



New Hampshire  
Department of Agriculture

**GOOD NEIGHBOR GUIDE FOR HORSE-KEEPING: MANURE MANAGEMENT**

Carefully-collected animal manure was once the main source of nutrients for crop production. Today, horse owners with one or more animals often don't have enough land for crop production to use the manure their animals produce. Some municipalities require daily or weekly manure removal. Consequently, this valuable by-product is often considered waste or, at best, a disposal nuisance. In New Hampshire, all livestock manure could be used advantageously if it was accessible in a useful form.

Estimates indicate that there may be as many as 30,000 horses in New Hampshire. Ten thousand properties house horses, with millions of dollars being spent on feed and services. Yet all too often potentially valuable manure from these animals ends up in the municipal land-fill and is wasted because it's not available to gardeners, landscapers, and other plant growers in a usable condition. A solution is composting manure or composting manure with other materials such as leaves and lawn clippings that yield organic matter in a form similar to potting soil. Like recycling, composting removes a portion of the municipal waste stream resulting in extended landfill life-expectancy.

**Manure Accumulation and Composition**

Each year, a 1 000-pound horse can generate eight to ten tons of manure, accumulating at the

rate of as much as two cubic feet per day, including bedding. Composition of this material varies depending on the type and quantity of bedding used, age and function of the animal, kind of feed, and how the manure is stored. Typically, a ton of fresh horse manure with bedding would have a nutrient composition of about 13 pounds of Nitrogen [as N], 5 pounds of phosphorous [as  $P_2O_5$ ], and 13 pounds of Potassium [as  $K_2O$ ]. Approximately one-half of these nutrients may be

available to a crop during a growing season with a spring application. Part of the remaining nutrients will provide fertilizer value in subsequent years. Manure also contains other valuable trace elements. In addition to providing valuable nutrients, manure improves soil texture and soil moisture-holding characteristics, thereby reducing the need for irrigation.

Decomposition of manure starts as soon as it's voided. Nitrogen is easily lost from horse manure. Decomposition rates depend on handling and storage methods. Horse manure should be kept compact and moist to prevent excessive losses.

Manure left in a loose heap loses nitrogen rapidly to the atmosphere in the form of ammonia. Nutrients in urine are readily available for crop use. Bedding used in horse stalls absorbs and holds this valuable component well.



## Manure Storage

A single horse will produce 3/4-1 cubic foot of manure every day. Bedding can easily bring total volume of material that must be managed each day to 2 cubic feet per animal. Provision must be made for proper handling and storage along with a plan for effective utilization.

While daily removal of manure from the premises might be ideal, it's usually impractical and, contrary to popular belief, it doesn't eliminate fly breeding problems. Adult fly populations within barns can be controlled through use of traps, residual insect sprays, and baiting. Stalls and paddocks should be kept clean and dry. Refuse, scattered hay, and wasted grain about the barn or in the yard can be fly breeding spots if wet. Keeping breeding sites around stalls and feeders at moisture levels below 60% should significantly reduce fly populations. If manure can't be removed weekly in warm weather, a screened storage area or covering the pile with a plastic tarp could be helpful.

Make adequate storage for manure available-144 square feet of confined storage space will conveniently hold manure from one horse for a year. Accumulation might be 3-5 feet in depth. Large storages should be well-constructed and accessible for use of power equipment. Locate storage sites so loading and unloading is convenient. Create a positive image by storing and handling manure as neatly and inoffensively as possible.

Grade the surrounding area to keep surface water from running over or through the manure and into streams or other surface waters. Covering the manure pile will help prevent liquid from leaching into groundwater. Also keep roof and yard water from draining into the storage area.

Design criteria regulations for new well construction and placement adopted by the New Hampshire Water Well Board on July 2, 1985, "require or recommend that animals should not be penned or tied within a 75-foot protective radius around a water well, particularly if uphill." Owners and managers of horse farms should consult UNH Cooperative Extension and the USDA Natural Resources Conservation Service about manure storage design and management. They have educators, specialists, and engineers who can provide detailed information on planning a workable, environmentally-sound manure handling system.

## Exercise Runs and Paddocks

Exercise areas or paddocks are assumed to be areas of bare soil, or sand/soil mix with little grass or other vegetation in them. They are simply a fenced, open area for horses to use for outdoor exercise. Horses may be turned out into these exercise areas as often and for as long as the horse owner desires. Management of pastures is much different from management of exercise areas.

