Composting: An Alternative Method of Deadstock Disposal

Manitoba Conservation regulates the disposal of deadstock under the Livestock Manure and Mortalities Management Regulation, MR 42/98 amended by MR 52/2004. Under this regulation:

15(1) No person shall keep mortalities in or at an agricultural operation unless the mortalities are kept (a) in a secure storage room, covered container or secure location; and (b) continually frozen or refrigerated, if not disposed of within 48 hours after death.

The approved mortality disposal options in Manitoba are:
1. 1. Burial
2. 2. Incineration
3. 3. Composting
4. 4.Rendering

Unfortunately, burial is not suitable for light, sandy soils and is impractical in the winter. As well, large operations (300 or more animal units) are not permitted to bury deadstock on the operation property without written approval from the director. Incineration can be quite expensive, particularly for larger carcasses, and the incinerator must be licensed and operated in accordance with the Incinerators Regulation. Finally, due to the BSE crisis, renderers will no longer handle ruminant (cattle, sheep, goat) material. This leaves on-farm composting as the only viable alternative in many situations.

This website provides an overview of on-farm composting mortalities. It includes interactive screens to assist in planning your composting site. For more information on carcass composting, please contact your local Manitoba Agriculture, Food and Rural Initiatives office or click here to find an agricultural office near you.

Diseased animals should be reported to your local veterinarian and disposed of accordingly!

Why Compost?

**Practical:** Composting requires good management, but minimal training. Carcasses of all species and all sizes can be composted if properly managed and composting can be done all year long. Labor is minimal and potential problems are easily resolved.

**Biosecure:** Allows for immediate year round management of mortalities to ensure disease is not spread. High temperatures within a well managed compost pile kill bacterial pathogens such as salmonella and will inactivate most viruses. Composting eliminates many biosecurity problems as trucks do not enter the farm to dispose of livestock.

**Cost effective:** Low to moderate start up costs and minimal operating costs. The main cost is in building a composting structure whether it be a bin or a pad. Typically loaders already available on farm can be used to turn the pile. Bulking agents used in the pile such as straw, bedding, or litter are usually readily available on farm.

**Environmentally sound:** The finished compost can either be used as part of the bulking agent for the next pile or it can be spread on fields as a beneficial source of organic matter and nutrients. Since the regulations on Specified Risk Materials (SRMs) came into effect, if this material is composed it cannot be spread on any land that is used to produce human or animal foods (i.e. gardens, pasture, etc.).
Composting Elements

Composting is a controlled aerobic process in which bacteria, fungi, and other microorganisms convert organic material into a stable humus-like product. Since microorganisms do most of the work, you must provide the best environment for them to live. To provide the best habitat for microorganisms the following is required:

1. **Good carbon to nitrogen (C:N) ratio**: Animal carcasses are high in nitrogen so you must add large amounts of carbon. A C:N of 20:1 – 40:1 is reasonable, the preferred range is 25:1 – 30:1.
2. **Adequate moisture**: Microorganisms need water to move around and transport nutrients. A moisture content of 40–65% is reasonable, the preferred range is 50–60%.
3. **Good aeration**: Composting is an aerobic process, which means the microorganisms need air to compost properly. Oxygen levels should be maintained above 5%. The target range is about 5-15%.
4. **Controlled temperatures**: The warmer the pile, the faster the microorganisms work. Temperatures between 43-65°C (110-150°F) are acceptable, but anything above 70°C (158°F) is too hot for the microorganisms to survive. The preferred range is 54-60°C (130-140°F). Temperatures maintained above 55°C (130°F) for 3 consecutive days kills pathogens.
5. **pH Levels**: Composting is effective at pH levels between 5.5 and 9. The target pH is 7.

The above five factors in combination are the key to making microorganisms happy and working hard. If you can achieve these things, then composting will be possible.

Site Selection

According to the *Livestock Manure and Mortalities Regulation, MR 42/98 amended by MR 52/2004*:

15.1(1) No person shall compost livestock mortalities on the property of an agricultural operation unless

.a. The composting site is located at least 100m from
   . i. Any surface watercourse, sinkhole, spring or well, and
   . ii. The operation’s boundaries

.b. The mortalities are composted in a manner that does not cause pollution of surface water, groundwater or soil; and

.c. The composting facilities and process are acceptable to the director

Other Considerations

- Clay or asphalt liner is required for certain soil types (sand, gravel)
- Well-drained area with all season accessibility not subject to run off or ponded water.
- Wind direction
- Aesthetics
- Future expansion

Co-Composting Material
Co-composting material is referred to any material added to the composting pile to aid in the composting process. Mortalities are high in nitrogen; therefore, co-composting materials high in carbon such as sawdust, straw, and woodchips should be used when composting deadstock. Particle size should also be taken into consideration. The co-compost material should be large enough to allow air flow into the pile, but small enough not to cool the pile. Particle size ranging from 0.25-2 inches should be targeted.

