

# WOOD CHIPS AND SLUDGE FORM RICH COMPOST MIX

by John A. Kerr

Conservationists of trees and wood by-products will see the day, if they haven't already, when their wood becomes a vital resource for a multitude of applications. In the last few years, researchers with the U.S. Department of Agriculture have found that wood chips mixed with sewage sludge produce a rich form of compost. Cities around the country are starting to make and market the compost and its reaction from users has been very favorable.

Problems of sewage disposal have forced cities to look for new methods. Legislation has imposed strict limitations on incineration (Air Quality Act of 1967), fresh water dilution (Water Pollution Control Act Amendments of 1972), and ocean dumping (Marine Protection, Research and Sanctuaries Act of 1972). Moreover, the cost of these methods has tremendously increased as has the amount of sludge production. Thus, scientists working on the problem discovered that composting the sludge with wood chips was a viable alternative.

A team in Beltsville, Maryland, used a windrow method, which proved suitable for composting digested sludge, but unacceptable for composting undigested sludges because of their higher number of malodors. The answer to disposal of the undigested sludge resulted in an aerated pile method of composting, developed by Dr. Eliot Epstein, a research soil scientist at the time with the USDA.

The sludge is mixed with wood chips and then composted in a stationary aerated pile for 21 days. Sludge at this moisture content (78 percent water) will not compost aerobically alone because sufficient air cannot penetrate the biomass, either by diffusion or forced aeration. The chips, acting as a bulking material, provide the necessary texture, structure, and porosity for aeration; lower the moisture content of the biomass to about 50 or 60 percent; and provide an additional carbon source for micro-organisms to ensure rapid composting.

Once the sludge/wood chip combination is homogenous, a front-end loader lays the mix over perforated plastic pipes which are connected to a blower that draws air through the pile. The effluent air stream is conducted into a small pile of cured compost where odorous gases are absorbed. After the initial 21 days, the sludge is stabilized by the rapid decomposition of volatile organic solids and must be cured another 30 days. Curing allows dissipation of any phytotoxic gases and offensive odors, and ensures more complete destruction of pathogens. The compost is then ready for use.

Applications vary as much as each community's style of composting. Epstein thinks its best potential use is in sod and turf. "Instead of 16 to 18 weeks (an average time for a sod crop), sod can grow six to eight weeks on the compost, and it is light weight without the turf," he says. It also works well for revegetation of strip mines and gravel pits where it doesn't get into the food chain. Thus, permits are easy to obtain because health is no question, Epstein says.

## Close-up of cured compost

shows the rich qualities created from the combination of sewage sludge and wood chips. Heat underneath the surface of the pile reaches 170°.



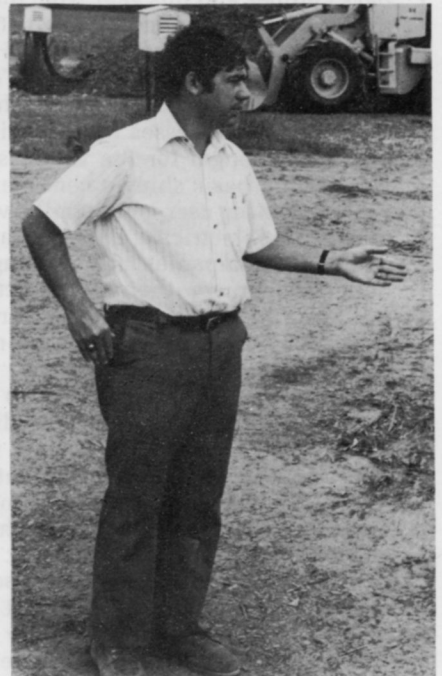
Questions of health, system operation and maintenance, cost, and climatic impacts still had to be resolved and the Environmental Protection Agency initiated a composting project in 1975 in Bangor, Maine, to obtain answers. At the same time, Ralph Mishou, superintendent of waste water treatment in Bangor, and his assistant, Tom Ham-brock, were considering the increased cost of fertilizer and all the sludge they were hauling to dump. The EPA's request to use their city as an experimental station turned thought into action.

