An *Our Garden Gate* Special Report:

Composting—*Why & How Straight Talk*

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(To view other articles and special reports, visit www.HillGardens.com and click *Article Archives*)

We've got a problem! There's a point in each of our lives at which we find reason to question our actions and motivations. Long-standing methods of handling our residential and industrial wastes, for example, are falling by the wayside for a number of pressing reasons. There's an urgent need to conserve - *preserve*, if you will - fast declining resources critical to our survival in this fragile world. Actually, that need to conserve has always been there. As a global society, however, we have simply chosen to ignore it! We've also chosen to disregard the holes in the ground now filled to overflowing with stinking, sometimes caustic—if not downright deadly—waste products of our technologically-advanced society. The vast majority of citizens have turned a blind eye to the nearly countless multi-mega-tons of the nasty stuff dumped at sea, and a deaf ear to those proclaiming the warning signs.

Well, those days are gone. Right now—today—we've got a problem that *must* be solved. We're running out of the resources that we've taken for granted for so long, *and even more rapidly* running out of places to hide our wastes and discards.

Why should *we* be concerned? That's an easy one. The answer boils down to this very basic statement: *it's a simple matter of survival.* Not just yours. Not just your immediate family's. But survival of our species. That means your children; and *their* children; and their children after them. It means every living creature on this earth—including you and me.

You see, our very existence depends entirely upon the soil and its fertility, productivity and stability. Without healthy soil, there would be no plants. Plants produce oxygen—the air we breathe. Plants enhance our emotional well being and quality of life. Plants protect the soil from erosion. Plants cool and freshen the air. Plants, quite literally, cause it to rain. Plants provide us with a vital source of food and, in a great many cases, our employment. Deplete and ruin our soils by abuse, neglect or ignorance, and our food, water and air all go to pot—followed immediately by *us.*

***Alright, already. . . !* So how do we make our soils "healthy"?** Now that we have the why pretty well outlined—and the sermon is over—let's take a much closer look at the biology of the composting process, and the *how*. Every year, quite literally *millions of tons* of valuable organic materials (which includes just about everything except glass, metal, plastic, rubber, concrete and most hazardous waste...most of which can also be effectively recycled or reused) are either buried in landfills, hidden beneath construction sites, barged out and dumped at sea, or reduced to useless—and contaminating—ash. Wasted. Irretrievably lost.

"Valuable," because all that organic material should have been converted into soil-building humus to improve the health of our land, our crops *and* ourselves. The conversion process is really quite simple: various types of germs, molds and bugs digest, dissolve or munch the stuff into tiny, usually dark brown, nutrient-rich particles which, collectively, are referred to as "compost." When incorporated into the garden, this "brown gold," as it is rightly called, brings life to the soil and health to its produce—*and* the soil's steward.

The discussion could end right here! It's as uncomplicated as that. There are a number of factors, however, which, if understood and applied, would all but guarantee a faster process and a higher quality end product. So let's look at each of those factors one at a time—like the pieces of an important puzzle. Yes, I know we went through some of these in other gardening articles and chapters in my book, *Keys To The Garden Gate*, but at this point, I believe a brief review of soil basics in this new context of biological, *hot-rot* composting is in order. Then we'll conclude by pulling all the bits together into a *completed* puzzle to ensure we fully understand what goes on in a compost pile. It won't get too technical—*promise!* First, the germs. Not the type that normally cause infections, plagues or diseases in humans and animals; germs in the compost pile are the *good* kind.

Bacteria. A single pinch of healthy, high organic matter soil can contain millions upon millions of tiny creatures called "bacteria. They're perfectly natural and normal soil inhabitants. Their job in the soil—and they do that job remarkably well—is to convert fallen fruit, flowers, leaves, twigs, insects, roots, grass, stumps, even the remains of animals, fish and birds to *almost* their least common denominator. New life will be sustained by the nutrients that are released in the process. It's as if life springs from death, which is *exactly* what happens. For all intents, they are the same bacteria found in compost piles.

