भाकृअनुप
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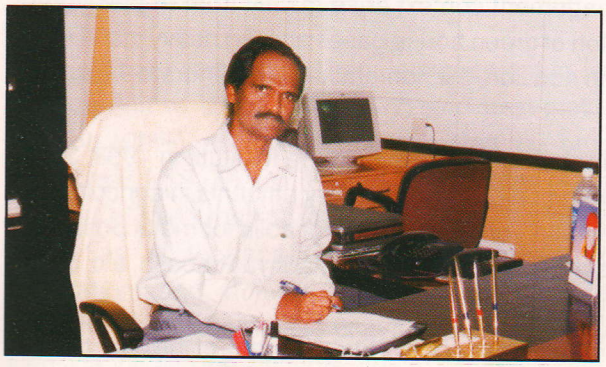
From the Director's Desk ....



Research Perspectives in Environmental Soil Science

One of the major concerns of the environmentalists pleading for sustainable agriculture is environmental pollution and ecological degradation. After three decades of successful green revolution using high-yielding varieties of crops responsive to increased inputs of chemical fertilizers and pesticides, farmers are now experiencing difficulty in maintaining high yields, some times even with higher levels of inputs. Second generation problems associated with soil quality, sustainability and environmental degradation have firmly come to the force and complaints on soil production potential getting slowly diminished, are increasing. The effects of physical degradation of soils like erosion, chemical degradation due to salinity, acidity etc. and biological degradation caused due to the loss of soil organic carbon and specific microbial communities are readily apparent. Negative effects of improper use of fertilizers and pesticides viz., eutrophication in water bodies, nitrate pollution of ground water, adverse changes in population and composition of soil microorganisms, increased emission of greenhouse gases and metal toxicities are a matter of concern in intensive agriculture zones. Even toxicity problems due to arsenic, fluoride, selenium and many industrial effluents are becoming more serious.

Environmental concerns will not only continue but will increase as society demands more growth to achieve and maintain a higher standard of living. Further growth leads to higher consumption and consequent higher waste disposal. Containment of toxic substances will continue to present challenges to soil scientists. In the past, we relied more on amelioration of the problems of nutrient deficiency, acidity or alkalinity on external inputs, but have not looked at the alternative means and methods of adopting the plants and management systems to effectively make best use of the environment as such. Whether the biotechnology developed products or some naturally occurring plants adapted to such soil related constraints could efficiently be used, has not been adequately studied. Bioremediation will be one of the important research directions to clear organic and metal pollutants from the soil. Soils have a major role to play in climate change research with special reference to mitigation and in maintenance of major ecological equilibrium. Soil serves as a source as well as a sink of carbon and other greenhouse gases. Developing strategies for sequestering soil carbon will be another important area of soil research

There is an urgent need for intensification of soil research in relation to environment. This should include investigation on rising nitrate levels in ground water, heavy metal build up in soils, release of green house gases from agro-ecosystems, and characterization of soil system as a sink for pollutants with an understanding of mechanisms of its interaction with pollutants.

A. Subba Rao

IN THIS ISSUE

Soil and Environmental Pollution - An Emerging Scenario

In modern economies, various types of activity, including agriculture, industry and transportation, produce a large amount of wastes and new type of pollutants. Soil, air and water have traditionally been used as sites for disposal of all these wastes. Sustainability of soil productivity in the present scenario will encounter constraints of degraded resource base, need for higher inputs and energy use which leads to environmental degradation. It is difficult and sometimes misleading to consider soil or land without its environmental context, and concern for the soil and its use is inseparable from the one for ecology as a whole. Concerns for environmental quality in nutrient management context arise mainly from (i) pollution of ground water aquifers (ii) eutrophication of surface water bodies (iii) emission of green house gases and (iv) heavy metal entry into the food chain and consequently affecting human and animal health. In addition, the contaminants deteriorate the quality of produce *vis-à-vis* its marketability.

With this background, the **Division of Environmental Soil Science** was established in the Institute in 1998. Since then the Division has made humble attempts to generate valuable information on i) Use of distillery effluents in agriculture ii) Effective utilization of sewage water for vegetable/crop production iii) Evaluation of sink capacity of soils for metal pollutants and iv) Some case studies on fluoride contamination of ground water and soil in Mandla district of Madhya Pradesh, etc. Some of the findings are high lightened in this issue of newsletter.

Considerable attention has been given to study the extent of soil pollution in urban and peri-urban areas of the country with continuous use of sewage sludge and other city and industrial wastes. In most of the cases, information has been generated on the level of contamination (particularly related to heavy metals) due to use of industrial waste. However, in-depth research efforts are required keeping in view the increased concern for various issues related to soil and environmental pollution.

