भाकृअनुप
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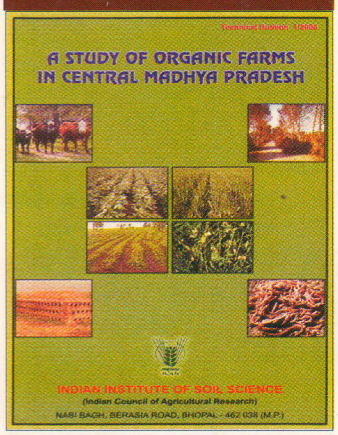
New Publication



In This Issue

Editors

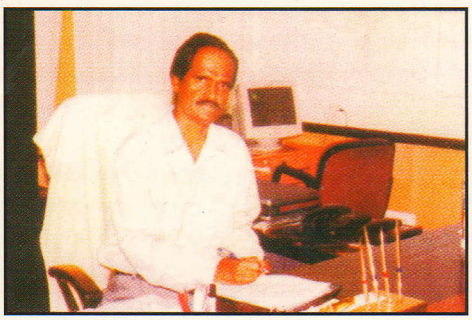
J.K. Saha
N.R. Panwar

Fourth Coming Event

Winter school on Soil Organic Carbon Stocks and Soil Organic Matter Management in Relation to Soil Quality and Climate Change during 1-21. December 2006

From the Director's Desk...

Wastewater is not all the waste



In our country, 423 Class I Cities and 499 Class II towns generate about 26254 million litre per day (mld) of wastewater of which only about 25% is treated. Further, about 57,000 industries generate about 13,468 mld of wastewater out of which nearly 60% (generated from large & medium industries) is treated. Such wastewater, unless reused, pollutes the surface and groundwater bodies leading to eutrophication of surface water bodies. In peri-urban areas of most developing countries, the use of municipal wastewater for irrigation is a low-cost disposal alternative. In semi-arid areas, the use of local sewage is the only water source that supports the livelihoods of millions of poor people who irrigate the high-value crops. This also reduces the burden on precious groundwater which is a costlier input in such climatic zones. There are many potential benefits offered by the use of municipal waste water for irrigation purposes, including the safe and low-cost treatment and disposal of waste water; the conservation of water and recharge of groundwater reserves; and the use of nutrients in the waste water for productive purposes. Field experiment at Indian Institute of Soil Science has clearly showed that six irrigations with untreated municipal sewage water can augment the wheat grain yield equivalent to 50% recommended dose of fertilizers or more. India has more than a lakh hectare area under sewage farms, many of which are not managed rigorously.

But the most obvious question: Is sewage irrigation safe? Sewage carries disease causing harmful bacteria, viruses and parasites and these should be kept away from our food. Hence, its generally not advisable to grow fodder or vegetable crops with sewage water as it may pose a health risk to human beings and animals. Further, there is a need to monitor the soil receiving sewage water continuously, for any possible build-up of pollutants, pathogens and change in microbial diversity. Municipal wastewater irrigation becomes more unsafe for the land resources when it gets mixed with industrial wastewater. Many a times farmers in the arid and semiarid regions don't have any alternative but to use the potentially toxic wastewater for irrigating their crops. Soils of quite a large area around the Indian cities have been reported to be deteriorated in this way. Hence, there is a need to develop quality standards and guidelines for waste water use as irrigation to agricultural crops and also develop suitable technology to ameliorate the already polluted soils.

A. Subba Rao

Impact of groundwater pollution in Ratlam and river water pollution in Nagda on soil and crop productivity

Central Pollution Control Board identified Ratlam and Nagda city areas conjointly as one of country's 22 most severely polluted areas due to industrial activity. About 1100 ha of the cultivated area (on an average 22 per cent of the total area) in 11 villages in Ratlam periurban areas lying on both sides of seasonal creek (Dosinala) of about 15-20 Km length are affected by groundwater pollution. Industrial activities in Nagda town result in a high volume of wastewater generation, which is carried away by a surface natural drain (about 5-6 km), leading to river Chambal. A man made dam constructed at the upstream side of industrial area withholds the fresh water of the river for domestic and industrial use during dry season and downstream side of the river carries mostly city and industrial effluents.

