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A COMPOST BIN FOR HANDLING PRIVY WASTES: ITS FABRICATION AND USE

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Abstract. A 24-ft^3 (6.8-m^3) fiberglass bin was constructed and tested for its effectiveness in composting privy wastes. A mixture of ground hardwood bark and raw sewage was used for composting. Temperatures in excess of 60°C for 36 hours were produced in the bin by aerobic, thermophilic composting. This temperature is sufficient to destroy most pathogenic microorganisms. Composting in a leak-proof bin seems a safe, practical, and economical method of handling privy wastes.

The safe disposal of human wastes is a common problem at backcountry recreation sites. Pit privies often are not effective in these remote areas because the soil usually is too shallow or poorly drained. Other methods of waste disposal such as leachfields or incineration are often too expensive or impractical; most overnight shelter sites are located at high elevations and are situated on bedrock (Fig. 1). We found that composting seems a safe, practical, and economical method of disposing of privy waste.

Some of the available information on composting (Golueke 1972; Poincelot 1974; Gray et al. 1971) describes configurations of compost piles and containers for a variety of conditions; much of this information is applicable for composting privy wastes. We constructed a leak-proof, fiberglass container and tested its effectiveness in composting privy wastes at shelter sites that accommodate as many as 30 visitors per night.

CONSTRUCTION

The container, called the "Bin Composter", is a 24-ft^3 (6.8-m^3) fiberglass box (Fig. 2). Its inside dimensions are 3 feet (.99 m) x 4 feet (1.2 m) x 2 feet (.61 m); the highest end is 3 feet (Figs. 3a, 3b, 3c, 3d). At the low end is a small slide-out door that allows access to the compost pile for loading or mixing. All sections, including the bottom of the unit, were made from 1/2-inch (1.27-cm) exterior-grade plywood. The sections were nailed together and the entire unit was covered with fiberglass for leak-proofing. We used polyester resin and 1-1/2-ounce (42.5-g) fiberglass mat.

We constructed a unit large enough to ensure that (when full) heat production exceeded heat

Figure 1.—Note the absence of roads at this backcountry shelter site. The high elevation is evident from the exposed bedrock, shallow soil, and exposed ridgeline in background.

Figure 2.—The 24-ft^3 fiberglass Bin Composter.

Figure 3a.—Full view of composting bin.

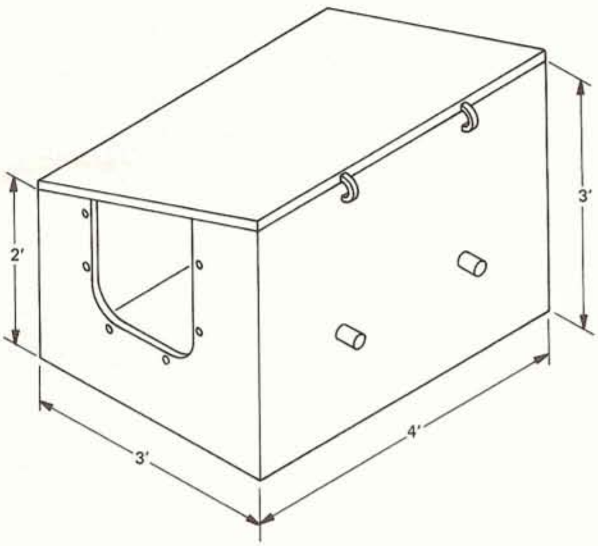


Figure 3b.—Top view of composter, solar panel cover removed.

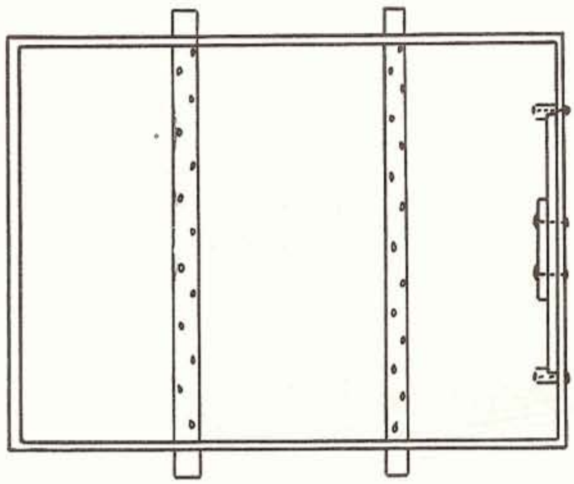


Figure 3c.—Side view of composter.

