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THE CUTTING EDGE
The Department of Agricultural Engineering • University of Illinois at Urbana-Champaign

# Composting Dead Swine

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## A New Option

### A workable alternative

The traditional methods for disposing of dead swine have long been burying, incinerating, or rendering carcasses. In many cases, however, these choices are not ideal.

The number of rendering plants in Illinois is dwindling, making this less of an option. Burying swine carcasses can use up valuable land, is labor intensive, and may pose a threat to groundwater. An incinerator can be a costly investment because it must comply with Environmental Protection Agency air quality standards.

With these problems in mind, an increasing number of swine producers are turning to a new alternative for disposing of dead animals—composting. Research and field experience suggest that composting will work for some producers.

During the compost process, bacteria and fungi decompose swine carcasses in an aerobic environment, allowing nutrients to be recycled. The end product can be spread on crop fields as fertilizer.

If composting is done properly, disease-causing bacteria and viruses are destroyed. Flies, vermin, and scavenging animals will not be a problem, and air and water pollution can be avoided.

The Illinois Dead Animal Disposal Act was amended in 1995, in part, to promote successful composting of swine. The following are some important guidelines.

## Construction and Design

### A firm foundation

Build the composter over impervious foundation materials. Use one of these materials:

- Compacted soil
- An impervious, weight-bearing foundation, such as concrete

If your foundation is compacted soil, you may want to control runoff by adding a 4- to 6-inch base of field lime of varying particle size (ungraded) over the soil.

To prevent water pollution, no matter what the foundation is made of, divert all surface water away from the composter. In addition, place the composter in an area where runoff and leachate will not contaminate wells, streams, ponds, or lakes. Build the composter no closer than 200 feet from a stream or private water supply well. You may also have to honor a 200- to 400-foot setback zone around a community water well.

Illinois law further requires you to locate the composter no closer than one-quarter mile from any residence that is not directly connected with the farm operation.

### Sizing and building the composter

The composter system consists of primary and secondary bins. Place the proper ingredients in the primary bin for a certain period of time. Then move them to another bin for a secondary composting phase.

Experience has shown that individual bins with 120 to 150 square feet of surface area work well. But if your operation is large, you may need more than one primary and secondary bin. It all depends on the farm's projected

mortality rate of swine during any three-month period. Here is the surest and best way to size the bins:

**Step 1.** Start by estimating your operation's yearly death loss. If you don't have this information for your facility, use Table 1 to estimate the yearly death loss in pounds of carcass.

**Step 2.** Divide the *yearly* death loss in pounds of carcass by 365—the number of days in a year. This gives you the *daily* death loss in pounds.

**Step 3.** Multiply the daily death loss by 20. This gives you the total cubic feet of bin volume needed in the primary bins.

**Step 4.** Divide the total cubic feet of bin volume by the primary bin height (how high you can stack sawdust and compost). This gives you the total surface area required for the primary bins.

**Step 5.** Divide the total required surface area by a trial bin size—say, 120 square feet (10 feet by 12 feet). The answer is the total required number of primary bins. Round the result to the next larger number of bins or try other bin dimensions to see if they work better.

**Step 6.** Build the same number of secondary bins as you calculated for the primary bins.

See Table 2 on page 4 for an example of sizing bins.

Compost bins should have three walls, with one side open for loading, unloading, and mixing the compost. Build the walls of concrete, treated wood, or other rot-resistant material.

Large, round hay bales may be used as temporary walls, but permanent materials are preferred. Consider providing an additional bin or bins for storage of sawdust.

## Operation and Maintenance

### Equipment

You will have to handle large quantities of material throughout the composting process, so a tractor and loader, or a skid steer loader are necessary. You will also need access to a box-type spreader to apply the finished compost to cropland.

### Sawdust and other carbon sources

Sawdust must be the primary carbon source material to cover the carcasses. Sawdust works particularly well because it is absorbent but still allows oxygen to pass through. However, do not use sawdust from treated wood (for instance, wood treated with creosote, pentachlorphenol, or salts such as CCA and ACA).

You can use other carbon source materials, such as chopped straw, chopped corn cobs or cornstalks, or shredded newspapers, as long as they do not make up more than fifty percent (by volume) of the total carbon source.

**Table 1. Estimating the herd's yearly death loss**

| Stage | Excellent performance | Good performance | Poor performance |
|---|---|---|---|
| | % annual mortality rate | | |
| Birth to weaning | Under 10 % | 10–12% | Over 12% |
| Nursery | Under 2 | 2–4 | Over 4 |
| Grow-finish | Under 2 | 2–4 | Over 4 |
| Breeding herd | Under 2 | 2–4 | Over 5 |

The rest should be sawdust. If you go this route, mix the sawdust thoroughly with the other carbon materials.

