Proper disposal of mortality is one of the daily management responsibilities of a poultry producer. At normal mortality rates for commercial chicken or turkey flocks, producers must dispose of large quantities of birds. The weight and volume of carcasses that growers must deal with increases dramatically as poultry reach maturity (for example, 4 pounds each for broilers and 25 pounds for tom turkeys).

Disposal pits, trench burial, incineration, and rendering are common methods for disposing of the mortality. Recently, composting has been added to the list of available disposal options.

The best method for a particular farm depends on a number of factors, such as cost, ability to meet design requirements, and suitability for the flock size and management system. For example, burial on the farm and placement in disposal pits are poor options in areas with a high water table or shallow rock formation because it would be difficult to meet design requirements. Landfill disposal is a poor option in most areas of the state because of new regulations and limited landfill capacity.

This publication presents information on mortality disposal regulations and on the design, construction, and management of a mortality compost. Information on mortality disposal methods other than composting is provided in Poultry Science and Technology Guide No. 19, Proper Disposal of Dead Poultry.

Composting techniques have recently been adapted to provide sanitary degradation of poultry carcasses. In the composting process, organic materials such as dead poultry and litter are decomposed by the natural action of microorganisms. Whole turkeys and chickens, except for a few bone fragments and feathers, can be degraded within a few weeks. The composting process subjects the carcasses to temperatures high enough to destroy pathogenic bacteria normally associated with poultry disease, making the composting system biosecure. The resulting compost has chemical and physical characteristics similar to poultry litter and can be used as crop fertilizer.

Animal Disposal Regulations
North Carolina General Statute 106-403 requires that dead poultry be disposed of within 24 hours in a manner approved by the state veterinarian (an officer of the Veterinary Division, North Carolina Department of Agriculture). General Statute 106-549 requires every person, firm, or corporation having a flock of more than 200 birds to provide and maintain a disposal pit or incinerator of a size and design approved by the Department of Agriculture. The purpose of these requirements is to prevent the spread of disease organisms from dead poultry to healthy birds.

Poultry composters are currently being approved on a permit basis to assure proper design and attention to environmental considerations. Poultry producers interested in constructing a mortality composter should send a written request for a permit to the state veterinarian. The request should provide information on the composter design, flock size and type, grid number and county of the farm, producer’s address, location of the composter (marked on a topographical map), and name of the contracting company if the flock is under contract.

Disposal of dead birds is also regulated by the Division of Environmental Management, an agency of the North Carolina Department of Natural Resources and Community Development, whose objective is to protect air and water quality.
Designing and Managing a Mortality Composter

Determining Composter Size
The size of the composter depends on the quantity of carcasses that must be composted. For the daily mortality of broilers, roasters, commercial turkeys, broiler breeder pullets, and commercial egg pullets, the total weight of the carcasses near maturity should be considered. In contrast, for layers and breeders the average daily mortality should be considered because weights and mortality are more uniform throughout the flock cycle for these types of poultry.

Farm mortality records can be used as a basis for mortality calculations, particularly in cases where marketing programs or other factors make weights different from normal industry standards. Table 1 shows the average mortality and weights for various types of poultry. These data can be used with the information in Table 2 to estimate the size of the composter required. It is advisable to design a safety factor into the composter to accommodate unusually high mortality rates that may occur at times. For example, multiplying the mortality in pounds per day by 1.5 would accommodate 50 percent higher mortality than normal. Emergency capacity should also be designed into the storage section.

Allowing 2.0 cubic feet for combined primary and secondary composter volume per pound of bird mortality, the required composter capacity in cubic feet per thousand birds in the flock is estimated in Table 2. Based on these estimates, the number of 5-foot by 5-foot by 8-foot bins for standard sizes of North Carolina poultry units is given in the far right column of Table 2. Storage capacity for the compost that has gone through two heat cycles as well as storage for litter, straw, and other supplies should be designed as part of the facility. Storage space must be provided to allow the compost to go through a third heating. The required volume will vary greatly, depending on how often the compost will be utilized and removed from storage, but it is recommended that space be provided for storing at least a three-month supply. The formulas and an example of how to calculate composter size are given in the box at the right.

Composter Building and Bins
The building to house the composting bins and storage areas can take many forms, and construction methods can vary, depending upon what is most feasible on a specific farm. Composting works well in an existing building if the ceiling is high enough to allow mechanical turning of the compost. Composters can be built as stand-alone units or attached to an existing building.

