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Farmers' Day

Farmers' Day was organised on February 12 to disseminate technologies among farmers for better management of soil and nutrient resources. About 600 farmers, agricultural extension workers participated and visited the field experiments. A seminar was organised on "Balanced and Integrated Use of Nutrients in Crop Husbandry" in association with Bhopal Chapter of Indian Society of Soil Science. A publication in Hindi '*Mitti Parikshan Kyon, Kab aur Kaise?*' was released and distributed to the farmers.

In this Issue

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From the Director's Desk...

Micronutrient - No More a Micro Issue

The path set down for Indian Agriculture in the direction of food security was defined in the 1960s. Emphasis was given to provide more calories per person with the help of technologies like HYV of crops, agro-chemicals ranging from high analysis fertilizers to pesticides to synthetic plant hormones and farm machines. This production paradigm, however resulted in exhaustion with respect to the reserve as well as supplying capability of the soil for micronutrients to meet out crop requirement. Such mounting pressure on finite micronutrients resources in soil has already caused their deficiency to crop up in new areas besides aggravating the existing ones as evidenced by the extensive research works carried out under AICRP (micronutrients) and elsewhere. The latest reports indicate that zinc and boron deficiencies are most widespread in Indian soils and on an average, 49 and 31 per cent of the total samples analysed were found deficient in these two nutrients. Losses of micronutrients through leaching, liming, limited use of manures and increased purity of chemical fertilizers are among the factors responsible for widespread emergence of these deficiencies. The sustainable high productivity of agriculture can only be realized through constant monitoring and correcting the existing and emerging micronutrients deficiencies. Very high degree of responses ranging from 250 to 1480 kg ha^{-1} to zinc application and from 310 to 480 kg ha^{-1} to boron application in cereals in different parts of country clearly indicate the hunger of the soils for these two micronutrients. The benefit from macronutrient fertilizers and other agricultural inputs can not be realised until crop hunger for micronutrients is met. As organic matter plays an important role in soil micronutrient cycle, an integration needs to be worked out between organic and inorganic (fertilizer) sources in our nutrient management systems.

Now when the target for food security (adequate calories) has nearly been achieved, emphasis has also to be given for eliminating micronutrient malnutrition among people which is now appearing due to less dietary intake, especially of iron, iodine and zinc. Introduction of intensive green revolution cropping systems (cereal based) by displacing traditional micronutrient rich crops of pulses, vegetables and fruits has been found responsible for such emerging malnutrition which now afflicts more than 40% of the world population, particularly of developing countries like India. Indian agricultural research must address this issue of micronutrient malnutrition that degrades human health, productivity and well being.

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Phosphocompost : An alternative phosphate fertilizer for crops

Phosphocompost is a manure prepared from phosphate rocks and biodegradable wastes using certain micro-organisms like, P-solubilizing and cellulose degrading micro-organisms. These micro-organisms transform insoluble P present in phosphate rocks into labile P during composting.

Addition of P fertilizers into the soil has often been recommended to maintain adequate supply of P during crop growth. Realising the significance of phosphate fertilizers for increasing crop productivity and improving quality of crops, its consumption in Indian agriculture increased steadily to 3.22 million tonnes upto 1990-91. Since then, its annual consumption is hovering between 2.6 - 2.9 million tonnes. Phosphate fertilizer consumption, thus, did not increase as expected and resulted in widening the ratio of N & P use in agriculture. This signifies the need for developing alternative but cheap sources of phosphate fertilizer from indigenous resources like phosphate rocks.

India has a reserve of 212.87 million tonnes of low grade phosphate rocks. Their use in fertilizer industry is uneconomical. Indigenously available phosphate rocks could, however, be utilized as source of P in agriculture after either partial acidulation or microbial solubilization processes. Microbial solubilization is an environment friendly technology based on natural processes operating in soils with the help of certain micro-organisms like *Aspergillus awamori*, *Pseudomonas striata*, *Bacillus polymyxa* and *Bacillus sp.* etc.