The future research activities of the programme, " **Minimizing Environmental Pollution**" includes working on different aspects of (i) Maximum loading limit of particular city and industrial waste for different soil types and climatic conditions keeping in consideration of contamination in food chain as well as in ground water (ii) Devising technologies for utilization of different biodegradable and non-hazardous industrial wastes for crop production, keeping in view the effective utilization of plant nutrients which other wise pollute the environment (iii) Soil remediation technologies for cleaning of the soil from the point of view of prevention of food chain contamination (iv) Transport of nutrients and pollutants, leading to loss of nutrients under different management practices, so as to attain maximum input use efficiency and reduce pollution (v) Environmental and sustainable aspects of organic farming and its role in improving soil health and quality of crop produce.

Dr.B.Maji / Dr.P.Ramesh
Programme Leader
Minimizing Environmental Pollution

Research Highlights

Effect of sewage water irrigation on wheat

Application of sewage water (6 irrigations, 5 cm each) increased the mean plant height by 5%, grain yield by 11.7 q/ha as well as straw yield by 25.9 q/ha of wheat (WH-147) compared to ground water irrigation. Grain and straw yield of wheat responded significantly to different levels of fertilization in both ground water and sewage water irrigated plots. In ground water irrigated plots, maximum wheat grain and straw yield were obtained with 50% RDF + 10 t FYM/ha which were statistically at par with 50% RDF in sewage water irrigated plots. Further, grain yield obtained (47.4

Luxurious growth of wheat with sewage water irrigation

q/ha) in sewage irrigated control plots (no fertilizer) was almost equivalent to the yield obtained in groundwater irrigated plots receiving 50% RDF, indicating significant nutrient potential of the sewage water for wheat crop.

Distillery effluents on soil fertility and biochemical parameters

There was a significant improvement in fertility of the soil due to spent wash (SW) and post-methanation effluent (PME) application as indicated by organic C, available P, K, S, Zn, Cu, Fe and Mn contents of the soil at the end of five cropping cycles. Further, the biochemical properties of the soil *viz* microbial biomass carbon, respiration and activity of dehydrogenase, alkaline phosphatase and cellulase enzymes were also increased significantly with the effluents.

Sink capacity of soils

Based on the single-surface Langmuir sorption maxima, sink capacities of seven benchmark soil series viz Linga, Kagwad, Sarol, Bajatta, Lohara, Shahzadpur and Guttapalli have been determined from the pure metal solution matrix based on chemical soil test method. In respect of the maximum (S_{max}) and minimum sink capacity (S_{min}) values, the soils followed the order: Linga > Kagwad > Sarol > Bajatta > Lohara > Shazadpur > Guttapalli.

Phytoremediation of heavy metals with marigold and chrysanthemum

An experiment was conducted to study the effect of different levels of Cd (2.5,5,10,20 and 50 ppm) and Pb (10,20,50,100 and 150 ppm) on some physiological aspects in marigold and chrysanthemum. It was found that Cd and Pb did not show any inhibitory effect on seed germination even at the highest concentration. The study revealed that chrysanthemum was more susceptible than marigold to both Cd and Pb. Between the two elements, Cd was more toxic than Pb.

Effect of different doses of Cd on chrysanthemum

Effect of contaminated sewage-sludge on soil biological activity and biosorption capacity of isolated fungi

Increased levels of compost prepared from contaminated sewage-sludge decreased the Pb and Cd toxicity in terms of SMBC by about 1.2 to1.3 fold at 20 Mg ha^{-1}, and 1.45 to 1.65 fold at 40 Mg ha^{-1}, respectively. In growth medium, the Cd concentration of 10 mg l^{-1} showed marked effect on growth of *Aspergillus sp-2*and *Fusarium sp.* whereas *Aspergillus sp-1*and *Alternaria sp.* were affected at 5 mg l^{-1}. In the case of Pb, the growth of *Fusarium sp* and *Alternaria sp.* was affected at 50 mg l^{-1} and the *Aspergilus sp.* was affected at 25 mg l^{-1}. The Cd and Pb adsorption equation studies confirmed to the Freundlich isotherm for four fungi and was found that the bio-adsorption of Pb is relatively higher than Cd biosorption.