These bacteria exist in two broad categories, or types. Bacteria that require oxygen to live and function are referred to as **aerobic**. Their work-site, the compost heap, is essentially odorless. Well, there *is* a pleasant, earthy, humusy aroma but *nothing* like the powerfully unpleasant odor produced by the action of **anaerobic** bacteria. They're the type that does not need oxygen to live or do their job. Practically everyone has experienced the foul smell of anaerobic microbes. A sealed bag of garbage allowed to remain in the hot sun; the black, gooey, foul-smelling fermentation of green grass clippings left in a sunlit pile; the oppressive stench emanating from a recently-disturbed garbage dump.

During the process of digesting organic matter, aerobic bacteria consume nitrogen and produce heat. Actually, a *lot* of heat—as long as their air supply holds out and there's something for them to eat. Bacteria are about 1/25,000th of an inch long (or is it *wide*?).

Fungi (Molds) are actually tiny plants that derive their energy from eating organic matter. Those which are active in the cooler stages of decomposition within a biologically-active compost pile are referred to as "saprophytic" because they feed on dead and/or decaying matter such as the coarser, woody materials like sawdust, shavings, wood chips and larger twigs and branches. Another type, called "parasitic," prefers to eat live matter—in this discussion, living plants. Fungi are much larger than bacteria and appear as thready filaments called *mycelia,* which penetrate deep into whatever they've chosen to feed upon. They have a tough time with the kind of heat which most composting bacteria produce, so are active in the later, cooler stages of the process. Fungi commonly found in a compost pile have no objectionable odor and are harmless except to those with serious allergies or hypersensitivity.

Actinomycetes. Most of the "earthy" aroma of finished compost is the result of the action of *ac-tin-o-MY-seets.* They are very similar to bacteria but, like fungi, prefer their environment a little cooler. It is this group of microorganisms that are largely responsible for the formation of humus and the liberation of nitrogen, ammonia and carbon for efficient use by living plants.

Other microorganisms reside—and are active—in a compost pile but are of little significance in this present discussion. Now let's move on to larger, macro-organisms.

The Ones With "Teeth." An almost endless parade of larger creatures carry on the actual work of "munching," *or munching on the munchers.* Nearly all of these can be seen with the unaided eye but a hand lens would be helpful if you really wanted a closer look at the smaller ones. I'll list only the more commonly seen types.

Mites are exceedingly small members of the spider family, which multiply quickly and eat a variety of foods including living or decaying plants, other small insects and worms, and each other.

Centipedes, spiders, beetles of nearly all sizes, ants, nematodes and **flatworms** are, for the most part, carnivorous, meaning the chief component of their diet is other animal life. This group's digestive waste products are added to the pile and provide additional food for smaller organisms.

Slugs, snails, springtails, sowbugs, millipedes, fly larvae and **earthworms** are herbivores, living almost entirely on organic matter. Quite often, it is this group that reduces larger pieces of organic material to more manageable size bits (usually their waste products) which **micro**-organisms are better able to chemically break down and digest.

Another type of worm - **red wriggler** - is especially adept at reducing organic material *very* quickly at cool temperatures. They are also especially suited to indoor worm composting ("vermiculture"). Red wrigglers may be purchased by the pound from natural gardening supply sources or some local fish bait retailers.

What Is "Organic Matter?"

All of these bacteria, fungi and little creatures exist in a compost pile because there's something in it that they like to eat. Some are there because of other *creatures,* part of a preferred diet; others because they just like rotten stuff. Whatever their reasons, it's best that a decent assortment of tasty and digestible materials in suitable proportions be provided for them.

"Organic" material is any substance that either possesses life or was once alive. That includes quite literally any plant, bird, fish, animal or any other known life form. The definition does not include rocks, metals, glass, plastic, etc., etc. Try as you might, a chunk of *in*-organic material will not decompose in a compost pile—at least not in *our* lifetimes. Once again, the discussion could end right here but each type of organic material has chemical or structural differences about which we would benefit by knowing a *little* more.

A few sentences back, the phrase, "suitable proportions" was used. That refers to mixing the right amount of one type of material, **carbonaceous**, with just enough of another type, **nitrogenous**.

