# Proceedings of IRC Meeting

(June 24-26, 2019)

## ICAR-Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462 038 (M. P.)

## GUIDANCE AND DIRECTIONS

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

**Dr. M.C. Manna**
HoD, Soil Biology and Member Secretary, IRC

## COMPILATION AND EDITING

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

## SECRETARIAL ASSISTANCE AND COMPUTER PROCESSING

**Mr. Sanjay Kumar Kori**
Personal Assistant

# INTRODUCTORY REMARKS OF THE CHAIRMAN, IRC

The IRC meeting was held during June 24-26, 2019 in the committee room of the institute. The member Secretary IRC welcomed the Chairman and other members of IRC and briefed about the purpose and agenda of the meeting. I/c PME Cell presented an account of the ongoing and new projects in the institute and the modalities for presentation. The Director and Chairman of the IRC also welcomed all the members of IRC present over there. He took this opportunity to congratulate the award winning scientists for their recognitions and honors. He again stressed that all scientists must submit quality research proposals. The following ongoing, concluded and new projects were presented.

# IRC Proceeding (RPP-II and RPP-I)

Date: June 24-26, 2019 (10:30 AM; Venue: Committee Room)

## Institute in-house and external funded projects (RPP-II)

## Programme- I Soil Health and Input use efficiency

### a) Institute in-house projects

| Sl. No. | Title of Project | PI and Co-PI | Division/ Unit | Period | | RPP Status | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol | Muneshwar Singh<br>A. K. Biswas<br>B. P. Meena A. B. Singh<br>R. S. Chaudhary | LTFE | Reconstructed April 2012 | Long term | RPP-II 2014-15, RPP-II 2015-16, RPP-II 2016-17and RPP-II 2017-18 to be submitted | • Project to be continued<br>• Trend analysis for sustainability index and impact of BNF to be analyzed |
| 2 | Evaluating rock phosphates for their suitability for direct application | Sanjay Srivastava, Prabhat Tripathi, A.K. Tripathi, Priya Gurav and Pradip Dey | SC&F | October 2013 | May 2017 | RPP-II 2013-14, RPP-II 2014-15, RPP-II 15-16, RPP-II 2016-17; RPP-III to be submitted | • Project concluded<br>• RPP-III will be presented |
| 3 | Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat | S.K. Behera, A. K. Shukla, R. Elanchezhian and B. P. Meena | MSPE | October 2014 | June 2017 | RPP-II 2015-16, RPP-II 2016-17; RPP-III to be submitted | • Not presented<br>• PI will be requested to submit RPP-III |
| 4 | Evaluation of glauconite as source of potassium for crops | A.O. Shirale, Gurav Priya Pandurang, Sanjay Srivastava, BP Meena and A.K. Biswas | SC&F | November, 2017 | November 2020 | RPP-II to be submitted | • Project to be continued<br>• Boron release pattern to be studied |
| 5 | Enhancing the productivity of major crops through improving the natural resource base of tribal inhabited areas of central India | Shinogi K.C., Sanjay Srivastava, A.L. Kamble, B.P. Meena, N.K. Sinha, K. Bharati, Gurav Priya Pandurang, A.K. Tripathi, Hiranmoy Das, R.L. Raut (KVK, Balaghat), Rameshwar Ahirwar (KVK, Balaghat), Aparna Jaiswal (COA, Balaghat) | SC&F | January 2018 | December 2022 | RPP-II to be submitted | • Dr. H. Das to be included<br>• Capacity building to be conducted<br>• Quality of livelihood improvement to be recorded<br>• Organic farming to be promoted |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | Mineralogy of Vertisols in relation K availability in central and western India | Gurav Priya Pandurang, AO Shirale, B.P. Meena, B.L. Lakaria, Sanjay Srivastava, P. Chandran | SC&F | June 2018 | December 2023 | RPP-II to be submitted | • Letter to be sent to ICAR-NBSS&LUP, Nagpur to obtain consent of Co-PI (Dr. P. Chandran)<br>• Facility for mineralogy work may be explored in other places |

**b) Externally Funded Projects**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | Network Project on Organic Farming | A. B. Singh, B.P. Meena, Brij Lal Lakaria, S. Ramana, J.K. Thakur | Soil Biology | July 2004 | March 2017 | Project 2018-19 to be submitted | • Project title changed to All India Network Programme on Organic Farming<br>• Lower yield in inorganic treatments to be assessed in terms of water availability<br>• Biological properties may be assessed |
| 8 | Simulating the effect of elevated $CO_2$ and temperature on water productivity and nutrient use in soybean-wheat cropping system | N.K. Lenka, Sangeeta Lenka, A.K. Shukla, R. Elanchezhian, J.K. Thakur, Pradip Dey, P. Chandra (CIAE), K.K. Singh, A.K. Baxla (IMD, New Delhi) | SC&F | June 2015 | June 2019 | | • Project concluded<br>• New project may be planned for use of the facilities |
| 9 | Ensuring food security, sustainability and soil health through resource conservation based farmer FIRST approach in central India | A.K. Patra, A.K. Vishwakarma, R.K. Singh, A.B. Singh, B.L. Lakaria, R.H. Wanjari, K. Bharati, Asha Sahu, Shinogi K.C. and A.O. Shirale, A.L. Kamble and Hiranmoy Das | SC&F | March 2016 | March 2018 | Report to be submitted | • Project to be continued<br>• Success stories, bulletin and papers to be published |
| 10 | Development of an automated soil nutrient sensing system funded by NASF | Sanjay Srivastav, A.O. Shirale, P.S. Tiwari (ICAR-CIAE, Bhopal), Vijay Kumar (ICAR-CIAE, Bhopal), Ramesh Kumar Sahani (ICAR-CIAE, Bhopal), Baban Kumar (CSIR-CSIO) and Neelam (CSIR-CSIO, Chandigarh) | SC&F | 9 May 2017 | 8 May 2020 | Project to be presented | • Project to be continued |
| 11 | Assessing the impact of imbalanced use of chemical fertilizer on soil health using a soil function based quantitative approach funded | N.K. Lenka, B.P. Meena, Sangeeta Lenka, AO Shirale and R.H. Wanjari | SC&F | May 2018 | April 2021 | Project to be presented | • Project to be continued<br>• Analysis of NO3 & |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | by DST, New Delhi | | | | | | K pollution into water bodies may be included |

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

### A. Institute Projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12 | Assessing greenhouse gas emission and soil carbon storage with reversal in tillage practice | Sangeeta Lenka, N. K. Lenka, and S. Bhattacharjya | ESS | June 2016 | May 2020 | RPP-II 2016-17 and RPP-II 2017-18 to be submitted | • Project to be continued |
| 13 | Assessment of important soil properties of India using mid-infrared spectroscopy | K.M. Hati, M. Mohanty, Pramod Jha, R.S. Chaudhary, N.K. Sinha, J.K. Thakur, M. Vassanda Coumar, Pradip Dey, Muneshwar Singh, A.K. Patra, Javed Rizvi | Soil Physics | May 2015 | June 2020 | RPP-II 2015-16, RPP-II 2016-17 and RPP--II 2017-18 to be submitted | • Two years extensions is granted as ICRAF has already sponsored the project |

### B. Externally Funded Projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 14 | CRP-Conservation Agriculture Development, refinement and validation of conservation agriculture in Vertisols of central India and quantifying impact of CA practices on soil and environment" | LCPC: Dr. A.K. Biswas and Dy LCPC: Dr. R.S. Chaudhary, K M Hati (PPI), J Somasundaram, A.K. Vishwakarma, R.K. Singh, Pramod Jha | SC&F & Soil Physics | April 2015 | March 2020 | Report for 2015-16; 2016-17 and 2017-18 to be submitted | • Project to be continued |
| | (a) Demonstration of best-bed conservation agriculture practices on farmers' fields in Vertisols of Central India | A.K. Viswakarma, R.H. Wanjari, Shinogi KC and A.K. Tripathi | SC&F | April 2015 | March 2020 | Report for 2015-16; 2016-17 and 2017-18 to be submitted | • Project to be continued |
| | (b) Fine-tuning of conservation agriculture practices for Vertisols of Central India | J. Somasundaram, S. Ramana, B.P. Meena and AO Shirale | Soil Physics | April 2015 | March 2020 | Report for 2015-16; 2016-17 and 2017-18 to be submitted | • Project to be continued |
| | (c) Development of water and nutrient management practices in conservation agriculture for Vertisols of Central India | R. K. Singh, Sanjay Srivastava, N.K. Sinha and Priya Gurav | Soil Physics | April 2015 | March 2020 | Report for 2015-16; 2016-17 and 2017-18 to be submitted | • Project to be continued |
| | (d) Impact of conservation agricultural practices on soil health, carbon sequestration and greenhouse gas emission in different production systems | Pramod Jha, B.L. Lakaria, M. Mohanty, J.K. Thakur and K. Bharati | SC&F | April 2015 | March 2020 | Report for 2015-16; 2016-17 and 2017-18 to be submitted | • Project to be continued |
| 15 | Cropping systems and soil management effects on soil organic carbon sequestration and greenhouse gas emission in Vertisols of central India under change climate scenarios funded by NICRA II-Phase | M. Mohanty, Pramod Jha, Sangeeta Lenka, J. Somasundaram, N.K. Sinha, A.K. Vishwakarma, R.S. Chaudhary and Muneshwar Singh | Soil Physics | February 2017 | March 2020 | Project report 2017-18 to be submitted | • Project to be continued<br>• Dr. Seema Bhardwaj to be included |
| 16 | Hyper-spectral remote sensing approaches to evaluate soil quality and crop productivity of central India (under DST sponsored Network Project on Hyper-spectral Big Data Analytics) | M. Mohanty, N.K. Sinha, K.M. Hati, R.K. Singh, Pradip Dey, R.S. Chaudhary, A.K. Patra and Bhaskar Gaikwad | Soil Physics | April 2016 | March 2019 | RPP-II for 2015-16; 2016-17 and RPP-II 2017-18 to be submitted | • Project to be continued |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | Strategies for enhancing yield of soybean (Glycine Max L) and pigeonpea (Cajanus cajan, L) in India using climate variability information and crop growth simulation models in collaboration with ICAR-IISR, Indore | M. Mohanty, B.S. Bhatia, N.K. Sinha | Soil Physics | July 2018 | June 2021 | Project to be presented | • Project to be continued<br>• Dr. Prabhat Tripathi, Dr. R.S. Chaudhary, Dr. Seema Bhardwaj and Dr. A.K. Patra to be included |
| 18 | Sustainable adaptive water management resilient to variable climates in Madhya Pradesh funded by ICARDA | M. Mohanty, N.K. Sinha, A.K. Patra | Soil Physics | April 2018 | March 2021 | Project to be presented | • Project to be continued |
| 19 | Vulnerability and impact assessment of climate change on soil and crop production in Madhya Pradesh funding Agency: UNDP-GEF-MoEFCC | Sangeeta Lenka, N. K. Lenka, M. Mohanty, R. H. Wanjari and A. K. Patra | ESS | Jan 2017 | Dec 2019 | Report to be submitted | • Project to be continued<br>• RPP-III to be presented |

