Manure and Pasture Management for Recreational Horse Owners

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Adapted with permission from University of Minnesota Extension Service Bulletin, BU 07540, 2000 by Thomas D. Wegner and Thomas R. Halbach.

Why Care About Manure and Pasture Management?

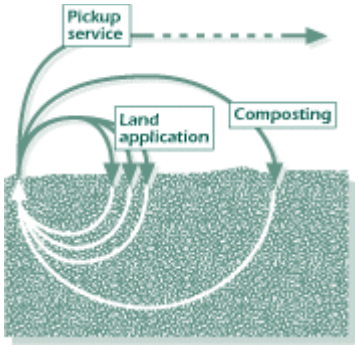
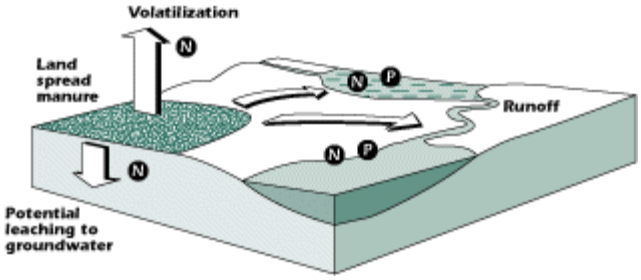


Figure 1. Manure management options

Proper manure management is important for the health of horses and the environment. Ideally, manure should be removed from stalls daily. If allowed to accumulate in stalls, it can attract flies, harbor parasites and pathogens, increase the risk of thrush and other hoof-related problems, and generate offensive odors. Exercise paddocks may need weekly cleaning.

Manure should be spread evenly on cropland and incorporated into the soil to maximize its nutritional benefits to crops and minimize odor pollution. However, some horse owners may not have enough land to spread manure without over applying, which creates a pollution hazard. If this is the case, rotationally grazing horses in pastures can help minimize manure buildup and manure-handling costs. If you have very little land, you might need to compost manure to reduce its nitrogen content and volume. Or you may wish to hire a pickup service or find a nearby landowner or farmer who can make productive use of your horse's manure (Figure 1).

Figure 2.
How nitrogen (N) & phosphorus (P) enter water supplies



Horse manure is an excellent nutrient source for pastures and other field crops when properly applied at the optimum time and in the correct amounts. It contains nitrogen, phosphorus, potassium, sulfur, and micronutrients, and is high in organic matter. Proper application of manure's nutrients can help reduce the need for costly supplemental fertilizers. Organic matter provided by manure enhances soil structure and water- and nutrient-holding capacity, reducing the soil's susceptibility to erosion. Overall soil quality is enhanced with manure applications.

Environmental Concerns

The nutrients in manure that boost plant growth can be a pollution hazard if the manure is improperly handled (Figure 2). For example, if manure is over applied to fields, nitrogen in the form of nitrates can move into the soil and eventually into groundwater, a major source of drinking water for many rural homes and communities. Consumption of water with high nitrate levels can reduce the oxygen-carrying capacity of blood (methemoglobinemia). Nitrate consumption has also been linked to cancer.

Horse manure also contains phosphorus. When phosphorus enters lakes, rivers, and other surface waters, it stimulates the growth of algae, aquatic plants, and other vegetation. One pound of phosphorus can produce up to 500 pounds of aquatic plants. When these plants decay, they reduce oxygen to levels where many fish species cannot survive. Generally, phosphorus moves into surface waters when manure applied or stored on the soil surface is moved laterally, usually by rainstorms, into a drainage flow system toward the water. Even manure that has been worked into the soil can be a concern if the soil erodes into the water body throughout the year.

Spreading Manure on a Few Acres

TIP: Many horse owners lack the equipment to load, handle, haul, and spread manure. Purchasing a tractor and manure spreader may be too expensive for your individual needs. If this is your situation, consider hiring neighbors who own the proper equipment or jointly purchasing equipment.

