Proceedings of IRC Meeting

(19th - 20th and 29-30 July, 2016)

ICAR-Indian Institute of Soil Science

Nabibagh, Berasia Road

Bhopal – 462 038 (M. P.)

GUIDANCE AND DIRECTIONS

Dr. ASHOK K. PATRA,
Director and Chairman, IRC

Dr. A.K. BISWAS
Pr. Scientist & Head and Member Secretary, IRC

COMPILATION AND EDITING

Dr. R. Elanchezhian
Pr. Scientist and I/c PME Cell

SECRETARIAL ASSISTANCE AND COMPUTER PROCESSING

Shri Sanjay Kumar Kori
Stenographer Grade -III

INTRODUCTORY REMARKS OF THE CHAIRMAN, IRC

The Institute Research Council (IRC) meeting of the institute was held during 19 – 20 and 29-30 July, 2016. The Member-Secretary (IRC), Dr. A. K. Biswas welcomed the participants. The Member Secretary, IRC requested the scientists to take the IRC as a platform for discussion on scientific matter for overall improvement of research activities. He also requested all the scientists to present the research findings and other prioritized activities for the year in the IRC meeting within ten minutes so that there can be discussion on the subject for another 5-10 minutes. The IRC Chairman Dr. A. K. Patra insisted upon the scientists to propose research projects in accordance with recommendations of RAC and QRT meetings and it should have usefulness in the farm, outcome oriented and development focused. He further stressed that the outcome of the research projects should be strengthened for improving the visibility of the institute. He requested that all the members should come forward for healthy discussion during the presentations. He also advised to follow instructions of ICAR with respect to submission of various reports as communicated by PME Cell. Thereafter all the projects under following programmes were presented and reviewed with respect to progress made in the last year as detailed below:

RESEARCH PROGRAMMES

Programme I : Soil Health Management 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)	Reconstructed April 2012	Long term	**Project to be continued** RPP-II 2014-15 and RPP-II 2015-16 to be submitted
2.	Studies on soil resilience in relation to soil organic matter in selected soils.	N. K. Lenka, Sangeeta Lenka Brij Lal Lakaria Asit Mandal	SC&F	July 2010	July 2015	RPP-II 2014-15 and **RPP-III to be submitted**
3.	Biochar on soil properties and crop performance	Brij Lal Lakaria Pramod Jha A.K. Biswas K.M. Hati J. K. Thakur M. Vassanda Coumar A. K. Dubey (CIAE) S. Gangil (CIAE)	SC&F	January, 2012	January 2017	**Incubation experiment for urea (N) release/loss to be undertaken** RPP-II 2014-15 and RPP-II 2015-16 to be submitted
4.	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 (On study leave)	ITMU Unit	July 2013	July 2016	**Six months extension granted up to July 2016** **RPP-II 2015-16 to be submitted**

5.	Nano-particle delivery and internalization in plant systems for improving nutrient use efficiency	R. Elanchezhian A.K. Biswas Tapan Adhikari K. Ramesh, S. Kundu A.K. Shukla K. Raju Kumar	SC&F	July, 2013	July 2016	**One-year extension granted, Extended till July 2017** **RPP-II 2015-16 to be submitted**
6.	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 A. K. Tripathi S. Kundu	ESS	July 2011	June 2016	**Project to be concluded** **RPP-II 2015-16 to be submitted**
7.	Evaluating rock phosphates for their suitability for direct application	Sanjay Srivastava K. Ramesh A.K. Tripathi I. Rashmi P Dey	SC&F	October 2013	May 2017	**Water soluble P to be analyzed; RP + acid treatment to be imposed** RPP-II 2013-14, RPP-II 2014-15, RPP-II 15-16 to be submitted
8.	Evaluation of modified urea materials and agronomic interventions for enhancing nitrogen use efficiency and sustaining crop productivity	B.P. Meena K. Ramesh Pramod Jha R. Elanchezhian	SC&F	October 2013	September 2017	• Patent application for BCU to be explored • Big plot experiment is to be conducted • Incubation study to be conducted **RPP-II 2015-16 to be submitted**
9.	Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat	Pankaj K. Tiwari, A. K. Shukla, R. Elanchezhian and B. P. Meena	MSN	October 2014	June 2017	Not presented RPP-II 2015-16 to be submitted
10.	Assessment of important soil properties of India using mid-infrared spectroscopy	K.M. Hati, M. Mohanty, Pramod Jha, R.S. Chaudhary, N.K.	Soil Physics	May 2015	June 2018	Will be listed as collaborative project with ICRAF RPP-II 2015-16 to be

		Sinha, J.K. Thakur, M. Vassanda Coumar, Pradip Dey, Muneshwar Singh, A.K. Patra, Javed Rizvi				submitted

B) **Externally Funded Projects**

11.	Network Project on Organic Farming	A. B. Singh K. Ramesh Brij Lal Lakaria S. Ramana J.K. Thakur	Soil Biology	July 2004	March 2017	• **Project to be continued** • **Nutrient budgeting of organic farming field to be made for last 10 years**
12.	(a) Use of nano sensors network for field detection of temperature and moisture stress in plant and soil	Tapan Adhikari, S. Kundu, C.D. Singh, Ajay, N.K. Sinha, A.K. Patra, Navkanta Bhat, K.S. Subramanium and Bajendra	ESS	April 2015	March 2017	•**Project to be continued** •**Project document to be submitted** •**Report for 2015-16 to be submitted**
	(b) Conversion of naturally occurring plant nutrient containing minerals into nano form by top down approach to enhance the availability of plant nutrients in soil and faster reclamation of problem soils	Tapan Adhikari, S. Kundu, A.K. Shukla, K. Ramesh, S. Bhattacharjya, J.K. Saha, A.K. Patra	ESS	April 2015	March 2017	• **Project to be continued** • **Report for 2015-16 to be submitted**
13.	Soil quality assessment and developing indices for major soil and production regions of India funded by ICAR-Extra Mural Project	N.K. Lenka, A.K. Biswas, Rajendiran S, S. Kundu, S. Lenka, N.K. Sinha, Abhay Shirale, A.K. Viswakarma, R.H. Wanjari, B.L. Lakaria, A.B. Singh, A.K. Patra, Muneshwar Singh, D.L.N. Rao, A.K. Shukla, Pradip	SC&F	April 2016	March 2017	•**Project to be continued** •**Dr. B.P. Meena to be included as Co-PI** •**Report to be submitted**

		Dey, B.P. Meena				

C. Collaborative projects with other institutes where IISS scientists are associated in

14.	Enhancing Resource Use Efficiency in Pulse Based Cropping System in Central India. Collaborating with ICAR-Indian Institute of Pulses Research, Kanpur (U.P.)	R. Elanchezhian and Abhay Shirale	SC&F	July 2014	June 2017	• **Project to be continued** • **Report 2015-16 to be submitted**

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

A. Institute Projects

15.	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. Chaudhary R. Elanchezhian	Soil Physics	June 2011	May 2016	**Project to be concluded** **RPP-III to be submitted**

B. Externally Funded Projects

16.	CRP-Conservation Agriculture	(LCPC: Dr. A.K. Biswas and Dy LCPC: Dr. R.S. Chaudhary)	SC&F	April 2015	March 2017	
	Development, refinement and validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment"	K M Hati (PPI), J Somasundaram, A.K. Vishwakarma, Sanjay Srivastava, Pramod Jha	Soil Physics	April 2015	March 2017	Report for 2015-16 to be submitted
	(a) Demonstration of best-bet conservation agriculture practices on farmers' fields in Vertisols of central India	AK Vishwakarma, RH Wanjari, R.K. Singh, K.C. Shinogi,	Soil Physics	April 2015	March 2017	**RPP-III of weed management project to be submitted** Report for 2015-16 to be submitted

