on "Maize for Food, Feed, Nutrition and Environmental Security" at Rama Gardens Hotel, Bangkok, Thailand	30th October – 1st November, 2014	V. K. Singh
National Meet on Modernization of Jaggery Industry in India organized at IISR, Lucknow	November, 1-2, 2014	Amit Nath Devendra Kumar
ASA,CSSA, SSSA 2014 International annual meeting "Grand Challenges Great Solutions" organized at Long Beach, CA, USA.	November 2-5, 2014	N. Subash
Training on "Drudgery Reduction Technologies for Farm Women to Enhance Productivity and Safety in Agriculture" at MPUAT, Udaipur (Rajasthan).	Nvember 12 – December 02, 2014.	Nisha Verma
10th Indian Fisheries and Aquaculture Forum (10th IFAF) organized at NBFGR, Lucknow	November 12-15, 2014	A. K. Prusty
5th Global Symposium on Gender Aquaculture and Fisheries (5 GAF) organized at NBFGR, Lucknow	November 13-15, 2014	A. K. Prusty

Seminar/Symposia/Workshops/Training Programme attended	Duration	Attended by
International workshop on Aquatic Animal Disease Surveillance organized at NBFGR, Lucknow	November 14-15, 2014	A. K. Prusty
National Symposium on Agricultural Diversification for Sustainable livelihood and Environmental security at PAU, Ludhiana	November 18-20, 2014	M. P. Singh V. K. Singh R. P. Mishra V. P. Choudhary
8th International Conference on Mushroom Biology and Mushroom Products (ICMBMP8) at New Delhi, India.	November 19-22, 2014	Chandra Bhanu
XXIII Indian Convention of Food Scientists and Technologists (ICFOST) on the theme Fostering Innovative Research and Entrepreneurship (FIRE) for Indian Foods organized at NIFTEM Campus, Kundli, Haryana	December 13-14, 2014	Amit Nath
CIPHET Silver Jubilee Seminar on Present Status and Future Strategies for Processing and Value Addition of Agricultural Commodities organized at CIPHET, Ludhiana, Punjab	December 19-20, 2014	Amit Nath Debashish Dutta
31st Biennial Workshop of AICRP on Integrated Farming Systems organized at TNAU, Coimbatore	December 22-24, 2014	B. Gangwar Kamta Prasad M.P.S. Arya S. S. Pal J. P. Singh Harbir Singh N. Ravisankar
Meeting of CIMMYT-CCAFS-ICAR Collaborative Project "Developing and defining Climate Smart Agriculture Practices Portifolios in South Asia".	January 6, 2015	N. Subash
2nd international conference on bio-resource and stress management at Hyderabad, India organized by RKM foundation, PJTSAU, ANGRAU at PJTSAU, Hyderabad.	January 07-10, 2015	Poonam Kashyap
Half yearly foreign aided projects review meeting organized at NRM Division, ICAR, KAB-II, New Delhi	January 27 , 2015	N. Subash
12th Agricultural Science Congress on "Sustainable Livelihood Security of Smallholder Farmers" at NDRI, Karnal	February 3-6, 2015	Kamta Prasad Harbir Singh N. K. Jat N. Ravishankar
International conference on technological interventions in agricultural science for enhanced productivity, nutritional quality and value additions (TIAS) at Dimapur, Nagaland.	February 17-19, 2015	Amit Nath V. P. Choudhary Dushyant Mishra A. K. Prusty M. Shamim
Launching and Planning Workshop of CCAFS Flagship Projects on Climate Smart Agriculture Practices Portfolios, Institutions and Policies at NASC complex, New Delhi.	February 24–25 2015	Harbir Singh
5th AgMIP Global Workshop at University of Florida, Gainsville, USA	February 25-28, 2015	N. Subash
AgMIP RRT workshop	February 28th - March 1st, 2015	N. Subash
National Seminar on Gender Equity, Sensitization and Women Empowerment organized by Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut.	March 11-12, 2015	Nisha Verma
National Seminar on Sustainable Fertilizer Management for Soil Health organized in joint collaboration of IFA-FAI at New Delhi.	March 16-17, 2015	N. K. Jat

EXHIBITIONS

Display of farming system model at Barwala, Muzzafarnagar

MOS, Dr. Sanjeev Balyan visiting IIFSR exhibition stall at Barwala, Muzzafarnagar

DISTINGUISHED VISITORS

Dr A. K. Sikka, DDG NRM, ICAR, Dr M. L. Jat, Senior Scientist, CIMMYT and Dr Santiago Lopez-Ridaura visited the Directorate on 3rd June, 2014.

ADG (Agronomy and Agroforestry) Dr. B. Mohan Kumar visited IIFSR on 15 February 2015

Delegates from Ethiopia visited on 16th July 2014

Visit of Dr Surendra Kumar Singh, Director, NBLSSUP, Nagpur on 29 October, 2014

Visit of Dr Sanjeev Kumar Balyan, MoS, Agriculture and Other Hon'ble MP's on 25 March 2015

Visitors to IIFSR

Name of group	Dated	Address	No of participants
Trainees of winter School	18.02.2014	Bio-technology Dept. SVPUA&T, Modipuram	25
Student group of UG programme	04.04.2014	Agronomy Dept. SVPUA&T, Modipuram	26
Student group of UG programme	07.04.2014	Agronomy Dept. SVPUA&T, Modipuram	27
Farmers group of ATMA	20.08.2014	A.D.O. ,Agri.Dept. Kaithal (Haryana	50
Student group	17.04.2014	Gochura Agricultural Intermediate Collage, Rampur Maniharin, Saharanpur	65
Officer trainees of different states	29.11.2014	CSWRTI,Dehradun,UK	18
Farmers group of ATMA	13.12.2014	Dy. Director Agri. Sikar ,Raj.	39
Farmers group of ATMA	19.12.2014	Dy. Director Agri. Jhunjhunu ,Raj.	35
Farmers group	08.1.2015	Rashulpur Jatan, Mujaffer nagar	5
Visitors from Afganistan	14.01.2015	IASRI ,New Delhi	8

Farmers visiting IFS Model developed at ICAR-IIFSR, Modipuram on 19 December 2014

Group of students from Aryan School, Meerut visiting ICAR-IIFSR farm on 2nd May 2014

PUBLICATIONS

Research papers: (International)

Chaudhary, V. P., B. Gangwar, D.K Pandey (2014). Energy budgeting of sustainable rice based cropping systems in sub tropical India. Agricultural Mechanization in Asia, Afria, and Latin America (AMA) vol. 45, (4): 48-68.

Das, M., Purkayastha, A. Nath, Bidyut C. Deka, CharuLata Mahanta (2013). Thin layer drying of tomato slices. *Journal of Food Science and Technology*, 40 (4), 642-653.

Dutta, D., P. Kumar, A. Nath, N. Verma, B. Gangwar (2014). Qualities of lemongrass (*Cymbopogan citratus*) essential oil at different drying conditions. *International Journal of Agriculture, Environment & Biotechnology*, 7(4): 903-909.

Mandal, S., A. Nath, R.K. Singh, A. Kumar, N. Deshmukh (2013). Physico-mechanical properties of Prunus nepalensis fruit and seed using image processing and experimental method. *Journal of Food Technology,* 11 (3), 60-66.

Mohapatra, S., T. Chakraborty, A. K Prusty, K. Pani Prasad and K. N. Mohanta (2014). Beneficial effects of dietary probiotics mixture on hemato-immunology and cell apoptosis of *Labeo rohita* fingerlings reared at higher water temperatures. *PLOS One*. 9(6):e100929.

Mohapatra, S., T. Chakraborty, A. K Prusty, K. Pani Prasad and K. N. Mohanta (2014). Dietary multispecies probiotic supplementation enhances the immuno-hematological responses and reduces mortality by *Aeromonas hydrophila* in *Labeo rohita* fingerlings. *Journal of the World Aquaculture Society* 45 (5): 532-544.

Subash, N., Shamim, M., Singh,V.K., Gangwar,B., Singh,B., Gaydon, D.S., Roth,C.H., Poulton,P.L. and Sikka, A.K. (2014). Applicability of APSIM to capture the effectiveness of irrigation management decisions in rice-based cropping sequence in the Upper-Gangetic Plains of India. *Paddy Water Environ. DOI 10.1007/s 10333.014-0433-1.*

Research papers: (National)

Bhanu, C., Khilari, K. and Gangwar, B. (2014). Natural occurrence of pathogens, insects and competitive plants to *Parthenium hysterophorus*. *Annals of Plant Protection Sciences* 22 (1):183-189.

Das, B., Chakraborty D, Singh V.K., Aggarwal P., Singh R., Dwivedi, B.S. (2014). Effect of organic inputs on strength and stability of soil aggregates under rice-wheat system. *Int. Agrophys.* 28: 163-168.

Das, B., Chakraborty D, Singh VK, Aggarwal P, Singh R, Dwivedi BS, Mishra RP (2014). Effect of integrated nutrient management practice on soil aggregate properties, its stability and aggregate-associated carbon content in an intensive rice-wheat system. *Soil & Tillage Research*. 136, 9-18.

Dhaiya, B., M. Shamim and Sunil Kumar (2015). Intelligent Monitoring the crop field using wireless sensor network based on URAT and FPG technique. *Progressive Agriculture*, Vol. 15(1): 71-76.

Dulta, J. S., Poonam Kashyap, A. R. Karale, S.P. Singh and Vijay Meena (2014). Variability and correlation studies for pomological characteristics in Guava clones. *Annals of Horticulture*, 7(1): 58-63.

Dutta, D., Supradip Saha, Deb Prasad Ray, Madhuban Gopal (2014). Comparative phosphorus uptake profile of Bt transgenic and non-transgenic cabbage (*Brassica oleraceae* L.var.capitata). *International Journal of Bioresource Science*. 1(1):19-24.

Jat, G., S. P. Majumdar, N. K. Jat and Sonali P. Mazumdar (2014). Effect of potassium and zinc fertilizer on crop yield, nutrient uptake and distribution of potassium and zinc fractions in Typic Ustipsamment. *Indian Journal of Agricultural Sciences*, 84 (7): 832-838.

Kadam, V. V., Meena, L.R., Singh, S., Shakyawar, D.B. and Naqvi, S.M.K (2014). Utilization of coarse wool in agriculture for soil moisture conservation. *The Indian Journal of Small Ruminants* 20 (2):83-86.

Kashyap, Poonam A. K. Prusty, J. P. Singh and A. Kansal. 2014. lefUor —f"k ç.kkyh esa ckxokuh ls jkstxkj vkSj vkenuh . *Kheti*, August, 2014: 15-17.

