Proceedings of IRC Meeting

(25-28, February, 2013)

भाकृअनुप
ICAR

Indian Institute of Soil Science

Nabibagh, Berasia Road

Bhopal – 462 038 (M. P.)

GUIDANCE AND DIRECTIONS

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

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

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Principal Scientist and I/c PME Cell

Dr. SHINOGI K. C.
Scientist (PME Cell)

SECRETARIAL ASSISTANCE AND COMPUTER PROCESSING

Smt. Geeta Yadav, Personal Secretary

Introductory Remarks of the Chairman, IRC

The 2nd Institute Research Council meeting for the financial year 2012-13 began on 25th February, 2013. Dr. A. K. Biswas, Member-Secretary, welcomed the participants and detailed the agenda items of the IRC. He stressed on the convergence of RFD, HYPM and IRC targets and achievements. The chairman of IRC, Dr. A. Subba Rao, Director, IISS, informed that as per discussions held in HOD meeting at New Delhi, we need to keep a data base of projects in view of public investment made on research. He further suggested that our future research projects should be based on theme areas as per IISS XIIth Plan. All projects of the Institute have to be brought under these thematic areas. He urged upon the scientists to play big role for the laurels and fame of IISS. Each scientist has to focus on one or two areas of soil research so as to develop expertise in a field and should refrain from involving in many areas. He also exhorted upon the scientists to bring the Institute into limelight by publishing good materials in one's area of research interest. Thereafter, research projects were presented under the following research programmes:

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 Security

STATUS OF PROGRAMME WISE ON-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 (Operational PI) A. B. Singh R. S. Chaudhary B. P. Meena	LTFE	April 2002	Long term	Progress is satisfactory and project to be continued.
	Comment: Data presented is of first cropping cycle (Maize-chick pea)					
2.	Study on nanoporous zeolites for soil and crop management.	K. Ramesh I. Rashmi	Soil Chemistry and Fertility	March 2010	Feb. 2013	Progress is satisfactory and project to be continued.
	Comment: Collaboration with NBSS &LUP may be established. Project extended up to February 2014 **(Action: Dr. K. Ramesh)**					
3.	Efficacy of soil sampling strategies for describing spatial variability of soil attributes.	Neenu S Sanjay Srivastava Hironmoy Das	Soil Chemistry and Fertility	August 2010	July 2012	Progress is satisfactory and project to be continued.
	Comment: The project needs momentum. Spatial variability has to be quantified. Project extended up to June 2013. The name of Dr. B.N. Mandal deleted as per PI's request, as he expressed his inability to carry on. **(Action: Ms. Neenu S)**					
4.	Participatory integrated nutrient management for improving the productivity and quality of soils of Nagaland.	Brij Lal Lakaria N. K. Lenka R. H. Wanjari	Soil Chemistry and Fertility	May 2010	April 2013	**Project is Concluded**

5.	Studies on soil resilience in relation to soil organic matter in selected soils.	N. K. Lenka, Sangeeta Lenka Brij Lal Lakaria Asit Mandal	Soil Chemistry and Fertility	July 2010	July 2015	Progress is satisfactory and project to be continued.
	Comment: Maize be used as test crop instead of soybean. Resilience study should be taken up. Stress-strain relationship may be included. **(Action: Dr. N.K. Lenka)**					
6.	Changing climatic factors' influence on the nutrient acquisition, utilization and recovery by soybean and wheat/gram germplasm lines/ genotypes on black soils of central India.	Neenu S. K. Ramesh S. Ramana J. Somasundaram I. Rashmi	Soil Chemistry and Fertility	June 2010	June 2013	Progress is satisfactory and project to be continued.
	Comment: While presenting the data focus be given to influence of climate parameters on crop performance. **(Action: Ms. Neenu S)**					
7.	Biofortification of grain sorghum and finger millet varieties with zinc through agronomic measures.	Ajay A.K.Shukla J.K.Saha,	ESS	July 2010	July 2013	Progress is satisfactory and project to be continued.
	Comment:					
8.	Development of phosphorus saturation indices for selected Indian soils.	I. Rashmi Neenu S	Soil Chemistry and Fertility	April 2011	April 2014	Progress is satisfactory and project to be continued.
	Comment: Possibilities of using statistical models may be explored to characterize behaviour pattern w.r.t yield & dry matter production. **(Action: I. Rashmi)**					
9.	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)				
10.	Detection of water and nitrogen stress and prediction of yield of soybean and maize using hyper-spectral reflectance and vegetation indices.	K. M. Hati R. K. Singh	Soil Physics	June 2009	June 2013	Progress is satisfactory and project to be continued.
	Comment: Information generated so far may be consolidated to comprehend the work done so far **(Action: Dr. K.M. Hati)**					
11.	Participatory assessment of qualitative parameters for categorizing different degrees of soil quality to enhance the soil health and productivity.	R. S. Chaudhary J. Somasundaram, Santosh R. Mohanty A. B. Singh	Soil Physics	March 2010	August 2013	Progress is satisfactory and project to be continued.
	Comment: Project to be continued **(Action: Dr. R.S. Chaudhary)**					
12.	Impact of crop covers on soil and nutrient losses through runoff in Vertisol.	R. K.Singh, J. Somasundaram I. Rashmi	Soil Physics	June 2010	May 2014	Progress is satisfactory and project to be continued.
	Comment: Crop cover (%) data may be collected under different crops **(Action: Dr. R.K. Singh)**					
13.	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	2011	2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. N.K. Sinha)**					
14.	Soil Resilience and its Indicators under Some Major Soil Orders of India.	Ritesh Saha K.M. Hati Pramod Jha M. Mohanty R.S. Chaudhary	Soil Physics	March 2011	February, 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Ritesh Saha)**					

15.	Quality assessment of crops under different nutrient management system in long term experiment	A.B. Singh A. K. Tripathi	Soil Biology	May 2008	May 2013	**Project is concluded.**

B) <u>Externally Funded Projects</u>

16	Understanding the mechanism of variation in status of a few nutrietionally important micronutrients in some important food crops and the mechanism of micronutrient enrichment in plant parts (NAIP project)	A.K. Shukla Muneshwar Singh Tapan Adhikari	MSN	Feb. 2009	Project Extended up to March 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. A.K.Shukla)**					
17.	Nano-technology for Enhanced Utilization of Native-Phosphosrus by Plants and Higher Moisture Retention in Arid Soils (NAIP Project)	Tapan Adhikari A. K. Biswas S. Kundu	ESS	18th July 2008	Project Extended up to March 2014	Progress is satisfactory and project to be continued.
	Comment: Plan for a brainstorming session with division of Soil chemistry for a sound methodology. Field experiments if trials need to be conducted for assessing input use efficiency. **(Action: Dr. Tapan Adhikari)**					
18.	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 (Executive PI) A. K. Shukla Muneshwar Singh Sanjay Srivastava R. H. Wanjari Hiranmoy Das	STCR	June 2009	March 2013	Progress is satisfactory and project to be continued.
	Comment: Maps, Practices with recommendations be put in the institute website. **(Action: Dr. Pradip Dey)**					

19.	Network Project on Organic Farming	A. B. Singh K. Ramesh Brij Lal Lakaria S. Ramana J.K. Thakur	Soil Biology	July 2004	July 2012	Progress is satisfactory and project to be continued.
	Comment: Project to continue subject to approval from lead centre. **(Action: Dr. A.B. Singh)**					
20	Soil quality assessment for enhancing crop productivity in some tribal districts of Madhya Pradesh	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.
	Comment: **Progress presented by Co-PI.** Progress need to be presented more comprehensively through mapping and temporal variation in the coming IRC. **(Action: Dr. Rajendiran S.)**					

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

A. <u>Institute Projects</u>

21	Soil carbon saturation and stabilization in some soils in India.	Pramod Jha, Brij Lal Lakaria Ritesh Saha S.R. Mohanty A.K. Biswas Muneshwar Singh	Soil Chemistry and Fertility	March 2010	February 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Pramod Jha)**					

22.	Tillage and manure interactive effects on soil aggregate dynamics, soil organic carbon accumulation and by pass flow in vertisols	Sangeeta Lenka M. C. Manna Brij Lal Lakaria R. K. Singh R. C. Singh (CIAE)	Soil Physics	June 2008	June 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Sangeeta Lenka)**					
23.	Evaluating conservation tillage on various sequences/rotations for stabilizing crops productivity under erratic climatic conditions in black soils of Central India	J. Somasundaram R. S. Chaudhary Neenu S Ajay	Soil Physics	March 2010	June 2016	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. J. Somasundaram)**					
24.	Assessing impacts of climate change on different cropping systems in Central India and evaluating adaptation studies through crop simulation models	M. Mohanty K.M. Hati, N.K. Sinha Sangeeta Lenka Pramod Jha Neenu S. R. S. Choudhary R. Elanchezian A. Subba Rao	Soil Physics	June 2011	May 2016	Progress is satisfactory and project to be continued.
	Comment: Attempts may be made to work at Sehore and Jabalpur sites. **(Action: Dr. M. Mohanty)**					

