Proceedings of IRC Meeting

(19th - 20th March and 27 May, 2015)

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. BRIJ LAL LAKARIA
Principal Scientist and I/c PME Cell

SECRETARIAL ASSISTANCE AND COMPUTER PROCESSING

Shri Sanjay Kumar Kori
Steno Grade -III

INTRODUCTORY REMARKS OF THE CHAIRMAN, IRC

The Institute Research Council (IRC) meeting of the institute was held during 19 – 20 March and 27th May 2015. The Member-Secretary (IRC), Dr. A. K. Biswas welcomed the participants and an external expert, Dr. A. Subba Rao, Former Director, IISS. 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 within ten minutes so that there can be discussion on the subject for another 5-10 minutes. Dr. A. Subba Rao, the external expert, appreciated the achievements of institute scientists. However, he stressed that there is a need to highlight IISS findings since people outside the organization are highlighting IISS research work more than IISS. The IRC Chairman Dr. A. K. Patra thanked Dr. A. Subba Rao for accepting the invitation and sought further guidance and suggestions for future research issues. He 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 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	• Date of initiation changed to 2012 • Some biological parameter like β glucosides, acid phosphadase, FDA should also be determined after completion of 4-year cycle
2.	Study on nanoporous zeolites for soil and crop management.	K. Ramesh I. Rashmi	Soil Chemistry and Fertility	March 2010	February 2014	**Project concluded**
3.	Studies on soil resilience in relation to soil organic matter in selected soils.	N. K. Lenka, Sangeeta Lenka Brij Lal Lakaria Asit Mandal	Soil Chemistry and Fertility	July 2010	July 2015	Project extended up to December 2015
4	Biofortification of grain sorghum and finger millet varieties with zinc through agronomic measures.	Ajay A.K.Shukla J.K.Saha,	ESS	July 2010	June 2013	**Project concluded**
5.	Biochar on soil properties and crop performance	Brij Lal Lakaria Pramod Jha A.K. Biswas K.M. Hati J. K. Thakur Vassanda Coumar A. K. Dubey (CIAE)	Soil Chemistry and Fertility	January, 2012	January 2017	Progress is satisfactory and project to be continued

		S. Gangil (CIAE)				
6.	Impact of crop covers on soil and nutrient losses through runoff in Vertisol.	R. K.Singh, J. Somasundaram I. Rashmi	Soil Physics	June 2010	May 2014	**Project concluded**
7.	Characterizing rooting behaviours, soil water patterns and nutrient uptake of soybean-chickpea under different tillage and water regimes in Vertisols.	N. K. Sinha M. Mohanty Ritesh Saha I. Rashmi	Soil Physics	June 2011	December 2014	**Project concluded**
8.	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	Jan 2013	Jan 2016	Progress is satisfactory and project to be continued
9.	Nano particle delivery and internalization in plant systems for improving nutrient use efficiency	R. Elanchezian A.K. Biswas Tapan Adhikari K. Ramesh, S. Kundu A.K. Shukla K. Raju Kumar	Soil Chemistry and Fertility	July, 2013	July 2016	Progress is satisfactory and project to be continued The name of Dr. A. Subba Rao is deleted
10.	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 2015	• Progress is satisfactory and project to be continued • Facilities will be provided for conducting experiment at village level • **Project extended till June 2016**
11.	Evaluating rock phosphates for their suitability for direct application	Sanjay Srivastava K. Ramesh A.K. Tripathi I. Rashmi	Soil Chemistry and Fertility	October 2013	May 2017	Project to be continued

		P Dey				
12.	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	Soil Chemistry and Fertility	October 2013	September 2017	• Dr. Neenu is replaced with Dr. Pramod Jha • Progress is satisfactory and project to be continued
13	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	Project just initiated and data could be presented in next IRC meeting

B) **Externally Funded Projects**

14.	GPS and GIS based model soil fertility maps for selected districts for precise fertilizer recommendations to the farmers of India.	A. Subba Rao Pradip Dey (ExecutivePI) A. K. Shukla Muneshwar Singh Sanjay Srivastava R. H. Wanjari Hiranmoy Das	STCR	June 2009	March, 2013	**Project concluded** as no fund received from DAC, MOA, GOI
15.	Network Project on Organic Farming	A. B. Singh K. Ramesh Brij Lal Lakaria S. Ramana J.K. Thakur	Soil Biology	July 2004	March 2017	Progress is satisfactory and project to be continued Project is extended up to 2017 as approved in EFC of lead centre.

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

A. Institute Projects

16	Evaluating conservation tillage on various sequences/rotations for stabilizing crops	J. Somasundaram R. S. Chaudhary	Soil Physics	March 2010	June 2016	Project merged with CRP on conservation agriculture.

	productivity under erratic climatic conditions in black soils of Central India	Neenu S Ajay				
17.	Assessing impacts of climate change on different cropping systems in Central India and evaluating adaptation studies through crop simulation models	M. Mohanty K.M. Hati N.K. Sinha Sangeeta Lenka Pramod Jha Neenu S. R. S. Choudhary R. Elanchezian	Soil Physics	June 2011	May 2016	Progress is satisfactory and project to be continued The name of Dr. A. Subba Rao is deleted
18.	Tillage and manure interactive effects on soil aggregate dynamics, soil organic carbon accumulation and by pass flow in vertisols	Sangeeta Lenka M. C. Manna Brij Lal Lakaria R. K. Singh R. C. Singh (CIAE)	Soil Physics	June 2008	March 2015	**Project concluded**
19.	Weed Management for major cropping systems under conservation agriculture in Vertisols	A.K. Vishwakarma R.S. Chaudhary N.K. Sinha B.P. Meena K. Bharati Scientist from DWR, Jabalpur	Soil Physics	June 2014	May 2017	Progress is satisfactory and project to be **integrated under CRP on conservation agriculture**

B. Externally Funded Projects

20.	Evaluating Conservation Agriculture for Stabilizing Crop Productivity and Carbon Sequestration by Resilient Cropping Systems/Sequences under aberrant Climatic Conditions in Black Soils of Central India. (NICRA)	J. Somasundaram R. S. Chaudhary M. Vassanda Coumar K. M. Hati Pramod Jha K. Ramesh, Ajay	Soil Physics	August 2011	March 2014	**NICRA project is concluded**
21.	Quantifying Green house gases (GHGs) emissions in soybean-wheat system of M.P.	Sangeeta Lenka	Soil Physics	June		**Project concluded**

	(MPCOST)	N.K. Lenka S. Kundu A. Subba Rao		2011	September 2014	

Programme III – Soil Microbial Diversity and Biotechnology

A. Institute Projects

22.	Consequences of transgenic cotton on soil microbial diversity	Asit Mandal J.K. Thakur Asha Sahu M.C. Manna	Soil Biology	March 2011	February 2014	**Project concluded**
23.	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	Progress is satisfactory Project extended up to December 2015 from August 2014 Name of Dr. A. Subba Rao is deleted
24.	Chemical and Microbiological Evaluation of Biodynamic and Organic Preparations.	J. K. Thakur, Asha Sahu, Asit Mandal A. B. Singh.	Soil Biology	June 2011	June 2014	**Project concluded**
25..	Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating microbes	K. Bharati, J.K. Saha, S.R. Mohanty Shinogi K C	Soil Biology	June 2012	June 2016	Progress is satisfactory and project to be continued. Percentage of C and N lost as CH_4 and N_2O respectively be estimated Data need to be generated on GHG emission from different types of composting of country

