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**भा.कृ.अनु.प.-भारतीय मृदा विज्ञान संस्थान की २३ वीं
अनुसन्धान सलाहकार समिति की कार्यवाही**

**Proceedings of XXIII Research Advisory Committee
Meeting of ICAR-Indian Institute of Soil Science, Bhopal**

**२२-२३ सितंबर, २०१७
22-23 September, 2017**



**भा.कृ.अनु.प.- भारतीय मृदा विज्ञान संस्थान
नबीबाग, बैरसिया रोड, भोपाल ४६२०३८**

**ICAR-Indian Institute of Soil Science
Nabibagh, Berasia Road, Bhopal**

Proceedings of the XXIII RAC meeting of ICAR-IISS held on September 22-23, 2017

The XXIII meeting of the Research Advisory Committee (RAC) of the Institute (Second meeting of the current RAC) constituted vide the council letter no. NRM/12-16/2014-IA-II dated November 7, 2014 was held on September 22-23, 2017 at the Committee Room of ICAR-IISS, Bhopal. The following members were present:

1. Dr. C.L. Acharya	Chairman
2. Dr. T.K. Adhya	Member
3. Dr. N.S. Raghuwanshi	Member
4. Dr. S.K. Chaudhari, ADG (SWM), ICAR	Member
5. Dr. A.N. Ganeshamurthy	Member
6. Shri Thakur Bhupendra Singh	Member
7. Dr. Ashok K. Patra, Director, ICAR-IISS	Member
7. Dr. PradipDey, PC (STCR)	Member Secretary
8. Dr. Muneshwar Singh, PC (LTFE)	Special Invitee
9. Dr. A.K. Shukla, PC (MSN)	Special Invitee
10. Dr. S. R. Mohanty, NC (SBB&BF)	Special Invitee
11. Dr. J.K. Saha, HOD, ESS	Special Invitee
12. Dr. A.K. Biswas, HOD, SC&F	Special Invitee
13. Dr. M.C. Manna, HOD, Soil Biology	Special Invitee
14. Dr. R.S. Chaudhary, HOD, Soil Physics	Special Invitee

In addition to above, all the scientists of ICAR-IISS, Bhopal were present. Dr. (Mrs.) A. Juwarkar, and Shri Om Prakash Yadav could not attend the meeting due to their pre-occupations. The Project Coordinators, Heads of Division, Scientists, Sr. AO and FAO participated in the meeting. The RAC deliberated on the work in progress and thrust areas of research keeping in view the mandate and vision of the Institute and made recommendations. A visit to the farm and research facilities including in laboratories was also organized. The Agenda Notes and Action Taken Report on the proceedings of the XXII meeting of the RAC held on April 4-5, 2016 were circulated beforehand. Action taken report has been provided in Table 1 and detailed Programme of XXIII RAC Meeting in Annexure-I.

Welcome by the Member-Secretary

The meeting started with ICAR song. This was followed by lighting of lamp by Chairman and Members of RAC. At the outset, Dr. Pradip Dey, Member Secretary, RAC welcomed the Chairman, Members of RAC and all Special Invitees of the RAC along with other scientists and informed that as a follow up of the Proceedings of the XXII RAC meeting (April 5-6, 2016) a critical review of the research projects was done in the IRCs. He also mentioned that ICAR-IISS is eagerly looking forward for objective reinforcement of research work of the institute from the RAC.

Confirmation of the minutes of the last (XXII) meeting of RAC

The Member-Secretary informed that the proceedings and recommendations (Council letter No. NRM-1-18/2013-SW&DF dated 7th June, 2016) of the last (XXII) meeting of the RAC held on April 4-5, 2016 has already been circulated to all.

Review of the Action Taken Report (ATR) on the XXII RAC Meeting

The Member Secretary presented the Action Taken Report on the issues raised in the XXII meeting of the RAC. The Action Taken Report with respect to action points raised during the last (XXII) RAC Meeting and the action taken on those points are mentioned in Table 1 below which, after elaborate discussions, was confirmed and approved by the RAC.

