Proceedings of IRC Meeting

(29 Nov. to 01 Dec., 2017 and 07 Dec., 2017)

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
Principal Scientist & Head and Member Secretary, IRC

COMPILATION AND EDITING

Dr. R. Elanchezhian
Principal 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 IRC meeting was held during 29 Nov., to 01 Dec., 2017 and 07 December, 2017 in the committee room of the institute. The member Secretary IRC welcomed the Chairman and other members of IRC and briefed about the purpose and agenda of the meeting. I/c PME Cell presented an account of the completed and new projects in the institute and the modalities for presentation. The Director and Chairman of the IRC also welcomed all the members of IRC present over there. He took this opportunity to congratulate the award winning scientists. He again stressed that all scientists must submit quality research proposals. He has 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:

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

A) Institute in-house projects

Sl. No.	Title of Project	PI and Co-PI	Division / Unit	Period		RPP status	Remarks
1	Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol.	Muneshwar Singh A. K. Biswas B. P. Meena A. B. Singh R. S. Chaudhary	LTFE	Reconstructed April 2012	Long term	RPP-II 2014-15, RPP-II 2015-16 and RPP-II 2016-17 to be submitted	• To be continued • One more cycle of assessment to be done
2	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	March 2017	RPP-II 2014-15, RPP-II 2015-16, RPP-II 2016-17 & RPP-III to be submitted	• Concluded • Biochar supply to be ensured and niche area to bet identified • RPP-III to be presented
3	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 (Nishad)	SC&F	July, 2013	July 2017	RPP-II 2015-16 and RPP-II 2016-17; RPP-III to be submitted	Concluded RPP-III to be presented
4	Evaluating rock phosphates for their suitability for direct application	Sanjay Srivastava, K Ramesh, A.K. Tripathi, I. Rashmi and Pradip Dey	SC&F	October 2013	May 2017	RPP-II 2013-14, RPP-II 2014-15, RPP-II 15-16, RPP-II 2016-17; RPP-III to be	• Not much headway made in work • Dr. Prabhat Tripathi and Dr. Gurav Priya Pandurang were included in place of Dr K Ramesh and Dr I. Rashmi to strengthen manpower • Extension granted upto May 2018

						submitted	
5	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	RPP-II 2015-16, RPP-II 2016-17; RPP-III to be submitted	• Effect of BCU on NUE to be analyzed • Best treatment to be assessed in a pilot experiment in farm
6	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	MSPE	October 2014	June 2017	RPP-II 2015-16, RPP-II 2016-17; RPP-III to be submitted	• Not presented • RPP-III will be presented in next IRC
7	Assessment of important soil properties of India using mid-infrared spectroscopy	K.M. Hati, M. Mohanty, Pramod Jha, R.S. Chaudhary, N.K. Sinha, J.K. Thakur, M. Vassanda Coumar, Pradip Dey, Muneshwar Singh, A.K. Patra, Javed Rizvi	Soil Physics	May 2015	June 2018	RPP-II 2015-16, RPP-II 2016-17 to be submitted	Project to be continued

B) **Externally Funded Projects**

8.	Network Project on Organic Farming	A. B. Singh K. Ramesh Brij Lal Lakaria S. Ramana J.K. Thakur	Soil Biology	July 2004	March 2017		• Dr. B.P. Meena to be included in place of Dr K. Ramesh • Extended upto March 2018 • Nutrient budgeting to be done
9.	(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		• Concluded • Project report may be submitted
	(b) Conversion of naturally occurring plant nutrient containing minerals into nano	Tapan Adhikari, S. Kundu, A.K. Shukla, K. Ramesh,	ESS	April 2015	March 2017		

	form by top down approach to enhance the availability of plant nutrients in soil and faster reclamation of problem soils	S. Bhattacharjya, J.K. Saha, A.K. Patra					
10.	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, Sangeeta Lenka, N.K. Sinha, A.O. Shirale, A.K. Viswakarma, R.H. Wanjari, B.L. Lakaria, B.P. Meena, A.B. Singh, A.K. Patra, Muneshwar Singh, D.L.N. Rao, A.K. Shukla, Pradip Dey	SC&F	April 2016	30 September 2017		• Report to be submitted • Pending work to be carried out through institute projects • Funding from Extra Mural Research may be explored
11	Ensuring food security, sustainability and soil health through resource conservation based farmer FIRST approach in central India	A.K. Vishwakarma, R.K. Singh, A.B. Singh, B.L. Lakaria, R.H. Wanjari, K. Bharati, Asha Sahu, Shinogi K.C. and A.O. Shirale	SC&F	March 2016	March 2018	Report to be submitted	• Project to be continued • Dr. A.L. Kamble (Sci., Economics) to be included

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

12.	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 A.O. Shirale	SC&F	July 2014	June 2017	Report 2016-17 to be submitted	Project concluded RPP-III to be presented

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

A. Institute Projects

13	Assessing greenhouse gas emission and soil carbon storage with reversal in tillage practice	Sangeeta Lenka, N. K. Lenka, Sonalika Sahoo, S. Bhattacharjya	ESS	June 2016	May 2021	RPP-II 2016-17 to be submitted	Project to be continued

B. Externally Funded Projects

14.	CRP-Conservation Agriculture Development, refinement and validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment"	LCPC: Dr. A.K. Biswas and Dy LCPC: Dr. R.S. Chaudhary, K M Hati (PPI), J Somasundaram, A.K. Vishwakarma, Sanjay Srivastava, Pramod Jha	SC&F & Soil Physics	April 2015	March 2017	Report for 2015-16; 2016-17 to be submitted	• Project to be continued • Hand weeding to be included
15.	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, P. Chandra (CIAE), K.K. Singh (IMD, New Delhi)	SC&F	June 2015	June 2018		• Project to be continued
16.	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	RPP-II for 2015-16; 2016-17 to be submitted	• PI was on tour • Project to be presented in next IRC • Project to be concluded
17	Hyper-spectral remote sensing approaches to evaluate soil quality and crop productivity of central India (under DST sponsored Network Project on	M. Mohanty, N.K. Sinha, K.M. Hati, R.K. Singh, Pradip Dey, R.S. Chaudhary, A.K.	Soil Physics	April 2016	March 2019	RPP-II for 2015-16; 2016-17 to be submitted	• PI was on tour • Project to be presented in next IRC • Project to be continued

	Hyper-spectral Big Data Analytics)	Patra and Bharat Bhaskar Gaikwad					

Programme III – Soil Microbial Diversity and Biotechnology

A. Institute Projects

18.	Long term effects of fertilizer and manure amendments on soil functional diversity and nutrient supplying capacity under different soils and cropping systems	S. Bhattacharjya, Asha Sahu, M.C. Manna	Soil Biology	April 2016	March 2021	RPP-I to be submitted	Project to be continued

B. Externally Funded Projects

19.	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	Report 2013-14, 2014-15, 2015-16, 2016-17 to be submitted	Project extended up to April 2017 Project to be concluded
20	Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential (Funded by AMAAS)	S.R. Mohanty, K. Bharati and D.L.N. Rao	SBB	April 2014	March 2017	Report 2015-16, 2016-17 to be submitted	Project to be reframed as per discussion in EFC meeting
21	Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential (funded by DST, New Delhi)	S.R. Mohanty, A.K. Patra, K. Bharati, Muneshwar Singh, J.K. Thakur	Soil Biology	May 2015	May 2018	Report 2015-16, 2016-17 to be submitted	Project to be continued
22.	In-situ residue decomposition of rice-wheat and sugarcane for enhancing crop productivity and soil health funded by ICAR-	M.C. Manna, Asha Sahu, R.C. Singh, Jyoti Thakur, Asit Mandal, S. Bhattacharjya, A.K.	Soil Biology	January 2016	December 2018 (September 2017 by ICAR)	Report 2015-16, 2016-17 to be submitted	• Methods for time reduction for decomposition to be explored • Demonstration of technology at ICAR-IISS farm and Farmers' field