Carbon containing materials. Fall leaves, dry evergreen needles, straw, hay, sawdust (*not* pressure treated), shavings, bark, wood chips, cardboard, "pulp" paper, aged animal wastes and peat-moss are all high **carbon** materials. Moistened and left on their own, they would all eventually decay and become humus or a humus-like substance. In most cases, however, the process is a slow one, sometimes requiring several years or, as in the case of peatmoss, perhaps *hundreds* of years.

Nitrogen containing materials. Lawn clippings, kitchen scraps (vegetable only), weeds, garden trimmings and *very* fresh farm animal wastes (*not* dog or cat wastes) all contain a high percentage of **nitrogen**. Here, again, left to their own devices, high nitrogen materials will decay and become a valuable soil-enriching amendment but lacking the nutritional variety and efficiency of a *mix* of materials.

Combining just the right blend—or "recipe"—of carbon and nitrogen materials (assuming a few other factors which we'll discuss next) and the process of decomposition becomes faster, hotter, and *infinitely* more efficient. An important point to always keep in mind is that **compost happens!** Even if the mixture and all other factors are "out of whack," the stuff is *destined* to break down; it's simply a matter of time.

The "Greens" and "Browns." I could spend several pages talking at mind-numbing length about the phrase **"carbon/nitrogen ratio"** (C:N) but we won't. For the average home gardener, it is enough to understand which materials are made up of high-carbon, and which contain usable amounts of nitrogen, and about how much of each to use for best composting results. So, we'll leave the intricacies of C:N ratio for longer dissertations and advanced courses. (If you require more information about the physics, mathematics and special formulas, contact the Cooperative Extension Service in your area. They'll probably put you in touch with one of growing numbers of Master Composters anxious to help.)

You may have noticed that materials generally listed above as high-carbon are dry, having brown or tan in color. For simplicity, they are commonly called "browns." High-nitrogen material, on the other hand, is almost always some shade of green. An exception, of course, is fresh farm animal waste. They are all lumped under the general heading of "greens."

One more time: *Browns* are dry carbon sources; *Greens* are generally moist nitrogen sources.

When figuring quantities of browns and greens to mix together, always remember that we're dealing with WEIGHT - *not* VOLUME. That's because a whole cartload of loose, dry leaves, for example, would likely weigh very little. But fill that same cart with green grass clippings or fresh manure and it will weigh *considerably* more. If the recipe was based on volume, it'd be all wrong and odds of an efficient composting process would plummet. So remember, we do everything in composting formulas *by* ***weight***.

Reducing a home-gardener mix for a compost pile down to the least complicated terms, if you took 1-part (by weight) "greens" and mixed it with 2½-parts (by weight) "browns," you'd have an almost perfect mix. In more real-world terms, 50-pounds of fresh lawn clippings and 125- to 150-pounds of shredded fall leaves, given application of a few other factors, would quickly turn into a small pile of the best compost you could ask for. Now, let's talk about those "other factors."

Particle Size & Surface Area. Bacteria and other composting organisms work from the *outside*-in, and can only work so fast. If the individual "chunks" in your compost pile are large, the time it'll take for organisms to reach the center increases in proportion to the size of the material. A year might be required to convert a golf-ball-size chunk of dense material to finished compost, even in a "hot," biologically-active pile. Reduce that same lump to irregular ½" pieces or slightly smaller, however, and the process is shortened to two or three months, possibly less.

There are a number of ways to reduce particle size. Chopping with a machete or hatchet is effective but labor intensive. A power shredder-chipper-grinder is very effective but can be a financial burden on the small gardener. Some businesses rent such equipment by the day or half-day, a significant cash savings over purchasing.