Irrigation water quality

Ratlam: Groundwater samples from polluted area have turned highly colored (yellowish to reddish brown). Similarity in color as well as high contents of sulphate and chloride indicates that effluents from a nearby Alcohol plant might be one of the possible sources of ground water contamination in the area. About 40% of the samples in the polluted area can be categorized as having very high salinity (>2.25 dS m^{-1}) and sodium hazard (SAR > 9) and about 71% of the samples have potential for severe Cl^- hazard (>10 meq Cl^- L^{-1}) permitting their use as irrigation only in tolerant crops. Groundwater samples of polluted area contained, on an average, 9.1 µg/L Pb, 4.1 µg/L Cd and 18.5 µg/L Cu. Several samples from Bhajankheda, Jadwasa khurd and Dosigaon villages of polluted area contained unsafe levels of Pb and Cd for drinking purpose.

Color of groundwater at Ratlam turned red due to Industrial pollution

Nagda: More than 14 villages at both side of the river are affected due to the use of effluent loaded river water in the agricultural land. Irrigation water (Chambal river) near affected villages had EC ranging from 2.38 to 4.11mS/cm due to sulphate and chloride salts of Na. The mean SAR value in Chambal river water was 5.1 times higher than that in unpolluted tubewell water. The EC of some of the tubewell water of polluted villages have gone up more than 2.5 mS/cm indicating that effluents of industrial area have contaminated the groundwater.

Severe pollution of Chambal River at Nagda by Industrial effluent

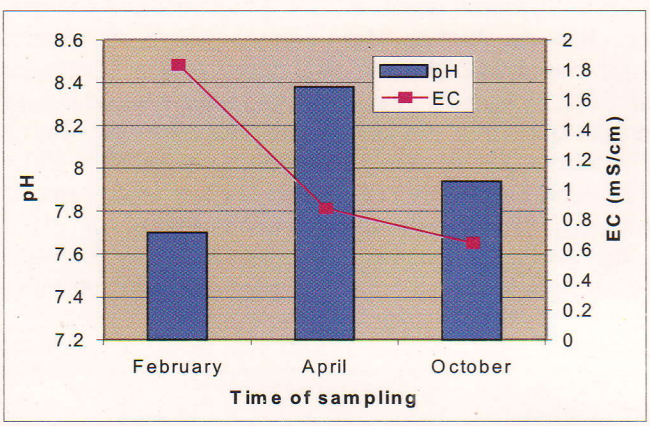
Changes in soil chemical properties due to continuous irrigation with polluted irrigation water

Surface soil samples of groundwater polluted area of Ratlam had, on an average, higher EC (4.5 times), SAR (4.6 times), organic C (1.5 times) and available K (22% more) as compared to the soils from unpolluted area. In Nagda also, considerable salinity build up in the surface soils of polluted area has been observed due to irrigation with polluted Chambal river water, as indicated by high EC (9.1 times) and SAR (12.3 times than unpolluted soils). There was clearly visible salt deposit on the surface of some of these soils. Polluted soils of both Ratlam and Nagda showed considerable accumulation of Na, Cl^- and SO_4^{-2}; the magnitude of accumulation being more in Nagda. While Cl^- was the predominant anion (60%) in soil solution of polluted area of Ratlam, concentration of SO_4^{-2} was very high (82%) in the polluted soils of Nagda.

Salt accumulation in soils at Nagda receiving polluted irrigation water

Effect of monsoon rainfall on soil salinity and sodicity parameters

In both Ratlam and Nagda, monsoon rainfall of about 970 mm removed salt ions from root zone depth through leaching. As a result, EC and SAR values decreased considerably in both Ratlam (by 71 and 26%) and Nagda (88 and 93%). Increase in soil pH was also observed during monsoon period due to replacement of Cl^- and SO_4^{-2} by HCO_3^- ion.



Effect of time of sampling on pH and EC of polluted soils of Ratlam

Concentration of NO_3^- ion in soil solution increased significantly (by 20-55%) at the end of monsoon period, indicating the role of rainwater infiltration on amelioration of polluted areas of these two cities.