TIP: To temporarily store manure, surround the pile with a narrow ledge or berm to guard against nutrient or pathogen runoff and prevent nutrient leaching. Avoid stockpiling in or near wetlands or surface waters. Keep the stockpile 300 feet from surface drainage inlets. Do not store manure for more than one year.

Most small acreage horse owners do not have operations that meet the requirements for Utah state regulation. Runoff of manure or wastewater into waters of the state (including canals and irrigation ditches) is always of concern, however. It may contribute to an overall degradation of downstream lakes and rivers, and may potentially lead to state regulation.

Take care to understand and employ proper practices when spreading manure. Limit manure application to agronomic rates (rates that are equal to or less than what the existing plants can use in a year), and ensure that the manure does not pollute water. In particular, take care not to spread manure:

- on soils with a high water table;
- on floodplains;
- on lakes, intermittent streams, seasonal streams, canals or ditches;
- on grassed waterways;
- on frozen soils with slopes greater than 15 percent; and
- near direct groundwater conduits (e.g., wellheads and quarries).

Check with your local soil and water conservation district or Natural Resources Conservation Service office to help identify these special protection areas on your land and on bordering properties.

Land Application Guidelines

Proper manure application generally requires a series of decisions and some additional information gathering. If all of the manure will be applied to existing pasture, the horses can do a fairly good job of distributing it themselves. Unfortunately, the droppings from the horses are often quite concentrated and can suffocate or stunt plants underneath them. To maximize pasture production, drag or harrow the pasture to break up the droppings and more evenly spread the manure.

Table 1. Nutrient content of horse manure

Manure (tons/year)	Percent Solids	Nutrient Content (lb / Year)		
		Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
9.3	21.0	110	59	110

Livestock Waste Facilities Handbook, MidWest Plan Service 1993, Table 2-2, p. 2.2.

If stockpiled manure is to be spread onto a field, you need to know the nutrient content so the application matches the nutrient needs of the crop. Although each source of horse manure will vary, a standard "N-P-K" value (Table 1) can be used to determine the number of acres needed to properly spread the horse manure.

When using stored manure in place of purchased fertilizer, you may wish to have a more accurate estimate of its nutrient content. Manure can be sampled, packaged, and sent to a soil-testing laboratory for nutrient analysis. Check with your county Extension office, or contact the USU soil testing laboratory for sampling procedures for manure and interpretation guidelines.

Not all of the nutrients in manure are available for plant use. For example, the percentage of the total nitrogen available is a function of the method of manure application and management as well as the chemical composition of the manure. For horse manure, typical nitrogen availabilities range from 35 percent of the total nitrogen if the manure is spread and left on the soil surface, to 60 percent if the manure is spread and worked into the soil within a day. Availabilities of phosphorus from phosphate (P2O5) and potassium from potash (K2O) are commonly set at 80 percent and 90 percent of totals, respectively.

After estimating the manure's nutrient content, select the field/crop targeted for application. Certain fields and portions of fields must be excluded from manure application based on environmental precautions. Some guidelines are listed in Tables 2 and 3.

The amount of nutrients to be applied to a field depends on the crop to be grown, its expected yield, soil test levels, and other credits. For more information contact your county Extension office.

Calculating manure application rates is a mathematical exercise that aligns the nutrients supplied in the manure and the nutrient demands of the crops. Although it sounds quite simple to take a manure analysis, account for availability, and then match this to crop needs, several decision aids are available.

After you determine application rates, you need to make some decisions about method of application. The primary goal is to uniformly apply manure throughout the field. This takes time and effort on the part of the person driving the applicator. It is also important to know the actual rate of manure application and how to modify the

tractor speed to achieve the desired rate. Several bulletins are available for making this calculation.

The timing of the manure application is also important. The ideal scenario is to spread manure in the spring. This supplies nutrients for the upcoming growing season and minimizes the amount of time for potential losses before crop uptake. An alternative is to spread manure in the fall. Avoid applying manure in winter. Manure applied in this fashion is highly susceptible to movement if it rains.