Formulas and Example Calculations for Sizing of Mortality Composters

Estimating Mortality and Mortality Weight
\[ W_e = (B \times M \times W_i)/T \]
Where
- \( W_e \) = weight of daily mortality (pounds)
- \( B \) = capacity of the poultry operation in number of birds
- \( M \) = anticipated mortality per flock, expressed as a decimal
- \( T \) = life of flock (days)
- \( W_i \) = weight of birds near maturity (pounds)

Example: For a 24,000-bird tom turkey operation with a 9 percent mortality rate and marketing 25-pound toms in 133 days:
\[ W_e = (24,000 \times 0.09 \times 25)/133 \]
\[ = 406 \text{ pound per day peak mortality} \]

Estimating Composter Capacity
\[ V_t = V_p \times W_e \]
Where
- \( V_t \) = total volume of primary and secondary composter bins
- \( V_p \) = primary and secondary composter volume per pound of bird mortality (2.0 cubic feet per pound)
- \( W_e \) = weight of daily mortality

Example: For the 24,000 term turkey operation:
\[ V_t = 2.0 \times 406 = 812 \text{ cubic feet} \]

Estimating Number of Combined Primary and Secondary Bins
First find the volume of an individual bin:
\[ V_b = h \times y_1 \times y_2 \]
Where
- \( V_b \) = individual bin volume
- \( h \) = height of bin
- \( y_1 \) = depth of bin
- \( y_2 \) = width (front) of bin

Example:
\[ V_b = 5 \text{ feet} \times 5 \text{ feet} \times 8 \text{ feet} \]
\[ V_b = 200 \text{ cubic feet} \]
Then divide the total volume by the volume per bin to find the number of bins:
\[ NB = V_t / V_b \]
Where
- \( NB \) = number of primary and secondary bins
- \( V_t \) = total volume of primary and secondary bins
- \( V_b \) = individual bin volume

Example:
\[ NB = 812/200 = 4 \text{ bins} \]

Calculating the Safety Factor
For a safety factor of 1.5, or 50 percent over normal mortality:
\[ NB_{sf} \times 1.5 \]
Example:
\[ NB_{sf} = 4 \times 1.5 = 6 \text{ bins} \]
Table 1. Anticipated Mortality for Various Types of Poultry

<table>
<thead>
<tr>
<th>Poultry type</th>
<th>Mortality rate per cycle (percent)</th>
<th>Flock life (days)</th>
<th>Average market weight (pounds)</th>
<th>Mortality weight (pounds per day at end of cycle per 1,000 birds)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laying hen</td>
<td>14</td>
<td>440</td>
<td>4.0</td>
<td>1.27</td>
</tr>
<tr>
<td>Broiler breeding hen</td>
<td>11</td>
<td>300</td>
<td>7.0</td>
<td>2.57</td>
</tr>
<tr>
<td>Broiler breeder pullet</td>
<td>5</td>
<td>140</td>
<td>4.3</td>
<td>1.52</td>
</tr>
<tr>
<td>Commercial egg pullet</td>
<td>5</td>
<td>140</td>
<td>2.8</td>
<td>0.98</td>
</tr>
<tr>
<td>Broiler</td>
<td>5</td>
<td>45</td>
<td>4.5</td>
<td>5.00</td>
</tr>
<tr>
<td>Roaster</td>
<td>8</td>
<td>80</td>
<td>8.0</td>
<td>8.00</td>
</tr>
<tr>
<td>Turkey hen</td>
<td>6</td>
<td>98</td>
<td>16.0*</td>
<td>8.79</td>
</tr>
<tr>
<td>Turkey tom</td>
<td>9</td>
<td>133</td>
<td>25.0*</td>
<td>16.92</td>
</tr>
</tbody>
</table>

*Breeder and layer values are based on average mortality rates rather than the end-of-cycle rate. For an example showing how to calculate the mortality weight, see the box on page 2.

*bFor a brood-grow turkey operation, the weight should be based on a combination of the two operations.

Table 2. Estimated Primary and Secondary Bin Capacity for Mortality Composting Per 1,000 Birds and Standard Size Units for Various Types of Poultry