		AK Tripathi				
	(b) Fine-tuning of conservation agricultural practices for Vertisols of central India	J Somasundaram, K Ramesh, S. Ramana, BP Meena and Abhay Shirale	Soil Physics	April 2015	March 2017	**RPP-III to be submitted for Evaluation of conservation tillage (Institute project)** RPP-II for 2015-16 to be submitted
	(c) Development of water and nutrient management practices in conservation agriculture for Vertisols of central India	Sanjay Srivastava, KV Ramana Rao, I Rashmi and N.K. Sinha	SC&F	April 2015	March 2017	**Project to be continued** Report for 2015-16 to be submitted
	(d) Impact of conservation agricultural practices on soil health, carbon sequestration and greenhouse gas emissions in different production systems	Pramod Jha, Brij Lal Lakaria, M Mohanty, J.K. Thakur and K. Bharati	SC&F	April 2015	March 2017	**Project to be continued** Report for 2015-16 to be submitted
17.	Simulating the effect of elevated CO_2 and temperature on water productivity and nutrient use in soybean-wheat cropping system	N.K. Lenka, Sangeeta Lenka, A.K. Shukla, R. Elanchezhian, J.K. Thakur, I. Rashmi and Pradip Dey	SC&F	June 2015	June 2018	**Project to be continued** Report for 2015-16 to be submitted
18.	Integrated assessment of soil and crops for enhancing productivity and C-sequestration potential of Vertisols of central India under changing climate scenarios (NICRA)	M. Mohanty, Pramod Jha, Sangeeta Lenka, J. Somasundaram, N.K. Sinha, R.S. Chaudhary and Muneshwar Singh	Soil Physics	Feb 2015	March 2017	**Project to be continued** Report for 2015-16 to be submitted

Programme III – Soil Microbial Diversity and Biotechnology

A. Institute Projects

19.	Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating microbes	K. Bharati, J.K. Saha, S.R. Mohanty and Shinogi K. C.	Soil Biology	June 2012	June 2016	**Project to be concluded** RPP-II 2013-14, RPP-II 2014-15, RPP-II 2015-16 to be submitted
20	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	Soil Biology	September 2011	December 2015	**Project to be concluded**

		(CIAE) Asit Mandal, M.C. Manna				

B. Externally Funded Projects

21.	Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes (DBT)	K. Bharati Neera Singh (IARI, New Delhi) T. K. Radha, S. R. Mohanty	Soil Biology	December 2013	December 2016	**Project to be continued** Report 2013-14, 2014-15, 2015-16 to be submitted
22.	Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential (Funded by AMAAS)	D.L.N. Rao, S.R. Mohanty, K. Bharati and T.K. Radha	BNF	April 2014	March 2017	**Project to be continued** **Report 2015-16 to be submitted**
23.	In-situ residue decomposition of rice-wheat and sugarcane for enhancing crop productivity and soil health funded by ICAR-Extra Mural Project	M.C. Manna, Asha Sahu, R.C. Singh, Jyoti Thakur, Asit Mandal, Sudeshna Bhattacharjya, A.K. Tripathi, A.K. Patra, D.H. Phalkel	Soil Biology	January 2016	December 2018	• **Project to be continued** • **Protocol on amount of residue to be constant & to be standardized** • **Report to be submitted**

C. Collaborative projects with other institutes where IISS scientists are associated in

24.	Isolation and characterization of heavy metal resistant bacteria & evaluation for their use in agriculture. Collaborating with NBAIM, Mau (U.P.)	M.C. Manna, Asit Mandal, Asha Sahu, J.K. Thakur	Soil Biology	May 2014	March 2017	• **Project to be continued** • **Data on heavy metal to be verified** • **Report to be submitted**

Programme IV: Soil Pollution, Remediation and Environmental Security

A. Institute Project

25.	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	**Project to be continued** RPP-II 2014-15, RPP-II 2015-16 to be submitted
26.	Impact of Long Term Use of Sewage Water	M.L. Dotaniya,		August	July	• **Project to be concluded**

	Irrigation on Soil and Crop Quality in Bhopal region of Madhya Pradesh	Vasudev Meena (On study leave), M. Vassanda Coumar, Rajendiran S., Asha Sahu, S. Kundu	ESS	2013	2016	• **Heavy metal content in normal water irrigated sample to be given** • RPP-II 2014-15, RPP-II 2015-16 to be submitted
27.	Determination of Baseline Concentration for Delineating Contaminated Areas in Black Soils of Central India	Rajendiran S., J.K. Saha, S. Kundu, Hironmoy Das (On study leave), M. L. Dotaniya	ESS	May 2014	May 2017	• **Project to be continued** • **RPP-II 2015-16 to be submitted**
28.	Assessment of Cotton for the remediation of soils contaminated with heavy metals	S. Ramana, A.K. Tripathi, K. Bharati, Asha Sahu	Soil Biology	June 2015	May 2018	**Project to be continued**
29.	Critical limits of Cd for major soil orders of India	M. Vassanda Coumar, Rajendiran S., M.L. Dotaniya, J.K. Saha, Tapan Adhikari, Ajay, S. Bhattacharjya	ESS	July 2015	June 2018	**Soil clay analysis to be repeated** RPP-II 2015-16 to be submitted

B. **Externally Funded Projects**

S. No.	Title	PI & Co-PI	Division/ Unit	Period		Remarks
30.	Determination of critical limits for identifying heavy metals contamination and their threats in major soil types of India funded by ICAR-Extra Mural Project	J.K. Saha, M. Vassanda Coumar, S. Rajendiran, M.L. Dotaniya, N.S. Bhogal	ESS	Jan 2016	March 2018	**Project to be continued** Report for 2015-16 to be submitted

New Projects
Externally Funded

31.	Hyper-spectral remote sensing approaches to evaluate soil quality and crop productivity of central India (under DST sponsored Network Project on Hyper-spectral Big Data Analytics)	M. Mohanty, N.K. Sinha, K.M. Hati, R.K. Singh, Pradip Dey, R.S. Chaudhary, Bharat Bhaskar Gaikwad and	Soil Physics	April 2016	March 2019	**Project to be continued** Report for 2015-16 to be submitted

		A.K. Patra				
32.	Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential	S.R. Mohanty, A.K. Patra, K. Bharati, Muneshwar Singh, J.K. Thakur	Soil Biology	May 2015	May 2018	**Project report 2015-16 to be submitted**

Institute projects (New Proposals)

Sl. No	Title	PI & Co-PI	Division	Period		Remarks
33	Response of global warming potential and soil carbon storage to reversal in tillage practices in Vertisol	Sangeeta Lenka	ESS			**Approved** **RPP-I to be submitted**
34	Management of soft beverage sludge applied soil for sustainable crop production and environmental protection	Ajay	ESS			**To be reviewed again with existing field without bringing sludge from any private farm**
35	Long term effects of fertilizer and manure amendments on soil functional diversity and nutrient supplying capacity under different soils and cropping systems	S. Bhattacharjya	Soil Biology			**Approved** **RPP-I to be submitted**

Contractual Projects

36	Evaluation of urease inhibitor product (limus) for nutrient use efficiency in cereal crops (BASF Pvt. Ltd.,)	Brij Lal Lakaria Pramod Jha B.P. Meena A.K. Biswas	SC&F	July 2014	June 2016	**To be concluded** **Report to be submitted**
37	Evaluation of efficacy of sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India (Zuari Agro Chemicals Ltd)	A.K. Shukla, A.K. Biswas, S. Srivastava, Pankaj K. Tiwari, B.P. Meena	MSN	April 2015	June 2017	**Not presented**
38	Evaluation of efficacy of zinc metalosate and boron	A.K. Shukla, A.K. Biswas, Pankaj K.	MSN	June 2015	June 2017	**Not presented**

	metalosate foliar supplements for maximizing yield through balanced nutrition of important crops grown in India (Indofil Ind. Limited)	Tiwari, B.P. Meena				
39	Upgradation of Mridaparikshak mini lab (Nagarjuna Agro Chemicals Pvt. Ltd., Hyderabad)	S Srivastava, P. Jha, I, Rashami, A.K. Biswas, P. Dey, M. Vassanda Coumar, Abhay Shirale, A.K. Patra	SC&F	Dec. 2015	April 2016	**To be concluded** **Report to be submitted**
40	Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan)	Muneshwar Singh, R.H. Wanjari, B.L. Lakaria, Abhay Shirale	PC (LTFE)	June 2016	May 2017	**Report to be submitted**

Project Concluded (06 Nos.)

