Proceedings of IRC Meeting

(28th - 30th January and 9th April, 2014)

भाकृअनुप
ICAR

Indian Institute of Soil Science

Nabibagh, Berasia Road

Bhopal – 462 038 (M. P.)

GUIDANCE AND DIRECTIONS

Dr. A. SUBBA RAO,
Director and Chairman, IRC

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Principal Scientist & Head and Member Secretary, IRC

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Principal Scientist and I/c PME Cell

SECRETARIAL ASSISTANCE AND COMPUTER PROCESSING

Smt. GEETA YADAV
Personal Secretary

INTRODUCTORY REMARKS OF THE CHAIRMAN, IRC

The Second Institute Research Council (IRC) meeting for the financial year 2013-14 started on 28th January, 2014 and the Member-Secretary (IRC), Dr. A. K. Biswas welcomed the participants and detailed the agenda items of the IRC. He also stressed on the importance of new RPP documents to replace the erstwhile RPF I, II and III as per the direction of the ICAR. He also stressed upon the need for convergence of HYPM, IRC targets and achievements with those of AAR targets and achievements and consequent RFD document prepared out of these achievements. Dr. A. Subba Rao, Director, IISS in his introductory remark stressed upon the need for identifying gaps in each project for further taking up new activities. Problem identification is the key to the success of any project and scientists have to be very meticulous in going through literature while taking up any new research projects. The institute has to concentrate its all energy and manpower to flagship programmes identified for the XIIth plan, and there has to be a proportionate deployment of manpower to generate useful data on those key theme areas. Significant emphasis has to be given to team research in attempting to answer key research issues and questions, and the experienced Sr. scientists and Principal Scientists have to take lead in this.

RESEARCH PROGRAMMES

Programme I : Soil Health and Input Use Efficiency

Programme II : Conservation Agriculture and Carbon Sequestration vis-à-vis Climate Change

Programme III : Soil Microbial Diversity and Genomics

Programme IV : Soil Pollution, Remediation and Environnemental

STATUS OF PROGRAMME WISE ONGOING PROJECTS

Approved on-going projects
Programme I: Soil Health and Input Use Efficiency

A) **Institute Project**

Sl. No.	Title of the project	Leader and Associates	Unit/ Division	Start	Completion	Remarks
1.	Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol.	Muneshwar Singh A. K. Biswas A. B. Singh R. S. Chaudhary B. P. Meena	PC (LTFE)	April 2002	Long term	Progress is satisfactory and project to be continued
	Comment: Data pertaining to HI values may be checked					**(Action: Dr. Muneshwar Singh)**
2.	Study on nanoporous zeolites for soil and crop management.	K. Ramesh I. Rashmi	Soil Chemistry and Fertility	March 2010	February 2014	Project extended up to May 2014
3.	Studies on soil resilience in relation to soil organic matter in selected soils.	N. K. Lenka, Sangeeta Lenka Brij Lal Lakaria Asit Mandal	Soil Chemistry and Fertility	July 2010	July 2015	Progress is satisfactory and project to be continued
4.	Development of phosphorus saturation indices for selected Indian soils.	I. Rashmi Neenu S	Soil Chemistry and Fertility	April 2011	April 2014	Project concluded
5.	Biofortification of grain sorghum and finger millet varieties with zinc through agronomic measures.	Ajay A.K.Shukla J.K.Saha,	ESS	July 2010	June 2013	Project extended up to June, 2014
6.	Biochar on soil properties and crop performance	Brij Lal Lakaria Pramod Jha A.K. Biswas K.M. Hati J. K. Thakur Vassanda Coumar	Soil Chemistry and Fertility	January, 2012	January 2017	Progress is satisfactory and project to be continued

		A. K. Dubey (CIAE) S. Gangil (CIAE)				
7.	Impact of crop covers on soil and nutrient losses through runoff in Vertisol.	R. K.Singh, J. Somasundaram I. Rashmi	Soil Physics	June 2010	May 2014	Progress is satisfactory and project to be continued for data compilation.
8.	Characterizing rooting behaviours, soil water patterns and nutrient uptake of soybean-chickpea under different tillage and water regimes in Vertisols.	N. K. Sinha M. Mohanty Ritesh Saha I. Rashmi	Soil Physics	June 2011	December 2014	Progress is satisfactory and project to be continued
9.	Soil Resilience and its Indicators under Some Major Soil Orders of India.	Ritesh Saha K.M. Hati Pramod Jha M. Mohanty R.S. Chaudhary	Soil Physics	March 2011	February, 2014	Project concluded
10.	Integrated assessment of some IISS Technologies in enhancing Agro-Ecosystems productivity and livelihood sustainability	Shinogi K.C. Sanjay Srivastava A.B. Singh D.L.N. Rao Radha T.K B.P. Meena N.K. Sinha Hiranmoy Das	ITMU Unit	Jan 2013	Jan 2016	Progress is satisfactory and project to be continued
11.	Nano particle delivery and internalization in plant systems for improving nutrient use efficiency	R. Elanchezian A.K. Biswas Tapan Adhikari K. Ramesh, S. Kundu A.K. Shukla A. Subba Rao	Soil Chemistry and Fertility	July, 2013	July 2016	Progress is satisfactory and project to be continued
	Comment: Results may also be discussed with the scientists involved in nano technology research. **(Action: Dr. R. Elanchezian)**					
12.	Soil quality assessment for enhancing crop productivity in some tribal districts of Madhya Pradesh (TSP)	Rajendiran S. M. L. Dotaniya M. Vassanda Coumar N. K. Sinha Sanjay Srivastava	ESS	July 2011	June 2015	Progress is satisfactory and project to be continued

		A. K. Tripathi S. Kundu				
13.	Evaluating rock phosphates for their suitability for direct application	Sanjay Srivastava K. Ramesh A.K. Tripathi I. Rashmi P Dey	Soil Chemistry and Fertility	October 2013	May 2017	Progress is satisfactory and project to be continued
14.	Evaluation of modified urea materials and agronomic interventions for enhancing nitrogen use efficiency and sustaining crop productivity	B.P. Meena K. Ramesh Neenu, S. R. Elanchezhian	Soil Chemistry and Fertility	October 2013	September 2017	Progress is satisfactory and project to be continued
	Comment Treatment structure may be discussed with the project personnel before the initiation of experiments**:**					**(Action: Dr. B.P.Meena)**

B) **Externally Funded Projects**

15.	Understanding the mechanism of variation in status of a few nutrietionally important micronutrients in some important food crops and the mechanism of micronutrient enrichment in plant parts (NAIP project)	A.K. Shukla Muneshwar Singh Tapan Adhikari	MSN	Feb. 2009	March 2014	Project concluded.
16.	Nano-technology for Enhanced Utilization of Native-Phosphosrus by Plants and Higher Moisture Retention in Arid Soils (NAIP Project)	Tapan Adhikari A. K. Biswas S. Kundu	ESS	July 2008	March 2014	Project concluded.
17.	GPS and GIS based model soil fertility maps for selected districts for precise fertilizer recommendations to the farmers of India.	A. Subba Rao Pradip Dey (ExecutivePI) A. K. Shukla Muneshwar Singh Sanjay Srivastava R. H. Wanjari Hiranmoy Das	STCR	June 2009	To Continue	Progress is satisfactory and project to be continued as per financial sanctioned of DOAC, MOA, GOI.
18.	Network Project on Organic Farming	A. B. Singh K. Ramesh Brij Lal Lakaria S. Ramana	Soil Biology	July 2004	March 2014	Project is extended up to 2015.

		J.K. Thakur				

Programme II: Conservation Agriculture and Carbon Sequestration vis-à-vis Climate Change

A. Institute Projects

19.	Soil carbon saturation and stabilization in some soils in India.	Pramod Jha, Brij Lal Lakaria Ritesh Saha S.R. Mohanty A.K. Biswas Muneshwar Singh	Soil Chemistry and Fertility	March 2010	February 2014	Project concluded.
20.	Evaluating conservation tillage on various sequences/rotations for stabilizing crops productivity under erratic climatic conditions in black soils of Central India	J. Somasundaram R. S. Chaudhary Neenu S Ajay	Soil Physics	March 2010	June 2016	Progress is satisfactory and project to be continued
21.	Assessing impacts of climate change on different cropping systems in Central India and evaluating adaptation studies through crop simulation models	M. Mohanty K.M. Hati N.K. Sinha Sangeeta Lenka Pramod Jha Neenu S. R. S. Choudhary R. Elanchezian A. Subba Rao	Soil Physics	June 2011	May 2016	Progress is satisfactory and project to be continued
22.	Tillage and manure interactive effects on soil aggregate dynamics, soil organic carbon accumulation and by pass flow in vertisols	Sangeeta Lenka M. C. Manna Brij Lal Lakaria R. K. Singh R. C. Singh (CIAE)	Soil Physics	June 2008	June 2014	Project extended up to March 31, 2015 (to take up kharif 2014 crop) as per PI's request to study water transmission characteristics.

