



# ISS



# Newsletter

Volume 17, Number 2

July - December 2014

*From the Director's Desk*

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## Forthcoming Events

- Model Training Course on Climate Change : 28 January to 04 February, 2015
- XXI RAC Meeting : 30-31 January, 2015
- Institute Research Council Meeting: 19-20 March, 2015
- Institute Foundation Day: 16 April, 2015



## Editors

Dr. N.K. Lenka  
Dr. R.H. Wanjari  
Dr. M. Mohanty

## INVEST IN SOIL HEALTH FOR FOOD SECURITY



The trinity of healthy seeds, healthy soil and enough water is indispensable for successful agriculture and prosperity of India. Using biotechnological breakthrough we may succeed to develop high yielding crops, but can it produce that yield on the impoverished soil? Continuous mining of soil nutrients by high yielding crops and imbalanced fertilization since the Green Revolution has created a widespread negative balance ( $\approx$  10 million tonnes/year of NPK) of major and essential micronutrients, and this gap is continuing year after year. The soil biota, which is the 'root' of healthy soil for efficient nutrient cycling is losing its genetic and functional diversity due to imbalanced fertilization, injudicious use of pesticides, unabated soil pollution and negligible or no return of organic residues. Soil carbon has reached to less than a critical level of 0.5% in many areas, rendering the soil more fragile, poor in buffering and resilience against biotic or abiotic stresses.

However, in view of the increasing soil degradation and soil quality deterioration, there has been world-wide attention to conserve soil and maintain its quality. It is heartening to know that the 68<sup>th</sup> UN General Assembly has declared 2015 as the International Year of Soils (IYS). The IYS aims to be a platform for raising awareness of the importance of soils for food security and essential ecosystem functions. Recognizing the importance of soil by the highest political forum of the world is a matter of great opportunity for the soil scientists, land managers, and related policy making bodies to harness the political will and develop action plans for implementation at varied time scale. It is only a happy coincidence that Government of India has also launched a countrywide programme of soil health assessment and distribution of around 14 crore soil health cards to farmers of the country in the next three years. The Institute's Scientists have been giving technical backstopping in formulating soil test based fertilizer recommendations.

A mini lab of soil testing named *Mridaparikshak*, is under development which is targeted to estimate 10 important soil parameters, viz., pH, EC, organic carbon, available N, P, K, S, Fe, Zn, and B and generate fertilizer recommendations for specified targets for selected crops and soils. Besides, work has been initiated to assess the quality of different types of soils existing in India. Integrated plant nutrient supply modules and modified urea materials are being evaluated to study their efficacy. Six mesophilic fungi were screened for bioremediation of heavy metals from municipal solid waste and *Trichoderma viride* was found superior for removal of Pb, Ni, Zn and Cd followed by *Aspergillus flavus*. A rapid composting unit was fabricated in collaboration with the ICAR-CIAE, Bhopal to speed up the composting time using a consortium of ligno-cellulolytic thermophilic organisms.

An important endeavor of the Institute is to disseminate the technologies and act as a knowledge platform on all aspects of soils. In this line, participatory research, demonstration and farmers' training programs were taken up in different states. Winter school/short courses were organized for researchers and state government officials. The six-monthly period was memorable with several awards and recognitions bagged by the scientists of the Institute. With such commitment of fellow colleagues, I am sure the Institute shall make realistic and tangible contributions towards sustaining soil health and food security of India.

(Ashok K. Patra)

## Long-term evaluation of integrated plant nutrient supply (IPNS) modules

Various IPNS modules comprising of integration of chemical fertilizers and organic manures like farm yard manure (FYM), poultry manure (PM) and green leaf manure (*Gliricidia* loppings), were evaluated for maize-chickpea cropping system in a long-term study at the IISS research farm. The treatments significantly influenced maize yield during *kharif* season (Fig.1). Total dry matter and grain yield of maize was highest with soil-test crop response equation (STCR) based recommended dose of fertilizers which was at par with general recommended dose (GRD) and 75% NPK of STCR dose plus 5 t FYM ha<sup>-1</sup>. The dry matter and grain yield in these treatments were significantly higher than the fully organic treatments including that in the treatment receiving 20 t FYM ha<sup>-1</sup> every season. A reduction in the fertilizer application by 25% of the STCR dose reduced the grain yield from 4.42 to 2.99 t ha<sup>-1</sup>. However, with addition of 5 t FYM ha<sup>-1</sup> in the treatment increased the grain yield from 2.99 to 4.30 t ha<sup>-1</sup>.

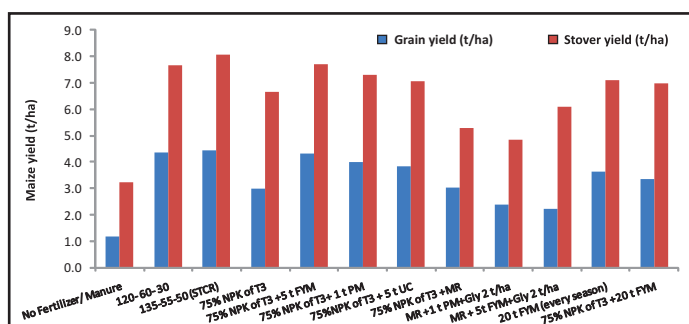


Fig. 1: Performance of maize under IPNS modules

## Soil organic matter - soil plasticity relationship as affected by amendment

An investigation was made to the relationship between soil native carbon (C) level and soil plasticity parameters in a clay loam soil. The soil was subjected to two levels of native C depletion and thus yielding three carbon levels i.e. no depletion (C<sub>1</sub>), 33% depletion (C<sub>2</sub>), and 54% depletion (C<sub>3</sub>). The C levels were combined with four management practices i.e. control (M<sub>1</sub>), 100% RDF + 10 t FYM ha<sup>-1</sup> (M<sub>2</sub>), 20 t FYM ha<sup>-1</sup> (M<sub>3</sub>) and 150% RDF (M<sub>4</sub>), and experiment was continued since *kharif* 2011. Data showed that the plastic limit and liquid limit reduced with depletion in soil C level, though the depletion was drastic from C<sub>1</sub> to C<sub>2</sub>. Averaged over management treatments, the plastic limit reduced from 29% (g g<sup>-1</sup>) under C<sub>1</sub> to 18% (g g<sup>-1</sup>) under both C<sub>2</sub> and C<sub>3</sub> treatments. Upon reclamation, the plastic limit of both C<sub>2</sub> and C<sub>3</sub> soils increased and the effect of M<sub>3</sub> treatment was higher. The effect of soil C depletion was also observed in terms of liquid limit. The liquid limit reduced from 45% (g g<sup>-1</sup>)