<table>
<thead>
<tr>
<th>Poultry type</th>
<th>Bin capacity in cubic feet per 1,000 birds*</th>
<th>Flock size in standard size units</th>
<th>Bin capacity in cubic feet per standard size unit</th>
<th>Number of 5' x 5' x 8' bins per standard size unit*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial egg hen</td>
<td>2.54</td>
<td>65,000</td>
<td>165</td>
<td>2 (0.82)</td>
</tr>
<tr>
<td>Breeding hen</td>
<td>5.14</td>
<td>8,500</td>
<td>44</td>
<td>2 (0.22)</td>
</tr>
<tr>
<td>Breeder pullet</td>
<td>3.04</td>
<td>16,000</td>
<td>49</td>
<td>2 (0.24)</td>
</tr>
<tr>
<td>Commercial egg pullets</td>
<td>1.96</td>
<td>70,000</td>
<td>137</td>
<td>2 (0.69)</td>
</tr>
<tr>
<td>Broiler</td>
<td>10.00</td>
<td>52,000</td>
<td>520</td>
<td>3 (2.60)</td>
</tr>
<tr>
<td>Roaster</td>
<td>16.00</td>
<td>39,000</td>
<td>624</td>
<td>4 (3.12)</td>
</tr>
<tr>
<td>Turkey hen</td>
<td>17.58</td>
<td>26,000</td>
<td>457</td>
<td>3 (2.28)</td>
</tr>
<tr>
<td>Turkey tom</td>
<td>33.80</td>
<td>24,000</td>
<td>811</td>
<td>4 (4.06)</td>
</tr>
</tbody>
</table>

Note: Calculations are based on allowing 2.0 cubic feet combined primary and secondary composter volume per pound of bird mortality.

*The formula for these calculations is given in the box on page 2.

*The first number is the number of bins needed; the number in parenthesis is the calculated number of bins required.

Note that at least two bins are needed to allow for aeration of compost even if calculations indicate that only a partial bin is needed.
A few construction features are essential to ensuring that the composting process will work consistently and to assure compatibility with environmental and nuisance concerns.

- **Roof.** A roof is necessary to prevent rainwater from reaching the compost because moisture promotes fly breeding and creates unsatisfactory composting conditions. The roof will also prevent water runoff from the compost, thus protecting groundwater and surface water. A roof overhang of 2 feet with guttering is recommended if compost bins are located at the sides of the building.

- **Foundation and Floor.** An impervious weight-bearing foundation of a material such as concrete is critical for an all-weather operation. Concrete also makes it easier to sweep up spilled litter ingredients and compost, which is important in preventing these materials from entering runoff water during rains. A concrete floor also assists in rodent control.

- **Building Materials.** Pressure-treated lumber should be used for bin construction because it resists the rotting process that the composting activity encourages.

Figures 1, 2, and 3 are layout drawings of composters constructed as freestanding units or as an extension of an existing building. Copies of these drawings and material listings are available from county Cooperative Extension Centers. As discussed earlier, the size of the composting building should be based on the size and number of composting bins needed. The cost of materials for composters varies considerably. Materials to construct the composter shown in Figure 1, which is sized for a 25,000-turkey operation, are estimated to cost $3,500.

Composting bins constructed inside the composting building must meet certain requirements to facilitate composting and to make it easy to turn the compost. The primary and secondary bins should be 5 feet high. Composter depth should not exceed 6 feet. The width of the compost bins should match the width of the compost-handling equipment but should not exceed 8 feet. Smaller bins make the composting process more efficient, particularly for mortality during the early part of the production cycle. The smallest bin recommended measures 3 feet in all dimensions.

**Composter Ingredients**

For composting to work, three components must be present in the correct ratio: a nitrogen source (birds and litter), a carbon source (straw, peanut hulls, or pine shavings), and aerobic (oxygen-requiring) microorganisms. When all three components are combined, the mixture heats naturally, reaching temperatures greater than 140°F, and mortality is broken down by microbial activity to produce water, carbon dioxide, nitrogen, and carbon. The high temperatures produced during the composting process destroy disease-causing organisms, making composting a sanitary method of mortality disposal. Ingredient proportions that will produce a

![Figure 1a. Litter storage shed with compost bins (isometric view).](image-url)
Figure 1b. Litter storage shed with compost bins (end view).

Figure 2. Delaware two-stage composter.

Figure 3. Maryland free-standing, two-stage composter.
carbon-to-nitrogen ratio in the range from 15:1 to 35:1 and a moisture content from 45 to 55 percent moisture are essential to the composting process. A typical recipe combines 1/10 part by weight of straw, 1 part by weight of dead poultry, and 1.5 to 2.0 parts by weight of poultry litter. This mixture will achieve a carbon-to-nitrogen ratio of 25:1 with a 45 percent moisture content (Table 3). Although optimum moisture is critical to the composting process, water need not be added if the litter has normal moisture content (25 to 35 percent). However, it may be necessary to adjust the moisture content of some dry litters (such as those from turkey brooder houses or from broiler houses with nipple drinkers) and of some wet manures (such as those from under broiler breeder slats or layer cages). For example, it may be necessary to add water to brooder litter or to litter from the scratch area in the breeder house. On the other hand, it may be necessary to add sawdust to raw manure from caged layers and breeder houses. The mortality compost after two heat cycles should have a moisture content similar to that of moist chewing tobacco.