Sl. No.	Programme No.	Sl. No. in IRC Proceedings	Title of Project	PI and Co-PI	Division/Unit	Period	
1	I	6	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 A. K. Tripathi S. Kundu	ESS	July 2011	June 2016
2	II	15	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. Chaudhary R. Elanchezian	Soil Physics	June 2011	May 2016

3	III	19	Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating microbes	K. Bharati, J.K. Saha, S.R. Mohanty and Shinogi K C	Soil Biology	June 2012	June 2016
4	III	20	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	Soil Biology	September 2011	December 2015
5	IV	26	Impact of Long Term Use of Sewage Water Irrigation on Soil and Crop Quality in Bhopal region of Madhya Pradesh	M.L. Dotaniya Vasudev Meena (On study leave) Vassanda Coumar Rajendiran S Asha Sahu S. Kundu	ESS	August 2013	July 2016
6	IV	36	Evaluation of urease inhibitor product (limus) for nutrient use efficiency in cereal crops (BASF Pvt. Ltd.,)	Brij Lal Lakaria Pramod Jha B.P. Meena A.K. Biswas	SC&F	July 2014	June 2016

Concluding Remarks of the Chairman

In the concluding remarks, the IRC Chairman complemented all the speakers for their presentations and healthy discussion on achievements. He also stressed that the project load of the institute is high and can be minimized after scrutinizing some of the projects. He also stressed that each scientist must present his research achievements and other prioritized activities for the year in the IRC meeting. All members in the project team must show team spirit for the success of the project and to publish good research papers.

General recommendations

- All the team working on soil health should collect information for future research.
- Along with project presentation, information should also be provided on aspects like paper published, conferences attended on the basis of project information.
- After the completion of the project one must present the further course of action on the similar lines.
- The future IRC will be guided by the decisions taken in PMC meeting which has been circulated separately.

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	9	1
4.	AINP on Biofertilizers	22	1
5.	Soil Chemistry and Fertility	2,3, 5, 7, 8, 13,14,17	8
6.	Soil Physics	10,15,18,31	4
7.	Soil Biology	11,19,20,21,23,24,28,32,35	9
8.	Environnemental Soil Science	6,12(a, b),25,26,27,29,30,33,34	10
9.	ITMU	4	1
10	CRP on CA	16 a,b,c&d	1

**contractual projects are not included*

Division-wise no. of Externally Funded Projects

Sl. No.	Centre/Co-coordinating Unit	Sl. No. of Project	Total
1.	AICRP LTFE	-	-
2.	AICRP STCR	-	-
3.	AICRP MSN	-	-
4.	AINP BF	22	1
5.	Soil Chemistry and Fertility	13,14,17	3
6.	Soil Physics	18,31	2
7.	Soil Biology	21,23,24,32	4
8.	Environmental Soil Science	30	1
9.	CRP on CA	16	1

Division-wise no. of Contractual Projects

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	40	1
2	AICRP STCR	-	-
3	AICRP MSN	37,38	2
4	AINP BF	-	-
5	Soil Chemistry and Fertility	36,39	2
6	Soil Physics	-	-
7	Soil Biology	-	-
8	Environmental Soil Science	-	-

New Projects Approved

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	-	-
6	Soil Physics	-	-
7	Soil Biology	35	1
8	Environmental Soil Science	33,34	3
9	ITMU	-	-

Project (serial numbers) with individual scientist

S. No.	Name of Scientist	Designation	Sl. Of projects	
			PI	Co-PI
1	**Dr. A.K. Patra**	**Director**	-	10, 12 (a, b), 13, 23, 31, 32, 39
AICRP on LTFE				
1	Dr. Muneshwar Singh	Project Co-coordinator	1,40	10,13,18,32
2	Dr. R. H. Wanjari	Senior Scientist	-	13, 16 (a), 40
AICRP on STCR				
1	Dr. Pradip Dey	Project Co-ordinator	-	10,17,31
2	Dr. Abhishek Rathore*	Scientist (SS)	-	-
3	Dr. Hiranmoy Das*	Scientist	-	4,27
AICRP on MSN				
1	Dr. A.K. Shukla	Project Co-ordinator	37,38	5,9,12(b),13,17
2.	Mr. Pankaj K. Tiwari*	Scientist	9	37,38
AINP on BF				
1	Dr. D.L.N. Rao	Project Co-ordinator	22	4,13
2	Ms. T.K. Radha	Scientist	-	4,21,22
Soil Chemistry and Fertility				
1	Dr. A. K. Biswas	Head of Division & Pr. Scientist	16 (LCPC)	1, 3,5,13,36,37,38,39
2	Dr. Sanjay Srivastava	Principal Scientist	7, 16c	4,6
3	Dr. Brij Lal Lakaria	Principal Scientist	3,36	2,11,13,16(d),40
4	Dr. R. Elanchezhian	Principal Scientist	5	8,9, 14,15,17
5	Dr. N.K. Lenka	Principal Scientist	2,13,17	-
6	Dr. K. Ramesh	Principal Scientist	-	5,7,8,11,12(b),16(b)
7	Dr. Pramod Jha	Senior Scientist	16d	3,8,10,15,18,36,39
8	Dr. I. Rashmi	Scientist	-	7,16(c),17
10	Dr. B.P. Meena	Scientist	8	1,4,9,13, 16(b),36,37,38
11	Dr. Abhay Shirale	Scientist	-	13,14,16(b),39,40
Soil Physics Division				
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	16 (Deputy LCPC)	1,10,15,18,31
2	Dr. Kuntal M. Hati	Principal Scientist	10,16	3,15,31
3	Dr. R.K. Singh	Principal Scientist	-	16(a),31
4	Dr. J. Somasundaram	Senior Scientist	16b	18
5	Dr. A.K. Vishwakarma	Senior Scientist	16a	-
6.	Dr. M. Mohanty	Scientist	15,18,31	10
7	Dr. N.K. Sinha	Scientist	-	4,6,10,12(a),13,15,16(c),18,31
Soil Biology				
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	23	20,24
2	Dr. A.K. Tripathi	Principal Scientist	-	6,7,16(a),23,28,
3	Dr. A.B. Singh	Principal Scientist	11	1, 4,13

4	Dr. S. Ramana	Principal Scientist	28	11,16(b)
5	Dr. S.R. Mohanty	Senior Scientist	32	19,21,22
6	Dr. K. Bharati	Senior Scientist	19,21	16(d),22,28,32
7	Dr. Asit Mandal	Scientist	-	2,20,23,24
8	Dr. Asha Sahu	Scientist	20	23,26,28
9	Dr. J.K. Thakur	Scientist	-	3,10,11,16(d),17,20,
10	Dr. S. Bhattacharjya	Scientist	35	16(b),23,29
Environmental Soil Science				
1	Dr. J.K. Saha	Head of Division and Prin. Scientist	30	12(b),19,25,27,29
2.	Dr. S. Kundu	Principal Scientist	-	5,6,12(a,b),13,25,26,27
3.	Dr. Ajay	Principal Scientist	34	12(a),29
4	Dr. Tapan Adhikari	Principal Scientist	12(a,b)	5,29
5	Dr. M. Vassanda Coumar	Scientist	29	3,6,10,25,26,30,39
6	Dr.(Mrs.) Sangeeta Lenka	Scientist Sr. Scale	33	2,15,17,18
7	Dr. M.L. Dotaniya	Scientist	25,26	6,27,29,30
8	Dr. Rajendiran S.	Scientist	6,27	13,25,26,29,30
9	Mr. Vasudev Meena*	Scientist	-	26
Institute Technology management Unit (ITMU)				
1.	Dr. Shinogi K C	Scientist	4	16(a),19
Scientists from other Institutes				
1	KV Ramana Rao	Principal Scientist, CIAE, Bhopal	-	16c
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	3
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	3
4	Dr. V. K. Bhargav	Senior Scientist, CIAE, Bhopal	-	20
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	20
6	Udai B. Singh	Mau	-	20
7.	Neera Singh	IARI	-	21
8.	K. Raju Kumar	NIHSAD, Bhopal	-	5
9.	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra	CIAE, Bhopal		12(a)

*On deputation/Leave.

