Disposing of Dead Swine: Pork Industry Handbook
Michigan State University Extension Service

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Disposing of Dead Swine

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Managers of farrow-to-finish units exhibiting good performance can expect 11 percent of the pigs born live to die before weaning. Death losses of three percent each in the nursery, growing-finishing building and breeding herd are considered typical.

A 100-sow unit producing 1.8 litters per sow per year and 10 pigs born live per litter translates into the following annual mortality estimates: 198 preweaning pigs, 48 nursery pigs, 47 growing-finishing hogs, and 3 sows. Using average weights of 2.75 lb for a preweaning pig, 32 lb for a nursery pig, 140 lb for a growing-finishing hog, and 450 lb for a sow, the amount of mortality produced by the typical, 100-sow farrow-to-finish operation exceeds five tons per year. When considering the U.S. has over five million sows in production, the annual tonnage of dead swine is staggering.

In order to protect the health of herds and farm personnel; avoid air, soil, and water contamination; and circumvent problems with both agricultural and non-agricultural neighbors, biologically and environmentally safe methods of mortality disposal must be employed on modern swine operations.

Current options for disposal of carcasses include composting, burial, incineration, and removal by commercial renderers. Placing dead pigs in properly licensed landfills represents another disposal method. One or more of the above mentioned techniques may be restricted by state and/or local ordinances. Finally, many states are experimenting with disposal options such as fermentation or the feeding of dead pigs to mink or alligators.

Disposal Options

Composting. The action of thermophilic, aerobic bacteria converts nitrogen-rich (manure, dead animals, etc.) and carbon-rich (whole peanut hulls, straw, sawdust, etc.) materials into humic acids, bacterial biomass, and organic residue (compost). During the process, heat, carbon dioxide, and water are generated as byproducts.

Temperatures in the range of 130° F to 160° F are indicative of a high level of microbial activity and decomposition of placed carcasses. These temperatures suggest that the composting process is proceeding properly. Active (as opposed to newly started) compost piles continue to function through cold weather regardless of ambient temperature. Cold or frozen carcasses placed in newly started compost piles during cold weather may not begin composting immediately.

The poultry industry has adopted composting as the method of choice for ridding farms of dead layers, turkeys, and broilers. In a typical system, carcasses, poultry litter, straw, and water are mixed, creating an ideal environment for the growth of the bacteria. Bacterial action heats compost piles to temperatures as high as 160° F; and carcasses are reduced, leaving only bones that are easily crumbled. The resulting product is free from harmful pathogens, is nutrient-rich, and can be used as fertilizer.

The system described above has been used to process dead swine weighing as much as 450 lb. Compost bins are situated on a concrete floor and constructed of pressure-treated lumber (5 ft. tall, 8 ft. wide and 5 ft. deep; see Figure 1). The unit shown was constructed at a cost of approximately $9,000.

Broiler litter is layered on the floor to a depth of 12 in. to 15 in. followed by a 4-in. to 6-in. layer of straw. A hog is placed, on its back, on the layer of straw. The thoracic and abdominal cavities are opened with a knife and deep incisions are made in the muscles. Intestines are cut and organs dissected. The animal is then covered with a 12 in. to 15 in. layer of broiler litter followed by a 6-in. layer of straw. A second hog can then be placed and dissected as previously described. A final layer of broiler litter is added and a minimum covering depth of 6 inches is ensured. The compost is then dampened with water.

Temperature of the compost pile usually approaches 160° F within a week and after two weeks all that usually remains of a hog carcass is bones. "Turning" the compost pile by moving it to a new bin (secondary bin) after two weeks helps maintain high