under C<sub>1</sub> to 34-35% (g g<sup>-1</sup>) under both C<sub>2</sub> and C<sub>3</sub>, respectively. Similar to plastic limit, the effect of management treatments was also conspicuous in reclaiming the liquid limit from the depleted soil C levels. Among the treatments, M<sub>3</sub> showed best reclamation effect. The plasticity index was computed from the difference between plastic limit and liquid limit. When estimated for the treatments, there was a trend of increase in plasticity index, however, not much variation was observed between the treatments.

## Evaluation of modified urea materials

An experiment on evaluation of different modified urea materials in respect to crop productivity and nitrogen use efficiency at the Institute's research farm showed that maize grain, stover yield and harvest index significantly varied with application of different modified urea materials. Amongst different modified urea materials, neem coated urea (NCU) recorded significantly higher grain, stover yield and harvest index followed by biochar coated urea (BCU), pine oleoresin urea (POR) and zeolite coated urea (ZCU) in the two doses of 120 kg N ha<sup>-1</sup> and 90 kg N ha<sup>-1</sup>, respectively (Fig. 2). The increase in grain yield was 19.0, 9.87 and 7.71% under NCU, BCU and POR over the prilled urea, respectively at N application level of 120 kg N ha<sup>-1</sup>. A related experiment was conducted in this project to evaluate best agronomic interventions, viz., split application of N, skipping of basal N dose and time of application for enhancing crop yield and nitrogen use efficiency of maize crop. The study showed that crop productivity and nitrogen use efficiency were significantly higher in the treatments where basal dose of nitrogen was skipped and total N was applied in two equal splits (60 kg N ha<sup>-1</sup>) at 20 and 40 days after sowing, respectively.

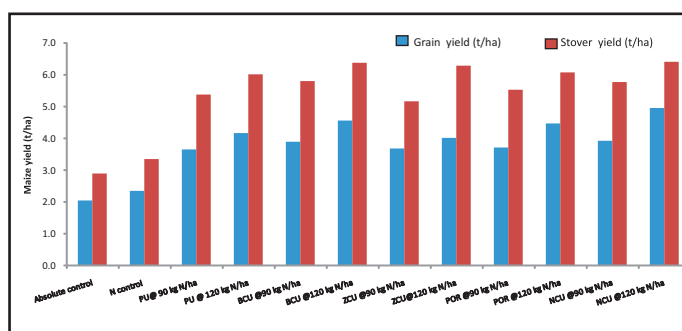


Fig. 2 : Performance of maize under modified urea materials

## Urease inhibitor product (LIMUS) for nutrient use efficiency in maize

A study on effect of different N sources for maize was carried out during *kharif* season at the Research Farm of Indian Institute of Soil Science during July 2014. Application of N more than 120 kg ha<sup>-1</sup> did not enhance the grain yield significantly. Splitting up of N application has resulted in a

decrease in grain yield of maize in almost all the cases. Application of LIMUS urea resulted in higher grain yield over normal urea, however, the yield increase ranged between 174 to 570 kg ha<sup>-1</sup>. Significant increase in yield was observed when 80 kg N was supplied in two splits at V<sub>4</sub> and V<sub>8</sub> stage of crop growth only. At the same time, neem coated urea has resulted in statistically higher grain yield of maize as compared to prilled urea application and statistically at par yield compared to LIMUS urea with the same method of application.

#### Effect of cadmium and zinc application on chromium uptake in spinach

Tannery industry effluent contains cations, anions and other heavy metals besides Cr in large concentration. A pot culture experiment was conducted to study the interaction of Cr with Cd and Zn on their uptake by spinach crop. Results showed that increasing the Cr, Cd and Zn application enhanced the concentration of the respective metal ions in root and shoot when applied alone. Cadmium application @ 2 mg kg<sup>-1</sup> decreased Cr concentration in root as well as shoot, in soils contaminated with 100 mg Cr kg<sup>-1</sup> soil (Fig. 3), though no significant effect was observed at contamination level of 50 mg Cr kg<sup>-1</sup> soil. Zinc application had no significant effect on Cr concentration in root and shoot, and its uptake. Thus, the study revealed that presence of Cd in tannery effluent may decrease the Cr concentration in spinach crop.

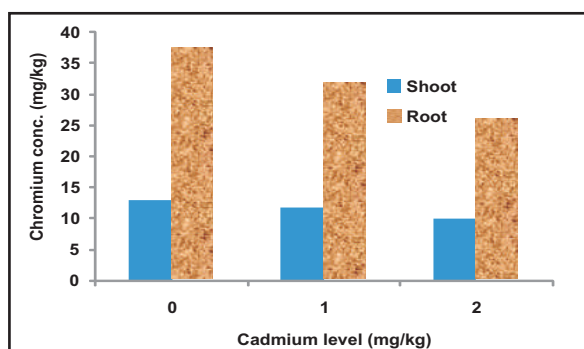


Fig. 3 : Effect of Cd on Cr concentration in root and shoot

#### Effect of sewage water on heavy metal pollution

The geo-referenced surface soil samples were collected from long-term sewage irrigated area of Patra Nala of Bhopal region at an interval of 1-2 km up to Halali dam (Plate 1). The collected soil samples were analyzed for total heavy metal (Cu, Cd, Pb, Cr, Ni and Zn) accumulation with the help of ICP-OES. Results showed that concentration of Cu, Cd, Pb, Cr, Ni and Zn in soils irrigated with sewage water was higher than that irrigated with ground water. The concentration (mg kg<sup>-1</sup>) of Cu ranged between 40.9-100.4 (mean 61.5); Cd 1.6-19.6 (mean 3.9); Pb 9.8-31.2 (mean 15.8); Cr 25.0-65.6 (mean 41.9); Ni 31.7-69.6 (mean 47.1); and Zn from 37.1-162.0 (mean 64.7). Total Cu, Cd, Pb, Cr, Ni and Zn built up by 2.1, 3.2, 1.4, 1.8, 2.0 and 1.6 times more due to use of sewage water for irrigation than tube well irrigated field.



