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Soil Health and Nutrient Management of Agricultural Crops

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Soul of infinite life**,** soil has undergone overexploitation in order to feed a vast population, creating an urgent need for corrective action in this often-neglected area of agriculture. Main objectives of soil nutrient management are to improve soil health and to meet the nutrient requirements of crops. Healthy soil, as defined by the Natural Resource Conservation Service, is the "continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans." In crop production, nutrient management is an important practice to attain a higher yield. Nowadays, farmers are exuberantly using chemical fertilizers and this is considered as the main cause of environmental pollution and also deteriorates soil health (Rekha *et al*., 2018). Most of the deficiencies observed in plants, animals and people are due to soil conditions not being conducive to nutrient uptake. The minerals are present in excess but simply not available to plant. Availability of nutrients insufficient and balanced quantities throughout the plant growth period is very important to maintain productivity. The most important constraint faced by developing countries and especially among resource-poor farmers, is poor soil fertility. Balanced application of fertilizer is the basis of both soil and plant health. The use of inorganic fertilizers alone without a proper understanding of balanced application has led to a decline in productivity of agricultural crops.

Soil nutrient management is defined by the USDA as managing the application of commercial fertilizers, manure, amendments, and organic by-products to agricultural

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landscapes as a source of plant nutrients. A common framework for approaching nutrient management is known as the "Four Rs".

Right amount - the proper rate of application

Farmers should supply right amount of fertilizer through different sources, which should match nutrient demand of crop, even once in three to four years, based on cropping system followed by farmers they have test soil and nutrient approach should done scientifically apart from these farmers should make sure equipment being used to spread the fertilizer or manure is calibrated properly for appropriate distribution.

Right source - applying the proper type

Based soil, crop and climatic variability of region farmers need to select particular source of nutrient to particular agricultural crops and it is always better to use concentrated chemical fertilizer in conjugation with the organic sources.

Right placement - using the appropriate method for application

Based on the agronomic operations followed viz., method of sowing, cropping system, and land preparation in the crops farmers need to supply the fertilizer in right place

Right timing - applying at the correct time in the lifecycle of the system

Right time of supply of nutrient is as important has quantity of nutrient supplied to the crops. One should supply the nutrient based on critical nutrient demand stage in split doses.

Need of better soil management

Year after year, we have rich harvest of the seasonal produce, despite of concern over the soil health. The lacks of understanding about imbalances in soil nutrients are the major reasons for this and some of the issues being faced in soil health are

Depleting soil organic matter: Imbalanced use of fertilizers has had a declining effect on soil organic matter, which is an important factor in maintaining soil health. Farmers tend to depend on fertilizers and neglect organic manure, which invariably leads to this decline, especially in intensively cropped regions

Declining soil fertility: Almost 95 percent of the soils in India are deficient in nitrogen and phosphorus. Potassium deficiency has become widespread with almost 50 percent of fields being deficient. The same deficiency exists with sulphur and other micronutrients particularly zinc.

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Physical degradation in soil conditions: Indiscriminate use of tilling, machinery used in harvesting, crop residue burning, and puddling leads to poor physical soil structure. This in turn affects future cropping and irrigation.

Chemical degradation of soils: Soils degrade chemically through diffusion and from local sources, leading to salinization, acidification, alkalization, and further soil toxification. Chemical fertilizers and pesticides have a major role in the process of soil chemical degradation.

Soil organic matters as a good indicator of soil quality

A sufficient amount of nutrients in the soil, particularly nitrogen, is necessary to form and maintain soil organic matter. A fertile soil has greater plant growth, which can create greater inputs of roots and other plant debris into the soil. This plant debris undergoes decomposition and adds to the soil organic matter. Applications of animal manures and composts, as well as the use of cover crops, all help increase soil organic matter. Organic matter provides a food source for soil microbes and increases microbial activity. As the microbe's breakdown organic matter, nutrients are released in forms that the plants can utilize. Because nutrient management accounts for the nutrients added to the system, it promotes increasing soil quality without creating nutrient excesses.

Nutrient management practices to improve soil health

As farm yields reduce, and cost of inputs keep rising, farmers are realizing the importance of improved soil health and nutrient management on their fields. Scientific practices have the ability to improve crop yields, reduce input costs, and have a host of environmental benefits. Some of these practices include,

Balanced and integrated use of fertilizers and micronutrients: All essential nutrients need to be applied in optimum quantities and in planned methods that are dependent on soil, crop, and climatic conditions. Timing and a judicious mix of nutrients will meet crop demands and will prevent excesses. Over-fertilizing of crops increases pest issues. Excess of nitrogen levels in plants can decrease resistance to pests, and result in crop damage. This, of course, is only made possible with proper soil testing, outreach program, and policy initiatives. For instance, a reform of the Nutrient Based Subsidy Scheme could be extended to include urea as well as other nutrients. Use of organic nutrients should also be encouraged, since an important factor in maintaining soil organic matter. Balanced nutrient management must look at factors

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such as nutrients present in the soil, nutrient removal by crop, fertilizer input costs, investment and profitability, agricultural methods, soil moisture, physical condition of soil, and soil degradation conditions such as salinity, alkalinity, and acidity.