An exercise area should be a minimum of 200 square feet per adult horse. For maximum use of a given area, several long, narrow runs are best. Minimum width is 14 feet. Length can be any distance that fits the landowner's plans. Long, narrow runs should be laid out across a slope to minimize soil erosion. Generally, try to avoid slopes greater than 3%. Square areas require less fencing. However, horses like to run along a fence line. Therefore, several long narrow runs will allow separated horses to exercise together without interfering with one another.

Plain board fencing is the most economical. A 2 or 3 board design should be satisfactory. Boards should be attached on the post side next to the horses. Care should be taken to eliminate protruding nail heads or other sources of injury to the horses.

Locate exercise runs or paddocks on fairly level, relatively stone-free, well-drained soils. Footing is improved by spreading sand at least two inches deep on existing soils. Sand should be added as previous applications become mixed with the soil. Sand will also reduce dust, mud, and soil erosion.

Keep runs and paddocks clean by removing accumulated manure frequently.

Clean surface water run-off from areas outside of animal exercise areas should be diverted away from these areas and conducted safely to the nearest watercourse or wetland area. Grass filter strips around the edges of an exercise area will greatly reduce any pollutants that might leave the site.

Consult your county Conservation District people for advice and designs to minimize erosion and potential for pollution from exercise runs and paddocks.

## Pasture Management

Pasture, while not essential, can provide an inexpensive supply of high quality feed with all the protein, vitamins, and minerals needed by most horses. However, pastures vary greatly in productivity. Pastures that are primarily grass offer excellent early and late season grazing, but are often severely depleted during mid to late summer. Pastures that contain clover may continue to allow reasonable good midsummer grazing. Pasture production is related to: (1) the number of animals per unit area, (2) vegetative makeup of the sod, and (3) the natural fertility of the soil.

Too often, horse pastures are grazed throughout the growing season without rotation. Ideally with small pastures, the horse should be rotated to a fresh area about every two weeks to break up the cycle of internal parasites. One to two acres of well-managed pasture can support one mature horse during the grazing season with rotation. When the animal is rotated as frequently as every two weeks, the acreage needed could be closer to one acre. Four to five acres of unimproved native grass pasture will support only one mature horse for the entire grazing season.

It's difficult to establish and maintain a dense vigorous sod that will withstand the constant trampling of horses. This is particularly true early in the season when the soil may be soft, or with early grazing following a reseeding. Sod that will stand traffic the best is also sod that's less palatable and less attractive to the horse.

A fertilizer program should encourage legumes, such as shallow-rooted white clovers, as well as grasses. The use of a complete fertilizer such as 10-10-10 will supply nitrogen and potassium to the grasses, and phosphorous will encourage the growth of legumes. The amount of fertilizer needed should be based on soil tests. Soil tests are available through UNH Cooperative Extension offices. Fresh manure should not be spread on pastures. Manure that has not been composted will introduce the threat of additional parasites to grazing horses.

## Using Manure As Removed From The Stable

Turning of manure under the soil immediately following spreading will reduce losses of valuable nutrients, especially nitrogen. Manure spread or piled and left exposed on sloping

surfaces is subject to erosion, possibly contributing to nearby water pollution downslope. Never spread manure on frozen surfaces or water-saturated ground. In addition, manure should not be stored in piles on land subject to flooding, or spread and left on the surface until flood season has passed.

Where there is nearby crop land, consider tilling in fresh manure when possible. This saves nutrients and alleviates storage problems. Fresh manure is best used for crops with long growing seasons, and better suited to clay and loam soils. Light or sandy soils benefit the most from applications of aged or composted manure. Portions of the nutrients in manure aren't as readily available for plant food as commercial fertilizer nutrients. However, slow release provides a continuing supply of nutrients with less potential runoff.

Crops grown and harvested annually on one acre of land can easily utilize the nutrients available in the yearly accumulation of manure from a single horse. Large amounts of bedding usually present in manure are low in nitrogen content and high in carbon. A high carbon/low nitrogen ratio ties up nitrogen temporarily until the bedding decomposes. A supplemental source of nitrogen could be needed to offset this nutrient imbalance.