Kumar D., and Sanjay Kumar (2014). Correlation and Path Coefficient analysis in sugarcane germplasm under sub tropics. *Prog. Agric*. 14 (2): 312-317.

Kumar, Sunil, B. Gangwar, and Mohammad Shamim (2015). Prospects of organic farming in Mizoram state of the North East India: A survey based study. Bharatiya Krishi Anusandhan Patrika. Vol. 30(1): 29-35.

Kumar, Sunil, Mohammad Shamim, Mamta Bansal, R.P. Agarwal and B.Gangwar (2014). Emerging trends and statistical analysis in computational modelling in agriculture. *International Journal of Electronics Communication and computer engineering* vol. 6 (6), ISSN (online): 2249-071X. 171-174.

Kumar, Sunil, B. Gangwar, N.K. Jat, and Mohammad Shamim (2014). Status and Prospects of Fertiliser Consumption in South India. *Progressive Agriculture*, Vol. 14(2): 242-250.

Kumar, Sunil, Mohammad Shamim, Mamta Bansal, B. Gangwar, and R.P Aggarwal (2014). Computational modelling in Agriculture, *International journal of contemporary Research in Engineering & Technology*. Vol.4(1&2) pp 125-128.

Meena, L. R. and Chand Roop (2014). Response of fodder cowpea (*Vigna unguiculata*) to varying levels of nitrogen and phosphorus under rain-fed condition of Rajasthan. The *Indian Journal of Small ruminants* 20(2):121-123.

Meena, B. P., Ashok Kumar, M.L. Dotaniya, N. K. Jat and B. Lal (2014). Effect of organic sources of nutrients on tuber bulking rate, grades, specific gravity of potato tubers. *Proceedings of National Academy of Sciences*, India 07/2014; DOI: 10.1007/s40011-014-0398-4.

Mishra, D. (2014). Nutrient Removal Studies in Guava under High Density Orcharding System. *Journal of Agriculture and Crop Science*, Vol 1 (2): 36-38.

Mishra, D., S K Shukla, H Ravishankar and Tarun Adak (2014). Impact of weather on phenology of guava in Uttar Pradesh: A cursory analysis. *Current Advances in Agricultural Sciences* (An International Journal). Volume 6 (1): 74-75.

Mohan Udit, R. Singh, P. Singh, Suhas, R. Bhutiani, Poonam Kashyap, Varun Tyagi, Sweety (2014). Determination of Zn, Cd, Pb and Cu in ground water of Dist. Hapur, U.P by anodic stripping voltametric technique. *Environmental Conservation Journal*, 14(3): 137-141.

Nath, A., K. Mukhim, T. Swer, Debashis Dutta, N. Verma, B.C. Deka and B. Gangwar (2014). A review on application of ozone in the food

processing and packaging. *Journal of Food Product Development and Packaging*, 1(2):7-21.

Pramanick, K. K., Poonam Kashyap, D. K. Kishore and Y. P. Sharma A (2015). Effect of summer pruning and CPPU on yield and quality of Kiwi fruit (*Actinida deliciosa* Chev.). *Journal of Environmental Biology*. Vol 36 (March):351-356

Rizvi, R. H., Yadav, R.S., Singh, R., Pandey, S.B., Wani, S.P. and Dhyani, S.K. (2014). Spatial analysis of soil parameters in Domagor-Pahuj watershed using Geo-statistical method of GIS. *Indian Journal of Agricultural Sciences* 84 (12)

Sanyal, S. K., Dwivedi, B. S., Singh, V. K, Majumdar, K., Datta, S. C. , Pattanayak, S. K. and Annapurna, K. (2015). Phosphorus in Relation to Dominant Cropping Sequences in India: Chemistry, Fertility Relations & Management Options. *Current Science* 108, 1-9.

Singh, V. K., Brahma S. Dwivedi, K.N. Tiwari, Kaushik Majumdar, Meenu Rani, Susheel K. Singh, Jagadish Timsina (2014). Optimizing nutrient management strategies for rice–wheat system in the Indo-Gangetic Plains of India and adjacent region for higher productivity, nutrient use efficiency and profits. *Field Crops Research* 164:30–44.

Singh, V. K., Arvind K. Shukla, M P. Singh, Kaushik Majumdar, Rajendra P. Mishra, Meenu Rani, Susheel K Singh (2015). Effect of site-specific nutrient management on yield, profit and apparent nutrient balance under pre-dominant cropping systems of Upper Gangetic Plains. *Indian Journal of Agricultural Sciences*, 4: 76-22.

Singh, V. K., Brahma S. Dwivedi, Arvind K. Shukla, Vinod Kumar, Babooji Gangwar, Meenu Rani, Susheel K Singh, Rajendra P. Mishra (2015). Status of Available Sulphur in Soils of North-Western Indo-Gangetic Plain and Western Himalayan region and Responses of Rice and Wheat to Applied Sulphur in Farmer's Fields. *Agricultural Research*, 85(3):335-343.

Subash, N. (2014). Assessing the impact of dry spell during monsoon season on rice productivity - A case study over Patna district. *Indian Journal of Soil Conservation* 42(3): 255-259.

Subash, N., V. K. Singh, M. Shamim, B. Gangwar, B. Singh, Don Gaydon and Christian Roth (2014). Applicability of APSIM to capture the effectiveness of irrigation management decisions in rice based cropping sequence in the Upper-Gangetic Plains of India. *Paddy and Water Environment. DOI 10.1007/s10333-014-0443-1.*

Subramani, T., R. Raja, S.K. Ambast, N. Ravisankar, S.K. Zamir Ahmed, V. Damodaran and N. Bommayasamy (2014). Evaluation of long duration rice varieties for enhancing productivity and profitability under island ecosystem, *Journal of the Andaman Science Association* 19 (1);14-18.

Swarnam, T. P., A. Velmurugan, Zacharia George, N. Ravisankar, Tulsi Pawan Sai, S. Dam Roy and Priyanka Srivastava (2014). Integrated Farming system for sustainable livelihood in tribal areas of Nicobar island, India, *Journal of the Andaman Science Association* 19 (1);19-22.

Velmurugan, A., T.P. Swarnam, S.K. Ambast, N. Ravisankar and T. Subrmani (2014). Land degradation and its spatio-temporal changes induced by natural events in Andaman Islands, *Journal of the Andaman Science Association* 19 (1);65-74.

Verma, N., A. Nath, S. Agrawal, K. Kishore, D. Dutta and B. Gangwar (2014). Value addition of Mango (*Mangifera Indica* L) at domestic level. *Bioinfolet*, 11 (3B) 880-884.

Verma, N., S. Agrawal A. Nath P. Kashyap, D. Dutta and B. Gangwar (2014) Quality Evaluation of Cottage Level Processed Value Added Fruits Products. *Journal of Food Products Development and Packaging*, 1 (3): 22-30.

Yadav, A. K., V. S. Acharya, Poonam Kashyap, V. S. Meena and S. P. Singh (2014). Population dynamics of major sucking pests on chilli and its relationship with weather factors. *Annals of Horticulture*. 7(2): 103-108.

Abstracts/Extended Summaries/Proceedings Papers

Ashfaq, M., P. Paramasivam, Harbir Singh, and Dumindu Hereath (2014). Climate Impact and Adaptation in South Asia: Pathways, Impacts and Adaptation. A New Trans disciplinary Approach to Regional Integrated Assessment of Climate Impact and Adaptation in Africa and South Asia', AAEA (American Agricultural Economics Association) Annual Meeting, Minneapolis, July 27-29.

Bhanu, C., Singh, J.P. and Gangwar, B. (2014). Organic production technology of milky mushroom (*Calocybe indica*) for farming system diversification and environmental sustainability. *In*: Extended Summaries of Voluntary Papers of the National Symposium of Indian Society of Agronomy on "Agricultural Diversification for Sustainable Livelihood and Environmental Security", 18-20 November, 2014, PAU, Ludhiana, India.pp: 596. (Ext. Summ.)

Bhanu, C., Singh, J.P. and Gangwar, B. (2014). Use of *Trichoderma* enriched button mushroom spent substrate (TEBMSS) for enhancing yield and quality of Kinnow mandarin. *Proc. 8th International Conference on Mushroom Biology and Mushroom Products (ICMBMP8)*, 19-22 Nov., 2014, New Delhi, India. pp :369-371.

Bhanu, C.,, Singh, J.P. and Gangwar, B. (2014). Use of *Trichoderma* enriched spent mushroom compost (TESMC) for enhancing yield and quality of Kinnow (*Citrus reticulata*). *In: Abstr. Book, 8th International Conference on Mushroom Biology and Mushroom Products (ICMBMP8)*, 19-22 Nov., 2014, New Delhi, India. :84.

Chaudhary, V. P. (2015). 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. Pp. 84

Chaudhary, V. P., K.K. Singh, Priyanka Patel and Anuj Kumar (2015).Evaluation of various residue management machineries for wheat sowing under different rice residue management practices. In Proc. 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), India.

Chaudhary, V. P. and K.K Singh (2014). Study of evaluation of different resource conservation technologies for planting of Rice. In Proc. XX Biennial National Symposium of Indian Society of Agronomy on Agriculture diversification for sustainable livelihood and environmental security held during 18-19 Nov 2014 at PAU Ludhiana, Punjab, India.

Dutta, D., Amit Nath,Nisha Verma, Pawan Kumar and B. Gangwar.(2014).Evaluation of Phyto-chemical qualities of minimally processed guava (*Psidium guajava* L.) fruits using different post- harvest treatments during storage. In: Proceedings of CIPHET Silver Jubilee Seminar on Present Status and Future Strategies for Processing and Value

Addition of Agricultural Commodities during 19-20 December, 2014 at ICAR-CIPHET, PAU, Ludhiana, Punjab.

Dutta, D., Pawan Kumar, A.Nath, N.Verma and B. Gangwar. (2014). Estimation of Lemongrass (*Cymbopogan citratus*) essential oil at different drying condition by using GCMS. International Conference on Horticulture for Nutritional, livelihood and environmental Security in Hills: Opportunity and Challenges held on 22-24 May, 2014 at Kalimpong, Darjeeling, India, organised by Uttar Banga Krishi Viswavidyalaya (Hill Campus).

Gangwar, B., N. Ravishankar, Poonam Kashyap and Brij Mohan (2014). Nutritional and livelihood improvement of small holders in hills through farming systems approach. In: Proceedings of International Horticultural Congress at Kalimpong Darjeeling May 22-24, 2014 organised by IARI R.S. Kalimpong.