While we're on the subject, if you decide to buy a power shredder/grinder, here are a few tips: Resist the temptation to purchase one of those tiny little "home gardener" types. They simply don't have what it takes and you'll almost surely regret the move later. Designed with dinky little hoppers that won't take more than a pitiful few leaves at a time (and probably cause the engine to stall—assuming the leaves make it through to the shredder mechanism), they waste fuel, time and patience. As if that isn't aggravation enough, the advertising may *say* the thing'll chip a three-inch branch but what they don't tell you is that it has to be force-fed by someone with the strength and endurance of an All-American football line-backer. Average human beings like you or I will end up with blisters, sore shoulders and a left-over shaking sensation that would rival a thousand mile trip across washboard roads in the mountains!

I can't tell you which brand *not* to purchase but I can tell you that I don't think there's a better small-to-medium shredder/chipper in today's market than an 8-HP MacKissic. We've tried to wear out the same machine for nearly fourteen years here in our nursery gardens—and we're *still* trying.

A machine with at least a 5-horsepower engine should do the trick in the average small garden. One with an 8-HP engine would be better but will cost more. Also, make sure all of the blades, hammers and flails are homeowner removable and can be sharpened.

Ok. Now back to reducing particle size. A rotary mower will work nearly as well as an expensive shredder/chipper. Spread materials to be chopped on asphalt, a concrete slab or a large sheet of plywood and run the mower back and forth until the job's done. It would be best to aim the discharge toward a fence or wall, and it would be unwise to chop with a mower over gravel. Small pebbles become bullet-size projectiles to break windows, seriously injure bystanders (especially children), puncture shins and terminate pets. Using a "mulching" mower that doesn't discharge to the side might be a better—and much safer—way to go.

A final alternative: although it's not the best method, spreading the weeds, leaves and other too-large materials on a hard surface and jumping up and down on them, or crushing them with the family car will "bruise" their structure, allowing easier access for composting bacteria. Small brush and twigs should be snipped or clipped into ½" chunks. Yes, yes...I know that's a lot of snipping but you want the stuff to compost, don't you? Go ahead. You probably need the exercise.

A caution about shredding: making the particles too small—smaller than, say, 1/4"—means less room for air, a vital element in composting. Remember, bacteria need air, and turning leaves, weeds and other materials into something akin to dust forces most air out. Then, what little air remains is used up *very* quickly. No air translates into: 1) slowed composting process and 2) dominance of anaerobic bacteria, which means: 3) *bad* odors (usually ammonia and hydrogen sulfide - *"rotten eggs"*), 4) unhappy neighbors, and 5) no finished compost for your garden.

Temperature. Temperature plays an important role in *efficient*, biologically active composting. Notice I said *efficient*. While organic materials will eventually turn themselves into compost without human intervention, the process is greatly accelerated when temperatures between 110- and 150-degrees (F) are sustained. No, it's not necessary to install a heater in a compost pile. When conditions are right and all factors come into play, the temperature will rise all by itself.

Here's how it happens: bacteria use nitrogen as an energy source and go to work on carbon, producing a little heat. The cumulative heat generated by a great many bacteria causes a noticeable rise in pile temperature. Assuming a continued supply of nitrogen, food, air and moisture, the bacteria multiply, creating even *more* heat. As a matter of fact, so much heat is developed that it is possible to tap excess heat generated by a compost pile to provide—or at least supplement—heating for a small home. I've also seen plans for greenhouse heating via under-bench compost bins.

Most garden waste contains a great many seeds, and probably some plant, and possibly human, disease organisms. Here are two points about temperatures to keep in mind: three days at a minimum of 133-degrees (F) will destroy almost all plant (weed) seeds; 145-degrees (F) for four or more days is hot enough to kill both animal pathogens and most of those common to plants.

Temperatures are monitored through the use of a metal, long-probe thermometer designed for the purpose, available at garden centers, environmental stores, mail order catalogs and some farm and garden stores. Cost runs between $15 and $40, the primary differences being sustained accuracy, ruggedness and length of probe. Unless you're the type who *simply must* have the best and most expensive, a less costly thermometer should serve the purpose if handled carefully.

