

# A Guide to Composting Horse Manure

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If you've been stockpiling your manure in a single pile for as long as you can remember, you may have found that if you dig into the middle of the pile, you'll find something that resembles dirt more than it does manure. If this is the case, at least some of your manure has already gone through the decomposition, or composting, process. Manure that has been left uncovered in large, spread out piles will eventually compost. However, this version of composting often creates unpleasant odors because there is not enough air reaching the inside of the pile. These piles also rarely reach high enough temperatures to kill parasites, fly larvae, weed seeds, and pathogens. The following information on composting will help you learn how to compost all of your manure, instead of what's just in the middle, speed up the process dramatically, and help heat manure up to temperatures that will kill parasites, fly larvae, weed seeds, and pathogens.

## The Benefits of Composting

### Horse Health

**Reduce flies.** A well-managed compost pile will reach temperatures high enough to kill fly eggs and larvae in manure. By reducing the amount of uncomposted manure you have, you'll also reduce breeding grounds for flies.

**Kill parasites and pathogens.** The high temperatures achieved through composting also kill worms and pathogens (organisms such as bacteria, viruses, fungi, and protozoa that are capable of producing an infection or disease). This is especially important if you are spreading your manure in the same fields your horses graze in or on vegetable gardens.

### Convenience and Aesthetics

**Reduce odors.** A well-managed compost pile will be free of the odors often associated with an uncomposted manure pile.

**Cut your pile in half.** Composting reduces bulk and has 40 to 60 percent less volume and weight than uncomposted manure. That means you can reduce the amount of your manure pile by about 50 percent by composting!

**Kill weed seeds.** The high temperatures achieved through composting will kill most weed seeds.

**Improve marketability.** Compost is much more marketable than uncomposted manure and is often used by topsoil companies, landscapers, nurseries, and organic farmers. You may be able to sell your compost and actually make money out of that mountain of manure!

**Even out grazing patterns.** Horses grazing in pastures spread with composted manure (instead of fresh manure) are more likely to graze normally and are less likely to restrict grazing to areas with the thinnest application rates.

## Healthy Soil

**Improve aeration and water retention.** Adding compost to soil builds good soil structure and texture, increasing the amount of air that can infiltrate and the amount of water it can hold. Adding compost to heavy clay soil loosens the packed soil by opening up pore spaces that, like little tunnels, carry air and water down into the soil. Sandy soils, which tend to let water drain away too rapidly, are also improved with the addition of compost. The fine particles are united into larger ones that can hold a greater amount of water—100 pounds of compost can hold about 195 pounds of water! By increasing the soil's moisture-holding capacity, compost also helps control erosion that would otherwise wash topsoil away.

**Supply nutrients.** When fresh manure is spread on a field, about 50 percent of the nitrogen is in a highly soluble form and will be washed out by rain when it is spread on a pasture. In compost, however, 95 to 97 percent of nitrogen has been converted to a much more stable form and will be slowly released, allowing plants to use it over a longer period of time. Compost doles out nutrients slowly when plants are small and at greater rates as soil temperatures warm up and the major growth period begins. (Soil microorganisms that release the nutrients from compost work harder as temperatures increase.) The benefits of adding compost will also last for more than one season. Composted manure releases about 50 percent of its nutrients in the first season and a decreasing percentage in the following years. This means that with constant additions of compost, the reserves of plant nutrients in the soil are being built up to the point where, for several seasons, little fertilizer of any kind may be needed.

**Bacteria, earthworms, and pH.** Compost also supports essential soil bacteria; feeds earthworms and allows them to multiply; and gradually changes soil pH levels that are either too low (acidic) or too high (alkaline).

## **The Environment**

**Protect water quality.** Because the composting process converts nitrogen into a less soluble form, it is less likely to be washed out of manure and into ground water and surface water. Excessive amounts of nitrate in drinking water can cause health problems such as blue baby syndrome and may be linked to cancer and birth defects. Recent samplings of wells in northern Whatcom County have found nitrate levels above the U.S. Environmental Protection Agency's safe drinking water standards.