Table 1. Action Taken Report on the recommendation of the XXIII RAC Meeting

Sl. No	Recommendation	Action taken report
1.	Strategic entry point of every project including conservation agriculture has to be conservation of water and soil resources apart from other input: all Institute projects have to be mandated to create facility for generation, conservation and management of water resources and other inputs. Focused work on conservation agriculture for chickpea and soybean should be taken up.	<ul style="list-style-type: none"> • To harvest and conserve excess runoff of rainwater, two of the existing farm ponds of Institute were lined with anti seepage polyethylene cross woven UV resistant film of 300 gsm. This will help in augmenting the water storage, check the water loss through seepage, of precious harvested rainwater from the ponds, extend availability of irrigation water for a longer period and the water can be a surety for irrigating winter season crops. • To improve water productivity and exploit the synergy of water and nutrient interaction under conservation agricultural practices a field experiment has been undertaken to identify suitable irrigation water application and nutrient management technique for two important cropping systems namely, soybean-wheat and maize-chickpea. Conservation agriculture through management of crop residues and reduction of tillage operations in situ conserves soil moisture within the profile and also reduces soil loss through reduced runoff. To fine tune conservation agricultural (CA) practices for the Vertisols a field experiment has been initiated on soybean and chickpea crops under Consortia Research Platform (CRP) on CA. CA practices for the soybean and chickpea crops have also been demonstrated in farmers' field.
2.	As per Government mandate entire urea is going to be distributed as <i>neem</i> coated urea and hence the	<ul style="list-style-type: none"> • A field experiment was conducted at ICAR-Indian institute of soil science, Bhopal to evaluate the different coated

	<p>institute needs to initiate work on efficiency and savings N from <i>neem</i> coated urea.</p>	<p>urea materials and found that <i>Neem</i> Coated Urea (NCU) recorded significantly higher grain, stover and total dry matter yield and N use efficiencies in maize as compared other urea materials. The same is being verified for economic feasibility.</p>
3.	<p>Critical analysis of soil organic carbon, micronutrient and setting up long-term ecological sites for addressing microbial diversity in major agro-ecological regions need to be taken up</p>	<ul style="list-style-type: none"> • A project entitled “Effects of long term use of fertilizer and manure on soil functional diversity and nutrient supplying capacity under different soils and cropping systems” has been initiated under the Institute programme III in the Division of Soil Biology (i) to study the impact of nutrient management on soil carbon dynamics and nutrient cycling (N,P,K) and related functional diversity of microbes under the long term fertilizer and manure application in major soil orders of India and (ii) to determine nutrient supplying capacity vis-à-vis establishing relationship with abundance of microbial functional gene in major soil orders under long term fertilizer experiments. The work is in progress. • The status of micronutrients in different agro-ecological regions of India has been assessed and published in Annual Report.
4.	<p>Studies on impact of disposal of municipal waste, sewage application on peri-urban agriculture and ground water pollution due to NO₃ and pesticides may be attempted</p>	<ul style="list-style-type: none"> • A project proposal entitled “Scientific management of municipal bio-waste for enhancing crop productivity and soil health” has been initiated for funding from ICAR-NASF (i) to develop an efficient composting technique using effective bio-inoculum consortium for rapid decomposition of bio-waste, (ii) to develop technology for reduction of heavy metals loading using a bio-filter and reduce pathogens in municipal solid waste, (iii) to evaluate nutrient enriched compost using various indigenous nutrient sources for improving nutrient use efficiency and soil health. The proposal has been accepted and need to be presented for final recommendation. • Another project on “Management of Municipal Solid Waste Contaminated

		<p>dumping Area of Bhanpur, Bhopal” has been initiated to study the impact of disposal of municipal waste.</p> <ul style="list-style-type: none"> • Although earlier two projects “Investigation on the effect of continuous use of sewage water as irrigation on the swell-shrink soil quality” and “Impact of long-term use of sewage water for irrigation on soil and crop quality in Bhopal region of Madhya Pradesh” have generated information on impact of sewage irrigation on soil quality, a new inter-institutional project on impact of soil and sewage water irrigation on fodder and milk quality is being formulated with collaboration between IGFRI-Jhansi and IISS-Bhopal.
5.	Methodology for easily measurable parameters for soil physical and biological properties should be developed and disseminated	<p>Soil respiration and dehydrogenase activity are the most convenient biological parameters. The work is in progress.</p> <ul style="list-style-type: none"> • Through an institute project easily measurable techniques for some important soil physical parameters like aggregate stability, penetration resistance, infiltration rate etc. has been developed and tested. Locally available and easy to fabricate instruments were used for measurement of these parameters. Refinement on the methods and implements is under progress for more reliable and reproducible data generation. • A uniform protocol has been discussed and communicated to all the centers to follow the same methods for the estimation of a specific physical, chemical and biological properties of soil, so that variation due to method is ruled out to determine soil quality in better manner.
6.	Economic evaluation and scope of applicability of technology developed by the Institute should be done.	<ul style="list-style-type: none"> • Economic evaluation of vermicompost technology with earth worm species <i>Eiseniafoetida</i>, <i>Eudrillus Eugenia</i> and <i>Perionyxexcavatus</i> showed that about 3 tonnes of vermicompost can be produced from 10 beds of 10 x 3 x 1.5 feet size bed per year. The cost of earthworms is Rs 400 per kg. A 50 kg

