



IISS

Newsletter

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From the Director's Desk.....



New Opportunities in Soil Testing

The soil testing is a fundamental scientific tool meant for diagnosing all soil related production constraints and to make suitable recommendations on material and management inputs to overcome such constraints. In true sense the soil testing encompasses a comprehensive analysis for quantitative measurement of soil physical, chemical and biological properties and their proper interpretation to evolve appropriate recommendations thereon. But unfortunately, the soil testing in India is widely perceived with limited sense as 'soil fertility management tool' and primarily used in most cases to prescribe fertilizer rates for annual field crops. This has led to measurement of only limited soil properties and very limited extension of soil testing applications in the areas of fruit crops, vegetables, lawns, social and urban forestry etc. The current and emerging issues relating to soil quality, human and environmental health, soil contamination and its remediation, organic farming, site-specific/precision farming would not only pose new challenges in the form of need for enlarged soil testing services (new soil testing protocols and measurement profiles) but also concurrently offer new and varied institutional, business and employment opportunities.

In India, the soil testing service started with the setting up of 16 soil testing laboratories (STLs) in 1955-56 and picked up momentum in the post-green revolution era particularly in the early nineteen seventies. The number of STLs has increased progressively to 177 by 1971, 330 by 1980 and 533 by 2000 at an annual growth rate of 6.94 % over a period of thirty years. With the present number of STLs in the country, the analysing capacity of only 56 samples per 1000 ha of Gross Cultivated Area (GCA) is very inadequate for a country of India's size. Coupled with this is the problem of low and declining capacity utilization efficiency of existing STLs. During the period from 1992 to 2000, the capacity utilization efficiency of STLs decreased by more than 50% in the East and North-East regions, 27% in the Northern region and 11% in the South and Western regions, with a 20% reduction on all India basis. Further, the soil-testing programme initiated by the government continues to be mostly in government domain, with the only 11% STLs being run by private sector participants. It is, therefore, essential to strengthen the network of STLs in terms of both increased analysing capacity and enhanced capacity utilization. Further, there is urgent need for greater private sector/industry participation in soil testing services to supplement the governmental efforts.

The recent initiative of the government to promote Agri-clinics and agri-business centers in the country is a welcome and much needed step in the right direction. Through these kinds of initiatives, it is quite possible not only to improve soil-testing services of varied nature but also help develop entrepreneurial skills among the agricultural graduates

Editors

T.K. Ganguly

Head,

Division of Soil Biology

A.B. Singh

Senior Scientist

Design & Layout

A. K. Sharma

Documentation Officer

Published by

A. Subba Rao

Director

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Indian Institute of Soil Science

Nabi Bagh, Berasia Road, Bhopal - 462 038 (M.P.)

Telephone : (0755) 2730946, 2747375, 2730970, 2734221 Fax : (0755) 2733310 E-mail : iiss@iiss.ernet.in

Visit us at : www.mp.nic.in/iiss

and post-graduates leading to greater self-employment opportunities. The success of soil testing services will, however, depends on the quality of soil testing results and their scientific interpretation that determine the appropriateness of recommendations/advice offered for adoption by the farmers. Scientific training and skill improvement among the human resources engaged in soil testing and interpretation should receive priority and be made an integral part of the soil-testing service.

(A. SUBBA RAO)

Soil Biology & Biochemistry in the Improvement of Soil Quality

Enhancement in soil productivity would result through better management of soil physical, chemical and biological component and beneficial soil biota. The biology of the soil processes is intended to act as vital part of research on soil microorganisms, their biochemical activities and their influence on the soil environment and plant growth. Soil microflora and fauna their interactions in soil, association on plant root, symbiosis are the processes that govern nutrient availability, uptake, plant productivity in general. The evaluation of soil physical, chemical and biological fertility indicators is the recent development in the soil biology biochemistry research.

Soil qualities for sustainable productivity: Quantification of changes in soil organic C and N pools and evaluation of the effect of variables on soil organic matter dynamics were carried out in various soils of India. Imbalanced fertilizer application, particularly N alone, could not bring the equilibrium for C balance even after 29 years of rice-based cropping system. Studies on relative impact of different cropping systems on C sequestration showed that horticulture based cropping system improved water soluble carbon status of soil more than the arable field crops. It was also observed that soil organic carbon was maintained at higher levels under best management practices than under traditional management practices followed by the farmers.