Plate 1. Collection of effluent and soil sample

#### Nitrous oxide (N<sub>2</sub>O) emission from coated urea

Application of N fertilizers to soil is the major source of N<sub>2</sub>O emission, contributing 70% of total emissions from all sources. Because of strong inter-relationship between N use and climate change, there is urgent need to search possibilities to reduce N<sub>2</sub>O emission from applied fertilizer N. An investigation under controlled condition in laboratory was attempted to measure N<sub>2</sub>O emission from pine oleoresin (POR), nano-ZnO (< 100 nm) and nano rock phosphate (< 48.6 nm) coated urea. In comparison with normal prilled urea, application of POR (5%) coated urea reduced the N<sub>2</sub>O emission in soil to the extent of 20.26%. Further, mixing of 2% nano-ZnO or 35% nano rock phosphate particles to POR coating decreased the N<sub>2</sub>O emission to 44.95% and 40.15%, respectively. Nano-ZnO coated urea showed the least N<sub>2</sub>O emission (0.28 µg N<sub>2</sub>O mg<sup>-1</sup> N) followed by 35% nano-RP coated urea (0.30 µg N<sub>2</sub>O mg<sup>-1</sup> N).

#### Tillage and manure effects on soil C pools in Vertisols

The sustainability of any crop production system depends on maintaining adequate soil plant nutrients and soil organic C levels. Residue management, which is normally altered by tillage systems, is a fundamental constituent for the maintenance of soil and nutrients. Tillage systems which limit the incorporation of plant residues have generally been shown to alter the soil organic carbon pools. After six years of experiment, effect of tillage viz., reduced tillage (RT) and no tillage (NT) and manure application was studied on soil organic C pools. Across manure application treatments, total organic carbon content, biologically recalcitrant pool, and particulate organic matter was higher in NT compared to RT at 0-5 cm soil depth by 15, 21 and 20% and by 11, 29 and 25% at 0-15 cm soil depth, respectively. However, the active and slow pool of carbon were higher under RT by 14 and 30% at 0-15 and 15-30 cm soil depth, respectively. Application of FYM with inorganic



fertilizers increased the soil organic carbon content by 20-22% over inorganic fertilizer in RT and 3-4% in NT at 0-15 cm soil depth. Data indicated that short-term tillage system controls soil organic C at the soil surface, while changes in residue and manure incorporation through RT controls soil organic C storage in deeper layers in the Vertisols. Thus, the study revealed reduced tillage with residue and manure incorporation increased the labile pool of soil organic carbon which is an indicator of biologically active soil and higher nutrient availability.

### Crop productivity under nutrient management systems

Productivity of soybean crop was higher in organic nutrient management than integrated and inorganic nutrient management systems. Among the different cropping systems, yield of soybean was higher in soybean-mustard in 100% organic treatment than 75% organic + innovative treatment. Similarly, yield performance of wheat, mustard, chickpea and linseed under organic management practice (soybean based cropping system) performed better followed by integrated nutrient management (INM). With respect to INM, 75% organic + 25% inorganic treatment was better than 50% organic+50% inorganic nutrient management. Highest count of bacteria, fungi and actinomycetes was found in the organic system compared to INM and inorganic systems. In terms of count, there was no much difference in the 100% organic and 75% organic + innovative practice. Among the different cropping systems, the total count of soil microbes was higher in chickpea than wheat.

### Evaluation of soybean-maize varieties under organic package

Different varieties of soybean and maize were evaluated based on crop duration and yield performance to screen out most promising variety for organic management practices for central India. Out of twelve soybean varieties, the yield of RVS-2002-4 was found to be higher followed by JS-97-52 and JS-20-41. Among the JS varieties, JS-97-52 recorded the highest yield, while among the RVS varieties, RVS-2002-4 was found to be the highest yielding. The yield of maize variety 'Arawali' recorded a maximum seed yield of 21 q ha<sup>-1</sup> while popcorn variety produced poor yield under organic management system.

### Biochar on nutrient retention

A leaching study with biochar and fertilizers was conducted simulating the field conditions in two soil types, i.e. red and black soils. The study revealed that biochar can control the N loss in the two soil types studied (Fig. 4). The N leached through the 30 cm column significantly decreased when in addition to fertilizer, biochar was added at the rate of 10 and 20 t ha<sup>-1</sup>. The reduction in N loss was by 4 and 18 percent

less than 100% NPK treatment for red soil and to the extent of 25 and 37 percent for black soil, respectively.

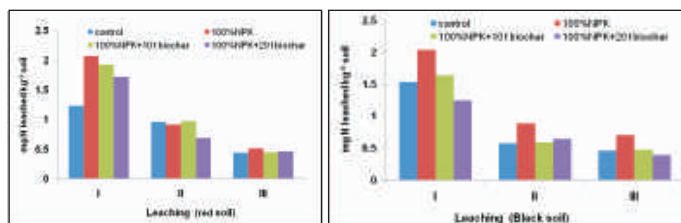


Fig. 4 : Leaching loss of N under biochar application

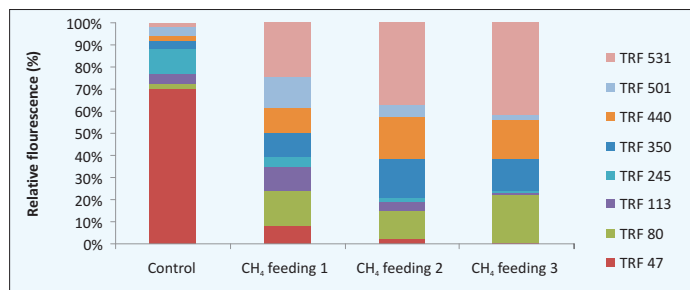
### Bioremediation of heavy metals from municipal solid waste

Six mesophilic fungi were screened namely *Trichoderma viride*, *Aspergillus heteromorphus*, *Rhizomucor pusillus*, *Aspergillus flavus*, *Aspergillus terreus* and *Aspergillus awamori*. Biofilter was developed in a perforated stationary phase (Dimension - 34 cm x 32 cm x 5 cm :: L x W x D) and individual fungus was grown with standard media at 30°C. The fungal growth of all these selected fungi was highly susceptible to more than 5 ppm Cd. The fungi *Trichoderma viride*, *Aspergillus awamori* and *Rhizomucor pusillus* were highly susceptible to more than 50 ppm Cu. The functional groups were mainly observed in the cytoplasmic membrane of isolated fungi namely amide group (-NH), hydroxyl group (-OH), carboxylate anions (-COO), carbonyl groups (-CO), C-F and C-Br. These fungi were mainly responsible for biosorption of heavy metals. Among six isolated fungi, *Trichoderma viride* performed better for removal of Pb, Ni, Zn and Cd followed by *Aspergillus flavus*. Mesophilic fungi would be a good biofilter to remove heavy metals from municipal solid waste compost and improve the quality of compost.

