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Managing Small-acreage Horse Farms

FOR GREEN PASTURES, CLEAN WATER, AND HEALTHY HORSES



OREGON STATE UNIVERSITY

EXTENSION SERVICE

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RESULTS OF GOOD MANAGEMENT

- Good grass cover, even in winter
- Fewer weeds
- Aesthetically pleasing landscape
- Healthy horses
- Clean water

RESULTS OF POOR MANAGEMENT

- Soil compaction
- Muddy pastures in winter
- More weeds
- Unhealthy horses
- Polluted streams, groundwater, and household wells

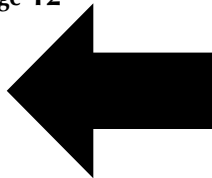
The basic steps



Diagnose and fix problems. Poorly managed small-acreage horse farms are a source of non-point water pollution as well as a cause of disease in horses.



GRAZING
MANAGEMENT
Page 12



Practice good grazing management. Overstocking causes many problems. Reduce horse numbers and rotate grazing to prevent overgrazing and allow pastures to rest.



Cover the manure pile. Rain seeping through a manure pile leaches nutrients and microorganisms into surface water and groundwater and reduces the manure's value as a fertilizer. Using a tarp or roof to cover the pile prevents leaching.



Keep animals off wet pastures. Animals on wet pastures create mud, compact soil, overgraze, and trample grass. The result is less vegetation to filter sediments and use nutrients.



Utilize a “sacrifice area” or paddock to keep animals off wet pastures. This restricts impacts to one area and saves pastures during the wet months. Paddocks can be prepared with “hog fuel” or gravel.

SACRIFICE AREAS
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Utilize grass or vegetation buffer strips. Grass and other plants filter sediments and use excess nutrients. Use buffer strips around paddocks.

BUFFER STRIPS
Page 10



Install rain gutters and downspouts on farm buildings. They direct water away from paddocks, resulting in less mud.

GUTTERS AND DOWN-SPOUTS
Page 9



Compost the manure. Instead of just storing manure in a pile, composting produces an excellent soil amendment for the pasture or for sale, and the composting process kills weed seeds and parasites.

MANURE MANAGEMENT
Page 20



Create a farm you can be proud of. Use of these management practices improves the productivity and appearance of a farm and protects water quality and horse health.

FOR MORE INFORMATION
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What do you want from your farm?

The goals for a well-managed small-acreage horse farm are:

- A productive pasture with plenty of grass and few weeds
- Almost no mud during the rainy season
- All nutrients (manure and stall waste) generated by the horses recycled to feed the pasture or removed from the farm and recycled
- Healthy horses free of problems associated with standing in mud and manure
- Happy owners who are able to conveniently feed and care for their animals without dreading the chore or losing their boots in deep mud

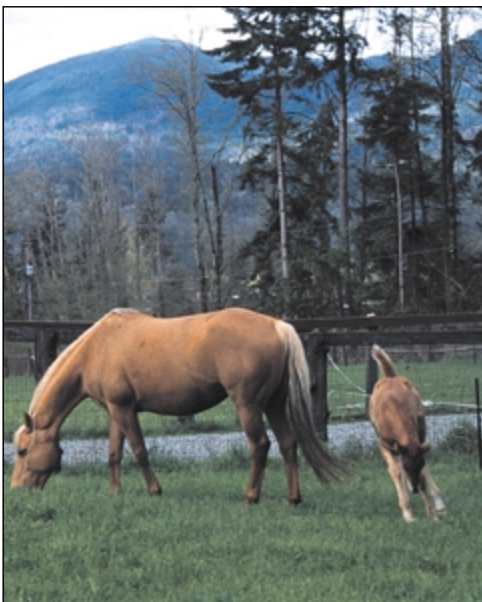
The key to meeting these goals is to recognize that horses, grass, manure, soil, and water are all connected. How you manage one affects the others. For example, when, where, and how long your animals graze affects grass regrowth, weed competition, and the safety of your well water. How you deal with water runoff affects your horse's health, nearby streams, and your own enjoyment of the farm. By managing each aspect of your farm well, the result will be greener pastures, less mud, healthier horses, and more personal satisfaction.

To establish and maintain an attractive, green, weed-free pasture, you need to understand several basic principles of plant growth as well as the impact of horses on pastures. To do more than “follow a recipe,” you must learn about plant growth and how pastures fit into the entire horse management system.

Horse pastures are different from other pastures. A green cover, free of weeds and mud, often is the primary objective. Meeting the horse's nutritional needs frequently is secondary. Nutritional needs likely are met primarily by hay or hay and grain. The pasture usually provides only supplemental feed, exercise, and recreation.

You are in control. Pasture condition is up to you. Maintaining a dense, green, weed-free, and mud-free pasture requires you to meet the water and nutritional needs of pasture plants and to carefully control the timing and duration of the horses' time on the pasture.

This publication is intended for small-acreage horse farms (those from 1 to 10 acres) in the high-rainfall areas of western Oregon and western Washington. Because they lack the space of larger farms, small-acreage owners are confronted with different problems. We've tailored our recommendations to fit small farms. Options for both low-cost and higher cost approaches are included. Of course, everything described here can be applied to larger farms as well.



Green pastures, healthy horses, and clean water aren't difficult to achieve. All it takes is a commitment to follow some basic farm management practices.

What makes horses different?

Horses are adapted to immense, arid grasslands. In their natural environment, they roam a range. Because they never stay in one area very long, they have little impact on their environment. When we keep them on small acreages, we must manage them to minimize their impact.

Most horse owners know that horses are different from other livestock. How and what horses eat, how they behave, and the reasons we own them differ tremendously from sheep or cattle.

Eating habits

Unlike sheep or cattle, horses have both upper and lower teeth. They also have very active lips. As a result of these traits, they are very efficient grazers—sometimes too efficient. Although sheep and cattle can overgraze pastures too, horses have the ability to quickly and efficiently eat grasses all the way to the soil surface. When this occurs too often, it kills the grass.

