



# ICAR - IISS Newsletter



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## FORTHCOMING EVENTS

An International Webinar on 'Soil Spectroscopy' will be held on 1<sup>st</sup> October 2020 jointly organized by ICAR-IISS, Bhopal & ICRAF, Nairobi, Kenya.

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## Director's Desk

### Recarbonization of Indian Soils

Conventional practices involving repeated intensive tillage operations, residue burning and high or low-input farming resulted in decline in crop productivity and soil health deterioration. Depending upon how soil is managed, it can serve as a source or sink for atmospheric carbon dioxide (CO<sub>2</sub>). As the atmospheric CO<sub>2</sub> concentration continues to increase globally,



more attention is being focused on the soil as a possible sink for atmospheric CO<sub>2</sub>. IPCC published a Special Report on Climate Change and Land (IPCC, 2019), highlighting that increased soil organic carbon (SOC) content is one of the most cost effective options for climate change adaptation and mitigation, and to combat desertification, land degradation and food insecurity. Soils constitute the largest pool of actively cycling carbon in terrestrial ecosystems and stock about 1500-2000 Gt C (to a depth of 1m). For India it is only 9 Pg, in various organic forms ranging from recent plant litter to charcoal to very old, humified compounds and inorganic carbon or carbonate carbon. The amount of SOC in Indian soils is relatively low, ranging from 0.1 to 1% and typically less than 0.5%. The influence of SOC on soil fertility and physical condition is of great significance. Indian soils classified under Inceptisols and Entisols contribute about 22 and 7% of the total SOC stock, respectively. Vertisols are extensive in the central and southern part of India and contribute about 13% of the total SOC stock, whereas arid soils belonging to arid ecosystem contribute 37% of the total SOC stock mainly because of large area occupied by them. Most of Alfisols occur in sub-humid to humid regions of the country contributes about 20% of the total SOC stocks. The low SOC concentration in Indian soil is attributed to extractive practices of nutrient mining, imbalanced fertilizer use, removal of crop residue for fodder or household fuel and soil degradation. Increasing carbon content in the soil, through good agronomic practices, produce a number of benefits in terms of soil biodiversity, soil fertility and soil water storage capacity including productivity. Soil carbon sequestration through the restoration of soil organic

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matter (SOM) can further reverse land degradation and restore soil health through restoring soil biota and the associated ecological processes.

Under natural vegetation, organic carbon may reach a near-steady state after 500 to 1000 years. Depletion of SOC under cultivated field was 23 to 48% of original value. It is documented that the agricultural soils of northwest India exclusive of the Himalayas have lost about one half to two thirds of their original organic carbon content. During the last few decades, researchers have identified specific SOM fractions with functional significance in the turnover of SOC. Among these fractions, soil microbial biomass C and water-soluble C fractions are the most active and labile pools, which having short turnover times. Moreover, slow pool or particulate organic carbon are used as an indicator of soil quality rather than total organic matter. Organo-mineral fractions of specific particle size ( $<0.053$  mm) helps in development of stable microaggregates and slow decomposition rate within aggregates with respect to their composition and turnover time. Diversified cropping systems with better management substantially improved C-sequestration rate in semiarid regions of India. The experience gained from long term fertilizer experiment established that NPK and NPK+FYM maintained or improved SOC pools over initial value. Further, it was reported that active fractions of SOC viz., particulate organic carbon, water-soluble carbon and hydrolysable carbohydrates, soil microbial biomass C and N, improved significantly with the application of NPK and NPK+FYM under different cropping systems. Alternate land use systems, viz., agro-forestry, agro-horticulture, and agro-silviculture are more remunerative for SOC restoration as compared to sole cropping system. In northeast hill states of India, practicing above three land use systems has resulted in reduced

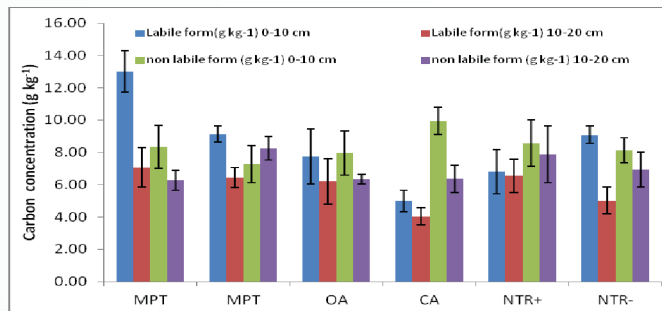
soil erosion and SOC considerably. Also, conversion of long-term arable crop land to agri-horticultural system resulted in a significant increase in SOC, soil biological activities, and fertility status. One way to increase the amount of crop residue carbon added to soils is through the use of cover crop which besides adding carbon to soil and helps to decrease erosion, suppression of diseases and nematode population. Multiple cropping with two or more crops in a year can result in increased SOC contents due to addition of large amount of above ground as well as belowground biomass in soil. This is further enhanced by inclusion of green manuring crops and minimum soil disturbances in the form of no-tillage or minimum tillage coupled with maximum soil cover (at least 30% crop residue cover) and diversified cropping system. This helps in checking the runoff and soil erosion but also improves soil aggregation, infiltration and enhances carbon sequestration in the long run. Conservation agriculture can conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with external inputs. It contributes to environmental conservation as well as to enhanced and sustained agricultural production. SOC-centered sustainable soil management practices not only mitigate GHG emissions but also provide multiple benefits such as enhancing food security and farm income, reducing poverty and malnutrition and essential ecosystem services. Recarbonization of our soils could be a feasible solution to decarbonize our atmosphere and mitigate climate change.

(Ashok K Patra)  
Director

## RESEARCH HIGHLIGHTS

### Land use affects soil carbon pools

Land use effect on soil carbon pool was assessed under different land use systems of central India. Very labile (VL) form of carbon ranged from 14 to 37.5% of total carbon under the different land use systems in 0-10 cm of soil depth. The highest value of 37.5% of VL form of carbon was recorded in agri-horticulture system (MPT). This was followed by pure horticultural (MP) system (33.4%). The lowest value of 14% was recorded under the conventional agricultural (CA) system. Retention of residue under no till system (NTR+) recorded 6% higher concentration of VL form of carbon than NT with 0% of residue retention (NTR-). The data indicates that as the carbon concentration of soil increases it contributes more carbon towards the very labile form of carbon. In contrast, the non labile (NL) form of carbon (percentage of total carbon) was found maximum (49%) in CA system and lowest (25%) was recorded under the MPT system. It also suggests that recalcitrant carbon concentration is the major fraction when the soil organic carbon concentration is at lower level. It is worth to mention that labile form of carbon was higher in 0-10 cm of soil depth whereas recalcitrant carbon was found higher in 10-20 cm of soil depth. Conservation tillage, incorporation of crop residues and application of manure as practiced in agro-forestry land use types should be promoted for more C sequestration in agricultural soils.

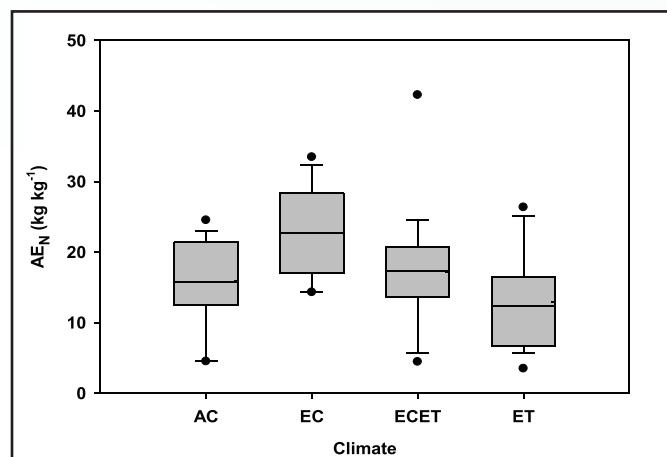


Effect of land use on soil carbon pools

### Climate change affects nutrient use efficiency in wheat

To investigate the effect of climate change on nutrient use efficiency, a field experiment was conducted in wheat crop for three consecutive cropping seasons during 2016 to 19 under elevated CO<sub>2</sub> and/or elevated temperature conditions in Open Top Field Chambers (OTC) in the Vertisols of Bhopal. The crops were grown under two atmospheric CO<sub>2</sub> levels (ambient and 550 ppmv) and two air temperature levels (ambient, 2.0 °C above ambient) in OTCs. Climate showed a significant effect on

agronomic N use efficiency (AE<sub>N</sub>). However, the effect of year and climate × year interaction was statistically insignificant. Elevation in CO<sub>2</sub> showed 43 % higher AE<sub>N</sub> as compared to ambient, whereas, co-elevation of CO<sub>2</sub> and temperature showed 8% higher AE<sub>N</sub>. Sole elevation of temperature decreased the AE<sub>N</sub> by 18.6%. Among the climate treatments, AE<sub>N</sub> under CO<sub>2</sub> elevation was significantly higher than ambient and sole temperature elevation treatments, with the latter two at par with each other. Also, elevation of CO<sub>2</sub> alone or combined with temperature elevation resulted similar agronomic N use efficiency.



Climate change impact on agronomic use efficiency in wheat

### Bulk density and labile carbon fraction: An important indicator for soil health monitoring

The Principal Component Analysis (PCA) based on the variance of the dataset indicated soil bulk density to be an important physical property that served as an indicator in the minimum dataset (MDS) for soil health in five out of the six agro-ecological sub-regions (AESRs) studied. Variation in soil bulk density is being observed and thus the soil bulk density should be included as a physical parameter in routine soil health assessment programs. In 50% of the AESRs covered under this study, active soil carbon fraction was observed to be an important parameter contributing to the total variance in the dataset. Thus, active C fraction can be included as an important parameter in the MDS for monitoring of soil health.

### Buildup of phosphorus in dominant food production zones of India

Distribution of data collected from farmers' fields in respect of major nutrients showed high availability of P to the extent that more than 60% samples were



rated high in available P in AESR 4.1 and AESR 9.1 representing the states of Punjab, Haryana, UP and eastern Rajasthan. Similarly, high P content was 46% in AESR 18.4 (east coast rice belt), 44% in AESR 6.1, 23% in AESR 4.3 and 18% in AESR 9.2. Further, 89% samples in AESR 4.1 were not deficient (low) in available P, 71% in AESR 4.3, 74% in AESR 6.1 and 73% in AESR 18.4. Thus, phosphorus recommendation should take care of the particular trend in available P distribution in soils of the major food production region of the country.

### Glaucanite as a source of potassium for crops

The effect of glauconite application with and without amendments on wheat (*Rabi*) yield was assessed in black (Vertisol, Wanirambhapur soil series) and red soil (Alfisol, Vijayapura soil series). The results revealed that the application of glauconite along with FYM was more effective over the sole application of glauconite. Out of the different treatments calcined glauconite and acidulated calcined glauconite application alone or in combination with FYM showed higher growth and uptake of K by wheat in red soils. In black soils, application of muriate of potash showed higher biomass yield and uptake of K by wheat. The effect of glauconite application on crop performance was more pronounced in red soils than black soil.



Response of wheat to glauconite application in Alfisol

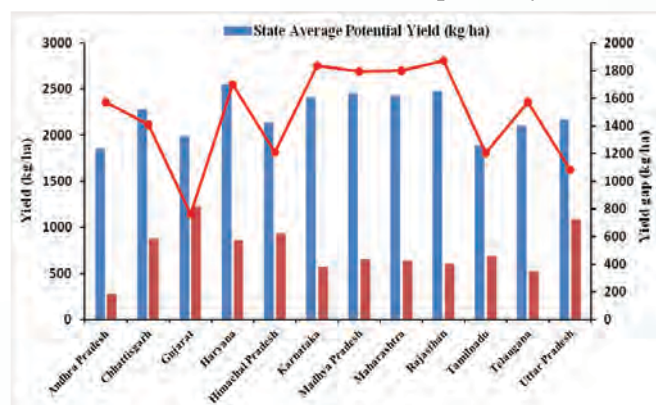
### Mid-infrared (MIR) spectroscopic technique for rapid estimation of key physical properties

A study was conducted to evaluate the potential of the mid infrared spectroscopy technique for non-destructive measurement of soil water retention capacity and particle size distribution in Inceptisols. For this study, 454 geo-referenced soil samples of Inceptisols order which were collected from the upper and middle Indo-gangetic plains (IGPs) of Haryana, Uttar Pradesh and Bihar, were used. The PLSR models in general performed better for estimation of most of the soil properties. The

sand, silt and clay contents of the soil and water retention capacity at field capacity and permanent wilting point were predicted well. MIR spectroscopy showed great potential for simultaneous estimation of these properties for the Inceptisols of Indo-gangetic plains.

### Yield gaps of pigeon pea crop across the Indian states

The yield gap analysis (Potential yield – actual yield) of pigeon pea crop was performed for different states viz., Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana, and Uttar Pradesh using simulation modelling approaches. These states contribute more than 80% of the total pigeon pea production of India. A total of 73 sites in these states were considered for yield gap analysis. The potential yield of the site was obtained using a well-calibrated and validated APSIM model considering soils and long-term weather data of these locations. The actual yields obtained from the databank of the state departments were compared with the potential yields estimated by the model. The average potential yield, actual yield, and yield gap average over all the studied states were 2.23 t ha<sup>-1</sup>, 0.745 t ha<sup>-1</sup> and 1.48 t ha<sup>-1</sup>, respectively.



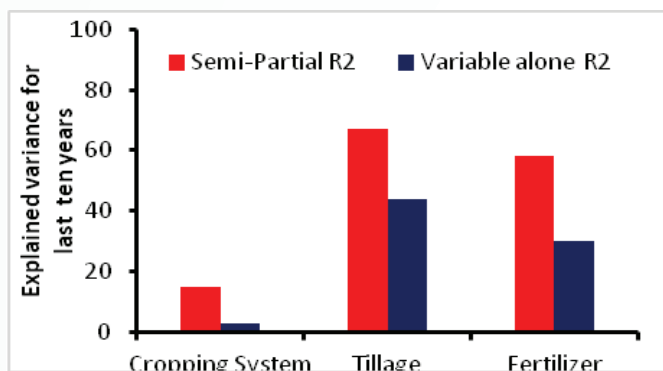
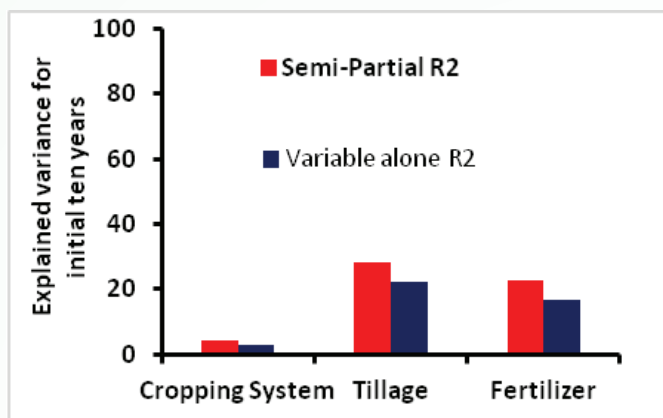
Yield gaps of pigeon pea crop across the Indian states

### Understating impact of cropping system, tillage, and fertilizers on soil organic carbon (SOC) sequestration

A long-term scenario analysis was undertaken to quantify the effect of the different explanatory variables on SOC sequestration using the APSIM modelling platform. The explanatory variables considered in this study were crop rotations, tillage, and fertilizers. The three cropping systems (Maize-Wheat, Maize-Chickpea, Soybean-Wheat), two tillage (conventional tillage, no-tillage), and three fertilizer treatments (N0%, N50%, and N100%) were considered for this purpose.



A  $R^2$  of the explanatory variable and the semi-partial  $R^2$  represented the contribution of the variable alone and the contribution of the variable with its interaction with other variables to the SOC variance, respectively. During the initial ten years of simulation, the types of cropping system, tillage, and fertilizer explained 4%, 28%, and 23%, respectively of SOC variation for 0-15 cm soil depth while in the final ten years of simulation, it was increased to 15%, 67% and 58%, respectively.



SOC variance as influenced by crop rotations, tillage, and fertilizers

### Buffering capacity and trace element release characteristics of weathered coal ash

Coal ash collected from ash dyke of Vindhyachal thermal power plant, Singrauli (M.P.) was investigated for pH buffering capacity and release characteristics for major and trace elements. The ash (pH 7.28) was equilibrated with various strengths of acid (0.001N, 0.01N and 0.1N HCl) and alkali (0.001N, 0.01N and 0.1N NaOH). After equilibration, pH increased from 3.12 to 6.67, from 2.23 to 4.2 and from 1.52 to 2.27 in 0.001N, 0.01N and 0.1N HCl solutions, respectively. This process neutralised 82 to 99% of added  $H^+$  ion. Similarly under alkaline environment, pH decreased from 10.69 to 7.43, from 11.7 to 8.93 and from 12.07 to 11.04 in 0.001N, 0.01N and 0.1N NaOH solutions respectively after equilibration. Results indicate that

such ash generated from burning of coals from Singrauli coal field may be effective in ameliorating both acidic and alkaline soils.

Solubilities of major elements Fe, Ca, Mn and Mg were the highest at lowest pH (2.27), which decreased progressively with increase in pH of extracting solution. On the contrary, solubilities of Al and K were the lowest at neutral pH and these increased under both strongly acidic and alkaline conditions.

### Spatial prediction modelling of maize equivalent yield as a function of soil properties

The objective of this study was to assess and compare different interpolation techniques (ordinary kriging, ordinary least squares (OLS) regression, geographically weighted regression and co kriging models) for evaluating the relationship between maize equivalent yield (MEY) and soil attributes in twenty climate smart villages of Rajgarh district in Madhya Pradesh. Soil properties were measured at 58 georeferenced locations within the research area with a sampling grid of 1 km  $\times$  1 km for a soil layer from 0 to 20 cm depth. From these samples, 40 were used for interpolation, and the 18 randomly remaining samples were used for evaluating accuracy. The results showed that geographically weighted regression and Co-kriging gave better estimate of MEY as a function of soil attributes. The results indicate that SOC, electrical conductivity, available zinc and inorganic application of fertilizer were the significant ( $p < 0.05$ ) explanatory variables for estimation of the spatial variability of maize equivalent yield in the study area.

### Methane consumption in response to different nitrogen sources in a tropical soil ecosystem

Methane consumption was evaluated under the influence of three nitrogen sources comprising  $N_2$  (5%, 10%),  $NO_3^-$ -N and  $NH_4^+$ -N at 10 mM and 20 mM. Three repeated  $CH_4$  feedings were carried out to determine nitrogen acquisition per unit of  $CH_4$  consumption.  $N_2$  stimulated  $CH_4$  consumption by about 1.2 to 1.7 times over no nitrogen control, while N in the form of both  $NO_3^-$  and  $NH_4^+$  inhibited  $CH_4$  consumption by 0.45 to 0.76 times than control.  $CH_4$  consumption was inhibited more by  $NO_3^-$ -N than  $NH_4^+$ -N irrespective of  $CH_4$  concentration.  $N_2$  stimulated abundance of both nif and pmoA genes. Abundance of methanotrophs pmoA gene copies and nitrifiers amoA gene copies were more in  $NH_4^+$ -N amended soil than  $NO_3^-$ -N. Di-nitrogen acquisition ( $\mu g$  N

acquired  $\text{g}^{-1}$  soil  $\text{ml}^{-1}$   $\text{CH}_4$  consumed) ranged from 12.56 to 34.97 with 1000 ppm  $\text{CH}_4$  and 1.58 to 4.35 with 10000 ppm  $\text{CH}_4$ . Study concludes that  $\text{N}_2$  stimulated  $\text{CH}_4$  consumption while nitrogen in the form of  $\text{NO}_3$  and  $\text{NH}_4$  inhibited  $\text{CH}_4$  consumption in tropical vertisol. Based on the experiment, it was concluded that (1) among various nitrogen sources,  $\text{N}_2$  stimulated  $\text{CH}_4$  consumption while  $\text{NO}_3$  and  $\text{NH}_4$  inhibited this process. (2) Abundance of methanotrophs were stimulated by  $\text{N}_2$ , but were inhibited by  $\text{NH}_4$  and  $\text{NO}_3\text{-N}$  indicating selective role of N fertilizers on methanotrophs. (3) Nitrogen sources including  $\text{NO}_3\text{-N}$  and  $\text{NH}_4\text{-N}$  inhibited  $\text{CH}_4$  consumption through feedback inhibition. However, this study raised several key questions to better understand the role of  $\text{CH}_4$

### Methane production and consumption under the influence of different crop biomass in a tropical vertisol

The current experiment was undertaken to unravel the differential effect of crop residues on  $\text{CH}_4$  production and consumption. Soils were incubated with biomass of maize, wheat, chickpea, and soybean at 1% w/w. Soils were incubated under non-flooded and flooded condition to estimate  $\text{CH}_4$  consumption and  $\text{CH}_4$  production rates respectively. The rate of  $\text{CH}_4$  production ( $\text{ng CH}_4$  produced  $\text{g}^{-1}$  soil  $\text{d}^{-1}$ ) varied from 0.068 to 0.107 with highest in wheat and lowest in chickpea.  $\text{CH}_4$  consumption rate ( $\text{ng CH}_4$  consumed  $\text{g}^{-1}$  soil  $\text{d}^{-1}$ ) was highest in wheat (0.79) and lowest in chickpea (0.53). In both  $\text{CH}_4$  producing and consuming soils, the organic carbon (%) and the available  $\text{NO}_3$  (mM) increased significantly ( $p < 0.05$ ) over control. Abundance of methanogens and methanotrophs estimated as *mcr* and *pmoA* gene copies  $\text{g}^{-1}$  soil. Abundance of both microbial groups increased significantly due to crop biomass over control. Linear models exhibited significant correlation among  $\text{CH}_4$  production and  $\text{CH}_4$  consumption with organic carbon, available nitrate and microbial abundance. Biomass of cereals stimulates both  $\text{CH}_4$  production and consumption at a higher rate than the biomass of legumes.

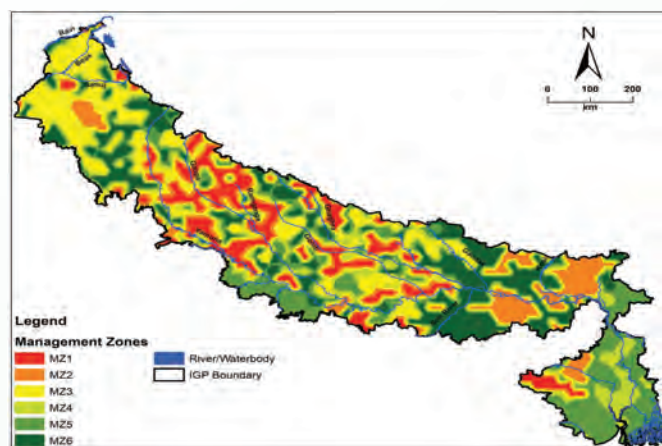
### Diversity of bacterial and archaeal amoA genes in the nodule of Glycine max

The community of archaea was examined in the nodular region of *Glycine max* grown in soil (vertisol) of central India. A clone library constructed using the archaeal amplicon. The archaeal amplicons were homologous to nitrifying groups. The sequences were similar to

*Nitrososphaera gargensis*, of uncultured thaumarchaeota groups. Subsequently a clone library was constructed using bacterial alpha subunit of ammonium oxidizing gene (*amoA*). The sequences of bacterial *amoA* gene were homologous to *Nitrosomonas* sp., *Nitrospira* sp. and *Nitrosolobus* sp. The relative abundance of archaeal *amoA* gene remained higher than the bacterial *amoA* gene. The copy number of archaeal *amoA* gene was about  $3.99 \times 10^6$  while copy number of bacterial *amoA* gene was about  $0.1 \times 10^2$ . Diversity indices suggested that AOA groups were more diverse than AOB in soybean nodule.

### Spatial distribution and management zones of available micronutrients and sulphur in Indo-Gangetic Plain

A study was undertaken to understand the spatial distribution pattern of available micronutrients i.e. zinc (Zn), boron (B), iron (Fe), manganese (Mn) and copper (Cu), available sulphur (S), and soil properties (soil acidity (pH), electrical conductivity (EC) and organic carbon (SOC) content) in soils of intensively cultivated Indo-Gangetic Plain (IGP) of India and to delineate soil MZs for efficient management of soil nutrients. Totally, 55101 soil samples from 0–15 cm depth were obtained from 167 districts of IGP during 2014 to 2017 and were analysed for different soil parameters. Soil pH, EC and SOC content varied from 4.44 to 9.80, 0.02 to 2.13  $\text{dS m}^{-1}$  and 0.10 to 1.99%, respectively. The concentration of available Zn, B, Fe, Mn, Cu and S varied from 0.01 to 3.27, 0.01 to 3.51, 0.19 to 55.7, 0.05 to 49.0, 0.01 to 5.29 and 1.01 to 108  $\text{mg kg}^{-1}$ , respectively. Geostatistical analysis resulted in varied distribution pattern of studied soil parameters with moderate to strong spatial dependence. The extent (% area) of nutrient deficiencies in IGP followed the order:  $\text{S} > \text{Zn} > \text{B} > \text{Mn} > \text{Cu} > \text{Fe}$ .



Management zones of available micronutrients and sulphur in Indo-Gangetic Plain



### PROGRAMME HELD

#### Republic Day celebration

Republic day was celebrated in the Institute with lots of zeal and joy on 26<sup>th</sup> January 2020. Dr Ashok K Patra, Director hoisted the flag and addressed the gathering on this occasion. He greeted all the staffs of Institute and urged to strive hard for the buildup of nation.



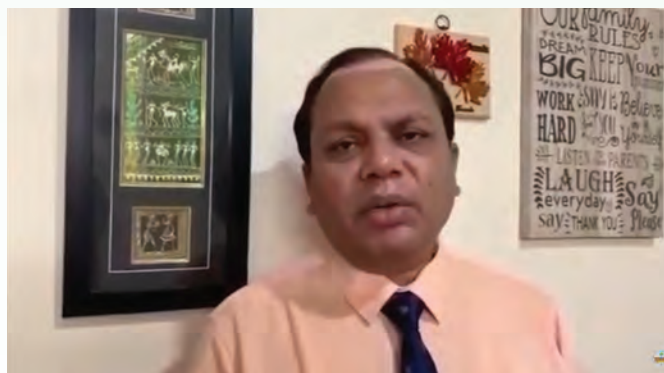
#### 9<sup>th</sup> International Women's Day celebration

International women's day was celebrated at ICAR-IISS, Bhopal on 7<sup>th</sup> March 2020 with great zeal and cheerfulness. Different competitions were organized for women staff and family members of IISS staff. The chief guest of function was Dr. Shobhana Bajpai Maroo, Retired Principal of Sarojini Naidu Girls PG College, Bhopal. Guest of Honor, Smt. Reena Patra highlighted the importance of inner strength of women and importance of education in the changing society.



#### 33<sup>rd</sup> Foundation Day Celebration

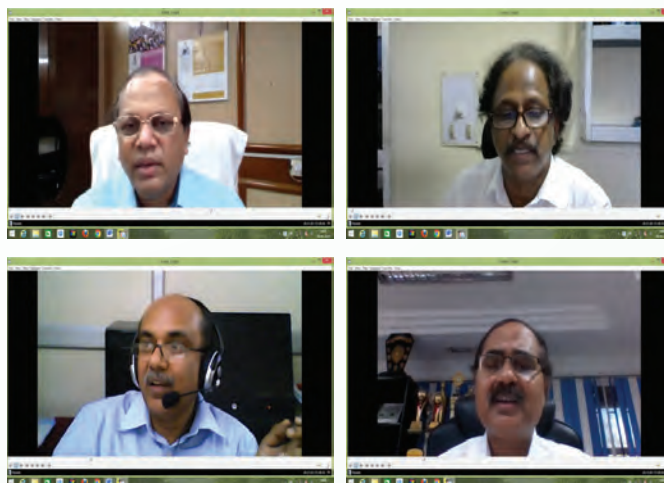
On virtual mode, ICAR-Indian Institute of Soil Science, Bhopal celebrated 33<sup>rd</sup> Foundation day on 16<sup>th</sup> April 2020 with great zeal and enthusiasm. Dr SK Chaudhari, DDG (NRM) congratulated all the staffs of ICAR-IISS, Bhopal on this



occasion and made an appeal to help our farmers through advisory service under the difficult COVID situation.

#### World Environment Day-2020

Webinar on "Soil Pollution – Threat to Soil Biodiversity" organized by ICAR-Indian Institute of Soil Science, Bhopal on the occasion of World Environment Day (5 June 2020) with the aim of creating awareness on the need to conserve soil and its biodiversity through prevention of pollution as well as mitigation of its impact. The Theme for this year World Environment Day is biodiversity. Honourable DDG (NRM) Dr. S. K. Chaudhari was the Chief Guest of the Function. Director of ICAR-IISS Dr Ashok K. Patra, Dr. Tapan Chakrabarti, Retired Scientist-H, CSIR-NEERI, Nagpur, Dr. Natesan Manickam, Senior Principal Scientist, CSIR- Indian Institute of Toxicology Research, Lucknow, Dr. B. Ramakrishnan, Principal Scientist, ICAR-IARI, New Delhi. Dr. J. K. Saha, Head, Division of Environmental Soil Science, ICAR-IISS, Bhopal, all project coordinators, HODs and scientists of the institute participated in the program.







## National Webinar on Biochar: Potential availability, Usefulness and Limitations

A webinar on Biochar: Potential availability, Usefulness and Limitations was organized on 19 June, 2020. About 300 participants attended the webinar. Hon'ble Dr. Trilochan Mohapatra, Secretary DARE and DG ICAR and Dr. S.K. Chaudhari, DDG (NRM) graced the occasion. Secretaries from different Ministries and former Vice Chancellor of Agricultural Universities, Directors of ICAR institutes, business professionals & academicians, students and farmers interacted about this issue on a single platform. Prof. Balwant Singh, School of Environmental and Life Sciences, University of Sydney, Australia and Prof. Dinesh Mohan, School of Environmental Sciences, JNU, New Delhi made detailed presentations on biochar and covered many aspects including biochar production and quality, characterization, response to crops and changes in soil properties and niche area of its application including environmental aspects.



## Webinar on Soil Biodiversity and Human Health

Webinar on Soil Biodiversity and Human Health organized by ICAR-IISS Bhopal on 22 May, 2020 in connection with the International Day for Biological Diversity. Honourable DDG (NRM) Dr S K Chaudhari was the Chief Guest of the Function. Director of ICAR-IISS Dr. Ashok K. Patra, Director of ICAR-National Bureau of Agriculturally Important Microorganisms Dr. A.K. Saxena, former Emeritus Scientist of the institute Dr. D.L.N. Rao, I/c All India Network Project on Soil Biodiversity Biofertilizer (AINP SBB) Dr. S.R. Mohanty, all project coordinators, HODs and scientists of the institute participated in the program. Microbial approaches to control soil borne pathogens and pollutants for protecting environment and farmers' health was identified as a key issue for further research.

## Webinar on farmers needs and preparedness for *kharif* season 2020 under covid-19 situations: Farmers FIRST Programme

ICAR-Indian Institute of Soil Science, Bhopal organized a Webinar on Farmers Needs and Preparedness for *Kharif* Season 2020 under Covid-19 situations on 1 June, 2020. A total of 75 participants attended the meeting. Dr. Ashok K. Patra wished all the participants to remain safe during this period by taking all necessary precautions and stressed not to fear and panic but to overcome this situation by taking safety, care and maintaining social distancing. He ensured farmers for extending all support from institute side and suggested various measures to maintain agricultural fields so as to sustain the productivity and ways to improve farm income. Dr. A.K. Biswas, in his address advised farmers to go for diversified farming and adopt resource conservation and water harvesting technologies to save resources, reduce cost of cultivation and improving productivity.





Dr. S.R.K. Singh, Principal Scientist ATARI Jabalpur interacted with farmers and suggested them to emerge stronger during this period and contribute to the progress of nation.



### Kishan Mela at Rajnandgaon, Chhattisgarh

A Kishan Mela was jointly organised by ICAR-IISS, Bhopal and AICRP on MULLaRP, Raipur at KVK Rajnandgaon on 6 March 2020, in which about 385 tribal farmers participated. Mostly tribal women farmers participated in this programme. District collector Shri Jaiprakash Maurya and superintendent of Police Shri B.S. Dhruve, Sub Divisional magistrate Shri Mukesh Rawte, Dean college of agriculture Dr. V.K. Dubey and other state agriculture officers of Rajnandgaon graced the occasion. District collector Shri Jaiprakash Maurya and superintendent of Police Shri B.S. Dhruve distributed agriculture inputs to the tribal farmers. These agri-inputs i.e. paddy seed and fertilizers were provided by the ICAR-IISS, Bhopal and small agriculture implements by AICRP on MULLaRP, Raipur. A total of 125 selected tribal farmers were benefitted with input distributed by



ICAR- IISS, Bhopal. The programme was coordinated by scientific team comprising Dr. R.Elanchezlian, Dr. P. Tripathi, Dr. M.V. Coumar and Dr. V.D. Meena conducted at KVK Rajnandgaon and adopted tribal villages.

### Mera Gaon Mera Gaurav (MGMG)

The interdisciplinary team of scientists has been made for the flow of technical messages and advisories to the farmers of 55 adopted villages under MGMG by the ICAR-IISS, Bhopal. Different activities include field demonstrations on organic farming, composting, soil sampling, *Kisan Sangosthi*, Field day, Farmers-Scientist interaction as well as training programmes regarding organic farming, composting, soil testing, conservation agriculture and soil health were organized. Besides mobile-based advisory to farmers was given on crop variety, the market price of commodities, fertilizer recommendation etc.

### EXTENSION ACTIVITIES

### Enhancement of Soil Health and Livelihood of Tribals of Barwani District of Madhya Pradesh

Training-cum-workshop on 'Soil health and nutrient management' was co-jointly organized by ICAR-Indian Institute of Soil Science, Bhopal and KVK Barwani on 24-25 February 2020 under STC (TSP) at KVK Barwani. The programme was organized to impart and upgrade the knowledge and creating awareness amongst farmers about agriculture techniques and practices like the importance of soil testing, organic farming, integrated nutrient management, conservation agriculture, soil health, soil health card, collection of soil samples and soil testing in horticultural crops. About 200 farmers from the tribal area of Barwani attended this training programme.





**Farmer Field School (FFS) on “use of organic inputs based on soil health card recommendations”**

Drs. K.C. Shinogi, B.P. Meena, and Nishant K. Sinha Organized a Farmer Field School (FFS) on “Use of organic inputs based on soil health card recommendations” for the tribal farmers of Kaweli, Kulpa and Sarra villages of Balaghat district during 22-24 January 2020.



**Farmers Scientist Interaction meet and distribution of agri-inputs to the farmers**

Farmers Scientist Interaction meet was organized at kalakhedi village on 5 March 2020. Farmers were appraised on the issues of nutrient and water management in wheat and maize, plant protection, subsidy on various agricultural implements etc. Maize Sheller (Number:32) and manual peg type dry weeder (Number:32) were distributed to the selected farmers under SCSP by MGMG Group-I members (Drs. A.B. Singh, Narayan Lal, Abhay O. Shirale, Sudeshna Bhattacharjya and Ashok K. Patra).







### Farmer day/ Field day cum Farmer- Scientist interaction meeting

ICAR-IISS, Bhopal Organized Farmer day/ Field day cum Farmer- Scientist interaction meeting on Climate Smart Agriculture under NICRA project for SC farmers on 05<sup>th</sup>, 12<sup>th</sup> and 17<sup>th</sup> March 2020 at Kalakhedi, Ratnapura and Mugalia hut villages, respectively. Linkages were also made with other government agencies like M.P. State Department of Agriculture, ICAR-CIAE and ATMA, Bhopal. Different farm implements like manual Cono Weeder, Manual Peg Type Dry Land weeder and Maize Sheller were distributed to the BPL SC farmers in adopted villages under MGMG programme.

### Capacity building programme organized

In view to popularize the importance of sustainable agriculture, One-day skill development training on “Organic manure production technique and soil health” was organized on 4 February 2020 by MGMG Group-I members (Drs. A.B. Singh, Narayan Lal, Abhay O. Shirale, Sudeshna Bhattacharjya and A.K. Patra) under SC sub-plan at ICAR-IISS, Bhopal.

#### TRAINING PROGRAMME/ WORKSHOP ORGANIZED

### Training cum Scientist–Farmers Interactive meet at Rajnandgaon (Chhattisgarh)

- ICAR-IISS, Bhopal organised training cum Scientist-farmers interactive meet during 29-30 January 2020 in collaboration with Krishi Vigyan Kendra, Surgahi, Rajnandgaon. The tribal farmers were contacted at their agricultural fields in Kodikasa village of Ambagarh Chowki Block to identify their problems related to soil, water and crop production. A Scientists-Farmers interactive meet was conducted in Pateli village of Ambagarh Chowki Block. On

30 January 2020, training programme on soil health and crop productivity was organised and at the end of the training programme, seed of summer moong and DAP (Fertilizer) were distributed among 75 tribal farmers of Pateli, Devvavadi and Mangatola Villages of Ambagarh Chowki Block in Rajnandgaon district to create awareness among farmers about short duration moong bean, so that legume crop may become part of crop rotation for maintaining good soil health.



On 5 March 2020, ICAR-IISS team conducted an interactive meet with tribal farmers at Boirdi and Ladijog villages in Ambagarh chowki block. A series of discussions were taken place on soil health-related problems and the scientists from ICAR-IISS Bhopal delivered the solution-oriented talk. An introductory orientation regarding soil health was also carried out at Anganwadi and primary schools of Boirdi village to create awareness among school children about the importance of soil health.

### Training on ‘Tribal Women Farmers’ Skill Development on Soil Health Management

- A training programme on ‘Tribal Women Farmers’ under Skill Development program was organised to impart skill development on soil health management among tribal women at ICAR-Indian Institute of Soil Science, Bhopal during 4-11 March 2020. This training was organised for women tribals of Malda (West Bengal) in collaboration with ICAR-CISH, Regional Research Station, Malda (West Bengal). The main theme of the training was on soil health management with a focus on the issues such as the importance of soil sampling, soil testing and analysis in the laboratory and introduction to ‘Mridaparikshak’, the importance of micronutrients, vermicomposting, organic farming, integrated nutrient management, methods of composting, fertilizers application, cultivation of vegetables





in polyhouse, exposer to farm implements & farm machinery, conservation agriculture, best management practices etc.



The trainees were also given exposure to different farm machinery at ICAR-CIAE, Bhopal. They also visited the micro-irrigation system and polyhouse cultivation facilities there. A visit to the organic farm was arranged at Parwalia Sadak (Dist Bhopal, Madhya Pradesh).

- Dr. M. Mohanty, Dr. N.K. Sinha and Dr. J.Somasundaram organized a ICAR-NICRA sponsored training programme on “Crop Simulation Modelling and Impacts of Climate Change on Agricultural Production Systems: Multi-model Training” was organized at ICAR-Indian Institute of Soil Science, Bhopal during 16-25 March 2020. Twenty five participants from different parts of country attended the training programme.



- Drs. B.L. Lakaria, A.K. Vishwakarma and K.C. Shinogi organized “Training on soil health assessment and preparation of soil health card” during 25-29 February 2020 for 20 participants of State Department of Agriculture, Ujjain Division, MP.



- Drs. R.H. Wanjari, A.B. Singh, Sudeshna Bhattacharjya and B.L. Lakaria organized training on “Tribal Women Farmers’ Skill Development on Soil Health Management” during 02-11 March 2020 for Tribal Women Farmers’ (28 nos) from Malda District of WB.
- Drs. Pramod Jha, A.K. Vishwakarma and A.K. Tripathi organized training on “Soil Testing & Nutritional Recommendation for *Kharif* and *Rabi* Crops” for officials of Government of M.P at ICAR-IISS, Bhopal during 17-21 February 2020.



- On-line Review Meeting of the ICAR-IISS-ICRAF Collaborative Project on “Assessment of important soil properties of India using Mid-Infrared Spectroscopy” was organized through Zoom Platform on 30 April 2020.



### Award/Honour/Recognition

- Dr R. Elanchezhian acted as a local organizing committee member for the International conference of Pulses 2020 organized at Bhopal during 10-12 February 2020.
- Dr Brij Lal Lakaria recognized as Test Developer for ICAR AIEEA-PG 2020 for National Testing Agency (MHRD, Department of Higher Education, and Govt. of India) during 23-25 January 2020.
- Dr Brij Lal Lakaria acted as External Examiner for evaluation of PhD. Thesis entitled "Assessment of Soil Quality under Prevalent Cropping Systems in Different Agro-climatic Zones of Himachal Pradesh" of CSK HPKV, Palampur, H.P.
- Dr Brij Lal Lakaria acted as an Expert for working group meeting on Vocational Curriculum on Soil and Water Testing Lab Assistant for class XI and XII at Pandit Sunderlal Sharma Central Institute for Vocational Education (PSSCIVE) on 23-24 June 2020.
- Dr Brij Lal Lakaria developed a model plan of Soil Testing Laboratory for constructing a new building of STL in various district of Tamilnadu vide their letter A/4/2020 dated 16 May 2020
- Mrs Seema Bhardwaj received competency certificate for getting a distinction in a six-week online course on "conservation agriculture-based sustainable intensification" by Centre for Continuing Education, Indian Institute of Technology, Kanpur, Bihar Agricultural University, Sabour, and Commonwealth of Learning, Canada on 31 March 2020.
- Dr. Asit Mandal was selected as Academic Editor in the journal PLOS ONE.
- Dr. Jitendra Kumar was selected as Editor in Research Journal of Agricultural Science
- Dr. Jitendra Kumar was conferred Fellow Member of Society of Agricultural and Nutrition on 5 June 2020
- Dr. R.S Chaudhary was appointed as an Advisor to RPSC, Rajasthan at Ajmer from 8-9 August 2019 and 26-28 February 2020.
- Dr. R.S Chaudhary acted as a Jury member, a Student Research Conclave-Anveshan-2020 at JLU, Bhopal from 6-7 February 2020.
- Dr. Asit Mandal received Young Scientist Award on the occasion of the virtual celebration of World

Environment Day-2020 (5<sup>th</sup> June), organized by Samagra Vikas Welfare Society, Lucknow, U.P 5<sup>th</sup> June 2020

- Dr. Pramod Jha acted as a resource person in ICAR-CAAST sponsored training workshop on Assessment methods for soil carbon and green house gas emissions in agriculture organized by Department of Soil Science, PAU, Ludhiana on 17 February 2020.

### INTERNATIONAL CO-OPERATION

#### India Japan collaborative project

Department of Science and Technology (DST) India and Japan Society for the Promotion of Science (JSPS) funded project "Methanogenic bioelectrode driven conversion of CO<sub>2</sub> to CH<sub>4</sub> in agro waste-based bioenergy system" was inaugurated on 26<sup>th</sup> Feb 2020. The meeting was chaired by Dr. Ashok K. Patra Director IISS, Bhopal. Investigators from India (Dr. S.R. Mohanty, Dr. Ashok K. Patra, and Dr. K. Bharati) and Japan (Dr. Seiya Tsujumura and Dr. Masanori Kaneko) along with scientists of the institute participated in the program.



### STAFF NEWS



Dr. Jitendra Kumar, Scientist, joined at ICAR-IISS, Bhopal on 2<sup>nd</sup> January 2020 on transfer from ICAR-RC for NEH Region, AP Centre, Basar, Arunachal Pradesh, 791101.



Dr. (Mrs.) Mayanglambam Homeshwari Devi, Scientist, Joined at ICAR-IISS, Bhopal on 4<sup>th</sup> April 2020.



Dr. (Ms.) Immanuel Chongboi Haokip, Scientist, Joined at ICAR-IISS, Bhopal on 4<sup>th</sup> April 2020.