NUMBER OF PROJECTS WITH INDIVIDUAL SCIENTIST

S. No.	Name of Scientist	Designation	No. of projects		Total
			PI	Co-PI	
1	Dr. A.K. Patra	Director	-	10, 12 (a, b),13,23, 31,32,39	8
AICRP on LTFE					
1	Dr. Muneshwar Singh	Project Co-coordinator	1,40	10,13,18,32	6
2	Dr. R.H. Wanjari	Senior Scientist	-	13, 16 (a), 40	3
AICRP on STCR					
1	Dr. Pradip Dey	Project Co-ordinator	-	10,17,31	3
2	Mr. Hiranmoy Das*	Scientist	-	4,27	2
AICRP on MSN					
1	Dr. A.K. Shukla	Project Co-ordinator	37,38	5,9,12(b),13,17	7
2	Mr. Pankaj Tiwari*	Scientist	9	37,38	3
AINP on BF					
1	Dr. D.L.N. Rao	Project Co-ordinator	22	4,13	3
2	Ms.T.K. Radha	Scientist	-	4,21,22	3
Soil Chemistry and Fertility					
1	Dr. A.K. Biswas	Head of Division & Pri. Scientist	16 (LCPC)	1, 3,5,13,36, 37,38,39	9
2	Dr. Sanjay Srivastava	Principal Scientist	7, 16c	4,6	4
3	Dr. Brij Lal Lakaria	Principal Scientist	3,36	2,11,13,16(d),40	7
4	Dr. R. Elanchezhian	Principal Scientist	5	8,9, 14,15,17	6
5	Dr. N.K. Lenka	Senior Scientist	2,13,17	-	3
6	Dr. K. Ramesh	Principal Scientist	-	5,7,8,11,12(b),16(b)	6
7	Dr. Pramod Jha	Senior Scientist	16d	3,8,10,15, 18,36,39	8
8	Dr. I. Rashmi	Scientist	-	7,16(c),17	3
9	Dr. B.P. Meena	Scientist	8	1,4,9,13, 16(b),36,37,38	9
10	Mr. Abhay Sirale	Scientist	-	13,14,16(b),39,40	5
11	Dr. Gurav Priya Pandurang	Scientist	-	.	-

Soil Physics					
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	16 (Deputy LCPC)	1,10,15,18,31	6
2	Dr. Kuntal M. Hati	Principal Scientist	10,16	3,15,31	5
3	Dr. R.K. Singh	Principal Scientist	-	16(a),31	2
4	Dr. J. Somasundaram	Senior Scientist	16b	18	2
5	Dr. A.K. Vishwakarma	Senior Scientist	16a	-	1
6	Dr. M. Mohanty	Scientist	15,18,31	10	4
7	Dr. N.K. Sinha	Scientist	-	4,6,10,12(a),13, 15,16(c),18,31	9
Soil Biology					
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	23	20,24	3
2	Dr. A.K. Tripathi	Principal Scientist	-	6,7,16(a),23,28,	5
3	Dr. A.B. Singh	Principal Scientist	11	1, 4,13	4
4	Dr. S. Ramana	Principal Scientist	28	11,16(b)	3
5	Dr. S.R. Mohanty	Senior Scientist	32	19,21,22	4
6	Dr. K. Bharati	Senior Scientist	19,21	16(d),22,28,32	6
7	Dr. Asit Mandal	Scientist	-	2,20,23,24	4
8	Dr. Asha Sahu	Scientist	20	23,26,28	4
9	Dr. Jyoti Kumar Thakur	Scientist	-	3,10,11,16(d),17,20,	6
10	Dr. S. Bhattacharya	Scientist	35	16(b),23,29	4
Environmental Soil Science					
1	Dr. J.K. Saha	Head of Division and Prin. Scientist	30	12(b),19,25,27,29	6
2	Dr. S. Kundu	Principal Scientist	-	5,6,12(a,b), 13,25,26,27	8
3	Dr. Ajay	Principal Scientist	34	12(a),29	3
4	Dr. Tapan Adhikari	Principal Scientist	12(a,b)	5,29	4
5	Dr. M. Vassanda Coumar	Scientist	29	3,6,10,25,26,30,39	8
6	Dr.(Mrs.) Sangeeta Lenka	Scientist	33	2,15,17,18	5
7	Dr. M.L. Dotaniya	Scientist	25,26	6,27,29,30	6
8	Dr. S. Rajendiran	Scientist	6,27	13,25,26,29,30	7
9	Mr. Vasudev Meena*	Scientist	-	26	1
10	Dr. Sonalika Sahoo	Scientist	-	-	-
Institute Technology Management Unit (ITMU)					
1.	Dr. Shinogi K C	Scientist	4	16(a),19	3

Scientists from other Institutes involved in research projects					
1	Dr. K.V. Ramana Rao	Principal Scientist, CIAE, Bhopal	-	16c	1
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	3	1
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	3	1
4	Dr. Vinod Bhargav	Senior Scientist, CIAE, Bhopal	-	20	1

5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	20	1
6	Udai B. Singh	Mau	-	20	1
7	Neera Singh	IARI, New Delhi	-	21	1
8	K. Raju Kumar	NIHSAD, Bhopal	-	5	1
9	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra	-		12(a)	1

* On deputation/Leave.

LIST OF PARTICIPANTS

S. No.	Name of Scientist	Designation
1.	Dr. A. K. Patra	Director & Chairman, IRC
2.	Dr. A.K. Shukla	Project Co-ordinator, MSN
3.	Dr. Pradip Dey	Project Co-ordinator, STCR
4.	Dr. D.L.N. Rao	Network Co-ordinator, BNF
5.	Dr. R.S. Chaudhary	Head of Division and Principal Scientist
6.	Dr. A.K. Biswas	HOD & Member Secretary, IRC
7.	Dr. J.K. Saha	Head of Division and Principal Scientist
8.	Dr. S. Kundu	Principal Scientist
9.	Dr. A.B. Singh	Principal Scientist
10.	Dr. Ajay	Principal Scientist
11.	Dr. A.K. Tripathi	Principal Scientist
12.	Dr. Sanjay Srivastava	Principal Scientist
13.	Dr. Tapan Adhikari	Principal Scientist
14.	Dr. Brij Lal Lakaria	Principal Scientist
15.	Dr. Kuntal M. Hati	Principal Scientist
16.	Dr. R. Elanchezhian	Principal Scientist
17.	Dr. S. Ramana	Principal Scientist
18.	Dr. N.K. Lenka	Principal Scientist
19.	Dr. R.K. Singh	Principal Scientist
20.	Dr. K Ramesh	Principal Scientist
21.	Dr. K. Bharati	Senior Scientist
22.	Dr. R.H. Wanjari	Senior Scientist
23.	Dr. A.K. Vishwakarma	Senior Scientist
24.	Dr. J. Somasundaram	Senior Scientist
25.	Dr. M. Mohanty	Scientist Senior Scale
26.	Dr. S.R. Mohanty	Senior Scientist
27.	Dr. Pramod Jha	Senior Scientist
28.	Dr.(Mrs.) Sangeeta Lenka	Scientist Senior Scale
29.	Dr. N.K. Sinha	Scientist
30.	Dr. Asit Mandal	Scientist
31.	Dr. Asha Sahu	Scientist
32.	Dr. S. Rajendiran	Scientist
33.	Dr. M.L. Dotaniya	Scientist
34.	Dr. Jyoti Kumar Thakur	Scientist
35.	Dr. Shinogi K C	Scientist
36.	Dr. Bharat Prakash Meena	Scientist
37.	Dr. Abhay Shirale	Scientist
38.	Dr. S. Bhattacharjya	Scientist