**Protect fish and shellfish.** When rain falls on soil rich with compost, raindrops seep into it. When rain falls on packed soil rain runs off the surface, creating erosion and carrying soil particles to nearby waterways. Sediment can smother trout and salmon eggs and make water cloudy, making it more difficult for fish to find insects to eat. Raw manure also contains fecal coliform bacteria which is commonly used to measure contamination of water from human or animal waste. The coliform bacteria may not necessarily produce disease, but can indicate the presence of other bacteria that may cause infections, hepatitis, and other illnesses. When coliform bacteria is found in the water around shellfish growing areas, it often leads to shellfish bed closures. Composting kills most of these coliform bacteria as well as viruses and parasites that may be a concern to human health.

**Conserve our natural resources.** Using compost instead of chemical fertilizers can reduce our use of non-renewable resources like natural gas. Approximately two percent of the natural gas consumed in the United States goes into the manufacturing of nitrogen fertilizer.

## **How to Make Compost Happen**

There are several key factors in having a successful compost pile and how well you manage each one will have an effect on how quickly your manure composts.

### **Managing Air and Temperature**

**Build the optimum pile size.** To achieve high enough composting temperatures to kill parasites, bacteria, and weed seeds, a pile must be at least three feet high. Otherwise, the heat generated in the initial stages will quickly dissipate before the pile can reach high enough temperatures. For best heating, try for a pile five to seven feet square on the bottom rising to three or four feet high.

**Maintain airflow through the pile.** After a pile is formed, keeping air in the pile is critical to prevent odors, achieve high temperatures, and to complete the composting process in a relatively short amount of time. If you have a tractor, turning the pile at

regular intervals, especially during the first few weeks after building the pile, will speed up the decomposition process considerably. In general, the more often you are able to turn the pile, the faster it will decompose. Turning will not only help allow air to reach all areas of the pile, it will also ensure that material on the outside of the pile is turned to the center where it can be subject to high temperatures where pathogens, fly larvae, and weed seeds are destroyed.

If you are not able to turn the pile with a tractor, you can insert a couple of five-foot PVC pipes into the center of the pile like chimneys. Use a drill to put some holes into the pipes—approximately a half inch in diameter at six-inch intervals.

Another method of achieving airflow through the pile is the aerated static pile method described later in the Composting Methods section.

**Monitor temperature.** Temperature is an important indicator of how well the manure pile is composting. You can buy a long-stemmed compost thermometer at local nurseries or home and garden stores to monitor your compost piles. Most compost piles begin at a lower temperature range (about 50°F-110°F) then increase to the higher temperature range (110°F-160°F) and then gradually drop to ambient air temperatures over a period of several weeks. These high temperatures are necessary to speed up the rate of decomposition and to kill weed seeds and diseases. At least several days of temperatures between 135°F and 150°F are recommended. You also want to avoid overheating the pile, overheating can immobilize many of the beneficial organisms needed for decomposition. If you find your pile is reaching temperatures above 160°F, you may want to try reducing the size of your pile.

Low outside temperatures during the winter months slow the decomposition process while warmer temperatures speed it up. On average, a well-managed pile can be composted in one or two months in the summer and three to six months in the winter.

## **Managing Moisture**

Unsuccessful attempts at composting often result from a failure to maintain the proper moisture conditions. If there is too much water in the pile, the water will occupy the pore spaces needed for air to flow through the pile. Too much water also makes the pile heavy, increasing settling and compaction. When there is not adequate air in the pile it can lead to odors, slow the decomposition process, and make high temperatures impossible to achieve. On the other hand, too little moisture causes composting organisms to dry out which also prevents the pile from heating up.

**Use the squeeze test.** Take a handful of material from the interior of the pile (not just the outer shell) and give it a squeeze. A handful of material should feel damp like a wrung-out sponge, not dripping wet. If you pick up a handful of material and it drips without being squeezed, it is too wet. If the material appears dry and crumbles after squeezing, it is too dry. If the material retains its clumped shape after squeezing without releasing excess water and your hand is damp, then it is just right for composting.

