

Maintenance and Impact of Organic Farming on Soil Health

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SUMMARY

A healthy soil provides many functions that support plant growth, including nutrient cycling, biological control of plant pests, and regulation of water and air supply. These functions are influenced by the interrelated physical, chemical, and biological properties of soil, many of which are sensitive to soil management practices. The organic management can improve soil structure, organic matter content, and porosity in soil. Several composts like vermicompost, farmyard manure etc. are generally used for nutrient management in organic farming, which ultimately promotes the beneficial macro and microflora in the soil. Application of organic inputs like human urine, sewage sludge, municipal waste, deep litter, cattle slurry, cattle manure etc. ensures higher soil microbial biomass. Application of good quality FYM improves the total nitrogen, and organic matter in the soil, control C:N ratio, total and available N, N mineralization, soil moisture, microbial activity and soil texture etc.

INTRODUCTION

Soil is a complex ecosystem where living microorganisms and plant roots bind mineral particles and organic matter together into a dynamic structure that regulates water, air, and nutrients. In an agricultural context, soil health most often refers to the ability of the soil to sustain agricultural productivity and protect environmental resources.

Throughout the history of organic agriculture, practitioners have emphasized healthy, living soil as the foundation of sustainable and successful farming (Howard, 1947; Pfeiffer, 1938), and have often assessed soil health in terms of soil organic matter (SOM) content. As the organic movement grew during the mid-late 20th century, its leaders urged farmers and gardeners to “build soil organic matter,” or humus, and to “feed the soil.” Recommended practices included:

- Return manure and crop residues to the soil.
- Compost materials to stabilize nutrients and develop humus before applying to the soil.
- Use organic mulches.
- Grow and plow-down green manure crops.
- Diversify the crop rotation.
- Integrate crop and livestock production
- Use cover crops
- Reduce pesticide use and provide habitat for beneficial organisms

Impact of Organic Farming on Soil Health

A. Impact on Physical Properties of soil

The physical properties of soil denote structure, texture, bulk density, porosity, water-holding capacity *etc.* and positive effects of organic farming on soil physical properties *viz.* soil structure, water holding capacity, soil aeration and soil temperature are well reported. Crop rotation is an important component under organic farming, which directly and indirectly influences the physical structure of the soil and accumulation of organic matter in the soil during the lean phase has a direct influence on the modification of soil structure. The architectural form of different root systems of several crops included in the crop rotation also helps to modify the soil structure. Mulching of soil surface with organic materials renders the soil soft, pulverized, and humid that ultimately creates a congenial environment for beneficial microbes to maintain bulk density and porosity in the soil. Organic farming adds more organic matter to the soil, which is the basic requirement for improving soil health.

B. Impact on Chemical Properties of Soil

Application of different organic inputs like FYM, vermicompost, green manuring *etc.* ensures both the sustainability of soil organic carbon and supply of nutrients to the plants. Application of good quality FYM improves the total nitrogen, and organic matter in the soil, which is “an important substrate of cationic exchange

and the warehouse of most of the available nitrogen, phosphorus, and sulphur; the main energy source for microorganisms; and is a key determinant of soil structure". Significant differences and higher values of soil organic carbon, carbon stocks, and carbon sequestration rate were observed by scientists in organically managed plots compared to non-organic plots. It is undoubtedly an important controlling factor for C:N ratio, total and available N, N mineralization, soil moisture, microbial activity, and soil texture. Strikingly, several studies have reported that organically amended soil holds more available N than the soil receiving inorganic fertilization, mainly due to relatively slow and constant mineralization rates, ultimately decreasing nitrogen leaching. Organic acids and humus fraction of decomposing matter are more efficient in releasing phosphorus and reducing its fixation in soil. Nutrient supply through organic sources also ensures micronutrient availability to the plant.

C. Impact of Organic Inputs on Biological Properties of Soil

These biological properties are very important while assessing soil quality since soil quality is strongly influenced by flora and fauna present in the soil. Soil micro-organisms are the living part of soil organic matter present in the soil. The microbial biomass and microbial activities in the soil are crucial to sustaining the productivity of the soil. For ensuring the consistent release of nutrients to the plants, there is a need to have a balanced ratio of microbial biomass and activity in the soil. Organic farming is reported to have enhanced both microbial biomass and microbial activity by 20-30% and 30-100%, respectively. Several beneficial microorganisms like arbuscularmycorrhizal fungi for ensuring improved crop nutrition and decreasing soil borne diseases. Arbuscularmycorrhizal fungi are a special fungal group, which makes a symbiotic association with the plant's root system enhancing plant nutrient uptake and water absorption. This mutualistic relationship primarily helps the plant to take more P from the soil and also protects plants from several diseases. As organic farming increases the microbial activity, leads to increased competition, parasitism and predation in the rhizosphere, it collectively reduces the chances of plant disease infestation. Application of quality organic inputs enhances the microbial population in the soil. Organic fertilizer application improved dry nodule weight, photosynthetic rates, N₂ fixation, and N accumulation as well as N concentration in several crops. However, it was also found that organic agroecosystem management strongly influences the soil nutrients and enzyme activity while it has a lesser influence on soil microbial communities.

CONCLUSIONS

To achieve higher crop yield and quality crop production, the primary requirement is the maintenance of soil fertility and soil health. Organic farming systems being highly complex and integrated biological systems could be the potential technology option to maintain good soil health. Organic farming also improves physical, chemical, and biological properties of soil.

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