Mechanical harvest-borne wheat residue management options evaluated

The pooled analysis of 5 years data clearly demonstrated that wheat residue incorporation or surface retention resulted in higher yields of soybean-wheat cropping system and led to an improvement in organic carbon and nutrient availability of soil compared to residue burning. Residue incorporation/retention was more effective when N was supplemented through FYM followed by poultry manure. The economic analysis of residue management options also showed that the wheat residue incorporation or surface retention was economically more profitable than residue burning. The value cost ratio (VCR) was 14.7 for residue incorporation and 3.1 for residue retention. The lower VCR for residue retention than for residue incorporation was due to more costs associated (on account of weeding) with residue retention practice.

Efficient utilization of limited available irrigation water in wheat through micro-sprinkler

When irrigation water was available up to maximum tillering stage, application of irrigation (14 cm) through sprinkler in 3 intervals, each at pre sowing (4 cm), crown root initiation(5 cm) and at maximum tillering (5 cm) stage registered significantly higher yield and water use efficiency of wheat than the application of same amount of

water through flooding in 2 intervals (PS 8 cm + CRI 6 cm). Even for the same frequency of irrigation, application of 14 cm of irrigation through sprinkler or combination of sprinkler and flooding registered higher water use efficiency than irrigation through flooding with same amount of water.

Performance of pigeonpea under organic farming

A two-year field experiment of pigeonpea under organic farming showed that application of cattle dung manure @ 4 t/ha recorded similar crop growth, yield attributes, yield and protein content as that with chemical fertilizers @ 30 kg N + 26 kg P/ha. Application of vermicompost or phosphocompost @ 3 t/ha resulted in identical crop growth, yield attributes and yield whereas, poultry manure @ 2 t/ha recorded the lowest crop growth and yield. Cattle dung manure recorded higher soil organic carbon, available N and K and increased dehydrogenase and phosphatase activity of soil compared to chemical fertilizers and control. Among the four varieties, ICPL-87119 recorded higher crop growth and yield compared to Jawahar-4, BDN-2 and Aasha.

Pigeonpea grown with cattle dung manure

Effect of organic manures on soil and fruit quality of pomegranate

Different organic sources like phospho-compost and vermicompost applied alone or combination of cattle dung manure + 50% NPK improved the chemical, biochemical and biological properties of soil over control. Similarly, the quality of fruit in terms of total soluble salts, sugar and ascorbic acid content also increased in organic, organic + inorganic and chemical fertilizers over control.

Biofertilizers improve fertilizer use efficiency

Research leads by the AINP on Biofertilizers-Bhubaneswar center on improving fertilizer use efficiency (FUE), were tested in three farmers' fields in Dhenkanal district of Orissa in acidic sandy loams (pH 5.2-5.6). Bioinoculants (*Azotobacter + Azospirillum*) improved the yield of okra, tomato and brinjal by 13.5-20.0 % over farmers' practice and 8.5-14.3% over recommended dose of fertilizers (RDF). Most significantly the apparent FUE was increased by 6-15% for N,10-22 % for P, 13-28% for K and 2.7-5.0 % for S. Averaged together they represent an increase in the yield of 16.6 % over farmers' practices and 11.3% over RDF due to the use of bioinoculants. Average increase in FUE due to inoculants was 11.3% in the case of N, 14.2 % in the case of P, 20 % in the case of K and 3.6% in the case of S.

Effect of long-term fertilizer and manure application on P-fractionation in Alfisols of Bangalore

Long-term fertilizer experiment is being continued for the last 14 years with finger millet-maize cropping system in Alfisols at Bangalore.The total P content of soil over the years has increased considerably due to most of the treatments, except 100% N and control, the two treatments devoid of P. Among the various fractions of P, the order of their occurrence is Fe-P> Al-P > Ca-P > saloid-P. The quantity of saloid-P ranged from 3.82 mg kg^{-1} in control to 16.24 mg kg^{-1} 100% NPK+FYM, while that of Al-P varied from 78.2 mg kg^{-1} in control to 163 mg kg^{-1} in 100% NPK+FYM. The Fe-P content ranged from 145.2 mg kg^{-1} in control to 200 mg kg^{-1} in 100% NPK+FYM in the soil. The quantity of Ca-P was relatively higher in plots treated with lime (100% NPK+lime) and control.