Phosphocompost production procedure consists of mixing compostable waste materials with a slurry of phosphate rock (25% w/w), cattle dung, soil and matured compost. The compostable material, cattle dung, soil and mature compost are mixed in the ratio of 8:1:0.5:0.5. To this mixture pyrite (10% w/w) and nitrogen (1% w/w) are added to prepare N-enriched phosphocompost. Inoculum comprising phosphate solubilizing fungi and cellulose degrading micro-organisms is added @ 0.5 kg per t of waste material. The material is composted either in pits or heaps while maintaining moisture content between 55-60%. Material is turned at 15 days interval to provide aeration for optimum microbial activity.

Table-1 Nutrient content in phosphocompost and other manures

Manures	Total-N (%)	Total P_2O_5 (%)	C:N	Citrate soluble P_2O_5 (%)
Ordinary Compost	0.8	0.55	25.0	0.05
FYM	0.7	0.75	22.0	0.06
Vermicompost	1.3	0.50	19.0	0.05
Biogas slurry	0.9	0.70	23.0	0.08
Phosphocompost (12.5%PR*)	1.2	4.70	17.2	1.15
N-enriched phosphocompost (25% PR)	1.9	7.10	14.8	1.80

* PR = Phosphate rocks

The mature compost with 50% reduction in original weight is ready for use in fields within 3-4 months of composting.

Phosphocompost and N-enriched phospho-compost contain higher amount of N, P and citrate soluble P as compared to ordinary compost like FYM, biogas slurry and vermicompost etc. (Table-1). Amendment with phosphate rocks increases total and citrate soluble P content as compared to other manures.

Results of experiments conducted under different agro-ecological regions showed that phosphocompost can substitute use of single super phosphate (SSP) in different crops (Fig.1). It was further noticed that supplying P to crops through N-enriched phosphoco-mpost not only substituted the use of SSP but also saved nitrogenous fertilizer use by 25% (Table 2).

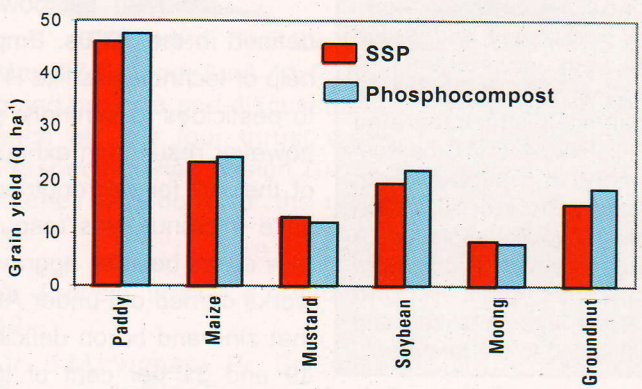

Fig. 1 : Comparative performance of SSP and phospho-compost on yield increases of different crops

Table 2 Fertilizer economy through use of N-enriched phosphocompost in crops

Treatment	Grain yield (q ha^{-1})				
	Paddy	Wheat		Soybean	Maize
	Kanpur (Sarju-52)	Indore (Sujata)	Ranchi (RR-21)	Indore (JS-335)	Ranchi (GS-2)
100% NPK	55.75	27.62	29.0	17.52	27.17
75% N+K+N-enriched Phos-pho-compost (2.5 t ha^{-1})	55.00	29.00	38.0	18.14	31.08
100% NPK+FYM (2.5 t ha^{-1})	57.50	28.90	36.0	18.60	29.0

Phosphocompost production and its use to supply nutrients and organic matter is an appropriate technology. This conserves natural resources, utilizes indigenously available low grade phosphate rocks and helps in abatement of environment pollution. It not only adds value to waste materials but also helps farmer to become self reliant in meeting the P requirement of crops.

