

Managing Manure and Mortality by Composting

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Implementation of sound manure management practices and methods of mortality disposal are important aspects of horse ownership and equine facility management. Composting provides equine owners and facilities with a financially and environmentally sound alternative to stockpiling manure and to common methods of mortality disposal (e.g. burial, rendering, incineration, use of a landfill).

Composting is a method of accelerating the decomposition of animal waste. Benefits of composting include the recycling of organic material and conservation of landfill space, decreased odor and parasites associated with manure piles, suppression of some soil-borne pathogens, and decreased mass and volume of the material being disposed of. When compost is completely processed it can be used as a soil amendment making it more attractive than raw horse manure to potential end users such as gardeners and nursery growers.

Composting of horse manure can be done using free standing piles or windrows, however, use of composting bins can provide better control of the process and will minimize runoff and leaching thus reducing the risk of water pollution. Selecting a suitable location and determining bin size are the first steps in designing a composting system. Information on how to determine the size and number of composting bins needed can be found at the links provided below.

Taking a more active role in managing the compost pile will produce a better quality compost in a shorter period of time, but horse owners and equine operations need to customize the composting system to fit their specific situation. Monitoring the pile and making adjustments can improve the process. Tips for trouble shooting during composting are also provided in the resources listed below. Finished compost will have an “earthy” or humus smell and will look like rich soil. Management of the compost pile consists of the following five components:

1. Amassing the pile – creating a minimum pile size of 1 cubic yard by adding bedding and manure from horse stalls, manure picked up from riding rings, corals, and trails being careful to avoid picking up too much dirt with the manure and making sure the pile is free from trash
2. Monitoring the temperature of the pile – maintaining a temperature of 130-150°F for at least 21 days and monitoring the pile every 2 to 3 days with a long-stemmed compost thermometer to ensure active composting is taking place
3. Turning and mixing the pile – this helps aerate the pile to deliver oxygen to the microorganisms involved in composting and accelerates the composting process
4. Adding water to the pile – the pile should be moist, but not too wet; squeezing a handful of compost should feel like holding a wrung out sponge
5. Amending the pile with nitrogen – bedding material contributes carbon, so the more bedding removed with the manure during stall cleaning, the more likely supplemental nitrogen will need to be added to maintain an active composting process

Mortality compost piles also require sources of carbon and nitrogen, moisture and oxygen. Woodchips provide a source of carbon and are an absorbent material. When used as a base, woodchips will soak up moisture from the mortality which helps prevent leaching of nutrients and other products into the environment and reduces odor emission from the pile. To build a compost pile for a large animal mortality, start by building a base of woodchips, or stall waste containing wood bedding, approximately 24 inches deep and approximately two feet wider on all sides than the mortality to be composted. Place the carcass in the center of the woodchips and cover with approximately 18 inches of stall waste. Top off the pile with another 18-24 inches of woodchips or stall waste. This will create a pile approximately 6-7 feet tall in the shape of a pyramid. This form will allow the pile to shed water and to maintain the appropriate moisture content. Turning a compost pile containing a large carcass can be an issue. The compost pile is usually left to process for at least 3-4 months before it is turned (static versus active composting). However, use of larger woodchips can increase porosity allowing air into the pile. When composting a carcass containing barbiturates (e.g. when a horse has been euthanized using pentobarbital), care must be taken to ensure pets and wildlife do not have access to the pile. Research on the use of composting to manage animal mortality is ongoing, but the publications and links listed below will be helpful to owners and equine operations looking for an alternative solution to animal mortality management.