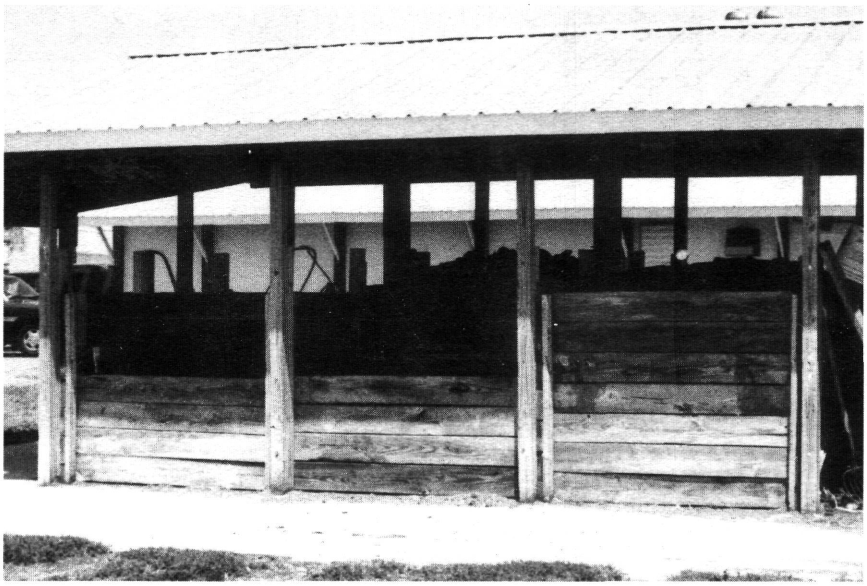

Figure 1. Unit for composting dead pigs. Each of the six bins is 5 feet tall, 8 feet wide and 5 feet deep. A facility of this size would accommodate a typical 100 sow farrow-to-finish operation.

temperatures and promotes further decomposition. Composting units of this type should be sized so as to allow two cubic feet of primary, and two cubic feet of secondary, bin space per pound of average death loss per day.

A "minicomposter" (Figure 2) has been utilized to dispose of placentae and dead pigs from the farrowing house and nursery. The minicomposter consists of a box made of four, 40- by 36-inch screen and lumber panels filled with alternate layers of six inches of loose straw and 65 pounds of poultry litter (a total of 200 pounds of litter and one-third of a bale of straw per minicomposter). Straw and poultry litter are dampened with approximately 15 gallons of water. Temperature of the minicomposter typically approaches 150° F within 24 hours of mixing the various constituents.

The minicomposter is loaded by forming a V-shaped trough in the poultry litter. Fresh litter and straw are added to the bottom of the trough, followed by the dead pigs or placentae (up to 30 lb of tissue per day) and water. Tissue is then covered with fresh litter.

Baby pigs are almost completely decomposed within 24 hours after placement. A minicomposter can process a total of approximately 800 lb of tissue before it must be emptied. Compost can then be used as fertilizer.

A composting system developed at the University of Missouri uses sawdust rather than poultry litter and straw. This system, however, may require more time to completely decompose mature boars and sows when compared to the procedure described above.

Compost piles utilizing sawdust can be contained in facilities similar to those described above or alternatively, large round bales (5 ft to 6 ft in diameter) of low-quality hay can be used to form the walls of three-sided enclosures that have an area of 125 to 150 square feet.

Approximately 100 cubic feet of sawdust is provided per 1000 lb of carcass to be composted. Carcasses are placed on a layer of sawdust that is a minimum of one foot deep. Each carcass is covered on all sides with a minimum of one foot of sawdust. No cutting or dissecting of carcasses is required with this method. All sizes of carcasses can be composted.

The ideal moisture content in a composting pile that uses sawdust is 50 to 60 percent. The moisture content of sawdust or a composting mixture can be judged somewhat by its appearance and feel. Sawdust that has a damp appearance and feel is probably near the proper moisture content for composting. Very dry sawdust may require the addition of one to one and one-half gallons of water per cubic foot of sawdust to obtain proper moisture content.

In a typical scenario, a bin is filled with three month's death loss, at which time a second bin is started. At the end of the second three-month period, the second bin is full, and the last carcass placed in the first bin has composted three months. The contents of the first bin are then ready to move to a third bin for the secondary composting phase. After three months of secondary composting, the material can be applied to land as fertilizer.

All composting units should be situated on well-drained soil and provide all-weather capability access roads and work areas. If properly managed, composting units are "invisible" and there is little or no risk of air, soil, or water contamination. For more complete information on the design and operation of composters, see references Murphy and Carr (1990), Murphy (1992) and Fulhage (1994) listed at the end of the fact sheet.

Burial. Perhaps the least expensive method of dead swine disposal is a burial pit. Deep burial (4 to 8 feet) is generally recommended. The practice of covering dead swine with lime retards decomposition and is not recommended. Restrictions vary from state to state regarding minimum and maximum burial depths as well as the amount of soil which should cover carcasses. Dead pigs should never be buried in areas where leaching can occur.

Problems with pit burial include odor from, and the accessibility of scavengers to "dead pits" that are not properly covered. There also is the possibility of significant ground and surface water contamination, for which producers may be held liable. Finally, hogs do not die only when the ground is soft. Burying dead pigs in frozen earth may be difficult.

Incineration. Incinerators reduce carcasses to ash and destroy pathogens. The capacity of many incinerators is limited, so this method of disposal works best for pigs weighing less than 50 pounds.

Purchase price of an incinerator with 600 lb capacity has been estimated at $2500, and annual operating costs (fuel, maintenance, etc.) exceed $1000. Incinerators may generate air pollution and objectionable odors.