Balanced fertilization for improving the productivity of wheat

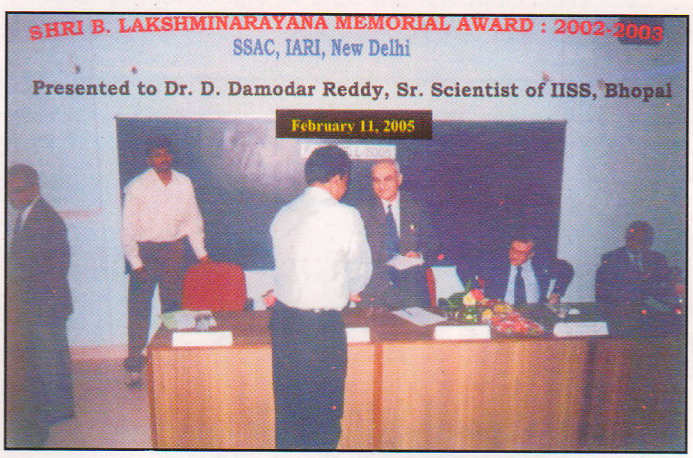
Based on the six on - farm trails conducted in farmers' fields in M.P., it was found that the balanced application of N, P, K, S and Zn at recommended rates (120kg N, 60 kg P_2O_5, 20 kg K_2O, 20 kg S and 5 kg Zn/ha) increased the wheat grain yield by 15 - 24% as compared to farmers' practice. The results of these trials clearly indicated that higher wheat grain yields could be sustained by encouraging farmers to correct N, P, S and Zn

deficiencies by adopting balanced nutrient management practices.

Response of wheat to NPKSZn in farmers' field

Awards and Honours

Dr.D. Damodar Reddy, Sr. Scientist: Shri B. Lakshminarayana Memorial Award (2003-2004), conferred by the Indian Agricultural Research Institute (IARI), New Delhi on February 11,2005.



Dr. D.L.N.Rao, Network Coordinator (Biofertilizers): Joined as Editor, 'Agropedology' from 2005 onwards.

Dr. D.L.N.Rao, Network Coordinator (Biofertilizers): Re-nominated as Editor, Journal of Indian Society of Soil Science for the years 2005-06.

Visits Abroad

Dr.M.V.Singh, Project Coordinator (Micronutrients): Presented an invited paper on Micronutrient deficiencies in crops of India in the 8th International Conference on Bio-Geochemistry of Trace Elements (8th ICOBTE) held at Adelaide, Australia, April 3-7, 2005.

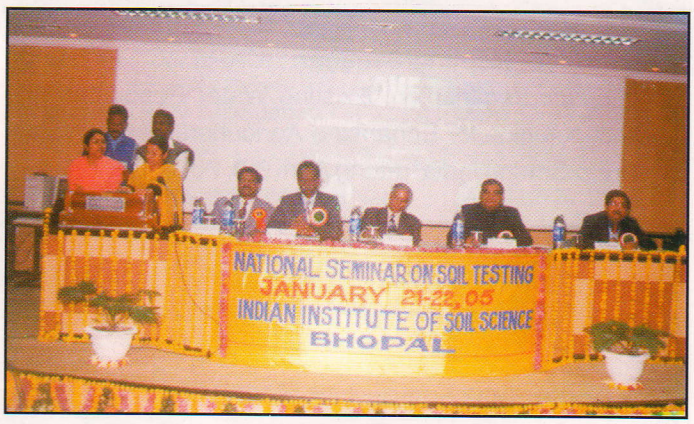
Dr. A.K. Misra, Pr. Scientist and Head, Division of Soil Physics: Attended the Review and Planning Meeting of ADB-ICRISAT Project "Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semi-Arid Tropics" at Kunming, China, April 27 29, 2005.

Staff News

Dr.Ashwani Kumar Sharma, Senior Scientist has been transferred to IISR, Lucknow on June 17, 2005.

Events

- **National Seminar:** National Seminar on Soil Testing during January 21-22, 2005 and National Workshop of AICRP on STCR during January 23-24, 2005.



- **Republic Day:** All the staff members and their families celebrated the Republic Day with great enthusiasm.
- **IMC Meeting** :February 8, 2005 and March 14 , 2005
- **Farmers' Meet:** Under the ACIAR research project, a

"Farmers' Meet Programme" has been organized at Geelakhedi village, (Rajgarh District) on February 15 and June 3, 2005 in collaboration with BAIF, Bhopal and University of Queensland, Brisbane.

✦ **RAC Meeting**: Held on March 5-6, 2005 under the chairmanship of Dr. N.N. Goswami.

✦ **Interface Meeting/Seminar:** ICAR/DAC sponsored Interface/Seminar on "Existing Water Resources and Technologies for Enhancing Agricultural Production in North Central India" during April 2-3, 2005.

✦ **Launching Workshop :** A launching workshop of the project entitled "Delineation and Mapping of Nitrate Contamination in Soil and Water in Heavily Fertilized and Intensively Cultivated Districts of the Country" was held during April 6-7, 2005.

✦ **SRC Meeting :** June 15-16, 2005.