References and Further Reading

Bonhotal, J., M. Schwarz, C. Williams, A. Swinker. Horse mortality: Carcass disposal alternatives. Cornell Waste Management Institute publication. Available at <http://cwmi.css.cornell.edu/horsefs.pdf>

eXtension at <http://www.extension.org/>. Search for manure management, composting, livestock carcass disposal, and/or livestock mortality composting

Florida Department of Agriculture and Consumer Services (FDACS) BMP Rules, Manuals, and Other Documents. Available at <http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy/Enroll-in-BMPs/BMP-Rules-Manuals-and-Other-Documents>

Florida's Online Composting Center. Available at <http://sarasota.ifas.ufl.edu/compost-info/>

Managing Horse Manure by Composting. 2005 Florida Equine Institute Proceedings. Lori K. Warren, Ph.D., Department of Animal Sciences. Available at <http://www.animal.ufl.edu/extension/equine/New/documents/2005EquineInstit/Composting.pdf>

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Overview

- Discussing the why's and how's of composting horse manure
- Composting as a method of equine carcass disposal

How do you view manure?

- Waste?
- Nuisance?
- Nutrient source?
- Costly disposal issue?
- Source of disease?



Photo courtesy of FDACS Equine BMP Manual

Manure happens

- Feces, urine, bedding
- Source of nutrients
- Manure management requires responsible action
 - Storage
 - Disposition



Photo courtesy of thehorse.com

A mountain of manure

- A 1,000 pound horse:
 - Defecates from 4 to 13 times per day
 - Produces 50 lbs of manure per day
 - Produces 9.1 tons of manure per year containing 11 pounds of N, 2 pounds of P, and 8 pounds of K
 - 2.4 cubic feet per day (manure and bedding); 876 cubic feet per year (32 cubic yards)



Photo courtesy of myhorseuniversity.com

Composting manure: Why compost?

- Production of a more homogenous material
- Final product is dry making it easier to spread and manage
- May have marketability (soil amendment, growth media, mulch, slow-release fertilizer)



Photo courtesy of myhorseuniversity.com

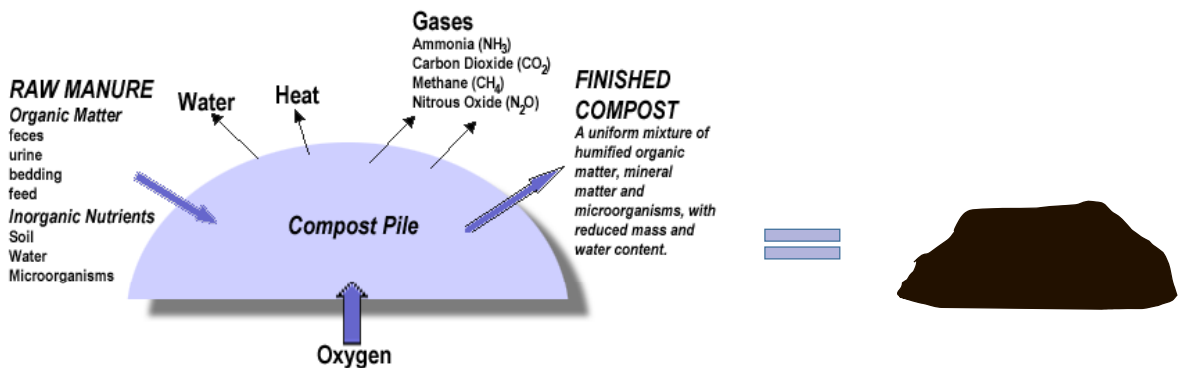
Composting manure continued

- Well composted manure has an earthy smell, 25-50% volume reduction, and destruction of pathogens and weed seeds due to heat of composting



Photo courtesy of eXtension.org

Composting principles



Essentially the same process as natural decomposition except that it is enhanced and accelerated by mixing organic waste with other ingredients in a manner that optimizes microbial growth

Illustration courtesy of www.agriculture.gov.sk.ca

Building a composting system

- Location of pile
 - Fairly flat site, away from low lying areas
 - 300 feet away from springs or wells
 - 100 feet away from open bodies of water
 - Out of view and downwind from neighbors
- Managing the pile
 - Minimum pile size (1 cubic yard)
 - Temperature (130-150°F)
 - Turning (by hand or mechanically to aerate)
 - Adding water (moist but not too wet)
 - Amending with nitrogen (bedding primarily contributes carbon)