Amelioration technique for improving production of soybean and wheat in polluted areas of Ratlam and Nagda

Field experiments carried out in the polluted areas of both Ratlam (village: Jadwasa Khurd) and Nagda (village: Parmarkhedi) indicated FYM application significantly increased soybean grain yield (21% in Ratlam and 31% in Nagda) at polluted area. Maximum increase in soybean grain yield was observed (27% in Ratlam and 35% in Nagda) in those plots where both lime and FYM were applied. Application of FYM alone or in combination with Lime caused significant reduction in EC and SAR in upper 30 cm soil layer in both Ratlam and Nagda.

Wheat was grown with polluted groundwater in Ratlam and polluted river water in Nagda after soybean crop. Application of FYM to previous crop of soybean resulted significant increase in grain yield of wheat over control at both Ratlam and Nagda. Application of lime (to previous crop) and straw mulch, though improved yield, the increase was not statistically significant.

Conclusions : *In-situ* conservation of rainwater in the agricultural field, conservation of soil moisture during post-monsoon season, application of organic manure and lime before sowing of kharif crop, growing salt tolerant crops/varieties are suggested measures for amelioration of degraded soils as well as enhancing crop productivity.

J.K. Saha, Sr. Scientist (Soil Science)

Research Highlights

Nutrient potential of sewage water to wheat in Vertisol

In a field experiment initiated in IISS farm, application of sewage water resulted remarkable increase on the mean plant height (by 8.7%), grain yield (7.6%) as well as straw yield (by 15.9%) of 7th crop of wheat. Sewage water has the nutrient potential equivalent to 50% RDF or slightly more. Sewage water application resulted, on average, 13.6 and 12.6% more uptake of N, 13.2 and 17.8% more uptake of P, and 12.3 and 17.5% more uptake of K by grain and straw respectively of wheat. On an average 40.7% N, 10.7% P and 35.2% K of total nutrients applied through sewage water were taken up by aboveground biomass of wheat.

There has been significant reduction in soil pH (by 0.3 unit) due to application of sewage water for 4 years. However, such effect was not so prominent in plots where fertilizers and manures were applied in wheat crops. Application of sewage water resulted about 44% increase in the content of available P and 16.6% increase in the content of available K in surface soils.

Integrated and balanced nutrient management for cotton

In a field experiment on a Vertisol to evaluate balanced and integrated nutrient management (INM) practices for cotton (H 8), integrated and balanced use of nutrients significantly improved yield attributes such as numbers of sympodial branches, leaf area plant^{-1}, number of bolls plant^{-1}, boll wt., and yield plant^{-1} etc. over the NPK alone. Application of Zn, B and Zn+B alongwith NPK increased cotton yield by 306, 209 and 419 kg ha^{-1}, respectively over NPK alone indicating importance of Zn and B. Substitution of 50% N through FYM in INM treatment also resulted in higher cotton yield (by 638 kg ha^{-1}) over the NPK as fertilizers. The INM practice also resulted in increased nutrient uptake and efficiency, and improved soil fertility. The cotton fibre quality, however, was not affected by nutrient management practices.

Integrated plant nutrient supply (IPNS) technology for improving the productivity of soybean-wheat system

On-farm trials conducted in Rajgarh and Bhopal districts (MP) indicated that the integrated use of 50%NPK+5t FYM/ha+*Rhizobium* to soybean and 75%NPK to wheat increased the soybean seed yield by 25% and wheat grain yield by 27% over the farmers' practice. This IPNS module produced not only higher soybean and wheat yields but also saved 42 kg N, 45 kg P_2O_5, 15 kg K_2O, 15 kg S and 5 kg Zn/ha during a soybean-wheat system.

Granubor-II: A new boron fertilizer

Efficacy of granular borax penta hydrate Granubor-II (14.6% B) for ameliorating B deficiency was evaluated in important crops e.g. paddy, wheat, groundnut, sunflower, soybean, mustard, gram, lentil, cotton, cauliflower etc., through field experiments conducted in different agroclimatic zones of India. Results revealed that Granubor-II was as efficient as borax decahydrate (Borax, 10.5% B) and did not differ significantly in correcting its deficiency in different soils, crops and regions. Since borax penta hydrate has higher B content than borax deca hydrate, Granubor-II can be a suitable source of B in crop husbandary.