Horses are more selective about what they eat than cattle or sheep. Horses have a stronger preference for grass over broadleaf plants, brush, or trees (although they will eat these plants). Horses also prefer shorter, tastier grass plants over longer, coarser grass.

Big, active animals

Horses are heavy animals with big, often steel-shod, feet. Unlike other livestock, they can be very active. They enjoy running and playing. In contrast, mature cattle tend to eat, lie down while they digest their meal, and make an occasional trip to the water trough. Horse owners are thrilled by watching their animals run, play, and generally kick up their heels. However, too much of this activity, when concentrated on a small acreage during the wet season, can severely damage pastures.



Why are horses hard on pastures?

The typical adult horse...

- Weighs about 1,200 pounds
- Has big feet, probably shod in steel
- Loves to run and play
- Possesses a specialized mouth that is one of the world's most efficient grazing machines

Horses are big animals and efficient grazers. Without proper management, they can easily damage pastures, leading to weed invasions and excess mud.

Mud, manure, and horse health

Living in mud and manure is unhealthy for a horse. Mud harbors bacteria and fungal organisms that cause health problems.

Mud fever (or scratches) is a common condition that usually affects horses' lower limbs. It is marked by inflammation of the skin and the appearance of crusty scabs. It usually is caused by bacteria that penetrate the skin following either damage or softening from exposure to wetness or mud. The bacteria thrive in wet, muddy conditions. On the upper body, the same condition is referred to as rain scald.

Wet conditions can soften the hoof and sole, causing cracking and splitting and making horses more susceptible to stone bruising and other related lamenesses. Thrush is a fungal infection that affects the frog of the hoof and also is caused by wet, muddy conditions.

When horses are directly exposed to manure, they suffer increased internal parasite infestations. Horses fed near manure reinfest themselves and spread internal parasites to other horses.

Other problems associated with mud include:

- Sand colic, a serious digestive disorder that occurs when horses fed on muddy ground ingest dirt and sand
- Low body temperature, causing unthriftiness and even hypothermia. Livestock in these conditions burn significantly more calories just keeping warm and require more feed.
- A slick, unsafe footing that can cause injuries
- Insects, especially flies, that breed in mud and manure. Insects are annoying at best. At worst, they carry disease, and their bites cause allergic reactions.



Standing in mud and manure can cause numerous health problems for horses. Manage grazing, manure, and the flow of water across your property to prevent mud.

Keep animals off wet pastures

The first step to keeping your pasture in good shape and reducing the amount of mud on your farm is to keep your horses off the pasture during the wet season (November through March or longer). How do you do this? The answer is to use a paddock—a small enclosure, such as a corral, run, or pen—for your horse’s outdoor living quarters. This area sometimes is called a “sacrifice area” because it is an area of pasture that is “sacrificed” to benefit the rest of the pasture.

Confine your horses to the paddock during the winter and early spring as well as in the summer *before* your pastures become overgrazed. A paddock also is useful for separating or confining animals, for controlling the amount of grass or feed they consume on a daily basis, and for caring for sick or injured animals.

Locate the paddock on high ground away from water and wells. It should be convenient to your barn or loafing shed to make it easy to care for your horses and maintain the area. A good option is to have an area set up like a run connected to each stall. This chore-efficient arrangement gives the horse free access to the stall, and you’ll have a clean, dry, convenient place to feed.

The size of the area can vary to fit the size of your farm, the number of horses, their ages and temperaments, and other needs. A general rule is to allow approximately 300–400 square feet per horse. A small paddock the size of a generous box stall (16 x 16 feet) could be adequate for some horses. A larger area that allows for running and playing might be 20–30 feet wide by as much as 100 feet long.

Footing is a crucial part of a paddock. The goal is to have a safe, well-drained, “all-weather” surface. Hog fuel, gravel, and sand all work well (see sidebar, page 8). Each type of footing has



Why keep horses off wet pastures?

Horses on wet pastures kill grass and create mud by continuously grazing and trampling grass and churning up the soil with their feet. Because of their size and weight, they also compact the soil. Soil compaction kills plant roots and reduces soil drainage, creating even more mud.

This situation is miserable for both horses and humans, but it doesn’t end there. Because the grass is weakened or killed, weeds now have room to grow. Desirable plants can’t grow in compacted soil, so undesirable plants that are well adapted to these conditions take over. Spring and early summer bring a crop of weeds, some of which are toxic to horses. The pasture becomes bare in the summer, except for some hardy weeds.

Less grass means having to purchase more hay. It also means there is nothing to protect the ground from erosion or to use the nutrients in manure and urine. During the rainy season, soil, nitrogen, phosphorus, and bacteria (such as fecal coliform) run off the farm, contaminating streams and household wells.

Horses should be kept off pastures during the rainy season. Use a sacrifice area instead.

its advocates, so spend some time investigating and select what will work best for your situation. A good guideline is to put down twice as much footing as you have mud in the winter. If you have 3 inches of mud, you will want the footing *at least* 6 inches deep.

It's important to minimize water runoff through the sacrifice area. See "Install rain gutters and downspouts" (page 9).

Fences for paddocks should be as safe as possible. Horses can be hard on fences, so a hot wire will provide a good psychological barrier. Keep in mind that gates need to be large enough for farm equipment and deliveries of footing material, hay, and so on. Also, to be sure your fence is the correct height, remember to take the thickness of the footing layer into consideration when putting in fence posts. A good height for a paddock fence is 4 feet. Electric fencing should be placed at the horse's chest height.

Your paddock is an integral part of your pasture rotation system. It is your horses' outdoor home in the winter. During the grazing season, use it to allow the pasture to recover and to prevent overgrazing.

Pick up manure every 1 to 3 days to prevent the buildup of a soupy surface layer and to reduce insects and parasites. Even the best maintained paddock will have some contaminated runoff. A buffer strip of grass or other vegetation around the paddock will intercept this runoff and prevent it from entering nearby streams or groundwater (see page 10).

