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.

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: (i) becomes more resistant to stresses such as drought, diseases and toxicity; (ii) helps the crop in improved uptake of plant nutrients; and (iii) 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 Process

The process of composting is a technique in which the natural process every organic substance undergoes through the action of microbes is controlled, accelerated and improved. It is an "aerobic process of biological decomposition of organic substances which occurs under controlled conditions, allowing us to obtain a biologically stable product in which the organic component presents a high degree of evolution". Rich in humus, in active microbial flora and in micro-elements, compost is suitable for many agricultural uses, from greenhouse plants to open field cultivation.

The composting process takes place essentially in two phases:

- Bio-oxidization, in which the mass is cleansed: this is the active phase (known as the high rate, active composting time), characterised by intensive processes of degradation of the organic components which can be broken down more easily
- The maturing process, during which the product becomes stable and enriched with humic molecules. This is known as the curing phase, and is characterised by processes of transformation of the organic substance, the maximum expression of which is the formation of humic substances.

The composting process can be carried out with selected organic waste (for example organic waste collected separately from general household waste, or organic waste collected from agri-business), from which is produced "High quality compost", a composted soil improver for use in agriculture or floriculture.

The organic fraction obtained from non-separated solid waste is treated by means of a mechanical-biological system of composting to obtain a Stabilised Organic Fraction for non-agricultural use, for example landscaping and land reclamation such as filling in old quarries, or for daily covering of landfill sites.

Continuous and Batch Composting

Continuous composting is a technique that works best if you have a steady stream of new material to work with. If you're composting the scraps from your household, this is probably the system you'll want to use. You can start with a small amount of compost and a handful of soil (or compost starter). Then, as you get extra ingredients, just add them to the mix. The compost will blend together — fresh ingredients will blend with more mature compost that's at an advanced stage of decomposition.

As your compost bin starts to fill up, you'll just want to stop adding to it for the last few weeks while you keep mixing up the materials so that the newest materials can finish breaking down too. Alternatively, you can sift out the unfinished materials with a compost screen, and throw them back into the pile or the bin to finish up.

The other method is called batch composting. If you have a large amount of organic waste (such as a pile of leaves or several bags of yard clippings) it can be enough to fill up your entire compost bin all

at once. As the compost decomposes, this pile of compost will gradually shrink. Finished compost often takes up about 30 to 50 percent less space space than the original ingredients. It can be tempting to add additional materials to the batch as it starts to shrink and turn into compost, but if you add additional waste, the entire pile of compost will take longer to finish.

Aerated Static Pile Composting

Aerated static pile composting produces compost relatively quickly (within three to six months). It is suitable for a relatively homogenous mix of organic waste and work well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g., food scraps, paper products), such as local governments, landscapers, or farms. This method, however, does not work well for composting animal byproducts or grease from food processing industries.

In aerated static pile composting, organic waste mixed in a large pile. To aerate the pile, layers of loosely piled bulking agents (e.g., wood chips, shredded newspaper) are added so that air can pass from the bottom to the top of the pile. The piles also can be placed over a network of pipes that deliver air into or draw air out of the pile. Air blowers might be activated by a timer or a temperature sensor.

Aerated (Turned) Windrow Composting

Aerated or turned windrow composting is suited for large volumes such as that generated by entire communities and collected by local governments, and high volume food-processing businesses (e.g., restaurants, cafeterias, packing plants). It will yield significant amounts of compost, which might require assistance to market the end-product. Local governments may want to make the compost available to residents for a low or no cost.

This type of composting involves forming organic waste into rows of long piles called "windrows" and aerating them periodically by either manually or mechanically turning the piles. The ideal pile height is between four and eight feet with a width of 14 to 16 feet. This size pile is large enough to generate enough heat and maintain temperatures. It is small enough to allow oxygen flow to the windrow's core.

Large volumes of diverse wastes such as yard trimmings, grease, liquids, and animal byproducts (such as fish and poultry wastes) can be composted through this method.

Pit or Trench Composting

This is the simplest way for composting kitchen scraps. Dig a one-foot-deep hole. Chop and mix the food wastes into the soil then cover with at least 8 inches of additional soil. Depending on soil temperature, the supply of microorganisms in the soil and the content of the materials, decomposition will occur in one month to one year.

