H-885 (Revised)

COMPOSTING PRACTICES

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One of the reasons North Dakota was so attractive to early settlers was the high organic matter content of the soil: crops sown grew at rapid rates and produced yields that were to set some standards for the Upper Midwest.

Soil management in those early years was in the utilization of organic matter residue. Petroleum based fertilizers, herbicides and insecticides were unheard of in 1900. Barnyard manure, straw, corncobs, etc., were all reincorporated into the soil to return some nutrient value, but primarily to maintain the soil's superior tilth.

The compost pile or bin was a common farmstead sight in those days. The family vegetable garden, flower garden, trees, shrubs and lawn would receive benefits from application of composted or organic matter.

Why Compost?

Proper composting is the gradual aerobic microbial decomposition of organic material. When the finished product, compost (also known as humus), is removed from the bin or pile it is a dark, friable, odorless product, very similar to the organic matter found in the soil. The quickly available nutrient value in compost is generally very low, but its major influence is on the improvement of physical conditions in the soil structure and slow release of nutrients (especially nitrogen).

Adding properly aged compost to the soil will improve its water holding capacity and enrich the soil bacterial activity which, in turn, has a direct affect on the availability of some mineral salts to plants.

If fresh organic matter were added to garden or flower bed soil, the microbes which carry out the decomposing process would compete with the growing plants for the available nitrogen. When this occurs, the plants usually show a nitrogen deficiency as a yellowing of the older foliage.

Today's typical homeowner has an aversion to establishing a compost pile: "It will attract rodents;" "It will draw flies;" "I don't want to offend my neighbors with the smell;" go the typical comments. Actually, the properly managed compost pile has none of these problems.

Basically, there are two acceptable systems for compost production: a very simple, cool, low production method utilizing only dry organic wastes, such as lawn clippings, leaves and corn husks, and a more rapid, sophisticated, high temperature production system, utilizing most organic kitchen waste as well as yard and garden refuse.

Cool System

This is simply a pile of leaves, grass clippings, egg shells, pea pods, etc., which slowly decompose into humus. Because of the low temperature associated with this type of compost production, weed seeds and plant diseases are not killed. Consequently, weeds which have gone to seed or plants which are obviously diseased should not be added to the pile.

Because a system such as this takes four to six months to produce compost, nutrient leaching (especially nitrogen) could take place. If a speeded up production of compost is desired, then occasional turning of the pile, and the addition of nitrogenous fertilizer, along with some water, will cut the time for compost production in half. If ants invade the compost pile, it is an indication it is being kept too dry.

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Hot System

The purpose of this system (shown in Figure 1) is to accelerate the decomposition process, and in so doing, kill of most weed seeds and plant pathogens.

The size of the compost pile should not exceed 6 feet (1.8 m) in height, and the maximum size of the organic matter pieces should be 6-9 inches (15-23 cm) long. If bins are constructed, the dimensions of 5x5x6 feet will yield 150 cubic feet (4.3 cu. m) of compost. This is a respectable volume of compost to produce in a four- to six-week time period and will cover over 500 square feet (47 sq. m) to a depth of 2 inches (5 cm).

