

Future research in soil science with changing needs

A. Subba Rao

Indian Institute of Soil Science, India

Abstract

Soil Science research in India started in 1898 with the characterization of Indian soils based on geographical information or colour. Since then India has made headway in the different disciplines of soil research including soil fertility, chemistry, microbiology, mineralogy, and soil technology. Green revolution resulted in phenomenal increase in the production of food grain and other crops but it has given rise to some soil related management problems that need urgent attention. This paper deals with the current scenario of soil conditions in India in major production systems. The paper then enumerates some future research areas that have become relevant under the present and future contexts of changing dietary patterns, changing climate, unavailability of labour and expected automation due to India's growth story.

Even though India's total food grain production has touched almost 259 million tonnes, the agricultural growth has been unstable and less than expected. In the recent years, a declining trend of total factor productivity and compound growth rates of major crops and low nutrient use efficiency have been observed primarily due to deterioration of soil health. The main reasons for soil health deterioration are wide nutrient gap between nutrient demand and supply, high nutrients' turnover in soil-plant system coupled with low and imbalanced fertilizer use, reduced recycling of organics, decline in organic matter status, reduced biodiversity, emerging deficiencies of secondary and micronutrients, nutrient leaching and fixation problems, impeded drainage, soil pollution, soil acidity, salinization and sodification, etc. Wide spread micro and secondary nutrient deficiencies in soils also lead to wide spread occurrence of mineral deficiency disorders such as anemia, goiter, dental caries, etc. Also, there has been a sea-change in the overall economic development in the country aided by the revolution in the information technology. This means, processes, and technologies that were relevant a decade ago need thorough revision. Some key challenges to be addressed are:

1. Providing food and nutritional security by improving nutrient and water use efficiencies.
2. Harnessing biodiversity and genomics for efficient agriculture and maintaining ecological balance.
3. Self sufficiency in plant nutrient supply through utilization of indigenous mineral resources.
4. providing clean and safe soil environment through waste recycling.
5. Soil quality/health management for sustainable agriculture.
6. Developing strategies for energy efficient and climate resilient agriculture.

Waste disposal has become a big problem which needs to be tackled. New techniques need to be evolved for the remediation of already contaminated soil sites. Similarly, indigenous mineral and by-product resources need to be tapped for their use in agriculture as country cannot afford to continue heavy subsidy on imported fertilizer materials. Climate change has become a reality and future research need to be oriented in developing climate resilient agriculture. Similarly, efficient use of energy is the need of the hour. New practices like precision agriculture and techniques like nanotechnology and biotechnology are required that are not only labour and cost-effective but also practicable and relevant in the present context of Indian agriculture. Tackling above challenges definitely requires a long term vision that visualizes the upcoming scenario and contains a roadmap to address the above researchable issues as well as that is dynamic to quickly adapt to the foreseeable and unforeseeable changes.