	Extra Mural Project	Tripathi, A.K. Patra, D.H. Phalkel					
23	India-UK nitrogen Fixation Centre (IUNFC)	S.R. Mohanty, GN Kumar (Baroda), AK. Saxena (Mau), MD Gupta (Kolkata), K.Annapurna (New Delhi), P.M.Ready (New Delhi), Dixon(Norwich), Vinoy Ramchandran (Oxford), DLN Rao	SBB	June 2016	June 2019	Report to be submitted	Project to be continued

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	Report to be submitted	• Project to be concluded • RPP-III to be presented

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	RPP-II 2014-15, 2015-16, 2016-17 to be submitted	Project to be concluded RPP-III will be presented
26	Determination of Baseline Concentration for	M. L. Dotaniya, Rajendiran S., J.K.	ESS	May 2014	May 2017	RPP-II 2016-17 to be submitted	• Project to be continued • Extension granted for one-year upto May 2018

	Delineating Contaminated Areas in Black Soils of Central India	Saha, S. Kundu, Hironmoy Das (On study leave)					
27	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
28	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	RPP-II, 2015-16, 2016-17 to be submitted	• Dr. Hironmoy Das to be included • Project to be continued
29	Management of Municipal Solid Waste (MSW) contaminated landfill area of Bhanpur, Bhopal	Ajay, Tapan Adhiakari, K. Bharati, Asit Mandal and J.K. Saha	ESS	Nov. 2016	Oct. 2019	Report to be submitted	• Project to be continued

B. Externally Funded Projects

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, Rajendiran S., M.L. Dotaniya, N.S. Bhogal	ESS	Jan 2016	March 2017	Report for 2015-16, 2016-17 to be submitted	Project to be concluded RPP-III will be presented
31	Reclamation and rehabilitation of coper mining affected land in Malanjkhand area of Madhya Pradesh (Hindustan Copper Limited)	Ajay, Tapan Adhikari, Asit Mandal J.K. Saha	ESS	April 2016	March 2021	Project to be presented	

C. Contractual Projects

32	Evaluation of efficacy of	A.K. Shukla, A.K.	MSPE	April	March 2018	Report to be	• Dr. Sanjib Kumar Behera in place of Dr. Pankaj Kumar Tiwari

	sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India (Zuari Agro Chemicals Ltd)	Biswas, Sanjay Srivastava, Pankaj K. Tiwari, B.P. Meena		2015		submitted	• Project to be continued
33	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)	A.K. Shukla, A.K. Biswas, Pankaj K. Tiwari, B.P. Meena	MSPE	June 2015	December 2017	Report to be submitted	• Dr. Sanjib Kumar Behera in place of Dr. Pankaj Kumar Tiwari • Project to be continued • Project extended up to March 2018
34	Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan)	Muneshwar Singh, R.H. Wanjari, B.L. Lakaria, A.O. Shirale	LTFE	June 2016	May 2018	Report to be submitted	Project to be continued
35	The Äquasorb" project Effect of aquasorb on water and nutrient use efficiency & crop productivity of soybean & tomato in selected soils of India (Funded by SNF India Pvt. Ltd. Vishakhapatanam	R.S. Chaudhary, R.K. Singh, K.M. Hati, B.P. Meena, A.K. Biswas, M. Mohanty, A.K. Patra and Sonalika Sahoo	Soil Physics	July 2016	June 2018	Report 2016-17 Submitted	Project to be continued
36	Effect of slow N release formulations for enhancing productivity and nitrogen use efficiency in cereals sponsored by Rhodia Specialty Chemicals India limited, Mumbai	B.L. Lakaria, Pramod Jha, Sanjay Srivastava, A.K. Vishwakarma, A.K. Biswas and A.K. Patra	SC&F	June 2017	June 2018	Project report to be submitted	Project to be continued
37	Evaluation of Soil Test Kit of Warkem, Mumbai	Sanjay Srivastrava, Pramod Jha, A.O. Shirale, M. Vassanda Coumar, Gurav Priya Pandurang, A.K. Biswas, Pradip Dey and A.K. Patra	SC&F	September 2017	February 2018	Project report to be submitted	Project to be continued
38	Impact of viscose staple fibre industry treated effluent on soil health and crop production surroundings	M.L. Dotaniya, J.K. Saha, Tapan Adhikari, Rajendiran S., R.H. Wanjari, Sonalika	ESS	June 2017	June 2020	Project report to be submitted	Project to be continued

	Nagda, M.P funded by M/s Grasim Industries Limited, Nagda, Ujjain, M.P.	Sahoo and A.K. Patra					

D. Institute project (New Proposals)

Sl. No	Title	PI & Co-PI	Division	Period		RPP status	Remarks
39	Evaluation of potential of indigenous source of potassium for crop production and K supply	A.O. Shirale, Gurav Priya Pandurang, Sanjay Srivastava, BP Meena and A.K. Biswas	SCF	November, 2017	November 2020	Project to be presented	Approved
40	Enhancing the productivity of major crops through improving the natural resource base of tribal inhabited areas of central India	Shinogi K.C., Sanjay Srivastava, A.L. Kamble, B.P. Meena, N.K. Sinha, K. Bharati, Gurav Priya Pandurang, A.K. Tripathi, R.L. Raut (KVK, Balaghat), Rameshwar Ahirwar (KVK, Balaghat), Aparna Jaiswal (COA, Balaghat)	SC&F	January 2017	December 2022	Project to be presented	Approved
	External funded (New Proposals)						
41	Development of an automated soil nutrient sensing system funded by NASF	Sanjay Srivastav, A.O. Shirale, P.S. Tiwari (ICAR-CIAE, Bhopal), Vijay Kumar (ICAR-CIAE, Bhopal), Ramesh Kumar Sahani (ICAR-CIAE, Bhopal), Baban Kumar (CSIR-CSIO, Chandigarh) and Neelam (CSIR-CSIO, Chandigarh)	SC&F	9 May 2017	8 May 2020	Project to be presented	Approved
42	Vulnerability and impact assessment of climate change on soil and crop production in Madhya Pradesh (Funding Agency:UNDP-GEF-MOEFCC)	Sangeeta Lenka, N. K. Lenka, M. Mohanty, R. H. Wanjari and A. K. Patra	ESS	June 2017	June 2018	Project to be presented	Approved

43	Exploring soil microbial community and mechanism in soil carbon sequestration under long term land uses in semi-arid sub-humid Central India funded by SERB, DST, New Delhi	S. Bhattacharjya	Soil Biology	10 August 2017	9 August 2020	Project to be presented	Approved
44	Use of fly ash in agriculture for sustainable crop protection and environmental protection funded by NTPC, Noida	J.K. Saha, M. Vassanda Coumar, Sonalika Sahoo, A.K. Patra, Tapan Adhikari, Ajay, K.M. Hati, M.L. Dotaniya, Sangeeta Lenka, Asit Mandal, A.K. Vishwakarma	ESS	30 August, 2017	29 August 2027	Project to be presented	Approved Dr. Hironmoy Das to be included

Concluded projects (RPP-III) to be presented in next IRC during Feb.-March 2018

Sl. No.	Title of Project	PI and Co-PI	Division/ Unit	Period		RPP Status/ Remarks
1	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	RPP-III to be submitted
2	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	RPP-III to be submitted
3	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-III to be submitted
4	Evaluating Conservation tillage on various cropping sequences/rotations for stabilizing crops productivity under erratic Climatic Conditions in Black Soils of Central India.	J. Somasundaram, R. S. Chaudhary, Ajay, S. Neenu Jha, K. Ramesh, Ajay	Soil Physics	March 2010	June 2016	RPP-III to be presented

Concluding Remarks of the chairman

In the concluding remarks, the IRC Chairman complemented all the scientists for their presentations and healthy discussion on progress made. He emphasized that each scientist must present his research achievements and other prioritized activities for the year in the IRC meeting. He stressed that all the members in the project team must show team spirit for the success of the project and to publish good quality research papers as well as demonstration of the outcome/technology of the project.