Because of the natural insulating properties of compost, and continued activity by microorganisms, temperatures within the properly constructed pile can reach 160-degrees, a critical biological limit. Larger insects can "cut and run" when it gets too hot; but bacteria and other little slow-moving creatures normally found deep in compost piles simply cannot tolerate or escape from temperatures that high. They very quickly die or go dormant, the process is said to biologically "collapse" and something has to be done—*fast!*

Aeration. By now the word "air" should be burned into your mind. Let's burn it in even deeper. Without air, nothing good happens in any compost pile which is supposed to be efficient and biologically active. When the air goes, so also do the aerobic bacteria. When the bacteria go, temperatures fall and efficient composting quickly grinds to a near-halt. So, you see, an adequate supply of air must be maintained throughout the process.

Air also serves another important function: that of removing excess heat, moisture and various gasses formed within the pile. When temperatures climb into or above the dangerous 160-degree zone, it's important to introduce some extra air to allow the materials to cool. Excess moisture can also be a serious limiting factor, forcing air out. To prevent organism death by drowning, extra water must be removed. That's accomplished by turning (or "aerating") the pile—literally turning it upside-down and inside-out.

Air and temperature are closely related. A compost pile's life relies heavily on air. When temperatures go up, the pile needs air. When temperature goes down, re-introduction of air is also required. You judge *when* to introduce more air by carefully monitoring the pile's temperature.

Several methods of introducing air into a pile are available to homeowners. Use of a good-old-fashion spading fork and a fair number of muscle fibers is time-honored and reliable. A special agitating tool is available (cost: $25 to $30) which looks like a long, slender "T" with a five- or six-inch "barb" (or “corkscrew”) on the bottom. Driven into the pile, the barb remains folded and out of the way. Pulling in reverse, however, forces the barb to flip down which consequently "hooks" material deep within the pile and drags some of it to the surface. The method is labor-intensive but moderately effective.

Larger composting operations use specially designed mixing equipment which look and act like a giant, mobile rototiller. A small tractor with a bucket/loader could also be used to turn a larger pile. A small, residential compost bin or pile, however, will get along handily with a spading fork.

Moisture

A pile of dry leaves, wood chips, sawdust, shavings or hay will probably just sit there, essentially unchanged, for *years*. The bacteria and other microorganisms may be there but without moisture they are completely immobile and ineffective. All metabolic processes of microorganisms rely on *just the right amount* of moisture. Moisture provides the fluid path along which microbes travel. Moisture carries food to those that can't move about. Moisture is the required medium for virtually all chemical processes. Without moisture, *nothing* happens in the pile. Too much, on the other hand, and the pile is faced with an even more pressing problem. Water displaces air; at the risk of becoming annoyingly repetitious, *no air* equals *no composting*.

During the composting process, moisture is continually being released through evaporation and as steam if the pile is disturbed or turned. Rain and unwise over-use of a garden hose, on the other hand, will make the pile too wet; you already know what happens then.

If you took a kitchen sponge, wet it, then wrung it out so all you could get with further effort was two or three more drops, *that's* what a properly-moistened compost pile should feel like. It is likely that moisture will need to be adjusted periodically. Just remember the moist kitchen sponge. For you technical-term-and-number buffs, when moisture drops below 40%, things slow down significantly. As moisture exceeds 65%, the process also slows down and little creatures that need air, drown. The ideal moisture content of an efficient biologically active pile is 55% - 60%.

When everything is just right in a compost pile, you can almost here it hum!

Acid?...or Alkaline?

Let's review pH. If you've already read the article on soil pH (www.HillGardens.com/soil-ph.htm), you'll recall that the term "pH" is nothing more than a way of expressing the amount of acidity or alkalinity in an organic material—usually soil. A "sour" soil is acidic, while a "sweet" one is alkaline. Most New England soils and materials available for composting are acidic by nature. The pH scale ranges from 0 to 14, 7 being neutral. Numbers smaller than 7 indicate increasing levels of acidity, those above 7 show various levels of alkalinity. The ideal pH for growing most flower and vegetable crops is about 6.5 - lightly acidic.

pH is adjusted up (to higher numbers) by the addition of ground limestone or wood ashes; down by the use of very high-acid organic matter or commercial sulfur.