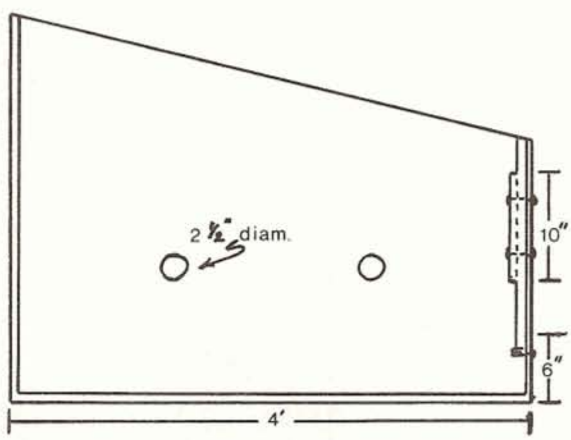
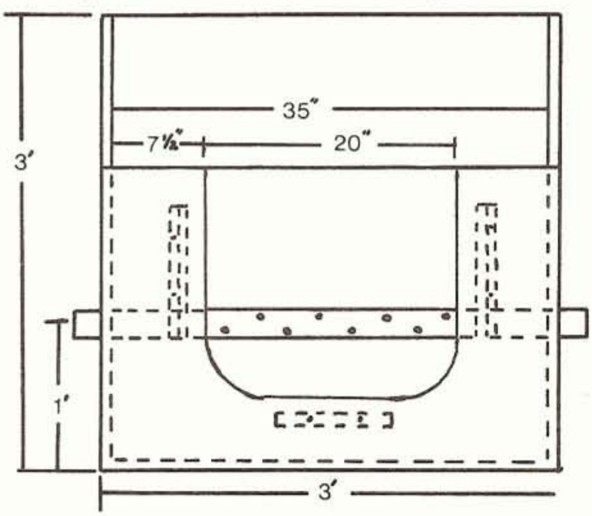


Figure 3d.—Rear view of composter.



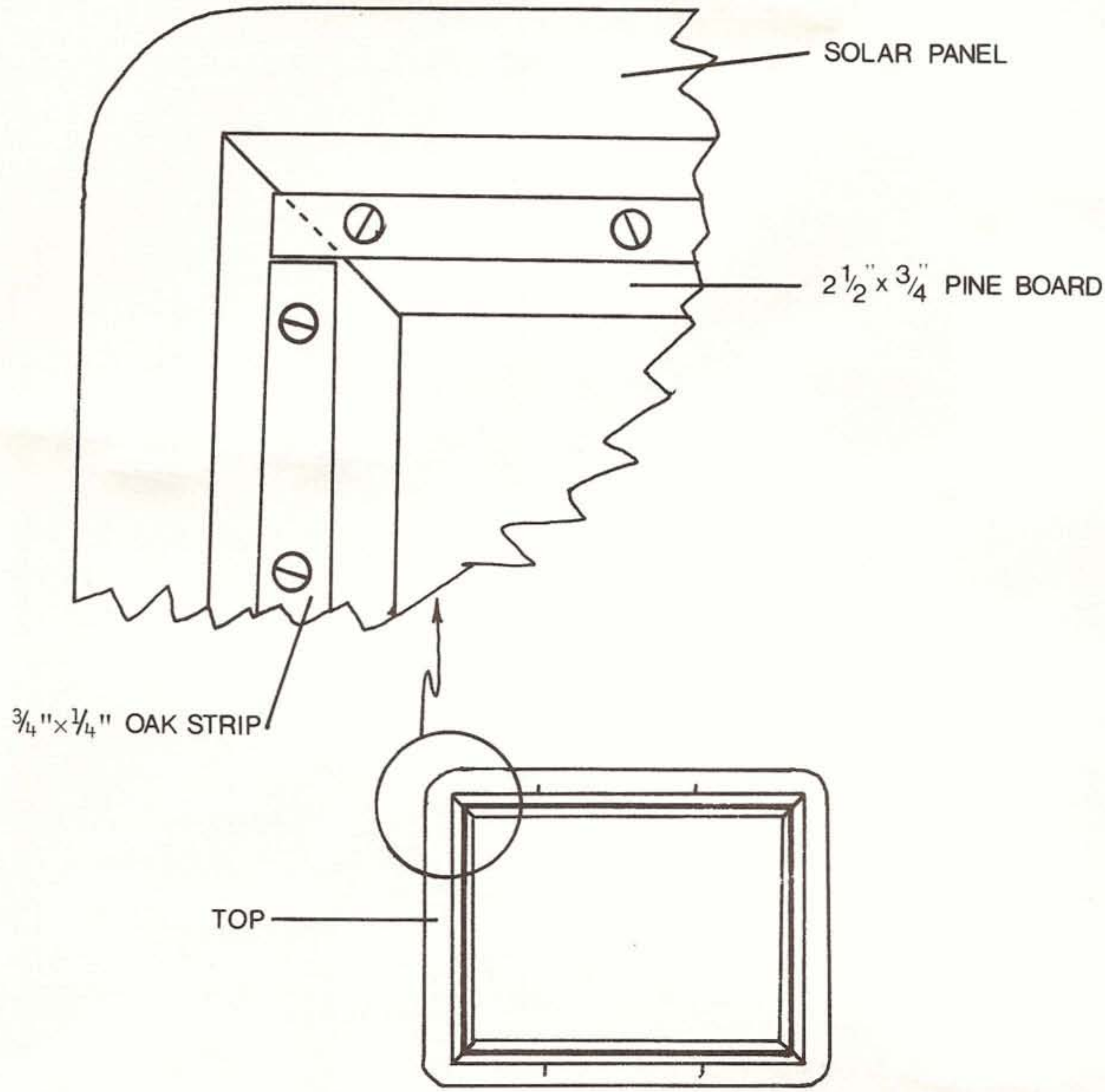
loss in the compost pile. The result was a small, transportable unit that produced and maintained relatively high temperatures.

