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# Impact of Composting on Drug Residues in Large Animal Mortality

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Mortalities are inevitable in animal agriculture. For most animal operations in the United States, the average annual mortality is estimated to be between 4.5 and 6 percent of the livestock population. Common methods of mortality disposal include burial, rendering, incineration, and use of a landfill. The availability of options for disposing of mortality, particularly rendering, have changed in recent years, and financially and environmentally sound alternatives are needed. Issues of concern include:

- Zoning restrictions/regulations – May make burial illegal or may dictate how and where burial can be conducted.
- Environmental impacts – Improper mortality management may cause foul odors, attract scavengers, or contaminate water sources; it may also include difficulties such as attempting burial in frozen ground during the winter months.
- Regulatory issues – Can limit the use of rendering or landfills or increase the costs associated with these methods.
- Financial burdens – Disposal services can cost as little as $50 (some landfills) to more than $1,500 (incineration) per animal, in addition to costs associated with treatment for disease or euthanasia.

In light of these concerns, **composting** is becoming a more widely accepted practice for mortality disposal. Some benefits of composting include environmental benefits through recycling organic material and conserving landfill space, reduced odor and parasites associated with manure piles, decreased mass and volume of material to be disposed of, and control or suppression of parasites and some soil-borne pathogens.

There are many Extension-related documents available that discuss composting of mortality and the construction of appropriate compost piles. Composting is an aerobic, biologically mediated degradation process used to decompose organic matter. This is often used to dispose of yard trimmings, fruit/vegetable residue from the kitchen, and livestock manure. In animal operations, proper composting can decrease odors and minimize the buildup of waste products. When the compost is completely processed, it results in a product that can be used as a soil amendment that improves soil structure, porosity, and density; increases infiltration and permeability of heavy soils; improves water-holding capacity of sandy soils; and supplies a variety of micro- and macronutrients, decreasing the need for commercial products. For more information on constructing compost piles for mortality, see the selected references at the end of this document or contact your local Virginia Cooperative Extension office (www.ext.vt.edu/offices).

## Drug Residues and the Composting Process

With mortality composting becoming more popular, concerns from livestock farmers have arisen regarding the effects of drugs used in large animals and the impact they may have on compost quality and soil environment. Improper disposal of carcasses containing drugs of veterinary origin has resulted in the death



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of domestic animals and wildlife when the carcass was consumed by scavengers. As was stated previously, composting mortality can reduce pathogens and nutrient release and can provide some measure of biosecurity. However, there is a concern that drugs used in the livestock industry may not degrade readily and may persist in compost or leachate (fluid that may run off a compost pile). Many of these pharmaceuticals are not rapidly or completely degraded in the animal's body and can be present in manure and animal tissue. Some common drugs of concern include nonsteroidal anti-inflammatories (NSAIDs) such as phenylbutazone ("bute"; used as an anti-inflammatory and for pain control), anthelmintics (deworming medications), and barbiturates (euthanasia solution).

## Nonsteroidal Anti-Inflammatory Drugs – Phenylbutazone

Minimal research has been conducted on the effect of composting on the fate of NSAIDs. Researchers at Cornell investigated the fate of bute in two mortality composting studies (Schwarz et al. 2013). In each study, a horse that had received a standard dose of bute 12 hours and one hour before euthanasia was composted. Because bute is processed by the liver in a living animal, liver samples were tested separately from the carcass in order to compare the degradation of the drug in the liver versus the entire mortality. In the first study, bute was detected in the liver tissue until 20 days after burial and in compost until 41 days after composting was started. In contrast, bute was not detected at any time in the compost during the second study. Leachate samples collected during both studies and soil samples collected from beneath the piles during the second study were also tested for NSAIDs; no bute was detected in any of those samples.

The results from this research revealed that the resulting material from composting animal mortality that contained bute had undetectable concentrations by the end of the composting process. Even during the process, concentrations of bute in the compost were not detected at levels that would have been dangerous to animals or people (Schwarz et al. 2013).