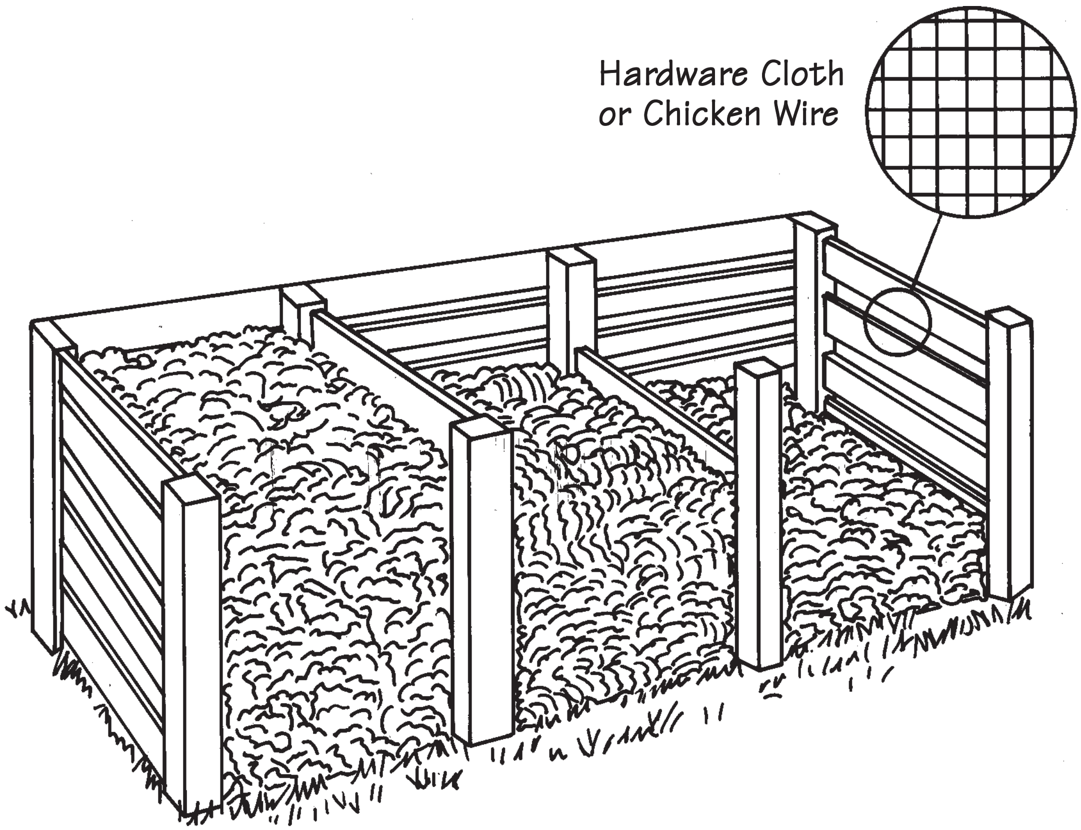

Figure 1. The three-bin method of compost production:

Bin 1 – The raw material bin. Daily refuse from the kitchen such as coffee grounds, egg shells and vegetable shavings, refuse from the vegetable or flower garden, grass clippings, shredded leaves. Turn every two to three weeks.

Bin 2 – The next stage of decomposted material which is taken from the bottom of bin 1 goes into this bin. It is turned every three to four days, until the material is humus. It is then transferred to bin 3.

Bin 3 – The compost or humus, ready for use. This method assures that only completely composted material is returned to the soil.

Construction Notes: 4 inches x 4 inches x 8 feet boards (10 x 10cm x 2.4 m) can be set into the ground 36 inches (92 cm) deep; hardware cloth (0.25 inches or 0.64 cm) can then be tacked to 3 opening sides for maximum aeration and separation of the piles. The front side is left open to allow turning and removal.

Another version can be made using concrete block (8 x 8 x 16 in) (20 x 20 x 4 cm) to define the bins. They are simply set on level ground.

Also note: Keep piles away from buildings due to possible fire hazards.

At this accelerated production rate, the average finished compost can be expected to have the following principle constituents available for plant growth:

Water	10-15%
Organic matter	10-20%
Nitrogen	0.8 %
Phosphorus	0.45%
Potassium	1.45%
Lime	1.25%
Magnesium	0.3 %

If bad smells are noted from the compost pile, it usually means that anaerobic bacteria are more active than the aerobic, and that aerobic decomposition is slowing down. This is usually caused by excessive moisture in the bottom of the compost pile. The problem can be easily corrected by turning the pile.

To keep the aerobic bacteria population high and active, 0.25 pound (0.12 kg) of actual nitrogenous fertilizer should be added per cubic foot of dry matter and punch holes (four to five) into the center of the pile. This is best done in phases or stages as the compost pile is building up. In our example of 150 cubic feet, if the pile is built up over a period of three stages - at 2 feet (0.61 m), 4 feet (1.2 m) and 6 feet (1.8 m), 12.5 pounds (5.7 kg) of a nitrogen fertilizer (1:0:0 ratio) should be added at each step. The total should be about 37-40 pounds (17-18 kg) of fertilizer for the entire pile.

In this high-temperature, bacterially active system, it is best to turn the composting material every three to four days. Once activated, expect the temperature to range between 120-160°F (49-71°C). The decomposition will go faster in summer (as short as three to four weeks) and take more time in the spring and fall. No measurable activity occurs during typical North Dakota winters.

Once the compost is no longer hot and is an odor-free, crumbling material, it is ready for garden use.

Two alternatives of the hot production system exist. One involves using a plastic trash bag, where the bag is rolled over every day. The other uses commercially available compost bins. Both will yield a compost product in two to three weeks.

Benefits of Compost

Beside improving the physical structure of the soil, using compost has these other benefits:

- Modifies temperature extremes in the soil, keeping it cooler in the summer and warmer in winter.
- Utilizes rainfall or irrigation water more efficiently, because less moisture is lost due to evaporation and runoff by permitting better absorption.
- Adds a bank of biological activity to the soil, which contributes to more efficient nutrient uptake and the tieing up of certain ions, notably aluminum and iron, which may be toxic at a low soil pH.
- A buffering capacity (resist change in pH) is added to the soil with the addition of compost. The effects of over-fertilization are not as critical.
- Because of its tremendous cation-holding capacity, the addition of compost to the soil would allow for the holding of plant nutrients for a longer period of time.
- As a mulch at least 2 inches (5 cm) thick, a reduction in weed problems can be expected.