With EPA's financial and technological backing, the Bangor crew built its first pile in August, 1975. By the end of July, 1979, they had built 201. "It's a shoestring operation," says Ralph Mischou, "hardly mechanized. We only use a front-end loader for mixing and tearing down piles to operate at minimum cost." Mishou figures they get back almost half of what it costs to make the compost, about \$11 a cubic foot.

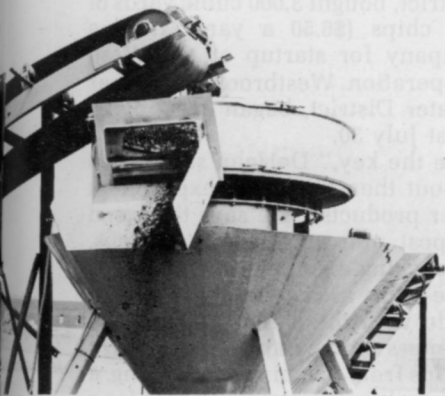
The city sells the compost and income goes back to the treatment plant's account. Going rate is \$5 a cubic yard for nurserymen and home gardeners and \$4, or the same cost of loam, for any municipal operation. Public works uses it with loam for reseeding and the parks department puts one application a year around shrubbery and trees. People in Bangor have found that a 50-50 mix of compost and loam produces a much better growth of grass than just loam. The nitrogen locked into the compost slowly releases for the seed.



**Plastic pipes** hooked up to a holding tank with a fan draw liquid waste and odors from compost piles.



**George Crombie** stands on the pilot project in Durham, NH, he helped engineer.



**Screening the finished product** removes bulky, unworkable matter, and also recycles many valuable wood chips.

**Logs fed** into this chipper are ground into wood chips and then trucked to composting sites.





## Tree operation cultivates uses for wood chips

Two to three years ago, Jerry Osborne, owner of Osborne Brothers Tree Service in Mentor, Ohio, burned the trees he axed for site clearing. That was before he and many others knew the potential of wood chips. "We used to blow them into the ground," he says. But that was two or three years ago.

Since that time Osborne has purchased a Morbark chipper and this year from the first of April to the middle of July had chipped 100 90-yard loads, which fill a Bocat semi-trailer. He sells the majority of these loads to CertainTeed, a company about 80 miles from Mentor, which makes shingles. CertainTeed processes the chips into fiber, which provides strength for the shingles, and then adds tars for the basic shingle consistency.

Another big user is pulp mills which burn chips to generate electricity. Osborne says that in Michigan some companies are burning wood in huge boilers to power their manufacturing plants or utilities. "Since trees can be harvested every 15 years, they are a recoverable energy source — not like oil, gas, and coal," he says.

Many of the contractors who Osborne clears ground for with his National Hydro-Ax brush cutter ask that he leave the woody remains on site. They appreciate wood's nutrients blended with their soil. Otherwise, Osborne may mix the fine pieces with topsoil to make mulch for vines, trees, and plants and use it on the site.

Other sites which need landscaping may find Osborne's chips. One unique spot is along railroad tracks, where Osborne's crew built a sound barrier, topped with dirt. Over the slopes he plants crown vetch or ivy and on the top he plants evergreen or deciduous trees.

Since the larger trees can't be cut like brush, Osborne utilizes a Hydro-Ax with attached shearing blades to chop them. A Timberjack skidder bundles the trees and carries them to the chipper which has a hand-like claw that places the trees into feed rolls which automatically draw the trees in. The chipper fills a Bocat load weighing 25 to 30 tons in three to five hours.

The equipment involved is worth about \$750,000, according to Osborne. Yet there are more buyers than ever. Landscapers purchase a load for \$750. Osborne will sell a tandem load, which holds 20 yards, for \$150.

Not a chip gets wasted anymore. "The future is in wood chips," Osborne says. "We think they will be a good business."



**Ralph Mishou**, superintendent of wastewater treatment in Bangor, Maine, captains one of the original sludge composting operations.

"We sell everything," Mishou says. "Last year we were turning everyone away." And this was with virtually no advertising.

Although the economic considerations are important, income is not the overriding motive for composting. "You have to look at it as an alternative to sludge disposal," Mishou says. "You're recycling a product, it's environmentally safe, and cost effective compared to incineration and land-filling."