Efforts to develop a **technology for vermicomposting** of different organic materials by earthworms (*Perionyx excavatus*, *Eisenia fetida*) were made. Addition of earthworm accelerated the breakdown of residues, which ultimately resulted in lowering of the C:N ratio, water soluble carbon, carbohydrates and increased cation exchange capacity, total phenol and decreased dehydrogenase enzyme activity. **Technologies for the production of enriched compost** such as phosphocompost and N-enriched phosphocompost from crop residue, forest litter and biodegradable wastes were developed using indigenously available mineral additives such as rock phosphate and pyrites and beneficial microorganisms like cellulose decomposers, phosphate solubilizers and N-fixing microorganisms. In waste utilization and composting technology; production, evaluation and assessment of biodegradability indices of wastes having various C: N ratios, development of *in situ* technologies of recycling of wastes of wide C: N ratio in shortest possible time are the need of the present day.

The **maintenance of soil organic matter** in agricultural soil at 0.5 to 1% is extremely important particularly in semiarid subhumid and tropics and is generally governed by annual temperature, precipitation and many interacting factors such as soil type, application of fertilizer, quality and quantity of residual wastes returned to the soil and method of residue management. There is a need to focus greater attention on how the different organic materials, what process and in what time the five soil organic matter compartments, namely, active, passive, slow, structural and metabolic pools regulate to achieve the maximum plant nutrients availability in soils are the matter of concerns in organic C management.

Success in **organic agriculture** depends greatly on local conditions. The recycling of crop residues and organic wastes through composting methods is the key technology for disposal and production of organic manures. The adoptability of organic farming among the farmers, the integration of inorganics, chemicals in the organic agriculture are to be seen.

The chemical behavior of **heavy metals** in soils and their effect on soil microbial activity play an important role in the areas where biocide and heavy metal accumulation on soil biota is to be seen. Research programme has to be developed on the heavy metal elements, which are recognized as the most hazardous soil pollutants. Studies are

therefore required to assess the toxicity of heavy metals on soil microbial biomass and enzyme activity under amended or unamended condition with manure or compost.

Soil biochemical qualities, plant root exudates, rhizodeposition are important because they influence soil nutrient availability through the activity of the microbial biomass. The quantitative and qualitative composition of root exudates is affected by pH, oxygen status, temperature, nutrient availability and microorganisms. Therefore, a method should be developed to assess the impact of microbial population on exudation. The biochemical investigation of soil and crop to see the quality aspect is important in respect of the soil health and crop seed quality.

The **future programmes** on maintaining soil biodiversity in agro ecosystem may be taken up as: (i) establishment of relationship between soil biochemical attributes and produce quality, (ii) development of technologies of recycling of wastes having wide/various C: N ratios, (iii) assessment of soil quality parameters under different farming system and, (iv) characterization of functional communities of soil organisms (flora and fauna) and soil biological activities under different soil crop situations.

Dr. T.K. Ganguly

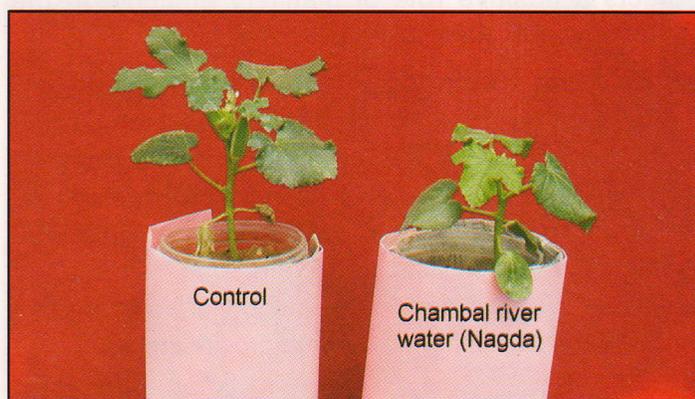
Programme leader

Soil qualities for sustainable productivity

Research Highlights

Effect of polluted irrigation water on growth of Okra

Results of the impact of polluted groundwater of Ratlam and Chambal river water near Nagda industrial area on growth parameters of Okra showed that the polluted waters of both the areas had severely



Severe shedding of leaves and flower buds in Bhindi (okra) due to use of polluted groundwater of Ratlam



Retardation of growth of Bhindi (okra) due to use of polluted river water of Nagda

reduced the plant growth parameters. Although polluted groundwater of Ratlam is less saline as compared to polluted river water of Nagda, the former had more impact in terms of reduction in above ground biomass, number of leaves, flowers and fruits yield.