General Recommendations

- Reference standard to be developed for samples analysis
- Laboratory upgradation/renovation to be taken up on priority
- Equipment and other infrastructure to be strengthened through external funded projects
- One time grant for capital infrastructure to be explored from ICAR
- Project associates to present in next IRC meeting
- Publication to be encouraged

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 MSPE	6	1
4.	AINP on SBB	-	-
5.	Soil Chemistry and Fertility	2,3,4,5,10,11,12	7
6.	Soil Physics	7	5
7.	Soil Biology	18,24,27	3
8.	Environnemental Soil Science	13,25,26,28,29	5
9.	ITMU	-	-

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 SBB	20, 23	2
5.	Soil Chemistry and Fertility	10,11,14,15	4
6.	Soil Physics	14,16,17	3
7.	Soil Biology	8,19,21,22	4
8.	Environmental Soil Science	9(a,b),30,31	3
9.	CRP on CA	14	1

Division-wise no. of Contractual Projects

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	34	1
2	AICRP STCR	-	-
3	AICRP MSN	32,33	2
4	AINP SBB	-	-
5	Soil Chemistry and Fertility	36,37	2
6	Soil Physics	35	1
7	Soil Biology	-	-
8	Environmental Soil Science	38	1

New Projects Approved

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	-	-
2	AICRP STCR	-	-
3	AICRP MSPE	-	-
4	AINP SBB	-	-
5	Soil Chemistry and Fertility	39,40,41	3
6	Soil Physics	-	-
7	Soil Biology	43	1
8	Environmental Soil Science	42,44	2

Project (serial numbers) with individual scientist

S. No.	Name of Scientist	Designation	Sl. Of projects	
			PI	Co-PI
1	**Dr. A.K. Patra**	**Director**	-	7,9(a,b),10,17,21,22, 35,36,37,38,42,44
AICRP on LTFE				
1	Dr. Muneshwar Singh	Project Co-coordinator	1,34	7,10,16,21
2	Dr. R. H. Wanjari	Senior Scientist	-	10,11,34,38,42
AICRP on STCR				
1.	Dr. Pradip Dey	Project Co-ordinator	-	4,7,10,15,17,37
2.	Dr. Abhishek Rathore*	Scientist (SS)	-	-
3.	Dr. Hiranmoy Das	Scientist	-	26
AICRP on MSN				
1	Dr. A.K. Shukla	Project Co-ordinator	32,33	3,6,9(b),10,15
2	Dr. Sanjib Kumar Behera	Senior Scientist	-	-
AINP on SBB				
1	Dr. S.R. Mohanty	I/c Project Co-ordinator	20,23	-
Soil Chemistry and Fertility				
1.	Dr. A. K. Biswas	Head of Division & Pr. Scientist	14 (LCPC)	1,2,3,10,32,33,35,36, 37,39
2.	Dr. Sanjay Srivastava	Principal Scientist	4,37,41	14,36,32,39,40
3.	Dr. Brij Lal Lakaria	Principal Scientist	2,36	8,10,11,34,3
4.	Dr. R. Elanchezhian	Principal Scientist	3,12	5,6,15
5.	Dr. N.K. Lenka	Principal Scientist	10,15	13,42
6.	Dr. Pramod Jha	Principal Scientist		2,5,7,14,16,36,37
7.	Dr. A.K. Vishwakarma	Principal Scientist	11	14,36,44
8.	Dr. Shinogi K.C.	Scientist	40	11
9.	Dr. B.P. Meena	Scientist	5	1,6,10,32,33,35,39,40
10.	Dr. A.O. Shirale	Scientist	39	10,11,12,34,37,41
11.	Dr. Gurav Priya Pandurang	Scientist	-	37,39,40
12.	Dr. A.L. Kamble	Scientist	-	40
Soil Physics Division				
1.	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	35,14 (Deputy LCPC)	1,7,16,17
2.	Dr. Kuntal M. Hati	Principal Scientist	7,14	2,17,35,44
3.	Dr. R.K. Singh	Principal Scientist	-	11,17,35
4.	Dr. J. Somasundaram	Principal Scientist	4	16
5.	Dr. Prabhat Tripathi	Principal Scientist	-	-
6.	Dr. M. Mohanty	Senior Scientist	16,17	7,35,42
7.	Dr. N.K. Sinha	Scientist	-	7,9(a),10,16,17,40
Soil Biology				
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	22,24	18
2	Dr. A.K. Tripathi	Principal Scientist	-	4,22,27,40
3	Dr. A. B. Singh	Principal Scientist	8	1,10,11
4	Dr. S. Ramana	Principal Scientist	27	8

5	Dr. S.R. Mohanty	Principal Scientist	21	19
6	Dr. K. Bharati	Principal Scientist	19	11,20,21,27,29,40
7	Dr. Asit Mandal	Scientist	-	22,24,29,31,44
8	Dr. Asha Sahu	Scientist	-	11,18,22,24,27
9	Dr. J.K. Thakur	Scientist	-	3,10,11,16(d),17
10	Dr. S. Bhattacharjya	Scientist	18,43	9(b),13,22,28,
11	Dr. Dolamani Amat	Scientist	-	-
Environmental Soil Science				
1.	Dr. J.K. Saha	Head of Division and Prin. Scientist	30,44	9(b),25,26,28,29,31,38
2.	Dr. S. Kundu	Principal Scientist	-	3,9(a,b),10,25,26
3.	Dr. Ajay	Principal Scientist	29,31	9(a),28,44
4.	Dr. Tapan Adhikari	Principal Scientist	9(a,b)	3,28,29,31,38,44
5.	Dr. M. Vassanda Coumar	Scientist	28	2,7,25,30,37,6
6.	Dr.(Mrs.) Sangeeta Lenka	Scientist Sr. Scale	13,42	10,15,16,44
7.	Dr. M.L. Dotaniya	Scientist	25,38,26	28,30,44
8.	Mr. Vasudev Meena*	Scientist	-	-
9.	Dr. Sonalika Sahoo	Scientist	-	13,35,38,44
Scientists from other Institutes				
1.	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	2
2.	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	2
3.	Dr. P.S. Tiwari	Principal Scientist, CIAE, Bhopal	-	41
4.	Mr. Vijay Kumar	ICAR-CIAE, Bhopal	-	41
5.	Mr. Ramesh Kumar Sahani	ICAR-CIAE, Bhopal	-	41
6.	Mr. P. Chandra	ICAR-CIAE, Bhopal	-	15
7.	Dr. K. K. Singh	IMD, New Delhi	-	15
8.	Mr. Baban Kumar	CSIR-CSIO, Chandigarh	-	41
9.	Miss Neelam	CSIR-CSIO, Chandigarh	-	41
10.	Dr. Neera Singh	ICAR-IARI, New Delhi	-	19
11.	Dr. K. Raju Kumar	NIHSAD, Bhopal	-	3
12.	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra	CIAE, Bhopal		9(a)
13.	Dr. D.LN. Rao**	Emirates scientist, ICAR-IISS, Bhopal	-	10,20,23
14.	Dr. Rajendiran S.	Scientist, ICAR-IIHR, Bengaluru	-	10,25,28,30,38
15.	Dr. K. Ramesh	Principal Scientist, ICAR-IIOR, Hyderabad	-	3,8,9(b)
16.	Dr. Pankaj K. Tiwari	Scientist, ICAR-IIWM, Bhubaneshwar	6	32,33
17.	Dr. N.S. Bhogal#	Pr. Scientist	-	30
18.	Mr. R.L. Raut	(KVK, Balaghat)	-	40
19.	Mr. Rameshwar Ahirwar	(KVK, Balaghat)	-	40
20.	Miss Aparna Jaiswal	(COA, Balaghat)	-	40