The top of the bin was made of solar panel .040-inch (.1016-cm) in a wooden frame of 2-1/2 x 3/4-inch (6.35 x 1.90-cm) stock softwood, and 3/4 x 1/4-inch (1.90 x .635-cm) hardwood (Fig. 4). The top is attached to the box by hooks and eyes for easy removal. When attached correctly, the top prevents rain from entering the container, and helps collect and retain heat, though this is not essential.

Two perforated tubes, each 2-1/2 inches inside diameter, were driven through the pile (Fig. 3b). Each tube was a 3-1/2-foot section of PVC pipe; a 1/4-inch hole was drilled on three sides. These tubes increase the aeration in the interior of the pile when the bin is full.

The compost bin is designed for use with a privy. Human waste is collected in a container under the privy seat, and is transferred to the bin periodically. In some privies, the space under the seat is large enough to accommodate a fiberglass container holding as many as 60 gallons (227 liters) of waste. A small space could accommodate a 10-gallon (37.8-liter) galvanized bucket. The privy and bin should be placed close together to simplify the transfer of wastes.

Figure 4.—Solar panel cover for composter.



OPERATION

The bin promotes aerobic, thermophilic composting by a combination of ground hardwood bark or other dry organic materials—such as peat moss or leaves—and raw sewage. The bark that we used was ground from northern hardwood debarker waste to about the texture of peat moss. This material is effective for composting because it eliminates odor from the sewage, absorbs moisture, and provides a source of nutrients for the decomposing microorganisms.

The bark-sewage mixture should be of a consistency that allows it to be picked up with a standard manure fork. It should be moist but not dripping. The amount of bark needed for this consistency was determined by the fecal-urine ratio of the waste. We used from 4 to 7 pounds (1.8 to 3.2 kg) of ground bark for each gallon of waste.

We thoroughly mixed the bark and raw waste in a series of small batches to prevent the formation of clods, in which anaerobic conditions can exist. The bins were filled to the height of the lower end of the unit (a depth of 2 feet).

Figure 5.—The compost pile must be exposed to a temperature of 60°C for 36 hours for destruction of human pathogen indicator organisms. Temperatures in the bin reached or exceeded 60°C for 7 days.