B. Externally Funded Projects

23.	Evaluating Conservation Agriculture for Stabilizing Crop Productivity and Carbon Sequestration by Resilient Cropping Systems/Sequences under aberrant Climatic Conditions in Black Soils of Central India.	J. Somasundaram R. S. Chaudhary M. Vassanda Coumar K. M. Hati A. Subba Rao Pramod Jha K. Ramesh, Ajay	Soil Physics	August 2011	March 2014	Application received for continuance of the project as in house project.
	Comment: Decision to continue the project under in-house or under CRP on CA would be taken based on approval of EFC .					**(Action: Dr. J. Somasundaram)**
24.	Quantifying Green house gases (GHGs) emissions in soybean-wheat system of M.P. (MPCOST)	Sangeeta Lenka N.K. Lenka S. Kundu A. Subba Rao	Soil Physics	June 2011	June 2014	Project extended upto September, 2014
	Comment Statistical analysis of data is to be performed					**(Action: Dr. Sangeeta Lenka)**

Programme III – Soil Microbial Diversity and Biotechnology

A. Institute Projects

25.	Structural and functional diversity of microbes in soil and rhizosphere	Santosh R. Mohanty M.C. Manna Muneshwar Singh	Soil Biology	January 2010	January 2014	Project concluded
26.	Consequences of transgenic cotton on soil microbial diversity	Asit Mandal J.K. Thakur Asha Sahu M.C. Manna	Soil Biology	March 2011	February 2014	Project extended up to August 2014.
27.	Actinomycetes diversity in Daccan plateau, hot, arid region and semi arid eco-sub-region (AER 3 and 6) and evaluation of their PGPR activity.	Radha T.K. D.L.N. Rao	Network Coordinate (BF)	August 2010	April 2014	Project concluded.
	Comment: Check grain yield vis-à-vis stover yield.					**(Action: T. K . Radha)**

28.	Developing technique for acceleration of decomposition process using thermophilic organisms	Asha Sahu U. B. Singh (NBAIM) J.K. Thakur V. K Bhargav (CIAE) H.L. Kushwaha (CIAE) Asit Mandal, M.C. Manna A. Subba Rao	Soil Biology	September 2011	August 2014	Progress is satisfactory and project to be continued.
29.	Chemical and Microbiological Evaluation of Biodynamic and Organic Preparations.	J. K. Thakur, Asha Sahu, Asit Mandal A. B. Singh.	Soil Biology	June 2011	June 2014	Progress is satisfactory and project to be continued.
30..	Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating microbes	K. Bharati, J.K. Saha, S.R. Mohanty Shinogi K C	Soil Biology	June 2012	June 2016	Progress is satisfactory and project to be continued.
31.	Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes	K Bharati T K Radha, S R Mohanty	Soil Biology	December 2013	December 2016	Progress is satisfactory and project to be continued.

B. Externally Funded Projects

32.	Metagenomic characterization and spatio-temporal changes in the prevalence of microbes involved in nutrient cycling in the rhizoplane of bioenergy crops (DST)	Santhosh R. Mohanty Asit Mandal K. Bharati	Soil Biology	November 2011	November 2014	Progress is satisfactory and project to be continued..
33.	Novel bio-filtration method using selected mesophilic fungi for removal of heavy metals from municipal solid waste in Madhya Pradesh (MPCOST).	M.C. Manna Asit Mandal Asha Sahu J. K. Thakur S. Ramana A. Subba Rao	Soil Biology	July 2012	July 2014	Progress is satisfactory and project to be continued

Programme IV: Soil Pollution, Remediation and Environnemental Security

A. Institute Project

34.	Phyto-extraction of Cr by some floriculture plants.	S. Ramana A.K. Biswas Ajay	Soil Biology	June 2009	December 2013	Project concluded.
35.	Non point sources of phosphorus loading to upper lake, Bhopal.	M. Vassanda Coumar M. L. Dotaniya Vasudev Meena J. Somasundaram J.K. Saha	ESS	April 2011	March 2014	Project concluded
36.	Interaction among tannery effluents constituents on heavy metals uptake by spinach.	M. L. Dotaniya J. K. Saha Rajendiran S M. Vassanda Coumar S. Kundu	ESS	January 2012	December 2016	Progress is satisfactory and project to be continued
37.	Impact of Long Term Use of Sewage Water Irrigation on Soil and Crop Quality in Bhopal region of Madhya Pradesh	Vasudev Meena M. L. Dotaniya Vassanda Coumar Rajendiran S Asha Sahu S. Kundu	ESS	August 2013	July 2016	Progress is satisfactory and project to be continued

B. Externally Funded Projects

Nil

Contractual Projects

S. No.	Title	Sponsorer	PI & Co-PI	Division/Unit	Period		Remarks
38.	Evaluation of plant nutrition product (NP - 1) for nutrient use efficiency in cereal crops	Nagarjuna Fertilizers and Chemicals Pvt. Ltd., Hyderabad	R. Elanchezhian A.K. Biswas K Ramesh, N.K. Lenka, A. Subba Rao	Soil Chemistry and Fertility	December 2012	December 2013	Project is extended upto December 2014
39.	Effect of urea pestlile productivity and nutrient use efficiency in some soils of India	Sandvik India Pvt. Ltd.	Pramod Jha B.L. Lakaria A.K. Biswas Pradip Day A. Subba Rao B. Kumar-Ranchi S.R. Singh – Barrackpur	Soil Chemistry and Fertility	December 2012	December 2014	Project is satisfactory and project to be continued
40.	Investigations on the safe use of sludge in agriculture land generated from effluent from plant of a soft drink.	Coca Cola India Pvt Ltd, Gurgaon	J.K. Saha A. Subba Rao S. Kundu Vassanda Coumar	ESS	July 2012	June 2014	Project is satisfactory and project to be continued
41.	Testing a new slow release 14-7-14 NPK fertilizer for its efficiency under field conditions	PRII, Gurgaon	Dr. Sanjay Srivastava K. Ramesh P. Dey A.K. Biswas A. Subba Rao	Soil Chemistry and Fertility	July 2013	June 2014	Project is satisfactory Project to be continued

New Projects Presented

Institute Projects

Sl. No	Title	PI & Co-PI	Division	Period		Remarks
42.	Determination of baseline concentration for delineation contaminated areas in black soils of central India	Rajendiran S J. K. Saha S. Kundu	ESS	May 2014	May 2017	Approved under Programme- IV
43..	Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat	Pankaj Tiwari A.K. Shukla R. Elanchezhian B.P. Meena	PC (Micronutrient)	October 2014	June 2017	Approved under Programme - I
44.	Weed Management for major cropping systems under conservation agriculture in vertisols	A.K. Vishwakarma R.S. Choudhary N.K. Sinha B.P. Meena K. Bharati Scientist from DWR, Jabalpur	Soil Physics	June 2014	May 2016	Approved under Programme - II

Project Concluded (9 Nos.)

