IISS Newsletter

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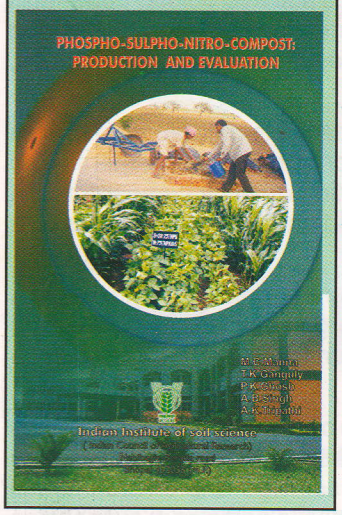
New publication



IN THIS ISSUE

From the Director's Desk...

Soil Microbial Community's Role in Soil Quality Improvement

Microbes play a vital role in biogeochemical processes in soil. In the last few decades, the prevention of soil pollution and cleanup of contaminated soils has become a world-wide priority. The goal of soil bioremediation measures is to hasten the pollutants degradation, transformation, and detoxification by chemical and biological means, and protect and ensure the soil quality.

Developed countries are challenged by visible damage to their environment by a multitude of contaminants as a consequence of industrial growth. Remediation measures generally employ physical, chemical or biological means or their combinations. The first two are referred to as engineering strategies, and the latter as bioremediation. In the latter tool, the living organisms are used to reduce or eliminate environmental hazards resulting from accumulation of toxic chemicals and other hazardous wastes. Another new trend in bioremediation is the use of phytoremediation using plants and vegetation as a clean up tool. This method exploits various biogeochemical processes in the rhizosphere including extraction, immobilization, and degradation of contaminants and offers some viable solutions for dealing with mixed wastes. Promising techniques in this area offer hope to simultaneously treat organic pollutants through degradative (enzymatic) pathways via root-microbial associations and both organic and inorganic waste by extraction of contaminants via root uptake and their concentration in the shoot biomass.

Microbial biodegradation of polycyclic aromatic hydrocarbons can be achieved by manipulating the substrate microenvironment, such as by adding nutrients (a mixture of NH_4NO_3, K_2HPO_4 and KH_2PO_4 etc.), enhancing aerobic status and introducing microbial inoculum. Heavy metals resistance mechanisms in microorganisms is an important area of research in helping to devise strategies for protection against metal-induced oxidative stress. Thus, the soil microbial community is an integral component of soil quality sustenance. So it is essential that the studies on impact of new inputs into agriculture systems need to focus on the soil biological environment to safe guard soil quality for sustainable and high crop production.

A. Subba Rao

Honorable DG, ICAR and Secretary, DARE Visits IISS

Honorable Dr. Mangla Rai, DG, ICAR and Secretary, DARE along with Dr.J. S. Samra, DDG (NRM) visited IISS Bhopal and interacted with all the scientists of this institute on December 3-4th, 2005. He emphasized the importance of long-term experimentation on issues concerning resource management technologies, conservation of water and organic farming. He appealed to the scientists to imbibe the qualities of simplicity and commitment to work and asked them to develop farmer friendly technologies in consultation with all the stakeholders.

Decontamination of Heavy Metals Contaminated Solid and Liquid Wastes through Biological Means

Low organic matter coupled with low native nutrient status in most arable soils of India, is responsible for low productivity and unsustainable production base. One of the most well known practices to recover and maintain the soil productivity is to add organic amendments. The availability of organic manure is not sufficient due to competitive uses for dung and biomass as fuel. Therefore, other sources like municipal solid wastes (MSW) are gaining prominence. Urban wastes (MSW and sewage sludge) are increasingly being used as organic amendments after composting to reduce possible environmental and health problems. MSW have a high amount of inert materials and other non-biodegradable by-products of industrial origin and are laden with heavy metals. Most heavy metals are accumulated as micronutrients such as copper, zinc, manganese and non-nutrient metals like nickel, cadmium, tin, mercury, lead in high amounts inducing toxicity towards soil microbiota. Long-term application of MSW or sewage water/ sewage-sludge slowly leads to accumulation of heavy metals in soil and inhibits the microbial activity. The application of metal contaminated wastes affects the soil microbial processes like carbon mineralization, ammonification, nitrification and nitrogen fixation.