### CH<sub>4</sub> feedback response and TEAP in tropical Vertisol

An experiment was carried out to examine how CH<sub>4</sub> feedback response influences reduction of NO<sub>3</sub><sup>-</sup>, Fe<sup>3+</sup>, SO<sub>4</sub><sup>2-</sup> and CO<sub>2</sub> (methanogenesis) and methanotrophs community. High CH<sub>4</sub> consumption rate (k) enhanced terminal electron accepting process (TEAP). Apparent CH<sub>4</sub> consumption rate 'k' (μg CH<sub>4</sub> consumed g<sup>-1</sup> soil) increased from 0.49 to 1.09 in three repeated CH<sub>4</sub> feeding cycle. Potential denitrification rate (PDR), potential iron reduction rate (PIR), potential sulfate reduction rate (PSR) increased in response to 'k' (p<0.0001). Diversity of methanotrophs was estimated by terminal restriction fragment length polymorphism (TRFLP) targeting the pMOA gene (Fig. 5). The relative signal intensities of terminal restriction fragments (T-RFs) resulted in eight major peaks that contributed at least 1% to the total peak area, i.e. T-RFs with fragment lengths of 47 bp, 80 bp, 113 bp, 245 bp, 350 bp, 440 bp, 505 bp and 531 bp (Fig. 5). Methanotrophic community shifted from dominant Type II to Type I in

response to CH<sub>4</sub> feedback activity ( $p < 0.0001$ ). Result provided comprehensive information on the complex interaction between CH<sub>4</sub> feedback response and biogeochemical activity, to predict ecosystem processes for now and future climate.



**Fig. 5: Terminal restriction fragment length polymorphism of methanotrophic bacteria**

### Effect of climate change and chlorpyrifos on N<sub>2</sub>O production from soil

Earth's biogeochemical cycle is likely to alter by future global change. However, simultaneous influence of global climate drivers and agrochemicals on soil biogeochemical processes is not clearly known. Experiments were carried out to reveal the interactive influences of these factors on N<sub>2</sub>O production. The environmental factors were CO<sub>2</sub> (ambient, 800 ppm), temperature (25°C, 35°C, 45°C), soil moisture holding capacity (MHC) (60%, 100%) and chlorpyrifos (0 ppm, 10 ppm). One way analysis of variance (ANOVA) revealed significant influence of the studied factors on N<sub>2</sub>O production ( $p < 0.0001$ ). Results highlighted that intensive use of pesticide chlorpyrifos in future climate may affect N transformation in tropical Vertisol.

### Rapid Composting Unit

An improved technology was developed to speed up the compost time using consortium of ligno-cellulolytic thermophilic organisms. For this purpose, rotatory drum type rapo-composting unit has been fabricated with a capacity of 200 kg (Plate 2). Waste materials like crop residues, farm wastes, animal feed wastes, vegetable wastes and city wastes were collected. Fresh cow-dung was mixed with the waste materials. The waste material was inoculated with ligno-cellulolytic thermophilic organisms. Moisture content was maintained throughout the composting period at 60% water holding capacity with periodic turning to provide aeration. Standardization was carried out using biodegradable waste materials and consortia of ligno-cellulolytic organisms in the thermophilic condition (70°C). The study indicated that the waste materials decomposed within 30 days in rapid composting technique.



**Plate 2. Rapo Composting Unit**

### Effect of transgenic cotton on arbuscular mycorrhiza and soil glomalin

The study evaluated the effect of transgenic cotton on root colonization of arbuscular mycorrhiza (AM) and soil glomalin in the rhizosphere soils of transgenic cotton based cropping sequence with soybean, red gram, wheat and vegetables grown under Vertisol. Root samples were collected after 42 days of Bt and non-Bt cotton based cropping systems and VAM infection was studied. It was observed that there was no variation in root colonization between Bt and non-Bt cotton. Further it was observed that soybean-based cropping sequence recorded relatively higher root infection. The amount of glomalin in soil samples is representative of presence and activity of AM fungi. Soil glomalin content in the Bt-cotton-soybean based cropping sequence was found to be higher (123 mg kg<sup>-1</sup>) than that of other cropping sequence under study, and it was found lowest under Bt-cotton-fallow (41 mg kg<sup>-1</sup>). The Bt rhizosphere soil samples had 2.5-98% more glomalin protein than non Bt samples in all the above cropping systems (Fig. 6). The higher amount of glomalin seen in the Bt-cotton-soybean cropping sequence might be due to rhizodeposition having a favorable effect on the colonization of AM fungi. However, the concentrations of water-soluble carbon and carbohydrates that may enhance the active pools of carbon acted as bio-energy for all organisms inhabiting the soil.

### Unified soil biological health indicator

There is increasing concern about the adverse impacts of fertilizers and pesticides on soil biological health and thus is a need to develop sensitive methods of assessing soil microbiological quality valid across soil types and management practices. Microbiological attributes of soils belonging to three soil orders under varying management were studied. In Vertisols, high chemical inputs at ~2.3× fertilizers and pesticides in black gram did not affect soil biological properties adversely but very high inputs ~5× fertilizers and 1.5× pesticides in chillies had an adverse effect. There was a decrease in proportion of Actinobacteria at both sites. In Aridisols there was improvement in 16S rRNA gene copy number and greater diversity of eubacterial community due to organic farming - 10% higher Actinobacteria and 20%

less Proteobacteria. In soybean and maize rhizosphere in Vertisols, eubacterial diversity was higher in organic management; Actinobacteria was dominant in organic and Proteobacteria in chemical farming. In a 100 year permanent manurial trial in an Alfisol, Proteobacteria were in higher proportions in chemically fertilized soils and Acidobacteria and Actinobacteria were higher in organic management. Methods for measurement of soil biological health should therefore emphasize the size of Actinobacteria. Thus, the relative proportions of Actinobacteria and Proteobacteria may serve as a good indicator of soil health.

