Composting Poultry Mortality:
A Critical Daily Management Chore

Normal everyday mortality from any commercial poultry operation can be managed efficiently and safely by composting, if the proper procedures are followed. Composting is the **biological decomposition and stabilization of organic matter under controlled conditions.** It is an aerobic process (meaning that oxygen is required) carried out by microorganisms that metabolize organic waste as an energy source. Composting is a naturally occurring process in which beneficial microorganisms, such as bacteria and fungi, reduce and transform organic wastes (in this case, poultry mortality) into a final product (compost material) that is a valuable fertilizer and soil amendment.

Composting daily mortality on the farm has several advantages, including these:

1) averts the potential for groundwater pollution that, in the past, was associated with burial or use of disposal pits;
2) avoids the high fuel cost and potential air pollution concerns associated with incineration; and
3) prevents potential disease spread associated with moving poultry carcasses off the farm.

This publication addresses the daily management chores required to ensure proper operation of either a bin/alleyway or in-vessel poultry composter.

The Facts

Across the country, the number of farms continues to decrease. This is true in the poultry sector as well as other agricultural segments. However, farms that remain tend to be increasing in size. For example, many broiler farms today generally have anywhere from six to twelve broiler houses on the farm, whereas, a generation ago, two to four houses were more common. In addition, individual house size is larger today than it was a generation ago. The increase in individual farm size potentially means more mortality to deal with in a smaller geographic area on a daily basis.

In most cases, daily mortality losses are small but continuous throughout the flock grow-out period. Therefore, dead bird disposal is a daily chore associated with chicken production. In addition to producing a usable end product, composting this daily mortality is cost-effective, environmentally sound, and biosecure.

Requirements for Composting

Creating compost is like baking a cake: you have to follow a specific recipe or it is not going to turn out very well. The microorganisms require carbon, nitrogen, oxygen, and moisture in the right amounts to work properly. Any elements lacking or in excess will cause the microorganisms not to flourish, resulting in inadequate heat and a poor composting environment. Whether using a static bin, alleyway, or in-vessel composter, **good composting requires that you follow a recipe.** Years ago, bin composters that included primary and secondary bins were a popular mortality-management option. Today in Mississippi, however, alleyway composters are a more popular choice because they are less labor intensive, are simpler to manage, and appear to do a better job of handling the larger birds (9.75 pounds and up) that many integrators are now growing. In-vessel rotary drum composters have recently become another mortality management option that yields excellent results when managed properly.

If the moisture content, carbon-to-nitrogen ratio (C:N), oxygen level, levels of bulking agent (or carbon source), and mortality are correct, the composting process works very well. However, if one or more of these ingredients is not adequate, you will have issues maintaining adequate temperature and achieving efficient composting. Improper compost management can also become a source of disease spread by producing odors that may attract dogs or wild animals, which can dig into a bin or alleyway composter and drag off dead birds. Flies can also be a major issue if neighbors are involved. In addition, improper management may lead to the generation of pathogens, such as clostridium, that may potentially result in botulism or gangrenous dermatitis. However, using the proper recipe will produce optimum composter performance, and that will mean few odors or pathogens and a poor breeding ground for flies.

The **composting process is directly affected by several factors**, including these:

- temperature
- oxygen
- moisture
- particle size
- surface area
- size and activity level of microbial populations
- physical properties of the wastes
- C:N ratio

Composting converts much of the carbonaceous material to carbon dioxide. Therefore, the volume and weight of the compost is less than that of the original waste product. Temperature is critical because the heat generated during the composting process can destroy fly larvae and pathogenic organisms and helps to drive off moisture present in the carcasses. The rate at which composting occurs, the

types of microorganisms present, and the level of biological activity involved in the composting process are a result of the surface area, particle size, and physical properties of the waste material.

