Urban Harvest
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Compost

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Part 1

We hear a lot about compost these days, from its miraculous benefits, to stories of how much it stinks. What is compost? Let's start by looking at a few definitions.

From *Webster's Dictionary* we get: Compost- 1)a mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land 2)mixture, compound 3)to convert (as plant debris) to compost.

From *The Rodale Book of Composting* we get: "Composting is, in broadest terms, the biological reduction of organic waste to humus."

From *The Practical Handbook of Compost Engineering* we get: "Composting is the biological decomposition and stabilization of organic substrates, under conditions that allow development of thermophylic temperatures as a result of biologically produced heat, to produce a final product that is stable, free of pathogens and plant seeds, and can beneficially be applied to land."

From the laws of the State of Texas as published in *The Texas Register*, Title 30 - Environmental Quality, Chapter 332 - Composting, we get the following definitions:

Compost - the stabilized product of the decomposition process that is used or distributed for use as a soil amendment, artificial top soil, growing medium amendment, or other similar uses.

Composting or functionally aerobic composting - the controlled, biological decomposition of organic materials through microbial activity which occurs in the presence of free oxygen.

Cured compost- A highly stabilized product which results from exposing mature compost to a prolonged period of humification and mineralization.

As you can see, there is a very wide opinion or understanding as to what compost is. Terms like biological reduction, humus, stabilization, thermophylic temperatures, functionally aerobic and free oxygen, mature compost, humification and mineralization all complicate one's understanding of compost.

Our knowledge of compost and composting has grown from the art of backyard composting into a full-blown research field with several universities now offering Ph.D. programs in compost technology.

Basically, compost is like any other product we buy and use. It can be many different things depending on how it is made, what it is made from, and how it is to be used. It can vary from poor quality and worthless, to extremely high quality, and valuable. To illustrate, compost prices in the United States range from free ($0.00) to over $2.00 per pound (i.e. $2,000/cubic yard).

The use of different types of compost also varies. Erosion control, potting media, fertilizer, fungicide, root stimulator, earthworm food, moisture control, bioremediation of explosives and toxic wastes, disturbed land reclamation, wetland re-creation, air filtration, water filtration, food preservative, microbial stimulant, are all uses of compost.

Part 2

In general, composting is the controlled conversion of dead organic material into a stable form by the action of beneficial microbes, generating sufficient heat to kill all weed seeds and harmful pathogens (bad microbes), producing a stable end product. This end product varies greatly in value, quality, and in possible applications from soil amendment to bioremediation or air filtration.

There are three major techniques (physical and chemical processes) used to produce compost: aerobic, anaerobic, and vermicomposting. Depending on the type of raw source materials (feedstock) and the processing variables (time available, quality desired, economic constraints, etc.), one process may be better suited than the other, as each method has its positive and negative attributes.

Aerobic composting occurs in the presence of oxygen from the air. Carbon from the source material by the action of microbes is combined with oxygen, producing carbon dioxide (CO_2) and energy (heat). Nitrogen, sulfur, and other nutrients in the material are stabilized and converted into amino acids, proteins, and humic substances which are beneficial for plant growth.

Anaerobic composting means 'without oxygen'. A different set of microbes digest the source material producing methane and other gases, including odors. A common example of anaerobic composting occurs when a plastic bag of grass clippings is stored for a few days and then opened. The odor that one smells is from nitrogen and sulfur compounds (nutrients that are typically lost). This type of composting is generally used for waste reduction and not agriculture or horticulture.

Vermicomposting occurs by the action of certain types of earthworms eating and digesting the source material. The manure produced is called vermi-compost and is generally the highest quality and most valuable type of compost. Demand for special variations of this type of compost has driven the price as high as $2,000/ton for use as a bio-stimulant in some areas of the world. In the US, most vermicomposts are sold bulk wholesale for $35-$100 per cubic yard. Many professionals on the west coast are starting to use vermicompost in potting mixes and are finding it very cost effective. Researchers at Ohio State University are finding many uses and benefits from vermicompost in horticulture and agriculture. Additionally, different species of earthworms produce vermicompost with different properties and uses.

Part 3

Aerobic composting is the most common method of producing compost. Aerobic compost is produced using two major methods, the windrow and static pile techniques. Each method has its advantages, depending on one's goals.

The windrow method was developed in the feedlots of West Texas and later for use in composting very wet material like biosolids (15-20% solids) from city wastewater treatment plants. A windrow is a compost pile 5-6 feet tall, 8-10 feet wide, and several hundred feet long. This pile is generally produced on a hard surface (asphalt or concrete) since special expensive machines called windrow turners are required to pass over the material, mixing it, every day. The piles tend to get very hot (55°-65° C), which produces a lot of gases, resulting in large volume reduction of the material. The gases include carbon dioxide (C02), water (H2O), ammonia (NH3), and many other compounds, some containing sulfur (S). As you know, both NH3 and S are important plant nutrients. Carbon (C) stored in the compost adds energy for beneficial microbes to feed on. Hence, if these components are lost, the compost can be of lower quality. This method can produce compost in 4-6 weeks (or less) depending on the type of feedstocks.

The other method, called the "static pile" technique, is to form large piles from the feedstock. These piles are commonly 12-15' tall (high as a front end loader can reach) to over 100' tall, 30-50' wide to over 200' wide, and can be any length the operator wants. These piles are turned only 3-8 times during the production process, which can last from 6 months to 3 years. The core of these piles can get very hot (55° C +) from the action of thermophilic bacteria, just as a windrow does, with the same gases produced. However, as these gases move from the hot core of the pile to the cooler outer layers (mesophilic regions) the microbial population changes from bacterial to fungal. The fungal species "eat" the nutrient-containing gases, converting them into amino acids, proteins, enzymes, etc., enriching the compost and preventing the loss of these beneficial chemicals.

Either method can produce compost that is beneficial for use in horticulture and agriculture. Millions of people, from backyard gardeners to commercial growers and producers around the country, are now using compost successfully. Recently we have seen growers like Gallo Winery and Fetzer Vineyards admit that the awards they have won were on organically grown grapes fertilized with compost. Gallo has become the largest producer of compost in California since it has proven so profitable for them. A couple of years ago Gary Logon of Indiana, a farmer using compost, won the national corn growing contest for best quality and highest yields. Last year in Texas, cotton growers had one of the biggest crop failures in history from boll weevils, yet the farmers using compost did not suffer a crop failure and had good yields.

Researchers are now studying how to apply what we have learned about compost usage in field crops to bedding and container media for nurseries. In the new issue of the journal *HortScience* (April 1997) the feature article was, *Suppression of Plant Diseases by Composts*. This is a summary of research at Ohio State University using compost for disease control in potting media. In future issues of the newsletter, as we continue our series on composts, we will continue to explore the factors related to compost utilization.

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