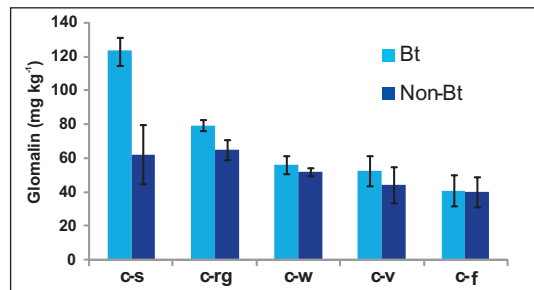


Fig. 6: Glomalin protein content in rhizosphere soil samples in Bt and non Bt cotton based cropping systems (c-s= cotton-soybean; c-rg=cotton-redgram; c-w=cotton-wheat; c-v= cotton vegetables; c-f=cotton fallow)

## ON-FARM RESEARCH AND TECHNOLOGY DEMONSTRATION

### Integrated assessment of some IISS Technologies

Some promising nutrient management technologies, viz., (1) Integrated plant nutrient supply system (IPNS) comprising farmyard manure, synthetic and biofertilizer, (2) Soil test based fertilizer recommendation for targeted crop yields (STCR), and (3) Phospho-sulpho-nitro compost were evaluated under farmers' field condition in Mengra Kalan Village in the Berasia Block of Bhopal district. The technologies were evaluated with soybean (JS 9560) crop in nine farmers' fields for the second consecutive crop year. The crop performance data showed an increase in yield of about 17% in IPNS, 23% in phospho-sulpho-nitro compost, and 18% under STCR treatment over farmers' practice. The soybean crop showed better performance compared to the first year (Fig. 7).

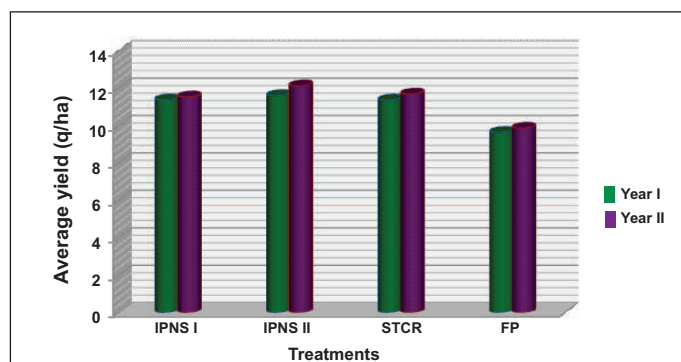


Fig. 7: Performance of soybean under nutrient management treatments

### Demonstrations in tribal districts of Madhya Pradesh

Demonstration trials (six for soybean and four for maize) were conducted on ten farmers' fields in tribal dominated Alirajpur and Jhabua district of M.P. Almost all soil samples showed sufficient range of DTPA extractable micronutrients and hot water soluble boron. Number of farmer fields based on relative soil quality index (RSQI) fall under poor (< 60%), moderately poor (60-70%) and medium (70-80%) categories were 3, 6 and 1, respectively.

The treatments included recommended dose of fertilizer (RDF), IPNS (75% chemical fertilizers + 25% organic) and soil test based nutrient recommendation (STNR). Overall reduction in the yield to the extent of 25-35% was observed due to late arrival and vagaries of monsoon. Average yield of soybean was higher by 4.30 5.94 and 7.35% and maize yield by 6.58, 6.82 and 10.59% with RDF, IPNS and STNR, respectively (Fig. 8).

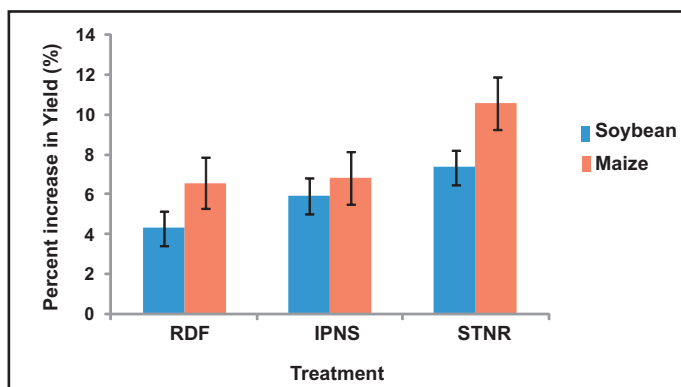


Fig. 8 : Per cent increase in yield over farmers' practice

### Balanced and integrated nutrient management in tribal districts of Odisha

Front line demonstrations were conducted in 30 tribal farmers' fields under Tribal Sub-Plan (TSP) scheme (Plate 3). Validation of the best performing manurial treatment of the long term fertilizer experiment (RDF+ FYM) was done on farmers' field as compared to farmers' practice (FP), recommended dose of fertilizer (RDF, 80:40:40 :: N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O kg ha<sup>-1</sup>) and soil test based recommendation (STBR). Field demonstration conducted in the farmers' field in Rayagada district of Odisha revealed increase in productivity of rice in the range of 800 to 2000 kg ha<sup>-1</sup> on intervention with balance and integrated nutrient management. Similarly, increase in productivity of rice ranged from 700 to 2100 kg ha<sup>-1</sup> in Muniguda block, while in



Bolagarh block it varied from 600 to 1200 kg ha<sup>-1</sup>. However, in Bissam block even though increase in yield was recorded but the magnitude was less and varied from 800-900 kg ha<sup>-1</sup>. Overall increase in rice yield was 28.9% in soil test based recommendation, 33.4% with RDF and the highest with RDF+FYM by 68.9%. Thus, the demonstration clearly indicated that there is ample scope to increase the productivity of rice in these areas.