For some horse owners, a reasonable solution for keeping horses off wet pastures is to have them stay at a boarding facility during the winter.



A sacrifice area doesn't have to be expensive.

Some options for sacrifice areas

Economical—hog fuel

Hog fuel consists of large wood chips. As a general rule, apply hog fuel at least twice as deep as the depth of mud (3 inches of mud = 6 inches of hog fuel). For more longevity, some authorities recommend applying up to 12 inches of hog fuel. The material will pack down and decompose over time, so add a new layer every year or two. Hog fuel reduces urine odors.

Mid-range—gravel or sand

Gravel is roughly two to three times as expensive as hog fuel, but used correctly lasts many years. Use $\frac{3}{8}$ -inch minus to $\frac{5}{8}$ -inch minus crushed gravel. Use a minimum 2:1 ratio of gravel to mud. For more longevity, some authorities recommend applying 6 to 8 inches of gravel. When applied directly over soil, gravel slowly migrates into the soil, so you'll need to add a new layer periodically. An alternative is to use gravel in high-traffic areas such as gateways, doorways, lanes, and so on, while using hog fuel in other areas such as paddocks.

Coarse, washed sand is another option. Don't feed horses on sand surfaces; they can ingest sand and develop colic.

Top-of-the-line—geotextile cloth with gravel, sand, or hog fuel footing

Geotextile cloth or filter fabric can be used with these footings to separate layers, improve drainage, and prevent footing from migrating into the soil. Filter fabric is a woven plastic material used in road building and other construction projects. The small holes in the material allow water to pass through, but not sand or silt.

Use these fabrics over a level, graded surface and cover with a minimum of 6 inches of footing (more is better). To create a highly drained surface, cover fabric with at least a 3-inch layer of crushed rock ($\frac{3}{4}$ to $1\frac{1}{2}$ inches works best), followed by another layer of fabric, followed by the footing of choice—6 inches of gravel or sand, or up to 12 inches of hog fuel.

Install rain gutters and downspouts

The high-rainfall climate of western Oregon and Washington produces annual rainfall ranging from 35 inches to more than 100 inches. The amount of water from rainfall alone saturates pastures and corrals. In addition, the roofs of barns and other farm buildings collect rain and deposit it on ground that already is soaked.

Installing rain gutters and downspouts on your farm buildings directs water away from high-use areas around the barn and immediately reduces the quantity of mud. Remember, to be effective, the downspouts must direct water away from animal confinement areas. In some instances, plastic pipe can be used to carry the water beyond the animal confinement area to a vegetated area on your property. Downspout systems also can be designed to divert water to rain barrels for emergency use.

To protect downspouts from damage, use heavy PVC pipe or hot wire, or make the downspout inaccessible to the horses.

Other ways to reduce runoff and mud

The natural drainage of your land might direct water into areas around (or through) your barn. In some instances, water moving downhill through the soil adds significant moisture to farm buildings and sacrifice areas. In these cases, you might need to look at additional ways to divert water. Some possibilities include French drain lines to divert water around a building, drainage tiles, grassed waterways, water bars (like a speed bump for water runoff), ditches, and dry wells. Design help is available from your local Conservation District, USDA Natural Resources Conservation Service, or Extension office. Or, look on the Web.

Plant and maintain native trees and shrubs. Plants use a lot of water and potentially can reduce the amount of water around your farm. A mature Douglas-fir can use 100–250 gallons of water per day. Evergreens have the added advantage of using water in the winter when deciduous trees are dormant.

Using water-loving shrubs along the outside of paddocks will keep the area drier and reduce runoff. Examples of potentially useful plants include willow, cottonwood, and red-osier dogwood. Trees have the added benefit of increasing habitat for wildlife, a plus for the aesthetics of your farm *and* the environment.

Trees in pastures and paddocks need protection from chewing and root compaction by livestock. Fence off trees along the drip zone—the ends of the branches where the raindrops roll off. Consider planting new trees where horses can't reach them, such as *outside* fence lines.



Gutters and downspouts reduce mud by directing water away from high-use areas.

Why are gutters and downspouts important?

An inch of rain on a 20 x 50 foot barn roof produces 620 gallons of water. In an area that receives 40 inches of rain per year, that's an additional 25,000 gallons of water! This extra water creates a soupy mess of mud, manure, and urine that makes horses and their owners miserable and eventually runs off into streams. It even can contaminate your household well.

Some options

Economical

It's easy to install gutters and downspouts as a do-it-yourself project. Home improvement businesses carry a variety of suitable materials.

Top-of-the-line

Numerous businesses specialize in installing aluminum continuous (seamless) gutters.

Use buffer strips

Why are buffers important?

On farms, a buffer of grass, shrubs, or trees can provide several benefits, including:

- Filtering mud, manure, pesticides, and bacteria out of water flowing across or through the soil
- Improving infiltration of water into the soil
- Providing food and cover for wildlife
- Protecting the land from erosion caused by floodwaters
- Creating an attractive landscape

Having small buffer strips between paddocks can save on fence repair and vet bills while filtering runoff from the paddocks.

A buffer is an area that protects one type of land use from another. For example, a buffer might be a wide, grassy strip between a manure pile and a well or a wide strip of trees between a paddock and a stream.

Buffers of grasses or grasses and legumes can be grazed in a managed rotation, as outlined below in “Summer pasture/winter filter,” but exclude horses from areas planted to trees and shrubs. They will browse or trample these plants.

Buffer strips can be installed just to buffer, but many serve multiple purposes. Properly managed buffers can produce income from harvested products while still providing many of the environmental benefits listed above. Some of these products include:

- Summer pasture/winter filter: Include the buffer in a managed grazing rotation or harvest hay during most of the growing season.
- Floral greenery: Plant types of shrubs used by florists for greenery; trim and harvest surplus growth seasonally.
- Wood products: Plant trees densely and thin later for pulp or other wood products. These areas should not be grazed.

Summer pasture/winter filter

One of the most common buffers consists of grasses (and often legumes) used for pasture and hay in the spring and summer, and left ungrazed to function as a buffer during times of slow growth, steady rain, or potential flooding. In western Oregon, this period usually is October through April.