Performance of Isabgol (*Plantago ovata*) under organic farming

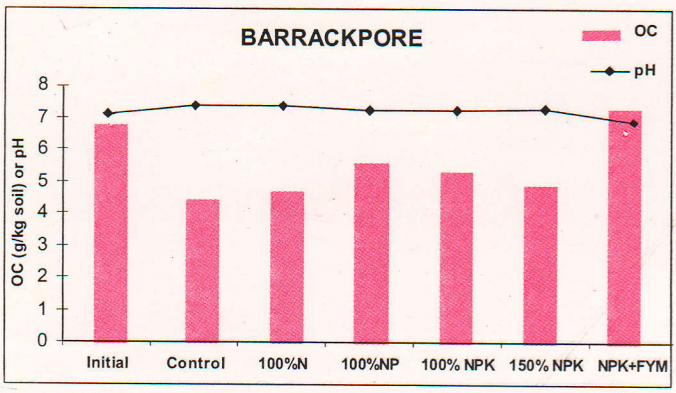
In a two year field experiment to study the effect of different sources of organic manure on the performance of isabgol, it is revealed that combined application of cattle dung manure (CDM) @ 1 t/ha + poultry manure (PM) @ 0.5 t/ha + vermicompost (VC) @ 0.5 t/ha each recorded significantly the highest seed yield (1285 kg/ha) which is 32.7 % higher than in control and 8.4 % higher than in chemical fertilizers. Combination of CDM + VC recorded the next best seed yield (1230 kg/ha). The swelling factor and mucilage content of isabgol did not vary appreciably with source of nutrients. At the end of the crop cycle, CDM + PM + VC combination recorded the higher soil organic carbon (0.59 %), available N (168.6 kg/ha), P (18.3 kg/ha) and K (595 kg/ha) compared to either chemical fertilizers or the other combination of organic manures.

Luxuriant growth of wheat under IPNS

Luxurious growth of isabgol under organic farming

Impact of long-term fertilizers and manure on yield and soil quality in inceptisols

In a LTFE experiment (continuing for 32 years) in Inceptisol (Typic Eutrochrept) of Barrackpore, mean responses of rice, wheat and jute to fertilizers were in the order of NPK + FYM > NPK > NP > N. Integrated use of NPK and FYM @ 10 t ha^{-1} yr^{-1} gave the highest sustained crop productivity over rest of the treatments. Continuous application of fertilizer for 32 years resulted in increase in available content of N, P and K magnitude being higher under balanced application of nutrients. The soil organic carbon (SOC) content decreased in all other treatments over the years from its initial status, except in treatments where manure has been applied The reason for decline in SOC is probably due to unsteady state of soil organic carbon at the time of initiation of experiment as the soil was brought to cultivation from virgin or forest land. Continuous application of fertilizer resulted 0.2-0.3 unit rise in pH. However, slight decline in soil pH was recorded in the plot receiving along with fertilizer.



Soil organic C and pH after 32 years under long-term fertilizer and manure

Tillage options for soil, water and energy conservation

In a long-term tillage experiment being conducted at Bhopal, conservation tillage treatments namely, no tillage and reduced tillage were as effective as conventional tillage treatments in terms of grain and biomass yield of soybean and wheat; thus found superior due to saving of energy and time. Imposition of tillage treatments significantly influenced the bulk density, soil water retention and infiltration rate of soil. The bulk density of the surface soil was less in mouldboard and reduced tillage treatments as compared with conventional tillage treatment. Infiltration rate was high in mould board tillage treatment followed by no tillage treatment while it was lowest in reduced tillage and conventional tillage treatments.

Broad bed and furrow system conserves soil and rainwater for higher system productivity

A field study at Bhopal on different land treatments showed that total productivity of different cropping systems under broad bed and furrow (BBF) was higher than that under flat-on-grade (FOG) land treatment. Under both the land treatments, the total system productivity (TSP) was higher in maize based cropping systems (viz., maize/pigeon pea intercropping, maize-chickpea and soybean/maize-chickpea cropping system), followed by soybean/ pigeon pea intercropping and soybean-chickpea cropping system. The BBF treatment recorded less loss of rain water and soil as well as ammonical and nitrate nitrogen through surface runoff than FOG.

