Managing Horse Manure by Composting

Lori K. Warren, Ph.D., Department of Animal Sciences

Key Points:

- *Properly prepared compost has many uses as a growing media, soil amendment, or slow-release fertilizer.*
- *Composted manure is more attractive than uncomposted stall waste, making it easier to give away or sell.*
- *Composting kills intestinal parasite eggs and larvae and destroys weed seeds, reducing the risk of re-infection if compost is spread on pastures.*
- *A well-managed manure pile can be composted in 2 to 3 months.*

Basic components needed for composting:

- ✓ Horse manure!
- ✓ Adequate space
- ✓ A mechanism for getting air into the pile
- ✓ A source of water
- ✓ A source of additional nitrogen (if needed)
- ✓ A bulking agent or high-carbon source (if needed)

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Why Compost?

The average horse generates over 9 tons of manure each year (or even more if bedding is included). Managing such large volumes of manure can often be a challenge for many horse owners, particularly for those who may not have enough land to dispose of raw manure by spreading on pastures.

Although not a disposal method, composting offers horse owners one way to increase the value of horse manure. The heat generated by microorganisms living in the manure pile will destroy weed seeds and parasite larvae and eggs, making compost more attractive to gardeners and nurseries as a growing media or soil amendment. Composting also benefits the environment by stabilizing the nutrients in manure, making them less likely to be potential pollutants to surface or ground water. Compost can be applied to pastures as a slow-release fertilizer, reducing the risk of parasite re-infection, as well as the need for chemical fertilizers. Composting also reduces the odor and fly problems commonly associated with manure and decreases the volume of waste horse owners will have to dispose of by half.

Building a Composting System

Although composting can be accomplished with free-standing piles or windrows, most horse owners find they have better control of the process (and thus, faster composting) when manure and stall waste are placed in bins or some type of enclosure. Containing the pile also makes it easier to reduce the risk of water pollution from runoff or leaching.

Bins constructed from 2 x 6" (untreated) boards and heavy-duty posts will work best for most horse facilities. Materials need not be new; you may find suitable wood planks, concrete blocks, or other materials recycled from other farm/home improvement projects that can assist in containing the pile. The floor of each bin should be constructed of impermeable clay or concrete. A gravel access is convenient for loading or using a wheelbarrow to bring the manure to the heap. Covering the compost bins with a permanent roof, plastic sheet or tarp is recommended. Protecting the pile from rainwater will help you to regulate the proper moisture level, as well as reduce the risk of rain leaching contaminants from the pile and creating a pollution hazard.

At least two bins are recommended for small operations that support just a few horses, or for those with no mechanical equipment. In this scenario, the first bin is filled to capacity and periodically turned and mixed with a shovel or pitchfork to promote composting. When the first bin is full, materials can be added to the second bin.

Larger facilities, or those equipped with a small tractor or front-end loader, should consider building three or more bins. A series of bins allows the containment of waste at different stages of the composting process. In a three-bin system, manure and bedding are piled into bin one until it's full, then shifted into bin two for holding and composting. Meanwhile, bin one can be refilled. When bin one is full again, materials in bin two are shifted into bin three, and materials in bin one are shifted into bin two. Shifting material from one bin to the next serves as part of the turning and mixing process. Ideally, by the time bin one is full again, materials in bin three will be completely composted.

Determining Bin Size

The size of your compost bins will be dictated by the amount of manure and bedding produced, how long the materials will remain in the bin, and any equipment the bins will have to accommodate. In general, you should plan for at least 4 to 6 months of manure storage for composting.

Step 1: Calculate the amount of manure and bedding produced

An 1100-lb horse produces 50 lbs or one cubic foot of manure (urine + feces) each day. If manure is mixed with bedding, the volume can increase to 2 – 3 ft^3 (or more). You can also count the number of wheelbarrow loads generated from stall cleaning each day and estimate the volume of each load.

Step 2: Determine how long the materials will remain in the bin

The use of only one or two bins usually means the materials will remain in the bins for longer periods (3 to 6 months). When using three or more bins, each bin should provide enough space to house material generated for about a one or two-month period. The volume of material in each bin will decrease over time as materials degrade, so subsequent bins may be slightly smaller if necessary.

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

Locating Your Compost Pile

Your composting system should be located on a fairly flat site, away from low lying areas, to prevent storm water from pooling and carrying away potential water contaminants. In addition, your compost site should be situated away from springs or wells (minimum distance 300 feet) and open bodies of water, such as streams, lakes, rivers and wetlands (minimum distance 100 feet). Although a well managed system will not have a foul odor or attract flies, be considerate of your neighbors by locating your bins out of view and downwind. Remember to allow room to maneuver mechanical equipment (if used). You may also wish to situate the pile near a water hydrant for ease of adding moisture when needed.

Managing Your Compost Pile

Management of the pile can be kept simple or be quite sophisticated, and should be customized to fit your specific situation. However, if you devote some time and energy to managing the pile correctly, you will produce better quality compost in a faster period of time.

Remember that composting is a flexible process—it will occur over a broad range of conditions. Decomposition will take place even if a compost pile doesn't contain the "ideal" mixture of ingredients or is ignored after it has been built, but at a slower rate. Trial and error is an essential part of successful composting, so do not feel discouraged if the process is not going as you anticipated. By monitoring your compost pile regularly, you can learn what is needed to improve the process. Most adjustments are very simple and problems are easily corrected.

1. Amassing the pile

Add manure and bedding directly to the compost pile as you clean your horse stalls. This is also the best time to add water if needed. Manure picked up from riding rings, arenas, trails and corrals can also be added directly to the pile. Avoid picking up too much dirt along with the manure and keep all trash out of the pile. A minimum pile size of one cubic yard (about the size of a standard washing machine) is needed to achieve composting temperature.