Runoff from animal-use areas can contaminate water sources such as streams and wells. Plant a vegetated buffer strip to protect these areas.

Manage this type of buffer area intensively, with brief grazing and frequent rotation of horses through a series of temporary paddocks. As with all pastures and hayland areas, do not mow or graze the grasses below the proper stubble height for the species or when growing points are vulnerable (see page 18). Never allow horses or equipment on the field when soils are waterlogged.

How wide should the buffer be?

Buffer width depends on the slope of the field, soil type, and plant density. The minimum width should be 50 feet; however, the wider the better. The width should be greater on steeper fields, fine-grained or dense soils, where plants are widely spaced, or if the area above the buffer is not well vegetated. For paddocks used as summer pasture/winter filter, width usually is not an issue, as almost all fields are wider than 50 feet.

If you don't have room for a buffer between a paddock and drainageway, consider a soil berm (a raised strip of ground) to catch the runoff and direct it to a filter strip.

How do I prepare my grass buffer each fall for its protection function?

- Leave grass at least 3 to 4 inches tall at all times during the buffering period.
- Do not apply commercial fertilizer or stockpiled manure to the field in the fall, as you want this area to capture nutrients and bacteria, not release them.
- The buffering period should begin about 30 days before consistent fall rains and/or flooding are expected. This lead time will allow time for manure deposited in the field during grazing to break down as well as for some extra plant regrowth.
- The buffer period should extend into the spring until soils are not saturated, grasses are tall enough to graze (or otherwise harvest), and the chance of flooding has passed.

Manage pastures for optimal grass growth

Why is grazing management important?

Well-managed pastures are an important part of any small horse farm. Horses are grass-land animals. They thrive on grazing and exercise. Grazing and moving around a pasture help food move properly through their digestive system. A well-managed pasture can reduce feed costs significantly while providing high-quality forage and exercise.

Healthy grass also keeps water clean by using the nitrogen and phosphorus in manure and urine. It traps and filters runoff carrying soil particles, bacteria, and excess nutrients that otherwise might contaminate household wells and streams.

Poorly managed pastures become muddy in the winter, weedy in the spring, and dust bowls in the summer. Horses forced to stand in mud, manure, and urine all winter can develop health problems—including high levels of parasite infestations—and even hypothermia. These conditions also lead to large populations of flies and other insects. Mud and manure are bad for horse health as well as for humans and the environment (see page 6).

Grazing timing, intensity, and duration

Restricting access to pastures and controlling the intensity and duration of pasture use is your most important pasture management responsibility. This controlled grazing can be accomplished by keeping horses in sacrifice areas whenever pastures are not suitable for grazing (see pages 7–8). Use pastures only when there is adequate green cover (more than 3 inches tall) and the soil is firm and not water logged.

How many acres per horse?

The number of acres of pasture needed per horse is difficult to determine. If the horses have an adequate exercise lot or are ridden or worked often, they might not need very much pasture. However, most horse owners feel that supplemental pasture grass is good for nutrition and the psychological well-being of the horse.

A Pennsylvania reference suggests that a 1,000- to 1,200-pound mare with foal requires about 2 acres for grazing use. This recommendation is consistent with conditions in western Oregon and western Washington. The amount varies widely, however, depending on the amount and frequency of rainfall or irrigation water provided. A minimum of 1 acre per horse is required to cycle nutrients from manure and urine and to provide adequate space for meeting the social and exercise needs of horses.

Plant regrowth

Plants manufacture their food in their leaves, using solar energy, carbon dioxide from the air, and water to make sugars and complex carbohydrates. This process requires “solar receptors” in



Poorly managed pastures can be overwhelmed by weeds. Good grazing practices can significantly reduce weed problems.

the green leaf area. Removing too many leaves through overgrazing will slow growth and damage the root system.

Plant regrowth occurs at growing points. One growing point is the collar, the junction of the blade and sheath. The other is the apical meristem, which eventually develops into the seedhead (see illustrations below). Removal of these growing points by overgrazing will eliminate the plant's ability to regrow. Susceptibility to overgrazing depends on the species, developmental stage, and other stresses. Learning more about growth and regrowth processes will help you become a better pasture manager.

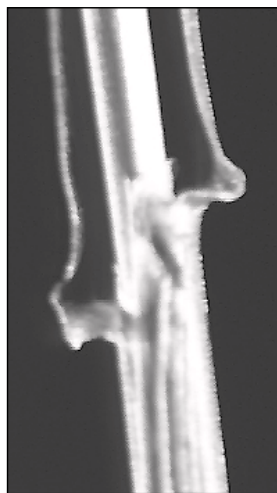
Water and fertilizer

Plants need water and nutrients in adequate and balanced amounts. Most pastures in western Oregon and western Washington are "dryland." In other words, they depend on rain to supply water needs. These pastures are productive during the fall, spring, and early summer, but dry out during the summer. To maintain actively growing plants during the summer, irrigation is required.

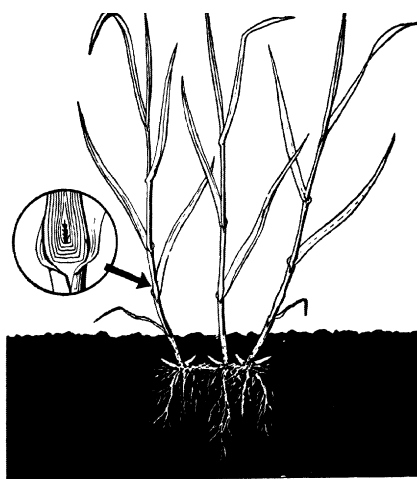
A moderate amount of fertilizer also may be needed to maintain green color and active year-around growth. Nitrogen, phosphorus, potassium, sulfur, and calcium are the nutrients typically added. To determine the amount of phosphorus, potassium, and calcium needed for your pasture, send a soil sample to a soil testing laboratory. Your local OSU Extension Service office can give you a list of testing labs. Then, fertilize according to recommendations based on the soil test results. Consult your fertilizer dealer about the proper



Move animals when a paddock has been grazed to 3 inches. Allow grass to regrow to 6 to 8 inches before being grazed again.