## Composting Manure

Often, horse owners and managers don't have access to enough crop or garden land for good use of valuable manure. Therefore, some form of composting should be considered as a means of enhancing the material for off-site use. Recycling this useful material ensures that naturally available nutrients are sensibly returned to replace those previously removed by vegetation.

Manure that has been composted generally has a better sale value. However, to compost manure, you must pile it properly, keep it moist, and turn it over several times for 1-2 months. Various techniques can improve and hasten the composting process. Processing methods can be kept simple or be quite sophisticated, depending on the desired condition of the end product and the time needed to complete the composting process.

Decomposition under composting conditions makes the fertilizing value of bedding more available to plants. It changes organic matter into substances that more readily form humus in the

soil. Availability of phosphorous is increased and many weed seeds that might be present are destroyed.

Good manure management is essential for horses to be accepted as friendly residential neighbors in increasingly crowded suburban settings. Forty-four percent of horses nationwide are said to be housed on private residential property. A solution to animal manure problems, anticipated or real, is a balanced ecological approach.

### Marketing Manure

Properly composted horse manure could be marketed to home gardeners, nurseries, and crop farmers. Nurseries are the most likely customers for large volumes of less-than completely composted manure, and tend to prefer shavings as a source of bedding. Finely chopped paper could become an acceptable source of bedding and compost in the near future. Crop farmers within a reasonable distance might use trash-free manure on a yearly basis with suitable arrangement. Home gardeners are a good outlet for smaller quantities of composted or aged manure.

Many gardeners would welcome bulk delivery of uniformly composted manure at prices competitive with other sources of organic matter that may have little fertilizing value. A New York state race track is successfully merchandizing composted horse manure in bags.

Most importantly to nature, every effort should be made to recycle horse manure safely and efficiently as a fertilizer to grow useful crops. Most of the nitrogen, phosphorous, and potassium contained in animal feeds is returned in the manure.

*"Make no mistake, horse manure management is becoming a hot issue in some heavily suburbanized New Hampshire towns, and satisfactory resolution will require cooperation between owners, regulatory officials, and abutting owners."*

*- Stephen H. Taylor, Commissioner NH  
Department of Agriculture New Hampshire  
Weekly Market Bulletin February 7, 1990*

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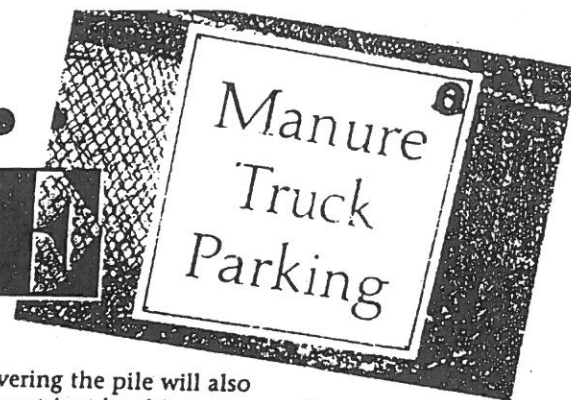
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## Space and Housing Guidelines for Fully Mature Farm Animals

Animal	Horse	Beef Cow	Dairy Cow	Dairy Goat	Pig	Sheep	Hen	Broiler	Turkey
Unit	1 horse	1 cow	1 cow	1 goat	1 pig	1 sheep	1 hen	1 broiler	1 turkey
Enclosed Housing Area/Animal	-Tie stalls 45 sq. ft. 5' x 9' - Box stall 12' x 8' Or 10' by 10'	50-75 sq. ft.	50-75 sq. ft.	20-25 sq. ft.	48 sq. ft. with exercise yard; 100 sq. ft. without exercise yard	15-20 sq. ft.	3-4 sq. ft.	3-4 sq. ft.	6 sq. ft.
Exercise Yard Area/Animal	200 sq. ft.	75-125 sq. ft. min. 150 sq. ft.	75-125 sq. ft.	50 sq. ft.	200 sq. ft.	50 sq. ft.	10 sq. ft.	---	20 sq. ft.
Pasture Area/Animal	1-2 acres	1-2 acres	1-2 acres	0.2-0.3 acres	12-14 sows/ acre/ rotational pasture	0.2-0.3 acres	---	---	100 sq. ft.
Type of Housing and Boundary Setback	Enclosed ventilated barn or open 3-sided barn Setback 50 ft.	Open Front 3-sided barn Setback 50 ft.	Open Front 3-sided barn or enclosed Stanchion Barn Setback 50 ft.	Enclosed Barn with Removable Side Panels or Windows, Setback 50 ft.	Enclosed Barn Huts, shed, hutches or lean-to Setback 50 ft.	Open front 3-sided shed Setback 50 ft.	Enclosed Barn Setback 50 ft.	Enclosed Barn Setback 50 ft.	Enclosed Barn Setback 50 ft.
Fencing	Electric Wooden Rail Woven Wire	Barbed Electric Woven Wire	Barbed Electric Woven Wire	Electric Woven Wire	Electric Woven Wire	Electric Woven Wire	Chicken Wire	---	Chicken Wire
Family Needs	1 horse per family member	1/2 - 1 beef animal/year, raise 2 animals/yr to provide con. supply	1-2 cows	2-3 goats	2 pigs per yr.	6 sheep	6 hens	24 broilers	12 turkeys