Food waste burial can be done randomly in unused areas of the garden or in an organized system. One system is to bury scraps in holes dug around the drip line of tress or shrubs. An English system, know as pit or trench composting, maintains a three season rotation or soil incorporation and growing. Sometimes this is also called Vertical composting. Divide garden space into 3' wide rows.

Chamber Composting : Single or Multiple Chamber Composters

A single chamber compost bin is the most common. This type of composter has several benefits – large chambers are an optimal size for generating heat, single chamber compost bins have minimal cost, and assembly is usually very simple. On the other hand, single-chamber composters have one major weakness: when the compost bin fills up, there's nowhere left to add waste while the contents decompose. Often, it requires more than one single chamber composter to run staggered batches of compost.

Multiple chamber composters were created to deal with this problem. They offer 2, 3, or more separate compartments for compost. As each compartment fills up, it's possible to seal that compartment and keep adding waste to a different chamber. This allows old waste to completely break down in one part of the composter while new waste is added elsewhere. Uninterrupted

composting in the full compartments will quickly yield finished humus, while the additional capacity prevents a backlog of raw waste.

Factors affecting aerobic composting

Aeration

Aerobic composting requires large amounts of O, particularly at the initial stage. Aeration is the source of O, and, thus, indispensable for aerobic composting. Where the supply of O is not sufficient, the growth of aerobic micro-organisms is limited, resulting in slower decomposition. Moreover, aeration removes excessive heat, water vapour and other gases trapped in the pile. Heat removal is particularly important in warm climates as the risk of overheating and fire is higher. Therefore, good aeration is indispensable for efficient composting. It may be achieved by controlling the physical quality of the materials (particle size and moisture content), pile size and ventilation and by ensuring adequate frequency of turning.

Moisture

Moisture is necessary to support the metabolic activity of the micro-organisms. Composting materials should maintain a moisture content of 40-65 percent. Where the pile is too dry, composting occurs more slowly, while a moisture content in excess of 65 percent develops anaerobic conditions. In practice, it is advisable to start the pile with a moisture content of 50-60 percent, finishing at about 30 percent.

Nutrients

Micro-organisms require C, N, phosphorus (P) and potassium (K) as the primary nutrients. Of particular importance is the C:N ratio of raw materials. The optimal C:N ratio of raw materials is between 25:1 and 30:1 although ratios between 20:1 and 40:1 are also acceptable. Where the ratio is higher than 40:1, the growth of micro-organisms is limited, resulting in a longer composting time. A C:N ratio of less than 20:1 leads to underutilization of N and the excess may be lost to the atmosphere as ammonia or nitrous oxide, and odour can be a problem. The C:N ratio of the final product should be between about 10:1 and 15:1.

Temperature

The process of composting involves two temperature ranges: mesophilic and thermophilic. While the ideal temperature for the initial composting stage is 20-45 °C, at subsequent stages with the thermophilic organisms taking over, a temperature range of 50-70 °C may be ideal. High temperatures characterize the aerobic composting process and serve as signs of vigorous microbial activities. Pathogens are normally destroyed at 55 °C and above, while the critical point for elimination of weed seeds is 62 °C. Turnings and aeration can be used to regulate temperature.

Lignin content

Lignin is one of the main constituents of plant cell walls, and its complex chemical structure makes it highly resistant to microbial degradation. This nature of lignin has two implications. One is that lignin reduces the bioavailability of the other cell-wall constituents, making the actual C:N ratio (viz. ratio of biodegradable C to N) lower than the one normally cited. The other is that lignin serves as a porosity enhancer, which creates favourable conditions for aerobic composting. Therefore, while the addition of lignin-decomposing fungi may in some cases increase available C, accelerate composting and reduce N loss, in other cases it may result in a higher actual C:N ratio and poor porosity, both of which prolong composting time.

pH value

Although the natural buffering effect of the composting process lends itself to accepting material with a wide range of pH, the pH level should not exceed eight. At higher pH levels, more ammonia gas is generated and may be lost to the atmosphere.