Composting 101

How to Effectively Operate a Poultry Mortality Compost Bin

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The objective of this presentation is to show the necessary steps to obtain a compost product from daily poultry mortality.
Composting is an age-old practice that can be beneficial for the environment. It is a natural process that generates a value-added end-product.
Bin composting is the method of composting that is discussed in this presentation. It is the most suitable method for daily mortality composting but is not feasible for mass mortality.

Bin composting is also the simplest contained composting method.

The process is carried out by heat loving micro-organisms in the presence of oxygen.
Bin composting dead birds can be done in a new construction, an addition to a stock (storage) house or a renovation to an existing farm structure.
Several criteria are to be considered when beginning your mortality compost.

A correctly operated compost requires a covered area with a concrete or impervious floor to prevent rain or storm water from reaching the compost.
Basic equipment is necessary for the daily operation of the compost bin.

- You will need a front-end loader or skid loader. These are usually already on the farm.
- Long-stemmed thermometers are necessary to check bin temperature.
- A shovel, hay fork and wheel barrow can also be useful.
- A water hose is needed to add water to the pile if necessary.
Thermophilic microbial activity fuels the compost process as the multiplication of these microbes generate the heat that is necessary for the carcasses to break down. Growth of these microbes must be encouraged by providing the necessary components: carbon, oxygen and water.

**Getting Started**

- Now that we have our facilities and equipment in place, we turn our attention to the materials that will be placed in the bins.
- A carbon-based material is needed in the mix. This can be supplied by the addition of poultry litter.
- We will also need the dead birds.
Pre-heating the litter will give the compost a jump start. This can be done by adding some water to the litter that will be used to layer the bin. The first layer of 8 to 12 inches of litter is necessary to absorb any leachate that may come from the decomposing carcasses.
The bulking material is a high carbon material that serves to aerate the pile. The pile should be aerated because the microbes involved are aerobic.
If the litter is too dry it will be necessary to add water to speed up the heating process.

Layering the Primary Bin

5. A small amount of water may be needed after each carcass layer; typically, thoroughly wetting the carcasses will be sufficient.

6. Add a layer of litter 6 to 8 inches thick.
Layering the Primary Bin

7. Repeat steps 2 through 6 until the pile reaches a height of 5 to 6 feet.

8. The last layer will be a cap of 8 to 10 inches of litter. This will help to eliminate odors and prevent flies and scavengers from invading your compost pile.
The composting process occurs in two phases: 1) Primary Phase and 2) Secondary Phase. The primary phase takes place in the primary bins and the secondary phase takes place in the secondary bin.
The temperature will begin to fall when the microbial activity is slowing down. The pile can begin to cool down earlier than usual for a number of reasons (see the troubleshooting section).

The Primary Phase

- Temperature should rise to ~ 140°F within 5 days and remain there for at least 7 to 21 days.
- The temperature will drop gradually after the first temperature spike.
- When the temperature falls below 130°F you will need to turn the pile for a second heating phase.
When the pile is turned, all the carcass may not be fully decomposed. Turning allows you to re-constitute the pile and add water so that it can re-heat.

**Secondary Phase**

- The secondary bin is essentially used for additional carcass decomposition.

- This secondary phase is also referred to as the maturation or curing phase.
Secondary Phase

- Transfer the pile from the primary bin to the secondary bin.

- Add water to allow the pile to undergo a second heating phase to complete the decomposition of any un-decomposed material that might remain.
Secondary Phase

- The temperature will quickly elevate again to 140°F or more, after which it will begin a gradual downward trend.
Proper management of the compost pile is essential in order for it to operate effectively. Monitoring the bins is an important management tool.

Monitoring Your Bins

- In order to have an efficient compost bin, it must be monitored frequently, especially during the primary phase of the process.
- Temperature, moisture content and time are all essential when managing and monitoring your compost bin.
The temperature should be checked regularly to ensure that it is at the required levels.

Note: High temperatures are beneficial for rapid decomposition, but temperatures that are too high can inactivate beneficial microbes!
High temperatures in the compost piles will destroy microbes.

