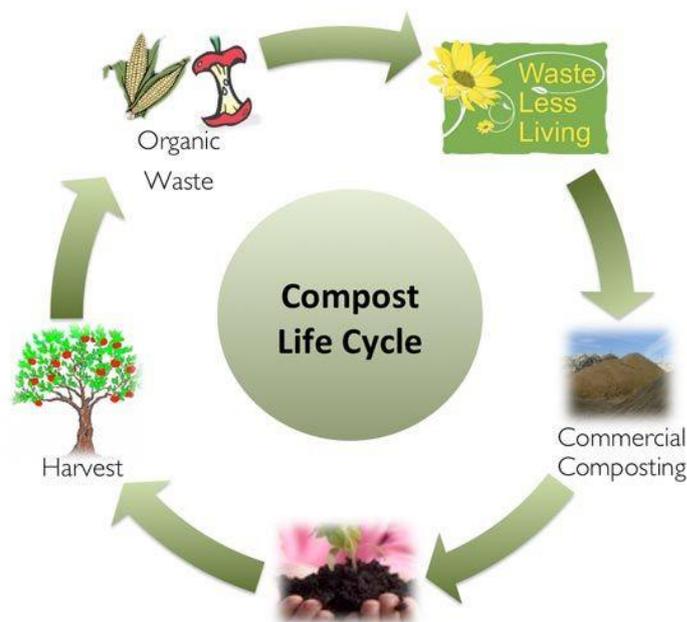


COMPOSTING

Composting is the natural process of ‘rotting’ or decomposition of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residues, animal wastes, food garbage, some municipal wastes and suitable industrial wastes, enhance their suitability for application to the soil as a fertilizing resource, after having undergone composting.

At the simplest level, the process of composting requires making a heap of wet organic matter (also called green waste), such as leaves, grass, and food scraps, and waiting for the materials to break down into humus after a period of months. However, composting can also take place as a multi-step, closely monitored process with measured inputs of water, air, and carbon- and nitrogen-rich materials. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture when open piles or "windrows" are used. Fungi, earthworms and other detritivores further break up the material. Bacteria requiring oxygen to function (aerobic bacteria) and fungi manage the chemical process by converting the inputs into heat, carbon dioxide, and ammonium.



Compost is organic matter that has been decomposed in a process called composting. This process recycles various organic materials otherwise regarded as waste products and produces a soil conditioner (the compost). It is rich in nutrients. It is used, for example, in gardens, landscaping, horticulture, urban agriculture and organic farming. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil. In ecosystems, compost is useful for erosion control, land and stream reclamation, wetland construction, and as landfill cover.

Compost is a rich source of organic matter. Soil organic matter plays an important role in sustaining soil fertility, and hence in sustainable agricultural production. In addition to being a source of plant nutrient, it improves the physico-chemical and biological properties of the soil. As a result of these improvements, the soil:

- becomes more resistant to stresses such as drought, diseases and toxicity
- helps the crop in improved uptake of plant nutrients
- Possesses an active nutrient cycling capacity because of vigorous microbial activity. These advantages manifest themselves in reduced cropping risks, higher yields and lower outlays on inorganic fertilizers for farmers.

Composting organisms require four equally important ingredients to work effectively:

- Carbon — for energy; the microbial oxidation of carbon produces the heat, if included at suggested levels. High carbon materials tend to be brown and dry.

- Nitrogen — to grow and reproduce more organisms to oxidize the carbon. High nitrogen materials tend to be green (or colorful, such as fruits and vegetables) and wet.
- Oxygen — for oxidizing the carbon, the decomposition process.
- Water — in the right amounts to maintain activity without causing anaerobic conditions.

PHASES OF COMPOSTING

Under ideal conditions, composting proceeds through three major phases:

- Mesophilic phase: An initial, mesophilic phase, in which the decomposition is carried out under moderate temperatures by mesophilic microorganisms.
- Thermophilic phase: As the temperature rises, a second, thermophilic phase starts, in which the decomposition is carried out by various thermophilic bacteria under high temperatures.
- Maturation phase: As the supply of high-energy compounds dwindles, the temperature starts to decrease, and the mesophiles once again predominate in the maturation phase

TYPES OF COMPOSTING

Composting may be divided into two categories by the nature of the decomposition process. In anaerobic composting, decomposition occurs where oxygen (O) is absent or in limited supply. Under this method, anaerobic microorganisms dominate and develop intermediate compounds including methane, organic acids, hydrogen sulphide and other substances. In the absence of O, these compounds accumulate and are not metabolized further. Many of these compounds have strong odours and some present phytotoxicity. As anaerobic composting is a low-temperature process, it leaves weed seeds and pathogens

intact. Moreover, the process usually takes longer than aerobic composting. These drawbacks often offset the merits of this process, viz. little work involved and fewer nutrients lost during the process.

Aerobic composting takes place in the presence of ample O. In this process, aerobic microorganisms break down organic matter and produce carbon dioxide (CO₂), ammonia, water, heat and humus, the relatively stable organic end product. Although aerobic composting may produce intermediate compounds such as organic acids, aerobic micro-organisms decompose them further. The resultant compost, with its relatively unstable form of organic matter, has little risk of phytotoxicity. The heat generated accelerates the breakdown of proteins, fats and complex carbohydrates such as cellulose and hemi-cellulose. Hence, the processing time is shorter. Moreover, this process destroys many micro-organisms that are human or plant pathogens, as well as weed seeds, provided it undergoes sufficiently high temperature. Although more nutrients are lost from the materials by aerobic composting, it is considered more efficient and useful than anaerobic composting for agricultural production. Most of this publication focuses on aerobic composting.

Composting objectives may also be achieved through the enzymatic degradation of organic materials as they pass through the digestive system of earthworms. This process is termed vermicomposting.