# Programme III – Soil Microbial Diversity and Biotechnology

## A. Institute Projects: Nil

## B. Inter-institute collaborative project

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 | Isolation and characterization of heavy metal resistant bacteria & evaluation for their use in agriculture. Collaborating with NBAIM, Mau (U.P.) | M.C. Manna, Asit Mandal, Asha Sahu, J.K. Thakur | Soil Biology | May 2014 | March 2017 | Report to be submitted | • Project concluded<br>• RPP-III will be presented & submitted |
| 21 | Effects of long term use of fertilizer and manure on soil functional diversity and nutrient supplying capacity under different soils and cropping systems (Inter-institute collaborative project with ICAR-IISR, Indore | Sudeshna Bhattacharjya, Asha Sahu, M.C. Manna, Muneshwar Singh, R.H. Wanjari, M.P. Sharma and A.K. Patra | Soil Biology | April 2016 | March 2021 | RPP-II to be submitted | • Project to be continued |

## C. Externally Funded Projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 22 | Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential (funded by DST, New Delhi) | S.R. Mohanty, A.K. Patra, K. Bharati, Muneshwar Singh, J.K. Thakur | Soil Biology | May 2017 | May 2018 | Report 2015-16, 2016-17 to be submitted | • Project to be continued |
| 23 | Enhancing decomposition rate and quality of bio-waste through microbial consortia for improving soil health funded by NASF | M.C. Manna, Asha Sahu, S. Bhattacharjya, A.B. Singh, A.K. Tripathi, J.K. Thakur, Dolamani Amat | Soil Biology | June 2018 | Jan 2021 | | • Project to be continued |
| 24 | India-UK nitrogen Fixation Centre (IUNFC) | S.R. Mohanty, GN Kumar (Baroda), AK. Saxena (Mau), MD Gupta (Kolkata), K. Annapurna (New | AINP on SBB | June 2016 | June 2019 | Report to be submitted | • Project to be continued<br>• Extension up to |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Delhi), P.M. Ready (New Delhi), Dixon (Norwich), Vinoy Ramchandran (Oxford), DLN Rao | | | | | December 2019 |
| 25 | Eco-genomics of soil microbes involved in global climate mitigation and nitrogen use efficiency in rice-wheat agroecosystem of central India under elevated $CO_2$ and temperature" funded by DST | S R Mohanty, K Bharati, S Gangil (CIAE) | AINP on SBB | September 2018 | April 2021 | Report to be submitted | • Project to be continued<br>• Dr. A.K. Vishwakarma to be included |
| 26 | Evaluation of Soybean-rhizobia interaction under elevated $CO_2$ and temperature to develop climate ready microbial inoculants for central India funded by AMAAS | S R Mohanty, A Mandal, K Bharati | AINP on SBB | April 2017 | March 2020 | Report to be submitted | • Project to be continued |
| 27 | Exploring soil microbial community and mechanism in soil carbon sequestration under long term land uses in semi-arid sub-humid Central India funded by SERB, DST, New Delhi | S. Bhattacharjya | Soil Biology | 10 August 2017 | 9 August 2020 | Project to be presented | • Project to be continued |

## Programme IV: Soil Pollution, Remediation and Environmental Security

### A. Institute Project

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28 | Determination of Baseline Concentration for Delineating Contaminated Areas in Black Soils of Central India | M. L. Dotaniya, Rajendiran S., J.K. Saha, S. Kundu, Hironmoy Das | ESS | May 2014 | May 2018 | RPP-II 2017-18 to be submitted | • Project concluded<br>• RPP-III will be presented |
| 29 | Assessment of Cotton for the remediation of soils contaminated with heavy metals | S. Ramana, A.K. Tripathi, K. Bharati, Asha Sahu | ESS | June 2015 | May 2018 | | • Project concluded<br>• RPP-III will be presented<br>• Dr. A.B. Singh to be included |
| 30 | Critical limits of Cd for major soil orders of India | M. Vassanda Coumar, Rajendiran S., M.L. Dotaniya, J.K. Saha, Tapan Adhikari, Ajay, S. Bhattacharjya and Hiranmoy Das | ESS | July 2015 | June 2018 | RPP-II, 2015-16, 2016-17 to be submitted | • Project concluded<br>• RPP-III will be presented |

### B. Externally funded projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 31 | Use of fly ash in agriculture for sustainable crop protection and environmental protection funded by NTPC, Noida | J.K. Saha, M. Vassanda Coumar, A.K. Patra, Tapan Adhikari, Ajay, K.M. Hati, Vasudev Meena, Sangeeta Lenka, Asit Mandal, A.K. Vishwakarma, Hiranmoy Das, Abhijit Sarkar, Madhumonti Saha | ESS | 30 August, 2017 | 29 August 2027 | | • Project to be continued<br>• Publication of reports may be reserved till receipt of money |

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|---|---|---|---|---|---|---|---|
| 32 | Reclamation and rehabilitation of coper mining affected land in Malanjkhand area of Madhya Pradesh (Hindustan Copper Limited) | Ajay, Tapan Adhikari, Asit Mandal J.K. Saha | ESS | April 2016 | March 2021 | | • Project to be continued |
| 33 | Management of Municipal Solid Waste (MSW) contaminated landfill area of Bhanpur, Bhopal funded by BMC, Bhopal | Ajay, Tapan Adhiakari, K. Bharati, Asit Mandal and J.K. Saha | ESS | Nov. 2016 | Oct. 2019 | Report to be submitted | • |

## Contractual Projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 34 | Evaluation of efficacy of sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India (Zuari Agro Chemicals Ltd) | A.K. Shukla, A.K. Biswas, Sanjay Srivastava, S.K. Behera, B.P. Meena | MSPE | April 2015 | Septemb er 2018 | | May be taken up later in Saturday seminar |
| 35 | Evaluation of efficacy of zinc metalosate and boron metalosate foliar supplements for maximizing yield through balanced nutrition of important crops grown in India (Indofil Ind. Limited) | A.K. Shukla, A.K. Biswas, S.K. Behera, B.P. Meena | MSPE | June 2015 | Septemb er 2018 | | |
| 36 | Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan) | Muneshwar Singh, R.H. Wanjari, B.L. Lakaria, A.O. Shirale | LTFE | June 2016 | May 2018 | | |
| 37 | The Äquasorb" project Effect of aquasorb on water and nutrient use efficiency & crop productivity of soybean & tomato in selected soils of India (Funded by SNF India Pvt. Ltd. Vishakhapatanam | R.S. Chaudhary, R.K. Singh, K.M. Hati, B.P. Meena, A.K. Biswas, M. Mohanty, A.K. Patra and Sonalika Sahoo | Soil Physics | July 2016 | June 2018 | Report 2016-17 Submitted | |
| 38 | Effect of slow N release formulations for enhancing productivity and nitrogen use efficiency in cereals sponsored by Rhodia Specialty Chemicals India limited, Mumbai | B.L. Lakaria, Pramod Jha, Sanjay Srivastava, A.K. Vishwakarma, A.K. Biswas and A.K. Patra | SC&F | June 2017 | June 2018 | Project report to be submitted | |
| 39 | Evaluation of Soil Test Kit of Warkem, Mumbai | Sanjay Srivastrava, Pramod Jha, A.O. Shirale, M. Vassanda Coumar, Gurav Priya Pandurang, A.K. Biswas, Pradip Dey and A.K. Patra | SC&F | September 2017 | February 2018 | Project report to be submitted | |
| 40 | Impact of viscose staple fibre industry treated effluent on soil health and crop production surroundings Nagda, M.P funded by M/s Grasim Industries Limited, Nagda, Ujjain, M.P. | Tapan Adhikari, J.K. Saha, M. Vassanda Coumar, R.H. Wanjari, N.K. Sinha and A.K. Patra | ESS | November 2017 | October 2020 | Project report to be submitted | |
| 41 | Evaluation of effect of Zeba fertilizer product on nitrate-N leaching funded by M/s | A.K. Biswas, R. Elanchezhian, N.K. Lenka, A.O. Shirale, A.K. Patra | SC&F | December 2018 | October 2019 | | |

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|---|---|---|---|---|---|---|---|
| | UPL Limited, UPL House, 610Bl2, Bandra Village, Off Western Express Highway, Bandra-East, Mumbai- 400 051 | | | | | | |

## RPP-I (New Projects)

### A) In-house Institute projects

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42 | Micronutrients distribution in major soil orders of India as influenced by soil properties and land use pattern | S.K. Behera, A.K. Shukla, N.K. Sinha, J.K. Thakur and K. Kartikeyan (ICAR-NBSS&LUP, Nagpur) | MSPE | 2019 | 2023 | | • Approved |
| 43 | Impact Assessment of Neem Coated Urea and Soil Health Card in Central and Western India | A.L. Kamble and Hiranmoy Das | SC&F | 2019 | 2023 | | • Approved |
| 44 | Socio-Economic impact of use of polluted irrigation water on soil quality and crop productivity near Ratlam industrial area in Madhya Pradesh | Utkarsh Tiwari, J.K. Saha, M.V. Coumar, A.L. Kamble and Hiranmoy Das | ESS | 2019 | 2023 | | • Approved |
| 45 | Enhancement of Soil Health and Livelihood of Tribals in Central India | R.H. Wanjari, R. Elanchezhian, Prabhat Tripathi, R.K. Singh, Shinogi K.C, M.V. Coumar, Vasudev Meena and A.L. Kamble | LTFE | 2018 | 2021 | | • Approved |
| 46 | Enhancement of nutrient (N & P) use efficiency and nutritional quality of wheat for improved soil and crop productivity | R. Elanchezhian, A.O. Shirale, B.P. Meena, Alka Rani, Sanjay Srivastava, Ajay, S. Ramana, A.K. Biswas and Renu Pandey (ICAR-IARI, New Delhi) | SC&F | October 2019 | Septemb er 2023 | | • Approved |
| 47 | Climate change impact on soil and water productivity of major crops in central India | N.K. Sinha, Seema Bhardwaj | Soil Physics | 2019 | 2023 | | • Approved |
| 48 | Impacts of conservation agriculture on runoff and soil loss under different cropping system in Vertisols | Prabhat Tripathi, R.K. Singh, Seema Bhardwaj | Soil Physics | 2019 | 2024 | | • Approved |
| 49 | Quantitative assessment of acid mine drainage affected areas in Madhya Pradesh | Madhumonti Saha, Ajay, Abhijit Sarkar, J.K. Saha and Hiranmoy Das | ESS | 2019 | 2013 | | • Approved |