Wood chips presently come from arborists, landscape contractors, fence post makers, tissue manufacturers, and anybody else that's working with wood. Yet, even in Maine, the chips must be conserved, because many mills are starting to burn them for energy.

The Bangor project has proved that sludge composting is an effective means of turning an odorous eyesore into a marketable product. It also shows that the process can work in a cold, rainy climate. Other operations are beginning, one modern facility being 130 miles south of Bangor, near Portland, Maine.

Roger DeHaan, solids handling engineer for the Portland Water District, bought 3,000 cubic yards of high-quality wood chips (\$6.50 a yard) from a nearby paper company for startup of the Westbrook composting operation. Westbrook, a member of the Portland Water District, began aerating its first pile of compost July 30.

"Wood chips are the key," DeHaan says. "You can't compost without them. We may experiment with bark and other products." He says the wood chips keep a compost pile permanently porous, "like the effect of sucking air out of a sponge."

DeHaan says the chips are mixed by front-end loader in a 3-1 ratio with the sludge. He will be implementing screeners with  $\frac{3}{4}$  and  $\frac{1}{2}$ -inch mesh to recover larger chips from the mix for recycling, a technique Bangor occasionally uses. He hopes for a 50 to 75 percent return. With a larger mesh, the final product is best suited for lawns and around shrubs and trees, whereas a small mesh makes a finer mix for growing sod.

"We lose the fines in screening and this way we can use the good, clean chips over," DeHaan says. Eventually he would like to do his own chipping, which would operate in the woods among the birch, maple, hemlock, fir, ash, white pine, and oak of the area.

Experiments are being conducted on the Westbrook site, monitoring air for *aspergillus fumigatus* as well as checking the safety of the compost.

*Continues on page 18*

DeHaan says there is no danger of pathogens in the compost after it has been aerated and cured because microbes in the wood chips and sludge produce natural bacterial action which increases temperatures in the pile from 160° to 170° F. The heat pasteurizes and kills pathogenic bacteria and thus the compost is suitable even for food-producing crops. DeHaan tells users about Maine's guidelines, which say the compost should not be used for food crops for 180 days after the sludge has been added.

DeHaan says the compost will be distributed for free on a trial basis when the first batch is ready some time in September. In Durham, New Hampshire, George Crombie, public works director and head of the town's composting operation, is doing the same. "We would like to market it," Crombie says. "So far we have put our efforts and energy into the operation."

It is easy to understand this when you see what is being constructed in the town of 20,000 — more than half students. Grabbing the eye, is a \$1,000,000 wastewater treatment plant/composting site, the first of its kind. Since the city needed a new treatment plant and its composting pilot program had been quite successful, it was granted the funds, only \$50,000 of which came from the city.

Durham is a model city for the use of sludge compost. Throughout the city — along sidewalks, in road medians, surrounding parking lots — 18,000 annuals are planted each year, all fed with the compost. In soccer fields and baseball fields it is integrated with soil as a soil conditioner for aera-

tion. It is mixed with loam on a number of projects. The state highway has used it for land reclamation.

Crombie agrees that the wood chips are essential to operation. He initially thought that New Hampshire would have an abundance of wood chips at a low price, but this was not the case. The paper mills in the state take all of the wood chips and have unloading platforms at the plants to automatically dump the 40-ft. trailers. An unloading dock had to be built and a bobcat loader used to unload the chips at the composting site.

During the search for chips it was found that the blades on the sawmill were set for ½-inch chips (which the paper mills required) and it was very difficult to induce a sawmill to change its blades for a ¾- to 1-inch chip for composting. Eventually, the chips were delivered to the site for a price which proved to be a major portion of the cost per pile of composting.