Gangwar, B., N. Ravisankar and Kamta Prasad (2015). Status of small holder farming systems and strategies for their improvement in India In: XII Agricultural Science Congress on sustainable livelihood security for small holder farmers, 3-6February 2015, National Academy of Agricultural Sciences and National Dairy Research Institute, Karnal, p 271.

Jat, N. K., R. S. Yadav and Sudhir Kumar (2014). Influence of tillage system, residue retention and legume inclusion on productivity, profitability and soil health of rice (*Oryza sativa*)-(wheat (*Triticum aestivum*) system in upper Gangetic Plains, India. *National symposium on "Agricultural Diversification for Sustainable livelihood and Environmental Security*" November 18-20, 2014 at PAU, Ludhiana, Punjab

Kashyap, Poonam, Avinash Kansal, B. Gangwar and A.K. Prusty (2014). Potential of Horticultural crops for Livelihood security and profitability in Western Plain Zone of Uttar Pradesh. In: Proceedings of 2nd International conference on bio-resource and stress management Hyderabad, India January 07-10, 2015 organized by RKM foundation, PJTSAU, ANGRAU.

Kashyap, Poonam, Kamta Prasad, Harbir Singh, Avinash Kansal, A. K. Prusty and Nisha Verma (2014). Development of horticulture based IFS models for providing livelihood security to small and marginal farmers of Western Plain Zones of Uttar Pradesh. International conference on "Horticulture for Nutritional Livelihood and Environmental Security in Hills: Opportunities and Challenges", Kalimpong, Darjeeling, India, May 22-24, 2014. Pp.F-17.

Kathirvelan, P., E. Somasundaram, C. Swaminathan, B. Gangwar and N. Ravisankar (2014). Evaluation of balanced fertilization in rice-rice cropping system through farmer participatory mode (Abstract No. IRC 14-1512) In: IV international rice congress, 27 October-1 November 2014, International Rice Research Institute, Bangkok International Trade & Exhibition Centre, Bangkok, Thailand.

Kathirvelan, P., E. Somasundaram, C. Swaminathan, B. Gangwar and N. Ravisankar (2014). Evolving resource conserving techniques in direct dry seeded rice through farmers participatory approach (Abstract No. IRC 14-1230) In: IV international rice congress, 27 October-1 November 2014, International Rice Research Institute, Bangkok International Trade & Exhibition Centre, Bangkok, Thailand.

Khilari, K. and Bhanu, C. (2014). Roof top vegetable production in cities: A way for improving nutritional

and health security and approaching sustainability. 2nd U.P. Agriculture Science Congress on 'Technological and governance strategies for advancement of agricultural education, research and extension in Uttar Pradesh', 14-16 June, 2014, ICAR-IISR, Lucknow, India. 286-287.

Kumar, S., Mohammad Shamim, Mamta Bansal, B.Gangwar and R.P. Agarwal, Computational modeling in agriculture: An overview. 2nd International Conference on Computing for Sustainable Global Development", technically sponsored by IEEE Delhi Section, held during 11th-13 March, 2015 at Bharati Vidyapeeth, New Delhi. Pp 115-119.

Kumar, S., Mohammad Shamim, Mamta Bansal, R.P. Aggarwal and B.Gangwar, Computational Modelling and Intelligence in Agriculture (2015). International conference on Technological Interventions in Agriculture Science for Enhanced Productivity, Nutritional Quality and Value Addition, hosted by CIH, Dept. of Agriculture and Co-operation, held during February 17-19, 2015 at Ministry of Agriculture, Government of India, Medziphema, Dimapur, Nagaland. Pp 8-9.

Meena, L. R., Chand Roop, Sahu, B.S. and Naqvi, S. M. K. (2014). World congress on Agroforestry: Development of Agro-horti pastures system suitable to semi-arid tropical conditions of India. Abs. No 2224. WAC-2014, held during February 10-14th, 2014.

Meena, S. R., Ashok Kumar, N.K. Jat and V. K. Yadav. 2015. Crop quality and nutrient uptake pattern of baby corn under varying nutrient management practices. In: Compendium of Abstracts of 12th Agricultural Science Congress on "Sustainable Livelihood Security of Smallholder Farmers" at NDRI, Karnal from Feb 3-6, 2015.

Mishra, R. P., Singh V.K., Singh, M.P. and Gangwar B. (2014). Effect of water release from Tehri dam on farmers socio-economic conditions of East Ganga Canal command. National Symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security'. Indian Society of Agronomy & PAU, Ludhiana.

Mishra, R. P., Singh, V.K., Singh M.P., Gangwar B. and Khare R (2014). Effect of water and nutrient management practices on production profitability of pre-dominant cropping systems under East Ganga Canal command. International Symposium on potassium fertilization and crop quality , IPI&BAU Ranchi

Nath, A., B. Gangwar, D. Mishra, D. Dutta and P. Kashyap (2014). Minimal Processing in Fruits and Vegetable Crops. XXIII Indian Convention of Food Scientists and Technologists (ICFOST) on the theme Fostering Innovative Research and Entrepreneurship (FIRE) for Indian Foods during December, 13-14, 2014 at NIFTEM Campus, Kundli, Haryana.

Nath, A., B. Gangwar, D. Mishra, D. Dutta and P. Kashyap (2014). Minimal processing in vegetable crops. National Conference on Pre-/post-harvest Losses & value addition in vegetables", July, 12-13, 2014 at IIVR, Varanasi, India. Pp. 68-71.

Nath, A., Bidyut C Deka, VK Verma, Bandita Bagchi, AK Jha and H Rymbai (2014). Effect of different concentrations of $KMnO_4$, as ethylene absorbent for shelf life extension of tomato fruits during ambient storage. International Conference on Horticulture for Nutritional, livelihood and environmental Security in Hills: Opportunity and Challenges held on 22-24 May, 2014 at Kalimpong, Darjeeling, India.

Nath, A., D Dutta, N Verma, Pawan Kumar and B Gangwar (2014). Extension of shelf life of minimally processed guava (*Psidium guajava L.*) fruits using different post harvest treatments. *In proceedings of* CIPHET Silver Jubilee Seminar on present status and Future Strategies for Processing and Value addition of Agricultural Commodities.

Nath, A., J.P.Singh, D. Dutta and B. Gangwar (2014). Importance and scope for value addition in jaggery based products. Abstract published in the proceedings of National Meet on Modernization of Jaggery Industry in India, November, 1-2, 2014 at IISR, Lucknow, India pp:119.

Paudel, G., Balwinder Singh, N. Subash, G. Baigorria and A. Mc Donald (2014). The paradigm of climate change impacts and adaptation in farming systems, income and poverty of western Indo-Gangetic Basin. Poster presentation under "AgMIP special session" of ASA, CSSA & SSSA. International meeting and published online at https://scisoc.confex.com/scisoc/2014am/webprogram/Handout/Paper90828/ASA_-AgMIP_Poster_CIMMYT_Karnal-IGB.pdf

Prusty, A. K., J. P. Singh, P. Kashyap and S. P. Singh (2015). Crop + Cattle + Carp system for enhancing productivity for livelihood security of small and marginal farmers of western plain zone of U.P. Presented at International conference on, "Technological Interventions in Agricultural Sciences for Enhanced Productivity, Nutritional Quality and Value Addition (TIAS-2014)" at Dimapur, Nagaland during 17th – 19th February, 2015.

Prusty, A. K., N. P. Sahu and S. Mohapatra (2014). Immuno-stimulating impacts of dietary enrichment of vitamin C and E combinations in *Labeo rohita* fingerlings. Paper presentation at 10th Indian Fisheries and Aquaculture Forum (10th ifaf) held at NBFGR, Lucknow during 12-15 November, 2014. Abs No. 10ifaf/ABS/00341.

Prusty, A. K., Singh, J.P. and Kashyap, P. 2014. Use of fish pond sediment for sustainable Agriculture – Aquaculture integration: A Case Study of western plain zone of U.P. 10th Indian Fisheries and Aquaculture Forum, Lucknow, 12-15th November, 2014. A.B.P.82 – Book of Abstracts, pp. 174.

Rani, Meenu, Singh V.K., Singh S.K. and Gupta V.K. (2014). Precision Nutrient Management Strategy for enhancing productivity and profitability under pre-dominant cropping systems of Upper Gangetic Plains. International Symposium on potassium fertilization and crop quality. IPI&BAU Ranchi

Shamim, M., B. Gangwar, N. K. Jat, Vipin Kumar, Sunil Kumar, N. M Alam and V. P. Mandal (2014). Morpho-Physiological Evaluation of Aromatic Rice (*Oryza Sativa*) Genotypes in relation to grain yield under timely sown irrigated condition of upper IGP. International symposium on new dimensions in Agrometeorology for sustainable agriculture, 16-18 October 2014. Pp. 38.

Shamim, M., B. Gangwar, S.P. Mazumdar, Sunil Kumar (2015). Effects of microenvironment on productivity of rice under irrigated condition of western plain zone of Uttar Pradesh. International conference on technological interventions in agricultural science for enhanced productivity, nutritional quality and value additions. 17-19, February, 2015. Central Institute of Horticulture Department of agriculture and co-operation, ministry of agriculture, Government of India. Medziphema, Dimapur, Nagaland (India). pp 12-13.

Shukla, A. K., Singh V.K, Gangwar, B. (2014). Futuristic approaches in agronomy education . In National Symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security' organized by Indian Society of Agronomy from 18-20 November, 2014.

Singh, H., Nataraja Subash, Babooji Gangwar, Roberto Valdivia and Guillermo Baigorria (2015). Climate change impacts and adaptations– An integrated economic assessment, In: *Compendium*, XII Agricultural Science Congress, NDRI, Karnal, p.248.

Singh, H., Nataraja Subash, Gokul Paudel, Kamrul Hassan, Dinesh Tapa Magar, Babooji Gangwar, Guillermo Baigorria, Roberto Valdivia and John Antle (2014). Integrated Economic Assessment of Climate Change Impacts in Indo-Gangetic Basin, In: ASA, CCSA & SSSA International Annual Meeting, *Grand Challenges, Great Solutions*, Poster Number 106, 2-5 November, 2014, Long Beach, CA, USA.

Singh, H., N. Subash, G. Paudel, B. Gangwar, G. Baigorria and R. Valdivia (2014). Integrated Economic Assessment of Climate Change Impacts in Indo-Gangetic Basin. Poster displayed on 5th November, 2014 under "AgMIP special session" of ASA, CSSA & SSSA International meeting and published online at https://scisoc.confex.com/scisoc/2014am/webprogram/Handout/Paper90821/ASA_AgMIP_IGB_Econ_Poster_IGB.pdf.