Composting poultry mortality should be an aerobic process. This means oxygen is required for the microorganisms to perform at their best. The bulking material used is important to the oxygen supply. For example, litter or sawdust that is too fine will limit the oxygen supply and microbial growth. Some common bulking materials are listed in **Table 1**. Slower microbial growth means lower composting temperatures that may not kill pathogens and, in turn, increase composting time. **Moisture level is also important** in determining whether the composting process is occurring under aerobic or anaerobic (without oxygen) conditions. A moisture content in the 50–60 percent range seems to work best. The process tends to slow down at a moisture content of less than 50 percent, and anaerobic conditions begin to occur at a moisture content of greater than 70 percent.

Table 1. Common composting bulking agents.

Carbon Source	C:N Ratio
Sawdust/shavings*	200–750:1
Straw	48–150:1
Corn stalks	60–73:1
Finished compost*	30–50:1
Horse manure	22–50:1
Cattle manure	19:1
Turkey litter	16:1
Broiler litter*	12:1
*Things we have tried.	

One good thing about composting is that **it is a fairly forgiving process**. If you mess it up, you can fix it relatively easily. Conditions that are too wet can be remedied by adding increased amounts of bulking material to absorb the moisture. Conditions that are too dry can be adjusted by adding limited amounts of water. Generally, the addition of water is less common because it appears that most producers have more problems with compost being "too wet" than "too dry."

An important point to keep in mind is that it is **better to add too much bulking agent than not enough.** This sounds simple enough, but it can actually be difficult because birds are constantly increasing in size; therefore, adjustments must continually be made to the amount of bulking agent added to balance for size increase. While a 1:1 ratio of bulking agent to mortality may be fine for 1-week-old chicks, there will be times when even a 4:1 ratio of bulking agent to mortality may not be enough for market-age birds each weighing 10 pounds or more. Growers must constantly adjust bulking agents not only to fluctuations in mortality rates (5 birds vs. 15 birds per house per day), but also for individual bird size (1 pound each vs. 10 pounds each). Some growers catch on quicker than others; but with a little practice, composting is a process that anyone can master.

The C:N ratio will also affect composting rate because it affects biological activity of the microorganisms. **A C:N ratio of 25–30:1 appears to work quite well.** Some nitrogen will be lost as ammonia if the C:N ratio drops below 25:1. This may likely result in unpleasant odors and a loss in potential fertilizer value. Unpleasant odors may result in unpleasant neighbor relations or, in some cases, even lawsuits if issues cannot be resolved. Therefore, it is important to properly manage your composter at all times to avoid any such situation that could threaten your farming operation.

In a bin or alleyway composter situation, as long as the temperature is increasing, the process is working well. **Bin or alleyway composters all have several features in common**:

1) a roof that drains water away from the composter;
2) a concrete slab floor; and
3) a bin (or bins) constructed of treated lumber or concrete that is sturdy enough to support the weight of the compost and capable of withstanding the stress applied by a tractor and front loader during turning and/or cleanout.

This type of structure allows the compost to be stored and housed in an environmentally sound manner, provides protection from rain and other adverse weather, preserves nutrients in the compost, and prevents nutrient losses and runoff to surface or ground water. When compost temperature peaks in a bin composter and then begins to decline, the material should be turned to incorporate additional oxygen. The turning process should cause the temperature to begin to once again increase. Bin and alleyway composters are sized to the number of chicken houses located on the farm. As a general rule, each cubic foot of composter space can handle 15 pounds of dead birds.

For an in-vessel rotary drum composter (**Figure 1**), the turning process occurs automatically on a daily basis (or perhaps more often, depending on how you have the timer set). These units have a built-in thermometer that allows you to constantly monitor the temperature inside the drum (**Figure 2**). **In-vessel composters use forced aeration and/or mechanical agitation** to control moisture and heat levels more effectively and promote rapid composting. As a result, composting can be more closely controlled, leading to faster decomposition and more consistent product quality. Effects of weather are diminished because the compost material is contained inside the drum. Public acceptance of a rotary drum composter may be better, simply because a drum composter may be more aesthetically pleasing than a bin or alleyway composter. Because of the perception many individuals currently have of agriculture, public acceptance of agricultural practices is an important issue that every farming operation must take seriously today.