		<p>bag of vermicompost can be sold for Rs 150 (Rs3000/ tonne).</p> <ul style="list-style-type: none"> • Rapid compost technology for the preparation of 100 kg compost, 150 kg fresh biomass (waste material), 50 kg fresh cowdung, 1.1 kg Urea, 50 g fungal inoculum (10^5 viable cell), 1 litre bacterial (10^8 viable cell), and 1 litre actinomycetes (10^8 viable cell), inoculum are required; the cost of bio compost worked out to be Rs 5 per kg (Benefit). • Phospho-Sulpho-Nitro compost for preparing 1000 kg of PSNC, 1000 kg organic wastes, 200 kg cow dung, 333 kg phosphate rock, 120 kg pyrites, 13kg urea and 50 kg soil. In addition, suitable fungal and bacterial culture required; the cost analysis showed that requirement of capital of Rs. 21,000 for pit preparation (first year) + Rs. 3000/tonne. The cost of the bio compost is Rs.3/kg. • District wise applicability of fertilizer prescription equations under different agroecological regions have been documented and transferred to DAC, Ministry of Agriculture and Farmers Welfare which was included in the online DSS developed under soil health scheme of Govt. of India (http://soilhealth.dac.gov.in/). • Economics of technology worked out and demonstrated on farmers' field. The farmers have been informed about feasibility as well as cost: benefit ratio through <i>Mera Gaon Mera Gaurav</i> programme.
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Remarks of the Director and progress report of the Institute

At the outset Dr Ashok K. Patra, Director, ICAR-IISS welcomed the Honourable Chairman and Members of RAC and also apprised them about the new initiatives taken after the last meeting of the RAC held on April 4-5, 2016. In his introductory remarks, he briefly presented the salient achievements of the Institute and highlighted several important issues related to soil health, nutrient use efficiency, conservation agriculture and carbon sequestration, soil microbial diversity and genomics, heavy metal pollution, remediation and environmental security and climate change.

He emphasized about the work done on integrated nutrient management, rapo-compost and use of nano rock phosphate for improving crop productivity and soil health. He further mentioned about the *Mera Gaon Mera Gurav* Programme and farmers' participatory research/ demonstration of the technologies at farmers' fields under the aegis of institute as well as various AICRP centers located across the length and breadth of the country. During the year reported, some new technologies and methodologies were developed and refined by the institute viz. Upgradation of Mridaparikshak – Minilab with five (Cu, Mn, Gypsum requirement, lime requirement and calcareousness) more parameters; development of prediction models for SOC using MIR spectroscopy; biofertilizer consortium; bio-reactor for accelerated biodegradable waste decomposition.

Address by the RAC Members

Dr. T.K. Adhya, Member, RAC in his address praised the overall research activities of the Institute and felt the structured efforts of the scientists have put the ICAR-IISS, Bhopal on International map. He also stressed for the strategic research on characterization of dominant chemical equilibrium in major benchmark soils, nutrient dynamics and solid phases controlling nutrient availability as influenced by soil microbial diversity. He further expressed concern that the soils are highly dispersible and even some normal soils are eroded with sheet, rill and gully erosions due to river water and thereby some fertilize soils are lost. He advised the scientists to develop fertigation schedules for different crops.

Dr. S.K. Chaudhari, ADG (SWM) & Member, RAC emphasized the need for making climate strategic use of soil resources. Bulk density, clay content, water holding capacity, etc. are some of the soil quality indicators are taken into account in addressing the concern over the issues of soil erosion and low water productivity. Further, he pointed out soil health deterioration, land degradation and nutrient imbalance in soil are the major concerns in contemporary agriculture. He suggested the use of water conservation technologies such as laser land leveler, zero tillage, etc for enhancing productivity and soil health. Dr. Chaudhari said that multiple use of water provides challenging opportunities for increasing water productivity and livelihood, and enabling crop diversification. Besides, he delved upon the economy of nitrogen losses, nutrient based subsidy policy, participatory watershed management, amelioration of acid soils, irrigation induced soil degradation, raising bund height for efficient utilization of rainfall, rainwater harvesting through farm ponds for supplementary irrigation, exploring new sensors for efficient water management and precision agriculture.