The amount of carcass:co-compost material required on a volume basis shown below has proven to be effective for mortality composting. For all other carcass:co-compost ratios, please contact your local Manitoba Agriculture, Food and Rural Initiatives office.

<table>
<thead>
<tr>
<th>Co-compost</th>
<th>Carcass : co-compost ratio</th>
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<tbody>
<tr>
<td>Sawdust</td>
<td>1:12</td>
</tr>
<tr>
<td>Straw</td>
<td>1:3-5</td>
</tr>
<tr>
<td>Woodchips</td>
<td>1:4-6</td>
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Note: If manure is used as a co-compost material a Manure Management Plan (MMP) must be filed with Manitoba Conservation for operations with 300 or more animal units.

Required Equipment

Before composting you must consider what equipment is available to you on the farm. Below is a list of equipment and supplies that producers should have access to prior to composting.

Material Transfer Composting requires a front-end or skid-steer loader to move carcasses as well as co-compost, cover the carcasses with co-compost, turn and mix the compost, and move the finished compost.

Temperature Monitoring Temperature is a key indicator in determining the success of your compost pile since microbial activity is directly related to heat. Temperatures should be monitored daily with a temperature probe approximately 1 m (3 ft) in length. There are both manual and digital temperature probes available.

Record Keeping It is critical to keep a record of your activities. This includes the weights of carcasses, type and amount of co-compost material, temperature measurements, weather conditions and any observations. Therefore, if something goes wrong with your composting pile you can look back to see when the error occurred and approach a solution.

Securing the Pile Manitoba Conservation requires that the composting pile be secure from scavengers. Chain link fences, chicken wire, and straw bales are commonly used.

Other Supplies It may be useful to have a shovel or pitchfork on hand to maintain your compost pile. It is also a good idea to have access to a water source. In areas where there is not much rain, water may need to be added to the compost pile.

Static/Windrow Composting
Static/windrow composting piles are commonly used in Manitoba. They are less costly than other composting structures such as bin or in-vessel composting units, but require more management since weather conditions (e.g. too much rainfall) that affect composting are not as controlled. This section will show you step by step how to build a static/windrow compost pile. Please refer to the "Compost Planning" section before proceeding with the following steps.

**Step 1** Place 2 ft (60 cm) layer of co-compost material on the ground. Ensure that the base is packed tightly and large enough to allow for a 2 ft (60 cm) clearance around the carcass. The 2 ft (60 cm) base acts as a sponge to absorb fluids. Take into consideration that the base layer will compact when the carcass is placed on top.

**Step 2** Lay the carcass in the centre of the base on its back or side, again, ensuring that there is a 2 ft (60 cm) clearance of co-compost around the carcass.

**Step 3** For ruminants larger than 300 lbs (136 kg), it is recommended to cut open the thoracic, abdominal cavities, viscera, as well as, slice large muscle mass to accelerate the compost process and prevent possible explosion of the intestinal cavities. For non-ruminant animals, no lacerations are required. Before the animal is covered, wet the animal hair or fur with water, this provides good carcass to co-compost contact.

**Step 4** Cover the entire carcass with at least 2 ft (60 cm) of material (straw). The 2 ft layer of material will act as a biofilter to reduce unwanted odours.

**Step 5** Once the composting pile is set up you are in the Primary Stage. In this stage, the temperature should increase to 40-65°C. Once the temperature stays above 40°C for seven consecutive days and then drops, the pile is ready to be turned (approximately 3 months in ideal weather conditions). By this time the compost pile should contain bones and minimal flesh.

**Step 6** Once the pile is turned you are in the Secondary Stage. The secondary composting period is usually equal to the primary composting time (approximately 3 more months). Monitor the pile daily, the composting process is usually finished after the temperature greater than 55°C for seven consecutive days drops. Check the pile, if there are no signs of flesh and only brittle bones left, the composting is done and can be applied on-farm. If there are still signs of flesh, turn the pile again and check the pile in a couple of months for flesh. Remember, composting is complete when all of the flesh has disappeared.
There are many different types of composting bins that can be used for carcass composting. They may be constructed with wood, concrete or straw bales. Hoop structures and altered machine sheds can also be used for bin composting. A bin system usually consists of at least two primary bins and one secondary bin, a concrete pad with a 4-6 inch curb to prevent leaching, and a roofing system to help control moisture levels. The width of each bin is wide enough to allow access with a front-end or skid-steer loader and are usually filled up to six feet.