**Cover your pile(s).** During our rainy season it is easy for an uncovered compost pile to become too soggy, inhibiting airflow. The end result is often a foul-smelling pile that is very slow to compost. Covering your compost pile allows you to regulate the amount of water and will speed up the process by not letting it get too wet in the winter or too dry in the summer. It's much easier to add water than it is to remove it. Covering your compost pile also limits fly breeding and keeps rain from washing nutrients out of the pile. Using a tarp is one of the easiest ways to cover a compost pile. Stapling or nailing a board across the front of the tarp can make it easier to pull the tarp forward and back. A permanent structure with a roof also works well, especially for larger horse farms with larger compost piles.

**Add water when needed.** Heat and airflow generated during composting can evaporate large amounts of water from a pile and you may find that your pile may get too dry in the summer. If you turn your compost pile, you can water it down with a garden hose when you're turning it. Otherwise, you can water down wheelbarrow loads before adding them to the pile.

**Choosing a good location for your compost pile(s).** Select a level site that drains easily and that sits on fairly high ground so the pile never sits in a pool of water. A dry level area is especially important when it comes to accessing the pile with any kind of heavy equipment (a tractor, truck, etc.). Equipment needs dry, level ground for turning around and positioning. Choosing a location for your compost pile that's convenient to your stall and paddock areas will make the chore of cleaning up easier and less time consuming. You'll also want to have the pile in an area that you can reach with a hose so that you can add water during those dry summer months.

A buffer zone is also required between your compost piles and nearby streams, ditches, wetlands, and residences. Contact your local Conservation District for more information.

**Turn to help dry out the pile.** If a pile becomes too moist you can help it dry out by increasing the turning frequency. Turning the pile can release significant amounts of water.

## **Managing the Ingredients in the Pile**

The organisms that do the decomposing in your compost pile need carbon for energy and nitrogen for growth. It's important to supply both kinds of materials in roughly the right proportions. The ideal carbon to nitrogen ratio for composting is between 25:1 and 30:1, with carbon being the higher number.

High carbon materials are plant materials materials such as straw, wood chips, shavings, sawdust, and leaves. Materials that are high in nitrogen often include animal by-products like manure and blood meal but also includes grass clippings and hay. On its own, horse manure is about the ideal ratio. But if you add a lot of bedding to your compost pile, you can end up with too much carbon and not enough nitrogen.

When you have too much carbon (bedding) in the pile more time is needed to complete the composting process. The less bedding you put in the pile, the faster it is likely to compost. A manure pile with a lot of bedding is also less likely to compost completely. When added to the soil, high-carbon compost “robs” nitrogen from the soil to continue decomposition, making it unavailable to growing plants. When this occurs, the plants usually show a nitrogen deficiency as a yellowing of the leaves.

**Minimize bedding.** By minimizing the amount of bedding you use you’ll save money and end up with a manure pile that composts faster. Most horses don’t need as much bedding as is often used, they just need enough to soak up urine and moisture. When you clean stalls, try to remove only soiled bedding so that less bedding makes it into the compost pile. You may want to consider using rubber mats in stalls to provide the same amount of cushioning with less bedding. Rubber mats have other advantages also: they prevent horses from ingesting dirt or sand when eating off the stall floor, make stall cleaning easier, decrease dust, prevent a pawing horse from digging holes in the stall, and provide an even surface for horses to stand on (uneven surfaces may cause or exacerbate leg problems).

**Consider your bedding options.** Different types of bedding will decompose at different rates so which bedding you use will affect the speed of the composting process. Straw and shredded newspaper will compost faster than sawdust or shavings because they contain less carbon. There are also wood pellets on the market that are much more absorbent than straw or shavings—as a result, you end up using less bedding and less bedding ends up in the compost pile. These pellets are more absorbent because they go through a drying process that reduces the water content. They also break down into finer material that composts faster than shavings and that makes it easier to remove only soiled bedding when cleaning stalls.