Singh, M. P., Singh, V.K., Mishra, R.P., Gangwar, B., Kumar M. and Kumar P. (2014). Integrated farming system approach for sustained production, profitability and livelihood security in Garhwal region. National Symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security' Nov.18-20 . Indian Society of Agronomy & PAU, Ludhiana

Singh, M. P., Singh, V. K., Mishra R.P., Prusty A.K., Kumar P., Kumar M., and Khare R (2014). Role of K nutrition on production profitability and lively hood security under pre-dominant farming situations of Garhwal region. International Symposium on potassium fertilization and crop quality, IPI&BAU Ranchi.

Singh, S. K., Singh V K, Meenu Rani. (2014). "Homogeneous fertility management zones based on available NPK in Central Plain Zone of India". National Symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security'. Indian Society of Agronomy & PAU, Ludhiana.

Singh, V. K. (2014). "Managing cropping systems for up-keeping natural resources – way forward" during NAAS Silver Jubilee Symposium on "Managing Natural Resources for Posterity: 25 Years of Achievements and Way Forward" on December 30, 2014 at, BCKV, Kalyani.

Singh, V. K. (2014). Resource management under cropping systems using GIS" in national symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security' organized by Indian Society of Agronomy & PAU, Ludhiana

Singh, V. K., Dwivedi B.S., Kaushik Majumdar, Meenu Rani, Singh S K. (2014). Optimizing nutrient management strategies for rice-wheat system in the Indo-Gangetic plains and adjacent region for higher production profitability, nutrient use efficiency and ensuring food security.20th World Congress on Soil Science", Jeju, South Korea.

Singh, V. K., Meenu Rani, Singh S.K, Gupta V.K. (2014). Predicting soil organic carbon stock in upper Gangetic plains of India- a Geo-statistical model approach". In: National Symposium on 'Agricultural Diversification for Sustainable Livelihood and Environmental Security' organized by Indian Society of Agronomy & PAU, Ludhiana

Singh, V. K., Singh M. P., Mishra. R. P. and Gangwar B. (2014). *Optimizing nutrient management*

strategies for pre-dominant cropping systems in the Upper Gangetic Plains". International Symposium on potassium fertilization and crop quality , IPI&BAU Ranchi

Singh, V. K., Singh S.K., Dwivedi B.S., Jat M. L., Meenu Rani and Majumdar K. (2014). "Effect of crop establishment technique and residue management options on response to K application under rice-maize system". 12th Asian-Maize Conference and Consultation meet" from 30 October to 1 November, 2014 held at Bangkok, Thailand

Subash, N., Harbir Sigh, B. Gangwar, A.K. Sikka, G. Baigorria, A. Ruane, K. Boote and R. Valdivia (2014). Linking farmer's participation with modeling approach to study the impact of climate change and to identify suitable adaptation strategies for rice-wheat production in Indo-Gangetic Basin. Poster displayed on 5th November, 2014 under "AgMIP special session" of ASA, CSSA & SSSA International meeting and published in file:///C:/Users/HP/Downloads/ASA_-AgMIP_Poster_Subash%20et%20al-IGB.pdf.

Subash, N., Harbir Singh, B. Gangwar and G. Baigorri (2014). Linking farmer's participation with modeling approach to study the impact of climate change on rice-wheat production in Indo-Gangetic Basin. Online abstracts of oral presentation on 4th November, 2014 under "AgMIP special session" of ASA, CSSA & SSSA International meeting and online copy available https://scisoc.confex.com/scisoc/2014am/ webprogram/Paper87300.html

Subash, N., Harbir Singh, B. Gangwar, A. Sikka, B. Singh, G. Baigorria, A. Ruane, Sonali McDermid, Kenneth Boote, John Hargreaves, R. Valdivia, J. Antle, C. Porter, C. Rosenzweig, J. W. Jones and C. Mutter (2014). Linking Farmer's Participation with Modeling Approach to Study the Impact of Climate Change and to Identify the Suitable Adaptation Strategies for Rice-Wheat Production System in Indo-Gangetic Basin. In: ASA, CCSA & SSSA International Annual Meeting, *Grand Challenges, Great Solutions*, Poster Number 103, 2-5 November, 2014, Long Beach, CA, USA.

Subash, N., Harbir Singh, Babooji Gangwar, Guillermo Baigorria, Alex Ruane, Kenneth Boote, John Hargreaves, Roberto Valdivia, Cynthia Rosenzweig, James W. Jones and Carolyn Mutter (2014). Integrated Modelling for Assessing Climate Change Impact on Future Agricultural Production System A Farm Level Modelling Approach to Assess Food Security and Livelihoods in Future. (Eds.). A.S. Nain, Ranjan Srivastava, Sunil Goria, Ankita Jha, Lata Vishnoi, Shweta Gautam, Asha Latwal and Shakuli Kashyap. New Dimensions in Agrometeorology for Sustainable Agriculture. Compendium-cum -Abstract of NASA 2014, 16-18 October, 2014, Department of Agrometeorology, G.B. Pant University of Agriculture & Technology, Pantnagar-263 145(Uttarakhand), India

Subash, N., Harbir Singh, Baigorria, G., Ruane, A., Boote, K.J. and Valdivia, R.O. (2015). Demonstration of adaptation strategy through multi-modeling approach for integrated assessment of climate change impact on agricultural productivity in Indo-Gangetic Plains of India. Poster displayed in 5th AgMIP Global workshop at University of Florida, Gainsville, USA on 27th February, 2015 and published in www.agmip.org/wp- content/uploads/2015/03/subash.pdf.

Valdivia, Roberto O John, M Antle, Cynthia E. Rosenzweig, Alex C Ruane, Joost Vervoort, Muhammad Ashfaq, Ibrahima Hathie, Sabine Homann-Kee Tui, Richard Mulwa, C. Nhemachena, Paramasivam Ponnusamy, Dumindu Herath and Harbir Singh (2014). Agricultural Pathways and Scenarios for Regional Integrated

Assessment of Climate Change Impact, Vulnerability and Adaptation. In: ASA, CCSA & SSSA International Annual Meeting, *Grand Challenges, Great Solutions*, Poster Number 109, 2-5 November, 2014, Long Beach, CA, USA.

Verma, N., M. P. S. Arya, Poonam Kashyap, MP Singh, A Nath and SP Singh (2015). Gender work participation and access to resources in the predominant farming systems of Meerut District: *In souvenir of National Seminar on Gender Equity, Sensitization and Women Empowerment organized by SVPUA&T, Meerut 250110*

Verma, N., Poonam Kashyap, A. Nath, D. Dutta and B. Gangwar (2014). Value addition of horticultural crops: A source of nutritional security and income generation for rural women of Odisha In: Proceedings of International Conference on Horticulture for nutritional, livelihood and environmental security in Hills at Uttar Banga Krishi Vishwavidyalaya (Hill campus) Kalimpong, Darjeeling, West Bengal

Yadav, R. S., Gangwar, B.,Singh, M., Singh, S.P., Singh, J.P., Prasad, K., Kumar, A., and Jat, N.K. (2014). Carbon footprint of sugarcane, wheat and rice production in western plain zone, India. 78th' Annual Convention, Oct.23-26, 2013, Indian Society of Soil Science. National Seminar on development in Soil Science, November,2014; pp-69.

Yadav, R. S., N.K. Jat and Anil Kumar (2015). Assessment of greenhouse gases and mitigation of climate change in Western Plain Zone, India In: Compendium of Abstracts of 12th Agricultural Science Congress on "Sustainable Livelihood Security of Smallholder Farmers" at NDRI, Karnal from Feb 3-6, 2015.

चौधरी, वेद प्रकाश, कंचन कुमार सिंह एवं दिनेश कुमार पांडे (2014)। विभिन्न मशीनों के प्रयोग से संसाधन सरक्षण खेती में उत्पादन एवं लाभ का तुलनात्मक अध्ययन। राष्ट्रीय संगोष्ठी विषय "राष्ट्र के बदलते परिवेश में कृषि अभियांत्रिकी अनुसंधान एवं विकास के नए आयाम" के स्मारिका एवं शोघ पत्र–सारांश मे प्रकाशित। पेज 39। जुलाई 28, 2014 को आयोजित ।

चौधरी, वी. पी., संजीव कुमार, ए अनुज कुमार, एवं एम. पी.एस. आर्य (2014)। मृदा कर्षण एवं फसल अवशेष प्रबंधन का मृदा कार्बनिक कार्बन पर प्रभाव। राष्ट्रीय कृषि एवं विज्ञान संगोष्ठी विषय "कृषि उधानिकी एवं पशुपालन हेतु जलवायु परिवर्तन के संदर्भ मे प्राकृतिक संसाधनो का समुचित दोहन चुनौतियों एवं अवसर" पर आयोजित दिनांक 5 से 7 दिसम्बर द्वारा भारतीय कृषि अनुसंधान समिति, करनाल एवं राजमाता विजयराजे सिंधिया कृषि विश्वविद्यालय, ग्वालियर (एम.पी.) । पेज 49।

Popular articles

Choudhary, V. P., Kiran Rawat and D. K. Pandey (2014). कृषि से उत्सर्जित ग्रीन हाउस गैसों से वातावरण को हानि। खेती जून (June, 2014), pp.28-31.

Jat, N. K., S. S. Pal and R. Singh (2014). रबी फसलों में वैज्ञानिक विधि से सिंचाई प्रबंधन। खाद पत्रिका 55 (9) pp. 16-20.

Jat, N. K., and S. K. Dhaka (2014). जनवरी माह के कृषि कार्य। फसल क्रांति (January, 2015) pp. 43-45.

Kashyap, Poonam and Sunita Yadav (2014). फलोत्पादन में पादप वृद्धि नियामकों का उपयोग। किसान इंटरनेशनल, April-June, 2014, pp. 31-35.

Kashyap, Poonam, A. K. Prusty, J. P. Singh and A. Kansal (2014). समन्वित कृषि प्रणाली में बागवानी से रोजगार और आमदनी। खेती (August, 2014) , pp.15-17.

Kashyap, Poonam, Avinash Kansal, Ashisa Kumar Prusty and S.P. Singh (2015). Way ahead for Karonda (*Carissa carandus* L.) in Integrated Farming System. Indian Horticulture, (Jan- Feb) pp 28-29

Kumar, K., R. P. Shukla, B. K. Pandey, P. K. Shukla, B. Lal, Dushyant Mishra, Atul Singha, T. Adak, B. Rajkumar and H. Ravishankar (2014). आम की उत्पादकता एवं गुणवत्ता सुधार हेतु बागों का तुड़ाई पूर्व प्रबंधन। उद्यान रश्मि 13-14 (Vol 2,1) pp. 1-4

Kumar, S. and B. Gangwar (2014). सही उर्वरक उपयोग से फसलोत्पादन में वृद्वि,। खेती pp. 14-21.