Plate3: Front line demonstrations on farmers' fields (Rayagada district) in Odisha

### Demonstration of composting and biofertilizer use in Bhopal district

Method demonstrations on preparation of phospho-sulpho-nitro compost in portable compost pits and seed treatment of soybean with biofertilizers were conducted for the farmers of Mengra Kalan Village, Berasia (Bhopal district, Madhya Pradesh) on 13 July, 2014 by Drs. K.C. Shinogi, Nishant K. Sinha, Bharat P. Meena, Hiranmoy Das and Sanjay Srivastava.



Plate4: Composting in portable pits and use of bio-fertilizers in farmers' Field

## AWARDS AND HONOURS

**Dr. M. C. Manna** elected as Fellow of the National Academy of Agricultural Sciences (NAAS), New Delhi

**Dr. Tapan Adhikari** awarded "The Twelfth International Congress Commemoration Award – 2014" of the Indian Society of Soil Science, New Delhi.

**Dr. Narendra Kumar Lenka** selected as Associate of the National Academy of Agricultural Sciences (NAAS), New Delhi

**Dr. Tapan Adhikari** awarded "J. C. Bose Gold Medal Award - 2014" of the Indian Society for Plant Physiology, New Delhi.

**Dr. Arvind K. Shukla** awarded the International Zinc Association and Fertilizer Association of India Award (IZA-FAI) for the year 2014 for "Promoting the Use of Zinc in Indian Agriculture".



**Dr. (Mrs.) I. Rashmi**, Scientist received the ISSS Best Doctoral Research Presentation award – 2014 of the Indian Society of Soil Science (ISSS).

**Dr. A. K. Tripathi** received "Shri Ram Khad Patrika Award" for the best article published in Khad Patrika.

**Dr. Muneshwar Singh** and **Dr. R. H. Wanjari** awarded Third Prize in the "Dhiru Morarji Memorial Award" for "Best Article in Agricultural Sciences 2013-14" for the article published in Indian Journal of Fertilisers by FAI, New Delhi.

**Dr. A.K. Biswas** selected as President, Bhopal Chapter of ISSS for the biennium 2014-15.

**Dr. S. Srivastava** acted as Nodal Officer from India for setting up of Soil Water Tissue Laboratory in African Countries.

**Dr. Anand Vishwakarma** as a team member received ICAR Award for Outstanding Interdisciplinary Team Research in Agricultural and Allied Sciences (Natural Resource Management & Agricultural Engineering) for 2011-12 by ICAR on the occasion of 86<sup>th</sup> Foundation Day at New Delhi.

**Dr. Pradip Dey** Chaired a Workgroup on Nutri-dense farming and area specific nutria-crops of Mountain Agricultural Assistance Service (MAAS), New Delhi.

## FARMERS' TRAINING AND EXHIBITIONS

### Farmers' Training conducted at IISS, Bhopal

Sponsoring Agency	State	No. of Farmers	Duration	Coordinators
Agricultural Technology Management Agency (ATMA), Sehore	M. P.	25	14 -18 July, 2014	Dr. A. K. Tripathi & Dr. A. B. Singh
Agricultural Technology Management Agency (ATMA), Shivpuri	M. P.	32	14 -18 Oct., 2014	Dr. A. K. Tripathi & Dr. K. C. Shinogi
Agricultural Technology Management Agency (ATMA), Guna	M. P.	10	24 -28 Nov., 2014	Dr. A. K. Tripathi
Agricultural Technology Management Agency (ATMA), East Champaran (Motihari)	Bihar	25	8-12 Dec., 2014	Dr. A. K. Tripathi & Dr. Sanjay Shrivastava

### Farmers' Training in Himachal Pradesh

Farmers' training programmes were organized in Udaipur, Hinsu, Sishu, Rangrik (Kaza), Lari of Lahul and Spiti and Nako of Kinnaur districts, the tribal districts of Himachal Pradesh by STCR centre at Palampur during 8-14 October, 2014 in which a total of 617 farmers (287 female farmers) participated. Besides imparting knowledge on balanced use of fertilizers based on soil testing and STCR, farmers were given hands on training in collection of soil samples.

### Farmers training in Kerala

One day capacity-building programme was organized at Perumatty village (Palakkad district, Kerala) on September 10, 2014. The program was attended by 119 farmers from Perumatty and Pattancherry Panchayats where the TSP under AICRP (STCR) is under progress. The highlights of the results of demonstrations conducted on tribal farmer's fields on the aspect of soil test and yield goal based fertilizer application for rice crops were presented.



### Exhibitions

Drs. R.H. Wanjari, A.K. Vishwakarma, Ms. K.C. Shinogi, Sh. V.B. Pal and Sh. Vinod Chaudhary displayed Institute's technologies and models in 'Haldhar Krishi Yantra Kisan Mela' under Krishi Mohotsav, 2014 at the Nehru Stadium, Lal Parade Ground, PHQ, Bhopal during 26-28 September, 2014. The Institute staff interacted with the farmers and scientists participated in the 'Kisan Sangoshti' during the farmers' fair.

Drs. R.H. Wanjari, Anand Vishwakarma and Sh. Vinod Chaudhary coordinated the Institute stall activities in the exhibition organized by IGKV during Regional Committee Meeting (RC VII) on 17 October, 2014 at IGKV Raipur. Hon'ble Agriculture Minister, Govt. of India, Shri Radha Mohan Singh; Shri Raman Singh, CM Chhattisgarh; Dr. S. Ayyappan, DG ICAR; Dr. A.K. Sikka, DDG (NRM) and Dr. S.K. Patil, VC, IGKV inaugurated the exhibition in the University campus. Students from school and Agriculture College visited the Institute stall and interacted during the exhibition.

## STAFF NEWS

### Promotion

Sh. Khilan Singh Raghuwanshi promoted from Senior Technical Assistant to Technical Officer, w.e.f. 29 December, 2013

Sh. Sant Kumar Rai promoted from Senior Technician to Technical Assistant, w.e.f. 22 May, 2014

### Transfer

Dr. Ritesh Saha, Sr. Scientist transferred in the same scale to NBSSLUP, Regional Centre, Kolkata on 05 Nov., 2014

Sh. M.S. Hedau, Assistant transferred on promotion to Directorate of Weed Research, Jabalpur on 10 Oct., 2014



## PROGRAMME HELD

### Independence Day Celebration

The Staff Recreation Club (SRC) celebrated the Independence Day on 15<sup>th</sup> August 2014 with great gaiety and enthusiasm. Different sports and cultural events were organized for the family members of the staff on the day.