**B) Externally funded Projects**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50 | Assessing the potential impact of climate smart technologies on soil health and nutrient accounting in selected vulnerable districts of MP funded by EPCO, Bhopal | Sangeeta Lenka, N.K. Lenka, MV Coumar, M. Mohanty, S. Bhattacharjya, J.K. Saha, A.K. Patra | ESS | July 2018 | July 2021 | | • Project to be continued<br>• Dr. Dolamani Amat to be included |
| 51 | Assessing the potential impact of climate change and management on soil carbon and nitrogen storage in selected ecosystems of India funded by NASF | Sangeeta Lenka, N.K. Lenka, Vasudev Meena, Asit Mandal, Biswapati Mandal (BCKV, West Bengal) | ESS | August 2018 | July 2021 | | • Project to be continued |
| 52 | Management of Municipal Solid Waste | Ajay, Tapan Adhikari, K. Bharati and | ESS | February | January | | • Project to be continued |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | contaminated dumping area of Bhanpur, Bhopal funded by MPCST, Bhopal | Asit Mandal | | 2019 | 2021 | | |
| 53 | Exploring endophytic fungi for the phytoremediation of heavy metal contaminated soils funded by DST | Asit Mandal, JK Thakur, MC Manna, AK Patra, M. Vassanda Coumar | Soil Biology | September 2018 | September 2021 | | • Project to be continued |

## Division wise/Co-coordinating Unit-wise Number of Projects

| Sl. No. | AICRP/ Division | Sl. No. of Project | Total |
|---|---|---|---|
| 1. | AICRP on LTFE | 1, 36, 45 | 3 |
| 2. | AICRP on STCR | - | - |
| 3. | AICRP on MSPE | 42 | 1 |
| 4. | AINP on SBB | 24, 25, 26 | 3 |
| 5. | Soil Chemistry and Fertility | 2, 4, 5, 6, 8, 9, 10, 11, 14 (a,d), 38, 39, 41, 43, 46 | 15 |
| 6. | Soil Physics | 13, 14(b, c), 15, 16, 17, 18, 37, 47, 48 | 10 |
| 7. | Soil Biology | 7, 20, 21, 22, 23, 27 | 6 |
| 8. | Environnemental Soil Science | 12, 19, 28, 29, 30, 31, 32, 33, 40, 44 | 10 |

## 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 MSPE | - | - |
| 4. | AINP SBB | 24,25,26 | 3 |
| 5. | Soil Chemistry and Fertility | 8,9,10,11,14 (a,d), | 6 |
| 6. | Soil Physics | 14 (b,c),15,16,17,18 | 6 |
| 7. | Soil Biology | 7,22,23,27 | 4 |
| 8. | Environmental Soil Science | 19,31,32,33 | 4 |

## New Projects Approved

| Sl. No. | Division/Co-coordinating Unit | Sl. No. | Total |
|---|---|---|---|
| 1 | AICRP LTFE | 45 | 1 |
| 2 | AICRP STCR | - | - |
| 3 | AICRP MSPE | 42 | 1 |
| 4 | AINP SBB | - | - |
| 5 | Soil Chemistry and Fertility | 43, 46 | 2 |
| 6 | Soil Physics | 47, 48 | 2 |
| 7 | Soil Biology | 53 | 1 |
| 8 | Environmental Soil Science | 44, 49, 50, 51, 52 | 5 |

# Project (serial numbers) with individual scientist

| S. No. | Name of Scientist | Designation | Sl. of projects | | |
|---|---|---|---|---|---|
| | | | PI | Co-PI | |
| **1** | Dr. A.K. Patra | Director | 9 | 13, 16, 18, 19, 21, 22, 31, 37, 38, 39, 40, 41, 50, 53 | 15 |
| **AICRP on LTFE** | | | | | |
| 1 | Dr. Muneshwar Singh | Project Co-coordinator | 1 | 13, 15, 21, 22, 36 | 6 |
| 2 | Dr. R. H. Wanjari | Senior Scientist | 45 | 9, 11, 14(a), 19, 21, 36, 40, | 8 |
| **AICRP on STCR** | | | | | |
| 1 | Dr. Pradip Dey | Project Co-ordinator | - | 2, 8, 13, 16, 39, 46, | 6 |
| 2 | Dr. Hiranmoy Das | Scientist | - | 5, 9, 28, 30, 31, 43, 44, 49 | 8 |
| **AICRP on MSPE** | | | | | |
| 1 | Dr. A.K. Shukla | Project Co-ordinator | 34, 35 | 3*, 8, 42, | 5 |
| 2. | Dr. S.K. Behera | Sr. Scientist | 3*, 42 | 34, 35 | 4 |
| **AINP on BF** | | | | | |
| 1 | Dr. S.R. Mohanty | I/c Project Co-ordinator | 22, 25, 26 | 11 | 4 |
| **Soil Chemistry and Fertility** | | | | | |
| 1 | Dr. A. K. Biswas | Head of Division & Pr. Scientist | 14, 41 | 1, 4, 34, 35, 37, 38, 39, 46 | 10 |
| 2 | Dr. Sanjay Srivastava | Principal Scientist | 2,10,39 | 4, 5, 6, 14(c), 34, 38, 46, | 10 |
| 3 | Dr. Brij Lal Lakaria | Principal Scientist | 38 | 6, 7, 9, 14(d), 36, | 6 |
| 4 | Dr. R. Elanchezhian | Principal Scientist | 46 | 3*, 8, 41, 45 | 5 |
| 5 | Dr. N.K. Lenka | Principal Scientist | 8, 11 | 12, 19, 41, 50, 51 | 7 |
| 7 | Dr. Pramod Jha | Principal Scientist | 14(d) | 13, 14, 15, 38, 39 | 6 |
| 8 | Dr. A.L. Kamble | Scientist | 43 | 5,9,44,45 | 5 |
| 8 | Dr. B.P. Meena | Scientist | - | 1, 4, 14(b), 45 | 4 |
| 9 | Dr. Shinogi K.C. | Scientist | 5 | 9, 14(a), 45 | 4 |
| 10 | Dr. Abhay Shirale | Scientist | 4 | 6, 9, 10, 11, 14(b), 36, 39, 41, 46, | 10 |
| 11 | Dr. Gurav Priya Pandurang | Scientist | 6 | 4, 5, 39 | 4 |
| **Soil Physics Division** | | | | | |
| 1 | Dr. R.S. Chaudhary | Principal Scientist & I/c Head of Division | 37 | 1,13,14,15,16, | 6 |
| 2 | Dr. Kuntal M. Hati | Principal Scientist | 13 | 14, 16, 31, 37 | 5 |
| 3 | Dr. R.K. Singh | Principal Scientist | 14(c) | 9, 14, 16, 37, 45, 48 | 7 |
| 4 | Dr. J. Somasundaram | Principal Scientist | 14(b) | 14, 15 | 3 |
| 5 | Dr. A.K. Vishwakarma | Principal Scientist | - | 9, 14, 15, 31, 38 | 5 |
| 6 | Dr. M. Mohanty | Principal Scientist | 15, 16, 17, 18 | 13, 14(d), 19, 37, 50 | 9 |
| 7 | Dr. N.K. Sinha | Scientist | 47 | 5, 13, 14(c), 15, 16, 17, 18, 40, 42 | 10 |
| 8 | Mrs. Seema Bhardwaj | Scientist | - | 15, 47, 48 | 3 |
| **Soil Biology** | | | | | |
| 1 | Dr. M.C. Manna | Principal Scientist & Head of Division | 20, 23 | 21, 53 | 4 |
| 2 | Dr. A.K. Tripathi | Principal Scientist | - | 2, 5, 14(a), 23, 29 | 5 |
| 3 | Dr. A.B. Singh | Principal Scientist | 7 | 1, 9, 23 | 4 |
| 4 | Dr. S.R. Mohanty | Principal Scientist | 22, 24, 25, 26 | - | 4 |
| 5 | Dr. K. Bharati | Principal Scientist | - | 5, 9, 14(d), 22, 25, 26, 29, 33, 52 | 9 |
| 6 | Dr. Asit Mandal | Scientist | 53 | 20, 26, 31, 32, 33, 51, 52 | 8 |
| 7 | Dr. Asha Sahu | Scientist | - | 9, 20, 21, 23, 29 | 5 |
| 8 | Dr. J.K. Thakur | Scientist | - | 7, 8, 13, 14(d), 20, 22, 23, 42, 53 | 9 |
| 9 | Dr. S. Bhattacharjya | Scientist | 21, 27 | 12, 23, 30, 50 | 6 |
| 10 | Dr. Dolamani Amat | Scientist | - | 23, | |