Meena, L. R. (2014). पशु आहार रू चारा फसलों को स्वादिष्ट बनायँ जीवाणु खाद से । खेती (September issue) pp.24-26.

Meena, L. R. (2014). जिप्सम प्रयोग से ऊसर भूमि में चारा उत्पादन। खेती (June, 2014) pp. 35-37.

Meena, L. R. and Gulyani Gulyani (2014). आमदनी : आंवला के साथ चारा फसलों की खेती। फल फूल (March- April issue) pp. 13-16.

Mishra, D., H. Ravishankar, S. K. Shukla, V. K. Singh, Gundappa. B and Ajay Verma (2014). आम के बाग में जीमोधार तकनीक। उद्यान रश्मि 13-14 (Vol 2,1) pp. 21-29

Prusty, A. K., Poonam Kashyap, P. Panikkar, D. K. Meena and S. P. Singh (2014). Role of fisheries in poverty alleviation and food security. Indian Farming. 64 (3) pp.32-36.

Ravisankar, N., Brijmohan, Gangwar, B. and Swain, S.K. (2014). रोजगार के साथ बढ़ती आय। खेती 66 (4): 29-30.

Shamim, M. P., P. Mishra, Sunil Kumar and N. K. Jat (2014). सब्जी का बीज खुद करे तैयार, फार्म एण्ड फूड़, pp. 12-14.

Singh, R., U. Choudhary, K. K. Dutta, M. Ghosh, P. P. Mishra and Sunil Kumar (2013-14). राष्ट्रीय डेरी अनुसंधान संस्थान लधु दुग्ध उत्पादको को डेरी एजेंसियों द्वारा प्रोत्साहनः पश्चिम बंगाल के 24 परगना (उत्तरी जनपद का एक सूक्ष्म अध्ययन), दुग्ध गंगा चुतर्थ अंक pp. 188.

Verma, H. C., R. Kumar, K.. Kumar, T. Adak, Dushyant Mishra, S. K. Shukla and Barsati Lal (2014). बागवानी में एक्सपर्ट सिस्टम के अनु प्रयोग। उद्यान रश्मि 13-14 (Vol 2,1) pp. 41-43

Books

Gangwar, B., J. P. Singh, A. K. Prusty and Kamta Prasad (Eds.). (2014). Research in Farming Systems. Today and Tomorrow's Printers and Publisher 4436/7, Ansari Road, Daryaganj, New Delhi – 11002 (India):pp 1-584.

Bulletin/ Folders/Compendiums

Gangwar, B., N. Ravisankar, S.Vijayabaskaran and A.P. Vishwanath (2014). On farm nutrient response of crops and cropping systems (Synthesized information), Project Directorate for Farming Systems Research, Modipuram, Meerut, p 182.

Gangwar, B., N. Ravisankar, S.Vijayabaskaran and A.P. Vishwanath (2014). On farm nutrient response of crops and cropping systems (Synthesized data), Project Directorate for Farming Systems Research, Modipuram, Meerut, p 178.

Gautam, R. K., P.K. Singh, Ajanta Birah, Krishna Kumar, A.K. Singh, Naresh Kumar, S.Swain, S.K. Zamir Ahmed, N. Ravisankar, K. Devakumar and S. Damroy (2013). Agro technology for higher rice productivity in Andaman and Nicobar Islands, Technical bulletin, Central Agricultural Research Institute, Port Blair, A&N Islands, India, p.42

Singh, M. P., V. K. Singh, A. K. Prusty, R. P. Mishra, V. P. Choudhary, Pooonam Kashyap and B. Gangwar (2015). Farming Systems Approach: Ensuring livelihood security in hill area of Uttarakhand. IIFSR Bulletin No. 3, pp. 50, ICAR- Indian Institute of Farming Systems Research, Modipuram Meerut.

Singh, V. K., B. S. Dwivedi and R. N. Sahoo, Meenu Rani, S. K. Singh (2015) On-farm nutrient management and soil fertility appraisal in Upper Gangetic Plains. IIFSR Bulletin No. 1, pp. 49, IIFSR, Modipuram, Meerut.

Singh, V. K., M. P. Singh, R. P. Mishra and K. Singh (2015). Farming system dynamics: Impact of supplemental irrigation in canal command areas of Western Uttar Pradesh. IIFSR Bulletin No. 2, pp. 58, IIFSR, Modipuram, Meerut.

Subramani, T. S., Jeyakumar, S.K. Ambast, N. Ravisankar, Kiruba Sankar, B.K. Nanda, Ajmer Singh and A. Velmurugan (2014). Water saving technologies for higher crop and water productivity, Central Agricultural Research Institute, Port Blair, p. 4.

Book chapters/Conference papers/ Chapters in Compendium

Bhanu, C., J. P. Singh, VeenaYadav, A. K. Prusty and Anil Kumar (2014).Global warming and remodeling of Integrated farming Systems, pp 151-175. *In*: Research in Farming Systems (Eds. B. Gangwar, J. P. Singh, A. K. Prusty and Kamta Prasad).Today and Tomorrow's Printers and Publisher 4436/7, Ansari Road, Daryaganj, New Delhi – 11002 (India):1-584.

Bhanu, C., Veena Yadav and R. P. Singh (2014). Mushroom – as a Component for Diversifying Small and Marginal Farmings. pp 109-120. *In*: Research in Farming Systems (Eds. B. Gangwar, J. P. Singh, A. K. Prusty and Kamta Prasad).Today and Tomorrow's Printers and Publisher 4436/7, Ansari Road, Daryaganj, New Delhi – 11002 (India):1-584.

Gangwar, B. and J. P. Singh (2014). Integrated farming Systems Research- Concepts and status, pp 1-34. *In*: Research in Farming Systems (Eds. B. Gangwar, J. P. Singh, A. K. Prusty and Kamta Prasad).Today and Tomorrow's Printers and Publisher 4436/7, Ansari Road, Daryaganj, New Delhi – 11002 (India):1-584.

Gangwar, B. and N. Ravisankar (2014). Diversification of existing farming systems for environmental security and livelihood of small farm holder In: Proceedings of National symposium on Agricultural diversification for sustainable livelihood and environmental security, 18-20November 2014, Indian Society of Agronomy and Punjab Agricultural University, Ludhiana, Pp 69-73.

Gangwar, B. and N.Ravisankar (2014).Farming System approach for providing sustainable livelihood to

small holders, Agriculture Year Book 2014, Agriculture Today, pp. 32-35.

Gangwar, B., Harbir Singh and N. Ravisankar (2014). Enhancing pulses production: the way forward, In: Enhancing Pulses production: technologies and strategies (Eds: B. Gangwar and A.K. Singh), New India Publishing Agency, New Delhi pp.1-20.

Islam, A., P. B. Shirsath, S. N. Kumar, N. Subash, A. K. Sikka, and P. K. Aggarwal (2015). Use of Models in Water Management and Food Security under Climate Change Scenarios in India, pp. 267-316. *In*: Practical applications of agricultural system models to optimize the use of limited water. Adv. Agric. Systems Model. 5. (Eds. L.R. Ahuja, L. Ma, and R.J. Lascano). ASA-SSSA-CSSA, Madison, WI. (ISBN: 978-0-89118-344-0).

Kashyap Poonam and Sudhir Kumar (2014). Abiotic stresses- Management and mitigation in fruit crops. *In*: Challenges and Prospective of Plant Abiotic Stress, (Eds. Pasala Ratnakumar, Kiran Bhagat, Yogeshwar Singh). Today and Tomorrow Printers and Publishers, India, pp.477-496.

Khilari, K., Bhanu, C. and Singh D. (2014). Diseases of vegetable tuber crops. *In:* Diseases of vegetable crops: Diagnosis and management (Eds. Dinesh Singh, P. Chowdappa and Pratibha Sharma). Indian Phytopathological Society, New Delhi. Pp: 441-514.

Meena, L. R. (2014). Chara Abhav mein Pashuan ke liye salige. Avipunj : p18-20.

Meena, L. R. (2014). Garamiyou mein chare kee vayvastha .Avipunj :pp: 60-64.

Mishra D. (2014). Canopy Management and Rejuvenation in mango orchards. *In Souvenir* National Conference on Mango Diversity, production, Post-harvest Management and Export (9-11 June 2014). Bihar Agricultural University, Sabour, Bhagalpur pp 32-36

Nath, A., S. Mandal, R.K. Singh, Bidyut C. Deka, S.V. Ngachan (2015). Ascorbic Acid, â-Carotene and antioxidant activity of broccoli during short-term refrigerated storage. Published In "Processing and Impact on Active Components in Food 2015, 27-34". Published by http://www.elsevier.com/book-authors/science-and-technology-book-publishing.

Prusty, A. K., Poonam Kashyap, J. P. Singh, S. K. Gupta and D. K. Meena (2014). Multiple use of water through integrated fish farming systems. In: Aquaculture and Fisheries Environment. (Eds. S. K. Gupta and Bharti Pawan K.). Discovery Publishing House, New Delhi ISBN- 93-5056-408-4, pp.187-195.

Rana, N. S., N. K. Jat and Sudhir Kumar (2014). Recent advances in improving nutrient use efficiency in sugarcane. In: *Summer School Compendium: Recent innovations for improving nutrient use efficiency through integrated nutrient management in major field crops* (Shivay, Y.S., Kumar, D. and Meena, S. L. Eds.). pp. 406-423, Division of Agronomy, IARI, New Delhi.

Ravisankar, N., B. Gangwar, T.P. Swarnam, S.K. Zamir Ahmed and N. Bommayasamy (2014). Islands, In: Enhancing Pulses production: technologies and strategies (Eds: B.Gangwar and A.K. Singh), New India Publishing Agency, New Delhi pp.201-220.

Ravisankar, N., S. Jeyakumar, D.R. Singh, S.K. Ambast and A.Kundu.2014.Integrated Farming System (IFS) models for different farming situations of Islands In: Research in Farming Systems (Eds: B. Gangwar, J.P. Singh, A.K. Prusty and Kamta Prasad), Today and Tomorrow Printers, New Delhi, pp: 517-550.

Shukla, S. K., Dushyant Mishra, Kailash Kumar and Ajay Verma (2014). A Value Chain Management of Mango in Malihabad for productivity and profitability: An Experience. Souvenir: Stakeholders Issues in Value Chain Management of Mango. (28-29 June 2014) CISH, Lucknow. pp 32-38

Singh, Harbir (2015). Watershed Development in India: Lessons Learnt and Policy Imperatives, pp: 65-73, *In*: *Water Management in Agriculture: Lessons Learnt and Policy Implications*, (Eds. M.S. Meena, K.M. Singh and B.P. Bhatt), Jaya Publishing House, New Delhi, ix+450.