## Deworming Agents – Ivermectin

Deworming agents such as ivermectin are commonly used in domestic animals to rid them of internal parasites. As with other pharmaceuticals, it's possible that the drugs will not be completely degraded in the animal's body at the time of its death, leading to potential environmental exposure via the mortality. While it is not expected that these drugs would negatively impact animals that might come in contact with them through mortality, it is possible that drug residues could impact other life forms they may come in contact with (microbes, earthworms, beetles, etc.). At this time, very little research has been conducted on the fate of deworming agents in mortality.

In particular reference to these drugs, the majority of orally ingested ivermectin is released in the manure of horses within 48 hours. Early research on earthworms exposed to 0.012, 0.025, 0.05, 0.1, and 0.2 µg/kg of ivermectin showed a dose-dependent weight loss in the earthworms — the more of the drug they were exposed to, the more weight they lost (Bloom and Matheson 1993). In another study, the concentration of ivermectin in horse manure was lethal or sublethal to many dung breeding invertebrates that are beneficial to the ecosystem (Lumaret and Errouissi 2002). This again leads to the question of whether or not ivermectin residues will remain after proper composting.

In preliminary work on composting and ivermectin, horse manure and bedding composted after the animals were given a standard dosage of 1.87 percent ivermectin paste still contained enough ivermectin after 56 days to be detectable and potentially detrimental to earthworms and dung beetles (J. Bonhotal, Cornell Waste Management Institute 2013, personal communication). In another study, horses given a standard dosage of 1.87 percent ivermectin paste 24 hours before euthanasia were composted. Manure samples were taken just before the horses were euthanized, as were samples of the compost and soil beneath the compost piles. All of the samples were tested for the presence of the drug. The only time ivermectin was detected was in the manure samples; it was undetectable in the compost or soil samples taken over 12 weeks of composting (Ciamillo et al. 2013).

Although preliminary, results from these studies revealed that the resulting material from composting animal mortality that contained ivermectin had undetectable levels of the drug by the end of the composting process, again suggesting that the final composted material was safe for use as fertilizer.

## Barbiturates – Sodium Pentobarbital

Sodium pentobarbital, an anesthetic, is commonly used for humane animal euthanasia. Concerns about this drug rose after wild animals died from secondary pentobarbital poisoning after feeding from mismanaged carcasses where euthanasia solution had been used. Once an animal has been euthanized with sodium pentobarbital, it cannot be left aboveground and must be buried, incinerated, or disposed of in another safe manner. Composting's effect on pentobarbital has been the focus of several research studies.

In Texas, compost samples from eight piles containing euthanized equine carcasses had detectable pentobarbital residues remaining at 180 days (Cottle et al. 2009). In Oklahoma, mortality compost samples still showed presence of pentobarbital at 129 days (Payne et al. 2012).

Research in New York showed that pentobarbital concentrations in liver tissue buried under 3 feet of soil or composted were undetectable by 83 days, but that pentobarbital concentrations in the mortality compost were still detectable after 224 days of composting (Schwarz et al. 2013). However, levels in this study had decreased to such a low concentration that it was determined that the compost was rendered safe for farm field use. Even the highest amount detected during the study would require a 45 pound dog to eat 110 pounds of woodchips in order to receive an anesthetic (nonfatal) dose of sodium pentobarbital, meaning the compost was safe to spread on a field.

Results on the fate of sodium pentobarbital present in compost after processing animal mortality are mixed, and further research should be conducted to ascertain whether or not the compost contains significant amounts of sodium pentobarbital during certain stages of the composting process.

## Summary

If piles are properly built and managed, composting provides a very viable, environmentally sound, and inexpensive solution to animal mortality management. Studies are just beginning to reveal the impact of composting on drugs and drug residues that may remain in mortality. While more research is needed, recent and ongoing studies are supporting the use of composting even where the potential for the existence of residual drugs in the carcass may be a concern.

## Additional Information

Cornell Waste Management Institute – http://cwmi.css.cornell.edu/horsefs.pdf

Washington State University Extension – http://cru.cahe.wsu.edu/CEPublications/eb2031e/eb2031e.pdf

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