B. Externally Funded Projects

25.	Evaluating Conservation Agriculture for Stabilizing Crop Productivity and Carbon Sequestration by Resilient Cropping Systems/Sequences under aberrant Climatic Conditions in Black Soils of Central India.	J. Somasundaram R. S. Chaudhary M. Vassanda Coumar K. M. Hati A. Subba Rao Pramod Jha K. Ramesh, Ajay	Soil Physics	2010-2011	2013-2014	Progress is satisfactory and project to be continued.
	Comment: Calculations on gaseous emission need to be checked . **(Action: Dr. J. Somasundaram)**					

Programme III – Soil Microbial Diversity and Biotechnology

A. Institute Projects

26.	Structural and functional diversity of microbes in soil and rhizosphere	Santosh R. Mohanty M.C. Manna Muneshwar Singh	Soil Biology	January 2010	January 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Santosh R. Mohanty)**					
27.	Consequences of transgenic cotton on soil microbial diversity	Asit Mandal J.K. Thakur Asha Sahu M.C. Manna	Soil Biology	March 2011	February 2014	Progress is satisfactory and project to be continued.
	Comment: **May r**evisit the soil analysis and uniformly express available NPK, enzymes, and alkaline phosphatase. . **(Action: Dr. Asit Mandal)**					
28.	Actinomycetes diversity in Daccan plateau, hot, arid region and semi arid eco-sub-region (AER 3 and 6) and evaluation of their PGPR activity.	Radha T.K. D.L.N. Rao	Network Coordinate (BF)	August 2010	August 2013	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Radha T. K)**					

29.	Developing technique for acceleration of decomposition process using thermophilic organisms	Asha Sahu U. B. Singh (NBAIM) J.K. Thakur V. K Bhargav (CIAE) H.L. Kushwaha (CIAE) Asit Mandal, M.C. Manna A. Subba Rao	Soil Biology	September 2011	Aug 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. Asha Sahu)**					
30.	Chemical and Microbiological Evaluation of Biodynamic and Organic Preparations.	J. K. Thakur, Asha Sahu, Asit Mandal A. B. Singh.	Soil Biology	June 2011	June 2013	Progress is satisfactory and project to be continued.
	Comment: Data should be generated on whether foliar application of organic preparations is going to help. **(Action: Dr. J.K. Thakur)**					
31.	Greenhouse gas (GHG) emission from composting systems and characterization of GHG regulating micropes	K. Bharti, J.K. Saha, S.R. Mohanty Shinogi K C	Soil Biology	2012	2016	Progress is satisfactory and project to be continued.
	Comment: The depth of columns of all manure heaps should be uniform while comparing flux , or, emission may be worked out on per tonne basis. **(Action: Dr. K. Bharti)**					

Externally Funded Projects

32.	Soil organic carbon dynamics and climatic changes and crop adaptation strategies (NAIP).	M.C. Manna S. Ramana A.K. Tripathi	Soil Biology	May 2008	September 2012	**Progress is satisfactory and project is concluded.**
	Comment: Project extended up to March 2013 for compiling data. **(Action: Dr. M.C. Manna)**					

33.	Metagenomic characterization and spatio-temporal changes in the prevalence of microbes involved in nutrient cycling in the rhizoplane of bioenergy crops (DST)	S.R. Mohanty Asit Mandal K. Bharti	Soil Biology	Novembe r 2011	November 2014	Progress is satisfactory and project to be continued.
	Comment: Initial soil data may be revisited. Collaboration with other organization with good facilities can be made for success of project. **(Action: Dr S.R. Mohanty)**					

Programme IV: Soil Pollution, Remidiation and Environnemental Security

A. Institute Project

34.	Phyto-extraction of Cr by some floriculture plants.	S. Ramana A.K. Biswas Ajay	Soil Biology	June 2009	2013	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. S. Ramana)**					
35.	Non point sources of phosphorus loading to upper lake, Bhopal.	M. Vassanda Coumar M. L. Dotaniya Vasudev Meena J. Somasundaram J.K. Saha	ESS	April 2011	March 2014	Progress is satisfactory and project to be continued.
	Comment: **(Action: Dr. M. Vassanda Coumar)**					
36.	Interaction among tannery effluents constituents on heavy metals uptake by spinach.	M. L. Dotaniya J. K. Saha Rajendiran S M. Vassanda Coumar S. Kundu	ESS	January 2012	December 2016	Progress is satisfactory and project to be continued.
	Comment: Treatment structure may be refined at divisional level to avoid complexity. (Action: Dr. M. L. Dotaniya)					

B. Externally Funded Projects

37.	Quantifying Green house gases (GHGs) emissions in soybean-wheat systems of M.P. (MPCOST)	Sangeeta Lenka N.K. Lenka S. Kundu A. Subba Rao	Soil Physics	June 2011	June 2014	Progress is satisfactory and project to be continued.
	Comment: The protocol for the estimation of greenhouse emission should be uniform across the GHG emission studies. **(Action: Dr. Sangeeta Lenka)**					

New Institute Projects Presented

S. No.	Title	PI & Co-PI	Division	Period		Remarks
38.	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 A. Sahu, J. K. Thakur S. Ramana A. Subba Rao	Soil Biology	July 2012	July 2014	Approved under Programme – IV
39.	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 Bharat P Meena Nishant K Sinha Hiranmoy Das	ITMU	January 2013	January 2016	Approved under Programme – I

40.	Nano particle delivery and internalization in plant systems for improving nutrient use efficiency	R. Elanchezian A.K. Biswas Tapan Adhikari K. Ramesh, S. Kundu A.K. Shukla A. Subba Rao	Soil Chemistry and Fertility	2013	2015	Approved under Programme – I
41.	Assessing the availability of phosphorus from rock phosphate and other phosphatic fertilizer and evaluation of their effectiveness	Sanjay Srivastava	Soil Chemistry and Fertility			To be revised and presented in the next IRC.

<u>New Contractual /Consultancy Project</u>

S. No.	Title	Sponsorer	PI & Co-PI	Division/Unit	Period		Remarks
42	Evaluation of plant nutrition product (NP-1) for nutrient use efficiency in cereal crops	Nagarjuna Fertilizers and Chemicals Pvt. Ltd., Hyderabad	R. Elanchezhian A.K. Biswas K Ramesh, N.K. Lenka, A. Subba Rao	Soil Chemistry and Fertility	December 2012	December 2013	MOU signed
43.	Effect of urea pestle productivity and nutrient use efficiency in some soils of India	Sanvik India Pvt. Inida	Pramod Jha B.L. Lakaria A.K. Biswas Pradip Day A. Subba Rao Kumar-Ranchi S.R. Singh - Barrackpur	Soil Chemistry and Fertility	December 2012	December 2013	MOU signed

44	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	2013	2014	MOU signed

Project Concluded (3 Nos.)

Sl. No.	Project	PI and Co-PI	Division/Unit	Period	
4.	Participatory integrated nutrient management for improving the productivity and quality of soils of Nagaland.	Brij Lal Lakaria N. K. Lenka R. H. Wanjari	Soil Chemistry and Fertility	May 2010	April 2013
15.	Quality assessment of crops under different nutrient management system in long term experiment	A.B. Singh A. K. Tripathi	Soil Biology	May 2008	May 2013
32	Soil organic carbon dynamics and climatic changes and crop adaptation strategies (NAIP).	M.C. Manna S. Ramana A.K. Tripathi	Soil Biology	May 2008	September 2012

Criteria for Number of Projects with Individual Scientist

In the Institute Research Council Meeting of 2012, certain norms regarding maximum number of projects that any scientist of IISS may be associated at any point of time were decided as mentioned below:

A. Principal Investigator (PI) in one projects and Co-PI in other four projects: (1+4)

B. Principal investigator in two projects and Co-PI in other two projects: (2+2)

C. Principal investigator in three projects without association in any other projects: (3+0)

D. Only Co-PI in projects: (0+5)

In the Institute Research Council Meeting, norms regarding minimum number of projects that any scientist of IISS may hold are mentioned below:

A. Principal investigator in one project without association in other one project: (1+0)

B. Only Co-PI in two projects: (0+2)

Note: 3-6 months overlap may be allowed between termination of a project and starting of a new project and hence in some cases 6 projects may be allowed for a brief period. The decision of the Chairman in all matters shall be final and binding.

Concluding Remarks of the Chairman

In his concluding remark the Director urged the scientists to encash the work done by the institute as many organizations are taking clue from our research and generating technologies that are fetching them significant monetary gains along with name and fame. He further stressed the need to have our major goal for path breaking research and we need to focus mainly on the frontier areas of research that are not being addressed by other institutions. Every division should have a few hot cakes technologies for dissemination. Further he emphasized on the patentable technologies. We need to file patents for highly suited technologies generating by the institute. He requested the house for developing strength in input use efficiency, climate change research carbon sequestration and biodiversity research. Our institute research findings may be communicated regularly to ICAR Newsletter.

In the end the Member-Secretary, IRC thanked all the PIs for nice presentation and the house for in depth deliberation during presentations.