Singh, J. P. and B. Gangwar (2014).Integrated Farming System Model for small farm holders of Uttar Pradesh. pp 293-321. *In*: Research in Farming Systems (Eds. B. Gangwar, J. P. Singh, A. K. Prusty and Kamta Prasad).Today and Tomorrow's Printers and Publisher 4436/7, Ansari Road, Daryaganj, New Delhi – 11002 (India):1-584.

Singh, V. K., R. P. Mishra, Meenu Rani and S K Singh (2014). Water and nutrient interaction in irrigated agriculture. *In*: Textbook of Plant Nutrient Management (Eds. Rajendra Prasad, Dinesh Kumar, D S Rana, Y S Shivay, R K Tewatia). Indian Society of Agronomy, pp 249-267.

Subash, N., Harbir Singh, B. Gangwar, G. Baigorria and A. K. Sikka (2015). Integrated Climate Change Assessment through Linking Crop Simulation with Economic Modeling–Results from the Indo-Gangetic Basin. In: *Handbook of Climate Change and Agro-ecosystems:* AgMIP *(Part 1 & Part 2)*, Eds. Daniel Hillel and Cynthia Rosenzweing, ICP Series on Climate Change Impacts, Adaptation, and Mitigation –Vol.4: 251–271, Imperial College Press, UK, 1100pp.

Subash, N., Harbir Singh, Gangwar, B., Baigorria, G., Sikka, A.K. and Valdivia, R.O. (2015). Integrated climate change assessment through linking crop simulation with economic modeling - Results from the Indo-Gangetic Basin. *In*: Cynthia Rosenzweig and Daniel Hillel, Editors, Handbook of climate change and Agro-ecosystems. The AgMIP, Part 2. ICP Series on Climate Change Impacts, Adaptation and Mitigation - Vol. 3. p. 259-280. ASA-CSSA-SSSA, Imperial College Press, UK. ISBN 978-1-78326-567-1.

Subash, N., Harbir Singh, B. Gangwar, G. Baigorria, A.K. Sikka and R.O. Valdivia. (2015). Integrated climate change assessment through linking crop simulation with economic modeling -Results from the Indo-Gangetic Basin. In: D. Hillel & C. Rosenzweig, editors, Handbook of climate change and agro-ecosystems. AgMIP Part 2. ICP series on climate change impacts, adaptation and mitigation - Vol.4. ASA-SSSA-CSSA.

Valdivia, Roberto O., John M. Antle, Cynthia Rosenzweig, Alex Ruane, Joost Vervoort, Muhammad Ashfaq, Ibrahima Hattie, Sabine Homman-Kee Tui, Richard Mulwa, Charles Nhemachena, Paramasivam Ponnusamy, Herath Rasnayaka and Harbir Singh (2015). Representative Agricultural Pathways and Scenarios for Regional Integrated Assessment of Climate Change Impact, Vulnerability and Adaptation, *In*: *Handbook of Climate Change And Agro-ecosystems:* AgMIP *(Part 1 & Part 2)*, Eds. Daniel Hillel and Cynthia Rosenzweing, ICP Series on Climate Change Impacts, Adaptation, and Mitigation –Vol.4, Imperial College Press, UK, 1100pp.

PESONNEL (As on 31.03.2015)

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

Director (Acting): Dr. J.P. Singh

S. No.	Name of the Scientist	Designation	Discipline
(A)	**Scientific cadre**		
Principal Scientist			
1	Dr. Kamta Prasad	Principal Scientist	Agronomy
2	Dr. M P S Arya	Principal Scientist	Agronomy
3	Dr. M.P. Singh	Principal Scientist	Agril. Extension
4	Dr. Vinod Kumar	Principal Scientist	Animal Nutrition
5	Dr. Prem Singh	Principal Scientist	Agronomy
6	Dr. Anil Kumar	Principal Scientist	Agril. Extension
7	Dr. L. R. Meena	Principal Scientist	Agronomy
8	Dr. V. K. Singh	Principal Scientist/ National Fellow	Agronomy
9	Dr. Harbir Singh	Principal Scientist	Agril. Economics
10	Dr. N. Ravisankar	Principal Scientist	Agronomy
11	Dr. R. S. Yadav	Principal Scientist	Soil Science
12	Dr. Suresh Malik	Principal Scientist	Poultry Science
13	Dr. Amith Nath	Principal Scientist	Food Technology
Sr. Scientist			
14	Dr. B.K.Sharma	Senior Scientist	Agril. Extension
15	Dr. R.P.Mishra	Senior Scientist	Agronomy
16	Dr. N.Subhash	Senior Scientist	Agri-Meteorology
17	Dr. V.P. Chaudhary	Senior Scientist	FMP
18	Dr. Dushyant Mishra	Senior Scientist	Fruit Science
19	Dr. Debasish Dutta	Senior Scientist	Agril. Chemicals
20	Dr. Devendra Kumar	Senior Scientist	Plant Breeding
21	Dr. T. Ram	Senior Scientist	Agronomy
Scientist			
22	Shri Vipin Kumar Chaudhary	Scientist	Computer Application
23	Dr. Chandra Bhanu	Scientist	Plant Pathology

S. No.	Name of the Scientist	Designation	Discipline
24	Dr. Poonam Kashyap	Scientist	Horticulture
25	Dr. A. K. Prusty	Scientist	Aquaculture
26	Shri Sanjeev Kumar Kochewad	Scientist	LPM
27	Dr. M. Shamim	Scientist	Agri-Meteorology
28	Dr. N.K. Jat	Scientist	Agronomy
29	Shri Sunil Kumar	Scientist	Agril. Economics
30	Dr. Sudhir Kumar	Scientist	Plant Physiology
31	Dr. Sanjeev Kumar	Scientist	Agronomy
32	Dr. Chethan Kumar G.	Scientist	Soil. Science
33	Dr. Nisha Verma	Scientist	Home Science
34	Shri Raghuveer Singh	Scientist	Agronomy
B)	**Technical Staff**		
1	Shri Chet Ram	Chief Technical Officer	
2	Shri Jagpal Singh	Chief Technical Officer	
3	Dr. Yogendra Singh	Chief Technical Officer	
4	Shri D. Tripathi	Chief Technical Officer	
5	Shri Krishanpal	Asstt. Chief Technical Officer	
6	Dr. Vipin Kumar	Asstt. Chief Technical Officer	
7	Shri K. V. Anand	Asstt. Chief Technical Officer	
8	Dr. Brij Mohan	Asstt. Chief Technical Officer	
9	Shri Om Kumar Tomar	Asstt. Chief Technical Officer	
10	Shri Naval Singh	Asstt. Chief Technical Officer	
11	Shri P. P. Mishra	Asstt. Chief Technical Officer	
12	Dr. S. P. Singh	Senior Technical Officer	
13	Shri S. K. Duhoon	Senior Technical Officer	
14	Shri R. B. Tewari	Senior Technical Officer	
15	Shri Vinod Kumar	Senior Technical Officer	
16	Shri D. P. Singh	Senior Technical Officer	
17	Shri Brijesh Sharma	Senior Technical Officer	
18	Shri A. P. Dwivedi	Technical Officer	
19	Shri D. K. Pandey	Technical Officer	
20	Shri Krishan Kumar	Technical Officer	
21	Shri Uma Shankar Pandey	Senior Technical Asstt.	

S. No.	Name of the Scientist	Designation
22	Shri Ashok Kumar	Senior Technical Asstt.
23	Smt. AnjuVerma	Senior Technician
24	Shri Raj Kumar Meena	Senior Technician
C)	**Administrative**	
1	Shri Sushil Kumar Singh	Senior Admn. Officer
2	Shri T. C. Sharma	Finance & Accounts Officer
3	Shri Attar Singh	Personal Secretary
4	Shri RaiBahadur	Personal Secretary
5	Smt. Jailata Sharma	Personal Secretary
6	Smt. Alka Jain	Assistant
7	Shri Sanjay Kumar Gupta	Assistant
8	Shri S. K. Bansal	Personal Assistant
9	Shri Rajesh Kumar	Personal Assistant
10	Shri Brij Beer singh	Personal Assistant
11	Smt. Sheela Devi	Assistant
12	Shri Jata Kant	Assistant
13	Shri Ravi Kant	Upper Division Clerk
14	Shir Prem Singh	Upper Division Clerk
15	Sh. Rajender Kumar	Lower Division Clerk
16	Sh. Permanand	Lower Division Clerk
17	Shri D.C. Mishra	Lower Division Clerk
D)	**Supporting Staff**	
1	Shri Anand Singh	Skilled Supporting Staff
2	Shri Prem Kumar	Skilled Supporting Staff
3	Shri Rakesh Kumar	Skilled Supporting Staff
4	Shri Rajendra Singh	Skilled Supporting Staff
5	Shri Kripa Shankar Pandey	Skilled Supporting Staff
6	Shri Ayodhya Prasad Dubey	Skilled Supporting Staff
7	Shri Prem Singh	Skilled Supporting Staff
8	Shri Mahavir Singh	Skilled Supporting Staff
9	Shri Siddh Kumar	Skilled Supporting Staff
10	Shri Harshnath Singh	Skilled Supporting Staff