The leaf blade is joined to the leaf sheath at the collar, a zone of tissue accounting for increasing blade length. Once the blade has achieved its maximum length, cells in the collar cease dividing.



Progress toward seedhead development can be seen when internodes at the base of the shoot have elongated and have raised the meristematic growing point (the potential seedhead) to a vulnerable height. This is a transition stage between the fast-growing vegetative and reproductive (seedhead) stages.

fertilizer, or blend of fertilizers, that will supply the needed nutrients most economically.

For nitrogen, the general recommendation is to apply 30 to 50 pounds per acre one or two times per year. Always apply nitrogen before an active grass-growing period—early spring and early fall.

For grass/legume mixed pastures, you'll need less nitrogen because legumes use nitrogen from the air. For these pastures, apply 30 to 40 pounds nitrogen per acre in early spring and again in early fall.

Do not overapply nitrogen. Overapplication of fertilizer is a waste of money and increases the potential for nitrogen leaching or runoff. High nitrogen applications also can cause horse health concerns, especially during dry years.

Apply sulfur at a rate of approximately 30 pounds per acre every other year.

Manure can provide many of the needed nutrients and improves the biological activity of the soil. Collect manure throughout the year and store it in a covered pile or compost it until a suitable time for spreading (see pages 20–21).

Weed control

Weeds compete with desirable plants, and some are potentially dangerous to horses. The best weed control strategy is to maintain healthy, vigorous grasses or grasses and legumes through proper fertilizing and grazing practices. With good management, desired pasture plants compete strongly against weeds.

Because horses do not graze all pasture plants to an even height, mowing may be needed. Mowing a pasture to 3 to 4 inches after moving horses to a new pasture helps control weeds and prevents grasses from developing seedheads and becoming dormant. Mowing after grazing also makes pastures more attractive.

Identify weeds by using various weed publications (see back cover) or by taking a sample plant to your county office of the Oregon State University Extension Service. Weeds differ in their life cycles (annual, biennial, perennial), and this influences what actions you should take to control them. Weeds also differ in their threat to a pasture. Some are toxic, some are noxious (spread quickly and dominate a pasture), and some are harmless. These factors influence whether you should control the weed.

Remove weeds that do become established by mowing, pulling, or digging. If you choose to use an herbicide, it is critical to time the application to the correct growth phase of the plant. Information on application timing is provided by the manufacturer. Follow all safety precautions and grazing restrictions; horses might eat sprayed weeds and suffer health problems. Regular use of herbicides to solve weed problems generally indicates a problem with how the pasture is being managed.

If you choose to use an herbicide

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the herbicide label—even if you've used the herbicide before. Follow closely the instructions on the label (and any other directions you have).
- Know whether the herbicide can be wind carried to unintended plants.
- Be cautious when you apply herbicides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from herbicide use.

Manure management

Distributing manure is important because horses won't eat where they defecate. As a result, areas of tall, untouched grass grow up around manure piles. It generally is enough to harrow or drag a pasture once or twice a year to spread manure piles.

Harrowing helps break up manure so plants can utilize it, and it reduces fly habitat somewhat. However, when you harrow manure in pastures, you spread worm eggs, so you will need to maintain a good deworming program for your horses. Consult your veterinarian for recommendations on the best deworming program for your specific situation.

Irrigation

If you have irrigation rights, your pastures can remain attractive and provide supplemental nutrition even during the dry summer months.

As summer approaches and the soil becomes dry, plants naturally begin to move into dormancy. Begin irrigation early enough to prevent the plants from going into dormancy. In some years, you may need to begin irrigating in late spring. If you irrigate for production, follow an irrigation water management plan that takes into consideration the infiltration rate and water-holding capacity of the soil. For help developing a water management plan, contact an irrigation specialist or your local USDA Natural Resources Conservation Service office.

If your goal is only to have a green pasture, irrigate whenever the weather is dry.

Do not leave horses in the pasture while irrigating. In saturated soil, they might damage equipment and/or pasture plants.

To avoid plant damage and soil compaction, wait 3 or 4 days after irrigating before allowing horses to graze pastures. As always, wait until the pasture is above the minimum 3-inch height before grazing, and graze only down to 3 inches.

Interseeding

To increase a pasture stand and fill in bare spots, broadcast seed (5 to 10 pounds per acre) over the pasture in late September or early October. The horses will "plant" the seed by walking it lightly into the ground. Perennial ryegrass is particularly effective at becoming established by interseeding. Be sure to use certified, endophyte-free seed.

Keys to successful pasture management

Most pasture management practices are inexpensive. The key is to develop an attitude that horses do not have to be on grass all of the time or even every day; they should be grazing a pasture only when adequate grass is available and the soil is not saturated. Use sacrifice areas most of the time (see pages 7–8).

- Do not graze pastures when the soil is saturated. Doing so creates mud, damages plants, compacts soil, increases weeds, and reduces grass production.
- Graze no lower than an average of 3 inches in height. This restriction maintains growing points for rapid regrowth and enough leaf area for sunlight absorption, which improves plant health.
- Allow plants to recover after grazing. Divide pastures into smaller areas with portable electric fencing. Move animals when a paddock has been grazed to 3 inches. Allow grass to regrow to 6 to 8 inches before being grazed again.
- Limit legumes to 20 to 30 percent of the pasture stand to reduce digestive system problems. For more information, consult your county OSU Extension office or your veterinarian.

Renovation

In some cases, and as a last resort, complete pasture renovation is needed. Renovation involves destroying the old sod (either with herbicides or by plowing), tilling, and then reseeding. The process is costly and should be considered only after trying to improve a pasture by other means. Often, simply improving fertility and using the management techniques suggested in this publication will dramatically improve a pasture.