Performance of soybean under organic farming

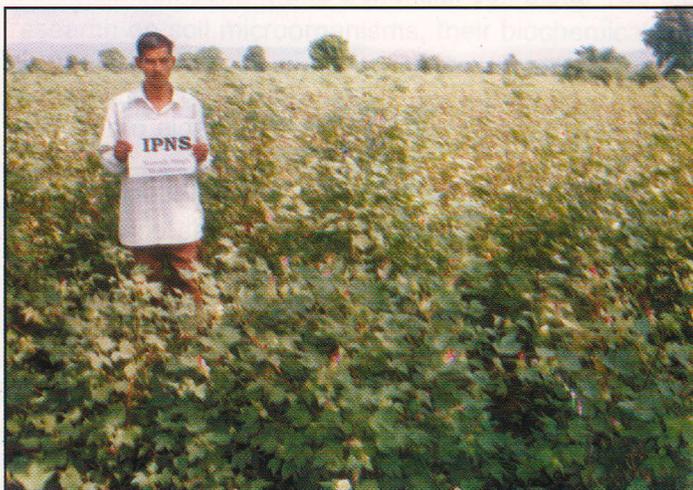
Nitrate nitrogen content of soil was found higher during the soybean crop growth at 30 and 60 days after sowing in organic treatment compared to either inorganic or integrated nutrient management. At 30 days after sowing physiological parameters like photosynthetic rate, nitrate reductase activity and chlorophyll content were higher in organic treatment. Among the four soybean varieties tested under organic farming, Samrat variety recorded the highest seed yield followed by PK-1044, NRCS-37 and JS-335.

Soybean nodulation survey in Madhya Pradesh

Soybean nodulation surveys in farmers' fields carried out during third phase in M.P. in the districts of Panna, Chattarpur and Tikamgarh showed that rhizobial cultures are being very widely used and as a result poor nodulation was not encountered. Nodulation status was medium in the initial years of the use of inoculants or where there was a break of 2-3 years of soybean cultivation but where it has been used continuously for a number of years it was good. Use of FYM alone also produced only medium nodulation. Nodulation was profuse wherever farmers have used FYM along with inoculants. Wherever all three inputs, i.e., FYM, phosphatic fertilizers as well as inoculants were used, nodulation was excellent and yields were high.

On farm Demonstration of IPNS technology for rainfed Cotton (RCPS-2 – NATP):

As per part of the NATP an Integrate Plant Nutrient Supply Technology package (consisting of 2 t FYM + 90-45-45 kg N-P₂O₅-K₂O ha⁻¹ plus 2% DAP spray once and 0.1% B spray twice) for improved productivity of rainfed cotton on vertisols was demonstrated on 20 farmers fields in Balwada and Muktyara villages of Khargaoan District, M.P. the IPNS technology proved far more superior compared to the farmers practice and received overwhelming appreciation from the local cotton farmers.



Relative performance of rainfed cotton under the IPNS vis- vis FP on a farmer's field

No tillage in soybean-wheat system

A field experiment on tillage showed that no tillage in the soybean-wheat cropping system in Vertisols was found as effective as other tillage treatments. Seed yields under 150% and 100% recommended N were at par and were significantly higher than those under 50% N treatments.

Organic carbon pools under various agro-eco system:

In sub-humid moist regions the soil microbial biomass carbon content followed the order: forest (teak)> soybean-wheat>paddy-wheat>cotton. In case of sub-humid dry regions of vertisols the soil microbial biomass carbon was maximum under horticultural system (citrus) followed by intercropping (cotton + pigeon pea) and mango-orchard. Among the horticultural based cropping systems citrus with high management have better soil organic carbon restoration compared to mango orchard. Cotton based cropping system either as intercropping or sequential cropping registered least improvement of soil organic carbon storage.