Removal of heavy metals from metal bearing waste water effluents before discharging them into natural water bodies is accomplished by physico-chemical processes which include precipitation, coagulation, reduction, ion-exchange, membrane process (such as ultra filtration, electro-dialysis and reverse osmosis) and adsorption. Adsorption on activated carbon is a recognized method for removal of heavy metals from waste water. These methods are costly and there is a need to search a low cost and easily available adsorbent preferably of biological origin for metal removal.

Recent developments in the field of environmental biotechnology include the search for microorganisms as biosorbents for removal of heavy metals. Two methods of heavy metal toxicity elimination, by action of microorganisms are (a) bioleaching in which specific organisms reduce the toxicity of metals by complexation through acid production under aerobic condition in solution phase and (b) biosorption to improve biomass production.

Biosorption, using suspended non-living biomass, and flotation for consequent separation of the metal loaded biomass is needed for removal of toxic metals from dilute aqueous solutions. The activity of soil microorganisms and enzymatic activity decreases significantly as the solubility of the metal species increases and is dependent on soil type and environmental conditions. Many sorbents and ion-exchangers are often particulate in nature. Sorption with free mobile particles in suspension provides high surface area for binding sites, but their subsequent separation from decontaminated effluent may be problematic particularly in ultra fine range. Heavy metals are recognized as the most hazardous soil biological pollutants because they cannot be broken down and only change from one oxidation state to another. Heavy metals are forever! therefore research has to be intensified for finding cheap and effective methods of removing heavy metal contamination from solid wastes and liquid water for their safe and efficacious recycling in agriculture.

M.C. Manna and D.L.N.Rao
Soil Qualities for Sustainable Productivity

Research Highlights

Integrated Plant Nutrient Supply technology for improving the productivity of soybean

Based on four on-farm trials conducted in two villages of Rajgarh and Bhopal districts of Madhya Pradesh, it was found that the integrated use of 50%NPK+5t FYM/ ha+*Rhizobium* not only increased the soybean seed yield by 11% and 25% over the 100%NPKSZn and Farmers' Practice, respectively but also saved 12 kg N, 30 kg P_2O_5, 15 kg K_2O, 10 kg S and 2.5 kg Zn/ha. *Rhizobium* inoculation with 50%NPK+5t FYM/ha produced 6% higher yield over 50%NPK+5t FYM/ha. Irrespective of the INM modules, soybean var JS 9305 produced 5.5% more yield as compared to JS 335.

Luxuriant growth of soybean under IPNS

Productivity of soybean in organic farming

A three years field experiment was conducted during the *kharif* season (2003-05) to compare the productivity of soybean with organic manures (poultry manure, vermicompost and cattle dung manure @ 1.5, 2.0 and 3.0 t/ha on dry weight basis, respectively) in comparison to recommended doses of

chemical fertilizers. In the first year (2003), chemical fertilizer treatment recorded the highest seed yield and application of organic manures resulted in 7.3 to 13.3 % reduction in yield. During the second year (2004), in general, the productivity of soybean was lower because of deficient rainfall (737 mm), and occurrence of moisture stress during grain filling stage. However, the productivity of soybean under organic manure

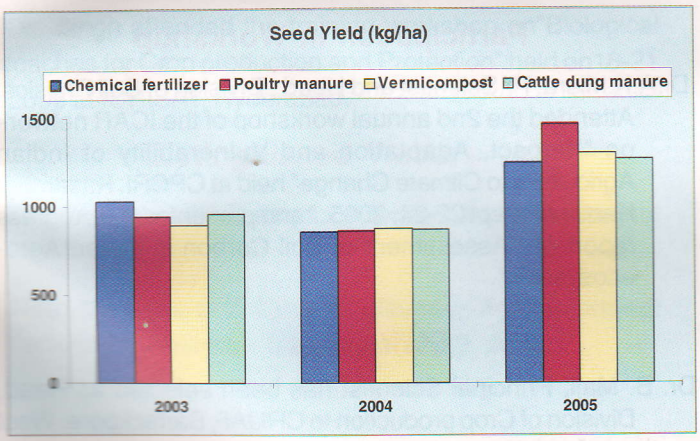


Fig.1. Productivity of soybean (kg/ ha) over the years

application was almost similar to that of chemical fertilizers. During the third year (2005), the productivity of soybean was

Organic soybean crop with *dhaincha* as a border crop for reducing pest incidence

higher with the organic manure application compared to that under chemical fertilizers. This is especially true with the application of poultry manure, which recorded 17.5 % higher yield than the chemical fertilizers (Figure 1).