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	19	1
3.	AICRP on MSN	16	1
4.	AINP on Biofertilizers	28	1
5.	Soil Chemistry and Fertility	2, 3, 5, 6, 8, 9, 21, 40	8
6.	Soil Physics	10, 11, 12, 13, 14, 22, 23, 24, 25, 37	10
7.	Soil Biology	19, 26, 28, 29, 30, 31,33, 34, 38	9
8.	Environnemental Soil Science	7, 17, 18, 35, 36,	5
9.	ITMU	39	1

Division-wise no. of Externally Funded Projects

Sl. No.	Centre/Co-coordinating Unit	Sl. No. of Project	Total
1	Soil Chemistry and Fertility	-	-
2	Soil Physics	25, 37	2
3	Soil Biology	19, 33, 38	3
4	Environmental Soil Science	17, 20	2
5	AICRP LTFE	-	-
6	AICRP STCR	18	1
7	AICRP MSN	16	1
8	AINP BF	-	-
9.	ITMU	-	-

Division-wise no. of Contractual Projects

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

Number of New Projects Approved in IRC Meeting of Feb., 2013

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	40	1
6	Soil Physics	-	-
7	Soil Biology	38	1
8	Environmental Soil Science	-	-
9	ITMU	39	1

PROJECT (SERIAL NUMBERS) WITH INDIVIDUAL SCIENTIST

S. No.	Name of Scientist	Designation	Sl. Of projects	
			PI	Co-PI
1	**Dr. A. Subba Rao**	**Director**	18	24, 25, 29, 37, 38, 40
AICRP on LTFE				
1	Dr. Muneshwar Singh*	Project Co-coordinator	1	16, 18, 21, 26
2	Dr. R.H.Wanjari	Senior Scientist		18
AICRP on STCR				
1	Dr. Pradip Dey*	Project Co-ordinator	18	
2	Dr. Abhishek Rathore**	Scientist (SS)		
3	Dr. Hiranmoy Das	Scientist		3, 18, 39
AICRP on MSN				
1	Dr. A.K. Shukla	Project Co-ordinator	16	7, 18, 40
AINP on BF				
1	Dr. D.L.N. Rao	Project Co-ordinator		28, 39
2	Ms.T.K. Radha	Scientist	28	39
Soil Chemistry and Fertility				
1	Dr. A.K.Biswas*	Head of Division & P. Scientist	1	9, 17, 21, 34, 40
2	Dr. Sanjay Srivastava	Principal Scientist		3, 18, 20, 39
3	Dr. Brij Lal Lakaria	Principal Scientist	9	5, 19, 21, 22
4	Dr. R. Elanchezian	Principal Scientist	40	24
5	Dr. N.K. Lenka	Senior Scientist	5	37
6	Dr. K.Ramesh	Senior Scientist	2	6, 19, 25, 40
7	Dr. Pramod Jha	Senior Scientist	21	9, 14, 25, 26
8	Ms. I.Rashmi	Scientist	8	2, 6, 12, 13
9	Ms. Neenu S	Scientist	3, 6	8, 23, 24
10	Dr. J.S.V. Tenshia**	Scientist		
11	Dr. B.P. Meena	Scientist		1, 39

Soil Physics Division				
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	11	1, 14, 23, 24, 25
2	Dr. Kuntal M. Hati	Principal Scientist	10	9, 14, 24, 25
3	Sh. M.Mohanty	Scientist	24	13, 14
4	Dr. J. Somasundaram	Senior Scientist	23, 25	6, 11, 12, 35
5	Dr.(Mrs.) Sangeeta Lenka	Scientist	22, 37	5, 24
6	Dr. Ritesh Saha	Senior Scientist	14	13, 21
7	Dr. R.K.Singh	Scientist Senior Scale	12	10, 22
8	Dr. N.K. Sinha	Scientist	13	20, 24, 39
Soil Biology				
1	Dr. M.C. Manna	Head of Division and Prin. Scientist	38	22, 26, 27, 29
2	Dr. A.K. Tripathi	Principal Scientist		20
3	Dr. A.B. Singh	Principal Scientist	19	1, 11, 30, 39
4	Dr. S. Ramana	Principal Scientist	34	6, 19,, 38
5	Dr. S.R.Mohanty	Senior Scientist	26, 33	11, 21, 31
6	Dr. Kollah Bharti	Senior Scientist	31	33
7	Dr. Asit Mandal	Scientist	27	5, 29, 30, 33, 38
8	Dr. Asha Sahu	Scientist	29	27, 30, 38
9	Dr. Jyoti Kumar Thakur	Scientist	30	9, 19, 27, 29, 38
Environmental Soil Science				
1	Dr. S. Kundu	Head of Division and Prin. Scientist		17, 20, 36, 37, 40
2	Dr. Ajay	Principal Scientist	7	23, 25, 34
3	Dr. J.K. Saha	Principal Scientist		7, 31, 35, 36
4	Dr. Tapan Adhikari	Principal Scientist	17	16, 40
5	Dr. Vasanda Coumar	Scientist	35	9, 20, 25, 36
6	Dr. M.L. Dotaniya	Scientist	36	20, 35
7	Dr. S. Rajendiran	Scientist	20	36
8	Mr. Vasudev Meena	Scientist		35
Institute Technology management Unit (ITMU)				
1.	Dr. Shinogi K C	Scientist	39	31

Scientists from other Institutes				
1	Dr. R.C. Singh	Principal Scientist, CIAE, Bhopal	-	22
2	Dr. A.K. Dubey	Principal Scientist, CIAE, Bhopal	-	9
3	Dr. S. Gangil	Principal Scientist, CIAE, Bhopal	-	9
4	Dr. Vinod Bhargav	Senior Scientist, CIAE, Bhopal	-	29
5	H.L. Kushwaha (CIAE)	Senior Scientist, CIAE, Bhopal	-	29
6	Udai B. Singh	Mau	-	29

* Operational/Executive PI, ** 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. Subba Rao	Director	1	6	7
AICRP on LTFE					
1	Dr. Muneshwar Singh	Project Co-coordinator	1	4	5
2	Dr. R.H.Wanjari	Senior Scientist		1	1
AICRP on STCR					
1	Dr. Pradip Dey*	Project Co-ordinator	1		1
2	Dr. Abhishek Rathore**	Scientist (SS)			
3	Dr. Hiranmoy Das	Scientist		3	3
AICRP on MSN					
1	Dr. A.K. Shukla	Project Co-ordinator	1	3	3
AINP on BF					
1	Dr. D.L.N. Rao	Project Co-ordinator		2	2
2	Ms.T.K. Radha	Scientist	1	1	2
Soil Chemistry and Fertility					
1	Dr. A.K.Biswas*	Head of Division & Prin. Scientist	1	5	6
2	Dr. Sanjay Srivastava	Principal Scientist		4	4
3	Dr. Brij Lal Lakaria	Principal Scientist	1	4	5
4	Dr. R. Elanchezian	Principal Scientist	1	1	2
5	Dr. N.K. Lenka	Senior Scientist	1	1	2
6	Dr. K.Ramesh	Senior Scientist	1	4	5
7	Dr. Pramod Jha	Senior Scientist	1	4	5
8	Ms. I.Rashmi	Scientist	1	4	5
9	Ms. Neenu S	Scientist	2	3	5
10	Dr. J.S.V. Tenshia**	Scientist			
11	Dr. B.P. Meena	Scientist		2	2

Soil Physics					
1	Dr. R.S. Chaudhary	Head of Division and Prin. Scientist	1	5	6
2	Dr. Kuntal M. Hati	Principal Scientist	1	4	5
3	Sh. M.Mohanty	Scientist	1	2	3
4	Dr. J. Somasundaram	Senior Scientist	2	4	6
5	Dr.(Mrs.) Sangeeta Lenka	Scientist	2	2	4
6	Dr. Ritesh Saha	Senior Scientist	1	2	3
7	Dr. R.K.Singh	Scientist Senior Scale	1	2	3
8	Dr. N.K. Sinha	Scientist	1	3	4
Soil Biology					
1	Dr. M.C. Manna	Head of Division & Prin. Scientist	1	4	5
2	Dr. A.K. Tripathi	Principal Scientist	-	1	1
3	Dr. A.B. Singh	Principal Scientist	1	4	5
4	Dr. S. Ramana	Principal Scientist	1	3	4
5	Dr. S.R.Mohanty	Senior Scientist	2	3	5
6	Dr. Kollah Bharti	Senior Scientist	1	1	2
7	Dr. Asit Mandal	Scientist	1	5	6
8	Dr. Asha Sahu	Scientist	1	3	4
9	Dr. Jyoti Kumar Thakur	Scientist	1	4	5
Environmental Soil Science					
1	Dr. S. Kundu	Head of Division and Prin. Scientist	-	5	5
2	Dr. Ajay	Principal Scientist	1	3	4
3	Dr. J.K. Saha	Principal Scientist	-	4	4
4	Dr. Tapan Adhikari	Principal Scientist	1	2	3
5	Dr. Vasanda Coumar	Scientist	1	4	5
6	Dr. M.L. Dotaniya	Scientist	1	2	3
7	Dr. S. Rajendiran	Scientist	1	1	2
8	Mr. Vasudev Meena	Scientist	-	1	1
Institute Technology Management Unit (ITMU)					
1.	Dr. Shinogi K C	Scientist	1	1	2
Total Number of Projects			**37**		