Using materials other than sawdust as the *primary* carbon source (more than 50 percent) for composting swine is considered an experimental practice that needs to be monitored carefully. Those other materials increase the risk of leaching and compost failure.

You can expect to use approximately one cubic foot of sawdust per ten pounds of carcass (or 3.7 cubic yards of sawdust per 1,000 pounds of carcass). Stockpile and maintain an adequate supply of sawdust on the premises at all times when the composter is in operation. Plan ahead!

Each compost bin should have a minimum of 10 inches of sawdust on the floor before the first carcass is placed in the bin. Also, keep a minimum of 10 inches of sawdust between the carcass and each of the vertical walls of the bin. Finally, cover the carcass with a minimum of 10 inches of sawdust.

### The process

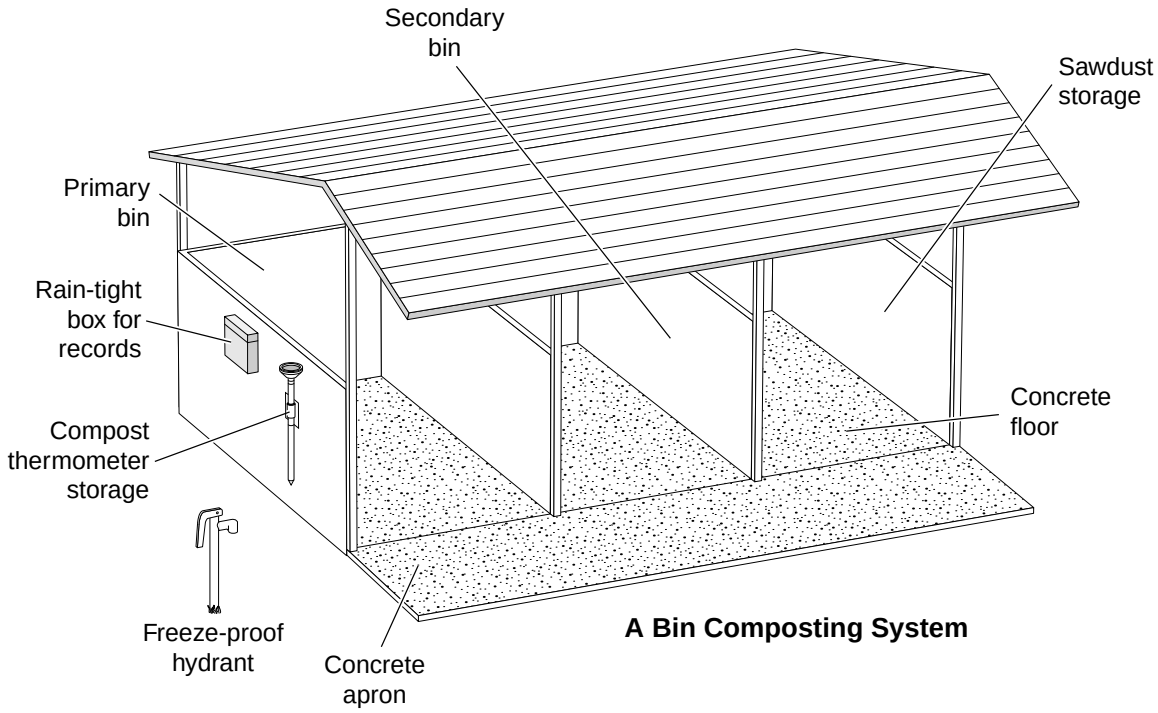
As composting begins, add sawdust to the pile daily, or as frequently as needed, to sustain a 10-inch cover of sawdust over all carcasses in the bin's uppermost layer. Sawdust and carcasses may be placed in the bin until it is full. Hog carcasses of any size can be put in the bins without any processing (dismembering, sectioning, etc.).

When carcasses begin to compost, there will be considerable settling and bubbling-up of liquid material. Be prepared to add sawdust on top of the pile every day for several days after placing a large carcass in the bin. If you don't keep up with the settling process, powerful odors will come from the composter.

Obtain a compost thermometer with a probe at least 36 inches long. (See the list on page 4.) Use the thermometer daily to measure the temperature of the compost in the middle of each bin.

The compost temperature should reach 135 to 160 degrees Fahrenheit (57 to 71 degrees Centigrade). Compost temperatures indicate microbial activity and the stage of the composting process. It's also important to maintain temperature records for examination by regulatory agency personnel.