*On deputation/Study leave.
**Emeritus Scientist, ICAR-IISS, Bhopal
Retired

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	-	7,9(a,b),10,17,21,22,35,36,37,38,42,44	13
AICRP on LTFE					
1	Dr. Muneshwar Singh	Project Co-coordinator	1,34	7,10,16,21	6
2	Dr. R.H. Wanjari	Senior Scientist	-	10,11,34,38,42	5
AICRP on STCR					
1.	Dr. Pradip Dey	Project Co-ordinator	-	4,7,10,15,17,37	6
2.	Dr. Abhishek Rathore*	Scientist (SS)	-	-	-
3.	Mr. Hiranmoy Das*	Scientist	-	26	1
AICRP on MSN					
1	Dr. A.K. Shukla	Project Co-ordinator	32,33	3,6,9(b),10,15	7
2	Dr. Sanjib Kumar Behera	Senior Scientist	-	-	-
AINP on BF					
1	Dr. S.R. Mohanty	I/c Project Co-ordinator	20,23	-	2
Soil Chemistry and Fertility					
1.	Dr. A.K. Biswas	Head of Division & Pri. Scientist	14 (LCPC)	1,2,3,10,32,33,35,36,37,39	11
2.	Dr. Sanjay Srivastava	Principal Scientist	4,37,41	14,36,32,39,40	8
3.	Dr. Brij Lal Lakaria	Principal Scientist	2,36	8,10,11,34,3	7
4.	Dr. R. Elanchezhian	Principal Scientist	3,12	5,6,15	5
5.	Dr. N.K. Lenka	Senior Scientist	10,15	13,42	4
6.	Dr. Pramod Jha	Principal Scientist	-	2,5,7,14,16,36,37	7
7.	Dr. A.K. Vishwakarma	Principal Scientist	11	14,36,44	4
8.	Dr. Shinogi K C	Scientist	40	11	2
9.	Dr. B.P. Meena	Scientist	5	1,6,10,32,33,35,39,40	9
10	Mr. Abhay Sirale	Scientist	39	10,11,12,34,37,41	7
11	Dr. Gurav Priya Pandurang	Scientist	-	37,39,40	3
12	Dr. A.L. Kamble	Scientist	-	40	1
Soil Physics					
1.	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	35,14 (Deputy LCPC)	1,7,16,17	6
2.	Dr. Kuntal M. Hati	Principal Scientist	7,14	2,17,35,44	6
3.	Dr. R.K. Singh	Principal Scientist	-	11,17,35	3
4.	Dr. J. Somasundaram	Senior Scientist	4	16	2
5.	Dr. Prabhat Tripathi	Principal Scientist	-	-	-
6.	Dr. M. Mohanty	Scientist	16,17	7,35,42	5
7.	Dr. N.K. Sinha	Scientist	-	7,9(a),10,16,17,40	6
Soil Biology					

1.	Dr. M.C. Manna	Head of Division and Prin. Scientist	22,24	18	3
2.	Dr. A.K. Tripathi	Principal Scientist	-	4,22,27,40	4
3.	Dr. A.B. Singh	Principal Scientist	8	1,10,11	4
4.	Dr. S. Ramana	Principal Scientist	27	8	2
5.	Dr. S.R. Mohanty	Senior Scientist	21	19	2
6.	Dr. K. Bharati	Senior Scientist	19	11,20,21,27,29,40	7
7.	Dr. Asit Mandal	Scientist	-	22,24,29,31,44	5
8.	Dr. Asha Sahu	Scientist	-	11,18,22,24,27	5
9.	Dr. Jyoti Kumar Thakur	Scientist	-	3,10,11,16(d),17	5
10	Dr. S. Bhattacharya	Scientist	18,43	9(b),13,22,28,	6
11	Dr. Dolamani Amat	Scientist	-	-	-
Environmental Soil Science					
1.	Dr. J.K. Saha	Head of Division and Prin. Scientist	30,44	9(b),25,26,28,29,31,38	9
2.	Dr. S. Kundu	Principal Scientist	-	3,9(a,b),10,25,26	6
3.	Dr. Ajay	Principal Scientist	29,31	9(a),28,44	5
4.	Dr. Tapan Adhikari	Principal Scientist	9(a,b)	3,28,29,31,38,44	8
5.	Dr. M. Vassanda Coumar	Scientist	28	2,7,25,30,37,6	7
6.	Dr.(Mrs.) Sangeeta Lenka	Scientist	13,42	10,15,16,44	6
7.	Dr. M.L. Dotaniya	Scientist	25,38,26	28,30,44	6
8.	Mr. Vasudev Meena*	Scientist	-	-	-
9.	Dr. Sonalika Sahoo	Scientist	-	13,35,38,44	4

Scientists from other Institutes involved in research projects					
1.	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	2	1
2.	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	2	1
3.	Dr. P.S. Tiwari	Principal Scientist, CIAE, Bhopal	-	41	1
4.	Mr. Vijay Kumar	CIAE, Bhopal	-	41	1
5.	Mr. Ramesh Kumar Sahani	CIAE, Bhopal	-	41	1
6.	Mr. P. Chandra	ICAR-CIAE, Bhopal	-	15	1
7.	Dr. K. K. Singh	IMD, New Delhi	-	15	1
8.	Mr. Baban Kumar	CSIR-CSIO, Chandigarh	-	41	1
9.	Miss Neelam	CSIR-CSIO, Chandigarh	-	41	1
10.	Neera Singh	IARI, New Delhi	-	19	1
11.	K. Raju Kumar	NIHSAD, Bhopal	-	3	1
12.	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra	-		9(a)	1
13.	Dr. DLN Rao**	Emirates Scientist	-	10,20,23	3
14.	Dr. S. Rajendiran	Scientist	-	10,25,28,30,38	5
15.	Dr. K. Ramesh	Principal Scientist	-	3,8,9(b)	3
16.	Dr. Pankaj K. Tiwari	Scientist, ICAR-IIWM, Bhubaneshwar	6	32,33	3
17.	Dr. N.S. Bhogal#	Pr. Scientist	-	30	1
18.	Mr. R.L. Raut	(KVK, Balaghat),	-	40	1

19.	Mr. Rameshwar Ahirwar	(KVK, Balaghat)	-	40	1
20.	Miss Aparna Jaiswal	(COA, Balaghat)	-	40	1

* On deputation/Study leave.