After a pasture is plowed and reseeded, the ground will be soft. Delay grazing until the soil is dry enough to support the horses. To ensure that the plants become well established and firmly rooted, don't graze a reseeded pasture until the new growth is more than 3 inches tall. The roots need a chance to get established. If horses are allowed to graze sooner, they might pull the plants out, roots and all. Graze lightly during the first season.

Seed mixtures

Pasture mixes should be tailored to the type of soil on the farm and the expected use for the pasture. Soils common to western Oregon and western Washington range from saturated to excessively well drained. In addition, some pastures are intended for both grazing and haying, while others serve as an exercise area rather than a source of feed and require a sod that will stand up to a lot of abuse.

The table below offers some basic options for pasture grasses. Always use "endophyte-free" varieties.

Soil type	Grazing only *	
	or grazing and hay	Exercise area*
Well-drained	Tall fescue	Bentgrass
	Orchardgrass	Fine fescue
	Perennial ryegrass	Tall fescue
Somewhat poorly drained	Tall fescue	Bentgrass
	Perennial ryegrass	Fine fescue
		Tall fescue

From: *Pasture and Hayland Renovation for Western Washington and Oregon*
(see "For more information," back cover)

*Pasture grasses should always be "endophyte-free."

Tall fescue is well adapted for horse pastures in western Oregon and western Washington. Tall fescue tolerates acid soils, low fertility, poorly drained soils, drought, and damage from horse hooves better than some other grasses.

Perennial ryegrass is another option for horse pastures. It establishes quickly and is highly palatable, but it may be difficult to maintain as a horse pasture unless fertility and grazing are well managed.

Orchardgrass is palatable and grows well in shaded areas but requires well-drained soils. Both orchardgrass and tall fescue are good candidates for irrigated pastures.

For pastures that are used primarily as exercise areas rather than as a source of feed, grasses that can survive very heavy use are best. Bentgrass and fine fescue are both low-growing grasses that work well in these conditions. Bentgrass is reasonably palatable; fine fescue is less so. Tall fescue also works in an exercise area.

Kentucky bluegrass and timothy are two species of grass familiar to most horse owners. They are not good selections for horse pastures. Kentucky bluegrass is not well-adapted to western Oregon and western Washington because it is susceptible to fungal diseases that reduce the quality of the grass. Timothy is an excellent option for hay but is not suitable for horse pastures due to its susceptibility to overgrazing. Bromegrass (except grazing bromegrass, *Bromus stamineus*) is similar to timothy in susceptibility to overgrazing and is not suitable for horse pastures.

Pasture grasses may be used alone, mixed together, or mixed with a legume. Pasture mixes with more than one grass can work well if they are grazed only and not hayed. Mixtures with more than one grass can be challenging, however, because horses may prefer one grass over the others, resulting in overgrazing of one grass and undergrazing of the others.

Seeding rates vary depending on the type of grass. For example, for tall fescue, use at least 30 pounds of seed per acre (more if planting into a rough seedbed). If using a tall fescue/perennial ryegrass mixture, two-thirds should be tall fescue and one-third perennial ryegrass. If you want to include a legume, add 2 to 3 pounds of white clover seed per acre. Consult *Pasture and Hayland Renovation for Western Washington and Oregon* (see back cover) for seeding rates for other forages.

Endophytes

Some varieties of tall fescue contain an endophytic (within the plant) fungus. “Turf-type” tall fescues typically contain the endophyte, while “forage-type” tall fescues do not. Toxins associated with this fungus can cause lowered reproductive rates, abortion, agalactia (lack of milk), and prolonged gestation. Always use “endophyte-free” seed when establishing tall fescue stands for horses. Remove brood mares from pastures containing endophyte-infested tall fescue at least 90 days prior to foaling.

If no reproductive or lactation problems have been observed on your current pasture, you probably have no reason to be concerned. If you are concerned, an endophyte test can determine the amount of infection, if any, in your pasture. Contact the Oregon State University Veterinary Diagnostic Laboratory for more information (<http://www.vet.orst.edu/biomed/biomed.htm>; phone: 541-737-3261; fax: 541-737-6817).

Putting the principles into practice

One of the principles of good pasture management is to never graze the grass too short. The optimum height for grass is between 3 and 8 inches tall. Grazing managers call this the “vegetative” stage because the grass is very leafy. It also is very high in nutrients and very competitive with weeds. Grass that is grazed to 3 inches and allowed to rest regrows very quickly. Grass that is grazed very short takes a very long time to regrow and is weakened and susceptible to competition from weeds. Grazing too short too often is overgrazing.

It is important to note that different grasses vary in their optimum grazing height. For instance, tall fescue should be grazed to about 4 inches. Bentgrass, since it is a turf-type grass and therefore lower growing, can be grazed to about 2 inches.

If you have only one large pasture, it is very difficult to manage the grass for the correct height; thus, these pastures are prone to overgrazing. To make the task of managing your grass easier, divide your pasture into several smaller pastures—at least three, but more is better. Start by turning the horses into the first pasture. When they graze the grass to the 3-inch level, move them into the next pasture, repeating the process for each small pasture. The first pasture should rest until it has regrown to 6 to 8 inches; then you can put the horses back in. Think of the process this way: when you have only one big pasture, you are grazing 100 percent of it and resting (regrowing) none of it. When you have four smaller pastures, at any given time you are grazing 25 percent of your pasture land and resting 75 percent of it.

Remember, horses tend to spot graze (overgrazing some areas while not grazing other areas), and you will have to consider this factor as you decide when to move them to the next pasture. Mow-

ing between grazings, or at least at the end of the grazing season, will clean up pastures and get everything back to the same height.

There will be times when none of your pastures is sufficiently tall to graze. This situation likely will occur during the summer on unirrigated pastures and during the winter. Use your sacrifice area or paddock during these periods to prevent overgrazing and damage from overtreading. During the summer, you can still turn the horses out for exercise on dry, dormant pastures but these periods should be brief, and the horses should be restricted from continuously standing, grazing, pawing, and other activities that are hard on dormant pasture plants.