B. Externally Funded Projects

26	Metagenomic characterization and spatio-temporal changes in the prevalence of microbes involved in nutrient cycling in the rhizoplane of bioenergy crops (DBT)	Santhosh R. Mohanty Asit Mandal K. Bharati	Soil Biology	November 2011	November 2014	**Project concluded**
27.	Novel bio-filtration method using selected mesophilic fungi for removal of heavy metals from municipal solid waste in Madhya Pradesh (MPCOST).	M.C. Manna Asit Mandal Asha Sahu J. K. Thakur S. Ramana A. Subba Rao	Soil Biology	July 2012	July 2014	**Project concluded**
28.	Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes (DBT)	K Bharati Neera Singh T K Radha, S R Mohanty	Soil Biology	December 2013	December 2016	Progress is satisfactory and project to be continued.

Programme IV: Soil Pollution, Remediation and Environnemental Security

A. Institute Project

29.	Interaction among tannery effluents constituents on heavy metals uptake by spinach.	M. L. Dotaniya J. K. Saha Rajendiran S M. Vassanda Coumar S. Kundu	ESS	January 2012	December 2016	Progress is satisfactory and project to be continued
30.	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	Project presented by Dr. M.L. Dotaniya Progress is satisfactory and project to be continued Dr. M.L. Dotaniya will be PI as Mr. Vasudev Meena is on study leave

31.	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	Progress is satisfactory and project to be continued

B. **Externally Funded Projects** Nil

Contractual Projects

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

New Project
Externally funded

36.	Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential	(Externally funded project from AMAAS)	D.L.N. Rao, S.R. Mohanty, K. Bharati, T.K. Radha	BNF	April, 2014	March 2017	Approved under Programme -III

Contractual

37.	Evaluation of urease inhibitor product (limus) for nutrient use efficiency in cereal crops	BASF Pvt. Ltd., Mumbai	Brij Lal Lakaria Pramod Jha B.P. Meena A.K. Biswas	Soil Chemistry and Fertility	July 2014	June 2016	Progress is satisfactory and project to be continued
38.	Evaluation of nano-nutrients product (NUALGI) for improving nutrient use efficiency of crops	NUALGI Biotech, Bangalore	R. Elanchezhian A.K. Biswas K. Ramesh A.K. Shukla J.K. Thakur A.K. Patra	Soil Chemistry and Fertility	June 2014	July 2015	Progress is satisfactory and project to be continued
39.	Evaluation of efficacy of polysulphate on oil seed crops (soybean-mustard)	PRII, Gurgaon	K. Ramesh Sanjay Srivastava A.K. Biswas	Soil Chemistry and Fertility	July 2014	June 2015	Progress is satisfactory and project to be continued
40	Generation of a rapid Soil Test Kit for making soil test based fertilizer recommendations and preparation of soil health card with respect to soil fertility parameters	In collaboration with Ms Nagarjuna Agro Chemical Pvt. Ltd., Hyderabad	Sanjay Srivastava, Pramod Jha, Neenu S, I Rashmi, Tapan Adhikari, A.K. Biswas, P Dey, A K Patra	Soil Chemistry and Fertility	Nov 2014	February 2015	Progress is satisfactory and project concluded with one month extended project period

New Projects
Institute

Sl. No	Title	PI & Co-PI	Division	Period		Remarks
41	Assessment of important soil properties of India using mid-infrared spectroscopy	K.M. Hati, M. Mohanty, Pramod Jha, R.S. Chaudhary, Nishant Sinha, J.K. Thakur, M. Vassanda Coumar, Pradip Dey, Muneshwar Singh, A.K. Patra, Javed Rizvi	Soil Physics	May 2015	June 2018	RPP - I to be recast in light of suggestions Approved under programme - I
42	Potential 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	Title to be changed as "assessment of Cotton for the remediation of soils contaminated with heavy metals" The project personnel may be reviewed In light of expertise and time availability of scientists Microbial aspects and micorhizal interactions may be included in technical programme. RPP - I to be recast in light of suggestions Approved under programme - IV
43	Critical limits for Cd, Pb and Cu to eco-toxicological effects on soil organisms and plants for major soil orders in India	M. Vassanda Coumar, Rajendiran S., M.L. Dotaniya, J.K. Saha, Tapan Adhikari, Ajay, S. Bhattacharya	ESS	July 2015	June 2018	Title be changed to " Critical limit of Cd for major soil orders of India" RPP - I to be recast in light of suggestions Approved under programme - IV

Other externally funded

CRP-Conservation Agriculture

44	CRP on CA	A.K. Biswas (LCPC) RS Chaudhary (Dy LCPC)		April 2015	March 2017	Already approved in EFC To be listed under programme - II
	Development, refinement and	K M Hati (PPI)				To be listed under programme - II

	validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment"	J Somasundaram A. Viswakarma Sanjay Srivastava Pramod Jha				All the investigators are Co-PPIs
	44 (a) Demonstration of best-bet conservation agriculture practices on farmers' fields in Vertisols of central India	AK Vishwakarma RH Wanjari RK Singh KC Shinogi AK Tripathi	Soil Physics	April 2015	March 2017	To be listed under programme - II First investigator is Co-PPI and others are CIs
	44 (b) Fine-tuning of conservation agricultural practices for Vertisols of central India	J Somasundaram K Ramesh S. Ramana BP Meena Abhay Shirale	Soil Physics	April 2015	March 2017	To be listed under programme - II First investigator is Co-PPI and others are CIs
	44(c) Development of water and nutrient management practices in conservation agriculture for Vertisols of central India	Sanjay Srivastava KV Ramana Rao I Rashmi NK Sinha	SCF	April 2015	March 2017	To be listed under programme - II First investigator is Co-PPI and others are CIs
	44 (d) Impact of conservation agricultural practices on soil health, carbon sequestration and green house gas emissions in different production systems	Pramod Jha Brij Lal Lakaria M Mohanty JK Thakur K Bharati	SCF	April 2015	March 2017	To be listed under programme - II First investigator is Co-PPI and others are CIs

CRP-Nanotechnology

45	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 2016	To be listed under programme - II First investigator is Co-PPI and others are CIs
46	Conversion of naturally occurring plant nutrient containing minerals	Tapan Adhikari, S. Kundu, A.K. Shukla,	ESS	April 2015	March 2016	To be listed under programme - I First investigator is Co-PPI and others are CIs

	into nano form by top down approach to enhance the availability of plant nutrients in soil and faster reclamation of problem soils	K. Ramesh, Sudeshana Bhattacharya, J.K. Saha, A.K. Patra				

NASF

47	Simulating the effect of elevated CO_2 and temperature on water productivity and nutrient use in soybean-wheat cropping system	Drs. N.K. Lenka, Sangeeta Lenka, A.K. Shukla, R. Elanchezhian, J.K. Thakur, I. Rashmi and Pradip Dey	SCF	22 June 2015	June 2018	To be listed under programme - II