Figure 2. "Minicomposter" for disposing of small pigs and placenta. Screen and lumber side panels measure 40-by 36-inch each.

Commercial renderers. The rendering industry recycles carcasses into useful products such as animal feeds (meat and bone meal), soaps, and fatty acids. Fatty acids are used in the manufacture of many products including cosmetics, paints, and deodorants.

In some parts of the country, renderers pick up dead swine from individual farms on a regular schedule or carcasses may be delivered by farmers to central pick-up stations. Today, however, there are fewer than 300 independent renderers and packer-renderers nationwide. Thus, many farmers do not have access to this service, and those that do may pay exorbitant handling fees. The potential spread of disease from farm to farm by renderer personnel and their vehicles is an important consideration.

Refrigeration and freezing. Commercial refrigeration units with 480 cubic foot capacity should provide sufficient storage space for operations up to 1000 sows hauling every six to ten days to a renderer. Storage beyond this time will limit intended results in carcass deterioration. Large commercial walk-in freezer units with capacities over 310 cubic feet can store carcasses for up to one month. Smaller household-type freezers can be used as storage on small and medium sized operations where the cost of a commercial freezer or refrigerator unit would be prohibitive. Any of these units could be mounted on a trailer for hauling to the renderer or emptied by the renderer on the farm.

Lactobacillus fermentation. Lactobacillus (buttermilk bacteria) fermentation, also known as lactic acid fermentation or acid fermentation, safely stabilizes animal tissue and prevents further decomposition for long periods of time when held in containers that limit exposure to oxygen. This allows the accumulation of enough material to justify a trip to the renderer, or for the renderer to arrange to pick up stabilized animal tissue. Preserved tissue may be safely held for several months, if necessary, without development of bad odors or further spoilage. In some cases, renderers may pay a nominal amount for stabilized material.

There are seven basic steps involved in lactobacillus fermentation of animal tissue. Failure to observe the basic steps results in an improperly stabilized material that will further decompose, produce offensive odors, and that may not kill disease causing organisms.

Step 1. Animal carcasses are reduced in size to particles not exceeding one inch in diameter. This is necessary to assure that the animal tissue comes in contact with lactic acid that is produced by the lactobacillus organisms. In addition, disease causing organisms found in the bone marrow must be exposed to the action of the lactic acid. Grinders are commercially available for less than $5000 and do an excellent job of grinding tissue, bone, and skin. Large animals, however, must be reduced in size in order to be accommodated. A carcass cutter can be constructed for less than $2000 using a hydraulic (20,000 PSI) cylinder and a horizontal guillotine-type blade mounted on a rectangular frame.

Step 2. The carbohydrate/lactobacillus mixture is added to the animal tissue during the grinding operation. Any source of carbohydrates such as ground corn, dried milk or whey, mill sweepings, dried or liquid molasses or sugar is satisfactory as long as it does not contain an antibiotic. The amount of carbohydrate needed varies with the product being ground. As a rule-of-thumb, an amount of carbohydrate equal to 20 percent of the weight of the carcass is used. Enough carbohydrates must be available to lower the pH to four or below. A dried culture of lactobacillus may be obtained from commercial sources and used according to the manufacturer's directions.

When a dried culture and a dry carbohydrate source are used, uniform coverage is more easily achieved by adding the dried culture to the carbohydrate source prior to combining with the tissue in the grinder. If a liquid culture is utilized, it is generally more economical and convenient to use a liquid carbohydrate source such as reconstituted whey, especially if extra moisture is required. If a liquid culture is used with a dry carbohydrate, the culture and carbohydrate source are added separately into the grinder along with the tissue.

If ground corn is the carbohydrate source, enough dried molasses or sugar should be added to the corn to act as a starter while the corn starches are being converted into a form that can be utilized by the lactobacillus. Otherwise, difficulty is experienced in reaching the proper pH.

In an emergency, the culture may be home grown by obtaining a cup of unpasteurized yogurt, mixing it with two gallons of reconstituted dried milk or whey, and incubating at 85° F for 12 hours.

Step 3. For optimum fermentation, the moisture level is maintained at 60 to 65 percent. If the moisture level drops below 50 percent or is above 70 percent, lactic acid production will be inhibited. Water is added if the mixture is too dry and ground corn or some other dry material is added if the moisture level is too high. The moisture is considered correct when a ball can be made of the mixture, and it is wet enough not to fall apart but dry enough not to run between the fingers. Whether or not extra moisture is needed may help determine the type of carbohydrate utilized.