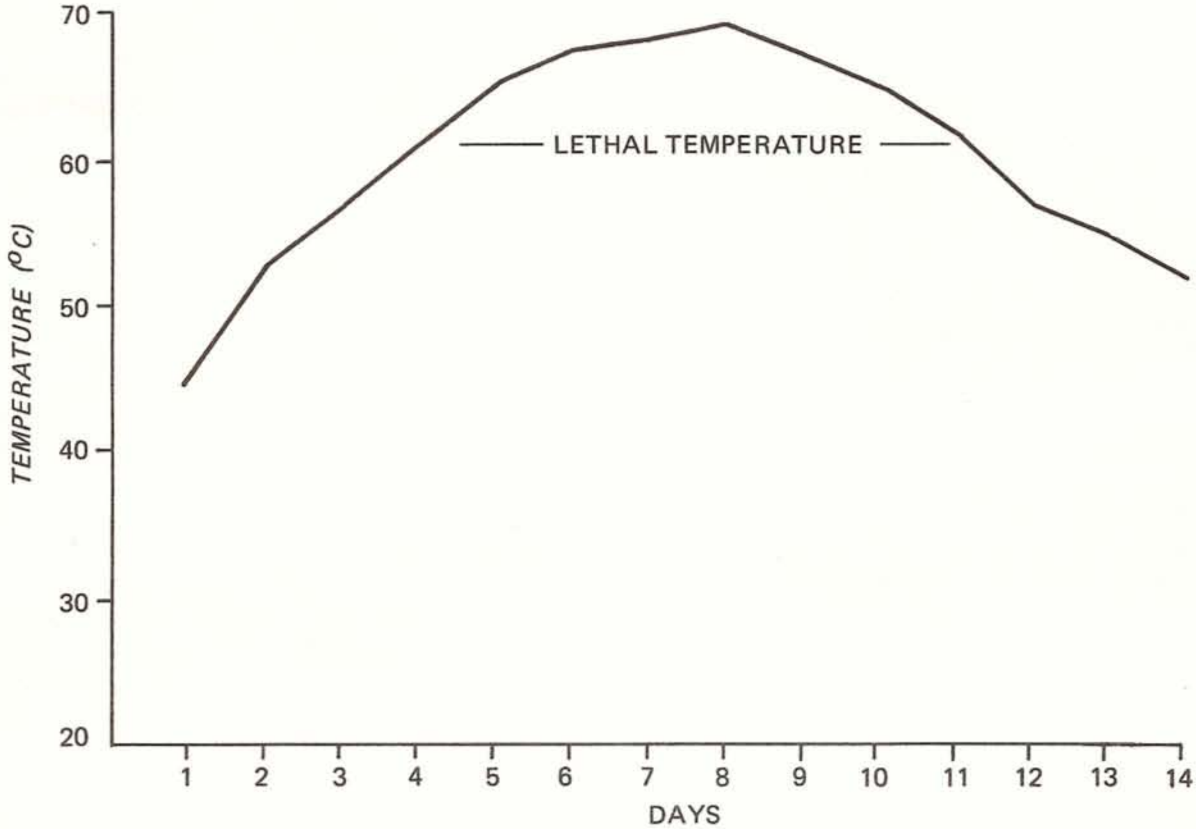
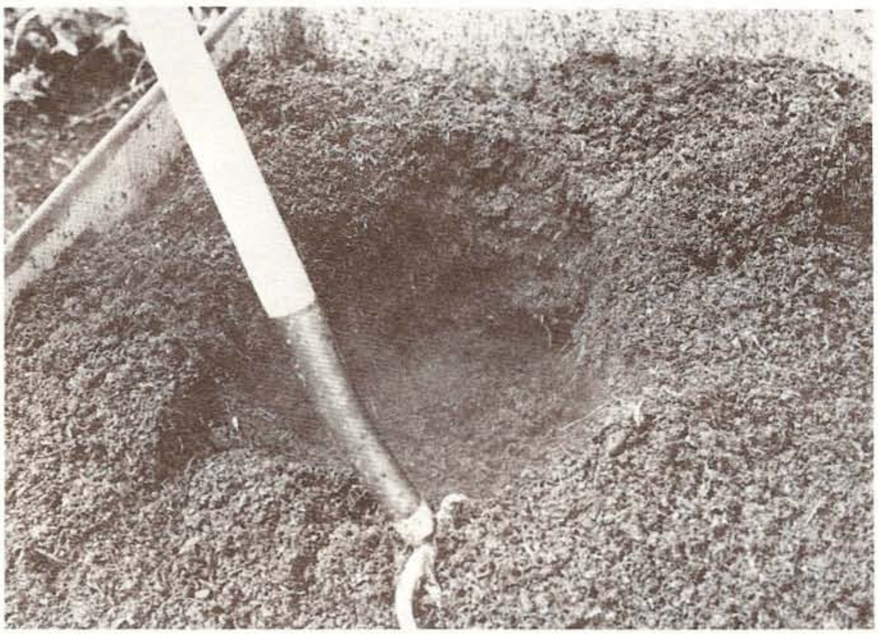


Figure 6.—Composted hardwood bark and raw sewage.