Table 2. Recommended separation distance (feet)

	Surface spreading (no incorporation)	Incorporation
Streams or rivers	-	-
Lakes	-	-
Water wells	200	200
Sinkholes	100	50
Individual dwelling**	100	50
Residential development	300	300
Public roadways	25	10

* See Table 3
** Distance may be reduced with permission of owner
Adapted from *Running Your Feedlot for Farm Economy and Water Resource Protection*, MPCA, 1993.

Table 3. Separation distance from streams, rivers, and lakes for land spreading of manure (feet)

Slope (%)	Soil texture	Time of year	Minimum separation (feet)
0-6	Coarse	May to October	100
0-6	Coarse	November to April	200
0-6	Medium to fine	May to October	200
0-6	Medium to fine	November to April	300
Over 6	Coarse	May to October	200
Over 6	Medium to fine	May to October	300
Over 6	All soils	November to April	Not recommended

Adapted from *Running Your Feedlot for Farm Economy and Water Resource Protection*, MPCA, 1993

Managing Manure by Composting

Composting requires several bins

Another way to manage horse manure is to compost it. Composting is managed, accelerated decomposition. In decomposition, microorganisms (including bacteria, actinomycetes, and fungi) break organic materials into smaller particles and build new molecules, in doing so they give off carbon dioxide, water vapor, and heat. Composting accelerates decomposition by promoting the growth of microorganisms. It kills weed seeds and reduces pathogens, odors, and volume. The finished compost is a valuable soil amendment.

Composting is often slightly more expensive than land spreading manure. However, many people who have become avid composters believe that the added benefits of composting far outweigh the costs.

Most people have at least some familiarity with composting through campaigns that encourage backyard composting of grass clippings or leaves. Composting of horse manure differs only in the type and volume of materials composted.

Horse manure and bedding contain the carbon and nitrogen necessary for successful composting. The challenge is to ensure the proper proportions of the materials. The type and typical daily volume of bedding will substantially affect the ease and rate of composting. Different types of organic materials compost differently. You'll need to customize the process to fit your specific combination of manure, bedding, and other organic materials. You can find the best mixture by developing a clear understanding of the process, accurately measuring materials, and going through some trial and error.

Composting is a balancing act. Providing ideal environmental conditions for microbial growth accelerates the process. Just enough water, air, carbon, and nitrogen getting piled, turned, and aged without contaminants makes for good compost. Some things to consider for successful composting:

Air. Approximately two-thirds of the pile's initial volume must be interconnected free air space. Air space allows oxygen to move into and carbon dioxide and water vapor to leave the pile. Too little air space reduces the oxygen available to the microorganisms; too much air space dries the pile out and prevents it from reaching temperatures high enough to compost.

Manure without bedding, or manure with sawdust or wood shavings, may create a pile with too little air space. Measure air space using the "5-gallon bucket test" (see right). Add bulking materials, such as shredded wood, bark, or dry straw, to increase air space.

Water. Water is required for good composting. Microorganisms grow best with moisture around 50 percent. If the compost feels like a freshly wrung out sponge, the pile most likely contains the proper amount of moisture. 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, fall tree leaves, corncobs, shredded bark, or chipped brush to dry the pile.

Closely monitor the moisture level, especially during hot, windy summer days when as much as 5 percent (water equivalent) of the pile's total dry weight can be lost. Adding a little water each day is much better than letting the pile get dusty and dry, and then trying to rewet it back to the 50 percent range.

Size and construction. Size of the pile does matter. Bins 4' x 4' x 5' tall seem to work best for horse manure. Bins constructed from 2" x 6" (untreated) boards and heavy-duty posts will hold up the best. Bins with a wooden floor with small spaces between boards that allow air to move from underneath the pile perform better than bins built directly on the ground. Laying flat drain tile on the wooden floor will further enhance airflow. Each of these bins should easily hold 1.5 tons of horse manure. If your horse manure fills up more than six bins of this size, you may want to consider a windrow composting system.

Five-Gallon Bucket Test

Materials needed:

- 5-gallon pail
- 1-gallon pail
- typical mix of materials added to the compost pile (horse manure, wood shavings, straw, etc.)

