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Soil Fertility Management in Organic Farming

Vasuki[1*], S.M. Sridhar[1], K. Saravanan[1], R.C. Prasanth[2] and J. Vanathi[2]
[1]Department of Agronomy, Agricultural College and Research Institute, Madurai
[2] Departments of Agronomy, Agricultural College and Research Institute, Coimbatore

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Introduction

Organic farming is the way of producing good quality farm products in harmony with nature. Organic farmers optimise the growing conditions of crops by enhancing the natural fertility of the soil to ensure good nutrient and water supply, creating diverse cropping systems and promoting natural enemies of pests, recycling organic materials and manures and using natural inputs while renouncing to synthetic chemical fertilisers.

Soil fertility has always been a primary focus and defining character in the tradition of organic agricultural systems. Soil fertility is most commonly defined in terms of the ability of a soil to supply nutrients to crops.

Soil fertility management in organic farming

A three-step approach

Organic soil fertility management can be seen as a three-step approach with a range of tools to manage soil fertility and plant nutrition. Each step of the approach builds the foundation for the next one.

The aim is to optimise step 1 (conserving soil and water) and step 2 (building organic matter and nutrients) that encourage natural rejuvenation of the soil, and to complement these measures with appropriate amounts of foreign fertilisers, soil amendments and irrigation water where necessary (step 3). Proper application of steps 1 and 2 saves on costs for fertilisers and other supplements and prevents possible negative impacts on the farm ecosystem.

Step 1: Conserving soil and water

The first step consists of conserving the soil, soil organic matter and soil water. The measures aim at protecting the soil surface from being exposed to the sun and drying out, and from being carried away by wind or washed down by rain. Protecting the soil The easiest way to protect the soil from being eroded is to keep it covered with living plants (cover crops) or

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dead material (mulches and crop residues). Erosion due to rains is more a problem in annual crops, when soil preparation coincides with rainfall. Covering the soil with crop residues and dry plant material, and tilling it minimally limits erosion during this period. Minimising soil disturbance, avoiding soil compaction and overgrazing by farm animals are other important measures to limit soil erosion. Growing trees in rows (alley cropping) and hedges in or around the fields reduces wind speed and provides shade in dry climates. Reducing the movement of water. An effective measure to limit soil erosion by water is, among other techniques, making contours along the contour lines of a slope and stabilising the ridges with grass, bushes or trees.

Step 2: Building organic matter and nutrients

The second step consists of improving the organic matter content in the soil and enhancing its biological activity, as this contributes to a more continuous and balanced nutrient supply and better plant health. In aerated and humid soils, organic materials encourage biological activity which improves nutrient mobilisation from organic and mineral sources and the decomposition of toxic substances. The incorporation of green plant materials, animal manures and compost supply nutrients for the crops, whereas compost also improves the soil's water and nutrient holding capacity, buffers soil acidity and suppresses soil-borne pathogens. Identifying appropriate organic resources is an essential step to building soil organic matter. Important organic resources include leguminous green manures, cover crops (living mulch), dead mulch, prunings, compost (e.g. with animal manure). Integration of nitrogen fixing plants in the rotation is essential to ensure the nitrogen supply of demanding crops. Building soil organic matter is a long-term process, but investing into it is highly beneficial to crop or forage production, and contributes to higher and more reliable yields. In this context, burning of crop residues should be avoided, as it destroys soil organic matter.

Step 3: Applying other approved fertilisers

The third step consists of completing the crops' nutrient requirements with approved organic and mineral fertilisers as well as improving the growing conditions by applying some soil amendments, where necessary. Nutrient deficiencies can be due to an unbalanced soil pH, dry soil conditions, insufficient release of nutrients from an organic source, or high nutrient requirements of a crop. Before choosing a specific fertiliser, one should know the

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reason for the deficiency. Using the wrong fertiliser can be a waste of money, create a nutrient imbalance in the soil, or pollute groundwater and water bodies. Liquid manures help overcome temporary nutrient shortages and stimulate plant growth. They are made from animal manure, compost or nitrogen-rich green plant material. Approved commercial organic fertilisers such as by-products from agro-processing (e.g. seed oil cakes), pelleted chicken manure, bone meal, feather meal, fish meal, horn and hoof meal, as well as commercially produced composts are valuable fertilisers with different nutrient properties

Natural fertilisers that provide the necessary minerals to the crops in organic farming are based on ground natural sources and include lime, stone powder, rock phosphate, gypsum, potassium magnesium sulphate, sodium nitrate, vermiculite and other natural reserves like bat guano. Soil amendments include lime to correct soil pH, and microbial fertilisers to enhance nitrogen fixation and plant nutrient uptake. Lime can be added to acid soils to balance its acidity level (pH), a soil pH of 6 to 7 being ideal for nutrient availability to plants, and for the soil organisms.

Microbial fertilisers (also called biofertilisers) such as symbiotic rhizobia are essential when growing leguminous crops in new fields to ensure nitrogen fixation. Mycorrhiza can be of high value in dry climates and phosphorus deficient soils where they can improve phosphorus and water uptake of the crops. The value of other biofertilisers, however, is much discussed and in many cases has not been proven. Most bacteria, fungi and other microorganism are naturally present in the soils and can be enhanced with the application of good compost. Microbial fertilisers cannot substitute appropriate soil management practices on the farm. Water supply to the soil is often neglected. Water is essential for biological activity in the soil and nutrient uptake by the plants. Using irrigation to supplement soil water requirements can have similar effects as fertilisers in dry soil conditions.

The amounts and types of fertilisers to apply depend on the following factors:

- ✓ Soil nutrient levels
- ✓ Quality of the nutrient sources
- ✓ Crop nutrient demand (medium or high)
- ✓ Growing stage of the crop (early stage with low nutrient demand or leaf-building stage with high demand).

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Conclusion

Soil fertility management is neither limited to addition of fertilizers nor to achieving high crop yields alone. It is about building up a rich, stable and living soil. Organic farming systems rely on the management of soil organic matter to enhance the chemical, biological, and physical properties of the soil, in order to optimise crop production.