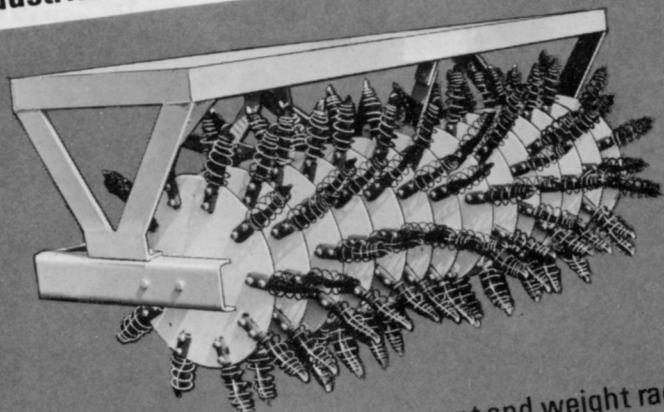
Crombie experimented with various sizes and ratios of wood chips before deciding on the best for the expected application. He found that to use as a top dressing for turf establishment, he needed to screen the chips through a fine mesh of ⅛ to ¼ inch. He could also use the small mesh in dry weather, but when it was wet the material needed a larger mesh to screen through.

A mixing of one part sludge to three parts wood chips gave the most consistent results for overall mix, especially during the winter. During summer months, a ratio of five parts wood chips to two parts sludge was satisfactory.

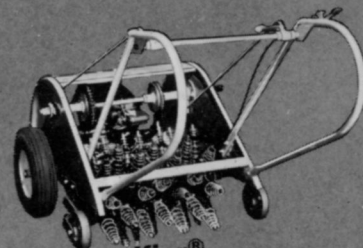
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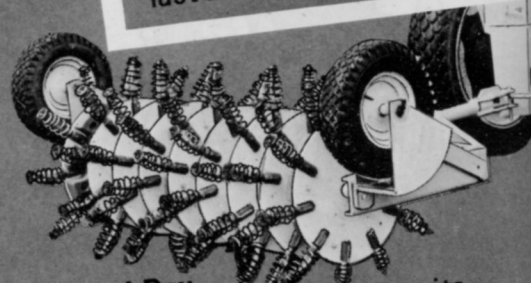
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Moisture and other climatic problems will not affect the new operation, which will be done completely inside. A conveyor will move the sludge to a pug mill where another conveyor will bring wood chips. All mixing will be done automatically.

Crombie says that a greenhouse may be built next to the treatment plant. If so, it is possible the greenhouse can be heated from the hot air being drawn out of the compost piles.

This won't be the first greenhouse in Durham. And it won't be the first greenhouse connected with sludge compost in some way. At the University of New Hampshire, Professor Douglass Routley from the Department of Plant Science is growing chalias, geraniums, chrysanthemums, and bedding plants in a greenhouse.

"I have received better results than with artificial commercial peat-lite mix," he says. "There are fewer disease problems." Routley says a major advantage of the material is that it never has to be sterilized since the composting itself is a sterilizing process.

"Many industrial communities can't use it for food crops because of a high metal content, but it is excellent for ornamentals, flowers, and nursery crops," he says. Another use, according to Routley, is as a top dressing on golf courses.

Routley, like many others working with the compost, sees immediate value for it with growing sod. He has grown it with a couple inches of compost on top of plastic. Since it does not have to be as thick as regular soil, it reduces the time of digging and cutting, also saving labor and space.

Routley thinks because of its darker color, it will absorb more energy and there's a possibility of growing two crops of sod a year in the spring and fall. Landscapers would then have a crop of sod for summer and spring.

The number of uses for sludge compost becomes even more illuminating with the seemingly infinite supply of bulking materials available. Wood chips may become too valuable as an energy source for composting. But experiments have already been done with other wood byproducts — paper cubes, bark, paper pellets, leaves, and licorice roots — with mostly successful results.

"Where the community is determines what waste materials can be used (for bulking)," says Eliot Epstein. He cites a list of wood and paper products in a bulletin from the Canadian Waste Materials Exchange. Certain regions in Canada have huge amounts of available wastes, such as 500 tons a day from sawmills, 25 tons a day from paper mills, 60 tons a week from demolition lumber, and 40 tons a week from publication paper. The list goes on for Canada and must be fairly similar for the United States.

Sludge composting may be one of the largest recycling efforts of the future. "I think it has tremendous potential for small treatment plants which serve up to 250,000 people," Epstein says. For larger cities, there are more challenges, but as they run out of room for land-filling and legislation prohibits other means of disposal, they too may be turning their sewage sludge into compost.

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