Material that has gone through the compost cycle can be substituted in part for the litter, but a carbon source (such as straw or peanut hulls) must be added continuously to keep the carbon-to-nitrogen ratio at the optimum level.

Layering Composting Bins
The three ingredients are layered into the bin every day in the following order—straw, dead birds, and litter—until the bin is full (Figure 4). Begin by placing 12 inches of litter on the concrete floor of the bin, then add successive layers of straw, dead birds, and litter. The bird carcasses should be kept at least 6 inches away from the side of the bin. Each day’s mortality should be covered with litter immediately to avoid insect and animal pest problems. If the mortality is low—for example, at the start of the flock—use only the portion of the bin needed daily, adding portions of each layer until that layer is complete. Be sure that each day’s mortality is covered with the appropriate layer of litter. When the bin is full, add 6 inches of litter to cap the bin.

Much like the daily mortality pickup and disposal to which poultry growers are accustomed, filling the composter is also a daily routine. Once the daily mortality has been picked up, it is weighed, and the other ingredients are weighed and layered in the proper proportions. After the grower gains experience with these weight measurements, the operations can be performed on the basis of volume using buckets and a front-end loader or other equipment. The activity takes one person about 20 minutes a day for a broiler grower with a 100,000-bird capacity or a turkey grower with a brooding capacity of 26,000.

Monitoring and Turning (Aerating) the Compost
The material in the first (primary) bin goes through a natural rise in temperature that peaks in the range from 140° to 160°F. Once the process has depleted the available oxygen, the temperature begins to drop, indicating

<table>
<thead>
<tr>
<th>Table 3. Recipe for Mortality Composting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
</tr>
<tr>
<td><strong>Bottom Layer</strong></td>
</tr>
<tr>
<td>12 inches of litter or shavings on concrete</td>
</tr>
<tr>
<td><strong>Middle Layer</strong></td>
</tr>
<tr>
<td>1/10 part (by weight) of straw or peanut hulls</td>
</tr>
<tr>
<td>1 part (by weight) of dead birds</td>
</tr>
<tr>
<td>(one bird deep, 6 inches from edge)</td>
</tr>
<tr>
<td>2 parts litter</td>
</tr>
<tr>
<td><strong>Top Layer</strong></td>
</tr>
<tr>
<td>6 inches of litter</td>
</tr>
</tbody>
</table>

**Example:**
- 5 pounds of straw or peanut hulls
- 50 pounds of dead birds
- 100 pounds of litter
Table 4. Average Nutrient Analysis for Poultry Mortality Compost and Poultry Litter

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Brooder turkey litter</th>
<th>Grower turkey litter</th>
<th>Broiler litter</th>
<th>Turkey mortality compost</th>
<th>Broiler mortality compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>22.0</td>
<td>30.0</td>
<td>25.0</td>
<td>40.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Nitrogen (%)</td>
<td>2.3</td>
<td>2.8</td>
<td>3.6</td>
<td>3.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>2.6</td>
<td>3.6</td>
<td>4.1</td>
<td>1.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Potash (%)</td>
<td>1.6</td>
<td>2.0</td>
<td>2.3</td>
<td>1.7</td>
<td>2.4</td>
</tr>
</tbody>
</table>

that it is time to move the material to the second (secondary) bin. Using a front-end loader, the material in the primary bin is moved to the secondary bin. During the transfer process, the ingredients are mixed and aerated by keeping the bucket of the front-end loader high while dropping the material into the secondary bin. A 6-inch layer of litter should be added to the top of the secondary bin to cap it. After the material goes through a second heating, it is removed from the secondary bin and placed in storage, where it undergoes a third composting and heating cycle. The final storage cycle should take place in a shed or in a plastic-covered outdoor pile on a site designed to prevent runoff during rainstorms.

Figure 5 shows the temperature cycle of a turkey composter. Management of the composter includes monitoring the temperature cycle to determine when to turn the compost. The temperature can be measured with a 36-inch probe thermometer. When the temperature during the first heating cycle has reached its peak and has dropped for several consecutive days (for a total drop of approximately 20°F), it is time to transfer and aerate the compost. After a similar temperature sequence during the second heating cycle, the compost should again be turned and aerated. It should then be transferred to a storage area. The compost is ready to spread on fields after going through three heating cycles (including a heating cycle during storage). If it is desirable to break down the ingredients further or to have a more stable compost, the compost can be aerated again in storage; it will go through the heating cycle each time it is aerated.