| | | | | | |
|---|---|---|---|---|---|
| **Environmental Soil Science** | | | | | |
| 1 | Dr. J.K. Saha | Principal Scientist & I/c Head of Division | 31 | 28, 30, 32, 33, 40, 44, 49, 50 | 9 |
| 2 | Dr. S. Kundu | Principal Scientist | - | 28 | 1 |
| 3. | Dr. Ajay | Principal Scientist | 32, 33, 52 | 30, 31, 46, 49 | 7 |
| 4 | Dr. Tapan Adhikari | Principal Scientist | | 30, 31, 32, 40, 52 | 5 |
| 5 | Dr. S. Ramana | Principal Scientist | 29 | 7, 14(b), 46 | 4 |
| 6 | Dr. M. Vassanda Coumar | Scientist | 30 | 13, 31, 39, 40, 44, 45, 50, 53 | 9 |
| 7 | Dr.(Mrs.) Sangeeta Lenka | Scientist Sr. Scale | 12, 19, 50, 51 | 8, 11, 15, 31 | 8 |
| 8 | Mr. Vasudev Meena | Scientist | - | 31, 45, 51 | 3 |
| 9 | Dr. Utkarsh Tiwari | Scientist | 44 | - | 1 |
| 10 | Dr. Abhijit Sarkar | Scientist | - | 31, 49 | 2 |
| 11 | Dr. Madhumonti Saha | Scientist | 49 | 31 | 2 |
| **Scientists from other Institutes** | | | | | |
| 1. | Dr. S. Gangil | Principal Scientist, ICAR-CIAE, Bhopal | - | 25 | 1 |
| 2. | Mr. R.L. Raut | KVK, Balaghat | - | 5 | 1 |
| 3. | Mr. Rameshwar Ahirwar | KVK, Balaghat | - | 5 | 1 |
| 4. | Miss Aparna Jaiswal | COA, Balaghat | - | 5 | 1 |
| 5. | Dr. P. Chandran | ICAR-NBSS&LUP, Nagpur | - | 6 | 1 |
| 6. | Dr. P. Chandra | ICAR-CIAE, Bhopal | - | 8 | 1 |
| 7. | Dr. K.K. Singh | IMD, New Delhi | - | 8 | 1 |
| 8. | Dr. A.K. Baxla | IMD, New Delhi | - | 8 | 1 |
| 9. | Dr. P.S. Tiwari | ICAR-CIAE, Bhopal | - | 10 | 1 |
| 10 | Dr. Vijay Kumar | ICAR-CIAE, Bhopal | - | 10 | 1 |
| 11 | Dr. Ramesh Kumar Sahani | ICAR-CIAE, Bhopal | - | 10 | 1 |
| 12 | Dr. Baban Kumar | CSIR-CSIO, Chandigarh | - | 10 | 1 |
| 13 | Miss Neelam | CSIR-CSIO, Chandigarh | - | 10 | 1 |
| 14 | Dr. Javed Rizvi | Director, ICRAF, South-Asia Programme, New Delhi | - | 13 | 1 |
| 15 | Dr. Bharat Bhaskar Gaikwad | ICAR-CIAE, Bhopal | - | 16 | 1 |
| 16 | Dr. M.P. Sharma | ICAR-IISR, Indore | - | 21 | 1 |
| 17 | Dr. GN Kumar | Baroda | - | 24 | 1 |
| 18 | Dr. AK. Saxena | ICAR-NBAIM, Mau | - | 24 | 1 |
| 19 | Dr. MD Gupta | Kolkata | - | 24 | 1 |
| 20 | Dr. K. Annapurna | New Delhi | - | 24 | 1 |
| 21 | Dr. P.M. Ready | New Delhi | - | 24 | 1 |
| 22 | Dr. Dixon | Norwich | - | 24 | 1 |
| 23 | Dr. Vinoy Ramchandran | Oxford | - | 24 | 1 |
| 24 | Dr. K. Kartikeyan | ICAR-NBSS&LUP, Nagpur | - | 42 | 1 |
| 25 | Dr. Renu Pandey | ICAR-IARI, New Delhi | - | 46 | 1 |
| 26 | Dr. Biswapati Mandal | BCKV, West Bengal | - | 51 | 1 |
| 27 | Dr. D.LN. Rao** | Emirates scientist | - | 24 | 1 |

*Concluded projects

**Emirates Scientist, ICAR-IISS, Bhopal

# LIST OF PARTICIPANTS

| S. No. | Name of Scientist | Designation |
|---|---|---|
| 1. | Dr. A. K. Patra | Director & Chairman, IRC |
| 2. | Dr. Muneshwar Singh | Project Co-ordinator, LTFE |
| 3. | Dr. A.K. Shukla | Project Co-ordinator, MSN |
| 4. | Dr. Pradip Dey | Project Co-ordinator, STCR |
| 5. | Dr. R.S. Chaudhary | Principal Scientist & I/c Head of Division |
| 6. | Dr. A.K. Biswas | Principal Scientist & I/c Head of Division |
| 7. | Dr. M.C. Manna | Principal Scientist & Head of Division and Member Secretary, IRC |
| 8. | Dr. J.K. Saha | Principal Scientist & I/c Head of Division |
| 9. | Dr. A.B. Singh | Principal Scientist |
| 10. | Dr. Ajay | Principal Scientist |
| 11. | Dr. A.K. Tripathi | Principal Scientist |
| 12. | Dr. DLN Rao | Emeritus Scientist |
| 13. | Dr. Sanjay Srivastava | Principal Scientist |
| 14. | Dr. Brij Lal Lakaria | Principal Scientist |
| 15. | Dr. Kuntal M. Hati | Principal Scientist |
| 16. | Dr. R. Elanchezian | Principal Scientist |
| 17. | Dr. Prabhat Tripathi | Principal Scientist |
| 18. | Dr. S. Ramana | Principal Scientist |
| 19. | Dr. NK Lenka | Principal Scientist |
| 20. | Dr. R.K. Singh | Principal Scientist |
| 21. | Dr. R.H. Wanjari | Principal Scientist |
| 22. | Dr. A.K. Vishwakarma | Principal Scientist |
| 23. | Dr. J. Somasundaram | Principal Scientist |
| 24. | Dr. S.R. Mohanty | Principal Scientist |
| 25. | Dr. Pramod Jha | Principal Scientist |
| 26. | Dr. K. Bharati | Principal Scientist |
| 27. | Dr. M. Mohanty | Principal Scientist |
| 28. | Dr. SK Behera | Senior Scientist |
| 29. | Dr. M.V. Coumar | Scientist |
| 30. | Dr. Hiranmoy Das | Scientist |
| 31. | Dr. Sangeeta Lenka | Scientist |
| 32. | Dr. N.K. Sinha | Scientist |
| 33. | Dr. Asit Mandal | Scientist |
| 34. | Dr. Asha Sahu | Scientist |
| 35. | Dr. JK Thakur | Scientist |
| 36. | Dr. Shinogi K C | Scientist |
| 37. | Dr. Bharat Prakash Meena | Scientist |
| 38. | Dr. Sudeshana Bhattacharjya | Scientist |
| 39. | Dr. AL Kamble | Scientist |
| 40. | Dr. AO Shirale | Scientist |
| 41. | Dr. Gurav Priya Pandurang | Scientist |
| 42. | Dr. Utkarsh Tiwari | Scientist |
| 43. | Dr. Dolamani Amat | Scientist |
| 44. | Dr. Seema Bhardwaj | Scientist |
| 45. | Dr. Vasudev Meena | Scientist |
| 46. | Dr. Abhijit Sarkar | Scientist |
| 47. | Dr. Madhumanti Saha | Scientist |

## Research Achievements

| Sl. No. | Title of Project |
|---|---|
| 1 | **Long-term evaluation of integrated plant nutrient supply modules for sustainable productivity in Vertisol** |
| | Maize grain yield was significantly influenced with the integrated nutrient management (INM) practices in long term fertilizer experiment at IISS research farm during 2019. Maize grain and stover yield was significantly improved with STCR based INM module i.e. 75% NPK of STCR along with FYM at 5 Mg $ha^{-1}$ as compared to recommended fertilizer management practices and 100% STCR based NPK fertilizers. STCR based 100% NPK fertilizers also improved the grain and stover yield as compared to organic treatments and general recommended dose (GRD). Long term trend clearly indicated that maize grain yield improved and sustained under the integration of 75% NPK with FYM as compared to GRD and other combinations of organic and inorganic nutrients. Whereas, chickpea grain yield was significantly higher with residual fertility of 75%NPK+ FYM at 5Mg $ha^{-1}$. Residual fertility of FYM at 20 Mg $ha^{-1}$ (every year) and 75%NPK+FYM at 20 Mg $ha^{-1}$ (once in four years) treatments also improved grain yield compared to the other treatments. Residual fertility of poultry manure and urban compost along with 75% NPK also improved yield more than 100% NPK alone. Overall, the residual fertility of integration of organics had significant effect on grain yield of chickpea than the residual fertility of GRD and 100% NPK of STCR alone. |
| 2 | **Evaluating rock phosphates for their suitability for direct application** |
| | Incubation study for P release was done. Replacement for Dr Rashmi and Dr. Ramesh is required. |
| 3 | **Standardization of foliar feeding of zinc for correcting its deficiency and grain enrichment in wheat** |
| | External Zn application to wheat crop indicated that grain Zn concentration increased by 25.1, 35.7 and 38.2% with soil, foliar and both soil and foliar application of Zn, respectively in Zn-inefficient genotypes and by 7.2, 21.1 & 30.6% with soil, foliar and both and foliar application of Zn, respectively in Zn-efficient genotypes. |
| 4 | **Evaluation of glauconite as source of potassium for crops** |
| | Potassium is an essential element for all plants and is the seventh most abundant element in the lithosphere. Potash fertilizers have played a significant role in Indian agriculture for attaining self-sufficiency in food grain production. As on date most of potassic fertilizers are imported and hence utilising the indigenous sources potassium is an absolute necessity. Glauconite is one such natural source of potassium. Glauconite samples were collected from Singrauli district of Madhya Pradesh for the study. The samples were ground to pass through various sizes ranging from 0.125mm to 2.0mm. These fractions were analyzed for different forms of potassium viz., total K, water soluble K, $NH_4OAc$ extractable K, cation exchange capacity as well as pH and electrical conductivity. The total $K_2O$ content in the samples ranged from 7.1 to 12.6%. Irrespective of the extractant, the amount of K release increased with a decreasing in size of the glauconite. The pH and EC ranged from 7.97-8.85 and 0.09-0.26 $dSm^{-1}$. The total elemental composition of whole rock reveals that it contains 5 to 9.6% of K, 1 to 2.2% of Fe, 0.4 to 4.4 % of Ca, 0.6 to 0.3% of Mg, 0.3 to 0.6% of B, 0.02 to 0.13% of Na. The concentrations of Mn, S, Zn, Ni, Cr, Co and As were less than 0.001%. The XRD pattern of the air dried gluaconite sample exhibited a (001) of K release was more with decreasing size of glauconite. The XRD pattern of the air dried gluaconite sample exhibits a (001) reflection at 10.05 Å, a (002) reflection at 4.5 Å and a strong reflection at 3.3 Å. The gluaconite is well ordered and having 5% expandable layers. The peaks are unmoved after glycol treatment and heating at $110^0$C, $300^0$C and $500^0$C indicating minimal inter-stratification between expandable and non-expandable layers. Over all from mineralogical studies, it can be inferred that the present material is composed of 55% of glauconite, 33% mica and around 11% of quartz, feldspars, illite, chasmosite, goethite are part of glauconite. |
| 5 | **Enhancing the productivity of major crops through improving the natural resource base of tribal inhabited areas of central India** |
| | To identify the villages with more than 90% tribal population in Balaghat district a pilot survey was carried out in eight villages and three villages viz., *Kaweli, Kulpa,* and *Sarra* were identified to implement the project activities. Surveys and farmer-scientist interface meetings were carried out in the three villages and documented various ITK in soil and water management. Soil samples were collected from the three villages from nine locations at first stage for the analysis of physical, chemical and biological properties. Also, farmer field schools on "soil sampling for soil testing" were organized for the tribal farmers of the project location. |
| 6 | **Mineralogy of Vertisols in relation K availability in central and western India** |
| | • Letter to be sent to ICAR-NBSS&LUP, Nagpur to obtain consent of Co-PI (Dr. P. Chandran).<br>• Facility for mineralogy work may be explored in other places. |
| 7 | **All India Network Programme on Organic Farming** |
| | • Soybean performed better under all the cropping systems (100 % organic was better than 75 % organic + innovative). Among the copping systems soybean-wheat /chickpea performed better than soybean-mustard/linseed cropping system. System productivity was found to be higher in Soybean – chickpea cropping system.<br>• Higher yields of all rabi season crops were found with 100% organic and 75 % organic + 25 % inorganic dose of |

