

Effect of compost on soil and water properties used in crop productivity

Anurag Dhankar, Department Of Agriculture
Galgotias University, Yamuna Expressway Greater Noida, Uttar Pradesh
E-mail id - anurag.dhankar@galgotiasuniversity.edu.in

ABSTRACT: *It summarizes the literature on the impact of compost fertilization on the soil plant system and current knowledge. Most researchers have reported that the application of compost could improve the physical, chemical and biological characteristics of the soil, organic matter of the soil and soil nutrient status. Increased SOM concentrations result in all long-term compost application trials. However, because of their greater amount of stable carbon, mature composts increase SOM much better than fresh and immature composts. Moreover, compost contributes to the stabilization and increase of crop productivity and crop quality due to its various beneficial effects on physical, chemical and biological soil properties. As a result, most researchers have shown that compost has the equalizing effect of annual/seasonal variations in soil water, air and heat balance, plant nutrient availability, and thus final crop yields. Good results are also seen mainly because of the slow release of nutrients and their availability in compost-combined fertilization schemes.*

KEYWORDS: *Crop productivity, matured compost, soil organic matter, plant nutrients, soil physical property, soil chemical property, soil biological property.*

INTRODUCTION

One of the most significant factors contributing to improved production and sustainable agriculture is the use of compost. In addition, compost will solve the problem that farmers face when their soil fertility is declining. Crops are also decreased due to soil fertility issues, and the crops are more vulnerable to pests and diseases because they are in poor condition. In regulated, aerobic conditions, compost consists of relatively stable decomposed organic materials resulting from the accelerated biological degradation of organic materials. Compost fertilizer is manufactured from plants and the aim of recycling plants remains with animals and crop production remains with animals [1]. The decomposition process transforms organic matter that is potentially harmful or putrescent into a stabilized state that can enhance soil for plant growth. Composted organics have other beneficial benefits, including the elimination of waste from landfills for alternative uses, the removal of inoculated pathogenic or weed seeds and the decomposition of residues of petroleum, herbicides or pesticides, erosion control and as a source of nutrients for the sustainable re-vegetation of degraded soils.

The use of compost will boost the ability to grow healthy, clean, green horticultural products and greatly increase the potential for large-scale organic food products. In preserving soil fertility and decreasing nutrient losses, the presence of organic matter in the soil is fundamental. So, since it contains nutrients as well as organic matter, compost is a strong organic fertilizer. Organic matter, both in its physical structure and as a conduit for biological activity, has a range of significant roles to play in soils [2]. Moreover, organic matter makes the greatest contribution to the productivity of soils. It provides the soil with nutrients, improves its holding capacity for water, and helps the soil to maintain good tilt and thus better aeration for seed germination and plant root growth [3]. In addition, soil fertility is correlated with the generalization of nutrients found in organic matter and their release into the soil solution in a plant-available form. Generalization is the product of natural biological cycles within the soil and can be induced by adding compost and cultivation of sufficient quality. Since generalization takes place over prolonged periods, it can make a major contribution to plant growth and mitigate the effect of rainfall-related leaching and excess irrigation. On the other hand, it is not enough to maintain a reasonable degree of soil fertility by adding artificial fertilizer alone. The retention of water and nutrients includes organic matter.

Yield response is limited in depleted soil where there is little organic matter, even if artificial fertilizer is being used. Farmers also need to take care of the content of organic matter in the soil [4]. Combining the use of compost and the use of artificial fertilizer as an integrated solution is a successful strategy for sustainable crop production. In Ethiopia, soil erosion and the decline in fertility pose a serious problem for agricultural productivity and economic development. It has been estimated that the total soil removal in the country is about two billion tons per year. Hence, to sustain the balance of soil fertility and reduce soil erosion, and to ensure agricultural productivity adoption of composting technology and application of amenable compost is quite essential. Therefore, the objective of this paper is to review the significance of compost preparation and use, and its effect on soil properties, water use and crop productivity [5].