Enforcement and Registration

The Mississippi Department of Environmental Quality (MDEQ) is charged with investigating complaints against livestock/poultry operations within the state. **Odor issues make up the greatest number of complaints to MDEQ, with fly complaints coming in a close second.** Composters should be located on the farm in a convenient location but as far from neighbors as possible. Keeping compost and litter dry can go a long way in resolving both of these issues. At no time should black fluids seep from the sides or bottom of a bin or alley composter. Seepage of black fluids is usually the result of poor carcass placement (carcasses placed

fewer than 6 inches from the sides of the composter), carcasses piled in the composter instead of being layered in, not enough carbon source, or excess amounts of rainwater blowing into the compost bin. However, odors and flies aren't the only complaints received. Neighborhood dogs can dig dead birds out of a bin or alley composter and drag the carcasses home, and other varmints can steal carcasses and scatter them in nearby fields and/or along roadways. Enforcement efforts at the state level (not just in Mississippi, but across the country) will likely increase in the future in response to pressure from neighbors and from the federal level.

Currently, the Mississippi Board of Animal Health (MBAH) regulates dead bird composters in Mississippi, and each composter should have an MBAH permit number associated with it, similar to the permit for South Farm at Mississippi State University (**Figure 3**). In addition, the composter must be located at least 150 feet from the property line and 600 feet from the nearest dwelling. It is the MBAH that determines the size composter you will need based on the size of your farm, so make sure they are included in your mortality management decisions when you are initially building or adding additional houses. If you are a poultry farmer in Mississippi and your composter does not have a permit number on-site, or if you do not know if your composter is registered with MBAH, contact MBAH at (601) 832-3351 to verify your farm's status.

Figure 1. Rotary drum composter.

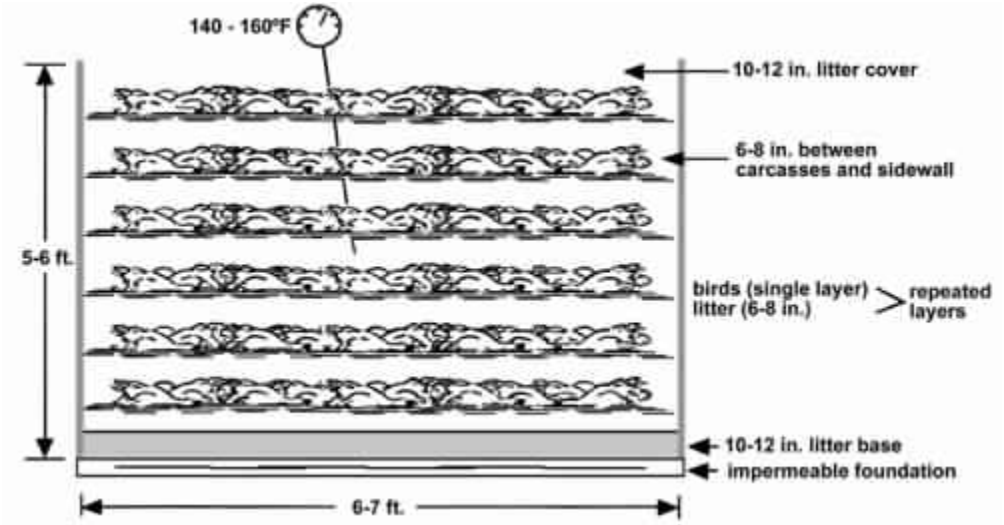
Figure 2. Temperatures above 130°F will kill pathogenic bacteria, fly larvae, and viruses.

Figure 3. Mississippi poultry mortality disposal permit.

Composter Operation and Management

The MBAH provides every client with the following information and guidelines to assist them with managing and operating their composter. The requirements for proper and complete decomposition of dead carcasses are reasonably simple and inexpensive. The materials needed (dead birds, litter, alternative carbon sources, water) are readily available on every poultry farm. Careful attention to proper management is essential for successful composting. Failure to manage the system will result in an odorous situation that attracts flies, scavengers, and other vermin to the site. Proper management is vital for avoiding nuisance complaints.

Orderly loading of ingredients is necessary for efficient compost activity. Layer ingredients into the composter as illustrated below.