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

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

LIST OF PARTICIPANTS

S. No.	Name of Scientist	Designation
1	Dr. A. Subba Rao	Director & Chairman, IRC
2	Dr. A.K. Biswas	HOD & Member Secretary, IRC
AICRP on LTFE		
3	Dr. Muneshwar Singh	Project Co-ordinator
4	Dr. R.H. Wanjari	Senior Scientist
AICRP on STCR		
5	Dr. Pradip Dey	Project Co-ordinator
6	Dr. Hiranmoy Das	Scientist, Senior Scale
AICRP on MSN		
7	Dr. A.K.Shukla	Project Co-ordinator
AINP on BF		
8	Dr. D.L.N. Rao	Project Co-ordinator
9	Ms.T.K. Radha	Scientist
Soil Chemistry and Fertility		
10	Dr. Sanjay Srivastava	Principal Scientist
11	Dr. Brij Lal Lakaria	Principal Scientist
12	Dr. R. Elanchezian	Principal Scientist
13	Dr. N.K. Lenka	Senior Scientist
14	Dr. K.Ramesh	Senior Scientist
15	Dr. Pramod Jha	Senior Scientist
16	Ms. I.Rashmi	Scientist
17	Ms. Neenu S	Scientist
18	Dr. J.S.V. Tenshia*	Scientist
19	Bharat Prakash Meena	Scientist
Soil Physics		
20	Dr. R.S. Chaudhary	Head of Division and Principal Scientist
21	Dr. Kuntal M. Hati	Principal Scientist
22	Dr. J. Somasundaram	Senior Scientist
23	Dr. Ritesh Saha	Senior Scientist
24	Sh. M. Mohanty	Scientist Senior Scale
25	Dr. R.K.Singh	Scientist Senior Scale
26	Dr.(Mrs.) Sangeeta Lenka	Scientist
27	Dr. N.K. Sinha	Scientist

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30	Dr. A.B. Singh	Principal Scientist
31	Dr. S. Ramana	Principal Scientist
32	Dr. S.R.Mohanty	Senior Scientist
33	Dr. Kollah Bharti	Senior Scientist
34	Dr. Asit Mandal	Scientist
35	Ms. Asha Sahu	Scientist
36	Dr. Jyoti Kumar Thakur	Scientist
37	Dr. Shinogi K C	Scientist
Environmental Soil Science		
38	Dr. S. Kundu	Head of Division and Principal Scientist
39	Dr. Ajay	Principal Scientist
40	Dr. J.K. Saha	Principal Scientist
41	Dr. Tapan Adhikari	Principal Scientist
42	Dr. Vasanda Coumar	Scientist
43	Dr. M.L. Dotaniya	Scientist
44	Dr. S. Rajendiran*	Scientist
45	Vasudev Meena	Scientist
Institute Technology Management Unit (ITMU)		
46	Dr. Shinogi K C	Scientist

***On leave/deputation**

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

Annexure – I

16. Progress of Approved on-going projects

Programme I: Soil Health and Input Use Efficiency

1. **Long-term Evaluation of Integrated Plant Nutrient Supply Modules for Sustainable Productivity in Vertisol**

   The first maize chickpea expt has been taken up after the change of cropping sequence. STCR based nutrient management had the highest maize yield. Among the INM modules 75% NPK either with 5 t FYM or 1 t PM or 5t UC were at par and significantly higher than other modules. Grain yield and total biomass yield correlated with NPK addition at different treatment.

2. **Study on Nanoporous Zeolites for Soil and Crop Management**

   Liquid Nitrogen isotherm of zeolite samples has shown the porous nature and the Type IV isotherm as per IUPAC classification and the results are presented. Reduction in soil urease activity due to the addition of zeolite is witnessed. Zeolite–organic manure interactions have shown the ammonium trapping by the zeolites. Discussions have been held with NBSS&LUP for the identification of various compounds in the zeolite samples. Zeolite-phosphorus interactions have been initiated.

3. **Efficacy of Soil Sampling Strategies for Describing Spatial Variability of Soil Attributes**

   Two farmers' fields (one in village Dhamarrah and another in Pipaliyabaaz khan) were selected. In both the fields Soybean-wheat cropping system is followed. Sampling of the Kharif crop (Soybean) was carried out in the first field by taking 28-32 random points within the field. The crop was air dried and yield of the grain was taken. The field was then divided into 5 zones based on yield map and 5 samples were collected from each of the zones. Grid based soil sample collection was performed for both the fields. For this purpose, soil samples were collected based on ½ acre, 1 acre, 2 acre and 5 acre grids. Collected samples were air dried and grinded and ready for laboratory analysis.

4. **Participatory Integrated Nutrient management for Improving the Productivity and Quality of Soils of Nagaland**

   The INM experiment was continued at different sites in Nagaland. The observations on crop performance and yield were collected from some sites at the harvest stage of paddy crop. Data has been received from few sites only. The analysis of data has revealed that there are variations in paddy yield across the sites owing to varietals and soil differences. Among the sites from which data has been received the highest yield has been recorded in Jaluki and Kohima. At Nuiland the yield was minimum due to moisture stress at tillering stage. The INM interventions have shown impact on the yield of paddy.

5. **Studies on Soil Resilience in relation to Soil Organic Matter in Selected Soils**

   As per the activity schedule, pot experiment was continued in *kharif* 2012. However, as per suggestions in last IRC meeting, maize (Kanchan hybrid) crop was taken for 60 days during 06/07/2012 to 05/09/2012 in place of soybean crop. The plant related observations such as leaf area, leaf chlorophyll content, above ground plant biomass, root weight were recorded at harvest. Soil related observations such as penetrometer resistance, bulk density were taken. As reported earlier, there was a significant increase in bulk density and penetration resistance with depletion in SOC. This was due to increase in cementation properties of soil particles. For quantifying the cementation effect and its consequences on soil elastic behaviour, stress – strain relationship of the soil samples of the clay loam soil was carried out using a Universal Testing Machine with a compressive load. The behaviour was expressed in terms of yield point (YP) stress, YP strain, maximum stress and maximum strain. The data showed yield point stress to be lower by 13 – 21% with depletion of soil C by 25 – 50%. On the other hand, the maximum stress increased with reduction in soil C. This shows with reduction in soil C, there is increase in plastic behaviour of soil. The effect of nutrient management treatments, viz., 100% RDF + 10 t FYM/ha, 20 t FYM/ha and 150% RDF, could not be noticed at the early stage of reclaimation (2 years after imposing depletion treatments). In addition to the above, soil samples from Barrackpore representing alluvial soil was collected and the treatment is being undertaken to start the experiment in the *kharif* 2013. Also, a study with the black soils of Bhopal region was started from *rabi* 2013, with soil samples collected from sites varying in SOC concentration.

6. **Changing Climatic Factors' Influence on the Nutrient Acquisition, Utilization and Recovery by Soybean and Wheat/Gram Germplasm Lines/ Genotypes on Black Soils of Central India**

Analysis of soil samples and plant samples from second year experiment with chickpea was done. The third year field experiment with soybean was conducted with 4 varieties and 4 fertilizer management practices. Field observations were taken. It was found that the treatment integrated nutrient management in variety JS 9752 recorded highest yield in both sowing dates. Soil and plant samples were collected and processed and the analysis is going on. Third year field experiment with chickpea varieties and 4 fertilizer management practices is laid in the field.

7. **Biofortification of Grain Sorghum and Finger Millet Varieties with Zinc through Agronomic Measures**

The major activity for this period was cultivation of the crop, harvesting of the crop and attempt on phytate content and phytase activity of the harvested grain. Because of different mode of zinc application (T1 = Control, T2 = Zn with NPK, T3 = Zn with FYM, T4 = Zn with EDTA) did not make any significant yield difference, nor any change in phytase activities or phytate content. However, genotype difference was observed between low, medium and high zinc efficient varieties. There was increasing trend between phytate/phytase activities from low to high zinc varieties. The zinc content from soil and plants is under progress and will be presented along with other biochemical parameters in the coming RPF3 presentation.

8. **Development of Phosphorus Saturation Indices for Selected Indian Soils**

The soils of Jabalpur, Bangalore, Trivandrum and Delhi were incubated with graded levels of phosphorus based upon respective sorption maxima values. The highest sorption maxima followed the order Jabalpur > Trivandrum > Bangalore > Delhi soils at the P applications upto 100ppm. The soils were later incubated with graded levels of phosphorus (0, 25, 50, 100, 150, 200, 400, 800% of sorption maxima) by three alternate wetting and drying cycles. The incubated soils were used for pot experiment and column to study crop performance and sub surface leaching. Maize was used as test crop for pot experiment. The crop was harvested after 90 days of sowing. The crop yield components like grain yield, stover yield harvest index and P uptake were estimated from all the four soils. Extraction with different extractants, calculation of PSI and correlation between extracted P, PSI and crop yield and uptake studies are in progress.