1	Dr. Abhisek Rathore*	Scientist	On deputation (ICRISAT)
2	Mr. Hiranmoy Das*	Scientist	On study leave
3	Mr. Vasudev Meena*	Scientist	On study leave
4	Mr. Pankaj K. Tiwari*	Scientist	On study leave
5	Dr. Gurav Priya Pandurang*	Scientist	On institute attachment training
6	Dr. Sonalika Sahoo*	Scientist	On institute attachment training

*On leave/deputation/training

Annexure – I

Progress of Approved on-going projects:

Programme I: Soil Health and Input Use Efficiency

1.	**Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol.**
	• As far as INM module is concerned, the result indicated that 25 per cent substitution of nutrient (NPK) through FYM was found at par with 100 percent NPK application. The yields obtained on integration of NPK with poultry manure and urban compost was more or less similar but inferior to FYM. Results further revealed that reduction of NPK doses to 50 percent with similar amount of all the three organic resources could not keep the pace of productivity. Application of organics resulted in increase in nutrient use efficiency of N by 10 to 12 per cent and P by 4 to 9 per cent. • Continuous balanced use of nutrient through INM resulted in increase in available N, P in soil but decline in available K. This indicates K could be threat to sustainability in future. Absence of N and P in fertilizer schedule (control) resulted decline in status of both the nutrients. Balanced or integrated nutrient supply of nutrient resulted in decline of bulk density and increase in mean weight diameter and water stable aggregates and porosity in soil. Application of organics along with fertilizer has more pronounced effect compared to supply of nutrient through fertilizer alone. Soil enzymes data revealed that application of chemical fertilizer increased the activities of enzymes in soil and incorporation of organic further increased the activities of these enzymes which means application of both fertilizer and manure encourages the activities on soil organisms.
2	**Studies on soil resilience in relation to soil organic matter in selected soils.**
3	**Biochar on soil properties and crop performance**
	• A field experiment was carried out for efficient delivery of nitrogenous fertilizer for higher crop yields with maize – gram cropping sequence. • Biochar was prepared from the pigeon pea stalks and required quantities of nitrogenous fertilizer, urea, was thoroughly mixed with varying quantities of biochar before application. • A mineralization study was conducted to assess the loss of biochar through decomposition and mineralization in different soils. • N mineralization incubation study conducted to test field experiences.
4	**Integrated assessment of some IISS Technologies in enhancing Agro-Ecosystems productivity and livelihood sustainability**
	• Farmers' field valuation of some of the IISS technologies viz., Integrated Plant Nutrient Supply (IPNS-I) System, Soil Test based Fertilizer Recommendation (STCR), Phospho-sulpho-nitro Compost as a replacement of FYM in IPNS-I (IPNS-II), and Biofertilizers (used in both IPNS treatments) was carried out for the soybean-wheat cropping system (2nd season of wheat and 3rd season of soybean and wheat) in the selected farmers' fields of Mengra Kalan Village of Bhopal. Method demonstration were conducted in each crop season to reinforce the farmers' learning regarding the compost preparation and use of biofertilizers. • The second year wheat crop showed an increased yield of 9.55 per cent in IPNS-I, 22.0 per cent in IPNS-II, and 14.81 per cent in STCR over farmers' practice. • In the third crop season, the adverse climatic condition affected the crop performance in the selected farmers' fields but gave better yields compared to other fields of the selected village. The yield performances of soybean crop over the farmers' practice for the three treatments in the first year were 10.2 per cent in IPNS-I, 27.0 per cent in IPNS-II, and 20.8 per cent in STCR. • The third year wheat crop showed an increased yield of 8.5 per cent in IPNS-I, 20.8 per cent in IPNS-II, and 14.8 per cent in STCR over farmers' practice. • Soil samples were analysed for physical, chemical and biological properties. Plant samples were also analysed for the NPK content.
5	**Nano-particle delivery and internalization in plant systems for improving nutrient use efficiency**
	The impact of nano-micronutrient fertilization on growth and metabolism of plants viz. rice, soybean, chickpea and maize were studied under hydroponic and sand culture system using ZnO, CuO and Fe_3O_4 nanoparticles (NPs). Most of NPs analysed in TEM were within the size range of 30-100 nm. Plant growth parameters viz. plant height, root length, shoot biomass, root biomass and chlorophyll content were recorded in the nano-micronutrient treated plants. Plants fertilized with optimal recommended dose of Fe in nano form (54µM) had registered an increased morphological features viz. plant height, biomass (shoot and root), and decreased antioxidant enzyme activity than the plants

	fertilized with the sub-optimal dose of Fe in macro form (salts). However, half of the recommended dosage of Fe (27μM) in nano form positively influenced leaf area and proline content of plants. This indicated that there is a possibility of reducing the dose of Fe in its nano form to increase the nutrient use efficiency. The gas exchange analysis of sand cultured soybean and rice grown with Fe, Cu and Zn nanoparticles revealed that photosynthesis rate was higher with Fe NP treatments followed by Cu NP and Zn NP treated plants.
6	**Soil quality assessment for enhancing crop productivity in some tribal districts of Madhya Pradesh (TSP)**
	• Soil quality assessment for Dhar district
7	• **Evaluating rock phosphates for their suitability for direct application**
	• Calcium oxide, SiO2 besides P2O5 were the most oxides forms found in the structure of the studied rock phosphates. • The reactivity of all the rock phosphates, as revealed by citrate soluble P content increased as a result of fineness in size. • Incubation of the organic matter with RP increased the solubility of RP. The other two treatments i.e. zeolites and acid clay increased the solubility of RP significantly when added in 1:1 ratio with RP, the maximum solubility was observed under incubation with acid clay in all the rock phosphate studied. • Release of P in two soils (Alfisol and vertisol) was also studied under different treatments. Two soil series, Sarol, which is a vertisols from Indore and Thymagondalu which is an alfisol from Bangalore were used for incubation experiment. Untreated rock phosphate (Jhamarkotra 1) released more P in alfisol than in vertisol, because of relatively lower pH in alfisols than in vertisols. • Zeolite treatment led to a gradual release of P in the soil system. However, there was a decrease in slope with increase in the number of extractions in alfisol. However, zeolite-system's ability to release P decreased as the number of extractions increased in alfisols possibly due to filling of exchange sites by Ca2+ in alfisol as the total exchange sites (CEC of zeolite+CEC of soil) for Ca2+ was far less in alfisol than vertisol. Even though the Ca saturation in vertisols and alfisol at the end of the extraction in zeolite system was nearly same, the RP continued to release P in vertisols as the vertisols on account of higher CEC is more buffered and continued to provide exchange sites for the adsorption of released Ca. • The results show that, in alfisols, it should be possible to renew the system's ability to release P from rock phosphate in the soil by adding more zeolite. Acid clay-rock phosphate curves released more phosphate than zeolite system in both the soils. However, zeolite and acid clay system's ability to release P decreases as the number of extractions increases. The likely cause is a filling of exchange sites by Ca2+ as Ca saturation of the exchange site was higher in acid clay system than zeolite system. These results indicate that, it should be possible to renew the system's ability to release P from phosphate rock still present in the soil either by adding more NH4-zeolite or by adding acid clay.
8	**Evaluation of modified urea materials and agronomic interventions for enhancing nitrogen use efficiency and sustaining crop productivity**
	• Among the different modified urea materials, particularly biochar coated urea was at par with NCU in enhancing the yield and nitrogen use efficiency of maize crop. • Crop productivity and NUE were significantly higher in the treatments where basal dose of nitrogen was skipped and total N was applied in two equal splits (60kgN/ha) at 20 and 40 DAS, respectively. • The application of large amount (10tonne/ha) biochar as soil amendment with recommended dose fertilizer recorded higher crop yield.
9	**Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat**
10	**Assessment of important soil properties of India using mid-infrared spectroscopy**
	In this project collected soil samples from various land use systems under vertisols, estimated soil properties following standard laboratory analysis protocol and also recorded MIR spectra of the soil samples. Using the information chemometric models were developed for estimation of soil properties like, SOC, EC, pH etc for the vertisols. Further work is continuing to validate the models and develop more robust prediction algorithms.

