1 Introduction

ZUENG-SANG CHEN

FOR MANY CENTURIES, the key to a permanent and sustainable agriculture had been the regular and extensive recycling of organic materials on soils as soil conditioners. Such materials included animal manure, green manure, crop residues, wood ashes, tree leaves, weeds from canals, wild grasses, urban sewage, and street refuse. Many of these materials were composted to destroy weed seeds and potential human and plant pathogens; to enhance their nutrient availability; and to facilitate their storage, transport, and application to land. These practices enabled farmers to maintain their soil quality and to maximize their crop production with negligible soil erosion and nutrient runoff. However, agriculture in the Asian and Pacific region has changed considerably, and farmers are now facing problems of rapid soil degradation and soil productivity loss. It is readily apparent that alternative agricultural practices and the ultimate goal of a long-term sustainable agriculture depend largely on regular additions of various organic amendments to soils. The quality and acceptability of many organic wastes, from both on-farm and off-farm sources, can be greatly enhanced through composting.

Composting is allowing organic materials to decompose under more or less controlled conditions to produce a product that can be used as a fertilizer and/or soil conditioner. In more recent technology of composting, forced aeration, mechanical shredding, mixing, grinding, drying, and even inoculation with microbial decomposers have been introduced. Composting is basically a microbial bio-oxidative process. Its purpose is to change the properties of an organic material or a mixture of organic biomass into a material that is safe to apply to crops as fertilizer or soil conditioner. The critical factors that affect composting and their interrelationships must be thoroughly understood to ensure optimum composting conditions and to produce good quality of composts. The value of organic wastes as soil conditioners can be estimated in a number of ways, depending on the ultimate objectives of their use. Inoculants of mixed cultures of beneficial microorganisms have considerable potential for controlling the soil microbiological equilibrium, thus providing a more favorable environment for plant growth and protection.

Organic matter content is usually used as an index of soil fertility. In their general review of the effects of organic matter, many researchers indicated that it influences the soil in three ways, such as, physically, chemically, and biologically.

The fibrous portion of organic matter plays an important role in improving soil physical properties. It promotes soil aggregation and improves permeability and aeration of clayey soils. Its high moisture-absorbing power and high carbon for growth of microbial mycelia may help in the granulation of sandy soils to improve their nutrient- and water-holding capacity. Organic matter accounts for at least half the cation exchange capacity (CEC) of soils. Thus, it is very important not only in retaining nutrients from fertilizers applied but also in increasing the buffering capacity of soils, enabling crops to better cope with such stresses as soil acidity and nutrient excess. It helps increase availability of many nutrient elements. By itself, organic matter is a source of nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and other major and secondary nutrient elements.

The management of soil organic matter is important in maintaining soil productivity, reducing soil erosion, keeping the soil structure and nutrient pools, and controlling the water balance for sustainable soil management system. This book discusses composting, which has been found to be an efficient means of managing soil organic matter.