9. **Biochar on Soil Properties and Crop Performance**

The total carbon content in mustard biochar has increased in different pyrolytic condition from the raw material (43.6%). When the temperature increased from 250, 300, 350 and 400 ^{0}C the total C content also increased to mean value of 64.10, 68.53, 68.23 and 71.98 percent. The total recovery was found to vary between 37.8 and 74.0 percent of the original value indicating the potential of recalcitrant carbon being formed under this process. The pH of mustard biochar was increased from the original raw material pH of 5.49 to 6.90, 8.29. The EC values also increased with mean values varying from 1.63 to 5.07 ds/m in comparison to the original value of 0.895 ds/m. Total N content in biochar of mustard increased from 0.56 percent to 1.40 percent at temperature of 400 ^{0}C respectively. About 45 to 78 percent of feedstock N can be sequestered in mustard biochar. The P content increased from 0.034 percent in orginial feedstock to 0.105. Potassium content in biochar prepared form mustard stalks varied between 0.61 and 0.96 percent. The recovery of biochar however decreased to 58.7, 42.0, 34.0 and 32.9 percent in the original K content at different temperatures. Sodium content in mustard biochar ranged from 510 to 740 ppm with a mean value of 565, 630, 670 and 690 ppm at 250, 300, 350 and 400 ^{0}C temperature aginst the orignal content of 330 ppm. The Mg content in mustard biochar did not increase with temperature like other nutrients. There was a decrease in its recovery from 40.1 ppm to 28.4, 11.8, 8.2 and 7.2 ppm at 250, 300, 350 and 400 ^{0}C temperature.Similar results were also observed with respect to Lantana biochar.

10. **Detection Of Water and Nitrogen Stress and Prediction of Yield Of Soybean and Maize Using Hyper-Spectral Reflectance and Vegetation Indices**

A field experiment was conducted during the rainy season of 2012 for studying the water and nitrogen stress effect on maize crop growth and spectral reflectance characteristics. Maize (cv. Kanchan101) was grown at four nitrogen and two irrigation levels on a split plot design. Leaf area index, biomass, nitrogen content in the leaves, and spectral reflectance from crop as well as from the bare soil was recorded during the cropping season. The nitrogen content of the maize leaf collected during the maximum vegetative stage was estimated and the nitrogen content was correlated with the spectral reflectance recorded during that period. Two new vegetative indices were tested for estimation of nitrogen stress in maize. The LAI, biomass values showed significant variations between the nitrogen levels. Vegetation indices like NDVI, green-NDVI, normalized difference red index (NDRE), were calculated and they were correlated with the LAI and biomass. These broad band indices showed good correlation with the LAI and biomass. The leaf nitrogen content showed a significant correlation with the hyper-spectral index DCNI and combined index II. DCNI, in association with indices related to biomass showed potential for assessment of nitrogen nutrition in plant. Grain and biomass yield of maize varied between 1270 and 4287 and 4927 and 12448 kg/ha, respectively among the nitrogen levels.

11. **Participatory Assessment of Qualitative Parameters for Categorizing Different Degrees of Soil Quality to Enhance the Soil Health and Productivity**

12. **Impact of Crop Covers on Soil and Nutrient Losses through Runoff in Vertisol**

During this period, crops were sown on 3 July, 2012 with optimum soil moisture content. During crop growth period, the observations on rainfall, soil moisture content, dry matter production, runoff and soil loss and crop yield were recorded. The total rainfall during 2012 was 966.8 and during crop period was 886 mm. There were five runoff events during crop period of 2012. Among the sole crops, the maximum runoff and soil loss was recorded under pigeon pea and lowest was in soybean sole crop. In case of intercrops, the maximum runoff and soil loss was in maize and pigeon pea and lowest in soybean + pigeon pea. The overall , the soybean as sole recorded minimum runoff and soil loss followed by soybean+ pigeon pea (2:1), soybean + maize, (1;1) maize +pigeon pea, (1:1) and sole crops namely maize and pigeon pea. The maximum runoff and soil loss was recorded in cultivated fallow over sole as well as intercrops. Among the treatments, weed biomass was significantly higher in soybean + pigeon pea and remaining treatments are similar. But in case of crop residue, highest crop residue recorded in soybean and soybean + pigeon pea and rest treatments are significantly at par. The dry matter production was lowest in pigeon pea among the treatment at 30, 45 and 80 days after sowing of crops. The soil moisture content at 78 Day after sowing was lowest in soybean in both soil depth (0-15 and 15-30 cm) and higher was in maize crop. At harvesting stage of crops, the soil moisture content was lowest in pigeon pea crop and highest was in cultivated fallow field. Grain yield was recorded and converted in soybean equivalent grain yield (SEGY) was higher in pigeon pea and lowest was in soybean crop.

13. Characterizing Rooting Behaviours, Soil Water Patterns and Nutrient Uptake of Soybean – Chickpea under Different Tillage and Water Regimes in Vertisols

Two cultivars of soybean viz JS 335 and JS 9560weresown as *kharif*crop under different tillage. Plant root and shoot samples were taken at different vegetative (V4, V6) and reproductive stages (R1 and R3) to analyse root length at different diameter, surface area, length density, surface density volume density, biomass and grain yield. In all the treatment, maximum root length density was observed at flowering stage (R1) for both cultivars. Effects of tillage on root growth characteristic were also observed. Two root length density model were used to simulate and compared for distribution of relative root length abundance in soil profile

14. Soil Resilience and Its Indicators under Some Major Soil Orders of India

Laboratory study carried out to analyse the index properties like plasticity, maximum dry density, optimum moisture content and strength characteristics like Californian Bearing Ratio (CBR) of various soil orders under simulated condition with different moisture and compaction levels. Study indicated that there is significant correlation between CBR value and clay content of the soil. Study showed low CBR (range 1.65-2.02% and 4.36-5.52% under soaked and unsoaked conditions, respectively) under *Vertisol* and *Inceptisol* (range 2.14-3.72% and 4.29-6.36% under soaked and unsoaked conditions, respectively) as compared to *Alfisol* (range 4.53-6.56% and 33.78-43.06% under soaked and unsoaked conditions, respectively). The reduction in CBR may be attributed to the water holding capacity of the soil subjected to load. Maximum dry density of all the soils increased while optimum moisture content reduced under heavy compaction as compared to light compaction. Incubation study conducted with *Alfisol* for biological resilience during this period. Cu stress is given for reducing the short-term decomposition and to find the recovery rate under various FYM management practices. The soil microbial biomass carbon (SMBC) value ranges from 220.34 to 417.36 µg/g of soil. Per cent reduction in SMBC was highest in control soil (56.59%) at the end of 8 weeks of incubation period and per cent reduction was decreased with increasing levels of FYM addition. In general, SMBC showed its recovery after 4 weeks of incubation period under Cu stressed condition. The microbial functional resistance increased with increasing levels of FYM addition.

15. Quality Assessment of Crops under Different Nutrient Management System in Long Term Experiment

Soybean and wheat grains collected from LTFE Jabalpur and Ranchi centers have been analyzed for 29hysic-chemical, nutritional and anti-nutritional quality parameters. Statistical analysis of the data generated during the year 2008-2012, is in progress. The detailed progress report of the experiment will be presented in RPF-III seminar by the end of May 2013 as per schedule.

16. **Understanding the mechanism of variation in status of a few nutritionally important micronutrients in some important food crops and the mechanism of micronutrient enrichment in plant parts**

17. **Nano-technology for Enhanced Utilization of Native-Phosphorus by Plants and Higher Moisture Retention in Arid Soils (Extended up to June 2013)**

Under the project as per approved programme schedule, all the activities like effect of nano particles on nutrient use efficiency, plant metabolism and enzyme exudation, characterization of synthetic and biologically developed nano particles, synthesis of nano- rock phosphate particles, assessing potential of nano-granules P and application and their doses in different experiments were completed. During this extended period a bulk amount of rock phosphate has been synthesized through high energy ball mill. The nano rock phosphate particles were characterized by XRD, TEM, SEM, DLS, FTIR and BET analysis. A field experiment was also conducted during *kharif* season of 2012 at IISS, Bhopal to evaluate the effect of application of different nano rock phosphates on the growth, yield and phosphorus uptake by the maize. The experiment consisted of six treatments (Control, NK (100 %), NPK (100 %), NK (100 %) + 60 kg P_2O_5 as Nano-RP through Sagar nano RP (26 % P_2O_5), Udaipur nano RP (31 % P_2O_5) and Udaipur nano RP (34 % P_2O_5) were tested in randomized block design with four replications. The results showed that 1000 grain weight, grain and stover yield etc. were significantly higher in the maize plant treated with Udaipur nano RP 34% as compared to the control which is being at par with single super phosphate treated plants. The total P content and its uptake were higher (0.65% and 40.29 kg ha^{-1}) in SSP treated plants which is closely followed by Udaipur nano RP 34% (0.63% and 38.29 kg ha^{-1}) over the control (0.60 and 27.82 kg ha^{-1}).