Impact of cultivation on soil organic carbon

In the coastal agro-ecosystems of Orissa, the soil organic carbon content (0-15 cm depth) of the cultivated soils varied widely and contained 33 71% less C than pristine soil. Carbon content (0-5 cm) in pristine top soil was 10-93 % higher than cultivated top soil. Carbon content was the highest in macro-aggregates followed by micro-aggregates-C and silt + clay size fraction. The per cent macro-aggregates was higher in pristine soils. A long-term tillage study under soybean-wheat system in a Vertisol also indicated that the conservation tillage enhanced the carbon content and soil structural stability. No-tillage increased macro-aggregates.

Moisture conservation and P nutrition increased yields and resource use efficiency of rainfed chickpea.

In rainfed maize-chickpea system moisture conservation practice involving late interculture followed by application of Gliricidia in inter row spacing of standing maize and maize stover cover for a week after chickpea sowing resulted in higher chickpea yield and it was at par with yields from one pre-sowing irrigation to chickpea. The practice along with proper P nutrition improved the water and P use efficiencies of chickpea.

Biofertilizers for dryland areas

Crops and dryland areas suffer due to moisture stress and low native soil nutrient status. Use of integrated nutrient management practices involving application of chemical fertilizers along with organics and biofertilizers is important to impart sustainability to production. Experiments in the All India Network Project on Biofertilizers in loamy sand soils with very poor organic matter content, at Bawal in Haryana showed that inoculation of bacterial biofertilizers like Azospirillum and Pseudomonas on pearlmillet, wheat and mustard gave 10-22% increase in yield in grain yield when applied alongwith75% recommended doses of nitrogen. The effect of the biofertilizers was visibly good at 50 and 75% recommended dose of fertilizers but not at 100% RDF which is as per expected response.

Awards and Honours

- Dr. K. Sammi Reddy received the Associate Fellowship of NAAS during the 13th Annual General Body Meeting of the NAAS on June 5, 2006 at New Delhi.

- Dr. D. Damodar Reddy received the Associateship of the National Academy of Agricultural Sicences (NAAS) for the years (2006-2010) on June 5, 2006 at New Delhi.

Visit abroad

- Dr. A. Subba Rao, Director, Dr. Muneshwar Singh, PC (LTFE) and Dr. D.L.N. Rao, Network Coordinator (Biofertilizer) visited the University of Queensland, Brisbane, Australia for 10 days during May 14 - 24, to undertake field visits and to review the progress of the ACIAR project (SMCN/2002/032).
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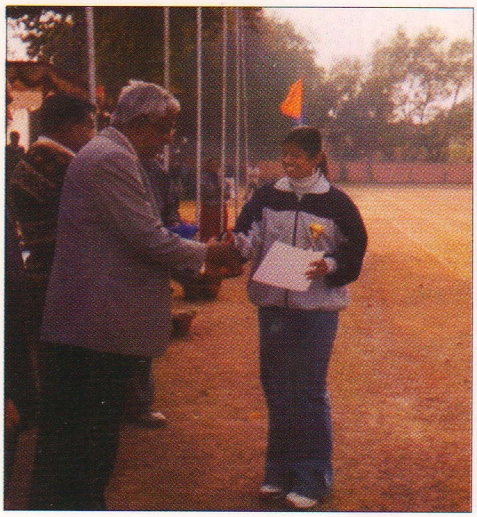
- Dr. K. Sammi Reddy, Senior Scientist visited the University of Queensland, Brisbane, Australia during April 25 to May 29, 2006 to under go training on crop simulation modeling, to undertake field visits of Australian side of the work and to review the progress of the ACIAR project (SMCN/2002/032).

Events

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

International Women's Day: International women's day was celebrated on March 8, 2006 with great enthusiasm. All the members of the institute actively participated in the debate competition on "The role of working lady in the society" organized on the occasion.

Sports : The Institute participated in the ICAR central zone sports meet held at IARI, New Delhi from 10-01-2006 to 14-01-2006 and won many prizes. Shri Thomas Joseph won first prize in chess in the men's category and the shuttle badminton team stood runners-up in the team events. In the women's category, Miss V.S.Bharti performed brilliantly and stood first in 200m race, second in high jump, third in 100 m race and long jump.