Mohan Singh

Project Co-ordinator (MD), IISS, Bhopal

Research Highlights

Water use efficiency in mustard and wheat

Irrigation water is a costly input. Its efficient use in crop production is of great concern. Field experiment on Vertisol indicated that water use efficiencies (WUE) in mustard and wheat were increased through better and integrated nutrient management (recommended NPK + 10 t ha^{-1} FYM) as compared to no nutrient control.

Kinetics of P sorption - desorption in soils

Studies on P sorption-desorption kinetics in Vertisol, Alfisol and Ultisol revealed that P sorption was triphasic; fast phase extended upto one day followed by medium phase from 1 to 8 days and a slow phase, extending from 8 days onwards. Sorption during medium and slow phases was similar in $CaCl_2$ and NaCl media in all soils. Vertisols sorbed maximum amount of P followed by Alfisol and Ultisol. Phosphate desorption rate was lower in fast sorption phase than the other two phases.

Zinc sorption kinetics in soils

Kinetics of Zn sorption in soils is biphasic, characterised with a rapid initial sorption phase upto 8 h followed by slow phase of 24 h. In the initial phase, sorption rate was faster in Vertisol than Alfisol and Inceptisol. Sorption of Zn by soils was best described by Elovich equation. Mainly clay, Fe_2O_3 and $CaCO_3$ contents influenced Zn sorption in soils.

Utilisation of distillery effluent

Spent wash, produced in distilleries is responsible for pollution of our natural resource base. Study has been initiated to explore the possibility of utilizing spent wash and biomethanated spent wash in agriculture. Preliminary studies indicate that the untreated and treated (post methanated) spent wash could be used as good source to supply organic C and nutrients to the soil.

Measurement of water extractable fluoride in soils by ion chromatography

Acetate, a common anion in soil extracts, interferes with the fluoride (F) determination by ion chromatography. Method has been developed and standardised for the determination of F even in presence of higher amount of acetate (upto 5 g/ml). The method requires DIONEX IonPac AG4A-SC, AS4A-SC (4 mm) columns and conductivity suppresser. Sodium tetraborate ($Na_2B_4O_7$, 5.0 mM) was used as eluent with 2.0 ml/min flow rate. The peaks for F and acetate were well resolved. About 1.6 min after injection, 50 mM $Na_2B_4O_7$ was passed for 5 min to wash the column and thereafter, columns were equilibrated with 5.0 mM $Na_2B_4O_7$ eluent. The whole operation was completed within 13 min.

STCR recommendations proved better

The technology generated under AICRP on Soil Test Crop Response (STCR) has been verified at farmers' holdings. Fertilizers application based on STCR recommendation produced higher response ratios in rice at Pusa (Bihar), Coimbatore and Molapalayam (Tamil Nadu) and in tapioca at Coimbatore. Application of IPNS technology through STCR approach also resulted in higher fertilizer nutrient use efficiency besides higher response ratio.

Workshop of AICRPs on Micronutrient and STCR at Anand, Gujarat

Workshop of AICRPs on Micronutrients and STCR was jointly organised at B.A. College of Agriculture, Anand during January 18-21. About 120 delegates from all over the country attended the workshop. Dr. G.B.Singh, DDG (NRM) in his inaugural address emphasized the need for generating low cost integrated technology for improving soil health. Dr. C.H. Rana, Vice Chancellor, Gujarat Agricultural University chaired the inaugural session.

Training Workshop on PDCO Survey

A training workshop of ICAR-IFFCO-FAO was held on April 14-17 to impart training on conducting PDCO (Participatory diagnosis of constraints and opportunities) survey to assess the farmers' resources. Scientists of ICAR/Universities and IFFCO officials involved in the ICAR-IFFCO-FAO collaborative project participated in the training workshop. The training programme included lectures, discussions, collection and interpretation of information and in-depth survey of some farm/farmers of nearby Mugaliahat village.