Step 4. The constituents are mixed, assuring uniform exposure of the ground animal tissue, carbohydrate source, and lactobacillus culture. If proper mixing does not occur, pockets of animal tissue may not be exposed to the lactic acid, and decomposition and putrefaction may occur. It may be necessary to run the material through the grinder a second time to assure proper mixing. An auger also may be adapted as a mixer.

Step 5. For lactobacillus fermentation to occur properly with maximum production of lactic acid, it is necessary to exclude oxygen from the process. This is done by placing the ground and mixed material in plastic bags, plastic garbage cans or in any other container that will keep oxygen away from the material. Containers made of metals other than stainless steel will corrode when in contact with lactic acid. Metal containers may be coated with asphalt on the inside to reduce rusting. A cover should be provided to prevent exposure to air. Since there is some carbon dioxide produced during the fermentation process, some means of escape without the introduction of air must be provided. A small hole in the top of the container covered by a flap will suffice.

Step 6. Lactobacillus fermentation occurs best at a temperature of 85° to 105° F. Cool temperatures reduce the speed of lactobacillus multiplication and lactic acid production. Extremely high temperatures may kill the lactobacillus culture and very little lactic acid will be produced.

Step 7. Properly ground, mixed, and stored material may be held for extended periods without deterioration. In storage tests, fermented material was held six years without problems other than some drying on the surface. From a practical standpoint, fermented material would be held only long enough to accumulate a truck load for transportation to a renderer. In the summer, it is advisable to have some method of fly control (e.g. spray) to prevent fly larvae from developing on the surface.

Considerations When Disposing of Dead Swine

Legal. In general, the legal basis for mortality disposal is rooted in state law. State legislatures place the responsibility for the control of animal diseases and disease of zoonotic significance with the state Departments of Agriculture or Boards of Animal Health. They then empower the control agency by passing laws that authorize the promulgation of rules and regulations. In many states the law is called the Dead Animal Disposal Act. On the federal level, the Environmental Protection Agency provides the guidelines. On the local level, county or parish health departments may have guidelines that relate to local conditions such as a high-water table, soil conditions, landfills, and burning. The U.S. Department of Agriculture usually follows the guidelines of the Environmental Protection Agency and state Departments of Agriculture.

There is variation among states, but state laws generally require the owners of dead animals to properly dispose of carcasses within 12 to 36 hours of discovery. Dead animals, including carcasses, parts of carcasses, any effluent and/or blood and body fluids associated with such animals must be disposed of in an approved manner. Under no conditions may dead animals be abandoned in wells or open pits of any kind on private or public land. The laws include penalties for violations of the Act or rules and regulations.

Most states have language in the Act that regulates intra- and interstate transportation of dead animals, effluent, and/or parts of animals. Most states will not allow dead animals and/or parts thereof, raw or not rendered, except green salted hides to enter their state without a written permit. Some counties also have regulations concerning movement of dead animals through their jurisdictions.

Producers should check with their county and/or state officials for recommendations and details regarding legal methods of dead animal disposal.

Environmental. Dealing with environmental concerns and regulations is one of the major challenges facing farm managers. Federal, state, and local regulations exist which impact the handling of dead swine. Many states require permits to transport dead animals or animal by-products on public roads. New interpretations of the Clean Water Act could result in prohibitions on burial (in unlined pits) for areas with a high-water table. Local ordinances in high-density swine production areas often require that carcasses be covered or a least not visible from public roads while awaiting pick-up by a renderer.

Environmental regulations are likely to increase production costs, but may have differential impacts on the costs of alternative methods of dead animal disposal. Anticipation of potential future environmental regulations is important in strategically choosing a method of disposal.

Practical and economical. The amount of specialized management, knowledge, and labor required is perhaps the most important economic consideration in choosing a disposal method. In order to justify a change, increased efforts toward these essential swine production inputs must be rewarded by increases in revenues above the costs of changing methods.

Some revenue may be generated from a renderer's willingness to pay for large amounts of good-quality fermented or refrigerated product delivered to the plant. Typically, renderers charge from $5.00 to $50.00 per pick-up for smaller amounts. The charge varies by location and often depends on the distance the renderer must travel.

Composting can generate some additional economic returns in the form of fertilizer. It is estimated that the N, P_2O_5, and K_2O composition of pigs composted with sawdust is 0.22, 0.64 and 0.34 percent, respectively. At 1994 fertilizer prices, the economic benefit is $3.65 per ton of compost. Adding poultry litter would significantly increase the fertilizer value of this compost, but the increases would come from the poultry manure and not the carcass.

Other considerations such as land base, water table, and proximity to neighbors may limit the practicality of some alternatives such as burial, incineration, and land application of compost.

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