Dr. N.S. Raghuwanshi, Member, RAC in his address mentioned that the soil quality performs variety of the functions for maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling, and providing support for plants and other structures. He also emphasized the importance good soil health for ensuring sustainability of higher agricultural productivity, especially in the context of climate change scenario as well as unprecedented exploitation of soil resources. He also stressed upon the water quality and its judicious use. He further added that identifying and overcoming the constraints that limit the pace of progress and capacity building at different levels should receive greater attention.

Dr. A.N. Ganeshaurthy, Member, RAC opined about crop nutrition and dependence of modern agriculture to the steady supply of synthetic inputs (mainly fertilizers), though several adverse effects have been reported due to the excess and imbalanced use of these synthetic inputs. He elaborated on the overuse of mineral fertilizers, pesticides and inadequate management practices of soil and their possible adverse effect on the soil health by changing its physical, chemical and

biological properties. The situation warrants to explore and identify harmless inputs like beneficial microbes. He also told that there was a need for research efforts to focus on methods to reduce the phytate content of Indian foods to enhance bioavailability. This should be at the forefront of nutritional programmes rather than trying to improve the quality or yield of crops. He also warned that efforts to improve the quality and yield of crops or the 'biofortification programmes' will prove to be a failure if they do not address the issue of bioavailability of nutrients.

Shri Thakur Bhupendra Singh, Member, RAC raised pertinent issues related to farm and farmers. He mentioned that farm families consume a substantial part of what they produce. While some of their output may be sold in the market, their total production is generally not much larger than what is needed for the maintenance of the family. Not only is productivity per worker low under those conditions, but yields per unit of land are also low. Even where the land was originally fertile, the fertility is likely to have been depleted by decades of continuous cropping. The availability of manures are also not sufficient, and the farmers cannot afford to purchase them for application.

Address by the Chairman

Dr. C.L. Acharya, Chairman, RAC in his introductory remarks expressed his satisfaction over the scientific work being carried out by ICAR-IISS, Bhopal and large number of technology demonstrations at farmers' fields. He also complimented the Director and all the staff members on their outstanding accomplishments in the field of soil science, but stressed the need to accelerate the technology dissemination.

The Chairman, RAC in his remarks mentioned that the Institute has done commendable work on different aspects of soil research. He emphasized that there is a need to develop technologies and methodologies for enhancing the use efficiency of inputs. He also called upon the soil scientists of the country in general and institute scientists in particular to make their presence felt at National level in addressing the soil related issues and for enhancing the productivity of soil resources. He also focused on judicious use of water and screen may be used for checking evaporation. He emphasized that Institute should come up with a viable model for rain water harvesting & soil conservations as to utilize the conserved moisture for pulse crop in the suitable cropping system.

He also mentioned that water is prime natural resources, a basic human need and a valuable asset. He opined that planning, development and management of water resources need to be governed by national perspectives. Hence, there is need for proper plan on local basis for improving and maintaining natural resources for better environment and benefit of people in the region as well as in the country. He emphasised that water is a critical input into agriculture in nearly all its aspects having a determining effect on the yield. Good seeds and fertilizers sometimes fail to achieve their full potential if plants are not optimally watered. He raised queries viz. - How does farmers' demographic and socio-economic characteristic affect water demand and crop production?; What are the types of agricultural crops grown and is it fit or suitable with the current water condition?; What are the major sources of agricultural water used and is it compatible for agricultural purposes with crops grown in terms of quantity and quality; How people perceive on the agricultural water quality?; and how to enhance the agricultural water efficiency to help the farmers in improving their agricultural technology and crop productions?

General discussion took place thereafter. In general, all the members appreciated the efforts of the Institute in maintaining excellence in research and farmer-friendly research programme.