** Emeritus Scientist of ICAR-IISS, Bhopal # Retired

LIST OF PARTICIPANTS

S. No.	Name of Scientist	Designation
1.	Dr. A. K. Patra	Director & Chairman, IRC
2.	Dr. A.K. Biswas	HOD & Member Secretary, IRC
3.	Dr. R. Elanchezhian	Principal Scientist & I/c PME Cell
4.	Dr. Muneshwar Singh	Project Co-ordinator, LTFE
5.	Dr. A.K. Shukla	Project Co-ordinator, MSPE
6.	Dr. Pradip Dey	Project Co-ordinator, STCR
7.	Dr. R.S. Chaudhary	HOD and Principal Scientist
8.	Dr. M.C. Manna	HOD and Principal Scientist
9.	Dr. J.K. Saha	HOD and Principal Scientist
10.	Dr. S. Kundu	Principal Scientist
11.	Dr. A.B. Singh	Principal Scientist
12.	Dr. Ajay	Principal Scientist
13.	Dr. A.K. Tripathi	Principal Scientist
14.	Dr. Tapan Adhikari	Principal Scientist
15.	Dr. Sanjay Srivastava	Principal Scientist
16.	Dr. Brij Lal Lakaria	Principal Scientist
17.	Dr. Kuntal M. Hati	Principal Scientist
18.	Dr. S. Ramana	Principal Scientist
19.	Dr. R.K. Singh	Principal Scientist
20.	Dr. N.K. Lenka	Principal Scientist
21.	Dr. Prabhat Tripathi	Principal Scientist
22.	Dr. Pramod Jha	Principal Scientist
23.	Dr. A.K. Vishwakarma	Principal Scientist
24.	Dr. J. Somasundaram	Principal Scientist
25.	Dr. S.R. Mohanty	Principal Scientist
26.	Dr. K. Bharati	Principal Scientist
27.	Dr. R.H. Wanjari	Senior Scientist
28.	Dr. M. Mohanty	Senior Scientist
29.	Dr. Sanjib Kumar Behera	Senior Scientist
30.	Dr. Sangeeta Lenka	Scientist
31.	Dr. M.V. Coumar	Scientist
32.	Dr. N.K. Sinha	Scientist
33.	Dr. Asit Mandal	Scientist
34.	Dr. Asha Sahu	Scientist
35.	Dr. Jyoti Kumar Thakur	Scientist
36.	Dr. Shinogi K C	Scientist
37.	Dr. Bharat Prakash Meena	Scientist
38.	Dr. Hironmoy Das	Scientist
39.	Dr. A.O. Shirale	Scientist
40.	Dr. Sudeshana Bhattacharjya	Scientist
41.	Dr. Sonalika Sahoo	Scientist
42.	Dr. Gurav Priya Pandurang	Scientist
43.	Dr. Ankush Lala Kamble	Scientist
44.	Dr. D.L.N. Rao	Emeritus Scientist

Brief Achievements

Institute in-house projects

Sl. No.	Achievements
1	**Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol.**
	Maize yield was significantly increased with the application of various integrated nutrient management (INM) modules in long term fertilizer experiment at IISS research farm compared to control. Among the different INM modules, maize grain and stover yield were significantly increased with application of 75% NPK of STCR based dose with 5t farmyard manure (FYM) and followed by general recommended dose (GRD) and other INM modules, but FYM amended module is far ahead than others. However, all INM modules were statistically at par with GRD in terms of maize yield, whereas application of nutrients through organic sources alone grain yield maize was significantly lower but chickpea elds were at par. Perusal of average yield data of chick pea revealed that irrespective of treatment the yields are more or less similar barring control. Which indicate that residual fertility of soil is sufficient to produce 2 tons seed grain chickpea.
2	**Biochar on soil properties and crop performance**
	A pot study conducted to assess effect of biochar and other ameliorants on wheat crop. Biochar resulted in above ground and below ground biomass yield that was at par with lime or FYM application. A laboratory study was conducted to simulate the pot study for its effect on soil properties. Biochar resulted in increased P release and decreased the activity of aluminum that was better than even lime and FYM. A field study was conducted to assess the effect of biochar application with and without inorganic fertilizers. The study revealed that without inorganic fertilizers the yield of wheat crop was low. Biochar application @ 10t ha-1 improved the wheat yield.
3	**Nano-particle delivery and internalization in plant systems for improving nutrient use efficiency**
	The impact of nano-micronutrient fertilization on growth and metabolism of soybean, wheat and maize plants was studied using Fe, Cu and Zn nanoparticles based nutrient formulation. In soybean, the nano-micronutrient fertilization of plants with normal concentration of Fe NPs/ Cu NPs / Zn NPs had positively influenced the shoot growth, grain yield and biochemical traits viz. total soluble protein, membrane stability, proline accumulation in plants. However, reduced concentration of NPs had positively influenced root growth and gas exchange parameters viz. photosynthesis rate, transpiration rate and stomatal conductance of plants. In wheat, the nano-micronutrient fertilization of plants with NPs had positively influenced most of the morphological parameters while the reduced concentration of NPs had positively influenced biochemical traits viz. proline accumulation, chlorophyll content of plants. Gas exchange parameters were also positively influenced by NPs in wheat.
4	**Evaluating rock phosphates for their suitability for direct application**
	Incubation study for P release was done. Replacement for Dr Rashmi and Dr. Ramesh is required..
5	**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 (60 kg N/ha) at knee high and tasseling stages, respectively. The application of large amount (10 tonnes/ha) biochar as soil amendment with recommended dose fertilizer recorded higher maize grain, stover and total biomass yield of maize.
6	**Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat**
7	**Assessment of important soil properties of India using mid-infrared spectroscopy**
	Mid infrared reflectance (MIR) spectroscopy has been used to develop chemometric models for simultaneous and rapid assessment of important properties of Alfisols. Geo-referenced soil samples, collected from representative arable lands at different places of Kerala and Karnataka, were first analyzed for soil organic carbon (SOC), available N, P and K, EC, pH, sand, silt and clay content following standard laboratory procedures. Seventy per cent of the soil spectral data, selected through Kennard-Stone (KS) algorithm method, were used for model development and rest thirty per cent of soil sub-samples spectral data were used for the model validation. Random forest regression method was used to develop prediction model for the various soil properties. Validation of the model with independent data set however, showed that the predictability as expressed through coefficient of determination (R2) varied markedly among the different soil properties tested.
B) Externally Funded Projects	
8	**Network Project on Organic Farming**