Sl. No.	Programme No.	Sl. No. in IRC Proceedings	Title of Project	PI and Co-PI	Division/Unit	Period	
1.	I	4	Development of phosphorus saturation indices for selected Indian soils.	I. Rashmi Neenu S	Soil Chemistry and Fertility	April 2011	April 2014
2.		9	Soil Resilience and its Indicators under Some Major Soil Orders of India	Ritesh Saha K.M. Hati Pramod Jha M. Mohanty R.S. Chaudhary	Soil Physics	March 2011	February, 2014

3.		15	Understanding the mechanism of variation in status of a few nutrietionally important micronutrients in some important food crops and the mechanism of micronutrient enrichment in plant parts (NAIP project)	A.K. Shukla Muneshwar Singh Tapan Adhikari	Micronutrient	Feb. 2009	March 2014
4		16.	Nano-technology for Enhanced Utilization of Native-Phosphosrus by Plants and Higher Moisture Retention in Arid Soils (NAIP Project)	Tapan Adhikari A. K. Biswas S. Kundu	ESS	July 2008	March 2014
5	II	19	Soil carbon saturation and stabilization in some soils in India.	Pramod Jha, Brij Lal Lakaria Ritesh Saha S.R. Mohanty A.K. Biswas Muneshwar Singh	Soil Chemistry and Fertility	March 2010	February 2014
6.	III	25	Structural and functional diversity of microbes in soil and rhizosphere	Santosh R. Mohanty M.C. Manna Muneshwar Singh	Soil Biology	January 2010	January 2014
7.		27	Actinomycetes diversity in Daccan plateau, hot, arid region and semi arid eco-sub-region (AER 3 and 6) and evaluation of their PGPR activity.	Radha T.K. D.L.N. Rao	Network Coordinate (BF)	August 2010	April 2014
8.	IV	34	Phyto-extraction of Cr by some floriculture plants.	S. Ramana A.K. Biswas Ajay	Soil Biology	June 2009	December 2013
9.		35.	Non point sources of phosphorus loading to upper lake, Bhopal.	M. Vassanda Coumar M. L. Dotaniya Vasudev Meena J. Somasundaram J.K. Saha	ESS	April 2011	March 2014

Concluding Remarks of the Chairman

Before his concluding remarks the house appreciated the work of Dr. A. Subba Rao, Director, IISS as chairman of IRC for last one decade and gave a big round of applause. In his concluding remarks the chairman expressed satisfaction in research and developmental activity undertaken by the institute in classical areas of soil science and in being able to touch upon new areas of soil science research namely soil biodiversity and biotechnology, climate change and carbon sequestration, soil quality and resilience and input use efficiency. He urged upon the scientists to work in these new areas in a mission mode and to generate enough data to be able to contribute meaningfully to the growth and development of the nation. The institute over the last over two decades has undertaken more than 100 projects and lot of information generated which need to be consolidated in different (8-10) theme areas and published so as to show visibility of the institute in a better way. HOD's may take lead in consolidating this information. He expressed his apprehension about accommodating the works of Co-workers in flagship programme and suitable mechanisms need to be devised. *The chairman expressed his thankfulness to all the members of the IRC for participating and contributing to the research and development activity of the institute and wished them best of luck for future.

*The team leaders have to ensure that all the participating team members get sufficient scope to develop work in their field of specialization and contribute meaningfully in the group and obtain due credit for his/her work.

Division wise/Co-coordinating Unit wise Number of Projects

Sl. No.	AICRP/ Division	Sl. No. of Project	Total
1.	AICRP on LTFE	1	1
2.	AICRP on STCR	-	-
3.	AICRP on MSN	-	-
4.	AINP on Biofertilizers	-	-
5.	Soil Chemistry and Fertility	2, 3, 6,11, 13, 14	6
6.	Soil Physics	7, 8, 20, 21, 22, 44	6
7.	Soil Biology	26, 28, 29, 30, 31	5
8.	Environnemental Soil Science	5, 12, 36, 37, 42	5
9.	ITMU	10	1

Division-wise no. of Externally Funded Projects

Sl. No.	Centre/Co-coordinating Unit	Sl. No. of Project	Total
1.	AICRP LTFE	-	-
2.	AICRP STCR	17	1
3.	AICRP MSN	43	1
4.	AINP BF	-	-
5.	Soil Chemistry and Fertility	-	-
6.	Soil Physics	23, 24	2
7.	Soil Biology	18, 32, 33	3
8.	Environmental Soil Science	-	-
9.	ITMU	-	-

Division-wise no. of Contractual Projects

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	-	-
2	AICRP STCR	-	-
3	AICRP MSN	-	-
4	AINP BF	-	-
5	Soil Chemistry and Fertility	38, 39, 41	3
6	Soil Physics	-	-
7	Soil Biology	-	-
8	Environmental Soil Science	40	1
9	ITMU	-	1

New Projects Approved in IRC Meeting of January, 2014

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	-	-
2	AICRP STCR	-	-
3	AICRP MSN	43	1
4	AINP BF	-	-
5	Soil Chemistry and Fertility	-	-
6	Soil Physics	44	1
7	Soil Biology	-	-
8	Environmental Soil Science	42	1
9	ITMU	-	-

PROJECT (SERIAL NUMBERS) WITH INDIVIDUAL SCIENTIST

S. No.	Name of Scientist	Designation	Sl. Of projects	
			PI	Co-PI
1	**Dr. A. Subba Rao**	**Director**	17	11, 21,23, 24, 28, 33,
AICRP on LTFE				
1	Dr. Muneshwar Singh*	Project Co-coordinator	1	17
2	Dr. R. H. Wanjari	Senior Scientist	-	17
AICRP on STCR				
1	Dr. Pradip Dey*	Project Co-ordinator	17	13
2	Dr. Abhishek Rathore**	Scientist (SS)	-	-
3	Dr. Hiranmoy Das	Scientist	-	10, 17
AICRP on MSN				
1	Dr. A.K. Shukla	Project Co-ordinator	-	5, 11, 17, 43
2.	Mr. Pankaj Tiwari	Scientist	43	-
AINP on BF				
1	Dr. D.L.N. Rao	Project Co-ordinator	-	10
2	Ms. T.K. Radha	Scientist	-	10, 31

Soil Chemistry and Fertility				
1	Dr. A. K. Biswas*	Head of Division & Pr. Scientist	-	1, 6, 11
2	Dr. Sanjay Srivastava	Principal Scientist	13	10, 12, 17
3	Dr. Brij Lal Lakaria	Principal Scientist	6	3, 18, 22,
4	Dr. R. Elanchezian	Principal Scientist	11	14, 21, 43
5	Dr. N.K. Lenka	Senior Scientist	3	24
6	Dr. K. Ramesh	Senior Scientist	2	11, 13,14, 18, 23,
7	Dr. Pramod Jha	Senior Scientist	19,	6, 21, 23
8	Dr. I. Rashmi	Scientist	-	2, 7, 8, 13
9	Dr. Neenu S	Scientist	-	14,20, 21
10	Dr. J.S.V. Tenshia**	Scientist	-	-
11	Dr. B.P. Meena	Scientist	14	1, 10, 43, 44
Soil Physics Division				
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	-	1, 20, 21, 23, 44
2	Dr. Kuntal M. Hati	Principal Scientist	-	6, 21, 23
3	Dr. R.K. Singh	Scientist Senior Scale	7	22
4	Dr. Ritesh Saha	Senior Scientist	-	8
5	Dr. J. Somasundaram	Senior Scientist	20, 23	7
6.	Dr. A.K. Vishwakarma	Senior Scientist	44	-
6	Sh. M. Mohanty	Scientist	21	8
7	Dr.(Mrs.) Sangeeta Lenka	Scientist	22, 24	3, 21
8	Dr. N.K. Sinha	Scientist	8	10,12,21, 44
Soil Biology				
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	33	22, 26, 28
2	Dr. A.K. Tripathi	Principal Scientist	-	12, 13
3	Dr. A.B. Singh	Principal Scientist	18	1, 10, 29
4	Dr. S. Ramana	Principal Scientist	-	18, 33
5	Dr. S.R. Mohanty	Senior Scientist	32	30, 31
6	Dr. K. Bharati	Senior Scientist	30, 31	32, 44
7	Dr. Asit Mandal	Scientist	26	3, 28, 29, 32,33
8	Dr. Asha Sahu	Scientist	28,	26, 29, 33, 37

9	Dr. Jyoti Kumar Thakur	Scientist	29	6, 18, 26, 28, 33
Environmental Soil Science				
1	Dr. J.K. Saha	Head of Division and Prin. Scientist	-	5, 30, 36, 42
2.	Dr. S. Kundu	Principal Scientist	-	11, 12, 24, 36,37, 42
3.	Dr. Ajay	Principal Scientist	5	20, 23,
4	Dr. Tapan Adhikari	Principal Scientist	-	11
5	Dr. Vasanda Coumar	Scientist	-	6, 12, 23, 36, 37
6	Dr. M.L. Dotaniya	Scientist	36	12, 37
7	Dr. S. Rajendiran	Scientist	12, 42	36, 37
8	Mr. Vasudev Meena	Scientist	37	-
Institute Technology management Unit (ITMU)				
1.	Dr. Shinogi K C	Scientist	10	30
Scientists from other Institutes				
1	Dr. R.C. Singh	Principal Scientist, CIAE, Bhopal	-	22
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	6
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	6
4	Dr. V. K. Bhargav	Senior Scientist, CIAE, Bhopal	-	28
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	28
6	Udai B. Singh	Mau	-	28
7.	B. Kumar	Ranchi	-	-
8.	S.R. Singh	Barrackpur	-	-

* Operational/Executive PI, ** On deputation/Leave.