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

About 1458 soil fertility maps (macro and micro-nutrients, organic C, pH, EC etc) based on GPS and GIS have been prepared for 135 major districts using soil testing data of 71260 geo-referenced soil samples. These maps showed that almost all soils of different districts of North, South, East and West zones are deficient in available N. In North Zone, majority of the soils are medium to high in available P and available K status. Only few soils (1-4%) in 2-3 districts are low in P and K. In West Zone, majority of the soils are low to medium in available P except Gujarat. About 92-100% area in Gujarat is medium to high in available P. Altogether only 1-3% area in west zone is low in available K. Most of the soils in Gujarat and Maharashtra are high and Rajasthan are in medium in available K. In East Zone, most of the area in Orissa (73-97%) is low in available P. Majority of the soils of Assam and West Bengal are medium to high in available P status of soils. Majority of the soils in East Zone are medium in available K except Kurda district in Orissa where 58% of the area is low in available K. In South Zone, majority of the soils in Andhra Pradesh, Tamil Nadu and Kerala are high in available P. In Karnataka, most of the soils are medium in available P. Regards to available K, majority soils of Tamil Nadu, Karnataka and Kerala are medium and majority of the soils of Andhra Pradesh are high in available K. Micronutrient fertility maps of 135 districts showed that almost all soils of Punjab, Haryana, and Himachal Pradesh in North Zone are high in available Zn whereas majority of Uttar Pradesh soils are medium in available Zn. Majority of soils of this zone are high in available Fe, Cu and Mn with minor exceptions. Manganese deficiency is wide spread in 4 districts of Punjab (15-56%). Fe deficiency was observed over an area of 25-61% in Fatehabad and Hisar districts. In West Zone, Zn and Fe deficiency is wide spread in Maharashtra. Other-wise, majority of soils are sufficient in available Zn, Fe, Cu and Mn. In East Zone, majority of soils are high in available micro nutrients. Zn deficiency was observed only in West Bengal. In South Zone, Majority of soils of Andhra Pradesh, Karnataka, and Kerala are sufficient in available micro nutrients. In Tamil Nadu, about 50-60% of the area is low in available Zn and 20-30% deficient in Cu. All soils of Wayanad district in Kerala are deficient in Mn.

19. **Network Project on Organic Farming**

The soybean yield equivalent of the previous was worked out and it was found that organic management system has produced higher soybean equivalent yield (2021 kg/ha) over inorganic/integrated management systems during 2011-12 and among the cropping systems, soybean-gram produced higher soybean equivalent yield (2369 kg/ha) over other systems. At the end of 2011-12 annual cropping cycle, organic management recorded a higher post harvest available phosphorus in the soil besides higher soil biological parameters. In the ninth year of the field experiment (Kharif 2012), there was a significant reduction in soybean seed yields due to heavy rains during the crop period. However, organic management system has produced higher yield over other management systems in experiment 1. In experiment –II, Maize/soybean yield attributing characters and grain yield were significantly enhanced by the combined application of organic manure + panchagavya + biodynamic preparations. Soybean-wheat system has recorded higher soil organic carbon (0.99%) over Maize-chickpea (0.84%) at the end of 2011-12 annual cropping cycle.

20 **Soil quality assessment for enhancing crop productivity in some tribal districts of Madhya Pradesh**

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

21. **Soil Carbon Saturation and Stabilization in Some Soils in India**

The investigation was carried out by using the samples collected from long-term fertilizer experiments of Jabalpur, Palampur, Ranchi and Delhi. Three treatments viz. control, 100% NPK and 100%NPK+FYM was selected to ascertain the fate of residue carbon stability in different soil aggregate size classes. The data on soil aggregate size distribution indicated that about 9-15, 59-66, 13-17 and 8-11% of soils are distributed in the size fraction of 2-4mm, 250-2000μm,53- 250μm and <53 μm, respectively in vertisol of Jabalpur . In case of Palampur, here also majority of aggregates were found in the size range of 250-2000μm. In Ranchi, soil aggregates in the size range of 2-4mm were almost negligible. Here, soils are almost equally distributed in remaining three size classes. In case of Delhi, majority of aggregates were found in the size range of 53- 250μm and <53 μm. In general application of FYM increased the size of soil large and small macro aggregate size class in all the sites. Soil organic carbon was also found maximum in soil large (2-4 mm) and small (250-2000 μm) macro aggregate size class in all the sites. In general, the carbon content in aggregates decreased with the decrease in the size of the aggregates. However, in case of Delhi, it was found minimum in the aggregate size class of 53- 250μm. The carbon stability in different aggregate size class indicated that high carbon input (high C:N ratio) in the treatment of 100%NPK may decrease soil carbon stability due to priming effect. We observed negative relationship between C input (high C:N ratio) and soil carbon stability in micro-aggregates and silt+clay associated carbon. The process is completely reversed when we apply FYM (low C:N ratio) along with chemical fertilizer to soil. The carbon stability significantly enhanced by application of FYM to soil.

22. **Tillage and Manure Interactive Effects on Soil Aggregate Dynamics, Soil Organic Carbon Accumulation and By Pass Flow in Vertisols**

Effect of tillage and manure on soybean productivity and soil properties was studied. In general, relatively higher grain and biomass yield were measured in Reduced Tillage (RT) than No Tillage (NT) treatments. The grain yield (Mg/ha) increased from 1.07 to 2.11 and 1.54 to 2.5 under NT and RT, respectively, with increase in FYM rate from 0 to 6 Mg ha^{-1}. There was no significant effect of tillage on soil penetration resistance at 2.5 cm soil depth. The ANOVA test indicated that tillage methods and FYM rate had a significant effect on soil penetration resistance (MPa), which decreased from 0.87 to 0.05 and 0.09 to 0.07 under NT and RT respectively, with increase in FYM rate from 0 to 6 Mg ha^{-1} at 5 cm soil depth. However there was no significant effect of tillage at depths greater than 10 cm. Significant variation in soil infiltration characteristics were observed among tillage and FYM treatments. On average, 32% more infiltration was observed under NT than RT. Effect of FYM was more pronounced in No tillage compared to reduced tillage on soil physical properties such as infiltration, penetration resistance and soil aggregation. Soil available phosphorus and potassium was found to be relatively higher in RT compared to NT. The soil available P (Kg/ha) increased from 24.2 to 38.7 and 22.8 to 37.0 for 0–15 cm under RT and NT respectively, with increase in manure rate from 0 to 6 Mg ha^{-1}. Similarly, available K (kg/ha) increased from 355.6 to 403.3 and 317.2 to 373.8 for 0-15 cm depth under RT and NT respectively, with increase in manure rate from 0 to 6 Mg ha^{-1}.

23. **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. The second year experimental *kharif* and *rabi* crops (2^{nd} year crop rotation) were completed. Yield parameters were recorded. Parameters like weed biomass, leaf litter and surface crack observations were also recorded. Post-harvest soil samples collected analyzed for soil organic carbon pools and micronutrient. Carbon pools data reveal that barring very labile pools, there was no change in carbon pools compared to initial soils. Similarly, the conservation tillage practices had no effect on micronutrient content (DTPA-Fe, Zn, and Cu) in soil except DTPA Mn. Carbon stocks were also calculated upto 30cm depth. Carbon stocks were relatively higher under CT than RT in 0-15 cm depth. It varied from 21.5 to 26.2 Mg C/ha under CT and 20.4 to 23.5 Mg C/ha in RT. Almost similar trend were observed for 15-30 cm. The various physical properties namely bulk density, soil moisture, penetration resistance were also recorded during the period. The BD value under CT and RT (0-7.5cm) varied from 1.37 to 1.55 Mg m^{-3}; 1.17 to 1.54 1.17 Mg m^{-3}, respectively and similar trend was found for 7.5-15cm depth. Infiltration rate (cm/hr) is relatively higher in RT compared to CT under different cropping system. From the yield data it is inferred that, higher soybean grain equivalent yield (SGEY) was recorded under reduced tillage compared to conventional tillage in all the cropping system barring soybean-wheat system. Among the cropping system, soybean-wheat system recorded higher SGEY in both CT and RT. During the reported period, third year experimental crops were also taken and observation/data are being recorded. *Kharif* crops were harvested and *Rabi* crops are yet to be harvested.

24. **Assessing Impacts of Climate Change on Different Cropping Systems in Central India and Evaluating Adaptation Studies through Crop Simulation Models**

Observations on plant growth and development according to model requirements for the soybean (JS 9560, 9305), maize cultivars (K 101 and K 103), chickpea (JG 11 and JG 310) were collected in different vegetative and reproductive stages in the year 2011-12 and 2012-13 kharif and Rabi season. The APSIM, DSSAT and CropSyst models were calibrated for these these cultivarscultivars. In the rabi season of the year 2012-2013, the chickpea crops were sown and data on biomass at different growth stages and other soil and plant characteristics were taken as per the model requirements. These data will be used for calibration when the weather data for the year 2012-13 is completed. Creation of A virtual cultivar for wheat using simulation model is under progress.

25. **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**

An externally funded project has been initiated with pre-crops during Rabi season of 2011. Subsequently, tillage treatments were imposed in the current year (2012-13) and following activities have been undertaken during the reported period. Experimental crops were raised and biometric observations were recorded. Weed biomass observation were taken under different tillage treatment. Reduced tillage recorded highest number of weeds and total weed biomass (g/m^2) than other tillage treatments. Green house gases (CO_2, N_2O, and CH_4) were also analyzed conservation agriculture. From the available data, it is inferred that CO_2 emission were higher under conventional tillage (CT) followed by no-tillage (NT) and reduced tillage (RT) during end of *Kharif* crop harvest. Similar trend was observed under CT for N_2O. The bulk density was lower in NT under 0-7.5cm (1.38 to 1.51 Mg m^{-3}) followed by RT and CT. The penetration resistance is also followed the similar trend (1.66 to 2.04 Mpa). The infiltration data reveals that RT recorded the highest rate (6.64cm/hr) followed by CT (5.54 cm/ha) and NT (4.13cm/hr) across the cropping systems. Soil samples collected after harvest *Kharif* crops and analyzed for organic carbon; the following trend were observed (0-5 cm) NT: OC varied from 0.52 to 0.75%; CT: 0.50 to 0.77% ; RT: 0.56 to 0.68% and similar trend were observed for 5-15cm depth across the cropping systems. *Kharif* crops were harvested and recorded yield parameters. *Rabi* crops are yet to be harvested. Yield analysis is in progress.