**Add materials if necessary.** If you have too much bedding in your pile and want to help speed up the composting process, adding materials high in nitrogen like grass clippings, chicken manure, and blood meal can help.

## **Composting Methods**

### **Passive Composting**

Passive composting works well for small horse farms (from one to five horses) that do not have a tractor to turn the piles or are not able to turn them on a regular basis. This method involves forming small piles of manure approximately five to seven feet at the base and three to four feet high and leaving them mostly undisturbed until it has decomposed into a stabilized product. To build a pile to the minimum three-foot height without a tractor, it’s easiest if the pile is contained in a bin or enclosure. The sides of the bin should have some space between each board to increase the amount of air that can reach the pile.

Small piles are designed to take advantage of natural air movement. As an actively composting pile heats from the inside, the warm air rises, pulling cooler, fresher air inward from the sides and bottom. Using PVC pipes with holes drilled in them (as described in the section on managing airflow) can also help aerate the pile. With this method it is especially important to cover the piles to keep them from getting too wet. With low amounts of bedding and the right amount of moisture, these piles can get quite hot and produce good compost.

If possible, you'll still want to turn the pile occasionally to get the manure on the outside into the center where the heat from the composting process can kill parasites and weeds.

The composting designs on pages 10 and 11 are designed for a small horse farm with one to five horses. You can tailor this system to meet your needs depending on how many horses you have, the amount and type of bedding you use, and how you plan to use the finished compost. If you plan to use a tractor you will need a much sturdier design.

Two bins will probably be adequate for one to five horses but you can add a third for convenience. Pile manure and stall wastes into the first bin until it is full, then leave it alone to compost and start filling the second bin. In two to four months, the first bin should be done composting and ready to use. Adding a third bin allows one bin for the daily stall wastes, another bin that is full and in the composting stage, and a third bin for the finished compost to be removed and used at your leisure.

## **Turned Piles**

If you have a tractor available to form and turn your piles, you'll improve the amount of air reaching all areas of the pile and speed up the rate of decomposition considerably. Turning also takes the material from the exterior of the pile and puts it into the interior of the pile so that all materials are composted evenly and weed seeds, parasites, pathogens, and fly larvae can be destroyed by the high interior temperatures.

Piles are most easily turned if placed on a concrete pad. This makes it easier for the bucket to scrape the surface and keeps the tractor tires from tearing up the ground. It also keeps nitrates from the pile from soaking down through the soil and into groundwater. As with the passive method, it is optimal to have three compost piles: one to which the fresh manure is added daily, one in the process of decomposing, and one composted and ready to use. A 30' x 30' pad will house three piles with some room to move.

## **Aerated Static Piles**

This method uses an aeration system—usually a system of perforated pipes connected to a blower—placed under the compost pile to periodically blow or draw air into the pile. A simple on/off timer is used to control the aeration rate. A typical setting might be 3 minutes on and 12 minutes off, running 24 hours a day, 7 days a week for 30 days or more. Adjusting the frequency and duration of airflow into the pile controls the temperature. This process provides more direct control of composting and permits larger piles.

This method requires a considerable initial investment but if you have more than five horses on your property it may be worth it, especially if you are able to sell your compost.

## Compost Troubleshooting Guide

Condition or situation	Possible source or reason	Other clues	Solution
Pile fails to heat	Pile too dry	Cannot squeeze water from material	Add water/wet the pile
	Materials too wet	Materials look or feel soggy, pile slumps	Turn and/or cover pile
	Not enough nitrogen	Large amount of bedding	Add high nitrogen ingredients, reduce bedding
	small pile size	Pile height less than 3 feet	Enlarge or combine piles
Temperature falls consistently over several days	Low oxygen	Temperature declines gradually rather than sharply	Turn and/or cover pile
	Low moisture	Cannot squeeze water from material	Add water
Odors	Materials too wet Insufficient aeration	Low temperatures	Turn pile, add PVC pipes, cover
Fly problem	Flies breeding in uncomposted manure		Cover pile with a tarp or a 6-inch layer of finished compost to prevent access

## How to Know When Compost Is Ready for Use

The composting process begins as soon as you begin to pile up your manure. Almost immediately, microorganisms begin their work and temperature increases are often noticeable within a few hours of forming the pile. With adequate airflow and moisture the pile's temperature should increase rapidly to 120°F-160°F and may remain in this range for several weeks. As active composting slows, temperatures gradually drop to around 100°F and then to ambient air temperature. Compost should "cure" for at least a couple of weeks before use. Finished compost is a crumbly, evenly textured, earthy-smelling, dark material that looks like a commercial potting soil mixture.