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| | nutrients which were statistically at par with each other.<br>• The highest SOC, available NPK, soil enzyme activity like DHA, FDA hydrolysis and alkaline phosphatase were recorded in 100% organic and 75%org+25% inorganic/innovative management.<br>• Maize grain yield was significantly influenced by non-chemical weed management practices. Incorporation of cotton seed cake + one hand weeding was recorded significantly highest grain yield (4313 kg $ha^{-1}$) followed by intercropping with cowpea treatment, two hand weeding at 25 and 50 DAS, one mechanical weeding at 25 DAS + one hand weeding at 50 DAS as compared to control.<br>• Total factor productivity reveals efficiency with which the factors inputs are converted into output within production processes. TFP is calculated (kg grain per kg NPK and kg grain per kg manure). The highest TPF was recorded under 100% organic treatment followed by 75% organic + inorganic, 75% organic + innovative, 100% inorganic and least in state recommendation treatment. The TFP index were noticed in different crops in the order of Chickpea > Wheat > Mustard >Linseed > Soybean. Whereas, the total factor productivity (kg grain per kg manure) was highest in 100% inorganic treatment as compared to 100% organic treatment.<br>• The energy input and out- put, energy use efficiency and energy productivity of different crops (soybean, wheat, mustard, chickpea and linseed) were calculated. The highest energy use efficiency and energy productivity were recorded under the application of 100 % organic treatment followed by 75%organic + innovative, 75 % organic + 25% inorganic as compared to 50% organic + 50 % inorganicand 100 % inorganic. Among the different crops wheat recorded the highest energy use efficiency.<br>• Nutritional quality constituents such as protein, ash and tryptophan content were determined in grains of different varieties of maize. Protein, ash and tryptophan content in maize grain influenced significantly among various varieties of maize. The higher values of protein and tryptophan were recorded in Proagro-4212 variety. |
| **8** | **Simulating the effect of elevated $CO_2$ and temperature on water productivity and nutrient use in soybean-wheat cropping system** |
| | Despite numerous literatures suggesting fertilization effect of elevated $CO_2$ concentration in $C_3$ plants, information on the effect of $CO_2$ fertilization on microbial activity and microbial composition is limited. Thus, a field experiment was conducted for two consecutive cropping seasons under soybean-wheat cropping system under elevated $CO_2$ and/or elevated temperature conditions in Open Top Field Chambers (OTC) in the Vertisols of Bhopal. The crops were grown under two atmospheric $CO_2$ levels (ambient and 550 ppmv) and two air temperature levels (ambient, 2.0 $^oC$ above ambient) in OTCs with four different nitrogen (N) levels (0, 50, 100 and 150% N of the recommended dose. Measurement of mineralizable carbon content by alkali trap method indicated elevated $CO_2$ and/or temperature resulting in a higher soil respiration as compared to ambient. The signature lipid profile from the Phospholipid Fatty Acid analysis (PLFA) of soil samples collected after 2$^{nd}$ year wheat crop indicated a significant increase in fungi-bacteria ratio, and significant reduction in ratio of $Gram^+$/$Gram^-$ bacteria and ratio of saturated to unsaturated fatty acid content under elevated $CO_2$ and/or temperature treatments. The amplified ribosomal DNA restriction analysis (ARDRA) of prokaryotic 16s rDNA using Taq1 restriction enzyme, indicated shift in the microbial composition under elevated $CO_2$ and/or temperature treatments. The gel fingerprint reveals a narrowing down of microbial diversity under the climate change conditions. |
| **9** | **Ensuring food security, sustainability and soil health through resource conservation based farmer FIRST approach in central India** |
| | Module-wise work carried out under progress during 2017-18.<br>A. Crop based Modules: Kharif season- Conservation agriculture based crop production technology for kharif crops.<br>B. Horticulture based Modules: Package of practices for better vegetables yield<br>C. Livestock based Modules: Scientific livestock management<br>D. Enterprise based Modules: Vermicomposting/ Bee keeping<br>E. Integrated Farming Systems (IFS) module: CA based agri - horti integrated farming system.<br>F. NRM, Soil, Resource and Crop based module- CA based demonstrations to promote location specific best bet crop management techniques for improving crop productivity, soil health and disposal of crop residues.<br>Organized Farmer first workshop on the occasion of National Productivity week on 14$^{th}$ February, 2017. The programme was participated by 150 farmers from different villages. Awareness programmme was conducted on 4$^{th}$ March,2017 and 15$^{th}$ March,2017 at village Khamkheda and Bherupura. Farmers were taken to CA demonstration plots to create awareness and to discuss on the implementation of the project in a participatory mode. |
| **10** | **Development of an automated soil nutrient sensing system funded by NASF** |
| | To automate the whole process of soil testing starting from sample collection to analysis, an auto soil sampler fixed with tractor has been developed in collaboration with ICAR-CIAE. This can automatically collect the soil samples through tractor thus reducing the time for soil sample collection. For developing methodology of quick analysis, the soil samples from vertisols, Bhopal and inceptisols, Chandigarh were collected and analysed for fertility parameters using standard lab procedures and ion selective field effect transistors (ISFET). The good calibration curves for the estimation of nitrate, phosphate and potassium ions have been successfully prepared showing calibration for nitrate). The use of ISFET is expected to simplify and expedite the process of soil analysis. |
| **11** | **Assessing the impact of imbalanced use of chemical fertilizer on soil health using a soil function based** |

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| | **quantitative approach funded by DST, New Delhi** |
| | In intensive agriculture areas, effect of high quantity of fertilizer use on soil and water quality has been debated at both scientific and at policy levels. A study thus was taken up collecting georeferenced soil and water samples from Udham Singh Nagar district of Uttarakhand at 10×10 km grids. Consumption of chemical fertilizers in the study district was at 545 kg per hectare with rice-wheat and sugarcane-wheat as the major cropping systems. Soil samples from 0-15 and 15-30 cm depths were analyzed for key parameters including pH, EC, soil organic carbon, available N, P, K and S, labile carbon and activity of key soil enzymes. Ground water samples were analyzed for $NO_3$-N content. The content of SOC varied from 0.20 to 1.44% in the surface layer (0-15 cm depth) with about 44% of samples was found in the medium range. However, 79% samples were found low in available N content (<250 kg $ha^{-1}$). On the other hand, all the samples were rated high in available P content (>25 kg $ha^{-1}$). About 60% samples were deficient in available S content. The activity of soil enzymes was satisfactory, with about 69% samples showed dehydrogenase activity in the range of 100-200 µg TPF/24 hr. The nitrate-N content in the analyzed water samples varied from 5 to 25 mg $L^1$ with about 66% water samples containing more than the permissible limit of 10 mg $L^{-1}$ of $NO_3$-N. Results indicate water quality is more affected than soil quality parameters because of high fertilization in the studied district. |
| **12** | **Assessing greenhouse gas emission and soil carbon storage with reversal in tillage practice** |
| | After three growing periods of converting 8 years long experiment under conservation tillage in soybean-wheat system, the results revealed that the NT system had the highest SOC content in the surface 0-5 cm layer only. The relative increase in SOC concentration for 5-15 cm soil depth was observed with reversal of no tillage (NT) and reduced tillage (RT) to conventional tillage (CT); this could be attributed to increased decomposition and mineralization of incorporated crop residue in NT-CT and RT-CT treatments. The soil nutrient content (N and P) was not significantly affected by interactive effect of tillage and fertilizer on surface soil layer (0-5 cm). Interactive effect of tillage and fertilizer was found significant on available P content at 5-15 cm soil depth. In contrast to N, soil available P relatively increased with reversal of tillage in NT and RT. In comparing the tillage systems, tillage reversal (NT-CT, RT-CT) and RT had significantly higher available potassium than NT in 0-5 and 5-15 cm soil layers. |
| **13** | **Assessment of important soil properties of India using mid-infrared spectroscopy** |
| | Chemo metric models were developed for prediction of some important physical and chemical properties viz., soil organic carbon, EC, pH, available P and K, sand, silt and clay content of Alfisols from Orissa and Jharkhand. Validation of the models was carried out to identify soil properties that can be measured through these techniques with reasonable accuracy. Chemo metric models were developed using specific soil properties measured through standard laboratory methodology and their corresponding mid-infrared soil spectra. Partial least square regression method was used for development of prediction models for various soil properties. The validation of the model showed that the predictability as expressed through co-efficient of determination ($R^2$), root mean square error (RMSE), Mean Absolute Errors (MAE) varied markedly among the different soil properties tested. The models developed could predict reasonably well the SOC concentration and pH of the soil. Particle size distribution (Sand, Clay and Silt) gave good calibrations with small root mean square error (RMSE), mean absolute errors (MAE) of below 5% and high r-squared value ($R^2$>0.7) for the validation set. The MIR spectroscopy techniques showed great potential for estimation of soil organic carbon, soil particle size distribution and pH for the Alfisols. |
| **14** | **CRP-Conservation Agriculture** |
| | Best bet conservation agricultural practices for two predominant cropping systems namely, soybean-wheat and soybean-chickpea were demonstrated through participatory field trials in four villages situated nearby Bhopal to popularize the conservation agricultural technologies developed for Vertisols. Crop yield recorded were relatively higher in conservation tillage compared to the farmers' practice. On station conservation tillage practices in combination with crop residue retention followed for six years showed positive impact on aggregate stability, aggregate associate–C concentration, and different carbon pools. Reduced tillage with residue retention showed a positive effect on macro- and micronutrient distribution and availability in soils after four crop cycles. Long-term effect of imposition of various conservation agricultural practices on soil chemical properties were studied through analysis of soils collected from the ongoing long-term conservation agriculture (CA) experiments at IIFSR, Modipuram and CSSRI, Karnal. |
| **15** | **Cropping systems and soil management effects on soil organic carbon sequestration and greenhouse gas emission in Vertisols of central India under change climate scenarios funded by NICRA II-Phase** |
| | In a climate change impact studies on soil organic C and grain yield under soybean-wheat cropping systems it was observed that the soil organic C remained unchanged in surface as well as subsurface layers under balanced fertilization to soybean and wheat. However, the grain yield of soybean increased substantially under different RCPs under investigation in both the year 2050 and 2080. In the year 2080, soybean yield was reported to be higher than 2050 due masking of temperature effects by increased CO2 concentration. There was a little change in wheat yield in both the year under study. The effects of different RCPs on wheat yield was found to be non-significant. |
| **16** | **Hyper-spectral remote sensing approaches to evaluate soil quality and crop productivity of central India (under DST sponsored Network Project on Hyper-spectral Big Data Analytics)** |