* Position as on

NUMBER OF PROJECTS WITH INDIVIDUAL SCIENTIST

S. No.	Name of Scientist	Designation	No. of projects		Total
			PI	Co-PI	
1	**Dr. A. Subba Rao**	**Director**	1	6	7
AICRP on LTFE					
1	Dr. Muneshwar Singh*	Project Co-coordinator	1	1	2
2	Dr. R.H. Wanjari	Senior Scientist		1	1
AICRP on STCR					
1	Dr. Pradip Dey*	Project Co-ordinator	1	1	2
2	Mr. Hiranmoy Das	Scientist	-	2	2
AICRP on MSN					
1	Dr. A.K. Shukla	Project Co-ordinator	-	4	4
2	Mr. Pankaj Tiwari	Scientist	1	-	1
AINP on BF					
1	Dr. D.L.N. Rao	Project Co-ordinator	-	1	1
2	Ms.T.K. Radha	Scientist	-	2	2
Soil Chemistry and Fertility					
1	Dr. A.K. Biswas*	Head of Division & Prin. Scientist	-	3	3
2	Dr. Sanjay Srivastava	Principal Scientist	1	3	4
3	Dr. Brij Lal Lakaria	Principal Scientist	1	3	4
4	Dr. R. Elanchezian	Principal Scientist	1	3	4
5	Dr. N.K. Lenka	Senior Scientist	1	1	2
6	Dr. K. Ramesh	Senior Scientist	1	5	6
7	Dr. Pramod Jha	Senior Scientist	1	3	4
8	Dr. I.Rashmi	Scientist	-	4	4
9	Dr. Neenu S	Scientist	-	3	3
10	Dr. J.S.V. Tenshia**	Scientist	-	-	-
11	Dr. B.P. Meena	Scientist	1	4	5

Soil Physics					
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	-	5	5
2	Dr. Kuntal M. Hati	Principal Scientist	-	3	3
3	Dr. R.K. Singh	Scientist Senior Scale	1	1	2
4	Dr. Ritesh Saha	Senior Scientist	-	1	1
5	Dr. J. Somasundaram	Senior Scientist	2	1	3
6	Dr. A.K. Vishwakarma	Senior Scientist	1	-	1
7	Dr. M. Mohanty	Scientist	1	1	2
8	Dr.(Mrs.) Sangeeta Lenka	Scientist	2	2	4
9	Dr. N.K. Sinha	Scientist	1	4	5
Soil Biology					
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	1	3	4
2	Dr. A.K. Tripathi	Principal Scientist	-	2	2
3	Dr. A.B. Singh	Principal Scientist	1	3	4
4	Dr. S. Ramana	Principal Scientist	-	2	2
5	Dr. S.R. Mohanty	Senior Scientist	1	2	3
6	Dr. K. Bharati	Senior Scientist	2	2	4
7	Dr. Asit Mandal	Scientist	1	5	6
8	Dr. Asha Sahu	Scientist	1	4	5
9	Dr. Jyoti Kumar Thakur	Scientist	1	5	6
Environmental Soil Science					
1	Dr. J.K. Saha	Head of Division and Prin. Scientist	-	4	4
2	Dr. S. Kundu	Principal Scientist	-	6	6
3	Dr. Ajay	Principal Scientist	1	2	3
4	Dr. Tapan Adhikari	Principal Scientist	-	1	1
5	Dr. Vasanda Coumar	Scientist	-	5	5
6	Dr. M.L. Dotaniya	Scientist	1	2	3
7	Dr. S. Rajendiran	Scientist	2	2	4
8	Mr. Vasudev Meena	Scientist	1	-	1
Institute Technology Management Unit (ITMU)					
1.	Dr. Shinogi K C	Scientist	1	1	2

Scientists from other Institutes					
1	Dr. R.C. Singh	Principal Scientist, CIAE, Bhopal	-	1	1
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	1	1
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	1	1
4	Dr. Vinod Bhargav	Senior Scientist, CIAE, Bhopal	-	1	1
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	1	1
6	Udai B. Singh	Mau	-	1	1

* Operational/Executive PI, ** On deputation/Leave.

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*On leave/deputation /training

1	Dr. Abhisek Rathore*	Scientist	On deputation (ICRISAT)
2	Dr. J.S.V. Tenshia*	Scientist	Child Care Leave

Annexure – I

Progress of Approved on-going projects:

Programme I: Soil Health and Input Use Efficiency

A Institute Project

1 Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol.

During the last six months a field experiment was conducted using maize as the test crop. Observations relating to dry matter yield, grain yield and related parameters were recorded. Analysis of previous chickpea was completed and input –output balance for N, P and K calculated for first year maize-chickpea rotation. As per the technical programme, the same treatments will be continued with the maize-chickpea sequence with fixed yield target of 5 t maize and 1.5 t chickpea for 4 years. Field experiment with chickpea is in progress. Also analysis of plant samples of maize experiment is going on.

2 Study on nanoporous zeolites for soil and crop management.

As per the recommendation of previous IRC, NBSS&LUP was in contact for the identification of various compounds in the zeolite samples. However, the XRD is under repair at NBSS&LUP and the samples could not be analyzed. Once the samples are analysed, RPF 3 will be presented during Apr-May 2014 and the project will be completed.

3 Studies on soil resilience in relation to soil organic matter in selected soils.

During the period under report, the pot experiment was continued with three soil types (Alfisol, Inceptisol and Vertisol) with maize (Kanchan hybrid) sown on 09 July, 2013 during *kharif* season. The crop was harvested 60 days after planting. The above ground biomass was recorded during harvest. As a part of the 4th objective, soil samples (Inceptisol, clay loam soil) from three carbon levels and the management treatments were collected and tested for plasticity index. To see the impact of reclaimation, the treatment samples were collected after five crop seasons. The data shows that with depletion of native SOC, both the liquid limit and plastic limit get affected. To assess the relation between SOC content and resilience capacity of soil, an incubation study was conducted with Cu stress, applied at 0 and 200 ppm, in two soil types, viz. sandy loam and clay loam. The data on microbial count, soil respiration, dehydrogenase and FDA are being presented.

4 Development of Phosphorus saturation indices for some selected soils of India.

The incubated soils with different levels of P were used for column experiment to study P leaching and distribution in soil layers which was subjected to 11 batches of leaching events. The cumulative volume of leachate in four soils was determined at periodic intervals and from 7th to 11th batch of leaching whole 500ml of volume was collected resulting in complete saturation of soil columns. Reactive P concentration in leachate was first observed at 400% and 800% Psmax treatment inceptisol at 5th batch of leaching event, followed by alfisol in 7th batch of leaching and vertisol 8th batch of leaching and ultisol 7th leaching event. The In Vertisol (Jabalpur), Inceptisol (Delhi), Alfisol (Bangalore) and Ultisol (Trivandrum) the RP concentration in leachate ranged from 0 to 9.76µg ml^{-1}, 0 to 12.31 µg ml^{-1}, 0 to 10.59 µg ml^{-1} and 0 to 8 µg ml^{-1} in P1 to P8 treatments respectively. The movement of P in column section was revealed with increase in total P content in lower layers of treated soils (5-10 and 10-15cm) and in upper layer (0-5cm) of untreated soil with higher P loading rates.

5. Biofortification of grain sorghum and finger millet varieties with zinc through agronomic measures

6. Biochar on soil properties and crop performance

Soil samples after wheat and spinach were analyzed for changes in soil properties such as pH, EC, available nutrients and nutrient uptake by the crops. The results indicated improvement due to biochar application with NPK in most of soil properties over FYM. The combined use of biochar and FYM resulted in the highest improvement in these soil properties and plant nutrient uptake.

7. Impact of crop covers on soil and nutrient losses through runoff in Vertisol.

The experiment is being conducted to assess the impact of crop covers on soil and nutrient losses through run off in vertisol at IISS Research Farm, Bhopal. The seven treatments were consisted with three sole (soybean, maize and pigeon pea) and three intercrops viz, soybean + maize (1:1), soybean + pigeon pea (2:1) and maize + pigeon pea (1:1) with cultivated fallow as a control. During this period, crops were sown on June 23, 2013 with optimum soil moisture content. During crop growth period, the observations on rainfall, runoff and soil loss and crop yield were recorded. The total rainfall during 2013 was 1418 and during crop period was 1347 mm. There were ten runoff events during crop period of 2013.The rainfall distribution was 348.6 (31.6%), 486.0 (34.3%), 342 (24.1%), 27.6 (1.9%) and 43.0 (3.0%) mm in month of June, July, August, September and October, respectively. Among the sole crops, the maximum runoff and soil loss was recorded under pigeon pea and lowest was in soybean crop in case of sole crops. But in case of intercrops, the maximum runoff and soil loss was in maize and pigeon pea (1:1) and lowest in soybean + pigeon pea (2:1). The maximum nutrient losses were recorded under cultivated fallow plot than sole and intercrop. The runoff and soil loss was higher in cultivated fallow as compared to cropped plot due to higher runoff and soil loss in absence of vegetation (crop covers).The per cent reduction of runoff and soil loss was higher in soybean and lowest was in pigeon pea but in case of inter crops, it was higher soybean + pigeon pea (2:1) and lowest in maize + pigeon pea (1:1).