EFFECTS OF COMPOST ON SOIL PROPERTIES

In maintaining the quality of both natural and managed soils, organic soil additions have long been considered important, mainly because of their role in providing nutrients and their role in influencing the physical properties of the soil. In farming systems, organic residues were the only means of adding many nutrients to the soil, particularly nitrogen, prior to the widespread introduction of manufactured fertilizers. In uncultivated soils, more than 95% of nitrogen and sulphur are likely to be present in soil organic matter, and probably as much as 25% of phosphorus. Compost application, generated particularly from biomass waste, is one effective way to increase the SOM level. Quantity, type and degree of humification of compost, soil properties (soil type; clay content) and management are, however, the important influencing factors for SOM enrichment [6]. Due to the higher degree of healthy, mature composts increase SOM much better than fresh and immature composts. In addition, due to the impact of plant cultivation and the increase of OM degradation in cultivated soil, high levels of OM in compost increased OC in both soil and OC quantity in uncultivated soil was higher than cultivated soil.

Soil organic matter

Bouajila and Sanaa (2011) reported that the use of compost for manure and household waste resulted in a substantial increase in organic carbon, the most successful being compost treatment. Their outcome showed that as compared to regulation, the use of 120 t/ha household waste compost and manure enhanced organic carbon (1.74 percent and 1.09 percent, respectively) (0.69 percent) [7]. The application of compost to soil raises the volume of soil OC with a rise in the rate of application of compost has been investigated by Soheil et al. (2012). Mohammed et al. (2004) also conducted an experiment of use of composted organic wastes as alternative to synthetic fertilizers in two different seasons (Wet and dry) on the Tropical Island of Guam. The results of the trial showed that organic compost land use improved soil quality and increased soil fertility and crop yield. There was a major increase in the quality of soil organic matter with the application of composted organic matter. There are few studies that indicate no major variations in the level of SOM through the application of various C sources (straw, manure, compost). Most research by different scientists; however, have unambiguously demonstrated a better reproduction of humus for composted materials [8].

Increase of aggregate stability

The structure of the soil is usually characterized by the size and spatial distribution of soil particles, aggregates and pores. Air balance and root penetration potential are influenced by the volume of solid soil particles and the pore volume. The more soil structure is compacted, the more unfavorable the soil conditions for plant growth are, as a general fact. In artificial and sandy soils, aggregate stability improves most efficiently by introducing compost into the soil. Well humidified (promoting micro-aggregates) and new, low molecular ones can be expected to have positive effects. Macro aggregates are mainly stabilized by fungal hyphen, fine roots, root hair and microorganisms with a high portion of easily degradable

polysaccharides (Amlinger et al., 2007). Fine roots, hyphen networks, and glue-like polysaccharides derived from root and microbial exudates, in addition to clay minerals and oxides, contribute significantly to the formation of micro-aggregates [9].

In addition, the volume of compost, the form of compost (fresh or mature compost), the application cycles and, above all, the soil to which compost is applied affect the effect of the compost. The field trial of Bouajila and Sanaa (2011) showed that the use of compost for manure and household waste resulted in a substantial increase in structural stability, with the most effective compost treatment. Their findings also showed that when compared to regulation, the application of 120 t/ha of household waste and manure improved the structural stability better. The high content of organic matter and essential microbial activities could result in such behavior (Amlinger et al., 2007). In addition, soil aggregate and pore properties are correlated with particular "active" surface areas that affect many soil storage and exchange processes. Under optimum conditions, the higher the specific surface area, the more intense interactions between soil fauna, microorganisms and root hair can occur (e.g. sufficient humidity). As a result, a high specific surface area can create the prerequisite for an optimal soil formation [10].

CONCLUSION & DISCUSSION

Intensive agriculture, misuse and excessive use of chemical fertilizers may result in the loss of organic matter from the soil, adversely affect the ecosystem, and endanger human and animal health, food safety and quality. Fertilizers are important, particularly in nutrient-poor soils, for high yields. Organic modifications such as compost and manure as a source of nutrients and organic matter are considered an economic and environmentally sustainable option, with increasing fertilizer costs and limited resource reserves. Composts release nutrients more slowly compared to plant residue and manure, and have longer-lasting effects. Slow decomposition is more successful in increasing the quality of soil organic matter, which plays a key role in soil fertility through the preservation of nutrients, the conservation of soil structure and water retention. They also have other benefits, such as the disposal and recycling of urban solid waste by reducing the material entering the landfill there.

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