It will probably take about one to three months for each pile to compost during the summer and about three to six months in the winter. If you monitor your piles with a

thermometer you will see a gradual drop in the higher “active” composting temperatures as it begins the curing process and becomes ready for use.

## **What to Do With Your Finished Compost**

**Spreading compost on pastures.** The easiest way to spread compost is to use a manure spreader and a tractor (or a strong riding lawnmower) to load, pull, and spread your compost. But you can also spread it without all that equipment: all you need is two people, a shovel, and a riding lawnmower, small cart, or pickup truck. Simply have one person drive while the other person spreads a thin layer of compost.

Only spread compost during the growing season (April-September) when plants can use it and when it’s less likely to be washed away by the rain. Apply approximately ¼ inch at a time (you don’t want to smother the grass) and no more than three to four applications per year. Re-apply only after the previous layer has worked its way into the soil.

**Using compost in garden and landscape areas.** Compost can be worked into garden beds by hand or with a tiller or added to the soil when planting trees, shrubs, annuals, or perennials. Compost is also an excellent mulch or topdressing around flowers, shrubs, and trees. This mulch will help your plants get through the dry summer with less need for irrigation. When using it as a mulch around trees or shrubs, start three to four inches from the trunk and spread the compost out to the dripline keeping it about three inches deep.

**Selling your compost.** To find a buyer for your composted manure, contact local topsoil companies, tree farms, landscapers, and organic farmers. There’s a good chance that you will need to deliver it to them but you can still end up making a profit on your compost.

**Giving away your compost.** If you somehow end up with compost that you want to get rid of, post a “free manure compost” sign where people can see it from the road. Try to make your pile easily accessible so that people can simply drive up and take what they want, when they want. You can also put an announcement in local newsletters and newspapers—many papers will let you advertise free things at no charge.

## **References**

The Rodale Book of Composting. Rodale Press, Inc., 1992.

Field Guide to On-Farm Composting. Natural Resource, Agriculture, and Engineering Service, 1999.

Healthy Horses, Clean Water. Horses for Clean Water, 2000.

## Compost Bin Design #1

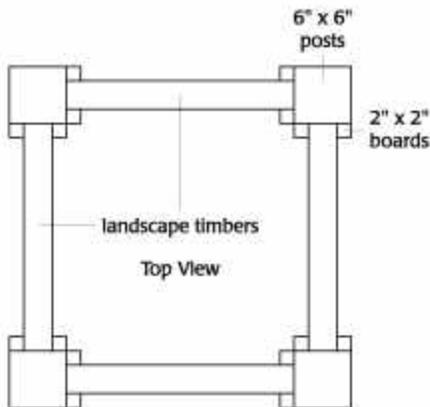
The supply list below is what you will need to build one bin. Two will allow greater convenience and three is even better: one for fresh manure, one in the process of decomposing, and one composted and ready to use. If you plan to use a tractor to turn or remove compost from the bin, you may want to consider sinking the posts in concrete and pouring a concrete slab.