8. Characterizing rooting behaviours, soil water patterns and nutrient uptake of soybean – chickpea under different tillage and water regimes in Vertisols.

During the period under report, the pot experiment was continued with three soil types (Alfisol, Inceptisol and Vertisol) with maize (Kanchan hybrid) sown on 09 July, 2013 during *kharif* season. The crop was harvested 60 days after planting. The above ground biomass was recorded during harvest. As a part of the 4th objective, soil samples (Inceptisol, clay loam soil) from three carbon levels and the management treatments were collected and tested for plasticity index. To see the impact of reclaimation, the treatment samples were collected after five crop seasons. The data shows that with depletion of native SOC, both the liquid limit and plastic limit get affected.

To assess the relation between SOC content and resilience capacity of soil, an incubation study was conducted with Cu stress, applied at 0 and 200 ppm, in two soil types, viz. sandy loam and clay loam. The data on microbial count, soil respiration, dehydrogenase and FDA are being presented.

9. Soil Resilience and its Indicators under Some Major Soil Orders of India.

Incubation study conducted with various soil amendments i.e. FYM, biochar and, poultry manure @ 25 t ha^{-1} and fly ash @ 1% weight of soil with and without Cu stress to characterize soil resilience as affected by soil amendments in *Vertisol.* The biological indicators like soil microbial biomass carbon (SMBC) and dehydrogenase enzyme activity (DHA) was measured at periodic interval up to 10th week and physical indicators of resilience were measured at the end of incubation period (10th week). Study showed that Californian Bearing Ratio (CBR) and Resilient modulous values were highest in the treatments with FYM + fly ash (2.79% and 28.88 MPa, respectively) followed by poultry manure + fly ash (2.25% and 23.28 MPa, respectively) depicting their higher strength due to addition of fly ash. Results indicated that application of Cu stress significantly reduced the SMBC and DHA activity up to 4-6 week in case of various treatments. The SMBC and DHA under Cu stress among various treatments ranges from 180.12 to 455.64 mg/kg of soil and 3.21 to 8.73 µg TPF g^{-1} soil h^{-1}, respectively. Soil without any amendment showed the lower resistance, hence higher reduction in SMBC and DHA (40.20 and 46.13%, respectively) followed by other treatments (range 7.92 – 20.97 and 3.44 – 26.76 %) at the end of 4-6 weeks after incubation.The resistance index of the soil studied under Cu stress is found better in either biochar or biochar + fly ash treatment with respect to SMBC (0.70) and DHA (0.61). The maximum soil resilience index was found under FYM + fly ash (0.74) followed by biochar + fly ash (0.71), poultry manure + fly ash (0.70) followed by other treatments.

10.. Integrated assessment of some IISS Technologies in Enhancing Agro-Ecosystems productivity and livelihood sustainability

Sowing of the *Kharif* Soybean was done in thirteen farmers' fields of the Mengrakalan village of Berasia, Bhopal. The crop was harvested in the end of the September and samples of the harvest were collected from three sites from each technology demonstration plot (T_1-IPNS-I, T_2-IPNS-2, T_3-STCR, T_4-BBF and Farmers' practice) for every farmer. Fresh weight and dry weight, average number of pods per plant, grain yield and straw yield of samples from each plot were recorded. Three farmers have been removed for the *rabi* wheat demonstration because of their inability to continue with the

field trials. Soil samples were collected from nine plots after the soybean harvest and analysed for the available nutrients to calculate the fertilizer requirement (STCR) for wheat. And the sowing of wheat was done accordingly during October-November. The average grain yield of the crop for the four treatments were IPNS-I - 11.2 q/ha, IPNS-2 - 12.3 q/ha, STCR - 11.3 q/ha, BBF - 8.3 q/ha, and Farmers' practice - 9.8 q/ha. The analysis shows there is an increase of 14.3% in IPNS – I, 25.9% in IPNS -2, 15.2% in STCR over farmers practice. Whereas in BBF there was 15.2% decrease in yield over farmers' practice as there was less germination in those plots due to low seed rate used for sowing compared to the rest.

11. Nano particle delivery and internalization in plant systems for improving nutrient use efficiency

The impact of nanoparticles on growth and metabolism of wheat and maize plants were studied under hydroponic system using ZnO, CuO and Fe_3O_4 nanoparticles. Various growth parameters viz. plant height, root length, shoot biomass, root biomass and chlorophyll content were recorded at different duration of time upto 45 DAS. The activity of antioxidant enzymes viz. SOD, catalase and peroxidase were recorded in maize and wheat plants treated with nanoparticles to ascertain their impact on plant metabolism.

12. Soil quality assessment for enhancing crop productivity in some tribal districts of Madhya Pradesh (TSP)

Available micronutrients status of soils of Jhabua district was studied and all the micronutrients were found to be in sufficient range except Zn. Soil indicators were identified for this district and the soil indicators that influence the productivity were soil texture particularly clay content, slope, soil depth, gravel content, SOC, pH, available N, P, K, S and Zn and DHA. Soil quality index (SQI) was calculated and SQI map was prepared for Jhabua district. Mostly these soils fall under moderate to poor quality categories. Soil fertility maps were prepared for Alirajpur district with respect to pH, SOC, Available P and K, and analysis of other parameters is under progress. Geo-referenced soil samples were collected from Dhar and Tirla blocks of Dhar districts and analysis of physico-chemical properties was initiated for Dhar district.

13. Evaluating rock phosphates for their suitability for direct application

This project has started only three months back.
Work required to be done

1. To document/compile the soil-crop-climate conditions (based on known principles) suitable for direct application of RPs (to be completed within six months from the date of start)
2. Evaluation of different accessible natural or modified rock phosphate (To start from January, 2014)

The work at S. No. 1 is in progress, will be completed and presented on or after March 31, 2014.
Work at S. No. 2 will be started shortly. The PI is in the process of procuring different rock phosphates.

14. Evaluation of modified urea materials and agronomic interventions for enhancing nitrogen use efficiency and sustaining crop productivity

The project has been started as per the activity chart. A nutrient exhaustive crop (Rabi maize) has been sown in the experimental area. Two field experiments as per technical programme will be started during *kharif* season 2014. Meanwhile, compilation of materials for a bulletin on nitrogen use efficiency in Indian context is in progress.

B. Externally Funded Projects

15.. Understanding the mechanism of variation in status of a few nutritionally important cronutrients in some important food crops and the mechanism of micronutrient enrichment in ınt parts (NAIP project)

The demonstration/validation trials in pigeon pea and wheat crop are in progress. The final presentation will be made in next IRC.

16. Nano-technology for Enhanced Utilization of Native-Phosphosrus by Plants and Higher Moisture Retention in Arid Soils (NAIP Project)

Under the project as per approved programme schedule, during this extended period a field trial at IISS, Bhopal to evaluate the effect of different doses of nano rock phosphate on the growth, yield and phosphorus uptake by the maize crop and a multi location trials are being conducted at Bhubaneswar (Orissa), Anand (Gujarat), Akola (Maharasthra) and Hyderabad (AP) to evaluate the effect of nano rock phosphate on different cropping system in comparison to conventional P fertilizer. Experimental

result of the field trial at IISS, Bhopal, revealed that application of nano rock phosphate @45kg/ha for maize crop was effective as @60kg/ha. In response to the comments of previous IRC "***Packaging of nano particles as a fertilizer product is to be the most important part of the project"*** NRP was coated with the different materials viz. (i) Oleic acid (ii) mixed with FYM (iii) Pine oleo resin, (iv) linear Alkyl Benzene Sulphonate (LAS) (v) Gum Acacia, and mixed with POR coated urea with different percentage of NRP (15%, 20%, 25% and 35%) for direct application in field. Field study and pot culture studies are being conducted with those materials taking wheat as a test crop.

17. GPS and GIS based model soil fertility maps for selected districts for precise fertilizer recommendations to the farmers of India.