If the compost is to be used as a mulch, it is suggested that a minimum of 2 inches (5 cm) be used, with 4 inches (10 cm) being better. All plant material, vegetables, flowers, roses, trees and shrubs, can benefit from the use of compost. The mulch cover should be maintained throughout the growing season for best results.

A Caution

Do not add paper products, especially colored paper, unless they are explicitly biodegradable. Foil, meat scraps and plastic should also be avoided.

Benefits of Compost as a Topdressing For Turfgrass

If all the environmental and physical conditions of composting are optimized, the process goes through three distinct phases (refer to Figure 2). First, a rapid rise in temperature, followed by a prolonged high-temperature phase in which rapid decomposition of the organic matter takes place. At this stage, the microbial antagonist population is either non-existent or at a very low ebb. Phase 3, the final or curing phase, is where the compost material begins cooling and decomposition decreases or ceases altogether. During this phase, the microbial antagonist population increases dramatically.

Topdressing with the humus or finished compost at a rate of 10 pounds per 1000 square feet have been shown experimentally to suppress diseases such as dollar spot, brown patch, Pythium and red thread. Heavier applications of the humus from compost piles at rates of 200 pounds per 1000 square feet were shown to be effective in suppressing winter diseases such as Typhula blight and in providing the grass surface from winter ice and freezing damage.

This fungicidal effect of compost on some of these pathogens is due to a number of factors. The microbial antagonists may parasitize the pathogens, colonize plant parts, and/or compete with pethogens for resources in soil and on plants. The homeowner should understand this is simply experimental information. The predictability of the suppressive activity of certain composts at controlling diseases is not yet available without actually field testing. *(Initial research on this subject was carried out by Dr. Eric Nelson, Cornell University.)*

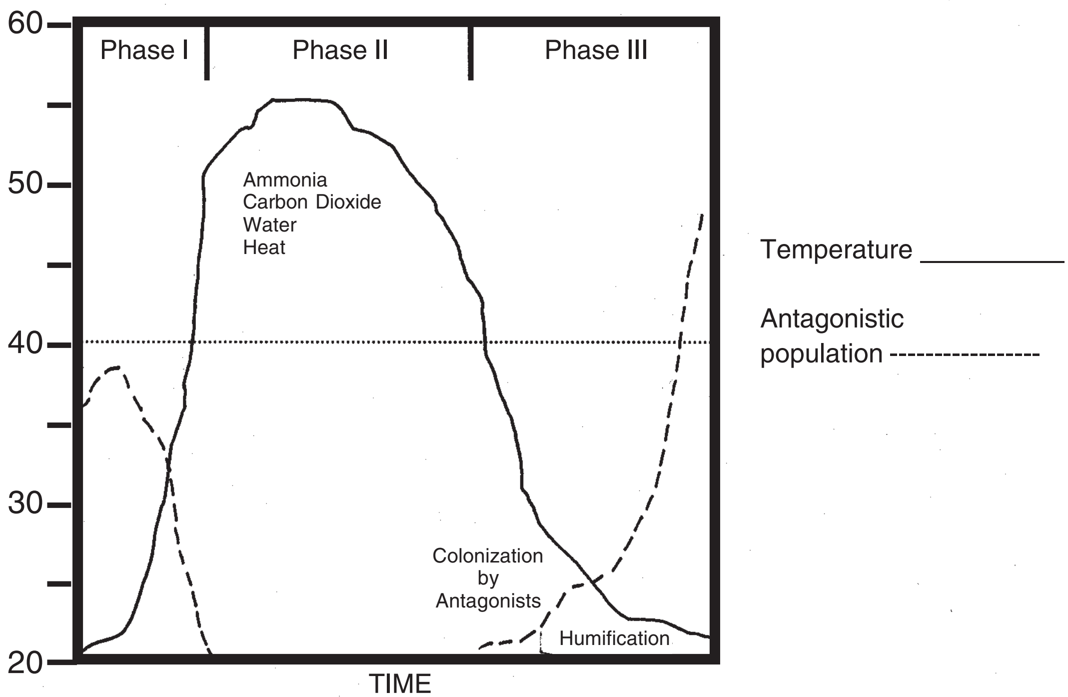

Figure 2. During Phase I of the composting process, initial heating takes place and readily soluble components are degraded. During Phase II, cellulose and hemicellulose are degraded under high temperature (thermophilic) conditions. This is accompanied by the release of water, carbon dioxide, ammonia and heat. Finally, during Phase III, curing and stabilization are accompanied by a drop in temperatures and increased humification of the materiaL Recolonization of rhe compost by mesophilic microorganisms occurs during Phase III. Included in these microbial communities are populations of antagonists.

For more information on this and other topics, see: www.ag.ndsu.edu

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