Reduction in inversion tilling: Excess tilling is detrimental to soil health. Tilling tends to decompose organic matter, and disturb the soil aggregates, leading to reduction in soil health, increase in erosion, and reduced productivity. Tilling would only be required in order to increase organic input via residual crops or manure. Reduction in tillage may appear to be cumbersome and dependent on the individual field's status; however, the benefits to the farmer are significant in the long run.

Reduction in synthetic pesticides/insecticides and promoting beneficial organisms: Indiscriminate use of synthetic pesticides and insecticides has adversely affected the environment and agricultural production. Harmful chemicals have found their way into the food chain and water table. Pesticide residue pollutes soil, groundwater and surface water, and affects livestock, crops, and humans. Use of agro-chemicals has been particularly rampant in commercial farming, as the damage to standing crops from pests is a continuing problem. Relying on pest-resilient plant varieties, crop rotation, biodegradable pesticides, and environment-friendly pesticides is the way forward. Newer concepts such as farmscaping could control the problem of pests through beneficial organisms and lead to a reduction in use of synthetic pesticides. Declining rate of productivity and environmental sustainability is forcing growers to use organic manures as a source of nutrient supplement in farming. The high cost of fertilizers and unstable crop production calls for substituting part of the inorganic fertilizers by locally available low-cost organic sources like FYM, green manuring and bio-fertilizer in an integrated manner which is essential for sustainable production. Hence use of organic sources in INM practices is one of the potential sources for supplying nutrients

Preserving soil moisture: A Water shortage due to shrinkage in groundwater availability is a major issue affecting soil health especially in monsoon dependent arid regions of north India. Crops are starved or stressed for water due to low rainfall, high temperatures, and inconsistent or poor irrigation. Methods or systems that promote moisture guard against droughts and have a cyclical effect on soil health and fertility. Techniques such as strip tillage, no tillage, mulching, cover cropping, contouring, etc., have been shown to increase moisture retention in soil.

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Sustainable Soil Management

It is evident that, in order to maintain and increase food production, efforts to prevent soil degradation must become a top priority of our global society. Current population models predict a global population of between 8 and 10 billion in the next 50 years (Bongaarts 2009) and a two-fold increase in food demand (Alexandratos, 1999 and Tilman *et al.*, 2002). If mismanagement of soil resources continues to diminish the fertility of the soil and the amount of productive arable land (Pimentel *et al.*, 1995), then we will have lost a precious and essential pillar of sustainable agriculture. Sustainable agriculture is an approach to farming that focuses on production of food in a manner that can be maintained with minimal degradation of ecosystems and natural resources. This sustainable approach to agriculture strives to protect environmental resources, including soil, and provide economic profitability while maintaining social equity. The concept of sustainable agriculture is often misinterpreted to mean that chemical fertilizers and pesticides should never be used. This notion is incorrect, as sustainable agriculture should embrace those practices that provide the most beneficial services for agroecosystems and encourage long-term production of food supplies in a cultural context of the region. It cannot be overstressed that sustainable practices should not only consider crop production and profit, but must include land management strategies that reduce soil erosion and protect water resources. By embracing certain modern-day technologies, and learning from the past, our society will be able to continue to conserve soil resources and produce food supplies sufficient to meet current and future population demands.

Conclusion

FYM, bio fertilizers (VAM and PSB), in-situ and ex-situ green manure (glyricidia) crops, and crop residues act as major potential organic source in INM practices. Major inorganic sources of nutrient supplements in INM practices include general fertilizers, soil and foliar applications of micronutrients. Addition of these organic manures along with chemical fertilizers helps in maintaining the crop productivity and sustains soil health through maintaining organic carbon which is key indicator of soil health. Considering the diversity in physical and moisture conditions prevalent in India, a blanket recommendation for soil management and health is not possible. A region-specific approach is the need of the hour and will go a long way in maintaining a balance between soil health and ecology preservation, ultimately resulting in increases in crop productivity. Educating farmers through outreach

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programs is necessary, and this can be achieved through regular capacity building and concerted policy efforts. The resulting benefits will be a reduction in soil erosion, better soil nutrition, improved water quality, and greater biodiversity. The spin-off will be better crop yields, fulfilling the vision **of** doubling farmer income.

Reference

Bongaarts, J., 2009. Human population growth and the demographic transition. *Philosophical Transactions of the Royal Society B -Biological Sciences*. 364: 2985-2990. doi:10.1098/rstb.2009.0137

https://extension.psu.edu/managing-soil-health-concepts-and-practices

https://www.agrifarming.in/soil-moisture-conservation-methods-for-beginners

Pimentel, D., 1995. Environmental and economic costs of soil erosion and conservation benefits. *Science*. 267: 1117-1123

Rekha, D. L. M., Lakshmipathy, R. And Gopal, G. A., 2018. Effect of integrated use of bio-fertilizers, chemical fertilizers and farmyard manure on soil health parameters of pearl millet (*Pennisetum glaucum* L.). *J. Soil. Sci. Plant. Health.* 2(2)

Tilman, D., Cassman, K. G., Matson, P. A., Naylor, R. and Polasky, S., 2002. Agricultural sustainability and intensive production practices. *Nature.* 418: 671-677. doi:10.1038/nature01014 (2)