Fill the 5-gallon pail one-third full with a mixture of typical compost materials. Drop the pail 10 times from a height of 6 inches onto a concrete floor or sidewalk. Be careful not to spill any of the compost materials.

Add more material to fill the 5-gallon pail two-thirds full. Drop the pail 10 times from a height of 6 inches.

Fill the 5-gallon pail to the top. Drop the pail 10 times from a height of 6 inches. Fill the 5-gallon pail to the top once again. Add water to the 5-gallon pail, keeping track of how much you can fit in before it overflows. If you can add 2-1/2 to 3 gallons of water, you have adequate free air space. If not, you need to add more bulking material, such as straw, coarse wood chips, or shredded bark. If you can add more than 3 gallons of water, you have too much free air space. The particle size must be reduced by shredding or grinding the compost materials or by mixing finer materials into the compost.

Retest new mix.

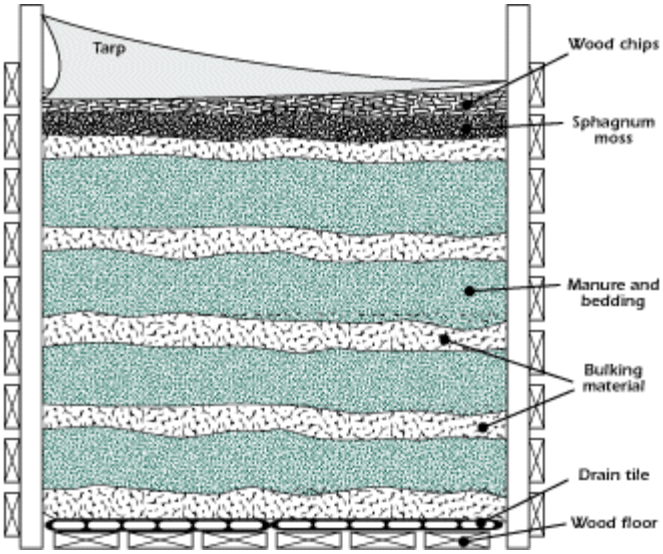


Figure 3.
Layering the compost pile

Temperature. Temperatures of 131° F to 150° F are ideal. Hotter or cooler temperatures will slow down the process. Maintain these temperatures for at least 21 days to reduce pathogens and kill weed seeds.

A 3 foot-long, non-mercury compost thermometer, available at some hardware stores, is useful for taking pile temperatures. Recording daily temperatures will help you become a better composter. If pile temperatures far exceed 150° F, reduce the size of the pile and check to make sure it has adequate free air space.

Location. Locate your bins at least 100 to 150 feet away from wells, ditches, streams, and lakes. Leave a buffer strip of taller grasses, wildflowers, and shrubs between the compost bins and any drainage way or water feature to keep manure from washing down a slope and into a water body during a heavy rainstorm. Place your bins in a dry area near the point of manure collection. Try to locate them out of view and downwind from neighbors. Bridal wreath spirea works well as a visual screening plant in most soils in this climate. Check with your local municipality for any additional regulations.

Line the bottom of each compost bin with flat drain tile.

Building a Compost Pile

Start by creating a base layer that will allow air to flow into the bottom of the pile. Lay down 6 to 8 inches of wood chips or flat drain tile directly on the wooden floor of the bin. (If you use drain tile, cover it with a thin layer of a synthetic polyester material to prevent the holes from plugging up.) The bin is now ready for the manure and bedding mixture, along with any bulking materials, such as wood chips or shredded bark, needed to provide free air space.

Build the pile by alternating layers of manure and bulking materials (Figure 3). Separate manure layers with 6 inches of bulking material. The finer the bedding material, the more likely the manure layer will benefit from additional bulking material, and the thinner the manure layer should be. The manure layer should be from 6 to 24 inches thick. To ensure good composting, add a bucket of mature compost or soil little by little as you build the pile.