Also, the soil organic carbon, available NPK and biological activity of soil were improved in organic manure application compared to the chemical fertilizers.

Improved land treatment effect on runoff, soil loss and nitrogen losses

Studies on broad bed and furrow (BBF) and flat-on-grade (FOG) land treatments showed that the runoff was less from BBF than from FOG land treatment. The BBF treatment recorded less ammonical and nitrate nitrogen losses through runoff than FOG. System productivity under BBF was higher than under FOG land treatment.

Soybean nodulation survey in Madhya Pradesh

Soybean nodulation surveys in farmers' fields in the fourth phase in M.P in Bhopal, Sehore, Rajgarh, Ujjain, Dewas, Indore, Dhar, Jhabua, Khargone, Khandwa and Harda districts was completed during Aug-Sept 2005. JS 335 continues to be the most widely cultivated variety; there is high usage of fertilizers, weedicides and pesticides; FYM is applied by most farmers but in moderate amounts (2t/acre) and that too after a gap of 3-4 years. Soybean nodulation is by and large good in black soils and poor in skeletal soils of western Malwa. Complete absence of nodulation was not encountered. Large majority of farmers are using or have used rhizobial cultures as well as phosphate solubilizing bacteria and their perception about its usfulness is very positive. Soybean growth was affected by a prolonged break in the monsoon during August due to water stress and diseases. Farmers' perception of soybean being no more profitable arose mostly because of low input costs which led to high profits in earlier years. However most farmers agreed that soybean is still the best bet and more remunerative than other crops and intercropping with maize fetched higher returns.

Organic and inorganic nutrient sources affect soil biological activity and pomegranate fruit quality

In pomegranate orchard, application of 11 kg vermicompost or13kg phosphocompost or 16.6 kg cattle dung manure (CDM) per plant or in combination of 50% CDM+50% recommended dose of fertilizer (RDF) improved the soil biological activity. The highest organic carbon (0.86%) was recorded in cattle dung manure treatment followed by phosphocompost (0.80%), vermicompost (0.79%) and 50% CDM +50% RDF (0.78%) treatments, whereas, in absolute control it was the lowest (0.54%). Similarly, soil enzymes such as dehydrogenase, cellulase, acid and alkaline phosphatase activity and microbial biomass C, N and P contents increased significantly in organic treatments followed by integrated nutrient management and inorganic alone and was least in absolute control. The fruit quality parameters viz; total soluble salt % , juice acidity %, Carotenoid and tannin content did not vary significantly due to application of organic, inorganic and organic + inorganic nutrient sources in the first year of the experiment..

Awards and Honours

Dr. P. K. Ghosh, Dr. M.C. Manna and Dr. K.K. Bandyopadhyay received IMPHOS-FAI award for 2005 for their work on "Role of phosphorus on crop yields and crop quality".

Dr. A. Subba Rao and Dr. K. Sammi Reddy received Dhiru Morarji Memorial Award for 2004-05 of FAI for the best article published in July, 2005 issue of Indian Journal of Fertilizers.

ICAR-Chaudhary Devi Lal Outstanding AICRP Award-2004 was presented to the All India Coordinated Research Project on long-Term Fertilizer Experiments under the leadership of Dr. M. V. Singh, Project Coordinator In-charge (AICRP-LTFE) on July 10, 2005 by Shri Sharad Power, Honorable Union Minister for Agriculture, Government of India.

Dr. D.L.N.Rao, Network Coordinator (BF) completed a consultancy assignment on Biofertilizer manufacture and development to M/s Rishita Biotech. Ltd., Hyderabad.

Dr. K.S. Reddy and Dr.D.D.Reddy selected as NAAS associates for the period of 1st January 2006 to 31st December 2010.

Visits abroad

Dr. K. G. Mandal Scientist (SS) Division of Soil Physics left for post doctoral studies in China for a period of 1 year.

Participation in Workshop

Dr.A.K.Misra, Pr.Scientist and Head , Division of Soil Physics: Attended the 2nd annual workshop of the ICAR network on ""Impact, Adaptation and Vulnerability of Indian Agriculture to Climate Change" held at CPCRI, Kasargod, Kerala on Sept 22-24, 2005. " and presented the progress report on "Assessment of Soil Carbon in Indian Agro-ecosystem".

Staff News

Dr. B. Maji, Principal Scientist has been selected as Head, Division of Crop production to CRIJAF, Barrackpore, West Bengal and left IISS on 20-08-05.