**Step 1** Place 2 ft (60 cm) layer of co-compost material on the floor of the primary bin 1.

**Step 2** Lay the carcass in the centre of the base on its back or side.

**Step 3** For ruminants larger than 300 lbs (136 kg), it is recommended to cut open the thoracic, abdominal cavities, viscera, as well as, slice large muscle mass to accelerate the compost process and prevent possible explosion of the intestinal cavities. For non-ruminant animals, no lacerations are required. Before the animal is covered, wet the animal hair or fur with water; this provides good carcass to co-compost contact.

**Step 4** Cover the entire carcass with at least 2 ft (60 cm) of co-compost material. The 2 ft layer of material will act as a biofilter to reduce unwanted odours. For more than one animal mortality, make sure there is at least 1 ft of co-compost between the carcasses.

**Step 5** When adding more carcasses, skim the top layer down to 1 ft.

**Step 6** Place the carcasses on top of the pile ensuring that the carcasses are not touching. It is recommended to leave approximately 1 ft of co-compost between mortalities. Once primary bin 1 is full you are in the **primary stage**. In this stage, the temperature should increase to 40-65°C.

**Step 7** Once primary bin 1 is full, start filling primary bin 2 following steps 1-7 above.

**Step 8** Once the temperature in primary bin 1 stays above 40°C for seven consecutive days and then drops, the pile is ready to be emptied into the secondary bin (approximately 3 months). By this time the compost pile should contain bones and minimal flesh.

**Step 9** Once the pile is turned you are in the **secondary stage**. The secondary composting period is usually equal to the primary composting time (approximately 3 more months). Monitor the pile daily,
the composting process is usually finished after the temperature is greater than 55°C for seven consecutive days and then drops. Check the pile, if there are no signs of flesh and only brittle bones left, the composting is done and can be applied on-farm. If all of the flesh has disappeared, the compost from the secondary bin can be emptied out and spread on-farm.

Step 10 After approximately 3 months, the contents from primary bin 2 should be turned into the secondary bin. If there are still signs of flesh in the contents in the secondary bin (remnants from primary bin 1), mix the contents from primary bin 2 with the contents in the secondary bin. Again, monitor the temperature daily, if the temperature is greater than 55°C for seven consecutive days and then drops (temperature drop should be close to ambient temperature) the compost should be finished. If there are no signs of flesh, composting is complete. Large bones may be present and can be sieved out and thrown back into a primary bin for further composting.

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<tr>
<th>Problem/Symptom</th>
<th>Probable Cause</th>
<th>Suggestions</th>
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Troubleshooting Guide for Carcass Composting
Adapted from the Minnesota Department of Agriculture, Composting Animal Mortalities
<table>
<thead>
<tr>
<th>Failure to Decompose</th>
<th>Odour</th>
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<tr>
<td>• Too dry • Too wet • Improper C:N ratio or bulking agent used is too porous • Adverse environment • Improper C:N ratio • Carcasses layered too thickly • Carcasses placed on the outside edge of the pile</td>
<td>• Too wet • Too low C:N ratio • Air flow restricted • Inadequate cover over carcasses • Extended periods of low temperature</td>
</tr>
<tr>
<td>• Add water. • Add bulking agent and turn pile. • Evaluate bulking agent and adjust amount as necessary. • Ensure adequate cover with bulking agent to provide insulation. • Turn pile and adjust amount of bulking agent. • Single layer the carcasses. • Maintain one foot of space between carcasses and outside edge of bins.</td>
<td>• Add bulking agent and turn pile. • Evaluate type of bulking agent used. Add bulking agent. • Maintain one foot of bulking agent near outside of bin. Turn pile. • Cover carcasses with one foot of bulking agent. • Follow steps in temperature section.</td>
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<th>Flies</th>
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<td>• Inadequate cover over carcasses.</td>
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<tr>
<td>• Poor sanitation conditions</td>
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<tr>
<td>• Failure to achieve proper temperature</td>
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<tr>
<td>• Cover carcasses with one foot of bulking agent.</td>
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<tr>
<td>• Avoid leaching from pile. Maintain a clean, debris free area near the pile</td>
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<tr>
<td>• Follow steps in temperature section.</td>
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<td>Scavenging Animals</td>
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