(B) Externally Funded Projects

11	**Network Project on Organic Farming**
	• Soybean performed better under all the organic nutrient management in all the 4 cropping systems (100

	% only organic was better than 75 % organic + innovative). The same trend followed in rabi crops too. • Soybean-wheat recorded higher SOC followed by soybean-linseed, soybean-mustard and soybean-chickpea. • The mean SOC was the highest under 100% organic nutrient management (0.93%) followed by 75% organic+ innovative practice (0.91%). • Highest count of bacteria and fungi was recorded in 100 % Organic followed by 75 % Organic + Innovative and 75 % Organic + 25 % Inorganic treatment. • Count of actinomycetes was recorded highest in 75 % Organic + 25 % Inorganic treatment. • Soil enzymes *viz.* dehydrogenase and FDA was recorded highest in 100 % Organic followed by 75 % Organic + Innovative and 75 % Organic + 25 % Inorganic treatment indicating beneficial effect of addition of organics on soil microorganisms identified. • Performence of different varieties of soybean, maize, chickpea and wheat were evaluated for their yield response to screen out promising varieties for organic management practices for central India. Among the 12 varieties of of each crops, soybean cultiver RVS-2002-4, Kanchan 101 maize variety, Chickpea JG-130 and wheat HI 8498 variety out performed in terms of seed yield.
12	**(a) Use of nano sensors network for field detection of temperature and moisture stress in plant and soil**
	A telemetry network has been developed and installed in response to an increasing need for accurate, real time soil moisture sensor data to assist irrigation scheduling in time on CIAE farm. System included the equipment to monitor field conditions, radios to transmit the information from the field, interpretation of soil water status in field. Data were collected in the field using 4 nos. of soil moisture (MP406) sensors having surface modified by Poly-aniline (PANI) nanofibers as a sensing layer for maximum response to soil moisture and transferred onto a server using radio telemetry and the mobile phone network.
	(b) Conversion of naturally occurring plant nutrient containing minerals into nano form by top down approach to enhance the availability of plant nutrients in soil and faster reclamation of problem soils
	• The results suggest that nano-porous synthetic zeolite could be used as a carrier of two important micronutrients, namely, Zn and Mo, for their smart delivery in the field. Retention capacity of N, P and S appear to be considerable but cannot be used for their smart field delivery through nano-porous zeolite in view of their relatively higher crop demands. However, they can be used for potted agriculture and seedling raising. • An experiment was conducted to investigate whether the soil heterotrophic bacteria can utilize the amorphous nano carbon (C nano powder, <50 nm, 99%; Sigma-Aldrich) as their energy source. In modified nutrient agar medium having C nano powder only as energy source (Agar, peptone, NaCl, C nano powder), two different bacterial colonies showed vigorous growth within 24 hrs, indicating their capability to utilize the nano carbon for their growth and development. • It was found that TiO_2 NPs seed soaking pretreatments had no stimulatory effect on growth of maize seedling rather adversely affected.
13	**Soil quality assessment and developing indices for major soil and production regions of India funded by ICAR-Extra Mural Project**
	• Collected representative/composite soil samples for estimating the physico-chemical properties of soils including *in situ* soil sampling for bulk density and pristine soils. The soil and grain sample collection was done by adopting grid sampling method by recording latitude, longitude and altitude of the sampling point / coordinator with GPS instrument from assigned villages in the districts of Kanpur (Nagar and Dehat), Jalaun, Kannauj and Hardoi districts of Uttar Pradesh. • Designed soil sampling protocol for soil quality assessment • Soil sampling from targeted study regions at 20 km grid points • Soil analysis to be taken up

Collaborative projects in other institutes where IISS scientists are associated in

14	**Enhancing Resource Use Efficiency in Pulse Based Cropping System in Central India. Collaborating with ICAR-Indian Institute of Pulses Research, Kanpur (U.P.)**
	Physiological analysis of resource use efficiency under soybean based inter-cropping system was carried out under flat bed and broad bed system of land configuration. Morpho-physiological parameters were recorded in Soybean based inter cropping system involving crops viz. pigeon pea, maize, sesamum, sorgum and black gram in *kharif* 2015 and lentil in *rabi* 2015-16 under rainfed and supplemental irrigation.

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

15	**Assessing impacts of climate change on different cropping systems in Central India and evaluating adaptation studies through crop simulation models**
	• The models have been calibrated and validated for soybean, wheat, chickpea and maize • The grain and biomass yield for all the crops have been predicted using the models • Yield gap analysis of maize was carried out for the state MP • Climate scenarios analysis were carried out using representative concentration pathways (RCPs) for the year 2050 and 2080.

16	**CRP-Conservation Agriculture**
	CRP on CA was approved in EFC of IISS, Bhopal for the Five year plan 2012-'17. However, in view of the budget cut the number of participating institutions was cut down, and finally eleven institutes were part of the platform with IISS, Bhopal as the lead centre, and CRIDA, Hyderabad, IARI, New Delhi, IIFSR, Modipuram, CIAE, Bhopal, DWR, Jabalpur, CSSRI, Karnal, NRRI, Cuttack, IIBWR, Karnal, ICAR-RCER, Patna and NIASM, Baramati ar partners. It has also been decided that CRIDA, Hyderabad will be the leader of rainfed eco-system, IIFSR as the leader of irrigated ecosystem and IISS, Bhopal as the leader in basic and strategic aspects of CA. Apart from that machinery issues will be dealt by CIAE, Bhopal and weed management issues will be tackled by DWR, Jabalpur. All the 11 institutes have started platform projects since the rabi season of 2015. An annual progress- cum-review meeting was held at IISS, Bhopal to review the progress of all the projects. Another meeting-cum-workshop was also held at CIAE, Bhopal to discuss all issues pertaining to CA machineries.
	Development, refinement and validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment"
	• To fulfill the objectives of the platform project four sub-project has been formulated and started two new on-station field experiments to fine tune different component technologies of CA and to study the interaction effect of tillage, nutrient and water on crop productivity and soil health in Vertisols. Different best-bet conservation agriculture techniques were demonstrated through farmer's field trials. Monitored the management of the field experiment during the cropping season, recording of crop growth parameters, soil sampling and analysis. Analyzed and interpreted information generated and presented the results during the review meeting. Also recruited SRFs, procured chemicals, glasswares and implements.
	(a) Demonstration of best-bet conservation agriculture practices on farmers' fields in Vertisols of central India
	• Demonstration on different modules of conservation agriculture (CA) in farmers' field were successfully conducted for different cropping systems. Farmers' Day (Kisan diwas) was organized for the dissemination and popularization of CA technologies amongst farmers. The major weed flora observed in soybean were *Echinochloa crusgalli*, *Cyperus rotundus* and *Digitaria sanguinalis* (as monocot weeds) and *Celosia argentea Commelina bendhalensis*, *Euphorbia sp.*, *Acalypha sp.*, as dicot weeds during kharif season. During rabi season *Avena fatua*, *Parthenium hysterophorus*, *Sonchus arvensis*, *Sonchus sp.*, *Convolvulus arvensis*¸ *Anagalis arvensis*, *Chenopodium album*, *Tridax procumbens* were predominant weed flora in chickpea. In wheat namely, *Sonchus sp.*, *Avena fatua*, *Convolvulus arvensis*, *Parthenium hysterophorus*, *Anagalis arvensis*, *Euphorbia geniculata* were found. However, *Phalaris minor* was a miscellaneous weed of wheat in terms of density. Yields recorded were too low in soybean due to distorted rainfall during kharif 2016. In rabi crops, conservation practices i.e. zero tillage followed by reduced tillage recorded significantly higher yield compared to conventional tillage (CT) and improved farmers' practice. • Demonstration of different modules of CA in farmers field successfully conducted for different