About 1839 soil fertility maps (macro and micro-nutrients, organic C, pH, EC etc) based on GPS and GIS have been prepared for 171 major districts using soil testing data of 84000 geo-referenced soil samples. GPS and GIS based soil fertility maps of 171 districts of India showed that almost all soils of different districts of North, South, East and West zones are deficient in available N. In North Zone majority of the soils are medium to high in available P and available K status. Only few soils (1-4%) in 2-3 districts are Low in P and K. In West Zone majority of soils are low to medium in available P except Gujarat. About 80-90% area in Gujarat is medium to high in available P. Altogether only 1-3% area in west zone is low in available K. Most of the soils in Gujarat and Maharashtra are high and Rajasthan are in medium in available K. In East Zone, most of the area in Orissa (97-100%) is low in available P. Majority of the soils of Assam and West Bengal are medium to high in available P status of soils . Majority of the soils in East Zone are medium in available K except Kurda district in Orissa where 60% of the area is low in available K. In South Zone, majority of the soils in Andhra Pradesh, Tamil Nadu and Kerala are high in available P. In Karnataka, most of the soils are medium in available P. Available K content of majority soils of Tamil Nadu, Karnataka, Kerala are medium and majority of the soils of Andhra Pradesh are high in available K. Micronutrient fertility maps showed that almost all soils of Punjab, Haryana ,and Himachal Pradesh in North Zone are high in available Zn whereas majority of Uttar Pradesh soils are medium in available Zn Majority of soils of this zone are high in available Fe, Cu and Mn with minor exceptions .Manganese deficiency is wide spread in 9 districts of Punjab (15-56%). Fe deficiency was observed over an area of 25-61% in Fatehabad and Hisar districts. In West Zone, Zn and Fe deficiency is wide spread in Maharashtra. Other-wise, majority of soils are sufficient in available Zn, Fe, Cu and Mn. In East Zone, majority of soils are high in available micro nutrients. Zn deficiency was observed only in West Bengal, In South Zone Majority of soils of Andhra Pradesh, Karnataka, and Kerala are sufficient in available micro nutrients. In Tamil Nadu, about 50-60% of the area is low in available Zn and 20-30% deficient in Cu. All soils of Wayanad district in Kerala are deficient in Mn.

18. Network Project on Organic Farming

As per recommendations of Annual Group meeting, NPOF, held at Sikkim during April, 26-27, 2013, the experiment-I stand modified by dividing the organic, inorganic and integrated plots into two plots of each with four cropping systems.

New treatment structure is as follows.

- 100% organic was divided into 100% organic and 75% organic + 25% through daincha (kharif) and glyricidia (rabi)
- 100% inorganic was divided into 100% inorganic and State recommendation
- Integrated management was divided into 50% + 50% and 75% and 25% (inorganic)

In experiment –I during kharif season, 100% organic nutrient management practice showed higher seed yield of soybean in each cropping system followed by 75% organic + innovative and 75 % organic + 25 % inorganic as compared to 100% inorganic and farmer's package. Analysis of chemical, biological and biochemical parameters in soil samples is in progress. The experiment –II have been started new on "Response of different varieties of major crops for organic farming" with the objective, to evaluate the response of different varieties with varying duration of major crops (Soybean and Maize, Wheat and Gram) to organic production system. Twelve different varieties of each soybean and maize were evaluated under organic production system. Soybean viz., JS9752, JS 2041 and RVS 2002-4 recorded more than7 q/ha while others recorded around 4 q/ha only. Among Maize, Arawali recorded a maximum seed yield of 21 q/ha. Sowing of Rabi crops (wheat, chickpea, mustard and linseed) for the year 2013-14 have been taken up in the experiment.

Programme II: Conservation Agriculture and Carbon sequestration vis-à-vis climate change

A. Institute Project

19. **Soil carbon saturation and stabilization in some soils in India.**

The soils samples were obtained from permanent manurial trial of Ranchi and analysed for soil carbon sequestration rate and carbon pool dynamics under different treatments. It was observed that application of FYM invariably increased total organic C and carbon in mineralizable and passive pool. Application of lime along with NPK was found good for sustaining crop yield but failed to increase soil carbon content. This was probably due to the liming induced rapid carbon mineralization

20.. **Evaluating conservation tillage on various sequences/rotations for stabilizing crops productivity under erratic climatic conditions in black soils of Central India**

The study was laid out in a split – plot design with two tillage treatments namely conventional tillage (CT) and reduced tillage (RT) along with six cropping systems i) Soybean- Fallow, ii) Maize- Gram, iii) Soybean- Fallow, iv) Soybean + Pigeon pea (2:1), v) Soybean+ Cotton (2:1) and vi) Soybean– Wheat. During the reported period, fourth year experimental crops were taken. *Kharif* crops were sown in the last week of June, 2013; however, crops were severly affected by continuous rainfall. *Rabi* crops were sown. During the period, soil moisture, temperature were recorded analyzed organic carbon, available nutrients (NPK) of third year soils samples. Soil organic carbon (SOC) was also relatively higher in RT compared to CT after third crop-cycle. Data compilation and analysis is in progress. Results will be presented in the forthcoming IRC meeting.

21. **Assessing impacts of climate change on different cropping systems in Central India and evaluating adaptation studies through crop simulation models**

Under this project, chickpea cultivars, JG 11 and JG 130 are in experimentation for validation purpose. The maize cultivar kanchan 101 was used for validation from the experiments conducted at the IISS research farm. From the validation it was observed that the APSIM model predicted maize yield reasonably well as determined by R^2 value of 0.55. The R^2 value between the observed and predicted could be improved when more dataset would be considered for this purpose. The data set used here for Bhopal only and in future more datasets from different parts of central India will be used for this purpose. The climate change effects (effects of rainfall, temperature and CO_2 concentration) on soybean and wheat yield for Bhopal and Jabalpur were analysed with the AGMIP team and the results from the response surface curve showed that temperature has detrimental effects of both soybean and wheat yield while rainfall and CO_2 concentration favours grain yield in both the crops. Combining the effects of all these factors showed different results. The increase in CO_2 along with rainfall favours soybean yield while increase in temperature along with increase in CO_2 levels decreases the grain yield. Similar observations were also recorded from wheat simulations for Bhopal and Jabalpur.

22. **Tillage and manure interactive effects on soil aggregate dynamics soil organic carbon accumulation and by pass flow in vesrtisols**

Effect of tillage and manure on soybean productivity and soil properties was studied. In general, relatively higher grain yield was observed in No tillage than reduced tillage however the biomass yield was significantly higher in Reduced Tillage (RT) than No Tillage (NT) treatments. The grain yield (q/ha) increased from 2.60 to 3.68 and 2.39 to 3.5 under NT and RT, respectively, with increase in FYM rate from 0 to 6 Mg ha^{-1}. Soil organic carbon was found to be higher in NT compared to RT at 0-5 and 5-15 cm soil depth. However permanganate oxidizable carbon, water soluble carbon and acid hydrolysable carbon were found to be higher in reduced tillage at 0-5 cm and 15-30 cm soil depth. Soil biological activity assessed through DHA and FDA were found to be higher in RT at 0-5 cm soil depth and the effects were at par at 5-15 cm soil depth. Soil available nitrogen was significantly more in RT at 0-5 cm than NT. However the tillage effect was nullified at lower depths beyond 15 cm soil depth.

B. Externally Funded Projects

23. **Evaluating Conservation Agriculture for Stabilizing Crop Productivity and Carbon Sequestration by Resilient Cropping Systems/Sequences under aberrant Climatic Conditions in Black Soils of Central India.**

The study was laid out in a split – plot design with two tillage treatments namely conventional tillage (CT) and reduced tillage (RT) along with six cropping systems i) Soybean- Fallow, ii) Maize- Gram,

iii) Soybean- Fallow, iv) Soybean + Pigeon pea (2:1), v) Soybean+ Cotton (2:1) and vi) Soybean–Wheat.