# Move Over... MANURE!



In order to keep our "good earth" good, horse owners need to follow best management practices—or, BMPs—regarding manure.

## Pollution Prevention

Make a map of the layout of your property. Show barns, pastures, paddocks, streams, ponds, and wetlands. Ask yourself how you can improve the current layout and facilities. Look at how, where, and when you collect, store, and dispose of manure. Learn and chart how the water runs off your property. Where does it enter and exit? Where are the slopes? Are there problem wet areas? Where is your well and septic system? Locate your neighbors on the map as well, and note appropriate setbacks.

Then take these steps:

- 1) Cover your manure piles to: protect lakes, ponds and wetlands; reduce fly breeding; prevent well water contamination.
- 2) Divert clean water away from your barnyard to: minimize mud; prevent erosion; and reduce polluted runoff.
- 3) Fence to: keep horses out of lakes, ponds, streams and wetlands; and to promote healthy grass to reduce erosion, mud and polluted runoff.

Did you know that the average horse (1000 lbs.) will produce about 50 lbs. of manure a day, and 8 to 10 tons per year? Manure must be handled in a way that it becomes an asset and resource and not a nuisance.

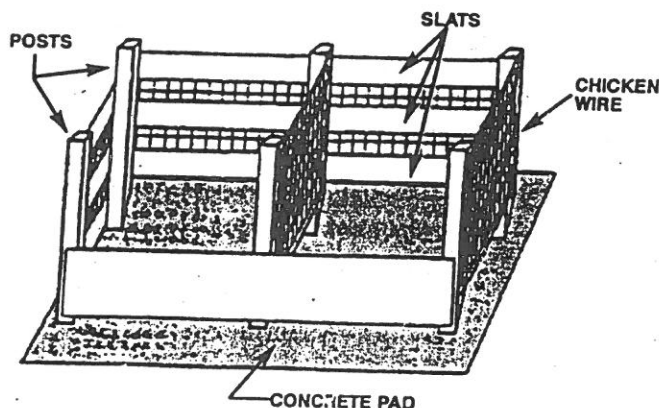
1) **Collection:** Manure should be picked up regularly from the horse's stall, paddock and pasture. Daily pickup is recommended in population dense areas, high herd count facilities and/or low acreage availability. It then will need to be stored at least temporarily.

2) **Storage:** An area about 12x12x5 ft. can hold the manure for one horse for a year. A carefully sited field stack can work as well as a constructed facility. A cement pad is advisable to prevent nitrogen build up over time in certain soils. Ground surface slope should range from 1%-7%, with 2%-4% being ideal. Building grassy swales will help take care of potential

run-off. Covering the pile will also help reduce nutrient leaching. Be sure that your pile is easily accessible to power equipment that may be needed for loading and unloading. Storage is a temporary solution. Manure will then need to be spread, composted, transported or given away.

3) **Spreading:** Manure can be spread on well-vegetated fields at appropriate times of year, at an application rate of 10 tons per acre. Manure should not be spread during winter months.