NICRA

48	Integrated assessment of soil and crops for enhancing productivity and C-sequestration potential of Vertisols of central India under changing climate scenarios	M. Mohanty, Pramod Jha, Sangeeta Lenka, J. Somasundaram, N.K. Sinha, R.S. Chaudhary, Muneshwar Singh	Soil Physics	Feb 2015	March 2018	To be listed under programme - II

New contractul projects

49.	Evaluation of efficacy of sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India	Zuari Agro Chemicals Limited	A.K. Shukla, A.K. Biswas, Sanjay Srivastava, Pankaj K. Tiwari, B.P. Meena	MSN	10 April 2015	June 2017	
50	Evaluation of efficacy of zinc metalosate and boron metalosate foliar supplements for maximizing yield through balanced nutrition of important crops grown in India	Indofil Industries Limited	A.K. Shukla, A.K. Biswas, Pankaj K. Tiwari	MSN	22 June 2015	June 2017	

Collaborative projects in other institutes where IISS scientists are associated in

S. No.	Title	Name of the institute	Scientists from IISS	Division	From	To	Remarks
51	Enhancing Resource Use Efficiency in Pulse Based Cropping System in Central India	IIPR research station, Phanda	R. Elanchezhian, Abhay Shirale	Soil Chemistry & Fertility	July 2014	June 2017	Programme - I
52	Isolation and characterization of heavy metal resistant bacteria & evaluation for their use in agriculture	NBAIM, MAU	M.C. Manna, A. Mandal, Asha Sahu, J.K. Thakur	Soil Biology	May 2014	March 2017	Programme - II

Project Concluded (9 Nos.)

Sl. No.	Programme No.	Sl. No. in IRC Proceedings	Title of Project	PI and Co-PI	Division/Unit	Period	
1	I	2	Study on nanoporous zeolites for soil and crop management.	K. Ramesh I. Rashmi	Soil Chemistry and Fertility	March 2010	February 2014
2	I	4	Biofortification of grain sorghum and finger millet varieties with zinc through agronomic measures.	Ajay A.K.Shukla J.K.Saha,	ESS	July 2010	June 2013
3	II	6	Impact of crop covers on soil and nutrient losses through runoff in Vertisol.	R. K.Singh, J. Somasundaram I. Rashmi	Soil Physics	June 2010	May 2014
4	II	7	Characterizing rooting behaviours, soil water	N. K. Sinha	Soil Physics	June	December

			patterns and nutrient uptake of soybean-chickpea under different tillage and water regimes in Vertisols.	M. Mohanty Ritesh Saha I. Rashmi		2011	2014
5	I	14	GPS and GIS based model soil fertility maps for selected districts for precise fertilizer recommendations to the farmers of India.	A. Subba Rao Pradip Dey (ExecutivePI) A. K. Shukla Muneshwar Singh Sanjay Srivastava R. H. Wanjari Hiranmoy Das	STCR	June 2009	March 2013
6	II	18	Tillage and manure interactive effects on soil aggregate dynamics, soil organic carbon accumulation and by pass flow in vertisols	Sangeeta Lenka M. C. Manna Brij Lal Lakaria R. K. Singh R. C. Singh (CIAE)	Soil Physics	June 2008	June 2014
7	III	22.	Consequences of transgenic cotton on soil microbial diversity	Asit Mandal J.K. Thakur Asha Sahu M.C. Manna	Soil Biology	March 2011	February 2014
8	III	24.	Chemical and Microbiological Evaluation of Biodynamic and Organic Preparations.	J. K. Thakur, Asha Sahu, Asit Mandal A. B. Singh.	Soil Biology	June 2011	June 2014
9	III	26	Metagenomic characterization and spatio-temporal changes in the prevalence of microbes involved in nutrient cycling in the rhizoplane of bioenergy crops (DBT)	Santhosh R. Mohanty Asit Mandal K. Bharati	Soil Biology	November 2011	November 2014
10	III	27	Novel bio-filtration method using selected mesophilic fungi for removal of heavy metals from municipal solid waste in Madhya Pradesh (MPCOST).	M.C. Manna Asit Mandal Asha Sahu J. K. Thakur S. Ramana A. Subba Rao	Soil Biology	July 2012	July 2014

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 achievements 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. Similarly there should be a group on nano materials for enhancing nutrient use efficiency.
- Along with 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	13	1
4.	AINP on Biofertilizers	36	1
5.	Soil Chemistry and Fertility	3, 5, 6, 9, 11, 12, 47	7
6.	Soil Physics	17, 41, 44	3
7.	Soil Biology	15, 23, 25, 28, 42,	5
8.	Environnemental Soil Science	10, 29, 30, 31, 43, 45, 46	7
9.	ITMU	8	1
10	CRP on CA	44 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	36	1
5.	Soil Chemistry and Fertility	47	1
6.	Soil Physics	48	1
7.	Soil Biology	15, 28	2
8.	Environmental Soil Science	45, 46	2
9.	CRP on CA	44	1

Division-wise no. of Contractual Projects

Sl. No.	Division/Co-coordinating Unit	Sl. No.	Total
1	AICRP LTFE	-	-
2	AICRP STCR	-	-
3	AICRP MSN	49,50	2
4	AINP BF	-	-
5	Soil Chemistry and Fertility	37, 38, 39, 40	4
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	44c, 44d,47	3
6	Soil Physics	41, 44a, 44b,48	4
7	Soil Biology	42	1
8	Environmental Soil Science	43,45,46	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**	-	38, 41, 45, 46
AICRP on LTFE				
1	Dr. Muneshwar Singh	Project Co-coordinator	1	41,48
2	Dr. R. H. Wanjari	Senior Scientist	-	44a
AICRP on STCR				
1	Dr. Pradip Dey	Project Co-ordinator	-	41, 47
2	Dr. Abhishek Rathore*	Scientist (SS)	-	-
3	Dr. Hiranmoy Das*	Scientist	-	8, 31
AICRP on MSN				
1	Dr. A.K. Shukla	Project Co-ordinator	-	9, 13, 38, 46, 47
2.	Mr. Pankaj Tiwari*	Scientist	13	-
AINP on BF				
1	Dr. D.L.N. Rao	Project Co-ordinator	36	8
2	Ms. T.K. Radha	Scientist	-	8, 28, 36
Soil Chemistry and Fertility				
1	Dr. A. K. Biswas	Head of Division & Pr.	44	1, 5, 9