A thermograph probe was inserted into the center of the pile to monitor the temperature, an important indicator of aerobic decomposition. In our test run (Fig. 5), the temperature inside the pile exceeded 60°C for 7 days. A temperature of 60°C must be maintained for at least 36 hours to destroy human pathogenic indicator organisms in windrow (ground bark/raw sewage) compost piles (Walke 1975). Because the exterior of the pile does not reach this lethal temperature, the pile must be turned "inside out" to ensure that the entire pile is composted. The pile should be turned after the first 36 hours at 60°C.

The final product of the composting process is a dark brown, humuslike substance which can be reused in at least one more "compost run" (Fig. 6). Once the ratio of carbon to nitrogen in the composted bark reaches an acceptable level (for controlling microorganisms), the compost can be scattered on the forest floor or used to recondition the soil in worn areas (campsites and along trails). As with any nutrient-rich mixture, this material should not be used near water sources.

The number of compost runs each season depends on the amount of use the privy receives. Most backcountry overnight sites in New England collect 100 to 150 gallons (378.5 to 567.7 liters) of privy waste. This results in two compost runs each year.

DISCUSSION

There are several points to consider in operating a bin composter. Most important, composting is as much an art as it is a science. For example, no manual can adequately describe the appearance of the bark-sewage mixture when it attains the proper moisture content; so the caretaker must have some experience or receive training in the field.

The unit may emit an ammonia odor that is barely detected or unimportant to many. However this odor is an indication that the pile is becoming anaerobic. The earthy odor of a properly operated pile is equally difficult to describe, yet it is an important indication that the process is working well.

The temperature of a compost pile is probably the best indicator of good, aerobic composting. A thermometer that reads to 60°C and beyond can be placed in the center of the pile after the material has been mixed. There should be a fairly rapid increase in temperature within a few days of starting the pile. If this increase does not occur, the most likely problem is too much moisture. Turning the pile with a pitchfork or adding more bark usually will solve this problem.

We know that bark is a good mixing agent, and experience suggests that the bark should be fairly fresh—not more than 3 or 4 months old—when used. At this age, the nutrient supply in the bark is at a maximum. Also, the bark should not be dried before use; drying seems to draw out oily substances, and reduces the capacity of the bark to hold moisture.

Little time is needed to operate a compost bin. Depending on location, packing the bark to the site requires about 4 days during the summer; actual operation of the unit requires 2 to 3 hours each week.

SUMMARY

The primary advantage of composting wastes in a leak-proof bin is that the unit is largely independent of site conditions; that is, the self- contained system can be used regardless of soil conditions—even when there is no soil. This feature is especially advantageous at high elevations.

The price of the bin is about $100, including materials and labor. The most expensive material is the fiberglass; however, the use of fiberglass makes the unit leak-proof, durable, and resistant to damage by animals, including porcupines.

The size and weight (about 70 pounds) of the bin allows it to be transported on a packframe by one person. It has been our experience, though, that it is difficult to carry the unit where there are low-hanging limbs or closely spaced trees, so it is best to use a trail that is wide and brushed.

LITERATURE CITED

Golueke, C. G.
1972. **Composting: A study of the process and its principles.** Rodale Press, Emmaus, Pa. 110 p.

Gray, K. R., K. Sherman, and A. J. Biddlestone.
1971. **Review of composting: The practical process.** Part 2. Process Biochem. p. 22-28.

Poincelot, R. P.
1974. **A scientific examination of the principles and practice of composting.** Compost Sci. 15(3):24-31.

Walke, R. H.
1975. **The preparation, characterization and agricultural use of bark-sewage compost.** Ph.D. thesis. Univ. of New Hampshire, Durham, 110 p.

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