Division of Environmental Soil Science

Threats from various anthropogenic activities to precious soil resources are increasing and in order to address these, this Division (unique in NARS) has been created in the year 1996. Flagship programme of the Division of Environmental Soil Science is **Soil Pollution, Remediation and Environmental security**. Major thrust areas of research in the Division are: Soil pollution impact assessment and toxicity amelioration; Determination of safe concentration limits of heavy metals in soils; Developing technology for efficient reuse/disposal of city and industrial wastes; Developing soil management practices for minimizing emission of greenhouse gases; Environmental impact and risk assessment due to unregulated use of agro-industrial wastes; Environmental impact and risk assessment of nano-particles on soil health and plant nutrition. To fulfil its responsibility, the Division welcomes collaboration and partnership with national and international organizations/institutions as well as with public & private enterprises.

Divisional Cadre Strength

Scientific staff
Dr. J. K. Saha, Principal Scientist & Head
Dr. Ajay, Principal Scientist
Dr. Tapan Adhikari, Principal Scientist
Dr. S. Ramana, Principal Scientist
Dr. Sangeeta Lenka, Senior Scientist
Dr. M. Vassanda Coumar, Senior Scientist
Dr. V. D. Meena, Scientist
Dr. Nisha Sahu, Scientist
Mrs. Madhumonti Saha, Scientist
Mr. Abhijit Sarkar, Scientist

Technical & Supporting Staff
Mr. Vinod Chaudhary, Sr. Technical Assistant
Mr. Ram Bharose, Lab. Attendant

Salient Achievements:

- Impact assessment of soil and water pollution near fifteen industrial area in six states namely M.P., Rajasthan, T.N., Gujarat, Chhattisgarh and U.P. due to discharge of industrial effluents and solid wastes, city sewage effluents and mining activities.
- Understanding nature of interaction of major ions and heavy metals on uptake of chromium by plant.
- Vegetation and stabilization of copper mine affected area and municipal dump site.
- Seasonal loading of P from catchment area into Upper Lake of Bhopal and identifying source of eutrophication.
- Role of methods of preparation on the quality of municipal solid waste (MSW) composts in Indian cities
- Understanding the mechanisms of entry of nano particles into the plant system
- Climate change vulnerability assessment and maps for districts of Madhya Pradesh.
- Native soil carbon mineralization and priming using ^{13}C labeled isotopes.

Technologies developed:

- Critical limits of heavy metals to indicate phytotoxicity and microbial toxicity for major soil types in India.
- Maximum safe concentrations of heavy metals in municipal solid waste (MSW) compost. Based on the findings of the Division, some of the quality control parameters in respect of city waste compost in Fertilizer Control Order, 1985 have been modified.
- Phytoremediation of heavy metal contaminated soil using floriculture plants.
- Innovative grading protocol for compost quality evaluation and safe utilization.
- Low cost method to reduce heavy metals contents in MSW composts
- Nutrient management technology for sewage irrigated crop production
- Technology for safe use of distillery and textile industry effluents for crop production
- Enhancing use efficiency of P in low grade rock phosphate through nanotechnology
- Novel slow release urea (pine oleoresin coated) fertilizer to enhance N use efficiency in soil
- Improved method for determination of boron and fluoride in soil and water
- Rapid method of soil testing (along with screening level) to detect heavy metal toxicity
- Protocol of soil quality and soil resilience assessment were developed

Facilities available: The divisional laboratory is equipped with the equipments like, Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), Gas Chromatograph, CN Analyser, Fourier-transform infrared spectroscopy (FTIR), Polarographic analyzer, BET surface area analyser, Microscope, Soxlet apparatus, COD analyzer, Infra red gas analyzer (IRGA), UV-visible spectrophotometer, N distillation system, Flame photometer, besides other basic facilities.

Collaborations: The institute has established strong collaborations with Ministry of Environment, Forest & Climate Change, Govt. of India; ICAR-National Agricultural Strategic Fund, Environment Planning & Coordination Organization, Bhopal; National Thermal Power Corporation Ltd.; Coca Cola India Private Limited, Gurgaon.

Books/bulletins published:

Books:

1. J.K. Saha, R. Selladurai, M.V. Coumar, M.L. Dotaniya, S.Kundu, A.K.Patra (2017) Soil Pollution - An Emerging Threat to Agriculture. Springer Nature Singapore Pte Ltd., pages 386+. ISBN: 978-981-10-4273-7

Bulletins:

2. Saha, J.K. and A.K. Sharma. (2006). Impact of the use of polluted irrigation water on soil quality and crop productivity near Ratlam and Nagda industrial area. Agricultural Bulletin : IISS-1. Indian Institute of Soil Science, Bhopal. p. 26.
3. Saha, J.K., Panwar, N.R., Singh, M.V. and Subba Rao. (2008). Quality indices of municipal solid waste compost for safe use in agriculture. Technical Bulletin No. 6. Indian Institute of Soil Science, Bhopal. p.44
4. Panwar, N.R., Saha, J.K., Adhikari, T., Kundu, S., Biswas, A.K., Rathore, A., Ramana, S., Srivastava, S. and Subba Rao, A. (2010). Soil and water pollution in India: Some case studies. IISS Technical Bulletin, Indian Institute of Soil Science, Bhopal, p. 40.
5. Biswas, A.K., Ramana, S., Singh, A.B., Saha, J.K., Hati, K.M., Kundu, S. and Subba Rao, A. (2011). Safe use of distillery effluents in agriculture. IISS Research Bulletin No.2. Indian Institute of Soil Science, Bhopal. p. 40.

6. Adhikari, T., Biswas, A.K., Ajay, Ramana, S., Saha, J.K., Singh, M.V., Kundu, S. and Subba Rao, A. (2012) Heavy metal pollution in soil-plant system and its remediation. IISS Technical Bulletin, Indian Institute of Soil Science, Bhopal, p. 57.
7. Grading of Municipal Solid Waste Compost for Safe and Maximum Recycling in Agriculture (Pamphlet).
8. Kundu, S., Adhikari, Tapan, Biswas, A.K., Tarafdar, J.C., Goswami, Arunava and Subba Rao, A. (2010). Nano-Science and Nanotechnology in Soil Fertility and Plant Nutrition Research. IISS Technical Bulletin, Indian Institute of Soil Science (ICAR), Nabibagh, Bhopal, pp 1-46.
9. Adhikari, Tapan, Kundu, S., Patra A. K. (2016). Nano-products: Production and Protection Technology (For Natural Resource management). IISS Technical Bulletin, ICAR-Indian Institute of Soil Science (ICAR), Nabibagh, Bhopal, pp 1-91.
10. Kundu, S., Adhikari, Tapan, and Subba Rao, A. (2012). Understanding the behaviour of nano particles and their safe handling. IISS Pamphlet, Indian Institute of Soil Science (ICAR), Nabibagh, Bhopal, pp 1-4.
11. Adhikari Tapan, R.H. Wanjari and Muneshwar Singh (2019) Research Bulletin on 'Microbial diversity and heavy metals build up in soils under long-term fertilizer experiments'. ICAR-Indian Institute of Soil Science, Bhopal, p. 1- 53.