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| | Total 600 soil samples were collected from Bhopal, Indore, Raisen and Jabalpur of the central India and were processed and soil spectra were generated at the central facility at the Division of Agricultural Physics, ICAR-IARI, New Delhi. Furthermore, to generate the crop coefficient at different stages of crop, which is required for APSIM crop growth model, a field experiment with wheat crop was started in split plot design with three levels of irrigation and four levels of nitrogen. The imposed irrigation levels are: IW (Irrigation water)/CPE (Cumulative pan evaporation) =1, IW/CPE =0.75 and IW/CPE= 0.5; whereas nitrogen levels are 0%, 50%, 100% and 150% of the recommended dose. Periodic observation on crop spectra, canopy temperature and others parameters related to plant growth were collected. |
| **17** | **Strategies for enhancing yield of soybean (Glycine Max L) and pigeonpea (Cajanus cajan, L) in India using climate variability information and crop growth simulation models in collaboration with ICAR-IISR, Indore** |
| | The Intergovernmental Panel on Climate Change (IPCC) has confirmed that there is substantial evidence that the mean and extremes of climate variables such as temperature and rainfall, have been changing in recent decades, and will have a significant effect on crop yield. |
| **18** | **Sustainable adaptive water management resilient to variable climates in Madhya Pradesh funded by ICARDA** |
| | • Collection of soil, climate and other information for parametrization of crop models.<br>• Crop experimentation is also conducted for generation of crop coefficient for calibration of model. |
| **19** | **Vulnerability and impact assessment of climate change on soil and crop production in Madhya Pradesh funding Agency: UNDP-GEF-MoEFCC** |
| | The overall climate vulnerability of the Madhya Pradesh districts is projected to increase towards mid-and end-century as compared to the current conditions for both emission scenarios of RCP 4.5 and RCP 8.5. Districts vulnerability under RCP8.5 scenarios is projected to be higher as compared to RCP 4.5 scenario. The projected increase in vulnerability towards end-century is higher than that of mid-century for RCP 8.5 scenario while the projected increase in vulnerability towards end-century is relatively lower than that of mid-century for RCP 4.5 scenario. Factors contributing to projected increase in climate vulnerability of districts include projected increase in rainfall variability and higher sensitivity to heat stress.<br>The overall agriculture vulnerability of the Madhya Pradesh districts is projected to decrease towards mid-and end-century as compared to the current conditions for both emission scenarios of RCP4.5 and RCP8.5. Districts vulnerability under RCP8.5 scenario is projected to be lower as compared to RCP4.5 scenario. |
| **20** | **Isolation and characterization of heavy metal resistant bacteria & evaluation for their use in agriculture. Collaborating with NBAIM, Mau (U.P.)** |
| | Collected soil samples from the dumping sites and analysed for the estimation of various heavy metals such as Pb, Ni, Cd, Cr, Hg, Cu, Zn, Co and As. In total 77 morphotypes of bacteria were isolated and minimum inhibitory concentrations (MIC) was carried out of the isolates against different heavy metals. Out of different morphotypes, 20 potential bacterial isolates have been identified possessing very high and showing multiple heavy metal tolerance. 9 promising strains identified and submitted to NAIMCC. |
| **21** | **Effects of long term use of fertilizer and manure on soil functional diversity and nutrient supplying capacity under different soils and cropping systems (inter-institute collaborative project with ICAR-IISR, Indore** |
| | • Nitrogen mineralization potential which dictates the N supply capacity of soil was found to be significantly higher in integrated nutrient management (100% NPK +FYM) in all the three soil orders namely, Inceptisol, Verisol and Alfisol.<br>• Significantly higher arginine ammonification is noticed in 100% NPK + FYM in Vertisol and Alfisol, however, no difference in Inceptisol.<br>• In three soil orders, heterotrophic nitrification contributed significantly in N supply capacity and it is found to be greatly controlled by SOC content. Moreover, autotrophic nitrification was not suppressed even if the soil pH was 4.6 under Alfisol condition.<br>• Geometric mean of nitrogen cycling enzymes appeared as good soil quality indicator for discriminating the sustainable ecosystem from stressed one in Alfisol.<br>• Among the microbial community, AMF and eukaryote appeared as the most crucial group to distinguish significantly the imbalanced fertilizer application from balanced fertilizer application in LTFE Palampur (Alfisol).<br>• Total microbial biomass and eukaryote biomass determined by phospho lipid fatty acid (PLFA) analysis were highest in 100% NPK +FYM treatment in LTFE Barrackpore (Inceptisol), whereas 100% NPK +FYM had the lower ratio of Predator/Pray, Cyclo/Monounsaturated precursor and higher ratio of G+ve/G-ve bacteria.<br>• Total glomalin have predicted good aggregate stability for silt and clay associated fraction in both Inceptisol and Vertisol. It has also predicted good aggregate stability for large macro aggregate in Inceptisol but not in Vertisol. However, in case of the intermediate fractions total glomalin had the predictability ranging from 40-43 % in Inceptisol and 60-70 % in Vertisol.<br>• Non exchangeable potassium analysis of LTFE Barrackpore (Inceptisol), Parbhani (Vertisol) and Palampur |

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| | (Alfisol) reflected higher K content non exchangeable sites in Inceptisol, as compared to Vertisol and Alfisol. However, in all the soil orders balanced fertilizer application (100 % NPK) had statistically similar non exchangeable K content with integrated nutrient management (100 % NPK+FYM).<br>The results of the P supply power has been depicted in the following figure, where it is evident that fallow had the highest P- supply which is statistically comparable with 100 % NPK+FYM. In addition, P solubilization rate was found to be in the following order $Ca_3(PO_4)_2$ > $AlPO_4$ >$FePO_4$. |
| **22** | **Metagenomic mapping of microbial diversity in rhizosphere of major crops of India and Argentina offsetting production potential (funded by DST, New Delhi)** |
| | Dr Mario Aguilar from Argentina visited IISS during 21.8.2017-28.8.2017. He gave a presentation at IISS Bhopal and later travelled to ICAR IISWC (Agra centre) and IARI N Delhi and discussed about various research activities. Soil samples from LTFE, Jabalpur has been collected and is being analyzed. |
| **23** | **Enhancing decomposition rate and quality of bio-waste through microbial consortia for improving soil health funded by NASF** |
| | • Bio-wastes have been collected from vegetable market, horticultural based farm waste, agrobased inductrial waste and from domestic waste.<br>• The chemical composition of these waste have been analysed for C/N ratio, Lignin/cellulose ratio, CEC/TOC ratio, water soluble carbon and carbohydrates.<br>• For rapid decomposition of organics, six fungi, eight thermophilic bacteria possessing cellulose and lignin degradation ability were isolated which could thrive and work at 50-60ºC temperature, from city waste, and fresh cowdung. Using these isolates, bio-waste like city waste (Kitchen waste), vegetable waste, horticultural waste and farm waste were subjected for decomposition and maturity and stability indices were assessed. The loss rate kinetics study revealed that the increased loss rate (*K*) of about 1.36 to 2- fold greater in kitchen, vegetable and horticultural waste compost than crop residue compost. Further the potential loss percentage was maximum (95.68%) in vegetable waste compost.<br>• Maturity parameters such as C/N ratio,L/C ratio, CEC/TOC ratio and degree of polymerisation reached much earlier in vegetable waste compost (20 days) followed by kitchen waste (25 days), horticultural waste compost (35 days) and farm waste compost (45 days). Point sources of segregation of domestic waste (Kitchen waste), vegetable waste substantially reduce the content of heavy metals and improve the quality of compost.<br>• Thermophilic microbes enhance the decomposition process at 50- to 60 0C. Microbial community has been studied at different stages of decomposition and it was found that thermophilic bacterial community increased with increase the temperature. |
| **24** | **India-UK nitrogen Fixation Centre (IUNFC)** |
| | Soil samples from about 105 agricultural fields were collected. The fields were grown with Pigeon pea with other cereals and horticultural crops. For isolation of Rhizobial strains -a glass house experiment was set up by taking 104 soil samples in paper cups with Asha variety of pigeon pea. Bacteria were isolated from the nodules of young plants using YEMA plates. Around 700 isolates were selected based on sample source, colony morphology and duration of emergence of colonies, out of which 75 were Gram negative bacteria which were further maintained on YEMA slants. Out of 12, six were fast growing bacteria and six were slow growing bacteria. Biochemical Characterization and Nodulation efficiency test of isolated strains are in progress. Molecular identification of Nodulating isolates (13) were performed by amplifying 16SrDNA gene using universal primers 8F (Forward) and 1492R (Reverse) and niH gene. Sequencing and Phylogenetic analysis is in progress. During nodulation experiment one of the isolate (P5F1) isolated from parwaliya region of Bhopal did not show nodulation but showed considerable PGPR activity as compared to control and reference strain. This isolate showed yeast like morphology and was chosen for further investigation regarding nitrogen fixation enhancement ad PGPR abilities. |
| **25** | **Simulating the effect of elevated $CO_2$ and temperature on water productivity and nutrient use in soybean-wheat cropping system** |
| | Experiment conducted in Open Top Chambers under five climate conditions with two atmospheric CO2 concentrations and two air temperature conditions, taking soybean and wheat crops. Observations on biophysical parameters and soil properties recorded. Plant tissue and grain nutrient concentration analyzed and uptake of major nutrients computed. |
| **26** | **Evaluation of Soybean-rhizobia interaction under elevated CO2 and temperature to develop climate ready microbial inoculants for central India funded by AMAAS** |
| | Soils were nitrified repeatedly to obtain different concentration of biogenic nitrate. The effect of nitrification on the redox metabolism was evaluated by comparing with the inorganic KNO3. Repeated NH4-N amendment increased nitrification rate (mM NO3 produced g-1 soil d-1) from 0.49 to 0.65. Nitrification stimulated ($p<0.01$) the abundance of 16S rRNA gene of eubacteria (43.67±4.510 x 106), amoA gene of nitrifying bacteria (102.33±8.50 x 104) and nitrifying archaea (94.33±7.77 x 104). The rate of reduction of terminal electron acceptors (mM reduced g-1 soil d-1) in the nitrified soil followed as: NO31- reduction 4.01±0.229, Fe3+ reduction 5.37±0.122, SO42- reduction 9.56±0.165. Methane production (µg g-1 soil) in the nitrified soil was 0.46±0.051. Nitrification inhibited denitrification by a factor of 1.4. Similarly, it inhibited the Fe3+ reduction, SO42- reduction, and CH4 production by factor of 1.8, 1.13, and 1.66 respectively. Raman spectra of the nitrified soils indicated the occurrence of aliphatics in soil. Probably, these aliphatics bind to NO3 and form biogenic nitrate. The microbial volatile organic |