All compost from the primary bins should undergo a secondary composting phase. When the temperature




**A Bin Composting System**

surrounding the last carcass placed in the composter drops below 130 F (typically up to three months after it was added), transfer the compost from the primary bin to a secondary bin.

Allow the compost to reheat through a second composting cycle (again, about three months). No additional sawdust is necessary during this phase. Continue to monitor the temperature during the secondary composting cycle.

## Using finished compost

Finished compost can be spread on cropland or reused in the composting process. Spread the swine compost, either alone or in combination with other nutrient-supplying materials, at whatever rate is necessary to reach a reasonable crop yield without exceeding crop nutrient requirements.

Finished compost may be returned to the primary composting bin, as long as you don't mix more than 50 percent finished compost with fresh sawdust.

## The key to success

A producer choosing to compost must be committed to making it work. If the process is not handled correctly, it will fail, with a risk of odor and water pollution.

The most frequent problem with composters is the moisture level. Moisture and oxygen levels of the compost determine the speed of composting and the success of the operation. If it is too wet or too dry, the composter will not work efficiently and may produce odors.

Moisture should be at about 65 percent. You can get a rough idea of moisture levels by sticking a shovel into the compost. If you can pack the compost material together to create a vertical wall, there probably is enough moisture. However, if you see liquid when packing the compost material, moisture may be too high.

Also, the moisture level of the sawdust could be either too high or too low if temperatures do not rise above 135 F within seven days. Turn the compost pile. If it is too dry, add water; if it is too wet, add sawdust.

Keep in mind that a winter startup of compost bins can take time. In very cold weather, cold carcasses may not begin composting. When the weather warms up, the process will start on its own, but you can hurry it along by using a tractor loader to mix the compost. Adding some manure or ammonium nitrate to the pile as you mix it will accelerate the composting.

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## Table 2. An example of sizing the bin

**Step 1. Estimate your operation's yearly death loss.**

Our example is a 250-sow farrow-to-finish operation. The producer uses the following figures to calculate yearly death loss for each stage.

| *Stage* | *Capacity* | *Average weight (lbs.)* | *Turns per year* | *% annual mortality rate* | *Yearly death loss, pounds of carcass* |
|---|---|---|---|---|---|
| Birth to weaning | 400 | 10 | 12 | 8% (.08) | 3,840 |
| *Calculation: 400 x 10 x 12 x .08 = 3,840* | | | | | |
| Nursery | 400 | 30 | 12 | 1.5% (.015) | 2,160 |
| *Calculation: 400 x 30 x 12 x .015 = 2,160* | | | | | |
| Grow-finish | 1,200 | 150 | 3 | 1.8% (.018) | 9,720 |
| *Calculation: 1,200 x 150 x 3 x .018 = 9,720* | | | | | |
| Breeding herd | 250 | 350 | 1 | 1.7% (.017) | 1,488 |
| *Calculation: 250 x 350 x 1 x .017 = 1,488* | | | | | |
| | | | | TOTAL yearly death loss, pounds of carcass | **17,208** |

**Step 2. Divide the total yearly death loss by 365—the number of days in a year.**

*Calculation: 17,208 ÷ 365 =* ***47.14*** (daily death loss in pounds of carcass)

**Step 3. Multiply the daily death loss by 20.**

*Calculation: 47.14 x 20 =* ***943*** (total cubic feet of bin volume needed)

**Step 4. Divide the total cubic feet of bin volume needed by the bin height.**

The producer uses 4 feet as the bin height.

*Calculation: 943 ÷ 4 =* ***236 square feet*** (total surface area required for the primary bins)

**Step 5. Divide the total required surface area by a trial bin size.**

The producer chooses a trial bin size of 12 feet deep and 10 feet wide (120 square feet).

*Calculation: 236 square feet ÷ 120 square feet = 1.97*

The producer rounds 1.97 up to 2. This is how many primary bins need to be built.

**Step 6. Build the same number of secondary bins as primary bins.**

The producer decides to build 2 secondary bins.

## Temperature Probes

### An incomplete list of temperature probe distributors

Meriden Cooper Corporation
112 Golden Street Park
Box 692
Meriden, CT 06450-0692
(203)237-8448
(800)466-8448
FAX: (203)238-1314

Omega Engineering, Inc.
One Omega Drive
Box 4047
Stamford, CT 06907-0047
(203)359-1660
(800)826-6342
FAX: (203)359-7807

Reotemp Instrument Corporation
11568 Sorrento Valley Road, #10
San Diego, CA 92121
(619)481-7737
(800)648-7737
FAX: (619)481-7415
E-MAIL: reotemp@reotemp.com