Build the pile to a height of 5 feet and cover with a 4-inch layer of sphagnum peat moss to control odors, and top it off with a 4-inch layer of wood chips. A tarp placed 2 to 10 inches above and covering only the top of the pile will prevent it from quickly drying out or receiving too much moisture from rain and snow. You can easily attach a tarp by extending the corner posts of the bin with short lengths of two-by-four.

The higher the bedding-to-manure ratio, the more likely it is that you will need supplemental nitrogen. If you have the proper amount of water and free air space and the pile still doesn't heat up, add one-third cup of a commercial nitrogen fertilizer such as ammonium nitrate or ammonium sulfate or another high-nitrogen fertilizer (33-4-2) to the pile each day.

Turning mixes the pile's cooler, outside layer with the hotter center and enhances the composting. Once you have your pile built, wait 7 to 28 days before turning so it can "cook." Try turning again at 24, 72, and 120 days. Three to seven turns during the life of the pile are common. Base the turning schedule on the pile's materials, weather, and the anticipated use of the compost. When piles have the right amount of moisture and air space, a temperature of 120° F or lower usually indicates the need to turn the pile so it can reheat.

Composting Hints

When cleaning the horse stalls, put the manure and bedding directly onto the compost pile. This is also the best time to add water if needed.

Sawdust contains very little nitrogen and a lot of carbon. In small quantities (less than 10 to 15 percent) it can help prevent compaction in compost piles. However, this is only true of coarse sawdust from sawmills or chain saws. The very fine sawdust from carpentry and cabinetwork (often preferred by horse owners) may actually compact so tightly so as to make a compost pile almost airless. If you use fine sawdust for bedding, you will most likely need to also add bulking material to prevent compaction and provide free air space so oxygen can get to the microorganisms.

Frequently Asked Questions About Composting

Does the compost pile need a starter or activator to get the composting process going?
No. Just add a 5-gallon pail of fertile soil or mature compost to the pile as you build it. That should provide enough microorganisms to ensure composting.

Can backyard materials go into the pile?
Yes, but limit grass clippings to layers of 1 or 2 inches. Dry fall leaves work well as bulking materials.

How long does it take to make good, mature compost?
It depends. With average management and most conditions achieved most of the time, good, mature compost will take about 6 months. Measure 6 months from the day you completely fill a bin.

How will I know when the composting is done?
The compost is done when the pile no longer reheats after turning and the volume has decreased to half its original size. Mature compost should look more like soil than bedding material and manure.

How do I prepare the pile for winter?
If you have an entire bin available, build a 6 to 8 inch layer of wood chips. Next, put down 3 feet of leaves and then alternate layers of manure and bulking materials. By spring the leaves will have decomposed and the pile will need some turning, but it should be nearly finished.

Wood shavings provide more air space than sawdust, but still require the addition of more bulking material to achieve the proper amount of free air space. Straw bedding can sometimes meet the requirement for air space. Use the bucket test to find out if you have adequate free air space. Remember to add the bulking material as you build the compost pile.

If you can't build enough bins to hold all of your manure for the roughly 6 months it takes to create mature compost, you may instead choose to produce immature compost. If you set up and properly manage your bins, you can expect to reduce the volume of manure up to 50 percent and produce immature compost in 6 to 8 weeks when outside air temperatures are above 50° F.

Immature compost provides organic matter, retains moisture, and can work quite well as mulch in home gardens. Do not apply in excess of 1/2 to 1 inch thick because it will likely create a nitrogen deficiency in plants for 4 to 10 weeks after application.

Using Compost

Making compost is really only a start. You need to think about how you will use the finished compost. Will you use it yourself? Sell it to your neighbors? Market it to a wider geographical area? By using compost to grow plants we complete the organic matter cycle.

Good quality compost should be applied only at recommended rates and to plants and soils that can use the nutrients. As a rule of thumb, good quality horse manure compost can be applied 1/2 to 1 inch thick (approximately 24 to 57 tons per acre) and then mixed well into the soil.

Sources of Information

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