Collaborations with International Institutes

1. ICAR-ICRISAT collaborative project on 'Sustaining production of soybean based cropping systems through soil- water- nutrient- management in landscape watersheds' has been initiated from January 1999.
2. FAO-ICAR-IFFCO collaborative project on 'Developing eco-regional integrated plant nutrient management systems for sustainable crop production' has been started from January 1999.

ADB funded ICAR-ICRISAT partnership research project meeting in progress on 10th March at the Institute

Shifting of Laboratories and Offices to Main Building

The Institute shifted to new building from the farm complex building on April 22, 1999.

Participation in Seminar/Symposium/ Training Programme

Dr. D. Damodar Reddy participated in 87th Indian Science Congress Association at Anna University, Chennai on January 3-7.

Dr. C. L. Acharya attended a meeting of ICAR-ICRISAT ADB funded project 'Sustainable Rainfed Agriculture in South and South-East Asian Countries' at Bangkok, Thailand on February 1-3.

Dr. K.G. Mandal completed the 65th FCARS at NAARM, Hyderabad on February 6.

Dr. A. Subba Rao attended a workshop on 'Recent trends in nutrition management of horticultural crops' at Konkan Krishi Vidya Peeth, Dapoli on February 11-12.

Dr. S. Srivastava participated in 4th Agricultural Science congress at RAU, Jaipur on February 21-24.

Dr. K.N. Singh attended training course on 'Remote Sensing and GIS application in agriculture' at IASRI, New Delhi on February 22-27 and 2nd workshop of ARIS Cell In-charges and Seminar on LINUX at NBPGR, New Delhi on March 5-7.

Dr. A. Swarup attended a workshop on 'Long term experiments on soil fertility in rice based cropping systems' at Dhaka, Bangladesh on March 8-11.

Research Review

RAC held: The Research Advisory Committee meeting was held on April 5-6 under the chairmanship of Dr. J.S. Kanwar to review the progress of the on-going projects.

SRC held: The Staff Research Council met on May 27-28 and June 11 to review the progress of on-going projects and discussed new project proposals. In each of the four thrust areas as outlined in IISS-Perspective Plan "Vision 2020", prioritisation of research themes was done for the next five years.

Distinguished Visitors

Dr. Patricia Imas, Co-ordinator of IPI, India on February 19.

Dr. S.M. Virmani, Pr. Scientist and Dr. P. Pathak, Sr. Scientist, ICRISAT, Hyderabad; Dr. H.P. Singh, Director, CRIDA, Hyderabad; Dr. N.S. Pasricha, Head, Dept. of Soils, PAU, Ludhiana; Dr. S.K. Bansal, Potash Research Institute of India, Gurgaon on March 11.

Dr. Y.S. Chauhan and Dr. A. Ramakrishna, ICRISAT, Hyderabad on March 30.

Dr.S.R.Singh, Director, DWMR, Patna on May 22.

Dr. R.N. Prasad, ADG (S), ICAR on May 26.

Staff News

New staff Joining the Institute

Dr. R.H. Wanjari, Scientist, January 7.

Dr. A.B. Singh, Sr. Scientist, March 22.

Dr. K.P. Raverker, Sr. Scientist, April 21.

Sh. M.M. Tiwari, Assistant and Sh. C.P. Mishra, Sr. Clerk, June 21.

Sh. Bhanwar Singh, Messenger, January 23.

Sh. N.S. Yadav, Driver, May 3.

Sh. A.K. Mishra and Sh. Kalicharan, Lab.Attdt. June 10.

Sh. Dharam Raj Singh, Messenger, June 14.

Sh. Ramesh Khawle, Messenger and Sh. Arun Bhoj Raj Mate and Sh. Sanjay Narayan Gharde, Lab. Attdt., June 15.

Staff left the institute

Dr. K.K. Bharadwaj, Pr. Scientist, April 30 (retired).

Dr. K.P. Tomar, Pr. Scientist, June 15.