		Scientist	(LCPC)	
2	Dr. Sanjay Srivastava	Principal Scientist	11, 44c	8, 10,
3	Dr. Brij Lal Lakaria	Principal Scientist	5	3, 15, 44d
4	Dr. R. Elanchezian	Principal Scientist	9	12, 13, 17, 47, 51
5	Dr. N.K. Lenka	Senior Scientist	3, 47	-
6	Dr. K. Ramesh	Senior Scientist	-	9, 11, 12, 15, 44b, 46
7	Dr. Pramod Jha	Senior Scientist	44d	5, 12, 17, 41,48
8	Dr. I. Rashmi	Scientist	-	11, 44c, 47
10	Dr. B.P. Meena	Scientist	12	1, 8, 13, 44b
11	Mr. Abhay Shirale	Scientist	-	44b, 51
Soil Physics Division				
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	44 (Deputy LCPC)	1, 41,48
2	Dr. Kuntal M. Hati	Principal Scientist	41, 44	5, 17
3	Dr. R.K. Singh	Scientist Senior Scale	-	44a
4	Dr. J. Somasundaram	Senior Scientist	44b	48
5	Dr. A.K. Vishwakarma	Senior Scientist	44a	-
6.	Dr. M. Mohanty	Scientist	17, 48	41, 44d
7	Dr. N.K. Sinha	Scientist	-	8, 10, 17, 41, 44c, 45,48
Soil Biology				
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	-	23, 52
2	Dr. A.K. Tripathi	Principal Scientist	-	10, 11, 42, 44a
3	Dr. A.B. Singh	Principal Scientist	15	1, 8
4	Dr. S. Ramana	Principal Scientist	42	15, 44b
5	Dr. S.R. Mohanty	Senior Scientist	-	25, 28, 36
6	Dr. K. Bharati	Senior Scientist	25, 28	36, 42, 44d
7	Dr. Asit Mandal	Scientist	-	3, 23, 52
8	Dr. Asha Sahu	Scientist	23	30, 42, 52
9	Dr. Jyoti Kumar Thakur	Scientist	-	5, 15, 23, 41, 44d, 47, 52
10	Dr. S. Bhattacharya	Scientist	-	43, 46

Environmental Soil Science				
1	Dr. J.K. Saha	Head of Division and Prin. Scientist	-	25, 29, 31, 43, 46
2.	Dr. S. Kundu	Principal Scientist	-	9, 10, 29, 30, 31, 45, 46
3.	Dr. Ajay	Principal Scientist	-	43, 45
4	Dr. Tapan Adhikari	Principal Scientist	45, 46	9, 43
5	Dr. Vasanda Coumar	Scientist	43	5, 10, 29, 30, 41
6	Dr.(Mrs.) Sangeeta Lenka	Scientist	-	3, 17, 47,48
6	Dr. M.L. Dotaniya	Scientist	29, 30	10, 31, 43
7	Dr. S. Rajendiran	Scientist	10	29, 30, 31, 43
8	Mr. Vasudev Meena*	Scientist	-	30
Institute Technology management Unit (ITMU)				
1.	Dr. Shinogi K C	Scientist	8	25, 44a
Scientists from other Institutes				
1	KV Ramana Rao	Principal Scientist, CIAE, Bhopal	-	44c
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	5
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	5
4	Dr. V. K. Bhargav	Senior Scientist, CIAE, Bhopal	-	23
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	23
6	Udai B. Singh	Mau	-	23
7.	Neera Singh	IARI	-	28
8.	K. Raju Kumar	NIHSAD, Bhopal	-	9
9.	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra			45

*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**	-	4	4
AICRP on LTFE					
1	Dr. Muneshwar Singh*	Project Co-coordinator	1	2	3
2	Dr. R.H. Wanjari	Senior Scientist	-	1	1
AICRP on STCR					
1	Dr. Pradip Dey*	Project Co-ordinator	-	2	2
2	Mr. Hiranmoy Das*	Scientist	-	2	2
AICRP on MSN					
1	Dr. A.K. Shukla	Project Co-ordinator	-	5	5
2	Mr. Pankaj Tiwari*	Scientist	1	-	1
AINP on BF					
1	Dr. D.L.N. Rao	Project Co-ordinator	1	1	2
2	Ms.T.K. Radha	Scientist	-	3	3
Soil Chemistry and Fertility					
1	Dr. A.K. Biswas	Head of Division & Pri. Scientist	1	3	4
2	Dr. Sanjay Srivastava	Principal Scientist	2	2	4
3	Dr. Brij Lal Lakaria	Principal Scientist	1	3	4
4	Dr. R. Elanchezian	Principal Scientist	1	5	6
5	Dr. N.K. Lenka	Senior Scientist	2	-	2
6	Dr. K. Ramesh	Senior Scientist	-	6	6
7	Dr. Pramod Jha	Senior Scientist	1	5	6
8	Dr. I. Rashmi	Scientist	-	3	3
9	Dr. B.P. Meena	Scientist	1	4	5
10	Mr. Abhay Sirale	Scientist	-	2	2

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

Scientists from other Institutes involved in research projects					
1	Dr. K.V. Ramana Rao	Principal Scientist, CIAE, Bhopal	-	1	1
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	1	1
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	1	1
4	Dr. Vinod Bhargav	Senior Scientist, CIAE, Bhopal	-	1	1
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	1	1
6	Udai B. Singh	Mau	-	1	1
7	Neera Singh	IARI, New Delhi	-	1	1
8	K. Raju Kumar	NIHSAD, Bhopal	-	1	1
9	C.D. Singh, Navkanta Bhat, K.S. Subramanium and Bajendra	-	-	1	1

* On deputation/Leave.

LIST OF PARTICIPANTS

S. No.	Name of Scientist	Designation
1.	Dr. A. K. Patra	Director & Chairman, IRC
2.	Dr. A. Subba Rao	Guest Member
3.	Dr. Muneshwar Singh	Project Co-ordinator, LTFE
4.	Dr. A.K. Shukla	Project Co-ordinator, MSN
5.	Dr. Pradip Dey	Project Co-ordinator, STCR
6.	Dr. D.L.N. Rao	Network Co-ordinator, BNF
7.	Dr. R.S. Chaudhary	Head of Division and Principal Scientist
8.	Dr. A.K. Biswas	HOD & Member Secretary, IRC
9.	Dr. M.C. Manna	Head of Division and Principal Scientist
10.	Dr. J.K. Saha	Head of Division and Principal Scientist
11.	Dr. S. Kundu	Principal Scientist
12.	Dr. A.B. Singh	Principal Scientist
13.	Dr. Ajay	Principal Scientist
14.	Dr. A.K. Tripathi	Principal Scientist
15.	Dr. Sanjay Srivastava	Principal Scientist
16.	Dr. Tapan Adhikari	Principal Scientist
17.	Dr. Brij Lal Lakaria	Principal Scientist
18.	Dr. Kuntal M. Hati	Principal Scientist
19.	Dr. R. Elanchezian	Principal Scientist
20.	Dr. S. Ramana	Principal Scientist
21.	Dr. N.K. Lenka	Principal Scientist
22.	Dr. R.H. Wanjari	Senior Scientist
23.	Dr. K. Ramesh	Senior Scientist
24.	Dr. A.K. Vishwakarma	Senior Scientist
25.	Dr. J. Somasundaram	Senior Scientist
26.	Dr. M. Mohanty	Scientist Senior Scale
27.	Dr. S.R. Mohanty	Senior Scientist
28.	Dr. Pramod Jha	Senior Scientist
29.	Dr. R.K. Singh	Scientist Senior Scale
30.	Dr. K. Bharati	Senior Scientist
31.	Dr.(Mrs.) Sangeeta Lenka	Scientist
32.	Dr. N.K. Sinha	Scientist