Divide pastures into paddocks with fencing. Then, rotate horses among paddocks to give pasture plants time to regrow before regazing.

Protect your well water

To assess the impact that you or your livestock have on the quality of your drinking water, first identify where your well is located in relation to your livestock, drainfield, petroleum storage tanks, and other potential sources of contamination.

Next, learn all you can about your well. Is it located in a low area of your property? Is the wellhead properly sealed, and are the vent pipe and screen in place? What is the age, depth, and construction quality of your well? By performing a visual inspection and reading your well report, you can learn a lot about your well.

Practices to protect your drinking water

1. Fence horses and other livestock away from your wellhead. The risk for contamination of your drinking water depends on many factors (soil type, condition of your well, amount of rainfall, direction of groundwater flow, etc.). Knowledge of these factors and common sense are your guides. If possible, maintain all livestock downhill from your wellhead.

2. Divert surface water away from your wellhead. Surface water that runs through a pasture or manure pile is laden with bacteria and excess nitrogen that can contaminate your drinking water and nearby surface water. Bacteria from manure and urine also can move downward in some soils and under certain conditions.

3. Locate manure piles at least 100 feet, preferably downslope, from your well. Place the pile on an impermeable surface such as concrete and **cover it** to prevent rain from leaching nitrogen into groundwater (see page 20). This method of storage also begins the composting process to turn this nitrogen-rich material into a useful soil amendment. Do not allow surface water to run across or through a manure storage area.

4. Test well water annually for coliform bacteria and nitrate. The presence of nitrate and/or coliform bacteria in groundwater indicates a connection to materials such as manure, fertilizers, and septic-system waste that are rich in nitrogen. **Excess nitrate is harmful to humans, especially infants, and to livestock.** Coliform bacteria *should not* be present in well water.

5. Do not leave a hose immersed in a stock tank. The potential for back siphoning of contaminated stock tank water into your well water systems is very real. **Backflow happens!** Purchase an anti-siphon valve for all outdoor hose faucets, especially those used to water livestock and mix chemicals.

6. Take a good look at your property, your neighbors' property, and your entire watershed. Are there any structures or practices that pose a threat to your drinking water source? Are any of them located on *your* property?



Keep horses and other animals away from your wellhead.

Why is groundwater protection important?

Many horse owners who live in rural areas depend on groundwater from a well for their drinking water. If not properly managed, manure is one of the many materials that can contaminate the groundwater supplying your well. Through proper management of animal waste, you can greatly reduce the risk of contamination to groundwater, the source of drinking water for you and your family.

Some options

See the options listed for manure management (page 20) and gutters and downspouts (page 9).

For more information, contact your county Extension agent or visit the Oregon State University Well Water Program Web site (<http://wellwater.oregonstate.edu>).

Cover and compost manure

Why is manure management important?

Proper manure management promotes horse health by reducing parasites in pastures. It promotes pasture health by reducing weed seeds and returning plant nutrients to the soil. It promotes water quality by stabilizing manure nutrients and keeping them out of water.

Some options

Economical

The most important step is the least expensive: cover manure piles with a weighted tarp during the rainy season. Water-filled jugs make excellent weights.

Mid-range

The next level of manure management is a concrete pad, perhaps with curbs, and weighted tarps. Size the pad according to the projected manure volume.

Top-of-the-line

Add a roof and, ideally, gutters and downspouts.

A 1,200-pound horse produces 1 cubic foot of fresh manure every day. Stall waste can be a soil-building resource or a source of muck, weeds, parasites, flies, and water pollutants. It all depends on the management. Improve your manure handling and composting techniques with these six simple tips.

Wet soils and low areas are not well suited to horses, confinement areas, or manure storage and composting. Horse health is affected when animals spend long periods of time on saturated pastures. Water flowing through and under compost piles results in low-quality compost that may be toxic to some plants.

Location, location, location

Observe the pathway that running water takes across your property. Do not locate manure storage areas in low spots or drainage ways. Store all waste above the floodplain so it won't be carried away by high water.

Keep manure out of the path of runoff from roofs and downspouts. Well-planned trenching diverts water away from waste piles (see page 9). Avoiding problems on less desirable storage sites requires more care.

Site the manure pile downslope from your wellhead; a 100-foot separation should protect your drinking water supply.

Cover waste piles during wet weather

At a minimum, cover waste piles with a weighted tarp to control the moisture level and reduce leaching. Many published sources show examples of roofed and open storage structures. Classic three-bin systems adapt to many situations.

Effective manure management requires adequate storage structure size. Bedding adds to storage space needs. Using rubber stall mats and minimal bedding is a good way to reduce waste storage demands.

Reduce stall waste volume

There's nothing you can do about the amount of waste a horse produces, but you can affect the size of your manure pile by reducing the amount of bedding you use. The amount required to absorb urine is far less than many horse owners provide. Horses do not require extra cushioning for comfort if the stall floor is dirt.

Using stall mats is a refinement of this approach. Stall mats provide a cushioned, level surface for standing. They reduce dust and prevent horses from digging. Unless horses have unlimited access to outdoors, you'll need to provide a small amount of

bedding to absorb urine. Despite the initial investment, stall mats reduce bedding costs.

Several bedding materials provide an alternative to shavings or straw. Shredded newspaper, sold in bales, has been used successfully. Newspaper is highly absorbent and has the advantage of composting more rapidly than wood products. Newspapers are now printed with nontoxic soy ink. Interest is growing in wood pellets, similar to wood stove pellets. Use pellets specifically manufactured for bedding. They are easy to pick, low in dust, and more absorbent than shavings. They effectively control ammonia odors. Because they are made of hammer-milled by-products, they take up less room in a compost pile than shavings.

Compost manure

Composting is easy and stabilizes the nutrients in manure. The technique depends on manure volume and available equipment.

Increased air exposure supports beneficial heat-producing bacteria and increases the rate of decomposition. As the pile heats up, decomposition accelerates and most parasites, flies, and weed seeds are destroyed. Manure volume is reduced by 50–65 percent, and valuable nutrients are stabilized.