Having said all that (to refresh your memory about pH), whether the material incorporated into the composting process is acidic or alkaline is of little importance. Even strongly acidic pine needles and oak leaves will finish out between pH 6.0 and 6.5 (moderately to slightly acidic). Composting extremely acidic materials like blueberry waste, or very difficult products like apple pomace (residue of apple cider production) or seafood waste, presents tricky problems best referred to the experts at your state's University Cooperative Extension Service. Our compost mix is predominantly pine needles, grass and weed clippings. and hardwood leaves (a very acidic mix yet the pH at the end of composting and a few days of stabilization is normally about 6.4).

Mass (Size of the Pile)

A little dab of shredded leaves and weeds in the bottom of a compost bin may have incorporated all the factors—moisture, air, particle size, etc.—but if there isn't enough of the material, it'll do nothing but sit there. A minimum volume of material is required for an efficient process. The minimum: 3' across by about 3' deep—but, in the small home composting operation, never over 5' deep.

"How can I get that much stuff together at the same time?" you might ask. Easy: since it takes *far* more "browns" than "greens" to create a good mix, and since "browns" do not decay at an appreciable rate independent of a moist nitrogen source, store dry, carbonaceous materials like leaves, straw or hay while you can or when they're in season. Then, as you accumulate some high-nitrogen materials, build the pile layer by layer. We almost always have a big pile of uncomposted pine needles and fallen leaves waiting for the next cart-load of lawn clippings or garden trimmings. You could also enlist the (usually more than willing) help of a neighbor or two. Many would be *thrilled* to give you all the weeds and grass clippings you'd care to haul away for them.

At Last...Time

All of the factors discussed above have a direct and combined bearing on the length of time required to complete the composting process. The closer you stick to the "rules," the faster things happen. Compost which needs to be thoroughly cured, dry and stable takes a little longer; material which can be spread and incorporated into the soil well ahead of actual planting won't need to spend as much time in the compost pile.

Generally speaking, it should take a well-ordered and tended backyard pile about two to three months to convert yard and kitchen vegetable wastes to dark, crumbly, nutrient-rich compost. Simply heaping organic waste in a pile over there in the corner and allowing it to break down entirely on its own is called "passive" composting. Done passively, the process can take anywhere from 6 months to 3 years depending on the type of materials. Fresh lawn clippings and garden trimmings break down fairly fast. Leaves, unless mixed with other materials, will take a *long* time.

Different Composting Systems

It is possible to shorten the time to as little as 48 hours, using a tunnel-like, constantly rotating, environmentally controlled mechanism called a "digester." Commercial operations utilizing a digester are usually huge, exquisitely expensive to construct and maintain, and must be precisely monitored and controlled.

Farms and community composting projects frequently use the windrow method, where materials are mixed in correct proportions, maintained in long mounds and mixed, when required, by machine.

Garden-size rotatable composting drums (made of recycled plastic or old metal barrels) will supply you with finished compost in as little as 14 days but must be rotated daily and closely-monitored. Costs of a pre-manufactured unit can top $1000; a large, salvaged oil drum fashioned into a rotating container, combined with two saw-horses, costs *markedly* less.

An easy-to-construct and manage composting enclosure can be made of: (1.) 48-inch fence wire formed into a 3½- to 4-foot circle (12 to 13 feet long will do the trick) and anchored with four corner posts made of wood or metal (cost: $25 +/-); (2.) essentially the same, except made of snow fencing (cost: $15 - $25); (3.) cement blocks stacked into a 3-sided bin (leaving spaces between blocks for air movement) (cost: $40 - $60); or my favorite, (4.) four recycled pallets placed on edge to form a "box" fastened with wire or synthetic cord at the corners (a fifth pallet should be laid flat in the bottom to allow for additional air circulation and to keep tree roots and rodents *out*). A detailed description of this pallet compost bin can be found in an article at www.HillGardens.com/composting.htm#21-day.