4) **Composting:** Actively managed compost piles can be part of a good manure management program. A manure pile **DOES NOT** qualify as a composting procedure. To compost manure, you must pile it properly, monitor the pile, keep it moist, turn it over several times for several months, and allow it to cure for at least one month. Because of the wood content when shavings are used as bedding, horse manure makes a good addition to cow manure for composting purpose. It also combines well with grass clippings and other landscaping byproducts. Contact local dairy and cattle farmers, and landscapers to see if you can combine efforts. Two bin composters are ideal since




A two-bin composter—ideal since once the process begins no new manure should be added. The 2nd bin stores new manure. Bins that are covered and turned correctly and that maintain the proper high temperature are not attractive to insects and rodents. From "Pollution Control for Horse Stables and Backyard Livestock", Terrene Institute, Pub. Div., Washington, DC

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once the process begins no new manure should be added; the second bin stores new manure.

5) **Transportation:** How will you remove the manure from your property? Do you have the necessary equipment, or will you need to hire someone to assist you?

6) **Give away:** Place your manure in empty feedbags, shavings bags or other biodegradable bags tightly closed. Offer it as fertilizer free for the taking. You may also be able to sell it if it's been composted first. Even if you provide the bags and give it away free, it may cost a lot less than storing the manure and moving it in bulk process. 

*Editor's Note: This is excerpted with permission from the NH Horse Council's new publication, "Guidelines & Best Management Practices for Horsekeeping". You can contact Lisa Derby Oden at (603)878-1694 or Lisa@horseconsulting.com. As we all get more neighbors, complaints about keeping horses will likely focus on odor, flies, and rodents due to improper manure management. Also, see Publisher Pondering pg. 4, Equerry, Feb. '01*



## Composting Livestock Manure

### How to compost and use livestock manure

#### Introduction

#### How to Compost Manure

#### Manure Nutrients

#### Using Composted Manure Safely

#### Manure Exchange Program

#### *Benefits*

Composting livestock manure is an excellent manure management technique for small farm owners. Collecting manure on a daily or weekly basis from paddocks, stalls, and confinement areas for composting has several benefits:

- it provides the owner with a free source of compost for the yard, garden, pasture, or gardening neighbors that slowly releases nutrients and won't burn plants
- it reduces flies by eliminating their breeding ground
- it reduces the possibility of parasite re-infestation of your animals- the heat generated in the composting process kills parasite eggs
- it reduces the chance of manure contaminated runoff from your property contaminating surface and ground water
- it reduces the amount of mud in your confinement area, and increases the life of organic footing material
- it prevents the introduction of foreign weeds by sterilizing weed seeds found in the manure

#### *Site selection*

First, select a site for your compost bins. You want to put them in a high and dry area of your property, not in a low lying area or in an area that receives surface flows. Otherwise, the compost will become a soggy mess and the nutrients you are trying to retain will be lost. A location that is also close to your stall and paddock areas will make the chore of cleaning up easier and less time consuming.

#### *How many bins?*

Next, decide on the number of bins needed. You will need at least two bins for 1 to 3 large animals. Pile manure and stall wastes in one bin. When that bin is full, allow it to compost and start filling the

second bin. Once the material in the first bin is done composting, you can start using it.

If you have more than 3 large animals or want more storage capacity, consider using a three bin system. This allows you to have one bin where daily waste can be stored, another bin which is full and in the composting stage, and a third bin for the finished compost to be stored for when you need it.

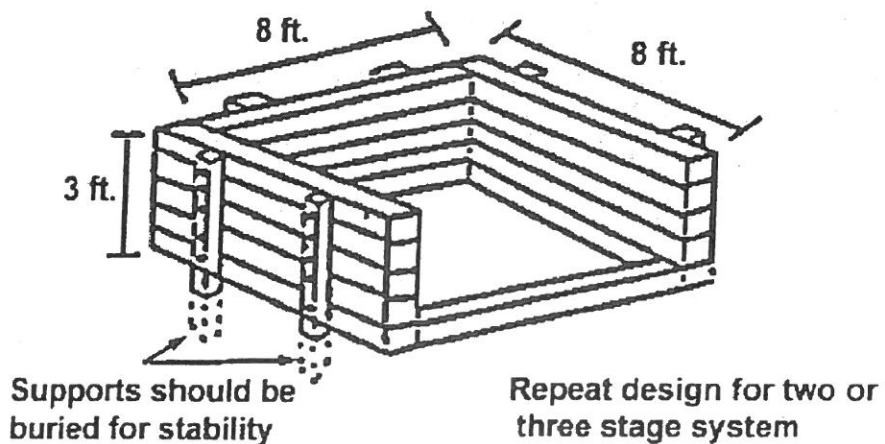
### ***Building your bins***

After you have decided where to put your compost bins, and how many bins you need, it is time to gather or purchase materials. Compost bins can be made of something as simple as wood pallets placed on end and nailed together, or of more durable and aesthetically pleasing landscape timbers. A two bin landscape timber system can be built by one person in about 8 hours, for approximately \$150.00 in materials using this typical [list of materials and tools](#).