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

Name	Programme	Venue	Period
Dr. K.S. Reddy	93rd Indian Science Congress	ANGRAU, Hyderabad	Jan. 3-6, 2006
Dr. A.K. Mishra	Right to Information Act- 2005 workshop	ISTM, New Delhi	Jan. 16-17, 2006
Dr. N.R. Panwar	National Conference on Agrobiodiversity	National Biodiversity Authority, Chennai	Feb. 12-15, 2006
Drs. Y. Muralidharudu, S. Srivastava and Abhishek Rathore	Regional workshop of AICRP on STCR	BCKV, Kalyani	Feb. 27-28, 2006
Dr. D.L.N. Rao	National workshop on selected technologies for rural technologies	DST, New Delhi	Mar. 1-2, 2006
Drs. Y. Muralidharudu and Abhishek Rathore	National Seminar on Soil Testing	IARI, New Delhi	Mar. 17-18, 2006
Dr. D.D. Reddy	Annual review workshop of TMC-MMC	PAU, Lidhiana	Mar. 21, 2006
Drs. A.Subba Rao and P.Ramesh	National Seminar on Standards and Technologies of Non-Conventional Organic Inputs	PDCSR, Modipuram	Apr. 8-9, 2006.
Dr. K.S. Reddy	National Workshop on "Right to Information Act 2005"	NAARM, Hyderabad	Apr. 18-19, 2006
Dr. J.K Saha	6th National Seminar on 'Environment Statistics Statistical Accounting of Land and Forest Resources'	Indian Institute of Forest Management, Bhopal	Apr. 28-29, 2006.
Dr. J.K. Saha	Biennial Scientists' Meet of AICRP on Groundwater utilization'	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur	May 9-12, 2006

List of Priced Publications of the Institute

S.No	Title of the Publication	Unit 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	Long Term Soil Fertility Management Through Integrated Plant Nutrient Supply	360	52
5	Technology at a Glance	30	36
6	Takneek Ek Drishti Mein	30	36
7	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
8	Mitti Parikshan Kyo,Kab aur Kaise	15	36
9	Mrida Tatha Poudho Mein Gandhak Ka Sumuchit Prabandh.	200	36
10	Phosphocompost :Ek Sampurna Prakritik Khad	20	36
11	Proceedings of the National Seminar on Standards and Technology for Rural/ Urban Compost	250	52
12	Proceedings of National Seminar on Existing Water resources and Technologies for Enhancing Agricultural Production in North Central India.	250.00	36.00
13	Nutrient Dynamics, Crop Productivity and Sustainability under long term fertilizer Experiments in India.	580.00	36.00
14	Long term Effect of Fertilizer, Manure and lime Application on Changes in Soil Quality, Crop Productivity and Sustainability of maize-Wheat System in alfisol of North Himalayas.	190.00	36.00
15	Soil Quality. Crop Productivity and Sustainability as Influenced by Long term Fertilizer Application and Continuous Cropping of Finger millet-Maize-Cowpea Sequence in swell-Shrink Soil.	250.00	36.00
16	Soil Quality, Crop Productivity and Sustainability Experiences under long term finger millet-maize Cropping in alfisol	220.00	36.00
17	Soil Quality, Crop Productivity and Sustainability Experiences under Long Term Maize-Wheat Cropping in Inceptisol.	170.00	36.00
18	Effect of long term Fertiliser application and cropping on the sustenance of fertility and productivity under sorghum-Wheat sequence in vertisol	120.00	36.00
19	A Study of Organic farms in central Madhya Pradesh	40.00	19.00
20	Organic Soybean Production	40.00	19.00
21	Jaivik Soybean ka Utpadan	40.00	19.00
22	Nutrient Competition and Nutrient Requirement in Intercropping System	35.00	19.00
23	Phospho - Sulpho -Nitro- Compost: Production and Evaluation	35.00	19.00
24	Vermicomposting :A technology for recycling of organic wastes(English)	15.00	19.00
25	Vermicomposting :A technology for recycling of organic wastes(Hindi)	15.00	19.00

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