THE JOY OF COMPOSTING

Steve Rees, Chautauqua County Master Gardener Volunteer

In anticipation of International Compost Awareness Week, a comprehensive international education initiative May 29th, it seems appropriate the community at large be reminded of the importance and usefulness of composting in both backyard and large-scale applications. The goal, as ever, is to encourage healthier soil, healthier food, and healthier people through increased use of composting techniques.

There is nothing new about composting. The process as performed by humans has been around in one form or another for millennia. Biblical, Talmudic, and other references exist indicating that mankind early on understood the importance of recycling organic vegetive and animal waste for the benefit of their soils and crops, resulting in better harvests. Researching the historic use of composting is an interesting exercise, but how is the practice relevant today?

Returning organic matter to the soil is increasingly important as the earth's population grows and generates more and more wastes of all types, much of which can be reused to the benefit of all species. For one example, the need for landfill space to accommodate waste stream materials could be reduced by as much as one-third if organic matter is diverted and recycled (composted). Also, plant matter, whether food crops or ornamental plantings is highly dependent on the biological diversity found in soils amended with composted organic matter. These amendments also aerate the soil, improve moisture retention, and can reduce certain diseases found in plants and soil, lessening the need for pesticide use. As well, by incorporating composted organics into the soil, carbon in the compost can be sequestered and removed from the atmosphere, helping to mitigate climate change. And finally, reduction of organic matter in landfills results in a corresponding reduction of methane and other harmful gases passing into the atmosphere.

There is much to be said in favor of composting or "managed decomposition," and indeed, MUCH has been written in recent years; resources abound with information and instructions ranging from simple pamphlets to 1000-plus page tomes with topics of wide-ranging complexity.

However, this discussion is directed to the residential, small-scale composter and only lightly touches on the more complex chemistry, mathematic formulae, and biological processes involved. While that information is vitally important to large-scale agricultural operations and commercial composting operations, home composters can be successful by following just a few simple rules of thumb to create a useful, organic amendment for their vegetable gardens or flower beds while reaching the goals suggested earlier.

The scale of the composting method chosen by an individual will be first tied to their property size and location. City dwellers or those in suburban or rural areas will select a method best suited to their locale. What works for a city resident on a 60'x100' lot likely would be inadequate for one with several acres of property. As such, choices need to be made. A large pile in a secluded corner of a large property may not work for a person with neighbors adjacent on all sides. Such a pile might be messy and unattractive and might draw vermin, possibly irritating close neighbors. A neatly built set of compost bins would be a better choice.

The composter should also decide how much effort they wish to expend on the process. It is possible to take a nearly hands-off approach or to be totally obsessive in maintaining bins or other devices on an almost daily basis. The resulting compost product will be nearly the same, the difference being the amount of time required to reach the desired result. Bins turned and worked often might produce results in two to three weeks where a simple unattended pile might take a year to reach completion.

The decomposition process relies on the microbiological activity of numerous organisms. Imagine a complex food web or pyramid consisting of organic matter such as leaves, grass clippings, and kitchen waste. This pyramid base is the food on which primary consumers such as bacteria, fungi, actinomycetes, and certain worms will feed to begin decomposition. Secondary consumers such as certain protozoa, nematodes, mites, and springtails will then feast on the deceased primary consumers who have taken up and retained nutrients from the food base biomass. Then finally, tertiary consumers like centipedes, beetles, ants, and earthworms will, in turn, feed on the secondary consumers. Earthworms, notably *Ensenia foetida* (Red Wigglers), will perform the bulk of the decomposition work. In addition to consuming first- and second-tier consumers, the worms are also endlessly tunneling through the pile eating decaying organics and insects. This tunneling by potentially thousands of worms in a healthy pile will aerate the biomass allowing air, water, and other nutrients to filter into the pile. Worms will also leave behind dung or castings that are high in bacteria, organic matter, and a variety of minerals important to soil structure.

The efforts of the micro- and macro-organisms will result in significant heating of the organic matter that occurs in several stages. The decomposition by primary consumers will rapidly raise the temperature, ideally attaining about 130°F (50°C). At this temperature, many human and plant pathogens will be destroyed. Should the temperature of the pile reach 150°F (65°C), many of the beneficial microbes will start to die off and decomposition will be slowed. Ideally a pile will be monitored and turned to keep temperatures in a safe range.