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| | compounds (mVOCs) from nitrifiers enhanced ($p<0.05$) nitrification. The mVOCs stimulated ($p<0.05$) abundance of nitrifying bacteria than the eubacteria and nitrifying archaea. Results highlighted that nitrification modulates the redox metabolism by forming biogenic nitrate and microbial volatiles. |
| **27** | **Exploring soil microbial community and mechanism in soil carbon sequestration under long term land uses in semi-arid sub-humid Central India funded by SERB, DST, New Delhi** |
| | • RuBisCO enzyme activity analysis revealed that grassland system maintained for long term under different management had higher RuBisCO activity at both soil depths (0-15 and 15-30 cm) than natural grassland system.<br>• Comparison among these two land use systems reflected that grassland system had more potential of autotrophic microbial assimilation of atmospheric $CO_2$in soil carbon as compared to natural forest system in semi-arid to sub-humid central India.<br>• Highest TOC is noticed under Fig based forest, and natural grassland system, irrespective of depth among all the land use soils. For intensive agriculture system in Long Term Fertilizer Experiment, (LTFE) the highest TOC is maintained in integrated nutrient management treatment as compared to imbalanced fertilizer application.<br>• Natural Forest and natural grassland promoted total glomalin related soil protein (TGRSP) which sequesters carbon within soil aggregates, among all the land use system, followed by horticulture system. In LTFE, balanced fertilizer application (100% NPK) had the highest TGRSP.<br>• Specific enzyme activity of phenol oxidase reflected carbon sequestration potential in Integrated nutrient management treatment as compared to imbalanced fertilizer application.<br>Similarly, specific enzyme activity of phenol oxidase indicated that the horticulture and grassland system has potential of more carbon sequestration in upper soil depth where as agro-forestry and Palash based black forest soil has higher carbon sequestration potential in lower depth. |
| **28** | **Determination of Baseline Concentration for Delineating Contaminated Areas in Black Soils of Central India** |
| | Soil profile samples (0-15, 15-30, 30-45, 45-60 and 60-75 cm) were collected from Bhopal, Raisen, Sehore and Vidisha districts. The baseline concentrations and spatial distribution of heavy metals (HMs) in agricultural soils of Bhopal, Indore and Raisen districts were studied. Among three different extractant, HF is more efficient in extraction of metals from black soils followed by aqua-regia and di-acid mixtures. |
| **29** | **Assessment of Cotton for the remediation of soils contaminated with heavy metals** |
| | Cotton plant was exposed to different combinations of heavy metals (Cd,Pb and Cr) i.e., multiple heavy metal stress. Cr was highly toxic when applied alone than it was applied in combination with other heavy metals particularly Pb. The tissue analysis revealed that, when Cr was applied in combination with Pb, there was a significant reduction in the uptake of Cr. The data on organic acids (Formic, Fumaric, oxalic, citric and malic acids) determined from rhizosphere soil samples revealed that only formic acid was detected in rhizoshpere samples. The plant was found to be an excluder of the all the three heavy metals. |
| **30** | **Critical limits of Cd for major soil orders of India** |
| | Pot culture experiments and Incubation studies were conducted to derive phytotoxicity limits of Cadmium for Major Soil Orders (Alfisol, Vertisol and Inceptisol) of India. The results showed that cadmium application had significant yield reduction over control. Among the different extractants, the magnitudes of bioavailable fraction were highest in $0.43MHNO_3$ followed by $1MCaCl_2$, DTPA and $0.01M\ CaCl_2$ extractant. Among the soil types, the bioavailable concentration was significantly higher in lateritic soil followed by alluvial and black soil in all the extractants used. |
| **31** | **Use of fly ash in agriculture for sustainable crop protection and environmental protection funded by NTPC, Noida** |
| | A field experiment was conducted at IISS farm to investigate the impact of fly ash application on soybean and wheat productivity. Contents of plant nutrients P, K, Zn as well as heavy metals in the fly ash were low. Growth and yield of soybean was unaffected by fly ash application. Grain yield of wheat increased up to 40 t-ha. Also, growth and yield of both soybean and wheat were not affected by fly ash even highest application rate. |
| **32** | **Reclamation and rehabilitation of coper mining affected land in Malanjkhand area of Madhya Pradesh (Hindustan Copper Limited)** |
| | • Analysis of soil, water, plant are underway.<br>• Physiological parameters have been completed.<br>• Vetiver plantation has been established in 35ha.<br>• Microbial observations are underway. |
| **33** | **Management of Municipal Solid Waste (MSW) contaminated landfill area of Bhanpur, Bhopal funded by BMC, Bhopal** |
| | • Analysis of soil, water, plant are underway.<br>• Physiological parameters have been completed.<br>• Green cover has been established.Microbial observations are underway. |
| **34** | **Evaluation of efficacy of sulphur and zinc containing complex fertilizers for maximizing yield through balanced nutrition of different crops in India (Zuari Agro Chemicals Ltd)** |

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| | The seed yield of soybean (Cv. JS-9560) varied from 0.75 to 1.55 t ha-1 and 0.81 to 1.47 t ha-1 under different treatments at two different locations of experimentation. Whereas, wheat grain yield varied from 3.11 to 4.96 t ha-1for Cv. HD-2987 and 3.62 to 5.96 t ha-1 for Cv. Lok-1 under different treatments. Application of sulphur and zinc either in the form of direct fertilizers or through NPS-1, NPS-2 and NPSZn produced higher seed/grain yield in soybean crops at both the locations. Higher crop responses under NPKSZn treatments over NPK treatment were recorded for both the crops. Total S uptake by soybean varied from 4.90 to 9.60 kg ha-1 and 3.1 to 6.0 kg ha-1 under different treatments at two places of experimentation. Wheras, total S uptake by wheat Cv. HD2987 ranged from 11.6 to 22.4 kg ha-1 and by Cv, Lok 1 ranged from 17.0 to 38.5 kg ha-1 under different treatments. Total Zn uptake by soybean varied from 55.8 to 119 g ha-1 and 58.1 to 137 g ha-1 under different treatments at two places of experimentation. Whereas, total Zn uptake by wheat Cv. HD2987 ranged from 191 to 319 g ha-1 and by Cv, Lok 1 ranged from 180 to 378 g ha-1 under different treatments. Application of S and Zn along wIth NPK enhanced S and Zn uptake by the crops respectively compared to NPK application alone. The uptake of S and Zn by the crops under direct fertilizer application was at par with S and Zn uptake of the crops obtained under application of NPS-1, NPS-2 and NPSZn. |
| **35** | **Evaluation of efficacy of zinc metalosate and boron metalosate foliar supplements for maximizing yield through balanced nutrition of important crops grown in India (Indofil Ind. Limited)** |
| | The grain yield of maize varied from 5.38 to 6.88 t ha-1 (Shaktiman 5) and 4.58 to 6.24 t ha-1 (Nath Samrat 1144) under different Zn treatments at two different locations. Whereas, wheat grain yield varied from 3.59 to 4.58 t ha-1 (HD 2987) and 5.52 to 6.43 t ha-1 (Lok 1) under different Zn treatments. Application of Zn either through soil or foliar application (either through Zn SO4 or Zn metallosate or Zn-EDTA) enhances grain yield of both the crops. The grain Zn uptake of maize varied from 96.2 to 164 g ha-1 (Shaktiman 5) and 87.6 to 181 g ha-1 (Nath Samrat 1144) under different Zn treatments. Whereas, wheat grain Zn uptake varied from 122 to 188 g ha-1 (HD 2987) and 154 to 239 g ha-1 (Lok 1). The grain yield of maize varied from 4.82 to 6.57 t ha-1 (Shaktiman 5) and 4.16 to 5.58 t ha-1 (Nath Samrat 1144) under different B treatments at two different locations, wheras, wheat grain yield varied from 3.94 to 4.73 t ha-1 (HD 2987) and 4.64 to 6.42 t ha-1 (Lok 1). Application of B either through soil or foliar application (either through B metallosate or Boric acid) enhances grain yield of both the crops. |
| **36** | **Response of crop to applied Potassium in Vertisols of India. (Sponsored project by PRII, Gurgoan)** |
| | • Both the crops rice and wheat responded to applied K in Vertisols of Bhopal, Jagtial (Telangana), Raipur, Jabalpur and Parbhani having K content more than 280 $kgha^{-1}$ (Critical limit).<br>• The revised critical limits work out based on the response at different places ranged from 330 to 355 $kgha^{-1}$ with an average of 335 $kgha^{-1}$. |
| **37** | **The Äquasorb" project Effect of aquasorb on water and nutrient use efficiency & crop productivity of soybean & tomato in selected soils of India (Funded by SNF India Pvt. Ltd. Vishakhapatanam** |
| | The effect of application of graded doses of PAA hydro gel (@0, 10, 20, 30, 40 and 50 kg $ha^{-1}$ to soil) on water absorption and retention at various suction levels (0 -15bar) in three soils of varying textures viz. clay, silty clay loam, and sandy loam, studied revealed that the water retention of these soils was augmented by hydro gel to variable degrees between 0.3 and 1.0 bar of matric suction. The effect seems good only at 0 - 0.3 bar, beyond which the effect is small that too up to 1 bar. The matric suction of 0 to 1.0 bar, however, is a narrow range especially for rain fed crops where the irrigation water is scarce and a farmer re-irrigates the crops even at 10 bar moisture content. |
| **38** | **Effect of slow N release formulations for enhancing productivity and nitrogen use efficiency in cereals sponsored by Rhodia Specialty Chemicals India limited, Mumbai** |
| | A field experiment was initiated to assess the formulations from M/s Rhodia Speciality Chemical Fertilizer Pvt Ltd. The experiment consisted of 15 treatment combinations involving two N levels, two formulations and a control. Maize (CV 4212) grain yield under different treatments varied between 2717 and 7484 kg $ha^{-1}$. Application of N at lower level *i.e*. 80 kg ha with test formulations, the maize grain yield ranged between 4636 and 5839 kg $ha^{-1}$. The formulation 0.3% AgRho N protect B resulted in significantly higher yield over 0.2% AgRho N protect B at 80 N $ha^{-1}$. The maize grain yield was increased with 120 kg N $ha^{-1}$ for urea, NUC as well as test formulations and was varied between 5578 and 6277 kg $ha^{-1}$. The formulation AgRho NN protect B has shown higher yields over N protect B at both the concentration levels. At 120 kg $ha^{-1}$ N application, highest grain yield was recorded with 0.3% AgRho NN protect B which was statistically at par with 0.2% AgRho NN protect B. The agronomic N use efficiency varied between 21.03 and 41.71 per cent which was highest at 80 kg N $ha^{-1}$ followed by 120 kg N $ha^{-1}$. |
| **39** | **Evaluation of Soil Test Kit of Warkem, Mumbai** |
| | The soil test kit developed by Warkem was evaluated. This project aimed at technical evalualtion of the kit against standard laboratory procedures. Also, if required suitable improvements in the kit would be suggested. The kit has been evalualted for N, P, K, OC, pH, B, Mn, Fe, Zn, Cu, Mo, and soil texture. The work is completed. |
| **40** | **Impact of viscose staple fibre industry treated effluent on soil health and crop production surroundings Nagda, M.P funded by M/s Grasim Industries Limited, Nagda, Ujjain, M.P.** |
| | • Survey and collection of soil water samples: Soil and effluent samples were collected from different sites surroundings Nagda town. Soil samples in particular collected from adjoining effluent irrigated fields as well as tube-well irrigated fields. Physico-chemical properties of the effluent and bore-well water were estimated including heavy metals by different standard methods. The results revealed that electrical conductivity in soil (recorded maximum 5.75 dS/m) was the critical problem for crop cultivation. As the E.C in irrigation water was also recorded high (7.28 dS/m), more number of irrigation will convert the land barren after few years. Heavy metal (cadmium, nickel, cobalt, lead, chromium etc.) content was not so high in water samples. The colour of bore well and river water was red.<br>• Green House Experiment: Bulk soil samples from different sites were collected for green house study. Pot culture study was conducted to identify suitable crops along with management practices using the treated |