LIST OF ON-GOING PROJECTS

Sl. No.	Name of Project	INSTITUTE Code	Name of PI & Co-PI	Date of Start
	Institute Project			
1	Identification of bio-intensive, complementary cropping systems for high productivity and efficient resource use.	**NRMAPDFSRSIL200800200093**	Dr. B. Gangwar Dr. MPS Arya Dr. M. Shamim Dr. Sudhir Kumar	2008-2014
2	Sustaining rice-wheat productivity through integrated nutrient supply system.	**NRMAPDFSRSIL199300100001**	Dr. V. K. Singh Dr. R. P. Mishra Dr. N. Subhash Dr. R. S. Yadav	1993-94 (Long term)
3	Long term influence of Resource Conservation Technologies in Rice-Wheat system.	**NRMAPDFSRSIL200400100058**	Dr. V. P. Choudhary Dr. R. P. Mishra	2004-2015
4	Development of suitable resource conservation modules to mitigate the ill effects of climate change.	**NRMAPDFSRSIL201300400133**	Dr. V. P. Choudhary Dr. M .Shamim Dr. Sudhir Kumar Dr. Chandra Bhanu	2013-2018
5	Climate Change: Effects on productivity of Rice-wheat cropping system in western plain zones of U.P. and its mitigation by using DSSAT model.	**NRMAPDFSRSIL201000800114**	Dr. M .Shamim Dr. Sudhir Kumar	2010-2015
6	Development of sustainable production model for rice-wheat cropping system.	**NRMAPDFSRSIL199800100006**	Dr. R. P. Mishra Dr. V. K. Singh	1998 (Long term)
7	Development of cost effective and sustainable Integrated Farming System Models for livelihood improvement of small farm holders.	**NRMAPDFSRSIL201001300119**	Dr. J. P. Singh Dr. B. Gangwar Dr. Dushyant Mishra Dr. A. K. Prusty Dr Vinod Kumar	2010-2017
8	Assessment of climate change impact on integrated Farming Systems through Modelling	**NRMAPDFSRSIL201300300132**	Dr. N. Subhash Dr. M. Shamim Dr. J. P. singh Dr. A. Prusty Mr. Chetankumar G. Dr Suresh Malik	2013-2016
9	Comparative studies of fish and crop based farming systems	**NRMAPDFSRSIL201200200128**	Dr. A.K. Prusty Dr. J. P. Singh Dr. P. Kashyap	2012-2015
10	Development of year–round production module of mushrooms for small and marginal farmers	**NRMAPDFSRSIL201300500134**	Dr. Chandra Bhanu Dr. J. P. Singh Dr. AmitNath	2013-2016

Sl. No.	Name of Project	INSTITUTE Code	Name of PI & Co-PI	Date of Start
11	Productivity and economic evaluation of horticulture based farming systems	**NRMAPDFSRSIL201100200121**	Dr. P. Kashyap Dr. Kamta Prasad Dr. Harbir Singh	2011-2015
12	On-Farm value addition for livelihood improvement of small farm households in Western Plain Zone of Uttar Pradesh	**NRMAPDFSRSIL201400100135**	Dr. Amit Nath Dr. M. P.Singh Dr. DebashishDutta Dr. R. P. Mishra Dr. Poonam Kashyap Dr. Nisha Verma	2014-2018
13	Comparative study of role of women in predominant farming systems of Western plain zone of UP and Hill zone of Uttarakhand	**NRMAPDFSRSIL201400400138**	Dr. Nisha Verma Dr. M. P. S. Arya Dr. M. P. Singh Dr. Poonam Kashyap Dr. Amit Nath	2014-2016
14	Development of fruit crop based high density farming systems for higher productivity and profitability under small farm conditions	**NRMAPDFSRSIL201400600140**	Dr. Dushyant Mishra Dr. Sudhir Kumar Dr. J. P. Singh Dr. M. Shamim Dr. Amit Nath Dr. Chandra Bhanu	2014-2024
15	Characterization and mapping of Farming Systems in India	**NRMAPDFSRSIL201401000144**	Dr. Harbir Singh Dr. Vinod Kumar Mr. Raghuveer Singh Dr. Nisha Verma Dr. S. Malik Dr. L. R. Meena	2014-2016
16	Conservation agriculture based weed management practices in rice-wheat cropping system	**NRMAPDFSRSIL201200300129**	Dr. N. K. Jat Dr. R. S. Yadav Dr. Sudhir Kumar	2012-2015
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	**NRMAPDFSRSIL201400200136**	Dr. Debashish Dutta Dr. Prem Singh Dr. Amit Nath Dr. D. Mishra Dr. Nisha Verma	2014-2018
18	Development of microbial consortia for crop disease suppression, growth promotion and yield enhancement under organic farming system	**NRMAPDFSRSIL201400800142**	Dr. Chandra Bhanu Dr. N. K. Jat Dr. S. S. Pal	2014-2018
19	Estimation of greenhouse gas emission from IFS modules and models under AICRP-IFS	**NRMAPDFSRSIL201400900143**	Dr. R. S. Yadav Dr. L. R. Meena Dr. J. P. Singh Dr. Vinod Kumar Dr. Dushyant Mishra	2014-2017

Sl. No.	Name of Project	INSTITUTE Code	Name of PI & Co-PI	Date of Start
20	System based proven technologies in farming system perspective under demonstration in Technology park	**NRMAPDFSRSIL201400500139**	Dr. M. P. Singh Dr. Prem Singh Dr. R. P. Mishra	2014-2018
21	On-Farm Integrated Farming Systems Management	**NRMAPDFSRSIL201100600125**	Dr. B.K. Sharma Dr. Anil Kumar Dr. A. K. Prusty	2011-2016
22	Diversification of existing farming systems through integration of poultry for improving livelihood of marginal and landless farmers	**NRMAPDFSRSIL201400700141**	Dr. S. Malik Dr. Vinod Kumar Dr. A. K. Prusty	2014-2018
23	Digitization of database of on-station and on-farm experiments of cropping systems under AICRP on IFS	**NRMAPDFSRSIL200800300094**	Dr. G. C. Sharma Mr. Vipin Kumar Chaudhary	2008-2015
24	On-farm crop response to plant nutrients in rice-wheat cropping system (RWCS) and their impact on crop-livestock-human continuum	**NRMAPDFSRCIL201400300137**	Sh. Raghuveer Singh Dr. N Ravisankar Dr. Sanjeev Kumar Verma	2014-2016
Exploratory Studies approved for one year				
1	Screening of short duration varieties in sugarcane-wheat cropping system	**ES/01/2014**	Dr. Debendra Kumar Dr. Sudhir Kumar Dr. Sanjeev Kumar Dr. Chethan Kumar G.	2014-2015
2	Study on suitability of non-traditional high value fruit crops under small farm conditions of Western U. P.	**ES/02/2014**	Dr. D. Mishra	2014-2015
3	Round the year forage production for rabbit based IFS model for marginal farm holders in Western U.P	**ES/03/2014**	Dr. L. R. Meena Dr. Kamta Prasad Dr. N. Ravisankar Dr. R. S. Yadav Dr. G. C. Sharma	2014-2015
4	Development of web based integrated information system for Indian farming systems research	**ES/04/2014**	Mr. Vipin Kumar Choudhary Dr. G. C. Sharma	2014-2015
Externally Funded Projects				
1	National Initiative on Climate Resilient Agriculture (NICRA).	**NRMAPDFSRSOL201100600124**	Dr. N. Subhash Dr. B. Gangwar Dr. M. P. S. Arya Dr. V. P. Choudhary	2011-2017
2	AICRP on Integrated Farming Systems.	**NRMAPDFSRCOL201000700113**	Dr. J. P. Singh Dr. B. Gangwar Dr. Poonam Kashyap Mr. S. K. Kochewad	2010-2017

Sl. No.	Name of Project	INSTITUTE Code	Name of PI & Co-PI	Date of Start
3	Ensuring Livelihood Security Through Farming Systems Approach in Tehri district of Uttrakhand (THDC, Rishikesh).	**NRMAPDFSRSCL201100400122**	Dr. M. P. Singh Dr. V. K. Singh Dr. R. P. Mishra Dr. V. P. Choudhary Dr. A. K. Prusty Dr. P. Kashyap	2011-2015
4	Precision nutrient management using GIS based Spatial variability mapping under upper and middle Gangetic Plain Zones of India. (National Fellow Project of ICAR).	**NRMAPDFSRSOL201100500123**	Dr. V. K. Singh	2011-2016
5	Integrated spatial farming systems analysis techniques with remote sensing and ancillary data (INFARM) (SAC, Ahmedabad).	**NRMAPDFSRCOP201300200131**	Dr. N. Ravisankar Dr. M. Shamim	2013-2016
6	Network Project on Organic Farming (NePOF).	**NRMAPDFSRCOL200500100064**	Dr. N. K. Jat Dr. Sudhir Kumar Dr. Chetan Kumar	2005-2017
7	Study of crop pattern and increase in agricultural produce due to release of water from *Tehri* Reservoir for irrigation purpose		Dr. V.K. Singh Dr. M.P. Singh Dr. R.P. Mishra	2014-2015
Foreign aided Projects				
1	Global Yield Gap and Water Productivity (ICAR-UNL Collaborative Project).	**NRMAPDFSRCOP201300100130**	Dr. N. Subash	2013-2015
2	Strengthen Simulation Approaches for understanding projecting and managing climate risks in stress- prone environment across central and eastern Indo- Gangetic Basin" under "Agricultural Model Inter-comparison and improvement Project"(AgMIP – ICAR Collaborative Project)	**NRMAPDFSRCOP201200100127**	Dr. N. Subash Dr. Harbir Singh	2015-2017

dk;dkjh lkjk'k

1- lLFkku dk uke o irk % भाकृअनुप–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मरेठ (उत्तर प्रदेश) 250110

2- ctV ¼2014&15½

d- lLFkkxr ¼: yk[k e½

	;kstukxr			xj&;kstukxr			
iko/kku	0;; vunku	Lkjdkjh vkoVu$ ifj"kn dk 'k;j ls e[;kky; }kjk inku dh xbZ vfrfjDr jkf'k	vkrfjd vkcVu ¼dkye 3$4½	dqy vunku ls 0;;	Lkjdkjh ikfIr ls 0;;	jkjLo ¼dkye 6$7½	dqy 0;;
1	2	3	4	5	6	7	8
125.0	124.54	104.5	79.5	1125.0	1038.0	37.10	1075.1

[k- okã Jkr ¼:- yk[k e½

Jkr	jkf'k	[kpZ
पेंसन और अन्य सेवानिवृत लाभ	100.0	58.25
भा.कृ.अनु.प	–	–
निजी ऋण और अग्रिम राशि	5.00	4.21
वाह्य वित पोषित परियोजनांए	46.98	44.35
कुल	151.98	106.81

x- jktLo izkfIr ¼2014&15½ ¼: yk[k e½

Jkr	jkf'k
प्रक्षेत्र उत्पाद	29.71
मत्स्य, दुध एवं पशु विक्रय	1.59
प्रकाशन विक्रय	0.01
लाइसेन्स शुल्क/जल शुल्क	4.56
निविदा फार्म मूल्य	0.07
सेवा प्रदान	–
विविध	0.66
ऋण एवं अग्रिम राशि पर ब्याज	7.52
टी.डी.आर. पर ब्याज	6.12
अन्य (रॉयल्टी और संस्थान शुल्क)	–
कुल	50.24

3- dsipkfj;ksa dh fLFkfr ¼31-3-2014 rd½

J.kh	eatwjh	fLFkfr	fjDr
oSKkfud			
निदेशक	01	01	.
प्रधान वैज्ञानिक	07	15	.
वरिष्ठ वैज्ञानिक	12	09	03
वैज्ञानिक	19	13	06
कुल	39	38	–
Rkduhdh dsipkjh			
क्षेणी–III (T-6,7/8,T-9)	02	02	–
क्षेणी–II (T-3, T-4 and T-5)	18	18+1*	–
क्षेणी–I (T-1 and T-2)	3	3	–
कुल	21	23	–

