COMPOSTING DEAD SWINE

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Summary

Composting dead animals from a swine production facility offers an environmentally sound disposal method to many producers.

(Key Words: Composting, Dead Swine.)

Introduction

Composting is a natural process whereby bacteria and fungi decompose organic material in a predominantly aerobic environment. Under controlled conditions, composting occurs in two stages. A high rate of biological activity results in rapid composting and high temperatures in the pile in the primary stage. This is when most of the organic breakdown occurs. The secondary stage has lower biological activity resulting in slower composting and lower pile temperatures. In this stage, the biological activity ends and the mixture stabilizes.

Proper conditions are required so that composting occurs rapidly, odor generation is minimized, and nuisance problems are prevented. Conditions that can be controlled in the composting process are the material mix, moisture levels, porosity, and temperature.

Material Mix

The proper compost mix requires a proper carbon to nitrogen (C/N) ratio to minimize odors generated yet offer an environment where microorganisms can flourish. Generally, a C/N ratio that is higher than 25:1 is satisfactory. Waste materials, such as manure, have a high N content resulting in a C/N ratio that is too low to compost. In order to compost these materials, amendments that contain a high C/N ratio or C content must be added. Plant materials such as wood chips, sawdust, or straw are ideal amendments for on-farm composting.

Moisture Levels and Porosity

Proper moisture levels and a stable porous structure for the composting pile are two other conditions required to encourage bacterial growth and rapid composting. The moisture content of the mixture should be 50 to 60%.

The bacteria in a compost pile are aerobic or require oxygen. Open spaces or porosity must be maintained to provide oxygen and allow air to penetrate and move through the pile. Ideally, 35 to 50 % of the pile volume should be small open spaces to allow air movement through the pile.

Temperature

The aerobic bacteria in the composting process grow at two temperature ranges: mesophilic (middle temperature) bacteria up to 100°F and thermophilic (high temperature) bacteria up to 150°F. The bacteria breaking down the materials in the pile generate heat and cause temperature increases. As the pile warms, different bacteria will grow at the higher temperatures. The mass of composting material will be more active and organic material will be

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broken down faster at higher temperatures. However, above 150°F, the rate of composting will decrease as bacteria are inactivated or even destroyed by the excessive temperatures.

Temperature increases warm air within the mixture. The air rises and moves out of the pile, while fresh air is drawn in. This process exhausts carbon dioxide (CO_2) created in the pile and maintains an aerobic environment for the bacteria. In addition, temperatures that remain above 130°F for 3 days will destroy disease-causing bacteria within the pile. Internal pile temperature is an indication of the current biological activity within the mixture and how well the pile is composting.

The composting process will generate heat and regulate its own temperature. However, to maintain high temperatures, the pile must have some insulation. A layer of inactive material (sawdust or finished compost) placed over the entire pile will insulate it. The insulation layer should be a foot or more in depth.

Composter Location

The composter should be located away from sensitive water quality features such as streams, ponds, drainage ditches, and wells. The composter site should be well drained and provide all-weather capability for access roads and work areas.

Placement of a composter should consider the location of the farm residence and any nearby neighbor residences, and the view of passing vehicle traffic. Although offensive odors usually are not generated in the composting process, the handling of dead swine and the resulting compost on a daily basis is not aesthetically pleasing.

Consideration should be given to traffic patterns required in moving dead swine to the composter, storing and moving the required ingredients to the composter, and removing finished compost from the composter. A storage area for other composter ingredients (sawdust, straw, and crop residue) also needs to be considered. A water supply is necessary to regulate moisture in the compost pile.

Composting Ingredients/Recipe

Composting dead swine requires the addition of a C source to ensure that a proper C/N ratio is present for the composting process. Sawdust is an ideal C source because of its small particle size, ease of handling, absorbency, and high C content. Sawdust seems to shed and/or absorb liquids sufficiently, so that leaching and drainage from the pile are minimal. Sawdust is preferred if big bales are used to form the compost structure. Composters utilizing straw or other crop residues may need to be placed in a roofed structure to keep rain from leaching through the pile. Crop residues can be chopped to reduce particle size and aid the composting process.

Experience with sawdust as a C ingredient indicates that about one-third to one-half cubic yd of sawdust per sow in the herd is required annually to support the composting process in a farrow-to-finish operation. Hence, a producer with a 100-sow herd would need in the range of 35 to 50 cubic yd of sawdust per year to operate the composter. Sawdust is used in swine composters at the approximate ratio of 100 cubic ft of sawdust per 1000 lbs of dead swine. Hence, a producer anticipating 10,000 lbs of death loss per year could expect to use about 1000 cubic ft, or 37 cubic yd of sawdust per year.

Composter Design

The composting process requires that the proper ingredients be placed in composting "bins" in the correct proportions (Figure 1) for an adequate composting period prior to moving the material to a second bin for the secondary stage. Composting bins or structures typically are designed for a 3 mo storage and composting interval.

Field experience suggests that outside composting bins can be constructed using large round bales (5 ft - 6 ft in diameter) of low-quality hay. Bales are placed end-to-end to form walls for 3-sided enclosures (bins). A minimum of 2 bins is required for primary and secondary composting phases. However, more bins may be required on larger operations or with different management schemes. Excessively large bins should be avoided. Experience suggests that 1.25 to 1.50 sq ft of bin area per sow in the sow herd is necessary for composting. Hence, a 100-sow herd would require 125 to 150 sq ft of area in the primary and secondary composting bins. A layout of 2 bales deep and 3 bales wide provides this approximate area and has worked well. Bin area requirements also can be determined on the basis of 10 to 12 sq ft of bin area per 1000 lbs of carcass composted annually. An operation anticipating 10,000 lbs of death loss annually would need a composter with 100 to 120 sq ft in each of the primary and secondary bins. Consideration might be given to providing an additional bin or bins for storage of sawdust or crop residues.