	Soybean performed better under all the cropping systems (100 % organic was better than 75 % organic + innovative). Among the copping systems soybean-wheat /chickpea performed better than soybean-mustard/linseed cropping system. System productivity was found to be higher in Soybean – chickpea cropping system. Higher yields of all rabi season crops were found with 100% organic and 75 % organic + 25 % inorganic dose of nutrients which were statistically at par with each other. Inorganic treatments were found statistically at par with 50 % organic + 50 % inorganic dose of nutrients. The highest SOC, available NPK, soil enzyme activity like DHA, FDA hydrolysis and alkaline phosphatase were recorded in 100% organic and 75% org+25% inorganic/innovative management. Among the varieties of wheat grown under similar nutrient source and doses GW-366 out performed in yield while C-306 produced poor yield. Among the varieties of chickpea grown under similar nutrient source and doses variety JG--130 recorded higher yield followed by RVS-2. Protein, ash and tryptophan content in maize grain influenced significantly among various varieties of maize. The higher values of protein and tryptophan were recorded in Proagro-4212 variety. There was improvement in the count of culturable group of microbes viz. bacteria, fungi and actinomycetes upon addition of organic nutrient sources. The soil enzyme activity also recorded maximum under 100% organic nutrient management practices. Based on observation of previous year of incidence of dry root rot in chickpea crop trichoderma enriched compost was prepared and applied during land preparation and also in the standing crop for control of dry root rot in chickpea.
9	**(a) Use of nano sensors network for field detection of temperature and moisture stress in plant and soil** **(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 Sphalerite zinc mineral was collected and after grinding into micro level, it was converted to nano level (< 30.73 nm) by High Energy Ball Mill (SPEX, 8000D Mixer/Mill) through top down approach. It took near about 6-9 hours grinding. The particle size was estimated by Particle Size Analyzer (Dynamic Light Scattering Techniques). Soil enzyme activities like urease, dehydrogenase, alkaline and acidic phosphatase, were measured and experimental results revealed that at lower doses up to 40 ppm of TiO2 nano particles enhanced the activity of the enzyme (induction), but the enzyme activities were reduced (inhibition) at higher doses of 100 ppm TiO2 NP. The copper oxide nano particles showed remarkable antibacterial activity against both Gram-positive (B. subtilis) and Gram-negative (E. coli) bacteria.
10	**Soil quality assessment and developing indices for major soil and production regions of India funded by ICAR-Extra Mural Project**
	Grid samples were collected from 61 districts and 670 grid points covering AESR 4.1, 4.3, 6.1, 6.2, 9.2 and 18.4. A questionnaire was prepared and was used for collection of information from the farmers regarding nutrient use, crop production and past cropping history. Samples were analyzed for pH, EC, organic carbon, KMnO4 oxidizable labile carbon (Weil et al., 2003), labile carbon fractions (Chan et al., 2001), available P, available K, available S, exchangeable sodium, and dehydrogenase activity. Thematic GIS maps were developed for soil pH, EC, organic carbon, labile carbon, labile carbon fractions, available potassium, available sulphur and exchangeable sodium content for AESR 4.3 and 9.2 covering 15 districts of Uttar Pradesh state. Spatial distribution maps were developed using ordinary kriging for the analysed soil quality parameters.
11	**Ensuring food security, sustainability and soil health through resource conservation based farmer FIRST approach in central India**
	Module-wise work carried out under progress during 2017-18. A. Crop based Modules: Kharif season- Conservation agriculture based crop production technology for kharif crops. B. Horticulture based Modules: Package of practices for better vegetables yield C. Livestock based Modules: Scientific livestock management D. Enterprise based Modules: Vermicomposting/ Bee keeping E. Integrated Farming Systems (IFS) module: CA based agri - horti integrated farming system. F. NRM, Soil, Resource and Crop based module- CA based demonstrations to promote location specific best bet crop management techniques for improving crop productivity, soil health and disposal of crop residues. Organized Farmer first workshop on the occasion of National Productivity week on 14th February, 2017. The programme was participated by 150 farmers from different villages. Awareness programmme was conducted on 4th March,2017 and 15th March,2017 at village Khamkheda and Bherupura. Farmers were taken to CA demonstration plots to create awareness and to discuss on the implementation of the project in a participatory mode.
C. Collaborative projects with other institutes where IISS scientists are associated in	
12	**Enhancing Resource Use Efficiency in Pulse Based Cropping System in Central India. Collaborating with ICAR-Indian Institute of Pulses Research, Kanpur (U.P.)**
	An investigation was undertaken to enhance crop productivity in soybean based intercropping system during Kharif in 2:2 replacement series both in flat bed and broad bed (in main plot) land configurations. These crops were followed by lentil during Rabi. The soil of experimental site was clay loam (vertisols) in texture and 7.87 pH with low in N and SOC (0.42%), medium in P and high in K at the surface depth (0-15 cm). Study showed that BBF had distinct advantage for both Kharif and Rabi crops as significant enhancement in crop productivity to the tune of 21.3, 25.7 and 23.6 per cent in soybean alone, SEY based on kharif inter crops and total productivity during Kharif,

	respectively was recorded under BBF over flat planting which was attributed to enhanced yields in most of the intercrops under it. When comparison was made on total system productivity for both Kharif+ Rabi (soybean +intercrop - lentil), significantly higher total soybean productivity was recorded with soybean + pigeonpea - lentil followed by soybean + urdbean - lentil. In addition, supplementary irrigation once to lentil at pod development could also enhance its productivity over the rainfed crop.
Programme II: Conservation Agriculture and Carbon Sequestration vis-à-vis Climate Change	
(A) Institute Projects	
13	**Assessing greenhouse gas emission and soil carbon storage with reversal in tillage practice**
	The effect of shift in tillage practices no tillage (NT) and reduced tillage (RT) to conventional at same level of crop residue was initiated on already established eight years long experiment on tillage and nutrient which is located at CIAE experimental farm to study the effect of reversal in no tillage and reduced tillage to conventional on GHGs emissions, soil carbon storage and dynamics and other soil properties. The project started with shifting the tillage in Soybean 2016 and wheat 2016-17. Greenhouse gas samples were taken at regular interval in Soybean 2016. Soybean and wheat crop was sown and yields were recorded at harvest. In the post-harvest soil samples of soybean and wheat soil properties viz., soil organic carbon, C and N cycling enzyme activity, soil microbial biomass carbon, soil respiration and dehydrogenase activity was estimated. In general, in first year of experiment shift in tillage practices had no significant effect on soybean and wheat grain yield and other soil properties. However, nutrient management had significant effect on yield and soil properties.
C. Externally Funded Projects	
14	**CRP-Conservation Agriculture** **Development, refinement and validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment"**
	Best bet conservation agricultural practices for two predominant cropping systems namely, soybean-wheat and soybean-chickpea were demonstrated through participatory field trials in four villages situated nearby Bhopal to popularize the conservation agricultural technologies developed for Vertisols. Crop yield recorded were relatively higher in conservation tillage compared to the farmers' practice. On station conservation tillage practices in combination with crop residue retention followed for six years showed positive impact on aggregate stability, aggregate associate–C concentration, and different carbon pools. Reduced tillage with residue retention showed a positive effect on macro- and micronutrient distribution and availability in soils after four crop cycles. Long-term effect of imposition of various conservation agricultural practices on soil chemical properties were studied through analysis of soils collected from the ongoing long-term conservation agriculture (CA) experiments at IIFSR, Modipuram and CSSRI, Karnal.
15	**Simulating the effect of elevated CO_2 and temperature on water productivity and nutrient use in soybean-wheat cropping system**
	Experiment conducted in Open Top Chambers under five climate conditions with two atmospheric CO2 concentrations and two air temperature conditions, taking soybean and wheat crops. Observations on biophysical parameters and soil properties recorded. Plant tissue and grain nutrient concentration analyzed and uptake of major nutrients computed.
16	**Integrated assessment of soil and crops for enhancing productivity and C-sequestration potential of Vertisols of central India under changing climate scenarios (NICRA)**
	In a climate change impact studies on soil organic C and grain yield under soybean-wheat cropping systems it was observed that the soil organic C remained unchanged in surface as well as subsurface layers under balanced fertilization to soybean and wheat. However, the grain yield of soybean increased substantially under different RCPs under investigation in both the year 2050 and 2080. In the year 2080, soybean yield was reported to be higher than 2050 due masking of temperature effects by increased CO2 concentration. There was a little change in wheat yield in both the year under study. The effects of different RCPs on wheat yield was found to be non-significant.
17	**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)**
	Total 600 soil samples were collected from Bhopal, Indore, Raisen and Jabalpur of the central India and were processed and soil spectra were generated at the central facility at the Division of Agricultural Physics, ICAR-IARI, New Delhi. Furthermore, to generate the crop coefficient at different stages of crop, which is required for APSIM crop growth model, a field experiment with wheat crop was started in split plot design with three levels of irrigation and four levels of nitrogen. The imposed irrigation levels are: IW (Irrigation water)/CPE (Cumulative pan evaporation) =1, IW/CPE =0.75 and IW/CPE= 0.5; whereas nitrogen levels are 0%, 50%, 100% and 150% of the recommended dose. Periodic observation on crop spectra, canopy temperature and others parameters related to plant growth were collected.
Programme III – Soil Microbial Diversity and Biotechnology	
(a) Institute Projects	