Extremely high temperatures that last for too long can also destroy the heat-loving microbes that are necessary for the compost pile to operate effectively.

Apart from the destruction of thermophilic microbes from extreme temperatures, temperatures that are too high for too long can cause fires.
The microbes need moisture to survive. The right balance must be met; that is, it must not be too wet and it must not be too dry. When the pile becomes too wet, the microbial environment becomes suitable for anaerobic microbes, which will result in the production of offensive odors.

- Excess moisture in the pile will result in a compost pile that does not heat up, reduction in the oxygen content of the pile and retardation of growth and activities of some of the beneficial microbes.
- Excess moisture will also result in the pile becoming anaerobic and giving off unpleasant odors.
- Too little moisture will also prevent the pile from heating up and will delay the decomposition process.
Taking a handful of material from the pile is a simple way to test the moisture content.

When squeezed into a ball, the compost material should loosely hold its shape.

If it drips, it is too moist and more carbon material should be added to reduce the moisture content in the pile.

If the ball does not keep its shape the pile is too dry, water should be added to increase the moisture content in the pile.
There is no fixed time that can be determined for carcasses to decompose.

Preheating the litter before it is added to the pile will help to speed up the process.

- The time that is required to complete the composting process depends on several factors:
  - Temperature profile achieved
  - Compost formulation
  - Size and weight of carcasses
  - Warm climate versus cold climate
  - Mixing and aeration
  - Pre-heating the litter

- Murphy and Carr (1991) reported that “composting broiler carcasses required two consecutive seven-day periods to reduce carcasses to bony residues.” Again, this is dependent on the previously mentioned factors.
The end product of the process is about 25% less than was started out with and can be easily stored until it is to be used.
Troubleshooting

- When operating a composter it is always good to be aware of the problems that one can encounter and the possible suggestions that can help to alleviate these problems.

- On the following slides we will address some of the most common problems, their causes and solutions.
Remember to check temperatures regularly!

If you are unsure of the moisture content of the pile, do the moisture check by squeezing a handful of the pile in your hand.

If the ball drips, the pile is too wet.

If the ball falls apart without keeping its shape, the pile is too dry.

If the ball loosely keeps its shape, the moisture content is just right.
2. Failure to Decompose

**Probable Cause**
1. Improper C:N ratio.
2. Carcasses layered too thickly.
3. Carcasses on outside edges of the pile.

**Suggestions**
1. Evaluate bulking materials and adjust as necessary.
2. Single layer the carcasses.
3. Maintain 6 to 10 inches between carcasses and the edges of the pile.

The C:N ratio should range from 25:1 to 40:1.
If you are smelling the pile, something is wrong.

### Probable Cause
1. Too wet.
2. Improper C:N ratio.
3. Inadequate cover over carcasses.

### Suggestions
1. Add bulking material and turn.
2. Evaluate bulking materials and adjust as necessary.
3. Cover (cap off) with 8 to 10 inches of bulking material.
4. Flies

**Probable Cause**
1. Inadequate cover over carcasses.
2. Too wet (leaching).
3. Failure to reach proper temperature.

**Suggestions**
1. Cover (cap off) with 10 to 12 inches of bulking material.
2. Turn pile and add bulking material.
3. Assess C:N ratio and layering.
If scavengers are hanging around the pit, something is wrong.

It is also helpful to secure your premises from rodents and other scavengers that may be attracted to your farm.
A- The desirable moisture level in the pit should be 40 to 60%. If the moisture content is higher, it will result in low pile temperatures.

B- Low moisture levels and improper use of carbon sources will result in failure to decompose.

C- The walls and floors of the compost pit act as a heat sink and will pull the heat from the carcasses, slowing down the decomposition process.

D- It is important to make the first layer 8 to 12 inches thick to absorb the leachate generated from the decomposition process.
References

- D. Adams, C. Flegal and S. Noll. Composting Poultry Carcasses. NCR-530. Purdue University.


- USDA – United States Department of Agriculture

- WSU – Washington State University

* Unmarked photographs provided by author.
Additional information on composting poultry mortality can be obtained at:

www.poultry.uga.edu/extension