Two units made of pallets, standing side-by-side are especially convenient. When it's time for turning, simply move the material one fork-full at a time from one bin to the other. Adding a third bin would give you a place to store either the finished compost, or uncomposted "browns" waiting for enough "greens" to put together a new pile (likely cost of a 5-pallet bin setup: $0, assuming you can find a source of free pallets; can't beat that!). Talk to your local contractor, big hardware store or trucking company. They'll probably be grateful to have you take a few used pallets if you explain what they're to be used for. Some, however, have realized the marketability of second-hand pallets and may ask something in the range of $5 each. Still a bargain when you consider the cost of concrete blocks and the energy required to move and stack them!

Standard pallets are roughly 4' x 4', are normally constructed from *very* durable wood and are "two-sided" - one side having only three or four boards while the other side (or top) has evenly-spaced boards covering nearly the entire surface. Try to get sturdy, serviceable pallets which aren't broken or missing important parts. I've found that I can just slide a standard pallet into the trunk opening of our medium size family car. Perhaps you can get the trucker to drop a few off on his next trip through your neighborhood. You'll never know unless you ask.

Garden centers and environment-conscious stores are almost awash with commercial, usually recycled plastic, composting bins. Some work well; others leave quite a bit to be desired. At prices ranging from $49.95 to hundreds of dollars, I'd recommend the more economically conservative approach of five pallets or a few feet of sturdy wire fencing.

Finally, an open (un-enclosed) "heap" will work almost as well as more expensive bins ***if*** the pile is put together according to "specs" and large enough to allow the build-up of necessary heat. Minimum footprint size is 5' x 5' and nothing under 3' tall but, again, no more than 5' high. Leave a slight depression on top to allow rainwater to soak in, and arrange for some sort of drainage beneath, unless the pile is constructed on a bed of pallets. A 4- to 6-inch layer of very coarse material like twigs and branches will serve the purpose. Perforated air-pipes would be a good idea. You monitor and turn this system just like you would a bin type.

Now...**Let's Put It All Together!**

Let's assume that you have decided to start a compost pile, and are now ready to make a commitment to composting your household and garden waste rather than see it buried in a landfill or turned into valueless ash. Also assume that you have constructed the simplest composting enclosure - for the purposes of this discussion, 4 pallets securely tied together and a 5th in the bottom for air and drainage. You've gathered up (1) a pail or two of kitchen vegetable scraps (including recycled paper towels, napkins and some "pulpy" paper products like fast-food restaurant carrying trays, and toilet tissue cores or paper towel tubes); (2) a bunch of leaves, spoiled hay and a basket of "stuff" raked from gardens and paths; (3) a spading fork; (4) something with which to chop or shred those gathered organic materials; (5) a sprinkling can full of water (or a garden hose); (6) an accurate long-reach thermometer; and (7) a quantity of fresh lawn clippings.

Some books on the subject will suggest you build your pile layer by layer - first some browns, then some greens; then some manure, probably followed by a thin layer of soil. Then you start all over again. I've found the most efficient (and convenient) method is to create the proportional mix while it's being shredded. First, 4 or 5 handfuls of leaves, then one of grass or weeds; shred a shovelful of manure, followed by 4 or 5 handfuls of leaves, etc., etc. When all the ingredients are chopped into little pieces and mixed together in a pile (you'll end up with a much smaller volume after shredding or chopping), *then* transfer the lot to your bin or other enclosure. About every 5 or 6 inches of depth, wet it to the desired moisture level (remember the wrung-out sponge?) and add another 5 or 6 inches.

Continue building layer upon layer until all of your material is used up. I like to "cap" the pile with about 4 inches of whole or shredded pine needles or leaves for insulation and to make sure heat builds right up to the top of the shredded mix. (*I really want to eliminate any and all seeds and plant pathogens!)*

Insert your long-probe thermometer into the pile's center and put your tools away. Here's what happens:

By the next day, the temperature in the pile will have reached something over 100 (F) as bacteria (which are already part of the mix) begin the process of chemically reducing big pieces (relatively speaking) into little ones. During the next couple of days, heat will have built to the mid-140s all the way out to within a few inches of the pile's edges. Microorganisms are doing their hardest work now, during the "thermophilic" stage.