18	**Long term effects of fertilizer and manure amendments on soil functional diversity and nutrient supplying capacity under different soils and cropping systems**
	Soil sampling has been done from LTFE BarrackPore, LTFE Parbhani and LTFE Palampur. Analysis of soil samples for pH, EC, SOC, Available N, P, K, DHA content has been done. Aggregate distribution analysis have been done. Microbial biomass carbon, Acid and Alkaline phosphatase, β-Glucosidase activity have been determined. N-cycling enzyme (Amidase, Ureasa, N-acetyl-glucosaminidase activity) and Potentially mineralizable nitrogen contents have benn estimated.
(b)	**Externally Funded Projects**
19	**Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes (DBT)**
	Rhizosperic soil was collected from Soybean crop grown under, control, inorganic, organic and integrated (both inorganic and organic) fertilized fields. Soil collected during vegetative growth phase were amended with chlorpyrifos (10 µg g-1 soil) and incubated under different climate factors. The climate factors were CO2 concentration (400 ppm, 800 ppm), temperature (25°C, 45°C), and moisture holding capacity (60%, 100%). Chlorpyrifos degradation rate varied from 0.28 µg g-1 soil d-1 to 0.65 µg g-1 soil d-1Elevated CO2 and temperature negatively influenced ($p<0.01$) the chlorpyrifos degradation and microbial abundance while the soil moisture positively influenced ($p<0.01$) the parameters. Chlorpyrifos degradation followed the trend of organic > integrated > inorganic > control. Study indicated that negative impact of elevated CO2 and temperature on chlorpyrifos biodegradation can be alleviated by organic fertilizer.
20	**Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential (Funded by AMAAS)**
	Soils were nitrified repeatedly to obtain different concentration of biogenic nitrate. The effect of nitrification on the redox metabolism was evaluated by comparing with the inorganic KNO3. Repeated NH4-N amendment increased nitrification rate (mM NO3 produced g-1 soil d-1) from 0.49 to 0.65. Nitrification stimulated ($p<0.01$) the abundance of 16S rRNA gene of eubacteria (43.67±4.510 x 106), amoA gene of nitrifying bacteria (102.33±8.50 x 104) and nitrifying archaea (94.33±7.77 x 104). The rate of reduction of terminal electron acceptors (mM reduced g-1 soil d-1) in the nitrified soil followed as: NO31- reduction 4.01±0.229, Fe3+ reduction 5.37±0.122, SO42- reduction 9.56±0.165. Methane production (µg g-1 soil) in the nitrified soil was 0.46±0.051. Nitrification inhibited denitrification by a factor of 1.4. Similarly, it inhibited the Fe3+ reduction, SO42- reduction, and CH4 production by factor of 1.8, 1.13, and 1.66 respectively. Raman spectra of the nitrified soils indicated the occurrence of aliphatics in soil. Probably, these aliphatics bind to NO3 and form biogenic nitrate. The microbial volatile organic compounds (mVOCs) from nitrifiers enhanced ($p<0.05$) nitrification. The mVOCs stimulated ($p<0.05$) abundance of nitrifying bacteria than the eubacteria and nitrifying archaea. Results highlighted that nitrification modulates the redox metabolism by forming biogenic nitrate and microbial volatiles.
21	**Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential**
	Dr Mario Aguilar from Argentina visited IISS during 21.8.2017-28.8.2017. He gave a presentation at IISS Bhopal and later travelled to ICAR IISWC (Agra centre) and IARI N Delhi and discussed about various research activities. Soil samples from LTFE, Jabalpur has been collected and is being analyzed.
22	**In-situ residue decomposition of rice-wheat and sugarcane for enhancing crop productivity and soil health funded by ICAR-Extra Mural Project**
	Conducted the field experiment at the farmer's field (size= 100 m2 each) of Bhopal for the in-situ crop residue decomposition. Microbial consortium (bacteria, fungi and actinomycetes) along with situable carrier materials was applied in the crop residue at field. Collection of soil samples at initial and one months after imposing treatment with effcient microbial consortium along with cowdung and urea. Frequent monitoring was done for maintaining optimum moisture at the field condition. Studied the soil biological analysis like soil respiration and soil enzymatic activities such as dehydrogenase, acid & alkaline phophatase. Visited the villages of Gyong and Bhaupur village at Karnal, Haryana to follow up the field experiment for the crop residue (wheat) decomposition.
23	**India-UK nitrogen Fixation Centre (IUNFC)**
	Soil samples from about 105 agricultural fields were collected. The fields were grown with Pigeon pea with other cereals and horticultural crops. For isolation of Rhizobial strains -a glass house experiment was set up by taking 104 soil samples in paper cups with Asha variety of pigeon pea. Bacteria were isolated from the nodules of young plants using YEMA plates. Around 700 isolates were selected based on sample source, colony morphology and duration of emergence of colonies, out of which 75 were Gram negative bacteria which were further maintained on YEMA slants. Out of 12, six were fast growing bacteria and six were slow growing bacteria. Biochemical Characterization and Nodulation efficiency test of isolated strains are in progress. Molecular identification of Nodulating isolates (13) were performed by amplifying 16SrDNA gene using universal primers 8F (Forward) and 1492R (Reverse) and niH gene. Sequencing and Phylogenetic analysis is in progress. During nodulation experiment one of the isolate (P5F1) isolated from parwaliya region of Bhopal did not show nodulation but showed considerable PGPR activity as compared to control and reference strain. This isolate showed yeast like morphology and was chosen for further investigation regarding nitrogen fixation enhancement ad PGPR abilities.
(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.)**
	Collected soil samples from the dumping sites and analysed for the estimation of various heavy metals such as Pb, Ni, Cd, Cr, Hg, Cu, Zn, Co and As. In total 77 morphotypes of bacteria were isolated and minimum inhibitory concentrations (MIC) was carried out of the isolates against different heavy metals. Out of different morphotypes, 20 potential bacterial isolates have been identified possessing very high and showing multiple heavy metal tolerance. 9 promising strains identified and submitted to NAIMCC.
Programme IV: Soil Pollution, Remediation and Environmental Security	
A. Institute Project	
25	**Interaction among tannery effluents constituents on heavy metals uptake by spinach.**
	The conducted field experiment soil samples were analyzed for monitoring chromium uptake mediated by FYM and pressmud application during the course of the investigation. The collected tannery effluent, contaminated soil & crop samples were also analyzed for the heavy metal content. The Geo-accumulation index was computed to evaluate the chromium accumulation rate, due to use of tannery effluent for crop production. The scientific research achievement also highlighted at various seminars & symposiums.
26	**Impact of long term use of sewage water irrigation on soil and crop quality in bhopal region of madhya pradesh**
	In this project, soil profile samples collected and analyzed up to the 60 cm depth (0-15, 15-30, 30-45, 45-60 cm). Soil organic carbon sequestration rate was computed up to 60 cm soil depth. The collected soil, effluent, sediment and plant samples were analyzed for the contamination of heavy metals. With the help of heavy metal risk assessment (hazard Quotient, HQ) was calculated and found that all the crops having heavy metal value in safe level. The scientific research paper was also presented in different scientific research forum.
27	**Determination of baseline concentration for delineating contaminated areas in black soils of central india**
	Soil profile samples (0-15, 15-30, 30-45, 45-60 and 60-75 cm) were collected from Bhopal, Raisen, Sehore and Vidisha districts. The baseline concentrations and spatial distribution of heavy metals (HMs) in agricultural soils of Bhopal, Indore and Raisen districts were studied. Among three different extractant, HF is more efficient in extraction of metals from black soils followed by aqua-regia and di-acid mixtures.
28	**Assessment of Cotton for the remediation of soils contaminated with heavy metals**
	Cotton (Bt)(RCH-2) was evaluated for its suitability for the remediation of soils contaminated with three heavy metals (Cd,Pb and Cr). Among the three heavy metals, the reduction in growth of the plants was more severe with Cr. The soil enzymes viz., dehydrogenase, acid phosphatase and alkaline phosphatase decreased with the application of all the three heavy metals. The data on the partitioning of Cd, Pb and Cr revealed that, the heavy metals mainly concentrated in root followed by shoot, seed and lint. Based on the data on partitioning of the heavy metals, the cotton plant was found to be an excluder of all the heavy metals and therefore could not classified as a hyperaccumulator of Cd,Pb and Cr. However, the plant could be a potential crop for phytostabilization of Cd, Cr and Pb.
29	**Critical limits of Cd for major soil orders of India**
	Pot culture experiments and Incubation studies were conducted to derive phytotoxicity limits of Cadmium for Major Soil Orders (Alfisol, Vertisol and Inceptisol) of India. The results showed that cadmium application had significant yield reduction over control. Among the different extractants, the magnitudes of bioavailable fraction were highest in 0.43MHNO_3 followed by 1M$CaCl_2$, DTPA and 0.01M $CaCl_2$ extractant. Among the soil types, the bioavailable concentration was significantly higher in lateritic soil followed by alluvial and black soil in all the extractants used.
30	**Management of Municipal Solid Waste (MSW) contaminated landfill area of Bhanpur, Bhopal**
	The plot size of 50x50 m2 was made to conduct and design the experiment at Bhanpur.
B. Externally Funded Projects	
31	**Determination of critical limits for identifying heavy metals contamination and their threats in major soil types of India funded by ICAR-Extra Mural Project**
	Growth reduction of spinach crop due to high doses of lead was more in alluvial soil as compared to black soil and absent in red & laterite soil. Chromium showed phytotoxicity only in alluvial soil. Soil Pb contents causing 20% reduction in aboveground biomass yield of spinach were computed as 393 mg/kg for black soil and 168 mg/kg for alluvial soil. Similarly, soil Cr content causing 20% reduction in aboveground biomass yield of spinach was computed as 265 mg/kg for alluvial soil. Transfer coefficient of lead in alluvial soil was higher as compared to black and red & laterite soils indicating more uptake of Pb by spinach in the former soil. Transfer coefficient of chromium was lower in red & laterite soil as compared to black and alluvial soil. Heavy metals extracted by dilute (0.01M) CaCl2 are considered available for plant uptake. Dilute (0.01M) CaCl2 extractable Pb and Cr were strongly correlated to their concentrations in aboveground biomass of spinach. Critical limits of Pb were determined as 143 mg/kg for black soil, 78 mg/kg for red & laterite soil and 84 mg/kg for alluvial soil. Similarly, critical limits of Cr were determined as 52 mg/kg for black soil, 332 mg/kg for red & laterite soil and 87 mg/kg for alluvial soil.
32	**Reclamation and rehabilitation of coper mining affected land in Malanjkhand area of Madhya Pradesh (Hindustan Copper Limited)**