### SUPPLIES:

4 – 8' x 6" x 6" treated posts  
16 – 4' x 2" x 2" treated boards  
22 – 8' x 2" x 8" boards  
(or landscape timbers)  
80 – 3" deck screws

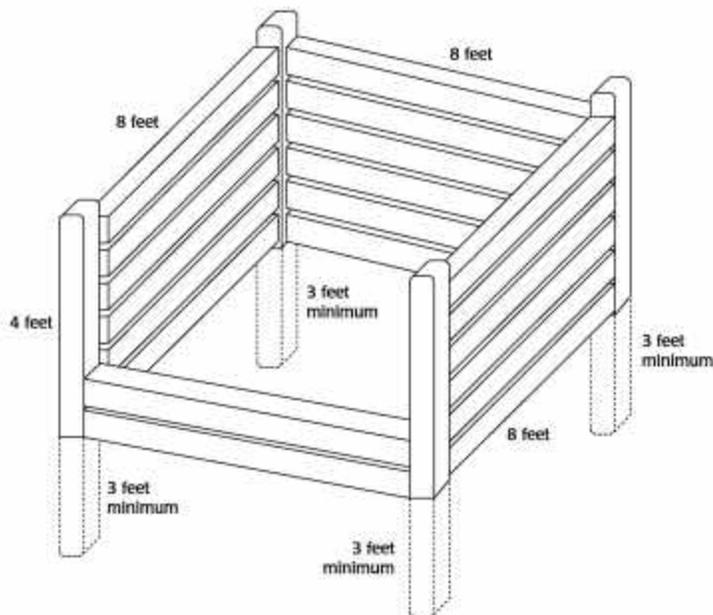
### EQUIPMENT:

Drill with screwdriver head and bit  
25' tape measure  
Chain saw or hand saw  
Carpenter's level  
Post hole digger  
Tamping rod or similar tool



Walls slide in place like a foaling stall.  
Repeat design for 2 or 3 bin system.

To see a demonstration  
compost bin built using this  
design, visit the Silver Lake  
Park horse camp facilities!



## Compost Bin Design #2

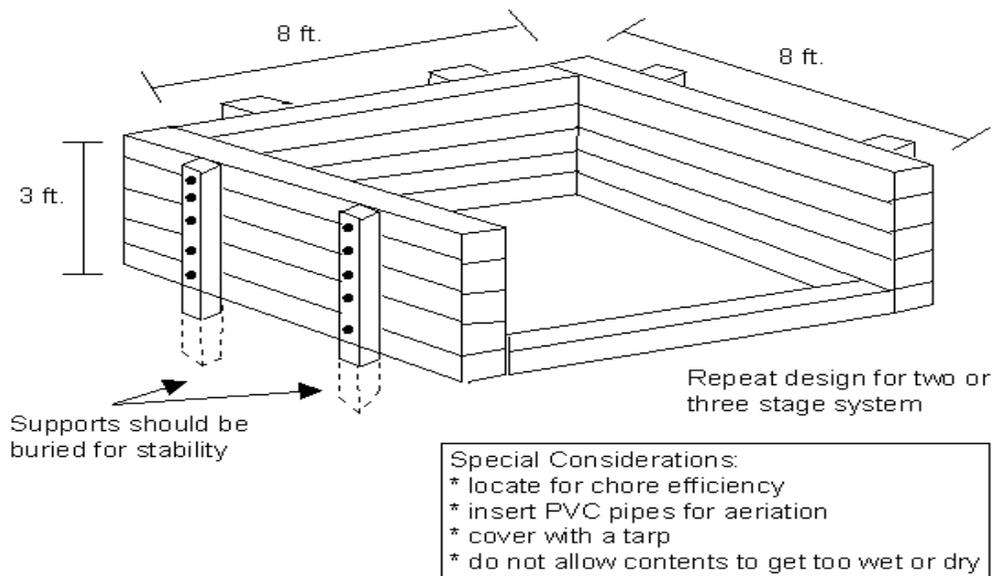
### SUPPLIES

35 - 8' landscape timbers (or similar wood)  
70 - 5/16" x 5 1/2" lag screws

### EQUIPMENT

Drill & bit (1/4" - 5" long)  
Ratchet & socket set  
Power or hand saw  
Carpenter's level  
Post hole digger  
Tamping rod or similar tool

NOTE: number of timbers and lag screws will depend on the width of the timbers you purchase and how tall you wish to make your bins.



*Compost bin design by Lyle Stoltman, King Conservation District.*