Photo courtesy of FDACS Equine BMP Manual

How to determine bin size

Example Calculation: 2-Bin System for a Small Operation	
Number of horses	2
Volume of manure and bedding generated each day	$2 \text{ ft}^3/\text{horse} \times 2 \text{ horses} = 4 \text{ ft}^3$
Total storage capacity (number of months)	4 months (120 days)
Amount of manure generated	$4 \text{ ft}^3/\text{day} \times 120 \text{ days} = 480 \text{ ft}^3$
Number of bins	2
Size of <u>each</u> bin	$480 \text{ ft}^3 / 2 \text{ bins} = 240 \text{ ft}^3$ $240 \text{ ft}^3 = 8 \text{ ft} \times 8 \text{ ft} \times 4 \text{ ft}$

Warren, L. 2005 Florida Equine Institute Proceedings. Managing Horse Manure by Composting.

Trouble shooting

Symptom	Cause	Solution
Compost pile will not get hot	Pile may be too dry	Add water
	Pile may contain too much bedding (carbon)	Add fertilizer or manure to supply more nitrogen
	Pile may be too wet	Add more bulking materials; cover from rain
	Pile may be too small	Build a bigger pile
Compost has foul smell	Pile may be too wet	Add more bulking materials and turn pile
	Pile may need more air	Turn the pile more often
	Pile may contain a dead animal	Remove the carcass
Compost pile doesn't seem to be breaking down	Pile may be too dry	Add water
	Pile may be too small; not holding heat	Build a bigger pile
	Pile might not contain enough nitrogen	Add fertilizer or manure to supply more nitrogen

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Large Animal Mortality Composting

The problem

- Disposal options for deceased/euthanized animals
- Burial
 - Zoning restrictions, groundwater contamination, odor
- Incineration
 - Air pollution, cost
- Rendering
 - Regulatory changes
- Landfill
 - Some won't accept, others limit numbers
- Composting

Composting

- Compost – decomposed organic matter
- When done properly
 - Effective, affordable, environmentally sound
 - End product use – land application
- The process
 - Aerobic bacteria and fungi
 - Requires carbon, oxygen, nitrogen, and water
 - Generates high heat (135-160°), kills many pathogens
 - Can pile up material and wait (static)
 - Shred material, add water, aerate/turn pile (active)
- Do you want to turn a pile with an animal in it?

Research questions

- Will composting effectively dispose of mortality?
- How do you build a proper pile?
- Can we use static versus active composting?
- How will we know it's working?
- How long will it take?
- How will it look?

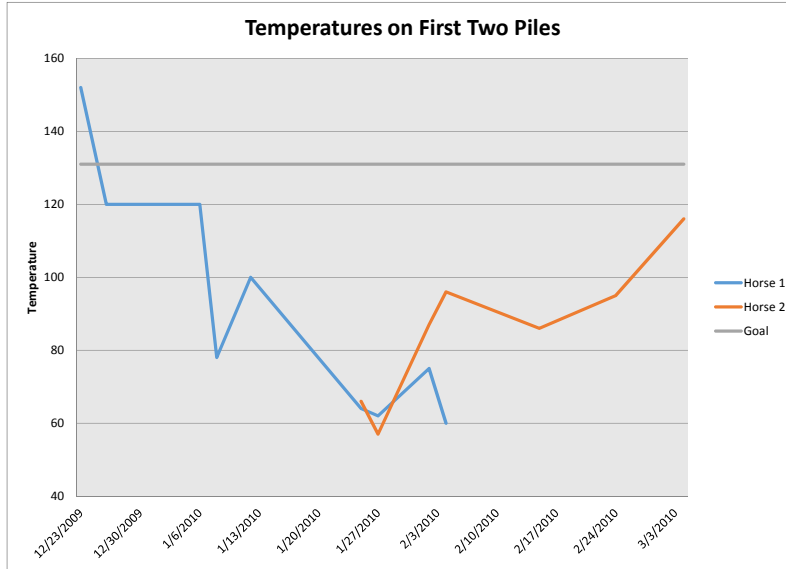


Pilot project (Virginia Tech)