During the reported period, fourth year experimental crops were taken. *Kharif* crops were sown in the last week of June, 2013; however, crops were severly affected by continuous rainfall. *Rabi* crops were sown. During the period, soil moisture, temperature were recorded analyzed organic carbon, available nutrients (NPK) of third year soils samples. Soil organic carbon (SOC) was also relatively higher in RT compared to CT after third crop-cycle. Data compilation and analysis is in progress. Results will be presented in the forthcoming IRC meeting

24. Quantifying Green house gases (GHGs) emissions in soybean-wheat systems of M.P. (MPCOST)

The present study was conducted to compare the GHG emission from different tillage and nutrient management practices during soybean growing season, 2013. GHG fluxes, soil temperature, moisture, soil nitrate and ammoniacal nitrogen were determined at frequent intervals throughout the cropping season. During the initial crop growth period i.e in July and August across manure management no tillage (NT) was found to have higher nitrous oxide fluxes than reduced tillage (RT). However, at the later stage of crop growth reduced tillage was found have significantly higher emissions than NT. At harvest there was no significant difference between the tillage treatments on nitrous oxide emission. Soil nitrate nitrogen also followed a similar trend as that of nitrous oxide fluxes. Averaged over tillage treatments, the nitrous oxide flux was higher under integrated nutrient management followed by inorganic and organic treatments. On farm demonstration of conservation tillage along with manure management in soybean-wheat system at village Bagroda in farmer's field is continued for second year also. The experiment was first carried out in two farmer's field in the year 2012 and in the second year (2013) other farmers have also taken up conservation tillage practices in rice-wheat system.

Programme III : Soil Microbial Diversity and Biotechnology

A. Institute Projects

25. Structural and functional diversity of microbes in soil and rhizosphere

Microbial succession in rhizosphere of soybean : Microbial diversity in the rhizosphere of soybean monitored at different growth period under inorganic and organic fertilizer amendment. Experiment carried out with an aim to reveal variation in the microbial association in response to fertilizer amendment and crop growth. Root samples of soybean plant were collected and DNA was extracted from the rhizoplane during 15d, 30 d, 45d, and 60 days of germination. Purified DNA was PCR amplified using eubacterial universal 16S rRNA gene primer. Both forward and reverse primers were labeled with FAM and HEX fluorescent dyes respectively. Amplified PCR products of about ~515 base pairs were digested with restriction enzyme RsaI (GT^AC). Purified digested products were run in an automatic capillary 3730 genetic analyzer. Fragments size and their fluorescence intensity estimated using the LIZ 500 internal standard. All together there were 20 major T-RFs comprising base pairs of 39, 42, 51, 64, 81, 90, 95, 117, 169, 234, 273, 303, 417, 426, 441, 469, 486, 494, 524, 529, and 532. The major TRFs were assigned as Delta proteobacteria, uncultured bacteria, uncultured actinobacteria, Fusabacterium, Deltaproteobacteria/Geobacter, Acidobacteria, Azorhizobium/ Spingomonas, Streptomyces, Deltaproteobacteria-Shewanella,Verrumicrobiota, uncultured bacteria, Desulfobacterium/Methylosinus, Acidophilum, Clostridium acetobutylicum respectively. TRF assignment was carried out by in-silico digestion of eubacteria 16S rRNA gene of RDP database. Total of 96316 numbers of 16S rRNA gene were used for phylogenetic assignment of the TRFs. Alphaproteobacteria Relative fluorescence of each fragments revealed that microbial diversity was higher in organic treatment field that inorganic field. Relative fluorescence of TRF's 42, 81, 303, and 417 were in the range of 30-42%. Association of deltaproteobacteria was more prominent while the association of alphaproteobacteria with soybean was earlier in organic amended soil than inorganic treatment. Result highlighted differential association of bacterial association in response to agronomic practice.

26. Consequences of transgenic cotton on soil microbial diversity

The impact of transgenic (Bt) cotton on the diversity of soil beneficial microbes such as total heterotrophs, free living aerobic nitrogen fixers, Phosphate solubilizers, cellulose decomposers, and soil biological properties were assessed. The diversity of soil beneficial microbes was found higher in Bt rhizosphere soil than non Bt. Simpson's diversity index was measured for Bt and non Bt cotton soil under different cropping systems. Overall the diversity index was high in case of Bt cotton based cropping system compared to non Bt cotton based cropping system. The soil total DNA isolation and

purification was done using metagenomic kits (HiPura Soil DNA purification Kit). The metagenomics study for assessing structural diversity is in progress.

27. **Actinomycetes diversity in Daccan plateau, hot, arid region and semi arid eco-sub-region (AER 3 and 6) and evaluation of their PGPR activity.**

The Shannon and Weaver diversity index (H) of 41 actinomycete isolates based on carbon utilization in three climatic region (arid, semi arid and humid) is 3.54, the diversity of actinomycete in arid and semi arid soil is same *ie.,* 2.81 and in humid soil the diversity is 1.94. Forty one isolates of actinomycetes were characterized for GA production, K mobilization. Among the 41 isolates tested 16 isolates produced GA which ranged from 1.17- 5.74 µg ml^{-1} of culture filtrate. The maximum GA production of 41.35µg ml^{-1} of culture filtrate was observed in A28 followed by A27 which recorded 35.32 µg $GAml^{-1}$ of culture filtrate. All the isolates were examined for their ability to mobilize Potassium on Alkesandrov medium. 15 isolates were able to mobilize potassium on Alkesandrov medium containing muscovite mica and it was ranged from 3.7 to 6.3 µg ml^{-1} of culture filtrate. Seventeen isolates of actinomycetes were field tested on maize; *Streptomyces* strains A1, A2, A6, and A10 gave best yield response.

28. **Developing technique for acceleration of decomposition process using thermophilic organisms**

The Shannon and Weaver diversity index (H) of 41 actinomycete isolates based on carbon utilization in three climatic region (arid, semi arid and humid) is 3.54, the diversity of actinomycete in arid and semi arid soil is same *ie.,* 2.81 and in humid soil the diversity is 1.94. Forty one isolates of actinomycetes were characterized for GA production, K mobilization. Among the 41 isolates tested 16 isolates produced GA which ranged from 1.17- 5.74 µg ml^{-1} of culture filtrate. The maximum GA production of 41.35µg ml^{-1} of culture filtrate was observed in A28 followed by A27 which recorded 35.32 µg $GAml^{-1}$ of culture filtrate. All the isolates were examined for their ability to mobilize Potassium on Alkesandrov medium. 15 isolates were able to mobilize potassium on Alkesandrov medium containing muscovite mica and it was ranged from 3.7 to 6.3 µg ml^{-1} of culture filtrate. Seventeen isolates of actinomycetes were field tested on maize; *Streptomyces* strains A1, A2, A6, and A10 gave best yield response.

29. **Chemical and Microbiological Evaluation of Biodynamic and Organic Preparations.**

To evaluate the effect of different organic and biodynamic preparation as nutrient source for wheat, pot culture study was set up. The soil used for pot culture study was characterized for its nutrient status and microbial parameter *viz.* total heterotrophic bacteria, fungi, actinomycetes, aerobic N-fixers, and P solubilizers. Activity of soil microbes was measured by FDA and dehydrogenase assay. Effect of foliar application of organic and biodynamic preparation was estimated by measurement of leaf chlorophyll, Nitrate reductase activity and phyllospheric microbial population (bacteria, fungi and N-fixers) at different interval of application of organic and biodynamic preparations. Initially there was no difference in the chlorophyll content of the leaf but after 75 days of sowing low chlorophyll content was found in control, panchagavya treatment and biodynamic treatment. Total count of phyllospheric microbes was highest in panchagavya, biodynamic and organic treatment however, there was little effect of these microbes since chlorosis was seen in the panchagavya and biodynamic treatment despite regular application of preparations.

30. **Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating micropes**

Greenhouse gas emission from poultry farm was measured at regular intervals. Poultry sampling was carried out at Parwalia village during months of May 2013-Dec 2013.Gas samples collected were analysed by GC to determine changes in the emission of N_2O, CH_4 CO_2.Phyisco chemical properties were taken into consideration while evaluating the pattern of GHG emissions. Among the GHG emission of N_2O ranged from 2.05-29.15 mg/m3/day. Methane emission was in the range of 0.20-5.22 mg/m3/day. Emission of CO_2 decreased over a period of composting which acted as an indicator for the maturity of poultry manure. NH_4-N (mg/g) was 2.37 initially which decreased to 0.32 over composting.