Presentation by Project Coordinators/Heads of Division

Earlier achievements of all the Divisions and AICRPs were presented by respective HoDs and PCs, the brief of which is given below:

AICRP (Long Term Fertiliser Experiment)

Dr. Muneshwar Singh, PC (LTFE) presented the highlights of AICRP (LTFE) research findings. He pointed out that data from field experiments conducted to study response of crops for potassium application in Vertisols at Bhopal, Akola, Jagtial, Jabalpur and Parbhani revealed that in spite of high K content in soil, crops responded to applied K. The soil carbon predicted by model revealed that soil can't retain carbon beyond a particular limit even if carbon is added more and also soil can't lose its carbon below a certain value which are called as saturation and threshold carbon values of soil. He also mentioned that increase in productivity on application of fertilizer resulted in increased soil carbon and microbial population. Thus ruled out the belief that chemical fertilizer deteriorate soil carbon and adversely affect plant growth and development and microbial population. .

AICRP (Micro and Secondary Nutrients)

Dr. A.K. Shukla, PC (MNS) highlighted the achievements; as delineation of micro-and secondary nutrients deficiency in 198 districts of the country and maps of S, Zn, Cu, Fe, Mn and B were prepared using GIS. He stated that heavy metal content in soil-plant system in peri-urban areas irrigated with untreated sewage effluents were assessed. He also informed that amelioration techniques were standardized for mitigating micro-and secondary nutrients deficiencies in different soil plant systems. The visible symptoms of Fe, Mn, Cu, Zn, Mo and B deficiencies in cabbage, cauliflower, mustard, tomato, radish, potato and spinach were catalogued through colour photographs. The critical limits were also refined for black gram, rapeseed, rice, wheat, groundnut, potato, lentil, soybean, moong bean, mustard, maize and chickpea.

AICRP (Soil Test Crop Response)

Dr. Pradip Dey, PC (STCR) highlighted development of fertilizer prescription equation for different crops. He also mentioned that STCR centres have developed post-harvest soil test prediction equations for recommending fertilizers to the crops. He also pointed out that several centres have developed fertilizer prescription equations under Integrated Nutrient Supply Systems (IPNS) to recommend nutrients through inorganic and locally available organic sources. He also highlighted about the frontline demonstrations organized on farmers' fields and capacity building programmes which are being conducted under the Tribal Sub Plan in 15 States to demonstrate the importance of soil test based fertilizer and manure recommendations for getting higher returns from applied nutrients through targeted yield approach.

AINP (Soil Biodiversity- Biofertilizers)

Dr. S.R. Mohanty, NC (SBB&BF) highlighted the benefits of biofertilizer for the bio-energy crop *Pongamia*. Inoculation with *Rhizobium* improved nodulation and dry matter production by 55% and 35%, respectively over control. Also mentioned about Nitrogen fixers like *Microbacterium*, *Cellulosimicrobium*, *Paenibacillus*, and *Azospirillum lipoferum* are being tested on black pepper, ginger, cowpea and bitter gourd. Among all biofertilizer strains tested, *Paenibacillus* was best for increasing nodulation and productivity. Population of *Trichoderma* was comparatively higher in the rhizosphere of healthy Arecanut palms in comparison to those affected by yellow dwarf

disease. Biofertilizers viz., *Azotobacter chroococcum*, *Azospirillum lipoferum* and PGPR mix-I of total 1.5 tonne was distributed to 150 beneficiaries in twelve tribal settlements of Wayanad district. He also expressed that Integration of biofertilizers with liming increased the yield of cereal-vegetable-pulse cropping system by 45% in acid soils of Orissa.

Division of Soil Chemistry and Fertility

Dr. A.K. Biswas, Head, Soil Chemistry and Fertility Division (SC&FD) highlighted about Long – term evaluation of integrated plant nutrient supply modules for sustainable productivity in a Vertisol. He mentioned that among different modified urea materials tested, NCU recorded higher nitrogen use efficiency, grain, stover and total dry matter yield of maize crop followed by biochar coated urea and pine oleoresin coated urea. He also highlighted that biochar application as soil amendment in acid soil increased the above ground and below ground biomass yield that was at par with lime or FYM application. He further informed that the overall performance of the crops under CA in farmer's field was quite encouraging and the system productivity recorded in farmers' field was higher under CA than farmers practice.

Division of Soil Physics

Dr. R.S. Choudhary, Head, Soil Physics Division (SPD) highlighted the best bet conservation agricultural (CA) practices for two predominant cropping systems namely, soybean-wheat and soybean-chickpea. He also explained conservation tillage practices in combination with crop residue retention followed for six years showed positive impact on aggregate stability; aggregate associated C content and different carbon pools. He also presented reduced tillage with residue retention showed a positive effect on macro- and micronutrient availability in soils after four crop cycles. Weeds in maize based cropping system under CA could be effectively managed with pre-emergence application of Pendimethalin @ 750 g ai/ha followed by post-emergence Atrazine @ 1000 g ai/ha at 30 DAS.