Dr. K.K.Bandyopadhya, Scientist has been selected as Senior Scientist at CICR, Coimbatore and left IISS on 15-10-05.

Events

Independence day: All the staff members and their families celebrated the Independence Day with great enthusiasm.

RAC meeting: Held on 14-15th September, 2005 under the Chairmanship of Dr. N.N.Goswami.

Winter school/ Summer school

Summer school on "Advance in frontier approaches to increase nutrient use efficiency in crop production" was conducted

from 22 July to 12 August 2005 at IISS Bhopal.

Winter school on" Efficient composting techniques for production of nutrient enriched composts from agro industrial and city wastes and standardization of methods " was conducted from 1-20 Dec, 2005 at IISS Bhopal.

Trainings attended

Dr.A.B. Singh attended the training workshop on"Biological approaches for Crop production and Protection" held on18-21 Oct 2005 at ICRISAT, Hyderabad.

Distinguished Visitors

Dr. Pax Blamey, ACIAR project scientist, Australia: August 8-11, 2005.

Dr. Neal Menzies and Dr. Pax Blamey, ACIAR project scientists, Australia: September 19-23, 2005.

Farmers' Meet Programme

Under the ACIAR project, a "Farmers' Meet Programme" has been organized at Geelakhedi (Rajgarh district) and Mugaliahat (Bhopal district) villages on August 10 and September 20, 2005 in collaboration with BAIF, Bhopal and University of Queensland, Australia.

Scientists Participation in Conferences/ Seminar/ Training/ Group Discussion During July to December,2005

Name	Programme	Venue	Period
Dr.A.B.Singh	National Seminar on" Resource management Options to reverse the declining trend in crop productivity"	TNAU, Coimbatore.	4-5th July, 2005
Dr. A. Subba Rao and D.D. Reddy	Seminar on "Recent Advances in Agricultural Reserch"	TNAU, Coimbatore.	5th Sempteber, 2005
Drs. A.B.Singh, J.K. Saha, A.K.Biswas, T. Adhikari, M.C.Singh, K.S.Reddy, D.D. Reddy, K.K.Bandyopadhyay	70th Annual convention of ISSS	TNAU, Coimbatore	28th September 1st October, 2005
Dr. N.R.Panwar	Group meeting of AICRP-CS, NPOF and AP Cess Fund Schemes	AAU, Jorhat	28-30th September, 2005
Dr. D.L.N.Rao	Brain storming session on "Policy Options for Efficient Nitrogen use" National Seminar on "Microbial Technology for Productive Agriculture"	NAAS, New Delhi TNAU, Coimbatore	4-5th October,2005 7-8th October, 2005
Dr. A.Subba Rao and M.C.Manna	National Seminar on "Role of PROM and Organic Sources of Plant Nutrients in Sustainable Agriculture"	M.P.U.A.Tech, Udaipur,	27th December, 2005

List of Priced Publications of the Institute

S. No	Title of the Publication	Price (Rs.)	Postage (Rs.)
1	Development of Farmer's Resource Based Integrated Plant Nutrient Supply System	475	52
2	Soil Test Based Fertilizer Recommendations for Targeted Yields of Crops	425	52
3	Indigenous Nutrient Management Practices – Wisdom Alive in India	600	68
4	Integrated Plant Nutrient Supply System for Sustainable Productivity	100	36
5	Long Term Soil Fertility Management through Integrated Plant Nutrient Supply	360	52
6	Sulfur Management for Oilseed and Pulse Crops	120	36
7	Technology at a Glance	30	36
8	Takneek Ek Drishti Mein	30	36
9	Methodologies and Package of Practices on Improved Fertilizer Use Efficiency Under Various Agro-Climatic Regions for Different Crops/Cropping Systems and Soil Conditions	100	36
10	Mitii Parkshan: Kyo, Kab aur Kaise	15	36
11	Mrida Tatha Poudho Mein Gandhak Ka Samuchit Prabandh	200	36
12	Phosphocompost : Ek Sampurna Prakritik Khad	20	36
13	Proceedings of the National Seminar on Standards and Technology for Rural/Urban Compost	250	52
14	Vermicomposting : An appropriate technology for recycling organic wastes (Hindi & English)	15	36

Editors

Dr. M.C.Manna, Sr. Scientist

Dr.D.L.N Rao, Network Co-ordinator (BF)

Published by

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