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INTEGRATED SOIL FERTILITY MANAGEMENT

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Soil is one of the most complex biological materials on our planet.Decline in the fertility status of the soil is a major concern in carrying out sustainable agriculture. The increased population has led to the introduction of high yielding varieties of seeds, pesticides and intensive excess of chemical fertilizers, extensive tillage. India is highly affected by land degradation. Land degradation is a serious problem in rain-fed areas. Integrated Soil Fertility Management (ISFM) has to be adopted for the recovery of soil health. The involvement of both chemical fertilizers and organic matter along with the practices of crop rotation and legumes as inter-crops can lead to improvised soil health (Srinivasarao *et al.* 2012; Kumar 2017).

Status of Indian Soil

In India, out of a total of 328.7 million hectares, 142 million hectares are net cultivated area. Out of this 40%, i.e. 57 million hectares are irrigated and rest 60% i.e. 85 million hectares are rain-fed. Out of 328.7 million hectares, about 120.4 million hectares suffer from land degradation, viz., water and wind erosion, waterlogging, soil alkalinity/sodicity, soil acidity, soil salinity and mining and industrial waste. Greater mining of nutrients and intensive agriculture has led to depleting the soil fertility and deficiencies of secondary and micronutrients, depleting water table level and its quality.

Causes and Management of Soil Degradation

Overgrazing, overexploitation of vegetation for domestic purpose, flawed use of land, large scale irrigation canals, deforestation and removal of natural vegetation, agriculture-related activities led to various soil problems like drought, erosion, salinization, flooding and waterlogging. These processes reduced agricultural productivity leading to social insecurity.

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Due to the emission of greenhouse gases causes global warming is a major cause of soil degradation.

1. Soil Erosion

It is the most common and major factor responsible for the degradation of natural resources. Soil erosion remains the most prevalent problem since ancient times. Soil degradation is through the loss of topsoil, which leads to low production and unstable crop yields in rain-fed, semi-arid to sub-humid, sub-tropics of India (Vittal et al. 1990). Wind causes erosion in the arid and semi-arid regions of India, which includes Gujarat and Punjab, Rajasthan, Haryana.

2. Slaking and Dispersion

It leads to the mechanisms of degradation and soil structural collapse (Dhruvanarayana and Babu 1983). Slaking happens when the breakdown of aggregates into smaller aggregates or single particles occurs. Addition of organic matter helps in the reduction of slaking by a reduction in the rate of aggregate wetting and strongly binding of the soil particles together. Separation of clay particles from the aggregates when the soil is wet is called dispersion. Usually, lime is used to avoid the problem of dispersion (Moody and Cong 2008).

3. Salinization and Alkalization

Net irrigated area in India is increased from 22 M ha in 1950 to about more than 68.2 M ha in 2016. This expansion helped to achieve targets of higher production, but it made the level of groundwater level. It leads to deterioration of soil through the accumulation of salts (Abrol and Bhumbla 1971).

4. Acidity

About 6.98 M ha area is affected by acid soils, which is about 9.4% of the total geographic area. Acid soils develop in humid and per humid areas. There are various problems associated with physical and chemical properties that arise due to acidic soils. Liming followed by light irrigation is the most effective technique to help in achieving improved biological and chemical properties of acid soils (Maji *et al.* 2008).

5. Nutrient Imbalance

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To achieve high crop yields, nutrient loss happens in various forms, viz. N_2O, NO, NH_3, and N_2.The usage of fertilizers is increased drastically during the green revolution era in agriculturally developed states like Punjab and Haryana. Poor soil health has been studied in high intensive cultivated areas of rice-wheat cropping system in Indo-Gangetic Plains.N imbalance, and N losses can be improvised by the incorporation of both fertilizers and organic manures without sacrificing the crop yield (Aulakh 2011).

6. Soil Sealing and Capping

Extractive mining activities, conversion of forest to agro-industrial land, as well as the extensive horizontal expansion of cities have been resulting in the soil sealing and capping. Waste and unproductive soils would be used for the establishment of new cities and industries. Artificial, impenetrable surfaces interfere with the essential environmental, economic and social functions performed by soil (Sutton et al. 2009).

Programmes on Soil Management

FAO and its members initiated the Global Soil Partnership (GSP) to improve governance of the soil resources for a food-secure world. Scientific techniques in agriculture for tillage, crop rotation and fertilizer application have to be adopted so that soil fertility, structure and carbon sequestration can be maintained. Use of latest technologies with Geographical Information System (GIS) and remote sensing a global/national soil map can be created to represent different soil types. GIS is used to display, analyze and collect soil data and processes so that different types of soils can be identified (Patel 2016). For the betterment of farmers' knowledge on soil and soil management practices, soil health cards Program was developed in 2006.

Conclusion

Soil health has been identified as a major concern all over the world. Governments have initiated certain programs for the benefits of farmers. Scientists are trying to use available techniques and tools to improve soil health as well as reclaim the lost land. Thus, integrated soil fertility management will enhance our land fertility, productivity and yield, which will be helpful in pulling our population out of poverty and distress.

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