Keep an eye on your thermometer because after a week or so, temperatures will begin falling (unless the pile is artificially aerated). When the temperature reaches just over 100, rake off the insulating top layer and set it aside—you'll be needing it a little later. Turn the pile one fork-full at a time, making sure that the outside edges are moved into the center, increasing your chances that all seeds and pathogens in the mix will be destroyed. Re-shape the pile, insure moisture levels are about right and replace the insulating top layer.

Temperatures should go back up to about 140 and hold for perhaps another week and a half, then start to fall again. Turn again and follow the same routine. Any time during this process, you can add more correctly shredded and mixed material, including more kitchen scraps. As temperatures fall to below 100 degrees and remain there (the "mesophilic" stage), fungi and the larger organisms and insects move in to continue mechanical breakdown of remaining larger particles. Earthworms, slugs, millipedes and others tunnel through the cooling pile, chewing, digesting and aerating until the job is completed.

Continue tending the pile until its temperature stabilizes at about the same as surrounding air. At this point, I like to give it one last turning, and then let it stand, undisturbed for about one month for curing (or "stabilizing") to take place. Stabilization neutralizes any remaining toxic elements and allows excessive nitrogen to volatilize. If you did it right, about 60 to 75 days will have passed and your finished, weed-and-pathogen-free compost is ready to use.

Contaminants *("NO-NOs")*

Some things just weren't meant to be put into the compost pile. Meat, fats, peanut butter and mayonnaise, for example, will sit there in smelly, greasy lumps until every cat, dog, raccoon, skunk, porcupine, squirrel, rat, blue jay and crow within miles move in and tear your pile apart. Flies (by the *zillions)* will be attracted to those things, too. (By the way, you'll only see an occasional small fly on or near a properly-constructed compost pile.) Don't put bones or dairy products in there, either.

Solvents, oils, tar and other inorganic substances mentioned above will also do nothing but harm and cause grief.

There's been a fair amount of discussion and disagreement about the use of pressure-treated wood in a composting enclosure. Of course you should never put anything in the pile which has a decay-retardant on it, like sawdust and shavings from CCA (copper, chlorine and arsenic) pressure-treated lumber; that would defeat the purpose of composting. The CCA pressure-treating industry has done a bang-up job of convincing the government of the near total harmlessness of their product but, as you might have expected, strictly organic farmers and gardeners strongly disagree.

My feelings? When I see absolute, unwavering proof that the arsenic, copper and chlorine (and possibly other compounds) used in the manufacture and processing of pressure-treated wood products are *totally* safe or *absolutely* will not dissolve and leach into soil or compost - *then*, I might consider using it. For now, cedar or hemlock will probably last longer than I will and suits my purpose just fine.

Activators

Virtually every shred of organic material in existence naturally contains, on or in the material, at least a few suitable decay-causing bacteria. Proof of that lies in the fact that leaves, grass, weeds, bark and garbage rot *all by themselves*. I have seen no evidence that adding an expensive "compost activator" (any product which is supposed to add bacteria, fungi or some enzymes to a compost pile) actually improves or enhances the composting process. Save your money and toss in a handful of garden soil or a shovelful of barnyard manure once in a while. You'll get all the micro-organisms you could ever possibly use.

Now, What?

So now, after two and a half months, you have a pile of the best looking, richest compost possible—a little less than half the volume you started out with. What do you do with it?

Use it in your vegetable or flower garden, thoroughly mixed in with a hoe, spade or tiller. It's wonderful as a nutrient-rich mulch around trees, shrubs and other plants. Compost can be added to potting and transplanting mixes and can be half-inch screened and used as a top-dressing on lawns in the spring. Foliage, grass, flowers and vegetables absolutely *thrive* in compost-enriched soil. And, of course, a surface mulch of compost will effectively discourage slugs because of its near-neutral pH, and provide harbor and forage for beneficial, predatory insects.

Using compost not only enriches the soil, it conserves valuable resources—to the ultimate benefit of our gardens, the enrichment of our personal satisfaction and well being and the character and appeal of our community as well. Hard to beat a bargain like that!