J.kh	eatwjh	fLFkfr	fjDr
i'kklfud deZpkjh			
वरिष्ठ प्रशासनिक अधिकारी	01	–	01
वित एवं लेखा अधिकारी	01	01	–
सहायक प्रशासनिक अधिकारी	01	00	01
सहायक	04	04	–
वरिष्ठ लिपिक	02	02	–
निजी सचिव	01	01	–
व्यक्तिगत सहायक	02	03#	–
कनिष्ठ आशुलिपिक	01	02#	
कनिष्ठ लिपिक	03	03	–
कुल	16	17	–
सहायक कर्मचारी	10	10	–
अस्थाई कर्मचारी	16	16	–
कुल	58	60	01

*केन्द्रीय मृदा लवणता अनुसंधान संस्थान, करनाल से स्थानांतरित किया गया ओवरसियर का एक पद जो भविष्य में वापिस किया जा सकता है।

#प्रशासनिक संवर्ग के पुर्नगठन के बाद ये अतिरिक्त पद है जो भा.कृ.अ.प. सस्थान के निदेशानुसार ये अगले आदेश तक बने रहेगें।

3-1 inkUurh@p;u

d-l Ukke	in uke	inHkkj xg.k dh frfFk
1 श्री. कृष्ण कुमार	वरिष्ठ तकनीकी अधिकारी	22.01.2010
2 डा. एस.पी. सिंह	मुख्य तकनीकी अधिकारी	02.10.2008

3-2 lsok fuofÙk

d-l Ukke	in uke	lsok fuofÙk dh frfFk
1 डा. बी. गंगवार	निदेशक	31.01.2015
2 डा. एस.एस. पाल	प्रधान वैज्ञानिक	31.01.2015

3-3 LFkkukarj.k@p;u

d-l Ukke	in uke	inHkkj xg.k dju dh frFk	dgk	fVli.kh
1 डा. जी.सी. शर्मा	प्रधान वैज्ञानिक	05.07.2014	केन्द्रीय मृदा एवं जल संरक्षण अनुसंधान एवं प्रशिक्षण संस्थान, देहरादून	स्थांनातरण
2 श्री एम.पी. त्रिपाठी	वाहन चालक (टी–2)	28.02.2015	भाकृअनुप–भारतीय स्थांनातरण गन्ना अनुसंधान संस्थान, लखनउ	

4- vuqla/kku ifj;kstuk,a

संस्थान आधारित : 24

बाहरी वित पोषित : 09

5- e[; vuqla/kku miyfC/k;k¡

- भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम पर विकसित किये गये एकीकृत कृषि प्रणाली मॉडल से कुल रूपये 62356/– प्रतिवर्ष बचत के रूप में प्राप्त हुआ।
- मशरूम मॉडयूल से कुल 757 किग्रा मशरूम की पैदावार दर्ज की गई जिसमें शुद्व लाभ रूपये 26233/– प्रतिवर्ष के साथ साथ 80 दिनों का रोजगार सृजन भी हुआ।
- पश्चिमी उत्तर प्रदेश के किसानों में कटाई उपरांत प्रबंधन एवं मूल्य संवर्धन ज्ञान की कमी होने के कारण लगभग 10 से 20 प्रतिषत तक का नुकसान कृषि उत्पाद में पाया गया।
- मेरठ जिले में महिलाऐं कृषि कार्यो में बहुत सक्रिय है लेकिन इनका जमीनों पर मालिकाना हक लगभग नही के बराबर है।
- अलीपुर गॉव में फसल एवं दुग्ध उत्पादन (डेयरी) किसानों का मुख्य व्यवसाय के रूप में दर्ज किया गया है तथा यह भी देखा गया कि मिलों का देर से खुलना किसानों के लिए एक गंभीर समस्या है।
- 8 से 9 इंच लंबा सेव के अन्ना किस्मों के कलमो में शत प्रतिशत उत्तर जीविता दर्ज किया गया जिनमे शून्य प्रतिशत मृत्यु दर के साथ साथ विपुल वनस्पति विकाश देखा गया। पौधो ने इस क्षेत्र में जून के महीनो में पड़ने वाली भीषण गर्मी (42 डिग्री सेल्सियस) को आसानी से सह गया।
- अरहर . उडद– गेहूँ(ZT)– लोबिया (F) की खेती जलवायु अनुरूप फसल प्रणाली पाया गया जिसमें 1.4°C तक मिटटी (0–15 सेमी) का तापक्रम कम पाया गया ।
- मक्का (बाली) लोबिया (BB) ढैंचा (F)– मसूर (BB) सरसों (F)– मूँग (MT) उत्तर प्रदेश के पश्चिमोत्तर भागों में सबसे अधिक लाभदायक कृषि प्रणाली सिद्व हुआ है।
- लंबे समय से चल रहे फसल प्रयोग से यह सिद्व हुआ है कि जिन फसलों में संतुलित पोषक तत्वों का प्रयोग किया गया उनमें स्थायी उपज सूचकांक

(SYI) ज्यादा जैसे चावल के लिए 0.85 एवं गेहूँ के लिए 0.90 पाया गया।

- सरसों की विकिरण उपयोग क्षमता अन्य फसलों जैसे – मक्का, गेहूँ और जौ की अपेक्षा कम पाया गया। साथ ही साथ यह भी देखा गया कि शून्यकर्षण से बोए गये सरसो की विकिरिण उपयोग क्षमता (0. 49 ग्राम प्रति मेगा जूल) पारंपरिक तरीकों से बोए गये सरसों (0.59 ग्राम प्रति मेगा जूल) से कम पाया गया।

- धान – गेहूँ फसल प्रणाली में यह देखा गया कि संयुक्त ताप उपयोग क्षमता ऋतु के शुरूआत में बोये गये फसले जिनमें नत्रजन की अधिक मात्रा (150 किग्रा/है0) डाला गया उनमें औरों के मुकाबले ज्यादा था।

- विभिन्न पोषक तत्व प्रबंधन विकल्पो में एकीकृत संयंत्र पोषक तत्व प्रबंधन के तहत लिये गये फसल प्रणाली की उत्पादकता अधिक दर्ज की गई।

- पश्चिमोत्तर प्रदेश में गन्ने की किस्में जैसे– Co 0238, CoSe 03234, Co 0124 एवं CoSe 01434 अन्य की अपेक्षा में ज्यादा अच्छा देखा गया।

- संरक्षित खेती पद्वति के अंतर्गत लिये जा रहे गेहूँ – धान फसल प्रणाली में मृदा जैविक कार्बन (SOC), उपलब्ध नत्रजन, पोटाश एवं फास्फोरस के साथ साथ सूक्ष्म पोशक तत्वों जैसे – जिंक, तांबा तथा मैगनीज पारंपरिक कृषि पद्वतियों की तुलना में अधिक पाया गया।

- स्पेंट मशरूम खाद *T. harzianum* की वृद्धि का अच्छा स्रोत पाया गया, जिनका उपयोग *T. harzianum* के बड़े पैमाने पर उत्पादन हेतु किया जा सकता हैं।

- ग्रीन हाउस गेस (GHG) आंकलन में देखा गया की अकार्वनीक नत्रजन की उपयोग से फसल के तहत 548 किलोग्राम तथा बागवानी/कृषि वानिकी की तहत 729 किलोग्राम क्रमशः सबोर एवं पटना केन्द्रों पर किए जा रहे आईएफएस मॉडलों से CO_2–e का उत्सर्जन होता है।

- किसानों के द्वारा किए जा रहे खेती पद्धति की तुलना में पोटाश के रूप मे रुपये 2250/हे० की अतिरिक्त खर्च से गेंहु की खेती से रुपये 13517 की शुद्ध लाभ दर्ज की गयी। वहीं गेंहू की खेती में रुपये 1300/– पोटाश की रूप में अतिरिक्त खर्च से रुपये 4316/– शुद्ध लाभ के रूप में प्राप्त हुआ।

- प्रबंधन विकल्पों के आधयन से सबसे ज्यादा क्षेत्रफल में बहुत कम नत्रजन, मध्यम फास्फोरस एवं पोटाश पाया गया। जिनका प्रतिशत 48.5% था। सबसे कम क्षेत्रफल 3.28% में बहुत कम नत्रजन, अधिक फास्फोरस एवं मध्यम पोटाश देखा गया।

- 2050 में अनुमानित जलवायु परिदृश्य के तहत गेहूं की बुआई 10 दिन आगे करने से शुद्ध लाभ का आंकलन 18.6% अधिक किया गया तथा 11.0% प्रति व्यक्ति आय की संभावना व्यक्त किया गया।

- पूर्वी यमुना केनल क्षेत्रों में खरीफ 2009–2014 के दौरान 7042 हेक्टयर से 22005 सिंचित क्षेत्रों में बढ़ोतरी देखि गयी वहीं रबी में 13834 हेक्टयर से 25476 हेक्टर की वृद्धि दर्ज की गयी।

- टिहरी जिल्ला के कोटेश्वर एवं कंडीसौड़ में मौजूदा कृषि प्रणाली में तकनीकी हस्तक्षेप से दुग्ध उत्पादकता में दो गुनी वृद्धि के साथ साथ दुधारू पशुओं को कृमि नाशक दवा एवं खाध्य पूरक के उपयोग से स्वास्थ में सुधार एवं समय से गर्मी में आना पाया गया। गेंहू के उन्नत किस्मों के प्रयोग से इनकी

उत्पादकता में 20.22% (सिंचित कृषि) एवं 30–40% (बारानी कृषि) की वृद्धि देखी गयी।

- जैविक उत्पादन प्रणाली के तहत खेती में 13 प्रतिशत अतिरिक्त लागत दर्ज किया गया जिसका मुख्य कारण इनमें उपयोग होने वाली जविक खाद की भारी मात्रा है। किन्तु अजैविक उत्पादन प्रणाली की तुलना में जविक उत्पादन प्रणाली से 17 प्रतिशत अधिक (20% प्रीमियम कीमत) शुद्ध लाभ की रूप में दर्ज किया गया, तथा पिछले 6 सालों में मृदा जैविक कार्बन में 22% की वृद्धि देखी गयी।

ICAR-IIFSR: AN APPROACH TOWARDS "FARMERS FIRST"


कृषक गोष्ठी
स्थान- कोटेश्वर

NOTES

NOTES

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch