ICAR-IIISS Newsletter

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Contents

Forthcoming Events

- ICAR short course on "Recent Advances in Soil Carbon Sequestration and Stabilization for Soil health Improvement and Climate Change Mitigation" to be held during 10 - 19 December, 2019 at ICAR-IISS, Bhopal.

Editors

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Director's Desk

Digital Soil Science: Indian Perspective

Nutrient and water stress is the major risk factors for agriculture in India. A precise characterization and in depth understanding of such stress is urgently required to enhance crop production. This can be achieved through modern technologies which assist to improve sensing, computing, communication and control within the devices driving towards digital soil science. Digital soil mapping (DSM) is one such innovation which explicates spatial soil information with the help of recent advanced technologies. Digital soil mapping has moved from research phase to operational phase across the countries. The countries like India which are facing challenges due to severe land degradation require accurate and quantitative soil resource information that can be used by planners, scientists, and stakeholders for preparation of suitable action plan. At present there are several institutes working on soil characterization at different scales. The Indian Council of Agriculture Research (ICAR) has uploaded more than 100 mobile apps on its website developed by ICAR institutes, State Agricultural Universities and Krishi Vigyan Kendras. These mobile apps are developed in different fields of agriculture including natural resources management. Currently, precision farming is one of the most discussed areas in farming. Robotics – Drones, or unmanned aerial vehicles (UAVs)-based images can help in in-depth field analysis, crop monitoring, scanning of fields and so on. Computer vision technology and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming. Drone technology is giving agriculture a high-tech makeover like (i) *Soil and field analysis*: By producing precise 3-D maps for early soil analysis, seed planting and gathering data for managing irrigation and nitrogen levels. (ii) *Irrigation*: Sensor drones can identify moisture-stress parts of a field for scheduling irrigation. In general, increasing the yield output by decreasing the inputs has always remained a desired target of the farmers. Sensors are used to measure the crops growth at maximum efficiency with accurate identification of

issues and problems. Monitoring systems and small sensors prepared by the nanotechnology has also a great potential to address this important issue. Nano-sensors can be used as nano-biosensors to control soil nutrients, which have helped to reduce fertilizer consumption and environmental pollution. Thus smart farming practices can be developed by using artificial intelligence to minimize loss of farmers and provide them with high yield. Using artificial intelligence platforms, one can gather large amount of open data from government and public websites or real time monitoring of various data is also possible by using IoT (Internet of Things). Thereafter, these data can be analyzed with accuracy to enable the farmers for addressing all the uncertain issues faced by the farmers.

Overall, digital technologies can help farmers to analyze soil/crop health for deciding right crop in each season with best possible yield. Currently, Indian government has taken strong steps to popularize ***Digital Technology*** which will help to modernize and organize rural agricultural activities. The deployment of technology is very important to make schemes of the Ministry successful. The ICAR/Government of India has also set up 713 Krishi Vigyan Kendras and 684 Agricultural Technology Management Agencies at district level for dissemination of technologies among the farming community. Although digital technologies offer vast opportunities for application in agriculture, there still exists a lack of familiarity with high tech machine learning solutions in farms of our country. Hence, we urgently need digital technologies to ensure sustainable intensification of agricultural systems in India.

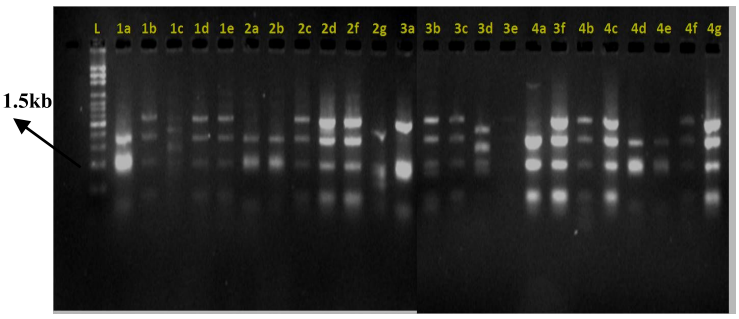
(Ashok K. Patra)
Director

Research Highlights

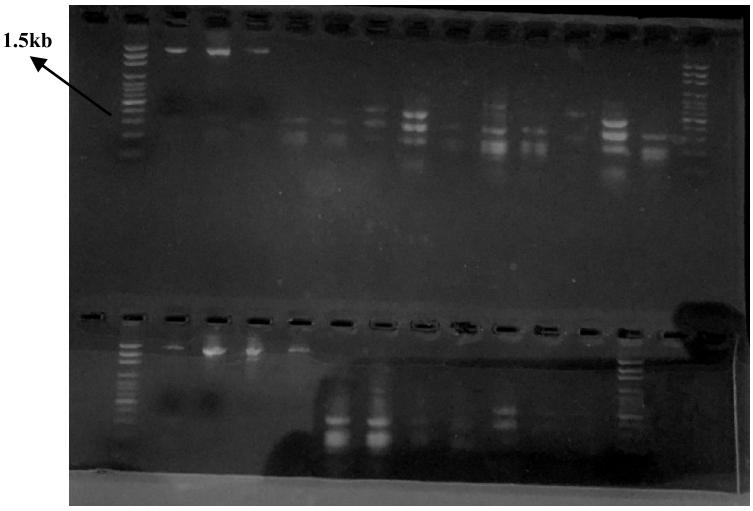
Shift in endophytic bacterial diversity with growth stage of corn (*Zea mays*)

A total of 26 bacterial endophytes were isolated from the root of corn plant at 15, 40, 60 and 90 days after sowing and 16s rRNA gene were amplified from genomic DNA of these isolates. The amplified 16s rRNA genes were digested with restriction endonuclease Alu1 and HaeIII (Plate 1A and Plate 1B). Appearance of two additional isolates one each at 40 and 60 days of sowing indicated no major shift in root endophytic bacterial diversity with change in growth stages of crop as detected by amplified ribosomal DNA restriction analysis (ARDRA) technique.

Plate 1 Restriction digestion profile of endophytes from different crop growth stages.



1A. Restriction Profile with Alu I

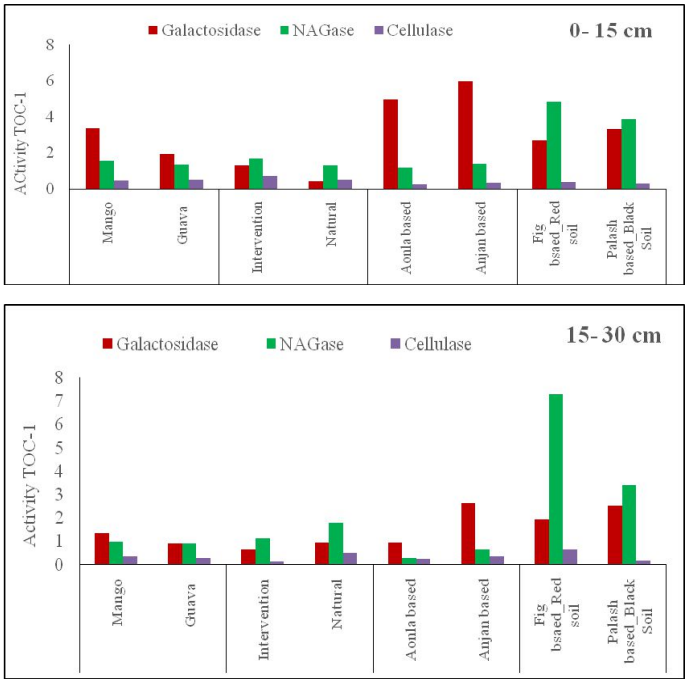


1B. Restriction Profile with HaeIII

Carbon cycling enzymes under different soils and cropping system

Major group of carbon cycling enzymes were analysed in the soils (0-15 cm and 15-30 cm depth) of dominant, non-agricultural land use systems of Central India. Results revealed that specific activity of Galactosidase followed in the trend of agroforestry system > natural forest> horticulture system > grassland soil at both depths. It

indicates that labile carbon availability is more in agroforestry system as compared to other systems. However, specific activity of NAGase (β-Glucosaminidase) which targets chitin decomposition pathways was found to be highest in natural forest system followed by grassland system. No significant variation was noticed in specific activity of cellulase among different land use systems.



Specific activity of carbon cycling enzymes in different land use systems of Central India

Total factor productivity (TFP) under organic production system

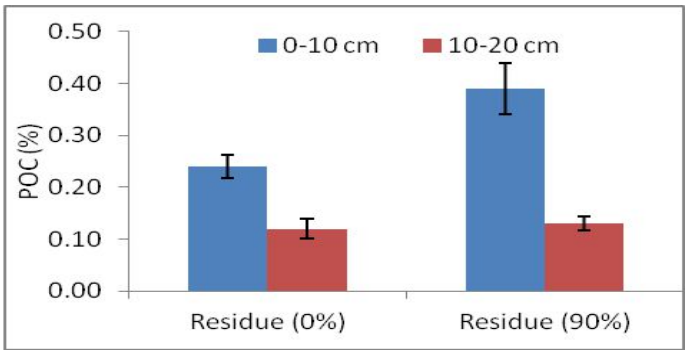
The highest TFP (kg grain per kg NPK) was recorded under 100% organic treatment followed by 75% organic + 25 % inorganic, 75% organic + innovative, 100% inorganic and least in state recommendation treatment. The TFP index were noticed in different crops in the order of Chickpea > Wheat > Mustard >Linseed > Soybean. Whereas, the total factor productivity (kg grain per kg manure/ ferlilizer) was highest in 100% inorganic treatment as compared to 100% organic treatment which may be due to bulkiness of organic manures which are having low concentration of plant nutrients.

Methane consumption potential of different cropping systems in vertisol

Interactive effect of cropping systems and tillage on CH_4 consumption potential of soil was studied for 9 years of field experiments with cropping systems comprising soybean-wheat (SW), maize-wheat (MW), and maize-gram (MG) cropping systems under conventional tillage (CT) and no tillage (NT) practices. CH_4 consumption rate (µg CH_4 consumed g^{-1} soil d^{-1}) was high in no tillage at upper soil layer (0-5 cm) than conventional tillage at 5-15 cm depth irrespective of cropping system and ranged from 0.35 to 0.56 in the trend of MW>SW>MG in 0-5 cm. Abundance of pmoa gene copies (abundance of methanotrophs) ranged from 13- 43 $x10^4$ g^{-1} soil and was highest in MW-NT and lowest in MG-CT. Soil and plant parameters, abundance of pmoa genes significantly ($p>0.05$) positively correlated with the CH_4consumption rate. NT stimulated CH_4 consumption compared to CT irrespective of cropping systems. Study highlights that CH_4 consumption potential was high in MW and least in MG. However, the magnitude of positive affect of NT towards CH_4 consumption was high in SW and MG than MW.

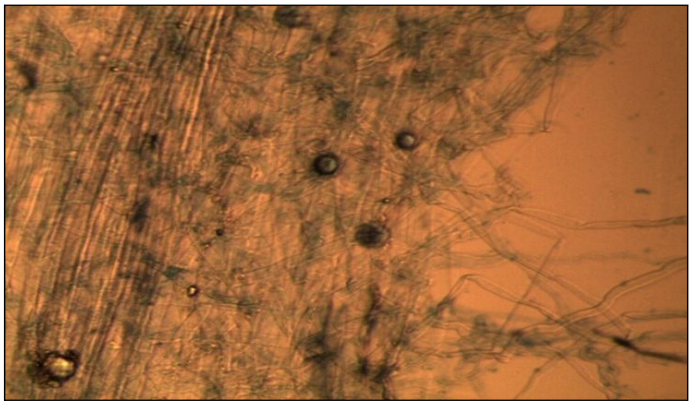
Effect of different level of residue retention on particulate organic carbon (POC), soil respiration (SR) and Vesicular Arbuscular Mycorrhiza (VAM) colonization

In order to study the effect of residue retention on soil properties under no till system in soybean-wheat cropping sequence, soil samples from 0-10 and 10-20 cm of soil depth was collected from research farm of ICAR-IISS, Bhopal. It was observed that five years of 90% of soybean and wheat residue retention had led to the improvement in soil organic carbon by 10% in comparison to nil residue retention. Regarding particulate organic carbon (POC), it was also significantly higher (62.5%) in 0-10 cm of soil depth as compared to no residue retention. Regarding, NO_3-N content at harvest in 0-10 cm of soil depth, it was 2.62 times higher in 0% residue retained plot in comparison to 90% of residue retained plot. The effect was also significant in 10-20 cm of soil depth. Here also, NO_3-N content was 1.74 times higher in 0% residue retained plot as compared to

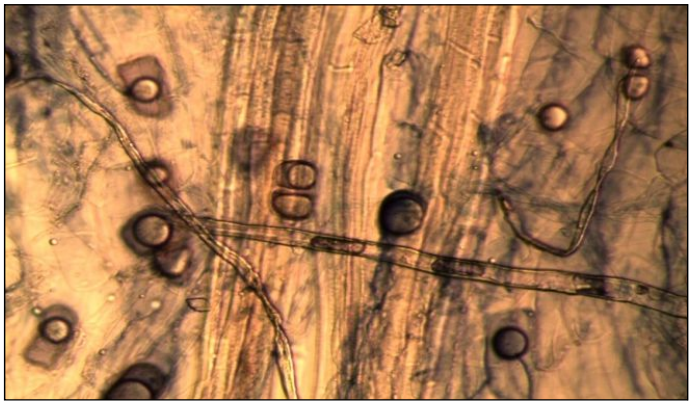


Effect of residue retention under no till system on POC and basal soil respiration under soybean-wheat cropping system

90% of residue retained plot. Soil basal respiration was found to 7.3% higher in 90% residue retained plot as compared to no residue retention. Similar trend was recorded in 10-20 cm of soil depth.



VAM colonization in 0% of residue retained plot (Wheat crop)



Effect of residue retention on VAM colonization in no till system under soybean-wheat cropping system

Evaluation of glauconite as a source of potassium for crops

Incubation studies were performed to study the potassium release behavior from glauconite after application in black (Vertisol, Wanirambhapur soil series) and red soil (Alfisol, Vijaypura, soil series). The effect of direct application of glauconite, calcined glauconite (heat treatments at 900^{0}C for 1hr), acidulated calcined glauconite, FYM and microbial inoculation with potassium dissolving bacteria (KSB) (*Bacillus cereus*) alone or in combination was evaluated. The results of the experiment suggested that calcined glauconite, application of glauconite + FYM and acidulation of glauconite showed pronounced influence on K release from glauconite. The microbial culture of *Bacillus cereus* did not show any significant improvement in K availability. Among the different treatments integrated application of acidulated calcined glauconite + FYM + microbial inoculation showed highest release of potassium throughout the incubation period.

Use of fly ash in agriculture for sustainable crop production and environmental protection

A long term field experiment (10 year) was initiated (2018-19) to investigate the impacts of fly ash application on crop yield and its sustainability with respect to soil and produce quality. Fly ash along with RDF was applied to the individual plot as per the treatment details of varying dose and frequency; 10, 20 and 40 t ha^{-1} (every year), 20, 40 and 80 t ha^{-1} (every alternate year) and 100, 200 and 400 t ha^{-1} (once). The results generated from first year (2018-19) revealed that soybean grain yield varied from 1.2 t ha^{-1} (control) to 1.4 t ha^{-1} (80 t ha^{-1} of fly ash). The soybean yield was increased with increase in fly ash dose up to 80 t ha^{-1}, however further increases in fly ash application from 100 to 400 t ha^{-1} reduced the soybean yield marginally. However, in case of wheat crop the grain yield was increased with increase in fly ash dose application only up to 40 t ha^{-1}, thereafter slight reduction in yield was observed.

Phytoremediation of copper mining (AMD) affected land in Malanjkhand area of Madhya Pradesh

Acid mine drainage (AMD) has had a huge negative impact on the environment, resulting in the inability to sustain life in badly affected areas. The levels of copper and other heavy metals present in the water around mines are significantly higher compared to similar geographical regions where mining has not occurred. An attempt was made to phytoremediate the water bodies surroundings the Malanjkhand copper mine area through growing of Vetiver (Chrysopogon zizanioides) on turf. Vetiver plant was successfully grown (Photo) in the affected water bodies leading to removal of the heavy metals and subsequently clean the soil sediments and water bodies.

Floating turf of Vetiver in Malanjkhand copper mining affected land

Management of municipal solid waste contaminated landfill area of Bhanpur, Bhopal

Bhanpur dumping waste sites are comprised of all the wastes arising from human and animal activities that are normally termed as municipal solid waste. The

composition of MSW of Bhanpur was recorded as plastics 10.71%, leather, rubber 30.25 %, clothes 5.23 %, soil 8.25%, glass 10.50 %, metals15.26%, bricks, stones16.23% other wastes 3.57%. PLFA analysis of the microbial community was analyzed to know the distribution of different microbes in undisturbed soil, cultivated soil, polluted soil and plant rhizosphere. It was observed that population of beneficial microorganisms was reduced in polluted soil. The microbial populations such as total heterotrophs, fungi and actinomycetes population was found more in the rhizosphere of vetivar plants as compared to control or unpolluted soil. The microbial activities in terms of soil respiration and soil enzyme activities such as soil dehydrogenase activities, fluorescein di-acetate hydrolysis was also found higher in the rhizosphere soil of the contaminated waste site as compared to control.

Development of Green Belt at Bhanpur Dump Area

Microbial population in MSW contaminated Bhanpur soil

Samples	Total Heterotroph (cfu g^{-1} soil)	Fungi (cfu g^{-1} soil)	Actinomycetes (cfu g^{-1} soil)	Soil respiration (mg CO_2-C kg^{-1} soil 10 d^{-1})	Soil dehydrogenase activity (µg TPF g^{-1} soil h^{-1})	Fluorescein di-acetate hydrolysis (g fluorescein g^{-1} soil h^{-1})
Rhizosphere soil from the vetivar, Bhanpur	5.5-8.5 x10^8	4.6-5.8x10^6	5.0-6.2 x10^8	94 ± 10.5	34 ±4.2	25 ± 2.0
Control soil (Unpolluted soil)	4.8 -5.4 x10^7	3.0-4.2 x10^5	3.0-4.5x 10^6	46 ± 7.4	18± 2.5	14 ± 1.2

Global warming potential of long-term application of fertilizer and manures

An attempt was made to quantify the amount of methane released from rice grown on Inceptisols of Ludhiana and to determine its global warming potential (GWP). It was observed that application of fertilizer, green manure and FYM resulted in enhanced methane release from soil. However, release of methane from rice field was counterbalanced by net increase in primary productivity of crop due to higher assimilation of CO_2 from atmosphere and it was also evident from narrow down in Yield Scaled-GWP on application of fertilizers and green manure.

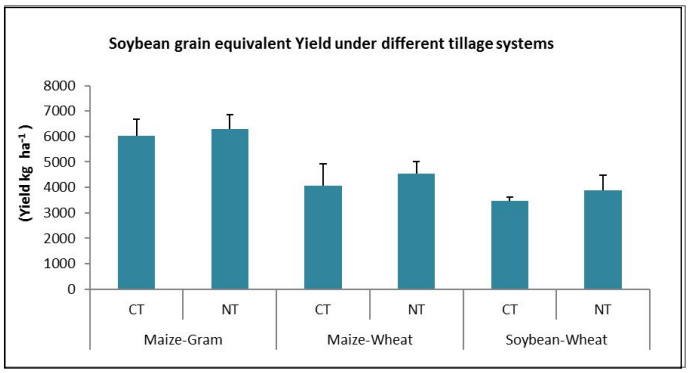
Methane production from rice field at Ludhiana centre of LTFE

Treatment	Average flux (kg ha^{-1} day^{-1})	Cumulative Methane emission (kg ha^{-1})	GWP (Mg ha^{-1} CO_2 equivalent)	YS-GWP (Mg CO_2 eq. Mg^{-1})
Control	0.13±0.01^a	14±0.8^a	0.47±0.02^a	0.12±0.01^a
100% NPK	0.43±0.07^b	49.6±8.29^b	1.65±0.28^b	0.28±0.04^b
100% NPK+GM	0.55±0.04^c	63.5±5.01^c	2.12±0.17^c	0.30±0.02^b
100% NPK+SI	0.89±0.02^e	103.1±3.46^e	3.43±0.11^e	0.55±0.01^d
100% NPK+FYM	0.72±0.02^d	82.7±2.59^d	2.75±0.08^d	0.40±0.01^c

Note : YS =Yield scaled GWP, Values within a column, followed by different letters are significantly different at P≤0.05 by DMRT,

Impact of conservation agriculture (CA) practices on crop yields

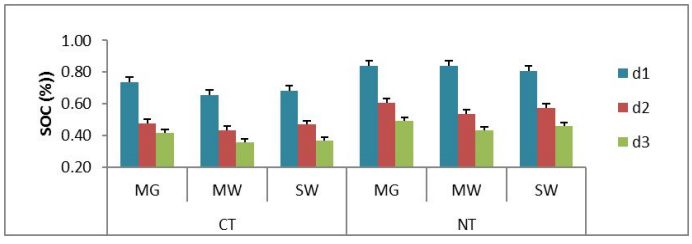
Grain yields of different crops under CA were recorded and converted into soybean grain equivalent yield (SGEY) for comparing different cropping systems. Tillage had no significant effect on the soybean grain equivalent yield (SGEY), whereas cropping system had a greater effect on SGE yield . Among various cropping systems studied, maize-wheat had significantly higher yield (7401 kg ha^{-1}) followed by soybean-wheat (6432 kg ha^{-1}) under NT. Similar trend was observed under CT. SGEY indicated that maize-gram cropping system recorded higher average yield compared to other cropping system, regardless of tillage system.



Effect of different tillage and cropping system on soybean grain equivalent yield (kg ha^{-1}) [MSP q-1 in 2018-2019; soybean -Rs 3399; maize-Rs1700; wheat-Rs 1840; gram-Rs 4620]

Long-term Impact of CA practices on soil organic carbon (SOC) after 9 crop cycles

A study was conducted to examine the soil organic carbon status under CA practices viz.different tillage system namely conventional tillage (CT), reduced tillage (RT) and

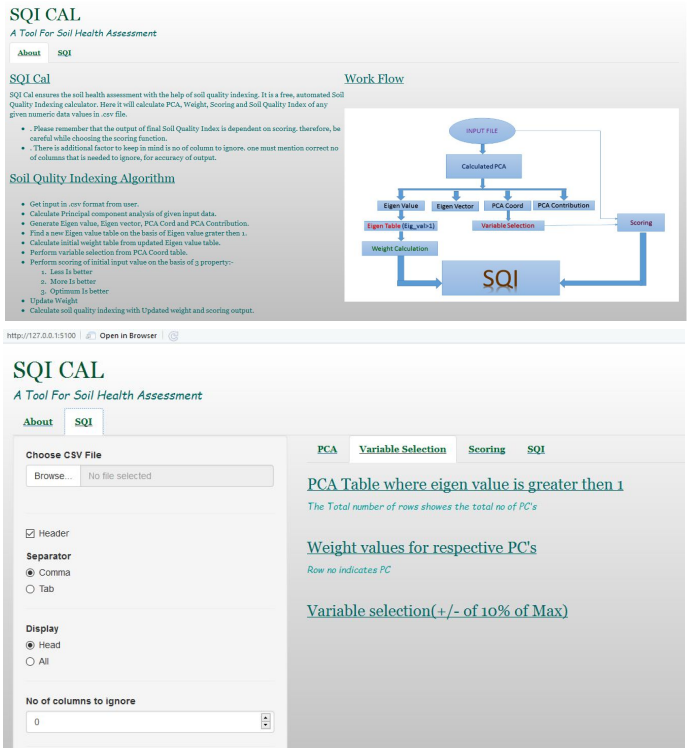


Effect of different tillage and cropping system on soil organic carbon (SOC) after 9 years at different soil depths (MG-Maize-Gram; MW-Maize-Wheat; SW-Soybean-Wheat; d1: 0-5cm, d2: 5-15cm, d3: 15-30cm)

no-tillage (NT) with residue retention under four different cropping systems. The mean data of SOC concentration for CT and NT were varied from 0.69 to 0.83 and 0.46 to 0.57 per cent at surface layer (0-5 cm), and subsurface layer (5-15 cm), respectively. Among the cropping systems evaluated, maize-gram and maize-wheat recorded significantly higher SOC (0.84%) followed by soybean-wheat (0.81%) under NT. Whereas, under CT maize-wheat recorded minimum SOC (0.65%) at 0-5 cm depth and SOC value decreased with increasing depth.The SOC content under NT was significantly higher than CT due to crop residue addition and relatively less soil disturbance by tillage operations under NT.

SQI CAL: A tool for soil health assessment

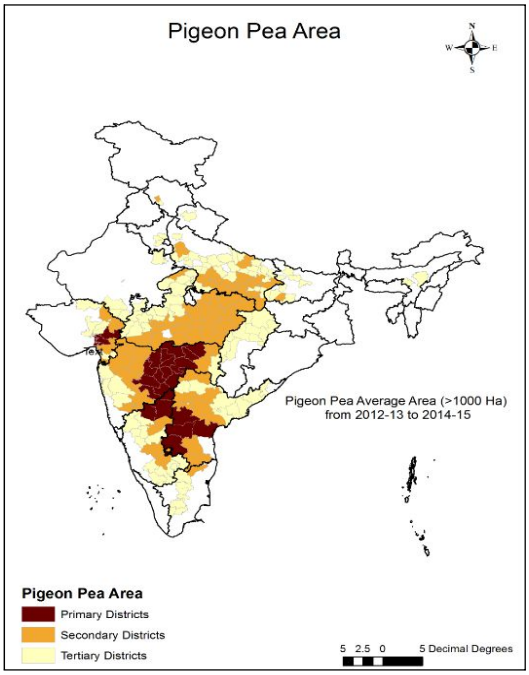
Soil Quality Index (SQI) is considered to be the most appropriate for quantitative assessment of soil quality. A software "SQI CAL" was developed for rapid calculation of SQI. The SQI CAL follows the standard method for calculating SQI which is comprised of following steps; i) Selection of the minimum dataset using PCA ii) scoring of indicators; iii) Weight determination of the individual soil properties (iv) Integration of weight and score into SQI. This software is developed using the R- platform and can be potentially used by the researchers and postgraduate students across the globe.



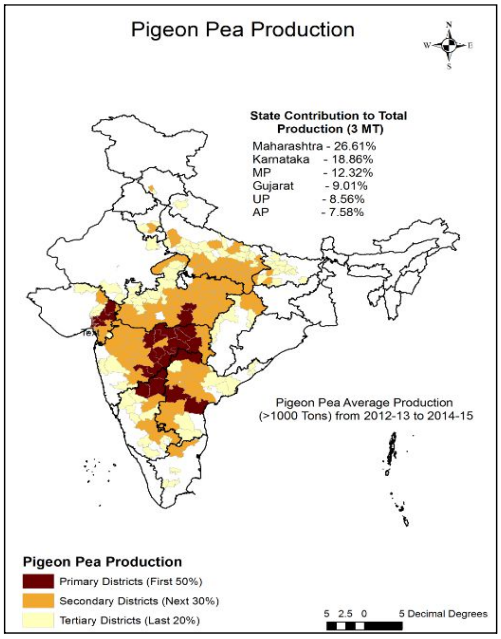
Screenshot of SQI CAL

Delineation of production zones for pigeon pea crop

Classification of districts was done into various production zones for Pigeon pea crop using district-wise available data on area and production of the pigeon pea crop for the last three normal years (2012-13 to 2014-15). All the districts of India growing the pigeon pea were arranged in a descending order based on the area under the crop. The top districts covering 50% of the total cropped area were



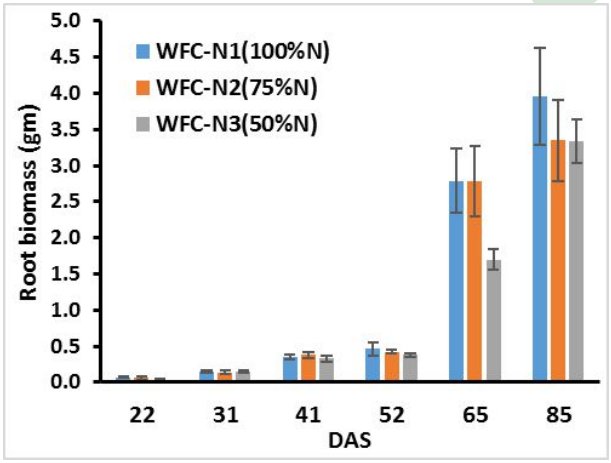
categorized into primary production zone (highest crop intensity) and the next group of districts covering 30% (50 to 80%) of the total area were categorized into secondary production zone (lowest crop intensity).



Primary, secondary and tertiary production zones of pigeon pea in India (Total districts = 446 (50%) Primary = 23 (Next 30%) Secondary=84 (Rest 20%) Tertiary = 339 (Out of which 213 districts have< 1000 ha)

Root biomass of wheat crop under different water and nitrogen treatments

Periodic root biomass of wheat crop was collected under different water and nutrient treatment.The results showed

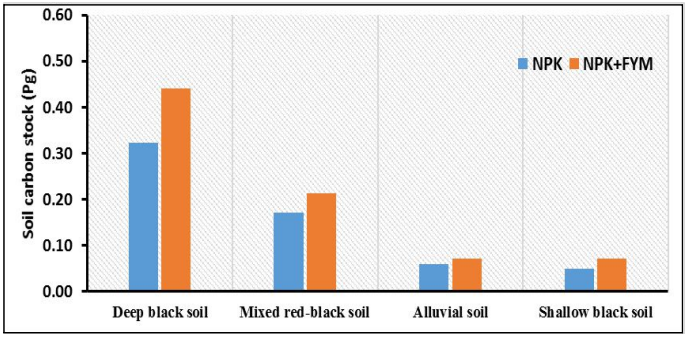


Root biomass (gm) of wheat crop as affected by water and nutrient management.

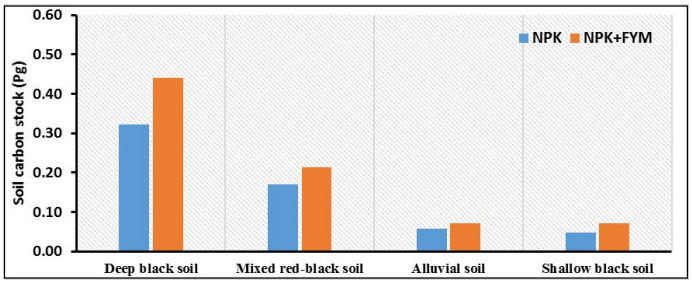
that treatment drought condition (WDR) significantly reduced the root biomass in later crop stages.Nitrogen treatments did not show significant effect on root biomass except 65 DAS. Wheat root biomass increased by 77%, 83%, 23%, 77% and 37% under the well water condition (WFC) compared to WDR at 31, 41, 52, 65 and 85 DAS. In general, under the WFC, trend of root biomass followed as N1>N2>N3, whereas higher root biomass in N3 (Nitrogen supply is 50% of recommended) under the WDR condition at later growth stage of wheat crop (65 and 85 DAS) was observed. Maximum observed root biomass was 3.96 gm and 2.87 gm in WFC and WDR, respectively.

Soil organic carbon stock of Madhya Pradesh

The total soil organic carbon stock in Maize-chickpea cropping system under NPK+FYM was 0.87 Pg which was 21.57% higher than NPK treatment (0.72 Pg). Similarly, in maize-wheat cropping system, total SOC stock was 0.79 Pg, which is 33.04% higher than NPK treatment alone (0.59 Pg). In maize-wheat cropping system, 49.44, 36.65, 25.29 and 22.24% increase in SOC stock was observed in shallow medium black soil, deep black soil, mixed red-black and alluvial soils, respectively. Similarly, in maize-chickpea cropping system increments of 28, 23.50, 22.96 and 16% was found in alluvial, shallow medium black, deep black



and in mixed red-black soils of Madhya Pradesh, respectively.

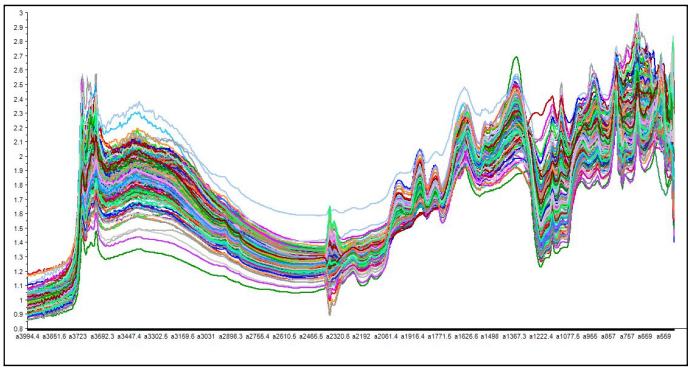


Soil carbon stock (0-30 cm) in different soils of Madhya Pradesh under different nutrient management under (a) maize-wheat and (b) maize-chickpea cropping system.

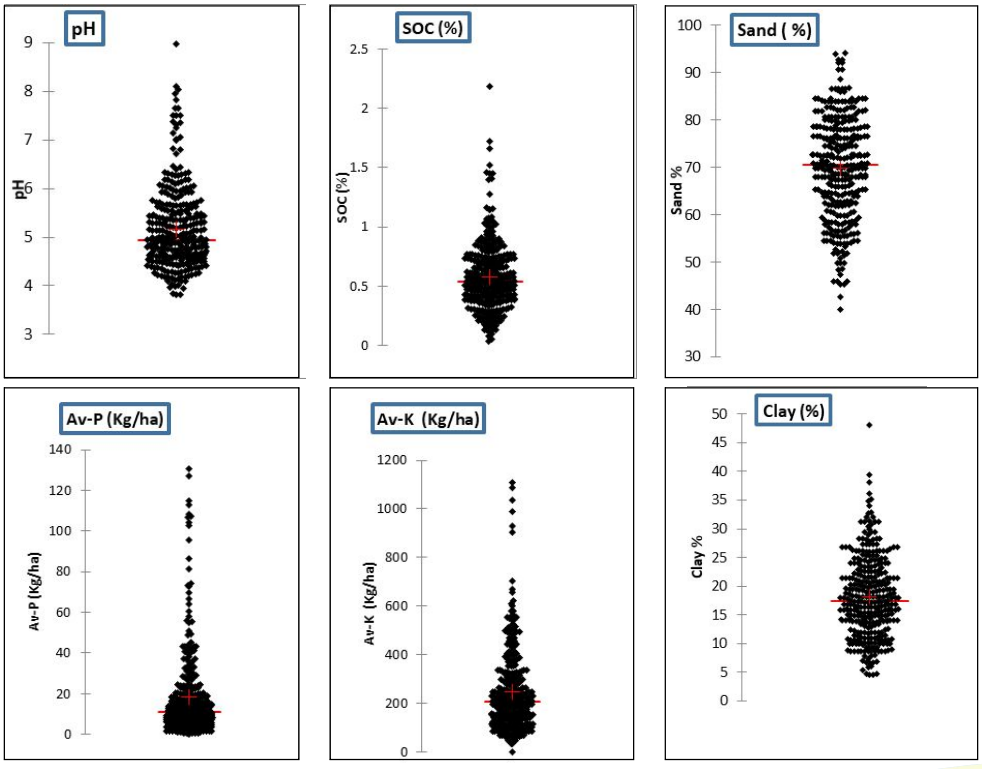
Application of diffused reflectance mid-infrared spectroscopy for rapid estimation of soil properties

An attempt has been made to develop chemometric models using laboratory analyzed data and MIR reflectance spectra for prediction of some important physical and chemical properties of Alfisols. Validation of the models was carried out to identify soil properties that can be measured through these techniques with reasonable accuracy. Soil properties namely, soil organic carbon, available P and K content, EC, pH, sand, silt and clay content of the soil samples collected from Orissa and Jharkhand were estimated through standard laboratory methodology.

Soil reflectance spectra in the mid-infrared region (2500-25000 nm range) of all the soil samples (n=360) were recorded using the alpha-MIR Spectrometer .The scattergram is depicting range, frequency, mean and median of soil properties . The models developed could predict reasonably well the SOC concentration and pH of the soil. Particle size distribution (Sand, Clay and Silt) also showed 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.



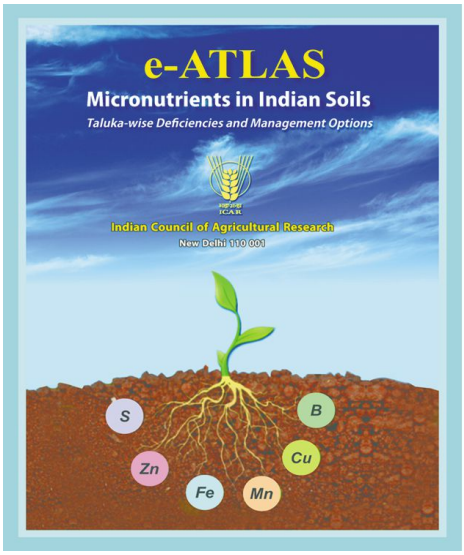
MIR Spectra of soil samples from Orissa recorded using alpha-FT-MIR spectrometer



Scattergram of soil properties of samples collected from the Alfisols regions of Orissa and Jharkhand.

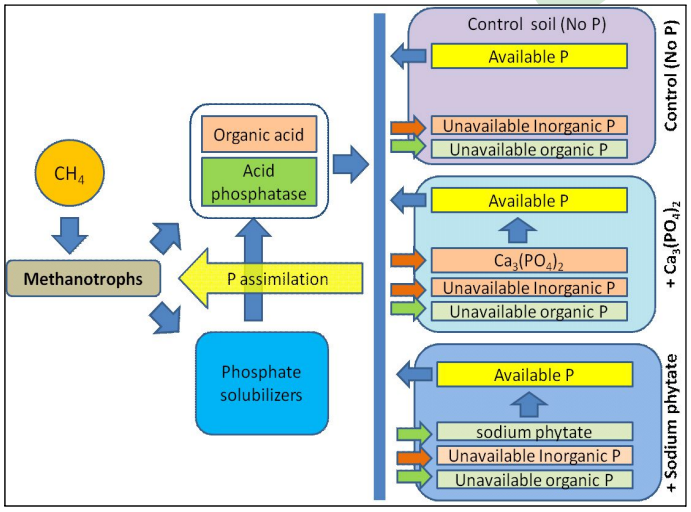
e-ATLAS on micronutrients in Indian soils

To address the problem of sulphur (s) and micronutrients (Zn, Fe, Mn, Cu and B) deficiency in different soils of the country and their impacts on crop production and crop quality, an *e-ATLAS on Micronutrients in Indian Soils* containing *taluka* wise soil micronutrients status of 536 different districts of twenty-three states of the country and their management in different crops and cropping systems was published for its use by different stakeholders for precise micronutrients supply and their management in different soils of the country for better and quality crop production. Analysis of more than 2.0 lakhs soil samples collected from 536 districts of the country revealed that on an average 28.5, 36.5, 12.8, 7.1, 4.2 and 23.2% soils were deficient in S, Zn, Fe, Mn, Cu and B, respectively. The categories of available sulphur and micronutrients status in soil used for mapping were acute deficient, deficient, latent deficient, marginally sufficient, adequate and high. Recommendations i.e. rate, time and source of sulphur and micronutrients were generated depending upon the crops and cropping system and fertility ranges of these nutrients.



Do methanotrophs drive phosphorous mineralization in soil ecosystem ?

Methane (CH_4) consumption is a key soil microbial process for mitigating global climate change. Experiments carried out to elucidate linkage between methane consumption and mineralization of P from inorganic [$Ca_3(PO_4)_2$] and organic (sodium phytate) sources. CH_4 consumption rate was significantly ($p<0.05$) correlated with available P and acid phosphatase. Based on the data, a hypothetical model developed to elucidate CH_4 driven P mineralization in soil ecosystem.



Schematic illustration of CH_4 consumption driven P mineralization in soil ecosystem

Programmes Held

PM Kisan Samman Nidhi Yojna

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) is a Central Sector scheme with 100% funding from Government of India. The Scheme was effective from 1.12.2018.Under the Scheme an income support of Rs.6000/- per year is provided to all farmer families across the country in three equal installments of Rs.2000/- each every four months. ICAR-IISS, CIAE, and NIHSAD, Bhopal jointly organized a programme on this theme in the month of February, 2019.

PM Kishan Samman Nidhi Yojna held ICAR-IISS, Bhopal

ICAR-Indian Institute of Soil Science, Bhopal organized 32nd foundation day

- The ICAR-Indian Institute of Soil Science (IISS), Nabibagh, Bhopal organized its 32nd Foundation Day on 16th April 2019. The Chief Guest of the Program, Hon'ble Vice-Chancellor, Barkatullah University, Dr. R. J. Rao emphasized on different ecosystem functions of soil and underlined the role of soil in the survival of mankind, animal and plant kingdom. Dr. Ashok K.

Dr RJ Rao, VC BU, Bhopal, addressing the gathering

Patra, Director, ICAR-IISS, in his welcome address briefed about the mission of the Institute to improve soil productivity with minimal environmental degradation. He highlighted different achievements of the Institute, viz. soil testing kit (Mridaparikshak), soil fertility maps for 536 districts, rapid composting unit and use of nanotechnology for generating soil nutrients from waste mica and rock phosphate. Dr. Pankaj Srivastava, Director, IIFM underlined the fact that soil is a finite resource and our first emphasis should be to save soil, then everything else including forest and agriculture ecosystem will be taken care of. The Foundation Day lecture was delivered by Dr. P. C. Sharma, Director, CSSRI, Karnal in which he highlighted about the Soil Health Mission and contribution of the Institute to the Government's initiative in soil health card (SHC) scheme. Progressive farmers from various villages adopted under Mera Gaon Mera Gaurav (MGMG), Farmers' First and CRP on Conservation Agriculture schemes and the National and State level award winning farmers were felicitated on the occasion.

Progressive farmer felicitated during the function

Awards / Honours / Recognitions

- Dr. Ashok K. Patra, Director was elected as President of Indian Society of Soil Science for the biennium 2019 and 2020.
- Dr. Asha Sahu was selected for "Bharat Ratna Indira Gandhi Gold Medal Award" given by Global Economic Progress and Research Association on 09/03/2019 at Bangalore.
- Dr. Kollah Bharati was conferred with Best Scientist Award (2019) at 8th Science & Technology EET CRS, Banglore.
- Dr. Sanjib Kumar Behera awarded "Mosaic Company Foundation Young Scientist Award" in the area of Plant Nutrition 2018-19 by Mosaic India Private Limited, Gurgaon, India on March 12, 2019 at Gurgaon.
- Dr. Sanjay Srivastava received "Reviewer's Excellence Award" certificate from Indian Journal of Agricultural Research in recognition of significant and outstanding contribution to the Journal and reviewing the article.
- Dr Pramod Jha elected as editor of Journal of Indian Society of Soil Science, New Delhi
- Dr NK Lenka adjudged Fellow of the Indian Association of Soil & Water Conservationists, Dehradun for the year 2018
- Dr R Elanchezhian elected as Zonal Secretary for Central Zone of Indian Society for Plant Physiology comprising Madhya Pradesh, Rajasthan, Chhattisgarh and Jharkhand for three years 2019-2021.
- Dr S.R. Mohanty awarded US Fulbright Fellowship 2019.
- Dr. Pradip Dey was awarded Best Poster Award in Golden Jubilee International Salinity Conference 2019 on Resilient Agriculture in Saline Environments under Changing Climate: Challenges & Opportunities, held during 7-9 February, 2019 at ICAR-CSSRI, Karnal, Haryana.

International Co-operation

Dr. Pradip Dey received certificate from TMG Research gGmbH, Germany as Soil Science Expert and National Steering Committee Member of GIZ Prosoil Project during Global Soil Week held at Nairobi, Kenya on 26-30 May, 2019.

Staff News

Dr. Samaresh Kundu, Former HOD (ESS) and Principal Scientist, superannuated on 31st March, 2019.

Ms. Alka Rani Joined as a Scientist (Soils) in the Division of Soil Physics on 12th April, 2019.

Extension Activities

Enhancement of soil health and livelihood of tribals of barwani district in Madhya Pradesh

Under Tribal Sub Plan (TSP), the Barwani district was selected as aspiration district in Madhya Pradesh. The

survey was done to identify the problems of tribal farmers in Barwani district. Farmer's visit-Cum-Training programme on 'Soil Health Management' was organized on 18th March 2019 at KrishiVigyan Kendra (KVK), Barwani. About 100 tribal farmers participated and the objective of training was to impart and upgrade the knowledge of farmers and creating awareness amongst farmers for modern agriculture techniques and practices.

Identifying indigenous technologies in tribal villages of Balaghat district of Madhya Pradesh

Surveys were carried out in tribal villages viz., Kaweli, Kulpa, Sarra, Khursodi, and Butta of Balaghat district of Madhya Pradesh to document Indigenous knowledge and practices of tribal farmers in soil and water management. Tribal farmers of these villages are practicing settled agriculture in the land demarcated for agriculture. They cultivate rice in their entire farmland in the kharif season followed by a little bit of other crops like pulses, mustard, and horse gram. Major indigenous technologies that are in practice among the tribal farmers are; growing crops on raised earthen beds, terracing of undulated land for farming, fragmentation of farm fields into small units, construction of grassy field bunds, deep summer ploughing using wooden plough, construction of water harvesting ponds in lower hill slopes, allowing cattle grazing in farm

Tribal homestead garden

fields, manuring of farm fields using farmyard manure and wood ash, and application of pond soil in farm fields. They also own rainfed homestead gardens for family requirement. Underground crops like ginger, turmeric, taro etc are growing on raised earthen beds in the homestead gardens.

Crops on raised beds

Farmer field school at Balaghat

ICAR- Indian Institute of Soil Science, Bhopal conducted a farmer field school on "soil sampling for soil testing" in Balaghat district during 9-10 January, 2019 to educate the tribal farmers about importance of soil testing.

Farmer Field School at Sarra Village, Balaghat

Training farmer to collect soil sample

Harit Dhara, an E-Magazine launched

Harit Dhara, an E-magazine was launched on April 16, 2019 by ICAR-IISS, Bhopal. The magazine link is available on the institute website (www.iiss.nic.in). Harit Dhara is to be published quarterly by the institute. The Hindi words 'Harit' means Green and 'Dhara' means Earth in English.

Revenue Generation

The revenue of Rs. 5000000/ (Rupees fifty lakh only) in the form of royalty was generated on 31st March, 2019 on account of commercialization of ICAR-IISS technology Mridaparikshak. Mridaparikshak is a mini lab which can analyze soil health parameters. It was commercialized in the year 2016 and so far has generated a royalty of Rs 2.65 crores.

Institute organized 70th Republic Day

Institute organized 8th International Women Day

- Training programmes were conducted in tribal villages to popularize the soil testing and its importance in tribal farming community on 8 January, 2019. Sixty four farmers including eight women farmers have participated in the event in Suryanagaram districts of Vijayanagaram. Different facets of soil testing and soil health, the farmers were provided hands on training on how to collect soil samples. Practical demonstration on collection of soil samples in the farmers' field was done both by experts and participants. Subsequently, after analysis of soils in the laboratory, soil health cards were distributed to selected tribal farmers and

explained the use of fertilizers as per soil testing for crop production.

- Training programme was conducted in tribal village at Alikol Thanda, Rangareddy district, Telangana State and gave lecture on "Importance of Soil Testing" on 8 February, 2019.

Capacity building programme organized under the aegis of ICAR-AICRP (STCR) at Rangareddy district, Telangana state

- With a view to popularize the importance of soil test based balanced fertilizer application with STCR approach among the farmers , a skill development programme was organized on 25 May, 2019 under the aegis of ICAR sponsored AICRP-STCR at Sheruguda Bhadraiahpally village, Kothur mandal, Rangareddy district, Telangana state.

National productivity week (12-18 Feb 2019)

ICAR-IISS, Bhopal celebrated National Productivity Week during 12-18 Feb., 2019 under the theme of Circular Economy for Productivity and Sustainability. All the staff of ICAR-IISS participated in the various functions. Dr. A.K. Patra, Director ICAR-IISS & Chairman, National Productivity Week gave his insightful thoughts on productivity enhancement in agriculture and soil science in particular on the concluding day. Dr. A.B. Singh and Dr. AK Viswakarma coordinated the farmers-scientist interaction meet organized at ICAR-IISS during the week.

Exposure visit cum workshop on soil health management for improved crop productivity

A two days Exposure visit cum Workshop on Soil Health Management for improved crop productivity for tribal farmers was organized at KVK Rajnandgaon, Chhattisgarh during 8-9 March 2019. On 8th March 2019, about 400 tribal farmers participated in an interactive workshop programme at KVK Rajnandgaon. Discussions were held with farmers on soil health assessment and management for improving crop productivity. On 9th March 2019 team of ICAR-IISS, Bhopal along with team of KVK, Rajnandgaon visited fields of tribal farmers at village Kekti Tola, Sonsai Tola and Manga Tola in Ambagarh chowki tehsil/block of Rajnandgaon. In an interactive session at Manga Tola village, soil related issues of farmers were discussed with their soil health cards and corrective measures were suggested by ICAR-IISS, Bhopal and KVK Rajnandgaon team.