Effect of continuous application of distillery effluents on soil health:

Continuous application over a period of five years of distillery effluents to the land under soybean-wheat system increased the organic carbon content in soil (1.14% vs 0.62%). The microbial population as reflected by increase in soil respiration and soil microbial biomass carbon (1507 vs 1004 mg g⁻¹ soil). There was also improvement in cellulase, phosphatase and dehydrogenase enzyme activities in the soil, which reflects a positive role of distillery effluents in the improvement of biological health of soil.

Efficient use of limited irrigation water to wheat

Scheduling of 20 cm irrigation water for wheat was assessed and it was observed that application of 20 cm irrigation through sprinkler in 3 installments (8 cm Pre-sowing, 6 cm CRI, 6 cm Flowering) registered significantly higher yield and Water Use Efficiency of wheat over application of same amount of water through flooding in 3 installments at same growth stages.

New project initiated

A network project "Impact, adaptation and vulnerability of Indian agriculture to climate change" has been initiated in the Division of Soil Physics as one of the cooperative centres.

Superimposition on N and Zn in long-term fertilizer experiments

In Inceptisol at Ludhiana, raising the level of N from 50% to 100% of the optimum and keeping the levels of P and K unchanged under the original 50% NPK treatment increased the maize and wheat yields by 0.9 and 1.57 t ha⁻¹ respectively over the years. In mollisol at Pantnagar, the superimposition of Zinc (i) with sulphur

(ii) without sulphur and alongwith (FYM+S) in original 150% NPK+S treatment resulted in significantly higher yields both for the rice and wheat crops.

Recycling of crop residues for ameliorating micronutrient deficiency in rice- wheat sequence in calcareous soils

Long term effect of crop residue recycling under rice-wheat system was evaluated on yield, micronutrient uptake by crops and available Zn status of calcareous soil of Pusa (Bihar). Data upto seventh sequence revealed that increasing levels of crop residue progressively enhanced the crop yield and zinc uptake at varying levels of zinc in rice and then wheat. It indicates that rice is benefitted more than wheat from crop residue incorporation.

Awards and Honours

Dr. P.K.Ghosh received senior award of the Academy for advancement of Agricultural Sciences from Indian Society for Plant Physiology at the University of Pune, Maharashtra on 27th Dec. 2004.



Dr. Tapan Adhikari, Scientist (SS) received The Golden Jubilee Commemoration Young Scientist Award for 2004 in the 69th Annual Convention of Indian Society of Soil Science at Hyderabad on October 27-30, 2004.

Dr. A. Subba Rao, Director, IISS, honoured with the Fellowship of Indian Society of Soil Science.

Dr. D.L.N.Rao, Network Coordinator (BF) was nominated as a member of the ICAR Task Force on Organic Farming.

Dr. D.L.N.Rao, Network Coordinator (BF) joined the editorial board of the Journal of Indian Society of Coastal Agricultural Research.

Dr. A.B. Singh, Senior Scientist elected Executive Member of Indian Society of Agricultural Biochemists, Kanpur for the year 2004-05.

Drs. A. Subba Rao, Director, IISS and A.B. Singh, Senior Scientist nominated as Vice President and Council Member respectively of the Indian Society of Agricultural Resource Management, Coimbatore for the year 2005- 06.

Events

Video Film: A documentary film in Hindi, English and local language(Telugu) was made on "Organic Farming for Profitability and Sustainability" for duration of 15 minutes in each language.

A short course: on Assessment of Compost Quality for agricultural crop production was sponsored by ICAR and organised by the Division of Soil Biology during 16- 25 November, 2004.

Independence Day: Celebrated with great enthusiasm by all the staff members and their families.

Sports: IISS Bhopal participated in the ICAR Zonal tournament held at IARI, New Delhi from November 22 to 26, 2004 and stood at 4th position amongst 13 Institutes that participated out of 15 institutes in the zone.

IISS won the team events of Shuttle Badminton (Men) and was runners up in Foot Ball. Under individual events, Sh. Sukhchain Das bagged 1st prize in Cycling. Sh. Sanjay Katenga won the 2nd prize in 800 m and 400 m race, 3rd prize in 1500 m race and in High Jump. Sh. Anurag won the 2nd prize in Discus throw.



RAC Meeting : 18-20 December 2004

IMC Meeting: 15th October, 2004

Vigilance Awareness Week: Indian Institute of Soil Science, Bhopal has observed Vigilance Awareness Week on November 1-6, 2004.