For two 3' x 3' x 8' bins, the following equipment and supplies are needed:

- 50 - 8' landscape timbers (or similar wood)
- 100 - 5/16" x 5" lag screws
- ratchet & socket set
- plastic sheet/tarp to cover top
- post hole digger or shovel
- drill & bit
- carpenter's level
- power or hand saw

The following sketch can be used as a construction plan for one section of the bin.





### Special Considerations:

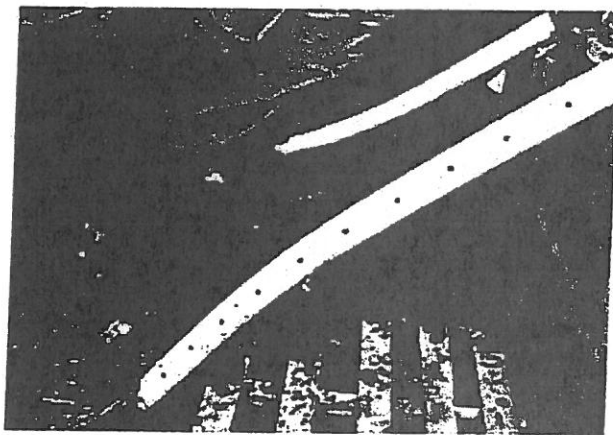
- place structure on high ground
- turn pile frequently to speed composting
- cover with a tarp
- do not allow contents to get too wet or dry

### *Compost management*

Compost management activities include tarping, turning, and watering. Like all living things, the micro-organisms which break down the manure and bedding require air and water. Too much or too little of each can cause problems.

Cover each of your bins with a tarp to prevent your manure piles from becoming soggy in the winter and too dried out in the summer. A tarp also prevents the nutrients you are trying to save from being washed out and contributing to surface and ground water contamination.

Turning the piles allows oxygen to get to the bacteria and organisms which break down the manure into a soil-like substance. How often the pile is turned, determines how quickly the compost will be ready. However, you have access to a small tractor, or have a strong back, turning the pile can be difficult. Air will permeate through the pile to a depth of about 3 feet. An easy way to get air to the center and avoid turning the pile frequently is to build a couple of 4 inch pre-drilled PVC pipes into the center of the pile. The pile will still need to be turned occasionally to get the manure on the outside into the center so the heat from the composting process can kill parasites and weed seeds, and to achieve a more completely composted product.



*On farm manure composting, showing aeration tubes*

Keep the manure pile as damp as a wrung out sponge. Water the pile with a garden hose every time you add a wheelbarrow of new material and when you turn it. You can also use the PVC pipes mentioned above to get water into the center of the pile. A soaker hose can also be used while the pile is building. Watering the pile in the winter is usually not necessary if you are adding rain soaked material collected from outside paddocks.

If you follow the above guidelines, your compost can be ready as soon as 21 days. Depending on how often you turn it and whether it stays damp, the composting process should take between 1 and 3 months. You will know when your compost is ready when the material looks evenly textured and crumbly like soil.

### ***Applying the compost in the garden***

Compost is a rich soil amendment which improves the health of both plants and the soil. Compost improves the physical structure by making it more porous, adds fertility and increases the ability of the soil to hold moisture and plant nutrients. It can be added to house plant potting soil, gardens, flower beds, lawns, or pastures. Sprinkle a thin layer (no more than 1 inch per application) on your lawn or use it as a mulch to control weeds and retain moisture in the garden or flower beds.

### **Using composted manure safely**

#### *Sources:*

*Pierce County Conservation District - In writing this article, excerpts were taken from "How to Compost and Use Horse Manure" by Alayne Blickle, Education Coordinator for the King Conservation District.*

*Manure bin example: King County Fair, King County Solid Waste Division and King Conservation District*

## **Composting**



**Backyard  
Composting**

**Kitchen Waste  
Composting**

**Livestock Manure  
Composting**

**Stewardship Gardening**