33.	Dr. T.K. Radha	Scientist
34.	Dr. I. Rashmi	Scientist
35.	Dr. Asit Mandal	Scientist
36.	Dr. Vasanda Coumar	Scientist
37.	Dr. Asha Sahu	Scientist
38.	Dr. S. Rajendiran	Scientist
39.	Dr. M.L. Dotaniya	Scientist
40.	Dr. Jyoti Kumar Thakur	Scientist
41.	Dr. Shinogi K C	Scientist
42.	Dr. Bharat Prakash Meena	Scientist

*On leave/deputation/training

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 Tiwari	Scientist	On study leave
5	Mr. Abhay Shirale	Scientist	On institute attachment training
6	Ms S. Bhattacharya	Scientist	On institute attachment training

Annexure – I

Progress of Approved on-going projects:

Programme I: Soil Health and Input Use Efficiency

Institute Project

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

Maize yield was influenced due to application of various integrated plant nutrient supply modules. Total dry matter yield and nutrient uptake of maize were the highest for Soil-Test Crop Response equation (STCR) based recommended dose of fertilizers which was at par with general recommended dose (GRD) and FYM based integrated plant nutrient supply module (IPNS) module. Grain and biological yield of maize were also increased with application of GRD, 75% NPK of T3 +5 t FYM (T5), 75% NPK of T3+ 1 t PM, and 20 t FYM in every season compared to other treatments except STCR based fertilizer application . All the IPNS modules, irrespective of sources of organics, were at par in recording total dry matter yield and nutrient uptake.

Study on nanoporous zeolites for soil and crop management.

Zeolites are important materials with very broad applications in refineries as catalysts, sorption and separation processes, and also in agriculture and environmental engineering. The current growing awareness of the phenomena and availability of inexpensive natural zeolites in the world has aroused considerable commercial interest. The reason zeolites are now attracting so much interest lies in the honeycomb structure of cavities and minute channels in different directions which work at the cellular level trapping of heavy metals and/or nutrient ions and releasing them slowly. As per the recommendation of previous IRC, NBSS&LUP was in contact for the identification of various compounds in the zeolite samples, and as it was not possible at NBSS&LUP, the samples were analyzed at IARI, New Delhi. The major zeolite types identified in the zeolite samples include analcime, chabazite, stilbite and haulendite etc. RPP 3 seminar will be delivered soon.

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

During the period under report, the pot experiment was continued with three soil types (Alfisol, Inceptisol and Vertisol) with wheat (HI – 1544) during rabi 2013-14 and maize (Kanchan hybrid) during kharif, 2014. The maize crop was harvested 60 days after planting and wheat was harvested after maturity. The above ground biomass was recorded during harvest. The resilience index was computed by comparing the absolute values of response variables before and after stress as per selected methodologies. The data showed higher resilience index in soils with higher SOC content. To assess the effect of SOC content and management effect on resilience capacity in terms of biological activity in soil, an incubation study up to 107 days was conducted with Cd stress, in a clay loam soil. The data on soil respiration, dehydrogenase and FDA showed that the management treatment involving 20 t FYM/ha showed a higher recovery rate as compared to other treatments.

Biochar on soil properties and crop performance

A leaching study with biochar and fertilizers was conducted simulating the field conditions in red and black soils. The study revealed that the N loss from the red and black soils is high when fertilizers are added to sol. The N leached through the 30 cm column increased with fertilizer addition, and there was a significant decrease in the N loss when biochar was added in addition to fertilizer at the rate of 10 and 20 t ha-1. Similar reduction in losses was observed with respect to P and K for both the soils. Studies were also conducted for assessing the potential of biochar to improve heavy metal polluted soils as well as to utilize the municipal solid waste with biochar to decrease the soil pollution, increase soil health as well as to reduce the transfer quotient of heavy metals to shoots. Increase in dry matter yield of spinach continued even under high Cu soil (250-500 ppm) applied along with biochar @2.5-5.0 t/ha

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

The project has been competed in December 2014, Hence, RPF-III will be presented.

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

The second crop season of the project started with field preparation of phosphor-sulpho-nitro compost in portable compost pits in nine farmers' fields of the Mengrakalan village of Berasia, Bhopal. Soil samples were collected in the month of May from the respective fields to calculate the fertilizer requirement for STCR treatment and sowing of Kharif soybean (JS-9560) was done in the third week of July. The soybean crop was harvested in the first fortnight of October and samples of the harvest were collected for each technology demonstration plot (T1-IPNS-I, T2-IPNS-2, T3-STCR and Farmers' practice) from each farmer's fields. Fresh weight and dry weight of the harvest, average number of pods per plant, grain yield and straw yield were also recorded. Soil samples were collected from nine plots after the soybean harvest and analyzed for the available nutrients to calculate the fertilizer requirement (STCR) for the following wheat crop. And the sowing of wheat was done accordingly during October-November, 2014. The crop season started one month late because of the late monsoon however, the crop showed a good response compared to the previous year with an average yield of 11.5 q/ha for IPNS 1, 12.1 q/ha for IPNS 2, 11.7 q/ha for STCR, and 9.9 q/ha for Farmers' Practice with an average yield advantage 16.96%, 22.9%, 18.48% respectively for IPNS 1, IPNS 2, and STCR over the FP.

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. wheat and maize were studied under hydroponic and sand culture system using ZnO, CuO and Fe3O4 nanoparticles (NPs). The morphology of nanoparticles was analyzed through Transmission Electron Microscope (TEM) for characterization of size and shape. Most of NPs analysed were within the size range of 50 nm. Plant growth parameters viz. plant height, root length, shoot biomass, root biomass and chlorophyll content were recorded in the nano-micronutrient treated plants. The activity of antioxidant enzymes viz. Super oxide dismutase (SOD), Catalase (CAT) and Peroxidase (POX) were recorded in plants treated with NPs. It was observed that NPs doesn't affect the root growth of maize and wheat up to 45 DAS but shoot growth was variably influenced after 30 DAS in maize. Taller plants with more biomass were observed with CuO NP treatment but not with Fe3O4 NP treatment. Antioxidant enzyme, SOD activity was observed after 30 DAS and CAT & POX activity was observed after 45 DAS. FeNP and ZnNP treated plants showed moderate level of SOD/ CAT activities and CuNP treated plants showed moderate POX indicating lower level of stress experienced by NP treated plants. With sub-optimal concentration of micro-nutrients i.e. 50% concentration of NP treatment, higher Fe and Cu content in shoot; higher Cu & Zn in root was observed; and highest Cu content was observed in shoot as well as root. The TEM analysis indicated that the nanoparticles were found to enter the root cortical cells and were found near the plastids of mesophyll cells at the junction of root and stem interphase.