Bin configuration is not critical; however, bins should be laid out so that the contents are easily accessible with a front-end or skid-steer loader. Square bins offer the greatest opportunity for reduced side effects (e.g., heat loss through walls). However, long, narrow bins, that can be accessed through both ends also have been used. Primary and secondary bins should be located adjacent to each other to facilitate moving the compost.

Composter Operation and Maintenance

Composter bins can be made inside a structure or outside in a pile or round bale containment (Figure 2). Some guidelines for composting are discussed below.

Step1. Start a primary composting bin by placing enough sawdust in the bin to provide a base of 1 to 2 ft.

Step 2. Place carcasses in the primary bin as necessary. Use sufficient sawdust such that each carcass is covered on all sides with a minimum of 1 ft of sawdust. Expect to use sawdust at the rate of 100 cubic ft of sawdust per 1000 lbs of dead swine. Additional sawdust may be needed after 1 or 2 days to re-cover the carcass, because settling will occur.

Step 3. Continue placing and covering carcasses as necessary, until the bin is full. Experience suggests that the last carcasses placed in the primary bin should be allowed to compost for a minimum of 3 months. Longer composting periods provide greater breakdown, especially in periods of cold weather.

Step 4. After the last carcasses placed in the primary bin have composted for at least 3 months, move the contents of the primary bin to a secondary bin for the second stage of composting. A thorough mixing of contents should occur during the transfer process.

Step 5. Allow the secondary bin to compost for another 3 months or longer. After this secondary stage of composting is completed, the compost should appear as a dark, nearly black, humus-like material with very little odor. Some large, resistant carcass parts (teeth or skulls) may still be identifiable but should be soft and easily crumbled.

Step 6. After secondary composting is completed, the compost can be hauled and spread on the land with conventional manure-spreading equipment.

Step 7. Keep fresh sawdust as dry as possible, because dry sawdust works much better in the composting. Fresh sawdust in a pile will shed water reasonably well if the pile is "mounded", with no pockets or depressions.

Step 8. Keep the area around the composter mowed and free of tall weeds and brush. Watch for any leachate from the composter and take steps to eliminate any leaching that might occur. Using more sawdust in the bottom of the bins can help eliminate leaching.

Biosecurity

Control of pathogens and disease transmission is critical to most swine operations.

Traffic patterns to and from the composting area need to be assessed for biosecurity implications. The composting process will destroy most diseases with high temperatures. Bacteria and viruses from fresh carcasses can be passed through the transport vehicle to production housing. Farm employees should be trained in the biosecurity implications of operation and traffic control of the composter. Scavenging animals and vermin also must be kept from the compost pile. Maintaining the recommended cover over the compost pile should reduce the problem. Fencing may have to be installed if scavenging animals cause problems.

Acknowledgment

The information in this report was taken from a series of publications developed by Ohio State University and the University of Missouri. Much of the work on swine composting has been done by these universities. The figures below are from Ohio State University, Extension Fact Sheets AEX 711-97 (Fig. 1) and AEX 712-97 (Fig. 2).

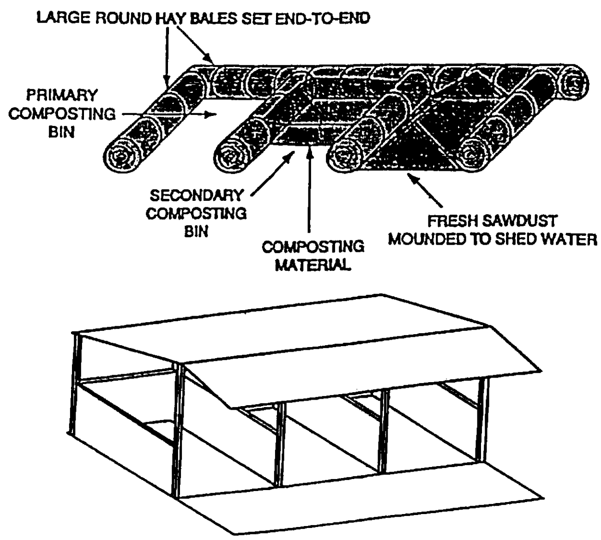

Figure 1. Construction of a Composting Pile for Dead Swine.

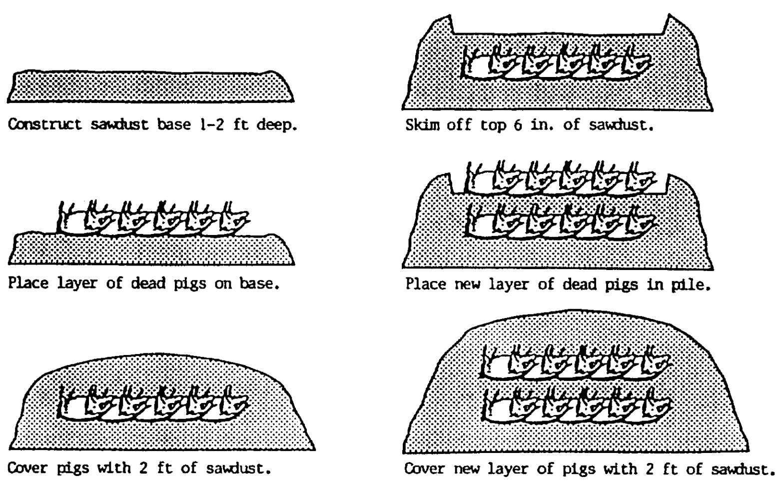

Figure 2. Bin System for Composting Dead Swine.