	Started the project with a layout of the experimental unit at mining area. Vetiver (Chrysopogon zizanioides) plantation has been done for the establishment of green cover at the copper mining area of Malanjkhand.
C. Contractual Projects	
33	**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)**
	The seed yield of soybean (Cv. JS-9560) varied from 0.75 to 1.55 t ha-1 and 0.81 to 1.47 t ha-1 under different treatments at two different locations of experimentation. Whereas, wheat grain yield varied from 3.11 to 4.96 t ha-1for Cv. HD-2987 and 3.62 to 5.96 t ha-1 for Cv. Lok-1 under different treatments. Application of sulphur and zinc either in the form of direct fertilizers or through NPS-1, NPS-2 and NPSZn produced higher seed/grain yield in soybean crops at both the locations. Higher crop responses under NPKSZn treatments over NPK treatment were recorded for both the crops. Total S uptake by soybean varied from 4.90 to 9.60 kg ha-1 and 3.1 to 6.0 kg ha-1 under different treatments at two places of experimentation. Wheras, total S uptake by wheat Cv. HD2987 ranged from 11.6 to 22.4 kg ha-1 and by Cv, Lok 1 ranged from 17.0 to 38.5 kg ha-1 under different treatments. Total Zn uptake by soybean varied from 55.8 to 119 g ha-1 and 58.1 to 137 g ha-1 under different treatments at two places of experimentation. Whereas, total Zn uptake by wheat Cv. HD2987 ranged from 191 to 319 g ha-1 and by Cv, Lok 1 ranged from 180 to 378 g ha-1 under different treatments. Application of S and Zn along wIth NPK enhanced S and Zn uptake by the crops respectively compared to NPK application alone. The uptake of S and Zn by the crops under direct fertilizer application was at par with S and Zn uptake of the crops obtained under application of NPS-1, NPS-2 and NPSZn.
34	**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)**
	The grain yield of maize varied from 5.38 to 6.88 t ha-1 (Shaktiman 5) and 4.58 to 6.24 t ha-1 (Nath Samrat 1144) under different Zn treatments at two different locations. Whereas, wheat grain yield varied from 3.59 to 4.58 t ha-1 (HD 2987) and 5.52 to 6.43 t ha-1 (Lok 1) under different Zn treatments. Application of Zn either through soil or foliar application (either through Zn SO4 or Zn metallosate or Zn-EDTA) enhances grain yield of both the crops. The grain Zn uptake of maize varied from 96.2 to 164 g ha-1 (Shaktiman 5) and 87.6 to 181 g ha-1 (Nath Samrat 1144) under different Zn treatments. Whereas, wheat grain Zn uptake varied from 122 to 188 g ha-1 (HD 2987) and 154 to 239 g ha-1 (Lok 1). The grain yield of maize varied from 4.82 to 6.57 t ha-1 (Shaktiman 5) and 4.16 to 5.58 t ha-1 (Nath Samrat 1144) under different B treatments at two different locations, wheras, wheat grain yield varied from 3.94 to 4.73 t ha-1 (HD 2987) and 4.64 to 6.42 t ha-1 (Lok 1). Application of B either through soil or foliar application (either through B metallosate or Boric acid) enhances grain yield of both the crops.
35	**Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan)**
	Field demonstrations were conducted on five locations on Vertisols with test crops were rice, wheat and soybean. The data generated at different locations revealed response of rice to applied K even though having available K more than 280 Kg ha-1 at Bhopal and Jagtial. Response of applied K in soybean was found at Parbhani and not at Jabalpur may be because of poor biomass production due to excess rain fall. Response of K in wheat was recorded when productivity level is high.
36	**The Äquasorb" project Effect of aquasorb on water and nutrient use efficiency & crop productivity of soybean & tomato in selected soils of India (Funded by SNF India Pvt. Ltd. Vishakhapatanam**
	The aquasorb with soil and different microbial sources has been kept under incubation study for 6 months and its mineralization study is undergoing.
37	**Effect of slow N release formulations for enhancing productivity and nitrogen use efficiency in cereals sponsored by Rhodia Specialty Chemicals India limited, Mumbai**
	A field study was initiated in kharif 2017 with maize as test crop to evaluate the product. Crop has been harvested and data compilation is in progress.
38	**Evaluation of Soil Test Kit of Warkem, Mumbai**
	The project was initiated for six months. For which analysis of soil samples by standard laboratory procedures is 80% completed. Also the analysis of soil samples with soil test kit provided by Warkem is 70% completed. The results of the analysis can be shared after finalization of the test report.
39	**Impact of viscose staple fibre industry treated effluent on soil health and crop production surroundings Nagda, M.P funded by M/s Grasim Industries Limited, Nagda, Ujjain, M.P.**
	SRF recruitment done and Finalized Specification for instruments