### Hindi Pakhwada

The Government of India encourages its organizations and the employees to participate in Hindi Pakhwada celebrations to promote and spread the use of Hindi as a common medium of language throughout the country. Accordingly, Hindi Pakhwada was celebrated at the Institute during 14-28 September, 2014. Several competitions such as Debate, Quiz, Hindi vocabulary (Sabda Gyan), typing etc. were conducted in the Institute premises during the fortnight in which majority of staff members participated. In the concluding day, Dr. K. K. Singh, Director, CIAE, Bhopal was the Chief Guest and distributed prizes to the winners of different competitions.



### Swachh Bharat Mission

The Institute staff members fully contributed in the nationwide program of “Swachh Bharat Mission” launched by the Government of India, as per the call of the Hon'ble Prime Minister. The Swachhta Spath was administered to all the staff members by the Director of the Institute on 2<sup>nd</sup> October, 2014. This was followed by the voluntary cleaning of the



Institute premises by the staff members. Afterwards, an intensive campaign was started with finalization of the weekly plan and timely execution for keeping the inside and outside of the Institute premises clean.

### Vigilance Awareness Week

As per the directive of the Central Vigilance Commission, Vigilance Awareness Week was observed in the Institute during 27 October to 01 November, 2014 with the theme on “Combating corruption – technology as an enabler”. A speech competition was organized among the staff members on the theme “Combating corruption – technology as an enabler” on 29 October, 2014. The concluding function was held on 01 November, 2014 with Mr. Arun Pratap Singh, Inspector General of Police in the Government of Madhya Pradesh as the Chief Guest.



### World Soil Day

The Indian Institute of Soil Science in association with Bhopal Chapter of the Indian Society of Soil Science celebrated the World Soil Day on 05 December, 2014 to highlight the importance of soil in the ecosystem and human welfare. A drawing competition was arranged for the school children on the theme “SOIL – Soul of Infinite Life”. About 75 children from various schools of Bhopal participated in the competition. The program was organized with Dr. G.A. Kinhal, Director, Indian Institute of Forest Management (IIFM), Bhopal as the Chief Guest of the function, with Dr. S.S. Khanna, Former Member, Planning Commission and Dr. P.J. Sudhakar, Additional Director General, Press Information Bureau as the invited guests.



### Brainstorming Session

A Brainstorming Session on “Waste Management” was

held at the Institute during 03 – 04 December, 2014 under the Chairmanship of Dr. S. S. Khanna, former Member, Planning Commission and former Vice-Chancellor of NDAU&T, Faizabad. Dr. A. K. Patra, Director of the Institute called for participation and involvement of all stakeholders in finding solutions to the problem of solid and biodegradable organic wastes. The discussions in the meeting focused on the 'Issues, Policies and Way forward on Bio-waste Management in Agriculture'. Dr. M.C. Manna, Head of the Soil Biology Division coordinated the Brainstorming Session as the Organizing Secretary.



## TRAININGS/WORKSHOPS ORGANIZED AT THE INSTITUTE

- Dr. S. Srivastava as convener conducted Interactive Workshop on “Contingency planning for *kharif* crops under delayed monsoon in Malawa plateau region of Madhya Pradesh” on 03 July, 2014.
- Drs. K.C. Shinogi and S. Srivastava as conveners conducted a training program on “Integrated assessment of some IISS technologies in enhancing agro-ecosystem productivity and livelihood sustainability” during 09-11 July, 2014.
- Drs. R. Elanchezhian, K. Ramesh and A.K. Biswas as Course Directors organized ICAR sponsored Short Course on “Advances in nutrient dynamics in soil-plant-atmospheric systems for improving nutrient use efficiency” during 02-11 September, 2014.

- Drs. M.C. Manna, A.B. Singh and A.K. Tripathi as Course Directors conducted ICAR sponsored Winter School on “Waste recycling and resource management through rapid composting techniques” during 3-23 December, 2014.



- Drs. K. Ramesh, Brij Lal Lakaria and S. Neenu as Course Directors conducted DAC sponsored Model Training Course on “Best nutrient management practices for major crops and cropping systems of India” during 07-14 October, 2014.



### Training organized by AICRP - STCR

- One day training program was organized by AICRP (STCR) in collaboration with Govt. of Himachal Pradesh at Shimla on 06 September, 2014. Dr. Pradip Dey, PC delivered lectures on 'GPS and GIS based soil fertility mapping of Himachal Pradesh' and on 'STCR based fertilizer recommendations'.
- One day training program on 'Use of GPS based soil fertility maps for District Officers, Soil Testing Staffs and progressive farmers of Tamil Nadu State' was organized in collaboration with Tamil Nadu State Government at TNAU, Coimbatore on 09 September, 2014.

### International Cooperation / Foreign visit

- Dr. Sanjay Srivastava, Principal Scientist visited Kenya, Rwanda and Tanzania in Africa during 12-18 November, 2014 for initiation of different projects under Indo - African Forum Summit-II (IAFS-II)
- Dr. Ashok Kumar Patra, Director visited the International Centre for Research on Agroforestry (ICRAF), Nairobi, Kenya during 17-19 November, 2014
- Drs. Tapan Adhikari, J. Somasundaram and Mrs. Sangeeta Lenka selected for Australian Government sponsored “Endeavour Fellowship”