Distinguished Visitors

* Dr. Neal Menzies, Dr. R. C. Dalal, Dr. Fax Blamey and Dr. Merv Probert, ACIAR Project Scientists, Australia : February 14-18, 2005.

* Dr. Kizyaev Boris Mikhailovich, Director and Dr. Kireycheva Liudmila Vladirovna, Deputy Director, All-Russia A.N. Kostyakov Scientific Research Institute of Hydrotechnique and Melioration, Moscow and Dr. Chernushenko Vladimir, Director, Smolensk Scientific Research Institute of Agriculture, Smolensk, Russia: February 24-26, 2005.

* A delegation of LUPIN Human Welfare & Research Foundation, Bharatpur: March 16, 2005.

* Dr. Christian Roth, Program Manager, Soil Management & Crop Nutrition, ACIAR, Australia and Dr. Kuhu Chatterjee, Country Manager, ACIAR, New Delhi: June 2-3, 2005 .

* Dr. P.G. Adsule, Director, National Research Center for Grapes, Pune: June 27, 2005.

Scientists' Participation in Conference/Seminar/Training/Group Discussion

Name	Programme	Venue	Period
Drs.A.Suba Rao and K.S.Reddy	92 nd Indian Science Congress Association (ISCA)	Ahmedabad	January 4-6, 2005
All scientists of the Institute	National Seminar on Soil Testing and Workshop of AICRP on STCR	IISS, Bhopal	January 21-24, 2005
Drs.A. Subba Rao, A.K. Misra, Muneshwar Singh, M.V.Singh, T.K. Ganguly, D.L.N.Rao, M.C. Manna, A.B. Singh, J.K. Saha, A.K. Biswas, P.K. Ghosh, A.K. Sharma, A.K. Tripathi, K.S. Reddy, D.D. Reddy, Tapan Adhikari,K.M.Hati, S.Ramana, K.G. Mandal, R.H. Wanjari, M. Mohanty and K.K. Bandyopadhyay	International Conference on Soil, Water and Environmental Quality- Issues and Strategies	IARI, New Delhi	January 28 - February 01, 2005
Dr.P.Ramesh	National Seminar on National Policy on Promoting Organic Farming	NCOF, Ghaziabad	March 10-11, 2005
Dr.D. Damodar Reddy	Annual Review Workshop of TMC-MM 2.1	CICR, Nagpur	March 22, 2005
All scientists of the Institute	Interface / Seminar on Existing Water Resources and Technologies for Enhancing Agricultural Production in North Central India	IISS, Bhopal	April 2-3, 2005
Dr.A.Subba Rao	National Seminar on Fertilizer Quality Control	Faridabad	April 11-12,2005
Dr. A.B. Singh	National Training on Biochemical and Molecular Characterization of Agriculturally Important Microorganisms	NBAIM, Mau Nath Bhanjan	April 22-29, 2005
Drs.A.Subba Rao,P.Ramesh and K.S.Reddy	National Seminar on Organic Farming: Current Scenario and Future Thrusts	ANGRAU, Hyderabad	April 27-28, 2005
Dr.S.Ramana	Training on Development of High End Resource Materials for Effective Teaching and Learning	NAARM, Hyderabad	April 28 to May 18, 2005
Dr.A.Subba Rao	National Meeting on Management of Change in AICRPs, 2005	New Delhi	May 16-17,2005
Dr.R.H.Wanjari	Western Regional Agriculture Fair	MAU, Parbhani	May 18-21, 2005
Dr.T.K. Ganguly	AICRP Workshop on Micro, Secondary and Pollutant Nutrients and Effect of Granubor on Various Crops	IISS, Bhopal	May 21-22, 2005
Sh. N. R. Panwar	Refresher Course on Information Technology in Agriculture	NAARM, Hyderabad	June 1-21, 2005
Drs.P.Ramesh and K.K. Bandyopadhyay	National Conference on Microirrigation	GBPUA &T, Pantnagar	June 3-5, 2005
Dr.A.Subba Rao	Annual General Body Meeting of the NAAS	New Delhi	June 4-5,2005

List of Priced Publications of the Institute

S.No.	Title of the Publication	Price (Rs.)	Postage (Rs.)
1	Development of Farmers' Resource Based Integrated Plant Nutrient Supply Systems	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	*Mitti Parikshan : 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

Forth Coming Event

Winter School on Efficient Composting Techniques for Production of Nutrient Enriched Composts from Agro-Industrial and City Wastes and Standardization of Methods during December 01 - 21, 2005 at IISS, Bhopal.

Editors
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