Organic Composting for Horticultural Use

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Composting to biologically stabilize organics into a humus material similar to soil organic matter is not a new process. Renewed emphasis on using this process is being fueled by increasing amounts of agricultural by-products resulting from the production and processing of livestock, poultry, cotton, peanuts and forestry as well as from municipal and urban activities resulting in sludge, yard clippings and biodegradable solid wastes. In some instances, composting may be a less expensive waste reduction process than alternative treatment methods. In every case, a well-composted by-product converts a potential liability into a usable resource such as organic fertilizers, soil amendments or potting media.

Process

The compost process is a partial breakdown of organics by microorganisms such as bacteria and fungi. When the process is optimized and goes to completion, the end-product is biologically stable, has an earthy odor, breeds few flies, has less volume and weight, and costs less to haul and spread than the original by-product. Heat created by composting destroys pathogenic organisms and weed seeds. If not protected, the end-product might reacquire viable weed seeds between the compost process and point of use.

Before organic by-product conversion into compost for horticultural or agricultural production, the non-biodegradable materials must first be removed. Objects such as plastic, glass, metal or stone must be physically separated. Most agricultural by-products contain little, if any, foreign objects while municipal solid wastes could contain substantial amounts. Some municipal wastes might contain metals such as cadmium, chromium, lead, or mercury restricting their use. Most agricultural by-products contain very little metals with the possible exception of copper. Raw materials suspected of containing significant pesticide residuals should be withheld from compost for horticultural uses.

Factors influencing the rate at which composting proceeds include raw material particle size, aeration, moisture content, and the carbon-to-nitrogen (C/N) ratio. The predominant bacteria in composting are
aerobic (needing oxygen). The particle size of raw materials determines the porosity of the pile which in turn affects aeration. Material which is too finely ground compacts so densely that air cannot penetrate the pile resulting in anaerobic (without oxygen) or undesirable conditions. Materials such as wood shavings-based poultry litter, leaves, shredded bark, or peanut hulls provide a more porous substrate for oxygen penetration. Wood chips, twigs and tree branches are dense, do not readily decompose and should be avoided.

**Moisture**

Optimum moisture contents for composting range from 50-60 percent. Above 60% the pile approaches saturation limiting oxygen penetration and becomes anaerobic. Below 50% moisture, microbial activity and rate of composting slows down. By-products and raw materials such as wet leaves, vegetable or fruit refuse, animal manures, sewage sludge, or food scraps would probably need little, if any, additional water to optimally compost. Materials such as wood shavings, sawdust, poultry litter, grass clippings, hay and straw, peanut hulls, chopped corn cobs and corn stover, cotton gin trash, or shredded newsprint would require additional water.

**Carbon/Nitrogen Ratio**

The C/N ratio significantly influences the rate and degree to which a mixture composites. Microbes use carbon as energy and nitrogen as a food source to produce proteins. Optimum C/N ratios range from 20-30 parts carbon to 1 part nitrogen. C/N ratios under 20:1 result in incomplete nitrogen use allowing ammonia to form in the pile and be released during turning or aeration. Animal manures, poultry litter, urea, grass clippings, legume residues and some sewage sludges are good sources of nitrogen. Wood shavings, straw, peanut hulls, and newsprint have high carbon contents.

**Temperature**

Temperature is a good indicator of how the composting process is progressing. Within 2-3 days of correctly forming the compost pile, temperatures generated by microbial activity should reach 140 - 160°F. Unless the pile is porous and well aerated, microbial activity will begin slowing within a few days with a temperature decrease until the pile is turned or reaerated. When this happens, the temperature again will peak. The only monitoring tool necessary to determine if the compost process is proceeding properly is a long-stemmed thermometer.

**Methods**

Three composting methods are most commonly employed: windrows, aerated static pile, and bins or aerated chambers. For high-volume composting of raw materials such as animal manure, poultry litter, sewage sludge, or municipal solid waste, the windrow or aerated static pile method is most often used. Windrows 3-5 feet tall and 10-15 feet wide at the base are formed by combining the proper recipe of raw materials on open earth surfaces. Windrows are turned periodically, with temperature determining how frequently, by manure collection and loading equipment such as front-end, skid-steer, or wheel loaders or by special purpose machinery. The turning machinery has a high initial cost. Minimum composting time is 1 month followed by 1-2 months of curing before the material is ready to be used or marketed.
Aerated static pile composting occurs in a windrow formed over a perforated pipe through which air is forced. Forced aeration eliminates the turning needs and costs. The perforated pipe similar to 4” corrugated plastic field drain tubing is connected to a squirrel-caged blower fan to distribute an updraft of air underneath and through the compost pile. Aerated static piles may be formed on earth surfaces or concrete floors and either outside or indoors where environmental factors can be more closely controlled.

Low-volume or batch composting can best be accomplished in smaller static or aerated bins where environmental factors are optimized. Batch composting similar to the backyard or home garden variety requires more hand labor and is less mechanized. Raw materials are initially layered in the bin according to the proper recipe. Material in the bin is either periodically turned by hand, or mechanically aerated by a forced air blower.

**SUMMARY**

By-product composting stabilizes organics, improves handling characteristics, and reduces odors and pests. Compost enriches topsoil with organic matter and plant nutrients, improves water infiltration, tilth and aeration of clay soils, and increases water availability and nutrient retention in sandy soils. Wood ashes added to compost mixtures sparingly provide some liming effect but in large quantities promote ammonia loss. Care should be taken at composting sites to protect ground water and to prevent surface water impairments. Before initiating a composting operation, the supply of raw materials and demand for the finished product must be reliably established.

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