For small volumes that will be turned by hand, promote aeration by laying lengths of 4-inch perforated drain line pipe across the pile every 2 feet of pile depth. Pipe ends must remain exposed. This technique is not recommended for piles that will be turned by a tractor. Turning a compost pile also adds oxygen, and it increases compost quality by mixing components and reducing particle size.

Small compost piles can be turned by hand. Tractors and front loaders gain traction when compost is stored on a concrete pad. This method is easier if you have a reinforced wall for equipment to push against.



By protecting manure piles from rain (left), you can keep nutrients in the manure, rather than letting them run off or leach into the soil.

Low moisture and insufficient aeration slow decomposition. Check moisture levels when you turn the pile; add moisture if needed. The trick is to provide enough water so that the materials have a thin film coating most surfaces but there is still space between the particles of bedding and manure that contains air, not water.

Oddly enough, too much water also slows decomposition. Under saturated conditions, oxygen-intolerant (anaerobic) bacteria take over the job of breaking down the compost pile. They work very slowly, not very efficiently, and may contribute plant-toxic compounds to the compost. During the wet season, it's important to cover compost piles with a weighted tarp to prevent saturation. During the dry season, it's important to cover compost piles to conserve moisture.

Isolate waste piles from streams

Buffer strips trap flowing contaminants and take up water-carried nutrients (see page10).

Spread manure and compost when plants can use it

Spread manure and compost when the soil is dry enough to permit field access and plants are actively growing. A good guideline is to spread no more than ¼ inch of compost at a time, and no more than twice per year. Spreading compost in spring might be ideal for plant growth, but heavy equipment can cause severe damage to wet pastures. In late summer, actively growing pastures are short enough to allow efficient application. Empty manure storage provides space for winter's accumulation.

Spreading manure in late fall is less desirable. Winter rains will carry nutrients away while dormant plants are unable to use them.



Spread manure and compost only when fields are dry and plants are actively growing. Otherwise, nutrients will end up contaminating surface water or groundwater rather than fertilizing your pasture.

For more information

General

County soil surveys are available at your library or county office of the OSU Extension Service.

Healthy Horses, Clean Water: A Guide to Environmentally Friendly Horsekeeping for King County Equine Businesses. For commercial horse facilities. Contact Laurie Clinton, King County Washington Livestock Programs, at 206-296-1471 or Laurie.Clinton@metrokc.gov

Healthy Horses, Clean Water: A Guide to Environmentally Friendly Horsekeeping. For noncommercial horse owners. Contact Laurie Clinton, King County Washington Livestock Programs, at 206-296-1471 or Laurie.Clinton@metrokc.gov. Available online at http://www.wa.gov/puget_sound/Programs/Agriculture.htm

Horse Housing and Equipment Handbook (Midwest Plan Service, 122 Davidson Hall, Iowa State University, Ames, IA 50011-3080; phone 1-800-562-3618).

Horsekeeping on a Small Acreage, Cherry Hill (Storey Books, Pownal, VT, 1990). Excellent book on horse facility design and management. Includes information on understanding horses, designing a horse facility for your land, and general considerations and designs for horse barns and other facilities.

Horses for Clean Water, Alayne Blickle. <http://www.horsesforcleanwater.com>

Managing Livestock on a Small Acreage (Washington State University Cooperative Extension). <http://coopext.cahe.wsu.edu/infopub/eb1713/eb1713.html>

Oregon Small Acreage Fact Sheets (Oregon Association of Conservation Districts and USDA-NRCS) <http://www.or.nrcs.usda.gov/pas/factsheet.html>

Organics Outlook. <http://www.ciwmb.ca.gov/organics>

Small Acreage Management (Colorado State University). <http://www.cnr.colostate.edu/RES/rc/small.htm>

Tips for Small Acreages in Oregon (Washington County Soil and Water Conservation District). May be available at county Extension offices, or call the Washington County SWCD at 503-648-3174.

Using Geotextile Fabric in Livestock Operations, AEX-304-97 (The Ohio State University Extension). <http://ohioline.osu.edu/aex-fact/0304.html>

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Good Neighbor Guide for Horse-Keeping: Manure Management (University of New Hampshire Cooperative Extension, 1995). <http://ceinfo.unh.edu/aahr1050.pdf>

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In-Vessel Composting of Horse Manure (Texas A&M University). www.tamu-commerce.edu/coas/agscience/res-dlc/horse/horse.html

Managing Horse Manure (North Carolina State University). Includes 42-slide show on proper storage of horse manure. <http://www.bae.ncsu.edu/programs/extension/manure/equine/manure/sld001.htm>

Manure Storage and Compost Facilities for Operation with Limited Numbers of Livestock (USDA-NRCS and Washington County (OR) Soil & Water Conservation District, Hillsboro, OR).

On-farm Composting Handbook, NRAES-54 (distributed by Northeast Regional Agricultural Engineering Service, 152 Riley-Robb Hall, Cornell University Cooperative Extension, Ithaca, NY, 14853-5701; phone 607-255-7654; fax 607-255-4080; e-mail NRAES@cornell.edu). Information on agricultural composting.

Pasture management

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- Pasture and Hay for Horses* (Penn State University). <http://pubs.cas.psu.edu/FreePubs/pdfs/uc099.pdf>
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Well water protection

- Backflow Protection for Private Water Systems*, G. Glick Andrews, EC 1488 (OSU Extension Service, July 1997).
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- Septic Tank Maintenance*, J.A. Moore, EC 1343 (OSU Extension Service, 1989).
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Note: Many OSU Extension Service publications may be viewed or downloaded from the Web. Visit the online Publications and Videos catalog at <http://eesc.oregonstate.edu>. Copies of many of our publications and videos also are available from OSU Extension and Experiment Station Communications. For prices and ordering information, visit our online catalog or contact us by fax (541-737-0817), e-mail (puborders@oregonstate.edu), or phone (541-737-2513).

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