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| | effluent.<br>• Field Experiments: Parallel to laboratory experiments, field experiments with different doses of FYM (0, 5, 10, 20 t/ha) were conducted at Atlawda, Nenawatkheda, Banbana, BCI Farm and Bheelsuda. Soybean (*Glycine max)* was taken as a test crop. In case of BCI Farm, due to bird and cattle menace crop was not grown. Green manuring through Dhaincha and Sunhemp was practiced in BCI Farm. It was found that the highest yield was recorded in Banbana Farm (Normal Soil). Due to salinity effect poor yield was recorded at Atlawda and particularly in Nenawatkheda village and soybean seeds were shrunken and small in size whereas soybean seed in normal soil was bold in size. |
| **41** | **Evaluation of effect of Zeba fertilizer product on nitrate-N leaching funded by M/s UPL Limited, UPL House, 610Bl2, Bandra Village, Off Western Express Highway, Bandra-East, Mumbai- 400 051** |
| | An incubation column experiment with Zeba coated fertilizer on N leaching was carried out in black soil. Two different application methods *viz,* surface application and incorporation was studied with simulated rainfall and saturated condition. The arrangement of N leached from the soil was being analyzed in the Zeba fertilizer in caparison with normal neem coated urea. |
| **42** | **Micronutrients distribution in major soil orders of India as influenced by soil properties and land use pattern** |
| | • Three fertilizer products namely NPS-1, NPS-2 and NPSZn containing sulphur and zinc were evaluated under soybean-wheat system at IISS, Bhopal.<br>• Application of sulphur and zinc either in the form of direct fertilizers or through NPS-1, NPS-2 and NPSZn produced higher seed/grain yield in soybean and wheat crops at both the locations.<br>• Higher crop responses under NPKSZn treatments over NPK treatment were reordered for both the crops.<br>• Application of S and Zn along with NPK enhanced S and Zn uptake by the crops respectively compared to NPK application alone. The uptake of S and Zn by the crops under direct fertilizer application was at par with S and Zn uptake of the crops obtained under application of NPS-1, NPS-2 and NPSZn.<br>• Two foliar supplements namely zinc metalosate and boron metralosate were tested for their efficacy in maize-wheat system at IISS, Bhopal, against the standard sources of fertilizers.<br>• Application of Zn either through soil or foliar application (either through $ZnSO_4$ or Zn metallosate or Zn-EDTA) enhances grain yield of both the crops.<br>• Application of B either through soil or foliar application (either through B metallosate or Boric acid) enhances grain yield of both the crops.<br>• Under AICRP-MSPE, studied the spatial distribution pattern of micronutrients in a deccan plateau region of India and derived micronutrient management zones for site-specific micronutrient management<br>• Accomplished duties and responsibilities such as compilation of AICRP material for cabinet/DARE report, regional committee report, annual report and newsletter of Institute, as and when assigned by the Project Coordinator<br>• Assisted Project Coordinator in compilation of achievements of AICRP for RAC, QRT and DG review meeting<br>• Prepared proposal for new research project |
| **43** | **Impact Assessment of Neem Coated Urea and Soil Health Card in Central and Western India** |
| | • Developed new research project on "Impact Assessment of Neem Coated Urea and Soil Health Card in Central and Western India"<br>• The divisional seminar was given on July 26, 2018<br>• The Pre-IRC seminar delivered on August 01, 2018<br>• The questionnaire has been developed to collect primary data and survey will be initiated after IRC seminar |
| **44** | **Socio-Economic impact of use of polluted irrigation water on soil quality and crop productivity near Ratlam industrial area in Madhya Pradesh** |
| | Project initiated and PI has been transferred to ICAR-IARI, New Delhi |
| **45** | **Enhancement of Soil Health and Livelihood of Tribals in Central India** |
| | New Project approved |
| **46** | **Enhancement of nutrient (N & P) use efficiency and nutritional quality of wheat for improved soil and crop productivity** |
| | New Project approved |
| **47** | **Climate change impact on soil and water productivity of major crops in central India** |
| | New Project approved |
| **48** | **Impacts of conservation agriculture on runoff and soil loss under different cropping system in Vertisols** |
| | Site was selected and preliminary earth work was carried out.<br>*For testing homogeneity among replications with in treatment initial raising of maize and soybean crop<br>*Fixing of multislot divisor and tanks at the site. |
| **49** | **Quantitative assessment of acid mine drainage affected areas in Madhya Pradesh** |
| | • Exploratory survey was done in two coal mines areas of MP (Singrauli and Chirmiri) in the month of September 2019. |

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| | • For primary investigation collected information form NCL & SECL office.<br>• Collected soil and water samples from coal mine & adjacent areas & also took in-site measurement of water quality parameter. |
| **50** | **Assessing the potential impact of climate smart technologies on soil health and nutrient accounting in selected vulnerable districts of MP funded by EPCO, Bhopal** |
| | • Project sanctioned in July 2018<br>• SRF appointed<br>• Instruments purchased<br>• Grid based (1 X 1 Km) soil and plant samples collected from 20 climate smart villages in vulnerable districts of Sehore and Rajgarh.<br>• Recorded basic site characteristics, land use, cropping history, quantity and types of fertilizer and manure use, etc<br>• The soil samples were processed and stored in containers for further analysis<br>The analysis of soil samples for different physico-chemical and biological properties using standard method is in progress. |
| **51** | **Assessing the potential impact of climate change and management on soil carbon and nitrogen storage in selected ecosystems of India funded by NASF** |
| | Lead Centre (ICAR-IISS):<br>• SRFs appointed.<br>• Project launching workshop organized and held from 25$^{th}$ to 27$^{th}$ Oct., 2018 to finalize the experimentation and methodology, trained the SRFs of both centres to follow a common and uniform protocol.<br>• Participated in the 5th Annual Review Meeting of the project under NASF on 30$^{th}$ January, 2019 at NASC Complex, PUSA, New Delhi.<br>• Procured the instruments BOD incubator (2 no.), FTIR (1 no.) and Gas Chromatograph (1 no.).<br>• The soil samples collected from 0-15, 15-30, 30-60 and 60-90 cm soil depths from three long-term experiments in soybean based cropping systems from different agro-ecosystems of Vertisol viz, Bhopal, Jabalpur, Indore.<br>• Soil samples were processed and incubation experiment set up<br>Characterization basic/initial soil properties was done following standard methods |
| **52** | **Management of Municipal Solid Waste contaminated dumping area of Bhanpur, Bhopal funded by MPCST, Bhopal** |
| | • Analysis of soil, water, plant are underway.<br>• Physiological parameters have been completed.<br>• Green cover has been established.<br>• Microbial observations are underway. |
| **53** | **Exploring endophytic fungi for the phytoremediation of heavy metal contaminated soils funded by DST** |
| | • Isolation of endophytic fungi from the root of vetiver grass<br>• The isolated fungi were tested for heavy metal tolerance |

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