- Place an initial layer of 8–12 inches of fresh litter on the floor. This litter will supply bacteria to start the process and will also help absorb carcass fluids or excess water that may be added to the composter.
- Next, add a thin layer of bulking material such as peanut hulls, coarse shavings, or straw. Now, add a layer of bird carcasses. Arrange the carcasses in a single layer side by side and touching each other. Place carcasses no closer than 6 inches from the walls of the composter. Carcasses placed too near the walls will not compost as rapidly because of lower temperatures and may cause odorous liquids to seep from the compost pile.
- A small amount of water may be needed after each carcass layer. Typically, thoroughly wetting the carcasses will add sufficient water to the mix to achieve the needed moisture level. If much water is needed, the litter is likely too dry and low in live bacteria. Using finished compost material or fresh litter directly out of the chicken house can prevent this situation.
- Next, add a layer of litter. This layer should be twice as thick (8–10 inches) as the layer of carcasses underneath. If only a

partial layer is needed for a day's mortality, the portion used must still be covered with litter. The rest of that layer can be used with subsequent mortality.

- After completing the initial layer, add subsequent layers of carcasses, bulky ingredient, and litter until a height not exceeding 5–6 feet is reached. The last layer will be a cap of 8–10 inches of litter. Compost piles limited to 5–6 feet in depth, with adequate porosity and moisture levels, do not pose a fire hazard. Keep in mind, however, the potential for spontaneous combustion; monitor temperatures throughout the composting process. Excessive height can induce compost temperatures that exceed 170 degrees Fahrenheit and increase the chance of spontaneous combustion.
- Larger birds may require extra care during composting. Additional water or carbon material may need to be added to better facilitate the decomposition process, and additional heating cycles may be needed to produce an acceptable end product. See **Table 2** for guidelines on troubleshooting carcass-composting issues.

Summary

Composting is the controlled biological decomposition and conversion of solid organic material into a humus-like product called compost. Composting poultry mortality is a viable process with a beneficial use; however, **it requires daily attention** and must be managed correctly. By properly managing a combination of oxygen, moisture, and nutrients, composting can turn large quantities of organic matter into useful compost in a relatively short period of time. Proper management will be necessary to prevent odors and flies from becoming an issue for you and your neighbors.

Do not forget: if you grow commercial poultry in Mississippi, your dead bird disposal method should be registered with the Mississippi Board of Animal Health, and you should have a silver-colored permit tag on-site verifying that fact. If this is not the case, contact the MBAH and follow the necessary steps to register your operation.

Table 2. Troubleshooting guide for carcass composting.

Problem/Symptom	Probable Cause	Suggestions
Improper temperature	Too dry (less than 40% moisture)	Add water.
	Too wet (more than 60% moisture)	Add bulking material and turn pile.
	Improper C:N ratio	Evaluate bulking material and adjust as necessary.
	Improper mixing of ingredients	Layer ingredients appropriately.
	Adverse environment	Ensure adequate cover.
Failure to decompose	Improper C:N ratio	Evaluate bulking material and adjust as necessary.
	Carcasses layered too thickly	Single-layer the carcasses.
	Carcasses at outside edges	Maintain 6–10 inches between carcasses and edges.
Odor	Too wet	Add bulking material and turn.
	Too low C:N ratio	Evaluate bulking material and adjust as necessary.
	Inadequate cover over carcasses	Cover with 10–12 inches of bulking material.
Flies	Inadequate cover over carcasses	Cover with 10–12 inches of bulking material.
	Poor sanitation conditions	Avoid leaching from pile.
	Too wet	Turn pile and add bulking material.
	Failure to reach proper temperature	Assess C:N ratio and layering.
Scavenging animals	Inadequate cover over top	Maintain 10–12 inches of cover. Avoid initial entry with fence, barrier, or cover (where vultures may be a problem).

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By Tom Tabler, Extension Professor, Poultry Science; Jonathan R. Moyle, Poultry Specialist, University of Maryland Extension, Lower Eastern Shore Research and Education Center; Jessica Wells, Extension Instructor, Poultry Science; and Morgan Farnell, Associate Professor, Poultry Science.

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