Programme III: Microbial Diversity and Genomics

26. **Structural and Functional Diversity of Microbes in Soil and Rhizosphere**

Diversity of microorganisms in soil samples of long term fertilizer experiment field of Pantnagar was estimated using molecular dependent methodology. Here we have present terminal-restriction fragment length polymorphism (T-RFLP) analysis of microbial diversity in different LTFE treatments. TRFLP analysis is a high-throughput fingerprinting technique that has been widely used to monitor changes in microbial communities in diverse ecosystems. The method uses one or two fluorescently labeled oligonucleotide primers for PCR amplification and then digestion of the PCR products with one or more restriction enzymes. This generates labelled terminal restriction fragments (TRFs) of various lengths depending on the DNA sequence of the microbe present and the enzyme used to cut the sequence. The results of T-RFLP are obtained through TRF separation by high-resolution gel electrophoresis on automated DNA sequencers. The laser scanning system of the DNA sequencer detects the labelled primer and from this signal the sequencer can record corresponding fragment sizes and relative abundances. Genomic DNA from three treatments of LTFE including control, NPK 100%, and NPK 100% + FYM were extracted by SDS, CTAB extraction method. Quality of genomic DNA verified using 1% agarose and purified using PVP column to remove humic inhibitors. Genomic DNA was amplified using 27F (6 FAM labeled at 5' end) and 927R primer targeting eu-bacteria 16s rRNA gene. PCR product obtained further purified using PCR purification kit. Purified PCR product was digested with two restriction enzymes (Msp and Rsa) following standard protocol. Fragment analysis was carried out in a capillary sequencer using POP polymer. Data obtained were analyzed by Genemapper V3.7. To assign different fragments, in silico digestion analysis carried out using high quality partial and full genomic DNA of RDP database ($7*10^6$ sequences). Microbial diversity varied significantly among the treatments. Control, NPK % and npk 100% +FYM were represented with 16, 12, and 30 unique ribotypes (fragments). Microbial diversity indices comprising species richness and evenness estimated and found higher in FYM followed by control and NPK 100%. FYM treatments were dominated by Bacillus cellulyticus, Geobacillus, Rhizobium and clostridium. Treatment comprising NPK 100% was dominated by Methylobacter, Ralstonia, Chloroflexi, and Nitrospira sp. While the unamended control soil was predominated by Arthrospira, Paenibacillus, Clostridium, sp, and many uncultured soil bacterium. Our result confirmed that diversity of soil microorganisms in soil varied under influence of long term fertilizer application, and the prevalent groups are related to fertilizer sources and type.

27. Consequences of Transgenic Cotton on Soil Microbial Diversity

Soil samples were collected in the month of August, 2012 and December, 2012 from Nagpur village areas and CICR research farm. The soil samples processed in the laboratory and immediate analysis of soil biological properties and rest amount were kept for 4^0C for further analysis. Bio-chemical properties of the collected soil samples were analysed. The rhizosphere soil samples of Bt and non-Bt cotton were analysed for soil microbial biomass carbon and soil respiration and also soil enzymatic activities soil dehydrogenase, acid and alkaline phosphatase and FDA. Total heterotrohic population was also done using Nutrient agar media. Enumeration of soil beneficial micro-organisms such as Nitrogen fixers, P solubulisers, and Cellulose decomposers were studied under Bt and non-Bt cotton. Soil samples were also analysed for glomalin protein. The soil metagenomics DNA will be studied for structural diversity.

28. Actinomycetes Diversity in Daccan Plateau, Hot, Arid Region and Semi Arid Eco-Sub-Region (AER 3 and 6) and Evaluation of their PGPR Activity

The catabolic diversity of 41 strains of actinomycetes was studied using 21 carbohydrate sources. All the C sources were utilized by one or the other strains. Dextrose was utilized by maximum number of strains (90%) followed by mannose (80%) and arabinose (75%). 35 isolates produced indole acetic acid (IAA) that ranged from 1.2-7.2 µg/ml of culture filtrate. All the isolates solubilised tri-calcium phosphate; the clearing zone ranged from 5.3-16 mm on Pikovskaya agar. 18 isolates were positive for potassium solubilization in muscovite supplemented medium. Quantification of P and K solubilisation is in progress.

29. **Developing Technique for Acceleration of Decomposition Process using Thermophilic Organisms**

A total of 60 morphotypes of bacteria and 20 morphotypes of actinomycetes and 10 morphotypes of Fungi were isolated by using different media namely Nutrient agar medium, Starch casein agar medium and PDA medium. After screening got 7 Bacteria, 7 actinomycetes and 6 Fungi as lignocellulolytic thermophilic microbes. Molecular and Morphological analysis of some of the screened microbes were done from National Bureau of Agriculturally Important Microorganisms (NBAIM), Mau. Lab-scale study of decomposition of various collected agrowaste was done by inoculating the screened organisms. Different physico-chemical parameters like C:N ratio, Lignin, Cellulose, Water Soluble Carbon, Water Soluble Carbohydrate, CEC were also tested at equal intervals. The bioreactor was designed by Central Institute of Agricultural Engineering (CIAE) and CAD model is under preparation. The project work is in progress.

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

Comparative microbiological analysis was conducted for biodynamic preparations (Biodynmic compost, BD500 and Cow pat pit) and liquid organic preparations like Panchagavya, Beejamrutha, Jeevamrutha and Amritpani. The results indicated that except panchagavya, other liquid organic preparations contain less number and groups of cultivable microbes compared to cow dung manure, BD compost, BD500 or CPP. Pot culture experiment was set up with wheat as test crop to evaluate the effect of these organic preparations *in vivo.* Initial soil biological properties like total viable cell count for bacteria, fungi, actinomycetes, P solubilizer and nitrogen fixer has been estimated. Soil biological activity has also been assayed by measuring soil respiration and soil dehydrogenase activity. After the end of crop growth again these parameters will be assessed to know the treatment effect.

31. **Greenhouse Gas (GHG) Emission from Composting Systems and Characterization of GHG Regulating Microbes**

The concentration of greenhouse gases in our atmosphere is becoming an issue of increasing concern. At this stage, the ramifications of inaction may be great, as increases in global temperatures following the uncontrolled release of greenhouse gases may lead to dramatic climate change, rising sea levels, and melting glaciers. Therefore it is important to examine greenhouse gas emissions from different sources in order to address this problem. Greenhouse gas emissions may be either biogenic or anthropogenic in origin. Field study was carried out from different compost viz. conventional compost (FYM), vermicompost, poultry manure and phospho compost using static box chamber method to trap the greenhouse gases. Static box chambers were fabricated along with the accessories required for manual measurement of emission studies under the project. Preliminary results of emission flux for CH_4 ranged from 0.1 – 1.5 mg m^{-2} d^{-1} while N_2O emission was found to be highest 10-12 mg m^{-2} d^{-1} in poultry manure. Microbial respiration activity of the compost site was also done in different composting systems. Respiration activity was high about 0.15 mg CO_2 produced g^{-1} d^{-1} in vermicompost during initial period. pH in vermicompost varied from 5.45 to 6.06, phospho 6.12 to 6.95, poultry 6.06 to 8.3, fym 5.5 to 8.0 during different composting period. In order to correlate greenhouse gas emission with composting process change of fluxes were correlated with EC, ash content, total organic carbon, total nitrogen content and microbial population during different composting period. Pearson product moment correlation of methanogens, metahnotrophs, ammonium oxidizers population change significantly correlated with CH_4 and N_2O flux (α=0.05, $p<0.0001$) indicated dynamic role of methanogens and methanotrophs with greenhouse gas cycling process of composts

32. **Soil Organic Carbon Dynamics and Climatic Changes and Crop Adaptation Strategies**

Soil Sample of selected treatments of long-term field experiments at Raipur research farm have been used for C emission. C-emission, N mineralization and composition of soil biota were studied at 60 % and submerged condition with three temperature conditions i.e., 25, 35 and 45°C for 32 weeks of incubation from whole soils (2mm) and from different aggregate size classes such as macroaggregate (250-2000 µm), microaggregate (53-250µm) and mineral associates (<53µm) in terms of CO_2 evolution and N mineralization. Further soil microbial biodiversity has been studied under elevated CO2 (680ppm) in close static chamber for 52 weeks in incubation in all treatments.. It was observed that the active pool of carbon viz., SMBC, acid hydrolysable carbohydrates, water soluble carbon were varied from 175-489,390 to 472 and 24 to 48 mg/kg, respectively. After 32 weeks of incubation at 25 oC temperature POM-C decreased over initial values from 15-28.9% at 60 % MHC and 11.7 to 15% under submerged condition. Similarly at 45 oC temperature the POM-C decreased from 26.9 to 41 % at 60 % MHC and 26 to 32.3 % under submerged condition. The activity of DHA was 34 to 61 % greater in elevated CO2 over initial in all these selected treatments. The bacterial/fungal SIR ratio was decreased with increase in temperature from 25 to 45oC.