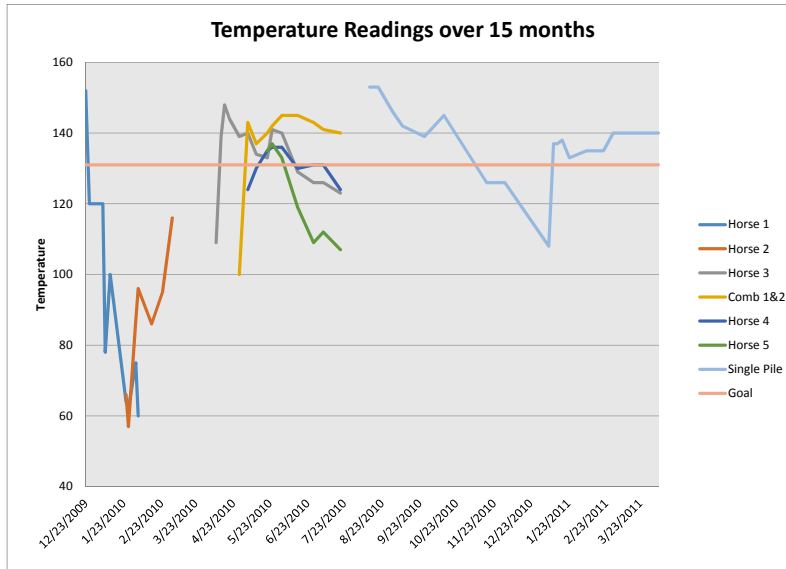
- Horses euthanized for health reasons donated to the project
- Wood chips, stall waste, mortality
- Built 5 test piles
 - Dec, Jan, Apr, May (2)
- Collected temperatures, observational data
- Answering research questions



Data collection - temps



Data collection – temps



Answers

- Will composting effectively dispose of mortality?
 - Yes
- How long will it take?
 - 60 days – 90+% of soft tissue gone, some odor
 - 15 months – still bones
- How do you build a proper pile?
 - Size very important
- Can we use static versus active composting?
 - Yes



Barbiturates

- Potential contamination
 - Environment
 - Compost
- Cornell study
 - Euthanasia dose – 102.9 mg/kg given to horse
 - No leachate after 56d; 2.2 ppm last detectable
 - Liver, soil – undetectable by 83d
 - Compost – 181d, <6 ppm
- Impact
 - Dogs, sedative 30 mg/kg, lethal 85 mg/kg
 - At “worst” (12 ppm in compost), 20 kg dog needs to eat 50 kg compost to become sedated

Ivermectin

- Drugs and importance of
 - Microbial activity
 - Manure degradation
- Ivermectin and manure research
 - Dosed manufacturer's recommendation
 - Max concentration in manure at 2.5d
 - Concentrations detected
 - in manure can have impact on beetles
 - in compost appear to decrease quickly
- Concentrations in compost not likely to impact microbial activity nor beetle health



Bones

- Rib bones, flat bones
 - Showing signs of degradation
 - Many not easily identified
- Long bones, complex bones
 - Still solid
 - Easily identifiable
- Is this a problem?
 - Appearance
 - Spreading
 - Sifting



Current situation

- Composting mortality can be done
 - Build pile correctly
 - Little/no issue with odor
 - Little/no issue with scavengers
- Drug considerations
 - Barbiturates seem to be “safe”
 - No apparent or anticipated effect of ivermectin
- Final product use
 - No regulations, but...



Acknowledgements

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References

- Florida Department of Agriculture and Consumer Services (FDACS) BMP Rules, Manuals, and Other Documents at <http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy/Enroll-in-BMPs/BMP-Rules-Manuals-and-Other-Documents>
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