Division of Soil Biology

Dr. M.C.Manna, Head, Soil Biology Division (SBD) highlighted enzymes like dehydrogenase, alkaline phosphatase and fluorescein diacetate can be used as an indicator of soil microbial function. The count of culturable group of microbes, viz. bacteria, fungi and actinomycetes were significantly higher upon nutrient addition from organic sources. Application of ligno-cellulolytic fungi, actinomycetes and bacteria along with cowdung slurry, starter nitrogen, molasses and curd accelerated the in-situ decomposition process resulted in rice and wheat residue decomposition within 30 days and for sugarcane about 45 days.

Division of Environmental Soil Science

Dr. J.K. Saha, HOD (ESS) highlighted the Impact of sewage water irrigation on heavy metal accumulation and food chain contamination. Among the different crops investigated high metal content of Cu, Cd, Pb, Cr and Zn were observed in mustard leaves. Also highlighted that critical limits of chromium and lead in different soil types of India were determined based on approach of zero tolerance to food contamination. Also highlighted the collaborative project entitled "Reclamation and Rehabilitation of Copper Mining Affected Land in Malanjkhand Area of Madhya Pradesh" sponsored by Hindustan Copper Limited, Malanjkhand, has been initiated.

Brainstorming Session

A Brainstorming session on *Inclusion of Physical & Biological parameters for soil health card* was organized on 23rd September, 2017 (afternoon). This was initiated by brief remarks from the Chairman, RAC about the need for integration of physical and biological parameters in soil health card to make it more meaningful. Two presentations were made by Dr. M.C. Manna and Dr. R.S. Chaudhary on different physical and biological parameters and the easily measurable indicators for biological and physical parameters, respectively. Dr. Manna informed that dehydrogenase activity and soil respiration are two important parameters for measuring soil biological health. Dr. Chaudhary pointed out that ICAR-IISS has developed procedures for determination of penetration resistance and soil aggregate stability. This was followed by general discussion on the issue. It was pointed out that among soil biological properties, organic carbon is a very good indicator of soil biological health and has already been included in Soil Health Card Scheme. After thorough deliberation regarding inclusion of indicators related to biological and physical aspects in Soil Health Card, the discussion was limited to the following recommendations to which the house agreed:

- Available data on soil texture, bulk density, infiltration and available water capacity need to be used for better enumeration of soil physical health.
- Soil organic carbon which continues to be a parameter in Soil Health Card Scheme will take care of soil biological health.

After detailed discussion, RAC finalized the following recommendations:

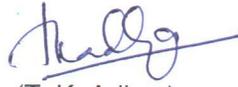
- Mechanism of K solubilizers and perspective analysis of biochar need to be reviewed and status papers should be prepared on these two aspects.
- Prediction of post-harvest nutrient status in a cropping system and functional food components should be studied with targeted yield approach.
- History of inputs management influencing microbial biodiversity need to be studied for their possible use to improve soil health.
- Soil spectroscopy study need to be broadened with more number of soils and management practices.
- Determination of critical limits and farmer friendly phytoremediation techniques for heavy metal contaminated soils need to be developed.
- The Institute should estimate/work out the monetary gains through Soil Science research for ascribing impact assessment.
- There is need to establish a soil ecology laboratory in the institute to enumerate the threat to the soil health and ecology consequential to agricultural intensification through enhanced Inorganic fertilizer use, pesticides and amendments

The meeting ended with the vote of thanks to the Chair, Members of the RAC and all others present in the meeting as well as all those who helped directly and indirectly for successful organization of the XXII RAC Meeting.

Chairman and Members of the Research Advisory Committee of ICAR-Indian Institute of Soil Science, Bhopal express their heartfelt thanks to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR and Dr. K. Alagusundaram, DDG (NRM) for providing opportunity to strengthen the research work of the Institute. They also thank the Director, Member Secretary and all Staff, ICAR-IISS for facilitating the work and visit of the Research Advisory Committee on September 22-23, 2017.


(C.L. Acharya)
Chairman


(A. N. Ganeshamurthy)
Member


(T. K. Adhya)
Member


(Thakur Bhupendra Singh)
Member


(N.S. Raghuwanshi)
Member


(S.K. Chaudhari)
ADG (SWM) & Member


(A.K. Patra)
Director & Member


(Pradip Dey)
PC(STCR) & Member Secretary