The organics in the pile will typically contain water, oxygen, carbon, and nitrogen in varying amounts. The success of the composting process can be determined by what might be called the

"Goldilocks Equation." The pile is neither too hot nor too cool; not too wet or dry; has sufficient oxygen and doesn't contain too much nitrogen-bearing matter, or not enough carbon material. In other words, all the proportions are "just right." Control of water and oxygen in a pile is fairly easy to get right, but it is important to strike a proper balance of carbon-to-nitrogen-bearing matter: the C/N ratio. The C/N ratio might also be called the "Brown/Green" balance. One could also think of brown and green organics as "…truly dead or newly dead." Brown organics that are rich in carbon would include shredded fallen leaves, coffee filters, sawdust and shavings, ground bark, dead plant stalks, straw, and more. The materials are generally quite dry. Green matter rich in nitrogen includes grass clippings, coffee grounds, tea leaves, egg and crustacean shells, fresh garden trims and peelings from harvested vegetables, certain manures from herbivores, and some animal bedding. They generally have a higher moisture content.

Importantly, some materials should be avoided in the compost pile. Keep human and other omnivore manure out, as well as weed seeds, diseased plant matter, diary products, oils, meats, treated lumber sawdust or shavings, and non-biodegradables. An inordinately complex series of algebraic computations are available to compute the balance based on mass and moisture of matter, but for the layperson, a ratio of 30:1 (Brown to Green) by volume is a good goal. Too much brown or green material will adversely affect the composting process. Keeping near this balance will also reduce the creation of strong "silage" odors resulting from too high a concentration of nitrogen organics.

The use of these varying compostables leads to a brief discussion of the pH of the decomposing matter. In an ideal situation, the microorganisms perform best when their environment is neutral to slightly acidic in nature, a pH range of 5.5 to 8.0. An acidic condition supports fungi growth and serves to break down lignins and cellulose in the plant material. The organic acids will gradually neutralize and the finished compost pH will stabilize between 6.0 and 8.0. Testing the pH by means of a soil test kit or pH test paper is recommended before incorporating the compost into growing beds.

At some point all this theory must be put to practice. Earlier it was suggested that a composting method could be very simple with low effort or perhaps as complicated as one desires. In ascending order of complexity, these methods are offered.

A Single Heap:

- Simple form, no construction of cost
- Little to no effort
- Slow decay if not turned - could take a year or more to deteriorate
- Could be unsightly - may provide habitat or attract vermin.

Single Bin:

- Many designs and material to choose from
- Ideally about one cubic yard in volume
- Layering of browns and greens most effective
- Neater than a heap but slow working if not turned occasionally
- Removable side panels are ideal for access.

Multi-bin Turning Unit:

- Two or more adjacent single bins of similar construction
- Continuous rotation of matter as it reaches different stages of completion
- Matter turned from one bin to the next as decomposition progresses
- Material can be screened before use to remove unfinished organics.

Commercial Bins and Tumblers:

- Moderately priced to very expensive
- Many rotary or static designs available
- Fairly small volume but relatively quick results
- Very neat and orderly appearance.

Generally, the more finely chopped any of the organic materials in the bin are, the more rapidly the material will break down. Chopped and shredded organics offer greater surface area to air, water, and microorganisms, resulting in faster heating and thus faster decomposition. Chopping the kitchen vegetable waste, shredding leaves with a commercial shredder, and reducing garden trims and twigs to small pieces can speed the composting process.

When the composting process has completed, it's recommended that the finished humus be screened before incorporating it into native soil. It can be a bit labor intensive, but passing the compost through a ½" x ½" wire mesh screen, for example, will produce a homogeneous mix while separating unrotted matter, stone and other non-biodegradables that inevitably find their way into the process. The incompletely rotted organics can be returned to break down further, while the other matter can just be discarded.

There are literally dozens of reference materials available in either print or digital formats. Here in western New York, Cornell University's Waste Management Institute in the College of Agriculture and Life Sciences offers a comprehensive website (cwmi.css.cornell.edu) dedicated to a range of waste management topics including basic composting. Also, the Chautauqua County Cornell Cooperative Extension Master Gardener website (Chautauqua.cce.cornell.edu) offers a compost resources site that is a trove of readily accessible information. Although a bit dated in its presentation, the light reading found in the 1007-page, 3.2 pound (!) "*Complete Book of Composting*" by J.I. Rodale, first published in 1960, still contains very good, detailed information as well as providing an interesting look back at the evolution of composting.