Scientists' Participation in Conferences / Seminars etc.

Name	Programme attended/ participated	Venue	Date
Dr. Abhijit Sarkar	"Recent advances in micro-irrigation and fertilization systems for improved input use efficiency through engineering interventions"	ICAR-CIAE, Bhopal	January 3-23, 2019
Dr. A.K. Patra	Participated in selection committee meeting for the appointment of senior scientist and Head (Under KVK) as DG, ICAR's nomine	JNKVV, Jabalpur	January 7-9, 2019
Dr. R H Wanjari	Workshop on 'Indigenous Seeds and Seed System'	Vidarbha Dev. Board, Nagpur	January 9-10, 2019
Dr. A K Patra	Ph. D. Viva-voce examination	Division of Soil Science and Agricultural Chemistry, MPKV, Rahuri	January 11-13, 2019
Dr A. B. Singh	Janparishad's 6th International Conference on "Science and Environmental Sustainability for a Peaceful Society	State Museum, Bhopal	January, 19-21, 2019
Dr. R S Chaudhary and Dr. J Somasundaram	Workshop on 'Building an Operational Composite drought Monitoring Index for India'	NASC Complex, New Delhi	January 22-23, 2019
Dr. R S Chaudhary	Workshop on 'Operational Composite Drought Monitoring Index for India'	New Delhi	January 22-25, 2019
Dr. N K Lenka	Annual Review Workshop of the National Agricultural Science Fund (NASF)	NASC Complex, New Delhi	January 30, 2019
Dr. A K Patra, Director Dr. Pradip Dey Dr. A.K. Shukla	"Annual Conference of Vice-Chancellors of Agricultural Universities & Directors of ICAR Institutes	NASC Complex, New Delhi	January 31 to February 1, 2019
Dr. A.K. Shukla	Attended Directors' Conference	ICAR, New Delhi	January 31 to February 02, 2019
Dr. N K Lenka	Conference on Farmers First for Conserving Soil and Water Resources	Sunabeda, Koraput, Odisha	February 6-7, 2019
Dr. A K Patra	ICAR-CSSRI Golden Jubilee International Salinity Conference, 2019 and he also chaired a session as Chairman and Lead Speaker on "Saline agro-ecosystem: impact and management of water and environment"	CSSRI, Karnal	February 7-10, 2019

Name	Programme attended/ participated	Venue	Date
Dr. Pradip Dey Dr. Tapan Adhikari	Golden Jubilee International Salinity Conference (GJISC-2019) "Sustainable plant nutrient management based on targeted yield approach in reclaimed salt affected soils of arid and semi-arid regions of India"	ICAR-CSSRI, Karnal	February7-9, 2019
Dr. A. B. Singh	Edible Alliums: Challenges and Opportunities	Yashwantrao Chavan Academy of Development Administration, Pune	February 9-12, 2019
Dr. A.K. Patra	Acted as Jury panelist in the National Jury Convention (Stage-4) for Mahindra Samriddhi India Agri Awards	New Delhi	February 11-12, 2019
Dr. N.K. Lenka	Research planning workshop on soil health and resilience studies under SAFBIN	Kathmandu, Nepal	February 18-20, 2019
Dr. A K Patra	Director participated and coordinated the technical session on "Soil Health (Soil & Fertilizer)" in the XIV Agricultural Science Congress on "Innovations for Agricultural Transformation	NAAS & ICAR-IAEI, New Delhi	February 19-23, 2019
Dr. A.K. Patra	Attended 5th Meeting of Asian Soil Partnership of FAO including steering committee centre of excellence of soil research in Asia	NASC, New Delhi	February 24-28, 2019
Dr. Tapan Adhikari	International Workshop "Indo-German workshop on waste to wealth" at CSIR-AMPRI),	CSIR-AMPRI), Bhopal	February 25-26, 2019
Dr. R.S. Chaudhary	User Engagement Initiative Meet on Water Resource Supply and Management in Central India'	IISER, Bhopal	February 28 to March 2, 2019
Dr A.O. Shirale & Mr. Deepak Kaul	Smart Farm Tech-2019	Raipur	March 1-2, 2019
Drs. A K Patra, Muneshwar Singh, Pradip Dey, Pramod Jha	"National Seminar on Strategies for Soil Health Management: Achievements and Researchable Issues"	RVSKVV, Gwalior	March 02-03, 2019
Drs. R.K. Singh, R.H. Wanjari, Hiranmoy Das, Utkarsh Tiwari and P.S. Sunil Kumar	Training on 'Soil Health Management' for 100 farmers	KVK Barwani (M.P.)	March 18, 2019

Name	Programme attended/ participated	Venue	Date
Dr. Seema Bhardwaj	Resource Management in Rainfed Drylands	UAS, Banglore , IIT,Kanpur and Commonwealth of Learning,Canada	March 25 to 6 May 2019
Dr A.K. Patra	Delivered a key note address and chaired a session of the Biotechnology international Conference	AKS University, Satna, MP	April 4-8, 2019
Dr. A.K. Patra	Participated in the expert meet on Soil and Use Policy	NASC, New Delhi	April 13, 2019
Dr. A.K. Patra	Participated in the 10th working session of the Intergovernmental Technical panel on soils (ITPS) and Global Symposium on Soil Erosion (GSER-19)	FAO, Hq, Rome, Italy	May 13-17, 2019
Drs. K.M. Hati, R.S. Chaudhary, Muneshwar Singh, Pradip Dey, Pramod Jha, M. Vasssanda coumar, Nishant K. Sinha, J.K. Thakur and M. Mohanty	Workshop of the ICAR-IISS-ICRAF collaborative project on "Infrared Spectroscopy use in Soil Health Assessment"	ICAR-IISS, Bhopal	May 29, 2019
Dr. A.K. Patra	Participated in the foundation day and 28th AGM of NAAS	NAAS, New Delhi	June 04-05, 2019
Dr. A.K. Patra	Attended a meeting on fertilizer awareness program me for farmers and conceptual framework for DBT to farmers for fertilizer subsidy	Krishi Bhavan, New Delhi	June 10-11, 2019
Dr. N.K. Lenka	Executive Council meeting of the Indian Society of Soil Science	IARI, Pusa Campus, New Delhi	June 14-15, 2019
Dr NK Lenka	Attended Methodology Workshop on 'Sustainability of Indian Agriculture'	ICARNational Institute of Agricultural Economics and Policy Research, New Delhi	June 18, 2019
Dr. R S Chaudhary	"Expert Consultation Workshop on Forest Hydrology",	IIFM, Bhopal	June 20, 2019
Dr. Muneshwar Singh	Workshop on "Strategy to increase carbon in soil"	UPCAR and Dept. of Agriculture, Govt. of U.P., Lucknow	June 28-29, 2019

Published By

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