## Scientists' Participation in Conference/Seminars/Training/Workshop

Name	Programme	Venue	During 2014
Drs. J. Somasundaram and M. Mohanty	Attended 3 <sup>rd</sup> Annual Workshop of NICRA	NASC Complex, New Delhi	3-4 July
Drs. R.S. Chaudhary, A. B. Singh and A.K. Vishwakarma	National Workshop on 'Technologies for Sustainable Rural Development – having Potential of Socio-economic Upliftment (TSRD -2014)'	CSIR-AMPRI and MPCOST, Bhopal	4-5 July
Dr. D.L.N. Rao	Research Review Meeting of the National Bureau of Agriculturally Important Microorganisms (NBAIM), Mau	NBAIM, Mau, UP	10 July
Dr. A.K. Biswas	EFC Meeting of CRP on 'Conservation Agriculture'	New Delhi	14-16 July
Dr. Pradip Dey	National Symposium on 'Natural Resource Management and Sustainable Hill Farming System for Livelihood Security'	SKUAT, Jammu	23 July
Dr. A. B. Singh	National Sangosthi on 'Rastra Ke Badalte Parivesh mein Krishi Engineering Research Evam Development ke Naye Aayam'	CIAE, Bhopal	28 July
Dr Ashok K. Patra	ICAR Foundation Day Celebrations and the Directors' and VC's Conference	NASC, New Delhi	29-30 July
Dr. Pradip Dey	National Workshop on 'Mountain Agricultural Assistance Service (MAAS) – Launch Meet'	New Delhi	7 August
Dr. Pradip Dey	National Seminar on 'Technologies for Sustainable Production through climate Resilient Agriculture'	Jabalpur	8 August
Dr. Brij Lal Lakaria	Workshop on 'Developing PME Indicators and Mechanism in NARS'	NASC, New Delhi	12 August
Dr Ashok K. Patra	Executive Development Program on 'Leadership Development'	NAARM, Hyderabad	19 -23 August
Dr (Mrs.) K.C. Shinogi	International Conference on 'Agriculture, Forestry, Horticulture, Aquaculture, Animal Sciences, Food Technology, Biodiversity and Climate Change-Sustainable Approaches'	JNU, New Delhi	30-31 August
Dr. S. Rajendiran	ICAR sponsored Short Course on 'Advance in Nutrient Dynamics in Soil -Plant-Atmosphere System for Improving Nutrient Use Efficiency'	Indian Institute of Soil Science, Bhopal	2-11 September
Drs. Ashok K. Patra, Muneshwar Singh, Pradip Dey	National Conference on 'Soil Health: A Key to Unlock and Sustain Production Potential'	JNKVV, Jabalpur	3 - 4 September
Dr. Ashok K. Patra	Special Convocation of the Post Graduate School of IARI	New Delhi	7 - 8 September
Dr. Pradip Dey	India Trento Program for Advanced Research Workshop 'Nano/Micro mechanical Sensing Systems for Chemical, Bio and Agriculture Applications'	IIT, Bombay	2 October
Drs. Ashok K. Patra, Muneshwar Singh, D L N Rao, A. K. Shukla, Pradip Dey	23 <sup>rd</sup> Meeting of ICAR Regional Committee - VII	IGKV, Raipur	17-18 October
Dr. A.K. Biswas	Standing Committee and Council Meeting of the Indian Society of Soil Science (ISSS)	IARI, New Delhi	17-18 October
Dr. Sanjay Srivastava	Meeting on Inclusion of New Fertilizers in FCO	Krishi Bhawan, New Delhi	21 October
Dr. Brij Lal Lakaria	RFD Meeting of ICAR and presented half yearly RFD Achievements	NASC, New Delhi	28 October
Drs. Sanjay Srivastava, J. Somasundaram	Workshop on 'Open Access to Agriculture Knowledge for Inclusive Growth and Development'	NAARM, Hyderabad	29-30 October



## Scientists' Participation in Conference/Seminar/Training/Workshop

Name	Programme	Venue	During 2014
Dr. D.L.N.Rao	55 <sup>th</sup> Annual Conference of the Association of Microbiologists of India	TNAU, Coimbatore	12-13 November
Dr. Pradip Dey	International Conference on 'Novel Innovations and Strategies for Boosting Production and Productivity'	Institute of Agriculture Science, BHU, Varanasi	15-16 November
Drs. R.H. Wanjari, K. Ramesh and B.P. Meena	National Symposium on 'Agriculture Diversification for Sustainable Livelihood and Environmental Security' by Indian Society of Agronomy	PAU, Ludhiana	18-20 November
Drs. M.C. Manna, Arvind K. Shukla, Tapan Adhikari, Brij Lal Lakaria, M. Vassanda Coumar, M. L. Dotaniya, Pankaj K. Tiwari, and I. Rashmi	79 <sup>th</sup> Annual Convention of Indian Society of Soil Science	Prof. Jayshankar Telengana State Agricultural University, Hyderabad	24-27 November
Dr. J. K. Saha	National Conference on 'Harmony with Nature in Context of Environmental Issues and Challenges of the 21 <sup>st</sup> Century'	Mohanlal Sukhadia University, Udaipur	28-30 November
Dr. Tapan Adhikari	International Conference on 'Emerging Electronics (ICEE-2014)'	Institute of Science, Bangalore	3-6 December
Drs. J. K. Thakur, M. L. Dotaniya and Asha Sahu	Winter School on 'Waste Recycling and Resource Management through Rapid Composting Techniques'	Indian Institute of Soil Science, Bhopal	3-23 December
Drs Ashok K. Patra, D L N Rao, Pradip Dey	Workshop of AINP on 'Soil Biodiversity-Biofertilizers'	Directorate of Groundnut Research, Junagadh, Gujarat	6-7 December
Drs. Ashok K. Patra, Muneshwar Singh and A.K. Shukla	50 <sup>th</sup> FAI Annual Seminar 2014	Fertiliser Association of India, New Delhi	10-11 December
Dr. Pradip Dey	4 <sup>th</sup> National Seminar on 'Innovative Saline Agriculture in Changing Environment'	RVSKV, Gwalior	12 December
Dr. A. K. Vishwakarma	National Conference on 'Emerging Challenges and Opportunities in Biotic and Abiotic Stress Management'	Hyderabad	13-14 December
Dr. M. C. Manna	Silver Jubilee Symposium of NAAS	BCKV, Kalyani	19 December
Dr. Pradip Dey	7 <sup>th</sup> International Congress of Environmental Research	Bengaluru	27 December
Dr. J. K. Saha	NAAS Silver Jubilee Symposium on 'Managing Natural Resources for Posterity: 25 Years of Achievements and Way Forward'	BCKV, Kalyani	30 December

**Editors: Dr. N.K. Lenka, Dr. R.H. Wanjari and Dr. M. Mohanty**

*Published by*

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