2. Monitoring the temperature of the pile

Effective composting temperatures range from 130 – 150°F. The center of a properly made heap should reach such temperatures within a week during the summer, or may take up to a month in cooler seasons. To destroy parasites and weed seeds, temperatures of 130 – 150°F should be maintained for at least 21 days. Piles that are too cool (below 130°F) break down more slowly and don't kill parasites or weed seeds. Piles that are too hot (above 160°F) kill the composting microorganisms and result in an extremely foul-smelling pile. The temperature of the compost pile should be monitored every 2 to 3 days to ensure active composting is taking place. Long-stemmed compost thermometers are available at most hardware and garden supply stores and are a relatively inexpensive investment.

3. Turning and mixing the pile

Microorganisms involved in composting need air. In addition, the most active site of composting takes place in the hotter center of the pile. Therefore, turning not only helps to aerate the pile, but also ensures that weed seeds and parasites in the cooler sections are destroyed by bringing them into the center to "cook."

Depending on your composting system and the amount of manure generated, the pile can be mixed and turned by hand with a pitchfork, or mechanically with a small front-end loader. Frequent turning accelerates the composting process; the more it's turned, the faster it breaks down. Turning may be done on a weekly or monthly basis, or may be based on the measured temperature of the pile. If using temperature as a guide, piles should be turned when temperatures fall to 100°F or when they rise above 150°F.

As an alternative to frequent turning, you may also elect to "passively aerate" your compost by inserting PVC pipes that have ½-inch holes drilled along each pipe at 6" intervals. These perforated pipes can be stuck down into the pile like chimneys, or inserted horizontally and layered along with the manure as the pile grows. Occasional turning of the pile may still be needed to get manure on the outside into the center so the heat from the composting process can destroy parasites and weed seeds. Please note that it may take longer to compost manure aerated by PVC pipes compared to a pile that is actively mixed on a regular basis.

4. Adding water to the pile

All materials in the pile must be moist, but not soaking wet. Moisture can be gauged by squeezing a handful of compost. Compost that contains an adequate amount of moisture will feel like a freshly wrung out sponge. If water runs out of the pile or if you can squeeze water from a handful of compost, it is too wet. In this case, you will need to add straw, tree leaves, shredded bark, or old hay to dry the pile. If it doesn't feel moist, you need to add water. Consider watering your compost with a garden hose when you turn it. Or, an easy way to add water is to hose down the manure in your wheelbarrow before you dump it into the pile, if it's needed. Make it a habit to check the moisture content of the pile on a regular basis.

5. Amending the Pile with Nitrogen

By itself, horse manure contains the ideal mixture of nutrients and moisture for composting. However, quite often the manure horse owners would like to compost contains bedding. Bedding primarily contributes carbon to the compost pile, which can offset the amount of nitrogen provided by the manure. The more bedding you remove with manure during stall cleaning, the more likely you will need to add supplemental nitrogen to maintain the composting process, particularly with wood bedding (chips, shavings, sawdust, etc). Commercial fertilizers, such as urea, ammonium nitrate, or another high-nitrogen fertilizer, can be added to the pile to provide additional nitrogen. Ideally, nitrogen should be sprinkled on each wheelbarrow load of manure dumped on the pile each day. Alternatively, nitrogen can be mixed into the pile when it is turned. Refer to the table below for guidelines on amending the compost pile with nitrogen.

Guidelines for amounts of supplemental nitrogen to add per ton (2000 lbs) of stall waste using common sources of nitrogen.

Manure : Bedding Ratio (by weight)	**Type of bedding**	**Nitrogen Source** (% N)		
		Urea (46% N)	**Ammonium Nitrate** (33% N)	**Calcium Nitrate** (15% N)
1 part manure : 1 part bedding	Straw or Hay	None	None	None
	Wood shavings	20 lbs	30 lbs	60 lbs
1 part manure : 2 parts bedding	Straw or Hay	15 lbs	20 lbs	40 lbs
	Wood shavings	30 lbs	40 lbs	90 lbs

Is it Ready?

A well-managed manure pile will be completely composted in as quickly as 60 days. The average time to completion for most horse owners is 120 days. Piles that don't have enough nitrogen, water or air, or those that aren't maintained, break down much more slowly, taking 6 to 12 months or more.

Finished compost will not heat up after routine turning and mixing. Compost will smell "earthy" and look like rich soil.

Putting Compost to Use

After you have successfully produced compost you need to think about what you will do with it. Composted manure is often a more attractive product than raw manure, making it easier to give away or sell to others if you cannot use it yourself. Properly prepared compost has many uses, including:

- **Soil Amendment**. Composted horse manure can be used to increase the organic matter content and the water and nutrient-holding capacity of sandy and heavy clay soils.
- **Growth Media**. Finished compost can be used by plant nurseries as potting soil and is an excellent media for the production of mushrooms, roses and fishing worms.
- **Mulch**. Compost can be a valuable mulching material for garden and landscape plants. And if used as mulch, the compost need not be completely finished.
- **Slow-release Fertilizer**. When applied to lawns, cropland or pastures, finished compost can supply a modest amount of nutrients that will be released slowly over time. Since compost is already broken down, it does not deplete the soil of nitrogen needed by plants to grow. Nitrogen depletion can occur when uncomposted manure is spread on fields. And because composting kills parasites and weed seeds, the risk of re-infection is reduced. Additional fertilization may be necessary to obtain acceptable growth yields when compost is applied as fertilizer.

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