33. **Metagenomic Characterization and Spatio-Temporal Changes in the Prevalence of Microbes Involved in Nutrient Cycling in the Rhizoplane of Bioenergy Crops**

Microbial activity and the population dynamics evaluated in the rhizosphere of bioenergy crop J Curcas. Soil samples were collected from National trial program on Jatropha located at Jawaherlal Nehr Krishi Viswavidyalaya (JNKV), Jabalpur. Another soil sample were collected from the Jatropha cultivated area of Bharat petroleum corporation limited (BPCL), Noida, UP. Mirobial activities including fluorescent diacetate assay (FDA), dehydrogenase assay (DHA), and alkaline phosphatase activity were measured in both bulk and rhizospheric soil samples. In addition methane monooxygenase activities were also measured in both bulk and rhizospheric soil samples. Microbial activity comprising FDA, DHA and phosphatase were more in the rhizospheric soil compared to the bulk soil irrespective of soil types. FDA acitivity in both soils were similarly expressed in both soil types. FDA ranged from 5-10 µg fluorescein released g^{-1} soil h^{-1}. However FDA activity is more in JNKV soil than the BPCL, Noida soil. DHA activity in both soils varied in the range of 0.79 to 2.18 µg TPF released g^{-1} soil d^{-1}. Dehydrogenase activity of soil samples collected from BPCL Noida were more compared to JNKV soil. Acid phosphatase in both soils was similarly expressed in the two soil types and we found higher in rhizospheric soil samples than the bulk soils. Abundance of total heterotrophs, N_2 fixers, Phosphase solubilizers, was enumerated in bulk soil, rhizospheric soil, rhizosplane and endorhizosphere. Ammonium oxidizers and methane oxidizers were enumerated only in bulk soil and rhizospheric soils. Total heterotrophs, N_2 fixers, phosphate solubilizers and methanotrophs were counted as colony forming units (CFU) while the ammonium oxidizing nitrifiers by most probable number method. Endophytes were analyzed with the root sample (2-5 g) washed and surface sterilized with 70% ethanol for 5 min. After surface sterilization, root samples were washed several times with sterile distilled water. The root samples were checked for efficacy of surface sterilization by rolling them on 0.1% tryptic soy agar (TSA) plates. The roots were meshed by using sterile mortar and pestle. A 10 fold dilution was prepared up to 10-7 and microbial population were determined using jensens N_2 fixers media. Microbial counts varied spatially in the rhizosphere of Jatropha curcas and were differentially populated in bulk soil, rhizospheric soil, rhizoplane and endorhizosphere. N_2 fixers ($33.67 * 10^5$) and P solubilizers ($34.33*10^4$) were more abundant along the rhizospheric zone preferably at the rhizosplane followed by rhizosphere and bulk soil.

Programme IV: Soil Pollution, Remidiation and Environnemental Security

34. Phyto-Extraction of Cr By Some Floriculture Plants

A study was undertaken to examine the response of some ornamental xerophytic plants i.e., *Euphorbia milli*, *Agave angustifolia*,*Furcaria gigantia* and succulent fern to different levels (0, 25, 50, 75,100,150 and 200 mg/kg soil) of chromium and their possible use for remediation of soils contaminated with chromium. Among the four plant species *Furcaria gigantia* was found to be more tolerant to Cr and agave least tolerant. In *Furcaria gigantia* up to 100 ppm of Cr, no toxic symptoms were observed whereas at 200 ppm there was either mortality or very negligible growth of plants. Euphorbia milli, could tolerate upto 75 ppm and beyond that there was mortality of the plants. In succulent fern and *Agave angustifolia* beyond 50 ppm there was a drastic reduction in growth of plants. The highest concentration of Cr was found in the roots and was followed by shoots. Among the four plant species *Euphorbia milli* recorded the highest total uptake and recovery efficiency of Cr *Agave angustifolia*, succulent fern and *Furcaria gigantia.*

35. Non Point Sources of Phosphorus Loading to Upper Lake, Bhopal

Soil samples from the catchment area of Upper Lake, Bhopal were collected and so far 125 samples were analyzed for total and available P. The total P content of the soil samples ranges from 0.028% to 0.144% with a mean value of 0.064% and the available P ranges from 2.79 kg/ha to 58.128 kg/ha with a mean value of 22.75 kg/ha.The Geo-referenced Sediment and Water samples (pre monsoon stage 2012) collected from 15 sampling points of Upper lake, Bhopal were analyzed for different fractions of P. The total P value in the pre monsoon stage water samples ranges from 0.23 to 0.46 mg/L with a mean value of 0.40mg/L. The mean total dissolved P (TDP), total reactive P (TRP), dissolved reactive P (DRP), dissolved organic P (DOP) and particulate P (PP) was 32.07%, 19.73%, 12.07%, 15.17% and 70.72% of TP, respectively. The total P in the sediment of pre monsoon stage samples ranges from 0.025% to 0.074% with a mean value of 0.039%. The mean sediment inorganic phosphorus (SIP) and the sediment organic phosphorus (SOP) is 70.75 % and 29.43% of total phosphorus (TP), respectively. Among the inorganic P fractions in the sediment, Ca bound P was maximum and found to be in the range of 89.42 to 95.82% of total sediment inorganic P followed by Fe bound P (2.72 to 8.75%) and loosely sorbed P (LSP) (0.47% to 6.72%).

36. Interaction among Tannery Effluents Constituents on Heavy Metals Uptake by Spinach

Effluent, ground water and soil samples collected from Kanpur region of U. P. were characterized. The pH of effluent samples varies 7.91 to 8.76 with an average of 8.2, while in ground water in effluent using agriculture field area it varies 7.46 to 8.26 (average 7.78). EC(dSm^{-1}) of effluent varies 2.35 to 13.15 with an average 11.53 while in ground water effluent using agriculture field it varies 2.48 to 3.15(average 2.84). Heavy metal concentration (ppm) in effluent samples are measured Cu from 0, Cd varies from 0 to 0.019, Pb (0 to .074), Cr (1.53 to 57.35), Ni (0.0 to .116) and Zn (0 to 0.480) and As (0.00 to 0.03), while in ground water effluent using agriculture field samples having Cu.00 to 0.057, Cd 0, Pb 0 to 0.012, Cr 0.022 to 0.038, Ni 0 and Zn 0.164 to 0.181 and As 0. Soil samples collected from agricultural field where tannery effluent is using as an irrigation purpose (polluted) or not used (non polluted) during crop cultivation. The pH (1:2.5) of polluted soil varies 7.15 to 8.33, EC (dSm^{-1})1.23 to 3.56, OC (%) 0.72 to 1.52. Total heavy metal concentration (ppm) Cu 35.3 to 82.80, Cd 2.30 to 14.10, Pb 23.7 to 58.80, Cr 252.4 to 971.7, Ni 22.9 to 30.3, Zn 138.7 to 338.1 and As 6.8 to 11. In agricultural field where effluent is not using as a irrigation purpose having pH varies 7.21 to 7.33,EC (dSm^{-1}) 0.19 to 0.56, OC(%) 0.33 to 0.68 and heavy metals Cu 33.1 to 72.3, Cd 0.6 to 0.80, Pb 5.9 to 11.60, Cr 15.2 to 33.2, Ni 7.9 to 14.2, Zn 28.5 to 99.3 and As 3.1 to 5.1.

37. **Quantifying Green House Gases (Ghgs) Emissions in Soybean-Wheat Systems of M.P.**

Total CO_2, CH_4 and N_2O emissions of different treatments ranged between 2.7–25.4 mg C m^{-2} h^{-1}, -35.27 to 1.21 µg C m^{-2} h^{-1} and 20.50 to 81.8 µg N m^{-2} h^{-1} during the experiment, and followed a similar pattern during the soybean growing season. Across tillage application of organic manure significantly increased emissions of all the three GHGs compared to inorganic fertilization. Although emission of CO_2 was relatively higher in Notillage compared to reduced tillage and conventional tillage however the nitrous oxide emissions were found to be higher in conventional tillage followed by reduced tillage and Notillage. In the farmer's field village Bagroda, Dist. Bhopal, there was no significant effect of wheat residue burning on soil organic carbon, inorganic carbon and available phosphorus at 0-15 and 15-30 cm soil depth. Residue burning also had no significant effect on Fluorescence diacetate test as indicator of soil biological activity. However, soil available nitrogen and permanganate oxidizable carbon was significantly lower in residue burnt field compared to residue removal at 0-15 cm soil and a reverse trend was observed at 15-30 cm soil depth. Available K was significantly higher in residue burnt field (302.77, 285.04 kg/ha at 0-15 and 15-30 cm soil depth respectively) compared to residue removal (286.16, 217.28 kg/ha).

38. **Novel Bio-Filtration Method using Selected Mesophilic Fungi for Removal of Heavy Metals from Municipal Solid Waste in Madhya Pradesh**

Samples have been collected from MSW compost and untreated domestic-sewage-sludge at Bhanpur, Bhopal to isolate mesophilic fungi. About ten fungi have been isolated and tested for their growth under 25-35oC temperature. Theses fungi were used for toxicity effects using different concentration of Cd, Pb, Cr, Zn and Cu. It was found that all these isolated fungi can grow under 400 ppm of Pb in growth media. Work is in progress.