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

Soil quality status of tribal dominated Alirajpur district has been calculated and based on relative soil quality index (RSQI), the soils of this district was found to be fall under poor (64.4%) and medium (35.6%) quality categories. Geo-referenced surface soil samples (780 Nos.) were collected from Dhar district and analysis of their physico-chemical properties is in progress. Demonstration trials were conducted in farmers' fields (10 Nos.; 6 for soybean and 4 for Maize) of tribal dominated Alirajpur and Jhabua district during kharif season, 2014. Due to late arrival and vagaries of monsoon, there was reduction in yield to the extent of about 30-40% was observed. In comparison with farmers practices, increase in soybean yield of 3.64-5.48%, 4.85-6.46% and 6.80-7.89% was observed in RDF, IPNS (75% inorganic fertilizers+25% organic) and soil test based nutrient recommendation (STNR), respectively. Similarly maize yield also increased to 5.06-8.65%, 4.73-9.89% and 7.34-12.92% respectively. During this rabi season, 11 demonstration trials for wheat is under progress.

Evaluating rock phosphates for their suitability for direct application

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

An experiment was conducted on evaluation of different modified urea materials in respect to crop productivity and nitrogen use efficiency (NUE) at IISS farm and found that the crop productivity and NUE were significantly variable with the application of different modified urea materials. Among different modified urea materials, neem coated urea (NCU) recorded significantly higher yield and NUE followed by biochar coated urea (BCU). Another experiment was conducted to evaluate best agronomic interventions for enhancing yield and NUE of crops. The study showed that maize yield and nitrogen use efficiency 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.

Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat

Experiment 1 and 2 are under progress. Wheat crop (variety C 306) has been sown in the ongoing Rabi season for both the experiments and crop is nearing physiological maturity. All the treatments have been given to the crop at appropriate time. Initial soil samples have been collected and all other parameters are being collected as planned. The results for these two experiments shall be available after harvest of the crop and analysis of soil and plant samples then after.

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

Decision to be taken in view of non-receipt of extension and sanction

Network Project on Organic Farming

In ninth year of field experiment during the kharif season (2014-15), 100% organic manure treatment recorded higher yield of Soybean in soybean-wheat, soybean-mustard and soybean-linseed cropping systems as compared 75% organic with innovative practices. Further, organic management outperformed inorganic management. Among the cropping systems, soybean-wheat/gram performed better than soybean-mustard/linseed cropping systems. In Soybean-chickpea cropping system, integrated nutrient management showed higher yield of Soybean as compared to organic and inorganic management. The soil analysis data could not detect any significant difference in soil pH and EC owing to the nutrient management options. Mean soil organic carbon content under soybean-wheat system varied from 0.52 to 0.81 percent and was lowest under inorganic nutrient management option irrespective of the cropping system. The mean SOC was the highest under soybean-wheat cropping system followed by 75% organic + innovative practice. Mean soil available P and K under different nutrient management options varied from 15.2 to 37.9 kg ha-1 and 392 to 609 kg ha-1. Soil biological parameters such as FDA and dehydrogenase activity was found to be higher in 100% organic followed by integrated management and least in inorganic management. Highest microbial count of bacteria, fungi and actinomycetes was found in the organic treatment. In general, the total count of soil microbes was higher in chickpea than wheat. There was improvement in protein and methionine content in soybean, tryptophan and mineral content in maize due to different organic sources of nutrient application. In the second experiment, response of different varieties with varying duration of major crops (Soybean and Maize, Wheat and Gram) to organic production system conducted during the year 2014-15, as per recommendations of Annual Group Meeting of NPOF 26-27 May, 2014 held at Bajura, (H. P). All the varieties of each crop received identical nutrient dose. Among the varieties of soybean and maize tested, RVS-2002-4 variety of soybean and Kanchan variety of maize outperformed others. Analysis of nutrional quality parameters in seed/grains of rabi crops and soil chemical and biological parameters for the year 2014-15 will be taken up after harvest of the crops.

Programme II: Conservation Agriculture and Carbon

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

The study was laid out in a split – plot design with two tillage treatments namely conventional tillage (CT) and reduced tillage (RT) along with six cropping systems i) Soybean- Fallow, ii) Maize- Gram, iii) Soybean- Fallow, iv) Soybean + Pigeon pea (2:1), v) Soybean+ Cotton (2:1) and vi) Soybean– Wheat. During the reported period, fifth year experimental crops were taken up. Kharif crops were sown in the last July,2014; After harvest of Kharif crops, Rabi crops (Nov, 2014) were sown as per approved programme. During the period, soil moisture, temperature was recorded periodically. Soil samples (4th year) were analyzed for organic carbon and available nutrients (NPK). Soil organic carbon (SOC) was also relatively higher in RT compared to CT after fourth crop-cycles. Yield data indicated that reduced tillage recorded relatively higher yield compared to conventional Tillage. Data compilation and analysis is in progress. Results will be presented in the forthcoming IRC meeting.

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

Under this project, Calibration of soybean, wheat, maize and chickpeas cultivars by different models are completed and the validation field experiment is under progress. The validation of maize, wheat and soybean has been completed for APSIM model and for other model it is in progress. The validation for chickpea will be completed once the data for the crop is collected from the ongoing field experiment. The climate change effects on grain yield of soybean and wheat has been reported and for other crops it is under progress.

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

Effect of tillage and manure on soybean and wheat productivity and soil properties was studied for the reporting period. In general, reduced tillage (RT) was found to be better on soybean yield and productivity during Kharif season and no tillage (NT) was found to have relatively higher yield during rabi season. This would be due to higher weed infestation and intensity in kharif than rabi. Soil organic carbon content was found to be higher in NT compared to RT at 0-5 and 5-15 cm soil depth. However permanganate oxidizable carbon, water soluble carbon and acid hydrolysable carbon were found to be higher in reduced tillage at 0-5 cm and 15-30 cm soil depth. Significant ($P < 0.05$) variations in bulk density and penetration resistance were observed among tillage and manure treatments. Higher bulk density and penetration resistance were observed in NT at 0-5 and 5-10 cm soil depth. Across tillage, bulk density and penetration resistance were found to be lower in manured plots compared to umnaured plots. The water infiltration capacity (ic) ranged from 2.2 cm h-1 (RT) to 1.5 cm h-1 (NT) recorded after harvest of soybean across manured plots. Soil biological activity assessed through DHA and FDA were found to be higher in RT at 0-5 cm soil depth and the effects were at par at 5-15 cm soil depth. Soil available nitrogen was significantly more in RT at 0-5 cm than NT. However the tillage effect was nullified at lower depths beyond 15 cm soil depth.

Weed Management for major cropping systems under conservation agriculture in vertisols

Weed control in zero till soybean based cropping system

- Application of Pre emergence Pendimethalin @ 1000g ai. /ha Fb Post Emergence application of Imazethapyr @70g ai. /ha at 30DAS provided season long weed control.
- The treatment recorded lowest weed biomass under both the cropping system.
- The treatment recorded maximum grain yield under both the cropping system.
- The cost of weed control comes to Rs 13000/ha for two hand weedings at 20 and 40 Days after sowing where as with herbicides it is only Rs 5000/ha.