	cropping systems. • Kisan Divas were organized for the dissemination and popularization of CA technologies amongst farmers.
	(b) Fine-tuning of conservation agricultural practices for Vertisols of central India
	A field experiment was initiated during *kharif* 2015 with five tillage treatments namely T1: Conventional tillage, T2: RT-1 (sowing with residues + 1 duck foot, WC with herbicides), T3: RT-2 (Strip tillage - sowing with strip till- drill with residues, WC herbicides), T4: RT-3 (Strip tillage - sowing with strip till- drill with residues, Hand weeding) and T5: No-tillage with three nutrient doses namely N1:75% RDF, N2:100% RDF, N3: Soil test based recommendation. Experimental crops were raised during kharif and Rabi season. Regardless of tillage systems, higher nitrogen application namely N100 and N application based on STCR recorded higher grain yield under soybean-wheat and maize-gram systems. First year data revealed there was no significant trend under different tillage system. I. Already running experiment on Conservation agriculture Contrasting Tillage x Cropping systems on Soil carbon and aggregation and crop yield) • Experiment I: Soil organic carbon concentration (%) relatively improved under NT and RT with residue retention at 0-5cm than CT. Subsurface layers did not show any significant trend among different tillage system. Soil aggregation as measured through mean weight diameter (MWD) significantly improved only in 0 -5 cm under NT and RT coupled with residue retention than CT. Among different cropping system studied, maize-gram, maize+ pigeon pea (1:1) recorded significantly higher crop yield in terms of soybean grain equivalent yield (SGEY). Soybean based cropping system registered relatively low yield due to continuous rainfall results in poor crop performance. Effect of tillage did not have significant effect on crop yield even after completion of five crop cycles. • Experiment II: Yield data indicated that tillage did not have significant effect on soybean grain equivalent after completion of six crop cycles. Irrespective of tillage system, maize-gram recorded significantly higher yield followed by soybean +pigeon pea (2:1) and soybean+ cotton (2:1). The interactive effect of tillage x cropping system showed non – significant effect on SGEY. Lower crop yield was recorded under soybean based cropping system was due to aberrant weather conditions.
	(c) Development of water and nutrient management practices in conservation agriculture for Vertisols of central India
	• Field experiment were conducted with soybean and wheat and the crops were raised. • There was impact of tillage on crop yields • The drip and microsprinkler were established in the field which will be used from next *rabi* season.
	(d) Impact of conservation agricultural practices on soil health, carbon sequestration and greenhouse gas emissions in different production systems
	• The project was initiated during 2015 to monitor changes in soil quality parameters by collecting soil samples from experiments running since 2013 at Directorate of Weed Science, Jabalpur. For this, samples were collected from soybean, rice and maize based cropping systems. The perusal of data from CA experiments of Jabalpur indicated that maximum build-up of SOC (0.87%) was recorded from rice based cropping system where zero tillage was practiced along with residue retention. • It was observed that labile C content (0-15 cm soil depth) was significantly higher under zero tilled plots along with residue retained (519 mg kg^{-1}) in rice based cropping system in comparison to conventionally tilled with residue retained (429 mg kg^{-1}). There was a build-up of P under different treatments in CA experiments of Jabalpur. • Available K was relatively higher in zero tilled plots with residue retained in comparison to no residue retained plots in all the experiments.
17	**Simulating the effect of elevated CO_2 and temperature on water productivity and nutrient use in soybean-wheat cropping system**
	• Compilation of weather data for 29 district of Madhya Pradesh. Initial soil properties of experimental site determined. Extraction of data of RegCM4 downscaled model of the IITM for RCP 8.5 • Experiment on wheat crop under ambient weather in absence of elevated CO_2 facility
18	**Integrated assessment of soil and crops for enhancing productivity and C-sequestration potential of Vertisols of central India under changing climate scenarios (NICRA)**
	• Best management practices for soil organic carbon (SOC) management in central Indian Vertisols have been identified • Climate change effects on soil organic carbon change and crop productivity under balanced fertilization in central Indian vertisols have been studied • Carbon dynamics in Vertisols using DNDC and RothC model is under progress

Programme III – Soil Microbial Diversity and Biotechnology

19	**Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating microbes**
	• Experiment was initiated with an aim to develop microbial technology to minimize odour problem by using microbial strains that would oxidize reduced (S^{2-}) or elemental S to SO_4. In this context S oxidizing bacteria were isolated through enrichment technique. • After 3 repeated enrichments six potential sulphur oxidizing bacteria were isolated. DNA from these isolates were extracted and purified for sequencing. • S oxidation potential of the isolates was estimated. The S oxidation potential was determined from the amount of SO_4 produced over oxidation of elemental S. Two isolates 3M and 4S+M were found most promising in terms S oxidation potential • In an experiment CH_4 oxidation at different depth profile of compost pit was evaluated. • CH_4cycling (oxidation) in cow manure in response to electron donors tested. • NO_3 and Fe^{3+} stimulated methane oxidation. SO_4 also stimulated CH_4 oxidation but inhibited at the later stage and resulted partial CH_4 consumption • There is inverse relation between abundance of pmoA gene and CH_4 consumption. This could be due to the inhibition of targeted methanotrophs. Probably, CH4 oxidation was carried out by anaerobic methane consuming bacteria.
20	**Developing technique for acceleration of decomposition process using thermophilic organisms**
	• DNA extraction and purification of Bacteria and Actinomycetes has been done. Bacterial DNA is sequenced and identified and submitted to Genebank, USA. Identification of Fungal cultures has been done from Indian Type Culture Collection (ITCC), IARI, New Delhi. Extraction and purification of fungal DNA has to be done. The consortium of these cultures has been made and used for accelerated decomposition of biodegradable wastes. Segregation was the first and most important step performed followed by mixing the segregated waste (150 kg) with fresh cowdung (50 kg) and consortium of microbes (10^5 viable cell). 60% of moisture content was maintained throughout the composting period. Periodic turning was done to provide aeration. Samples were taken at different stages of composting were analysed for its physical, chemical and biological properties. It was observed that after 30 days of decomposition the quality compost was obtained with C:N ratio of 14:1, CEC 94 cmol(p+)/kg, lignin/cellulose ratio 2.4%, CEC/TOC ratio 4.56. Thus, achieved desirable maturity and stability indices.
21	**Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes (DBT)**
	• Through this project we have brought out information on biodegradation of two intensively used pesticide; chloropyrifos and imidacloprid under the influence of climate factors CO_2 (400ppm, 800ppm), temperature (25C, 35C and 45C), and moisture (60%MHC, 100% MHC). • First experiment highlighted the significance of biochar on degradation of both pesticides. Biochar at 1% significantly ($p < 0.01$) stimulated pesticide degradation irrespective of treatments. Amelioration of biochar to soil would enhance pesticide biodegrdadtion under adverse climate. • Second experiment highlighted N_2O production from soil treated with imidacloprid under climatic factors. The lowest N_2O production was from soils incubated at 100% MHC-10ppm imidacloprid-800ppm CO_2. Highest N_2O production observed from soils incubated at 60% MHC-400pm CO_2-0ppm imidacloprid. N_2O production positively correlated ($p < 0.01$) with heterotrophic bacterial population and negatively correlated with actinomycetes population ($p<0.05$). • Third experiment examined CH_4 consumption in soil. Chloropyrifos inhibited CH_4 consumption and this negative effect was high under elevated CO_2. Real time PCR quantification of pmoA gene, 16S rRNA and actinomycetes indicated that methanotrophs and bacteria correlated positively with CH_4 consumption rate k. Study concluded that use of chloropyrifos under elevated CO_2 would negatively impact CH_4 uptake potential of soil.
22	**Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential (Funded by AMAAS)**