### SCIENTISTS PARTICIPATION IN TRAINING / SEMINAR / WORKSHOP

Name	Programme attended/participated	Venue/organizer	Date in the year 2020
Mrs. Madhumonti Saha	Winter School Training Programme on 'Data Analysis in agriculture using Statistical Software Packages'	ICAR-IASRI, New Delhi	January 16 - February 5
Dr. Pradip Dey	Attended Farmers Conference to know their perspectives and experiences	JNKVV, Jabalpur	January 28-29
Dr. Brijlal Lakaria	National conference on Resource conservation for soil security and Jalshakti: Farmers Perspective in Bundelkhand	ICAR-IISWC- Research Centre, Datia, MP.	February 3-5
Dr Pradip Dey	Participated and delivered the lecture on STCR at CSWCRTI RC, Ooty.	CSWCRTI RC, Ooty	February 6-8
Dr Narayan Lal and Dr. Nisha Sahu	4th International Conference on Multidisciplinary Research and Development	Hotel Pukhraj, E-2/18, Arera Colony, Bhopal	February 9
Drs. P.Dey, Sangeeta Lenka, R. Elanchezhian, M.V. Coumar, B. P. Meena, Dr. A.O. Shirale	International Conference on Pulses as the Climate Smart Crops: Challenges and Opportunities (ICPulse2020)	ICAR-IIPR, Kanpur	February 10-12
Dr. J. K. Saha	International Seminar on "Contaminated sites: Subsurface Investigation for Ground Assessment and Remedial Design"	IIT, New Delhi	February 17-21
Dr Alka Rani	National Conference on Geospatial Technologies in Agriculture	I C A R - N A A R M , Hyderabad	February 20-21
Dr. R. Elanchezhian	ISPP North Zonal Seminar – Crop Productivity and Stress Management	CSAU&T, Kanpur	February 22
Dr. N. K. Lenka	Training program on "Geospatial analysis using QGIS and R"	I C A R - N A A R M , Hyderabad	February 27 -March 3
Dr. Pradip Dey	11 <sup>th</sup> National KVK Conference as per instruction of the Director at the National Agricultural Science Centre Complex, New Delhi	NASC Complex, New Delhi	February 29
Dr. B. P. Meena	PUSA Krishi Vigyan Mela and demonstrated ICAR-IISS technologies	PUSA Campus, IARI, New Delhi	March 1-3
Dr. Pradip Dey	National Seminar on Agriculture Sustainability (as per instruction of DDG (NRM), ICAR)	Krishi Bhawan, New Delhi	March 6
Drs. Asit Mandal, J. K. Thakur, Narayan Lal and Nisha Sahu	National Conference On Scientific & Environmental Innovation and Implementation of Sustainable Development Goals (Climate Conclave 2020)	M.P. Council of Science and Technology Vigyan Bhawan, Nehru Nagar, Bhopal	March 7-8





Name	Programme attended/participated	Venue/organizer	Date in the year 2020
Dr Alka Rani	Online Webinar Series on “Remote Sensing in Crop Monitoring and Assessment	IIRS, Dehradun	March 16-21
Dr. Pradip Dey	ICAR Directors Conference	Zoom meeting	March 19
All Staffs	33 <sup>rd</sup> Foundation Day of ICAR-IISS through Video-conferencing.	Video-conferencing	April 16
Dr. Hiranmoy Das	Training on e-file module of e-office conducted by ICAR-IASRI, New Delhi	Online through Microsoft-teams platform	May 1
Dr R. S Chaudhary	Training programme on Carbon sequestration in climate-smart agriculture	MPKV, Rahuri	11-13 May
Dr. Narayan Lal	Online webinar on “Genomics for food, health and nutrition	ICRISAT-Hyderabad	May 14
Dr. Narayan Lal	Online seminar on Food Adulteration at PG Tech Research Institute	PGTRI, Indore	May 15
Dr. A. K. Biswas	International Training programme on 'Conservation Agriculture Based Crop Management Technologies in Climate Smart Agriculture'	C A A S T - C S A W M Mahatma Phule Vidhayapeeth, Rahuri, Tal Rahuri, Dist. Ahmednagar	May 18-22
Dr. Priya Gurav	Webinar on fertilizer code's implementation	FAO, Rome	May 19
Dr. Nisha Sahu and Dr. Narayan Lal	National Webinar on New J-Gate @ CeRA Platform: Consortium for e-Resources in Agriculture”	IGKV, Raipur and Informatics, Bengaluru	May 20
Dr. R. Elanchezhian	Webinar on Analytical Applications (Good Water Practices for LC-MS / ICP-MS / HPLC)	Merck Bio-Science	May 21
All scientist	Webinar on Soil Biodiversity and Human Health	organized by the ICAR-IISS, Bhopal	May 22
Dr. Narayan Lal	Online training on Advance in vertical farming	Brahma Singh, Horticulture Foundation	May 23
Dr. Narayan Lal	Online webinar on Science Communication for Smart Scholars	ICAR-CIFE, Mumbai	May 26 to June 8
Dr. Narayan Lal	Online webinar on Quantitative methods for social sciences	ICAR-NIAP, New Delhi	June 1-23
Dr. Nisha Sahu	Webinar on Journal Citation Reports-South Asia Training and Certification Program, 2020	Web of Science Group	June 3
All scientist of the Institute	Webinar on “Soil Pollution – Threat to Soil Biodiversity”	ICAR-IISS, Bhopal	June 5
Dr. N. K. Lenka	Webinar on “Covid-19: Impacts and New Normal in Agriculture”	NAAS, New Delhi	June 5



Name	Programme attended/participated	Venue/organizer	Date in the year 2020
Dr. A. K. Biswas	'Panel Discussion on COVID-19 : Impacts and New Normal in Agriculture'	NAAS, New Delhi	June 5
Dr. Asha Sahu	Virtual Conference on "Sustainable Solid Waste Management during Covid 19"	National Solid Waste Association of India	June 5
Dr. Brij Lal Lakaria	Web based training session on "Methodology for synthesis of district specific IFS models"	IIFSR, Modipuram	June 6
Dr. Narayan Lal	International online webinar on Intellectual Property Rights, An Overview: Myth & Realities	KLE Society's Science & Commerce College Kalamboli, Navi Mumbai, India	June 6
Dr. Pradip Dey	Webinar on Impact and Implications of COVID 19 on Agrochemicals Industry & Draft Order for Banning of 27 Molecules	Zoom meeting	June 11
All scientist of the Institute	National Webinar on Biochar: Potential Availability, Usefulness and Limitations for Use in Agriculture	ICAR-IISS, Bhopal	June 19
Dr. Asit Mandal	Webinar on "HPTLC-Technique and Herbal Applications"	Anchrom Enterprises, Mumbai & M.P.CST Bhopal"	June 20
Dr. Vasudev Meena	National Webinar on "Agriculture and Food Security Beyond COVID-19"	Rajasthan College of Agriculture, MPUAT, Udaipur	June 22
Dr. A. K. Biswas	Online project monitoring committee	TDB-DST, New Delhi	June 26
Dr. Vasudev Meena	National Workshop on "Research Methodology: Concepts & Applications"	Directorate of Students' Welfare, MPUAT, Udaipur	June 26-27
Drs. A. K. Patra, A. K. Biswas, Sanjay Srivastava and Pramod Jha	Asian Soil Laboratory Network (SEALNET)	FAO, Rome	June 30 – July 2

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