Using the Mortality Compost

Mortality compost can be used as a nutrient source for crops much like fresh poultry litter or manures. Table 4 shows comparative average nutrient values of poultry litter and mortality compost. Good nutrient management techniques include testing for nutrient content of any animal by-product and then applying the product according to crop needs, using soil tests as a guide to spreading rates. The mortality compost is thought to release nitrogen more slowly and over a longer period of time than fresh litter. Studies on plant response to mortality compost are being conducted.

Insects and Other Pests Associated with Composting

The insects associated with the composting of dead birds are relatively minor pests, as are scavenger animals such as raccoons, rodents, foxes, and wild dogs. All of these pests can be controlled or eliminated by proper construction and careful management of the composting process.

In general, insect pests are found in the upper 4 to 6 inches of compost or around the base of the pile. Few if any insects will be present when the material is actively composting if the moisture content is within normal limits. The heat generated by the process (140°F to 160°F) usually deters insect breeding. Low moisture also minimizes odors that are attractive to carrion-feeding (carcass-feeding) insects.

Flies and carrion beetles serve as useful indicators of the overall “health” of the compost. When large numbers of these insects are present, it is likely that the material is not composting properly. Excessive moisture or poorly balanced carbon-to-nitrogen ratios should be suspected in such cases. Once the problem has been identified and corrected, insects will no longer find the compost pile attractive.

In rare cases, insects and other pests can become a problem when compost is spread in the field. This situation generally occurs only if the compost is applied at excessive rates without incorporation and then absorbs enough water to promote fly breeding or if it is applied before the bird carcasses have completely decomposed.

Flies associated with bird mortality composters will
always be present at levels similar to the normal background population for the farm. A well-designed and well-managed composter will not contribute to either the number or species of flies already present in the area. The same can be said for other insects and animal pests that may be found in or around composters. The following suggestions will minimize or eliminate pest problems.

- Design and build the composter in a way that will minimize moisture problems.
- Locate the composter well away from tree lines, ditches, dumps, and areas of heavy brush to discourage easy access by vertebrate pests.
- Construct the bins to be reasonably tight (that is, leave no gaps by which animals can gain access). Bin lids will aid in keeping out larger animal pests, such as raccoons and dogs.
- Keep the site clean. Mow weeds and grass regularly. Keep at least a 50-foot perimeter clear around the site. DO NOT stockpile lumber or store old equipment on or near the site. If replacement lumber or bin planking is kept on the site, it should be stored on racks at least 18 inches above the ground.

- Be observant. Rats and mice often burrow along the edges of concrete pads and into compost bins or into compost that is being held for later use. Bait all rat burrows as soon as they are spotted; place baiting stations or bait bars for mice.

- Follow the 6-inch rule. Be sure that the top layer of birds is covered by at least 6 inches of litter or compost. Place dead birds 6 inches away from the sides of the bin as well. Cover partially decomposed birds with 6 inches of compost when the pile is turned.

- Follow the recommended composting proportions to maintain the proper moisture content and carbon-to-nitrogen ratio for efficient composting.

For more information on insects related to composting see Cooperative Extension Service publication AG-474, Poultry Pest Management.

Prepared by

T. A. Carter, Specialist-in-Charge, Poultry Science Extension
K. E. Anderson, Extension Poultry Specialist
J. Arends, Extension Entomology Specialist
J. C. Barker, Extension Agricultural Engineering Specialist
S. S. Bunton, Associate Agricultural Extension Agent, Alexander County
B. Hawkins, Area Specialized Agent, Poultry, Chatham County
J. Parsons, Area Specialized Agent, Poultry, Duplin County
D. V. Rives, Extension Veterinarian
S. E. Scheidel, Extension Poultry Specialist
S. M. Stringham, Extension Entomology Specialist
M. J. Wineland, Extension Poultry Specialist

Acknowledgment

The authors acknowledge the University of Maryland Extension Service, which conducted the original mortality composter work, and Auburn University Extension and University of Arkansas, whose literature provided some of the information used in this publication. The North Carolina Department of Agriculture, Veterinary Division, and the Soil Conservation Service are also recognized for assistance in developing the information presented in this guide.

Figures 2 and 3 courtesy of the Cooperative Extension Service,
University of Maryland System.

1,000 copies of this public document were printed at a cost of $372, or $.37 per copy.

Published by
North Carolina Cooperative Extension Service