Weed control in zero till Maize based cropping system

- Application of Pre emergence Pendimethalin 1000 g ai/ha fb Post emergence Atrazine 750 g ai/ha at 30DAS provided season long weed control.
- The treatment recorded lowest weed biomass.
- The treatment recorded maximum grain yield.
- The cost of weed control comes to Rs 13000/ha for two hand weedings at 20 and 40 Days after sowing where as with herbicides it is only Rs 4000/ha.

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

The study was laid out in strip plot design with 3 tillage systems namely Conventional (CT), Reduced tillage (RT) and (iii) No-till (NT) with four cropping system soybean-wheat, soybean + Pigeon pea (2:1), maize-gram, and maize+ pigeon pea (1:1). Experimental (Kharif) crops (3year) were taken up during the reported period. Crops yields were severely affected by continuous rains during the monsoon season. Relative improvement SOC stock value recorded under no-tillage/ reduced tillage compared to conventional tillage practices after two-year crop cycles. A relative improvement in soil properties like soil organic carbon, infiltration rate, mean weight diameter, soil moisture and moderation of soil temperature were noticed under conservation agriculture practices as compared to conventional agricultural practices. However, it is expected that in the long run say after 5-6 crop cycles the effect of tillage and cropping systems on soil properties will be clear due to the additive effect of surface crop residue addition and less soil disturbance under conservation agricultural practices.

Programme III : Soil Microbial Diversity and Biotechnology

Institute Projects

Developing technique for acceleration of decomposition process using thermophilic organisms

The main factors for accelerated composting process include temperature, moisture content and aeration ratio. Considering these factors accelerated a bioreactor rotating drum type of size 1.25m diameter and 1.5 m length was designed and developed for accelerated composting. It is made of double wall with outer insulated with 50mm glasswool. The heating arrangement was provided using four number of strip heating element of 1 kW each. The water was filled in between the double wall to provide uniform heating. A temperature indicator cum controller was provided to control the temperature of substrate inside the reactor. The bioreactor was mounted on three wheeled structure for easy transport. The bioreactor can be rotated manual to achieve mixing and better aeration. Evaluation of bioreactor for accelerated composting of bio waste materials has been successfully done. It was observed that C:N ratio was decreased from 61.84 (initial sample) to 13.28 (after 30 days of decomposition). Extracted and purified bacterial DNA is sequenced and identified. Extraction and purification of fungal and actinomycetes DNA is under process. Based on the laboratory study the consortium of thermo-lignocellulolytic organisms has been made. Standardization of the bioreactor model with consortium has been done through pilot-scale study. Hence, a bioreactor is designed and fabricated with a capacity of 100 kg. It is a rotating drum type reactor. The experiment for composting of soybean straw in this reactor is under progress.

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

Greenhouse gas emission from farm yard manure (FYM) measured using the static box method. Sampling was carried out at Itkhedi village. Green house gas emission and microbial diversity was studied along with physic chemical properties. CH4 emission was high compared to the mixed type composting system. N2O emission from the pile was also monitored over the composting period. Microbial diversity estimate elucidated that heterotrophic bacteria, and nitrifiers varied in response to GHG flux vaues (p 0.05). In order to mitigate GHG emission from composting system, methanotrophs isolated from compost are being evaluated. Inoculation of the isolates through different carrier material has been initiated.

Externally Funded Projects

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

Experiments were carried out to isolate potential microbial groups involved in nutrient cycling process in the rhizosphere of J curcas. Using enrichment method different functional groups were isolated and characterized. 16S rRNA gene sequence of the isolates sequenced using both forward and reverse primers set for whole 16S gene. DNA sequences of Bacillus safeness, Bacillus subtilis, Bacillus flexus, Methyloorhabdus multivorans, Brevibacillus sp, Staphylococcus succinis, Acinetobacter sp, Terribacillus sp and Rhizobium tropici etc were found in the ecto and endorhizosphere of J curcas. The isolates are further characterized for their C source utilization pattern. Acetylene reduction assay (ARA), and PGPR activities estimated by standard protocol. In another experiment, biomass of J curcas was used to prepare a novel bioproduct. Leaf biomass was extracted by a specific aqueous extraction method and two kinds of final products (aqueous and granular) were produced. The efficiency of the product towards improving the soil biological properties was evaluated to define the possible application in agriculture. First it was tested to detect the positive effect on soil biological properties. Leaf extract was added to soil at different concentration ranging from 0%, 0.1%, 0.5% and 1.0% v/v. In general with level of product application CH4 consumption potential improved over unamended control. Product enhanced soil methane (CH4) uptake at large of about 20-40% over control. Soil N2O production decreased with leaf extract amendment although higher dose of the leaf extract didn't significantly enhanced the N2O production. Therefore the best effective dose recommended was the low conc i.e 0.1% LE. Leaf extract increased significantly microbial abundance including heterotrophs, N fixers and P solubilizers. Further testing are being undertaken to study the effect of the extract on plant growth attributes

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

The adsorption peak due to bonded OH groups (R-O-H, hydroxyl group)are observed in the range of 3340-3380 cm-1 in Trichoderma viride, (3376.94 cm-1) and Aspergillus heteromorphus (3375.7cm-1). These functional groups also help for metal ligand classes of Cr, Ni, Cu Zn and Cd. The frequency of broad adsorption peaks 2854.8, 2924 and 2925.8 cm-1 were due to bonded –OH, C-H and >CH2 existed in the cell wall of all these six fungi such as Trichoderma viride, Aspergillus heteromorphus; Rhizomucor pusillus; Aspergillus flavus; Aspergillus terrus; and Aspergillus awamori. Among these six fungi Pb biosorption was maximum and least was observed for Zn. After 30 days, it was observed that the removal of Pb was maxium by these fungi followed by Ni and Zn. Further it was observed that among six fungi Trichoderma viride performed better for removal of Pb, Ni,Zn and Cd followed by Aspergillus flavus. It was also observed that the removal of heavy metals decreased with distance of the compost pit.

Biodegradation of pesticides under changing climate and metagenomic profiling of functional microbes

Earth's biogeochemical cycle is likely to alter in future global change. However, simultaneous influence of global climate drivers and agrochemicals on soil biogeochemical processes is not clearly known. Experiments carried out to explain how this interaction influences soil biogeochemical processes in a tropical vertisol. The environmental factors were CO2 (ambient, 800ppm), temperature (25C, 35C, 45C), soil moisture holding capacity (MHC) (60%, 100%) and chloropyrifos (0ppm, 10 ppm). The variables were N2O production, enzymatic activities, and microbial abundance. Production of N2O (ng g-1) was high (18.06) under normal environmental condition, while the rise in CO2, temperature and chloropyrifos reduced N2O production to 2.94. One way analysis of variance (ANOVA) revealed significant influence of the factors on the soil variables ($p<0.0001$). Soil enzymatic activities including fluorescein diacetate hydrolysis (FDA) and dehydrogenase (DHA) activities were significantly affected by the factors ($p <0.0001$). Pearson product moment analysis indicated significant correlation among the variables ($p<0.0001$). Principal component analysis (PCA) explained 68.18% and 19.13% variation by first two components. PCA biplot categorized factors (vectors) based on their level of similarity and identified linkage between the parameters. Result highlighted that intensive use of insecticide chloropyrifos in future climate may increase the severity of negative impact of climate change alone on the soil biogeochemical processes.