Hindi Pakhwada: Hindi Pakhwada was observed from September 14 to 29. During this pakhwada, debate, essay, poetry, noting-drafting competitions were organized by the institute to encourage Hindi language in day-today office work.

Farmers' meet: A farmers' meet programme has been organized at Mughaliahat on 3 Nov, 2004 in which farmers' have highlighted their problems related to crop production which mainly included, FYM management in villages, soil fertility constrains, root grub attack in coriander etc.

Group Meetings

ACIAR project (SMCN/2002/032), a group meeting of project scientists from IISS, Bhopal, Queensland Department of Natural Resources (QDNR), Brisbane, Australia and BAIF, Bhopal was held during August 24-31, 2004.

Annual Review Workshop of the RCPS-02 (NATP) on Optimizing Nutrient Supply in Relation to Soil Moisture Availability for Enhanced Productivity and Stability of Rainfed Cotton Based Production System was held on November 9-10, 2004.

A Workshop of Rallis India limited contractual research project on 'Evaluation of efficiency of Granubor in ameliorating boron deficiency in soils and crops' and Group meeting of the scientists of the All India coordinated research project of micro and secondary nutrients and pollutant elements in soils and plants at IISS, Bhopal during December 22-24, 2004.

Scientists Participation in Conference/ Seminar/Training/Group discussion

Dr. T.K. Ganguly, was invited as guest speaker to deliver talk in the Madhya Pradesh Vigyan Bhavan on August 5, 2004.

Dr. T.K. Ganguly, was invited as guest speaker to deliver talk in the Winter School at MPUAT, Rajasthan Agricultural College, Udaipur, held on September 20, 2004.

Dr. M.C. Manna attended National Conference on "Conservation Agriculture Conserving Resources for enhancing Productivity" at New Delhi, on September 22-23, 2004.

Drs. Tapan Adhikari and K.M. Hati attended ICAR sponsored Winter School on 'Soil resources appraisal and land use planning on watershed

development at Bangalore during September 12-22 October 2004.

Dr.P.Ramesh: National Seminar on Operational Methodology and Package of Practices in Organic Farming at UAS, Bangalore, October 7-9, 2004.

Dr. P.K. Ghosh: Attended National Symposium on "Enhancing productivity of groundnut for sustaining food and nutritional security at NRCC, Junagadh on October 11-13, 2004.

Dr. M.V. Singh: Participated in National symposium on enhancing groundnut crop production at NRC Groundnut, Junagarh during 11-14, October 2004.

Drs. B. Maji, Tapan Adhikari, K.K. Bandyopadhyay and N. R. Panwar attended 69th Annual Convention of Indian Society of Soil Science and National Seminar on Developments in Soil Science: 2004, at ANGRAU, Hyderabad on October 27-30, 2004.

Dr. M.V.Singh and Dr. R.H.Wanjari attended Workshop meeting of the All India Coordinated Research Project on 'Long Term Fertilizer Experiments at Punjab Agricultural University, Ludhiana on November 6-8, 2004.

Drs. P. Ramesh, P.K. Ghosh, and K.G. Mandal attended National Symposium on "Resource conservation and agricultural productivity at PAU, Ludhiana during November 22-25, 2004.

Dr. T.K. Ganguly, attended the Directors' National Workshop on Commercialization of Agriculture Technology in NAARM, Hyderabad held on 30 Nov to Dec 03, 2004 and presented talk on a base/policy paper.

Drs. M.V. Singh, Tapan Adhikari, and R.H.Wanjari participated in Workshop-cum-Group Meeting on 'Evaluation of Efficiency of Granubor in Ameliorating Boron Deficiency in Soils and Crops', at IISS, Bhopal on December 22-24, 2004.

Drs. A.K. Misra, A.K. Biswas and M. Mohanty attended a launching workshop on Network Project on "Impact, Adaptation and Vulnerability of Indian Agriculture to Climate Change", CRIDA, Hyderabad on December 20 - 21, 2004

Dr. P.K. Ghosh attended National Seminar on "Plant Physiology" at University of Pune, Maharashtra on December 27-29, 2004

Ashwani Kumar Sharma attended short course on Quantitative Methodology for Agricultural Policy Research at National Centre for Agricultural Economics and Policy Research, New Delhi on December 20-29, 2004.