	• *Arthrobacter* numbers were very low (<1%) in soils except those from Chickpea (5-10%) which also had higher diversity. 200 *Arthrobacter* isolates from rhizosphere of five crops from four locations in M.P. screened for PGPR attributes. 13 promising *Arthrobacter* isolates (liquid formulation) evaluated in Vertisol. Average increase in grain yield was 12-18% on soybean, rice and maize and 21- 25% in chickpea and wheat. Consortia of *Arthrobacter* (two strains) with *Bacillus* spp. (three) and *Streptomyces* spp. (two) gave best performance. • The extent of Archael nitrification rate can be equivalent to that of ammonium oxidizing bacteria. Both Ammonia oxidising bacteria (AOB) and Ammonia oxidising archaea (AOA) are linked to redox metabolic processes. If AOB are inhibited, then AOA initiate the nitrification and modulate TEAPs (terminal electron accepting processes) in flooded soil ecosystem. Community dynamics assessed by Real time PCR of the two populations to corroborate observed activates.
23	**In-situ residue decomposition of rice-wheat and sugarcane for enhancing crop productivity and soil health funded by ICAR-Extra Mural Project**
	• Different farmer field has been selected for *in-situ* decomposition of wheat (ICAR-IISS &ICAR-NBAIM) sugarcane (MPKV, Rahuri) residue. • Consortia of ligno-cellulolytic microbes have been used for rapid decomposition of crop residues. Mass multiplication of ligno-cellulolytic microbial cultures has been done at NBAIM and IISS, Bhopal. These cultures have been shared with all these cooperative centers. • Multi-location trials have been conducted in Bhopal, Karnal and Mau centres for wheat residue decomposition and in Rahuri center for sugarcane residue decomposition. • Soil samples have been collected before and after imposing of treatments. • Analysis of soil physico-chemical and biological properties is in progress. • Recruitment of SRF has been done in both Bhopal and Rahuri centre. • Some of the sanctioned equipments (Laboratory Refrigerator & AC) have been purchased.

Collaborative projects with other institutes where IISS scientists are associated in

24	**Isolation and characterization of heavy metal resistant bacteria & evaluation for their use in agriculture. Collaborating with NBAIM, Mau (U.P.)**
	• Survey and collection of samples from heavy metal polluted sites such as Copper (Cu) ore samples and iron(Fe) ore sludge sample were collected from Jharkhand, India which were composite ore sampling as well as Industrial waste sampling from Tata Nagar Steel where processing of iron ore from Noamundi iron mine range is done. The area for selection in Maharashtra was identified on basis of the pollutants produced by various textile industries effluents drained as sewage which is used as irrigating the adjoining agricultural fields. • Municipal solid waste dumping site in Bhopal was surveyed and samples were collected from there also. The samples. Samples collected analysed for various heavy metals such as Pb, Ni, Cd, Cr, Hg, Cu, Zn, Co and As. In the isolated bacteria in total 77 morphotypes were obtained • Characterization and screening of the bacterial isolates for resistance against various heavy metals was done. Minimum inhibitory concentration with heavy metals carried out. 20 potential bacterial isolates have been identified possessing very high and showing multiple heavy metal tolerance. 9 strains identified and submitted to NAIMCC. Bioadsorption/bioabsorption studies with potential strain are in progress.

Programme IV: Soil Pollution, Remediation and Environmental Security

25	**Interaction among tannery effluents constituents on heavy metals uptake by spinach.**
	• Pot Culture Experiment-Interactive effect of anions and cations on Cr uptake. • Field experiment: With FYM & Pressmud in tannery affected area of Kanpur. • Phytoremediation trial: Field experiment with mustard varieties in Sewage irrigated area. • Soil quality assessment for Dhar district. • Baseline concentrations and heavy metals distribution in Sehore and Vidishdistricts. Collection and analysis of soil samples collected from Indore, Kanpur, Unnao.
26	**Impact of Long Term Use of Sewage Water Irrigation on Soil and Crop Quality in Bhopal region of Madhya Pradesh**

	Biological properties **(**Enzymatic activities and microbial population count) of soil and water samples was analysed.
27	**Determination of baseline concentration for delineating contaminated areas in black soils of central India**
	• Baseline concentrations and heavy metals distribution in Sehore and Vidish districts. • Interactive effect of anions and cations on Cr uptake.
28	**Assessment of Cotton for the remediation of soils contaminated with heavy metals**
	• Cotton (Bt)(RCH-2) was exposed to different levels of Cd (0,25,50,100 & 200 mg kg $^{-1}$soil), Pb (0,250,500,750 and 1000 mg kg $^{-1}$soil) and Cr (0,12.5,25 &50 mg kg^{-1}soil). The study revealed that, the cotton crop could tolerate up to the highest levels of all the three heavy metals without any mortality. At higher levels of applied heavy metals, the dry weight of plants decreased. • Data on various physiological (Germination/emergence, total dry matter, root length and root dry weight, photosynthesis rate, yield components and yield) and biochemical (total sugar,phenols, total soluble protein, proline, total free aminoacids and nitrate reductase activity) were recorded. The data on the partitioning of Cd, Pb and Cr revealed that, the heavy metals mainly concentrated in roots followed by shoots and bolls • The soil enzymes viz., dehydrogenase, phosphotases(acid and alkaline) decreased with the application of heavy metals. The data on CFU count of Heterotrophs and actinomycetes revealed that, among the different heavy metals Pb inhibited heterotrophs significantly than other heavy metals. On the other hand, the count of actinomycetes, the stress indicator microbes were higher in cadmium, followed by Pb and Cr. • Initial soil and after incubation of heavy metals samples were analysed.
29	**Critical limits of Cd for major soil orders of India**
	• Soil samples collected from Ranchi, Kanpur and Indore districts • Pot culture experiment initiated.

30	**Determination of critical limits for identifying heavy metals contamination and their threats in major soil types of India funded by ICAR-Extra Mural Project**
	• Bulk soil samples have been collected from Indore (Vertisol), Kanpur (Inceptisol), and Ranchi (Alfisol) for conducting pot experiments • .Soil samples were collected from 10 locations belonging to Alfisol for laboratory experiments • Pot experiments have been initiated on three soil types on Cr and Pb with spinach as test crop.

New Projects

External Funding

31	**Hyper-spectral remote sensing approaches to evaluate soil quality and crop productivity of central India (under DST sponsored Network Project on Hyper-spectral Big Data Analytics)**
	The project was initiated in April 2016 and recruitment of JRFs is under progress.
32	**Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential**

Institute projects (New proposals)

33.	**Response of global warming potential and soil carbon storage to reversal in tillage practices in Vertisol**
34	**Optimizing crop residue cover/herbicide dose for weed management in Vertisols under conservation agriculture regimes**
35	**Management of soft beverage sludge applied soil for sustainable crop production and environmental protection**
	• Use of coca cola sludge in agriculture with proper remediation, mainly phytoremediation has been planned in kharif season and the final proposal is expected shortly and work will start from Apr, 2016. • The other projects initiative includes the anthropogenic pollution - like polystyrene etc. has been prepared for the discussion with MPCST.

Contractual Projects

36	**Evaluation of urease inhibitor product (limus) for nutrient use efficiency in cereal crops (BASF Pvt. Ltd.,)**
	A field experiment carried out with maize – wheat cropping system and observation recorded and reported to the agency. The tested product did not show much edge over the prilled urea.
37	**Evaluation of efficacy of sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India (Zuari Agro Chemicals Ltd)**
38	**Evaluation of efficacy of zinc metalosate and boron metalosate foliar supplements for maximizing yield through balanced nutrition of important crops grown in India (Indofil Ind. Limited)**
39	**Upgradation of Mridaparikshak mini lab (Nagarjuna Agro Chemicals Pvt. Ltd., Hyderabad)**
	Five parameters viz., Available Cu, Mn, Gypsum requirement, lime requirement, and calcareousness were added in Mridaparikshak.
40	**Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan)**
	Surveyed the farmers' fields and collected soil samples from the villages in the Bhopal district. Analyzed soil samples to estimate potassium content and other basic physico-chemical properties for selection of fields. Planned and conducting field experiments on soybean (cv JS 9560) and rice (cv Pusa Basmati-1) with recommended practices and imposed potassium treatments in farmers' field. Rice nursery has been raised and treatments imposed in transplanted rice on farmers' field.

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