Programme IV: Soil Pollution, Remidiationa nd Environmenal Security

Institute Project

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

A pot culture experiment was conducted to study the interaction of Cr with Cd and Zn on their uptake by spinach crop. Results showed that increasing the Cr, Cd and Zn application enhanced the uptake of the respective metal ions in root and shoot. Cadmium application @2 mg/kg (Cd2) decreased Cr concentration in spinach leaves at Cr contaminated soil (Cr100). Chromium had significantly reduced Cd concentration in leaf biomass. Uptake of Cd was reduced in shoot and increased in roots due to the application of Zn at 10 mg/kg soil (Zn10). Further, impact of Cr on soil enzyme activities i.e. dehydrogenase activity, alkaline phosphate and fluorescein diacetate, was studied. Increasing the concentration of Cr (0 to 100 mg/kg) reduced the enzyme activities and the maximum reduction was observed in the early stages of incubation. Among the enzyme activities, dehydrogenase activity was more sensitive to Cr toxicity.

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

The geo-referenced surface soil samples were collected from different locations in long-term sewage irrigated area of both sides of Patra Nala of Bhopal region. Sewage water samples at a distance interval of 1-2 km upto Halali dam and 47 soil samples from different sewage irrigated farmers fields were collected from the upper horizon (0-15 cm). The pH of the soil samples were in the range of 7.1-8.6 and EC of the soil were in the range of 0.12-0.37 dS m-1. Long-term use of sewage water for irrigating crops build up soil organic carbon (SOC) which ranged from 0.54% - 1.92%. Population of bacteria, fungi and actinomycetes; and soil enzymes in sewage irrigated soils were significantly higher as compared to groundwater irrigated area. The collected soil samples were analyzed for total heavy metals (Cu, Cd, Pb, Cr, Ni, and Zn) accumulation with the help of ICP-OES. The results showed that concentrations of Cu, Cd, Pb, Cr, Ni and Zn exceeded the respective in ground water irrigated soil.

Determination of Baseline Concentration for Delineating Contaminated Areas in Black Soils of Central India

In the process of preparation of standard reference soil material for heavy metals analysis, soil sample of

about 250 kg were collected from the farm (Location: N 23°18' 33.6" E77° 24' 27.2"; area 1m2 and 0-20 cm depth). The collected soil was air dried and processed and passed through 2 mm sieve. Thus obtained sample of about 160 kg was mixed by hand and split by coning and quartering, bulking opposite quarters to form the half samples, and setting one half samples aside, it was done till about 40 kg of soil obtained. Then it was ground manually using wooden pestle and mortar and manually homogenized for 72 hours using plastic rolling drum. Then bottling (250 bottles) was done. The homogeneity and stability test is under progress. Physico-chemical properties of the soil sample were also analyzed.

Externally Funded Projects

Nil

Contractual Projects

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

A field trial comprising wheat variety was undertaken in Rabi 2013-14 to study the effect of plant nutrition product (NP1) on the nutrient use efficiency of crop. The effect of various combinations of NP1 product and conventional recommended dose of fertilizers on morpho-physiological parameters like growth and yield attributing traits was studied. The nutrient status of the plants was also studied in the various treatments for analyzing the use efficiency. Plant height of wheat was slightly lesser in NP1 treatments, though non-significant, when compared to conventional recommended dose of fertilizers with prilled urea. However, the grain yield and biological yield of the wheat crop is found to be moderately higher in all the NP1 treated plots in comparison to conventional fertilizers. This indicates that the nutritional requirement of plant is met by the single dose of NP1 product application. The yield of crop treated with NP1 product was slightly better and on par with conventional fertilizers treatments and the harvest index of wheat was slightly better with NP1 treatments indicating that the crop may have better translocation efficiency of stored biomass into economic product (grain). Uptake of N in wheat grain, straw, total uptake and grain N concentration is found to be higher in NP1 treatments than conventional fertilizer treatment. The recovery efficiency (%), agronomic and physiological efficiency of N and P was better under NP1 fertilizer treatment than conventional fertilizer treatment. The harvest index of N was slightly better under NP treatments.

Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential

Much less is known on archaea in soils, than other microbial groups. Once thought to be restricted to extreme environments, it is now known that archaea are predominant in diverse environments. Recently diverse archaeal population has been reported in agricultural soils and information but their significance is less understood. Actinobacteria are a ubiquitous group of micro-organisms that make up 10-15% of the total microbial community in soil and are involved in decomposition of organic matter, antibiotic production, suppression of soil borne plant pathogens and phosphorus solubilization. Some actinobacteria are capable of growing in extreme, hostile and polluted environments. Exploration of actinobacteria to enhance crop response is limited. The focus of the present project will be to explore the structure and function (culturable and unculturable) of archaea and actinobacteria in Vertisols of central India, their role in biogeochemical cycles in relation to plant growth and soil functions with the long term goal to enhance nutrient transformation and agricultural productivity through developing novel microbial technology based on these stress tolerant group of microorganisms.

Evaluation of urease inhibitor product (limus) for nutrient use efficiency in cereal crops

A field experiment was conducted on black soil consisting of ten treatments involving different sources, doses and timings of N fertilizer to a hybrid maize. The first year study revealed that N application timing is crucial factor for realizing the maximum grain yield rather than the quantity of fertilizer alone. The highest grain yield of maize was recorded with modified urea product (LIMUS) with a lower rate of N application i.e. 80 N kg/ha applied in two splits at V4 and V8 stages, which was significantly higher than when applied in four splits viz basal, V4, V8 and tesseling stage. Further, reduction in the application rate resulted in significant decrease in the grain yield. At all levels of N application, the LIMUS urea has shown an edge over the prilled urea. However, the magnitude increase was not very dramatic as the NCU also behaved in a similar fashion when applied at the rate of 80 N kg/ha and resulted in statistically at par yield to that of LIMUS urea despite its application being in four splits.

Evaluation of nano-nutrients product (NUALGI) for improving nutrient use efficiency of crops

A field trial comprising maize hybrid Rasi 4212 and Soybean JS 335 was undertaken in kharif 2014 to study the effect of nano-nutrient product (NUALGI) on growth, yield and nutrient use efficiency of crop. The effect of various combinations of NUALGI nano-nutrient product and conventional recommended dose of fertilizers on morpho-physiological parameters like growth and yield attributing traits in the maize and soybean crop was studied. Soil physio-chemical characters like pH, EC, Organic Carbon, available N, Phosphorus and Potassium were recorded initially. The nutrient status of the plants was studied in various treatments for analyzing the use efficiency. The results of the experiment are being analyzed.

Evaluation of efficacy of polysulphate on oil seed crops (soybean-mustard)

Polysulphate is a naturally occurring mineral fertiliser containing the sulphates of potassium, magnesium and calcium. It is a **c**oncentrated sulphur source for low application rates, readily available sulphur plus potassium and magnesium and naturally occurring product. Due to delayed approval of the project, soybean could not bear filled pods in the kharif season and economical yield data could not be recorded. Mustard trial has been just harvested and the final results will be presented in the next IRC.

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