B. **Externally Funded Projects**

31. **Metagenomic characterization and spatio-temporal changes in the prevalence of microbes involved in nutrient cycling in the rhizoplane of bioenergy crops (DST)**

Microbial diversity in the rhizosphere of bioenergy crop - Diversity of archaea and bacteria measured in the rhizoplane of bioenergy crop J curcas. Root samples collected from 1 yr, 2 yr and 5-6 yr old crop, planted at different geographical locations. Experiment carried out with an aim to understand the extent

of microbial diversity, and the major phylogenetic groups associated with the crop. DNA from the rhizoplane was extracted using phenol:chloroform bead beating method. Purified DNA samples were PCR amplified using the primers targeting archaea and bacteria. For archaea, the primers selected were 109F and 915R, while for bacteria 8F and 535R. Both the forward and reverse oligos were labeled with FAM and HEX dyes. PCR product with 105F/915R targeting archaea was digested with Alu (AG^CT), while that of eubacteria was digested with RsaI (GT^AC). Selection of restriction enzyme carried out using the 1% agarose gel check and insilico digestion. Purified digested products were fragment analyzed by an automated capillary genetic analyzer. Size and area of fragments were calculated by applied biosystems (Abi) software. The major archaeal species associated with bioenergy crop were mostly uncultured type. Terminal restriction fragments comprising base pairs of 19, 24, 45, 46, 55, 61, 75, 82, 85, 95, 101, 107, 108, 115, 143, 171, 201, 233, 273, 280 and 294 were mostly observed in all samples. Predominantly TRFs covered many uncultured archaea, crenoarcheota, and ferroplasma which contribute 20-25% of total fluorescence.

32. Novel bio-filtration method using selected mesophilic fungi for removal of heavy metals from municipal solid waste in Madhya Pradesh (MPCOST).

Identified six fungi namely Trichoderma viride; Aspergillus heteromorphus; Rhizomucor pusillus; Aspergillus flavus; Aspergillus terrus; and Aspergillus awamori acted as good heavy metal bioaccumulator. Cr was found above than toxic limit in MSW compost. Lead is less toxic than Zn for most of mesophilic fungi and it may grow even under 400 ppm. Cd is more toxic followed by Cu, Cr and Ni , *T. viridi, A.heteromorphus and A. awamori* were the efficient bioaccumulator among these six fungi. Higher value of "K" indicated biosortive uptake capacity of metal ions. Higher the "n" value higher the metal adsorption affinity towards fungi cell. Biofilter has been developed and examined under matured compost. The work is in progress.

33. – Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes

Climate change factors such as atmospheric CO2 concentrations, warming, and altered precipitation regimes can potentially have both direct and indirect impacts on soil microbial communities involved in various soil function. However, the direction and magnitude of these responses is uncertain. To address how multiple climate change drivers will interact to shape soil microbial communities and function, there is need of understanding on biodegradation processes of pesticides in soils to predict the ecosystem and agricultural sustainability. The proposed project aims to investigate the impact of elevated CO2 and temperature on pesticide (chloropyrifos and imidacloprid) degradation process and microbes with following objectives :

1. Assessment of degradation kinetics of pesticides
2. Metagenomic characterization of microbial community during biodegradation processes
3. Linking agricultural practices like fertilizer, water management with degradation kinetics and microbial response to predict pesticide biodegradation under future climate change scenarios

Programme IV: Soil Pollution, Remidiationa nd Environmenal Security

A Institute Project

34.. Phyto-extraction of Cr by some floriculture plants.

An experiment was undertaken to evaluate the physiological responses of *Gladiolus* to Cr, its effect on growth, phytotoxicity, uptake and transport for remediation of soil contaminated with Cr. Overall, the experiment consisted of 5 treatments including soil without chromium i.e., control(Cr_0); 12.5 mg Cr Kg^{-1} soil, 25 mg Cr Kg^{-1} soil and 50 mg Cr Kg^{-1} soil. The results revealed that the applied Cr significantly decreased the total dry weight of the plant right from the lowest level (Cr 12.5 mg kg^{-1} soil). Beyond 12.5 mg kg^{-1} soil, flowering was affected. The plant samples were analysed for Cr content. The data revealed that, highest concentration of Cr was found in roots and was followed by shoot and inflorescence.

35. Non point sources of phosphorus loading to upper lake, Bhopal.

Water and sediment samples from various streams including primary and secondary streams (53 streams) at different locations of catchment area of Upper Lake Bhopal was collected and analyzed for different P fractions. The total P in the water samples ranges from 0.13 to 0.59 ppm with a average value of 0.30 ppm. Among different P fractions the mean total dissolved P (TDP), total reactive P (TRP), dissolved reactive P (DRP), dissolved organic P (DOP) and particulate P (PP) in the water sample collected from stream was 31.82%, 23.64%, 10.90%, 14.91 and 68.19% of TP, respectively. The water samples from different entry points (15 locations) where water enter from different source (Agriculture

and Municipal water) to the Upper Lake was collected and analyzed for different P fractions. The results showed that the TP in the water sample (entry point) ranges from 0.30 to 0.73 mg/L with a mean value of 0.47 mg/L with lowest and highest value from Kholukhedi (Agriculture source) and Bhadbada (domestic waste water), respectively. Among the P fractions, the bioavailable P fraction (TDP) was highest in the domestic waste water (56.23% of TP), where the dominant P fraction in water samples from agriculture source was particulate P (PP) (80.40% of TP).

36.. Interaction among tannery effluents constituents on heavy metals uptake by spinach.

To evaluate the chromium toxicity, the wheat seeds were exposed to five different concentrations of Cr (0, 20, 40, 80 and 100 ppm). The germination per cent was recorded after 72 hours (h). Root elongation and coleoptiles growth were measured at 72, 120, 168, and 240h. It was decreased by 6, 14, 30 and 37% under 20, 40, 80 and 100 ppm, respectively. The root elongation was more sensitive than coleoptile growth. Effect of chromium (Cr) contamination on microbial activity and carbon mineralization was also investigated in soil. Increasing the Cr contamination (0-100 ppm) decreased the microbial activity significantly during the 45 days of study. It can be concluded, that Cr contamination (*i.e.* from tannery effluent) has significant adverse effect on soil microbial activities.

37. Impact of Long Term Use of Sewage Water Irrigation on Soil and Crop Quality in Bhopal region of Madhya Pradesh

Collected secondary data information on municipal sewage water with respect to generation capacity (volume), treatment capacity etc. from various departments *like* CPCB, MP pollution board, Bhopal Municipal Corporation (BMC). Geo-referenced sample collection of sewage water as well as soil from different points along the main drainage channel (Patra nala) covering a total distance of 36.78 km. The analysis part of collected soil as well as water sample is in progress.

B. Externally Funded Projects

Nil

Contractual Projects

38. Evaluation of plant nutrition product (NP-1) for nutrient use efficiency in cereal crops

A field trial comprising rice variety Kranti and Maize hybrid PROAGRO was undertaken in Kharif 2013 to study the effect of plant nutrition product (NP1) on the nutrient use efficiency of crop. The effect of various combinations of NP1 product and conventional recommended dose of fertilizers on morpho-physiological parameters like growth and yield attributing traits in the rice and maize was studied. Soil physio-chemical characters like pH, EC, Organic Carbon, available N, Phosphorus and Potassium were recorded initially. The N status of the plants was also studied in the various treatments for analyzing the use efficiency**.**

39. Effect of urea pestle productivity and nutrient use efficiency in some soils of India

40. Investigations on the safe use of sludge in agriculture land generated from effluent from plant of a soft drink.

41 Testing a new slow release 14-7-14 NPK fertilizer for its efficiency under field conditions

There were incessant heavy rains during early crop growth. This is the reason why the yield levels are relatively lower. The quantified weather data will be reported in final report, **Weed operation:** Manual, There was no pest infestation, the protection from parrots was done by manual labour., Maize grain yield was recorded on whole plot basis.

Grain yield: The grain yield of maize is shown in table 3. The detailed report after the statistical analysis will be submitted subsequently. However, the yield data indicate that Compo fertilizer is working well for maize crop in this soil (Compare the yield between T2 and T6). The crop responded upto 100% recommended NPK. But beneficial role of second dose of urea was also observed (T7). The results suggest that Compo is working as effective fertilizer. The soil and plant samples have been collected from each plot after maize harvest. The SRF is just selected in the project. Wheat trail with the same treatments as shown in table 2 is continuing.

He further stressed on the importance of linking the RPP/HYPM/AAR with RFD/Performance Indicators/ASRB proforma/assessment parameters. Dr. A. Subba Rao, Director IISS and Chairman of

IRC in his introductory remark informed the house about HOD's meeting with Director General. He stressed to maintain a database of projects as we are ought to be accountable for the public investment in research. He further added that NRM institutes have to a research programme that is able to attract investments/budget from ICAR. He mentioned that IISS has to work as per Vision-2050. He also mentioned about the call for a new perspective in research with efficient/inefficient cultivars with respect to nutrient use efficiency, need for the development of GAP/BMPs, and soil health assessment and monitoring in some bench mark sites in production systems across agroecological region. Thus, use efficiency research has to be given a new meaning.