

Manure Management for Small Scale Livestock Operations



Manure, if used properly, can be a valuable addition to any operation's resource system. Many small scale livestock operators feel overwhelmed by the huge mound of manure and soiled bedding. It would be nice if that mound would just disappear, but the reality is that it will always be a concern. So how do you manage the never-ending supply of manure? This is where a good manure management program comes into play; benefiting you, your livestock, your land, the neighborhood, and the surrounding environment.

An average 1,000 pound horse produces approximately 9 tons of manure a year. This manure contains valuable fertilizer elements (See Table 1). Add in an additional cubic foot of bedding material and you get 730 cubic feet / year from one livestock. It's no wonder that the manure mound grows so fast, covering ground that could be put to more productive and attractive use.

Table 1: Average fertility content in horse manure (as-is basis) from the Penn State Agronomy Guide 2002.

12 lbs N / ton
5 lbs P2O5 / ton
9 lbs K2O / ton

Not only is the manure mound an eyesore, but it can cause serious environmental problems. The unsightly pile does not need to be near a stream or body of water to have the potential for contamination. Remember all water runs down hill, carrying potential problems with it. The sediment and nutrient runoff can

contaminate surface water, and inhibit fish and aquatic wildlife. Nutrients leached from unmanaged manure piles can also contaminate ground water.

Manure is excellent at holding moisture. That is why gardeners love the stuff. Improperly handled manure can mean more mud around your barn. When manure, mud, and water mix it produces a substance that is not only unsightly it can also be dangerous.

Having muck underfoot can lead to slipping and injuries for livestock and humans. This foul mixture also creates a breeding ground for insects.

Not only are these insects an annoyance; at worst they inflict painful bites, spread disease, and trigger allergic reactions. They also make non-livestock owning neighbors irritable. Organic muck is also a breeding ground for bacteria and fungal organisms responsible for diseases like rain rot, hoof abscesses, and thrush. Preventing manure and mud build up also helps water quality – the less muck you have for water to run through the fewer pollutants it will carry to the nearest body of water.

The U.S. horse industry uses two principal feed management systems, according to a Colorado State University survey. The first system permits horses to graze full-time on pastures and the manure is not collected or treated. Pasture manure usually is spread by harrow cultivation that promotes decomposition.

The second system confines animal feeding, which relies on intensive management, and the horses are kept in stalls or runs. The horses may be housed in box stalls and provided a bedding source for urine absorption. Alternatively, livestock are kept in corrals or runs and some runs are attached to stalls. Manure is managed in one or more of the following ways: 1) compost (manure is removed daily and composted); 2) stockpile (manure is removed daily and stored in piles) and, 3) daily land application (manure is removed daily and spread on cropland). Once manure is collected from the stables, turnout areas, or riding areas it can be used as a fertilizer, stored or removed from the property for use as a compost additive or soil amendment.

By now you are probably asking yourself, "What can I do to prevent these problems". The first step is to clean up all the manure and soiled bedding around your barn. It is recommended that you pick up the manure from stalls, paddocks, and turnout areas on a regular basis at least every three days to break the potential for parasite infestation.

Confinement Housing (Stalls, Drylots, and Runs)

Daily maintenance of animals in a confinement setting requires intensive labor. Horses housed in stalls and sheds require soft absorbent bedding. According to the 1999, USDA, APHIS survey, two-thirds (67.5%) of operations used bedding for horses. The most commonly used bedding was straw or hay (45.4%) followed by wood savings (30.9%). Some other sources are corn stalks, shredded newsprint, peanut shells, peat moss, rice hulls, etc. The USDA, APHIS study also noted, approximately one-third (34.5%) of livestock farms cleaned stalls daily or more often, while 60.2% cleaned stalls weekly or less, depending on the time these animals spend in the stalls. Remove manure and soiled bedding on a regular basis and handle appropriately to prevent fly infestation and disease transmission.

Pastures

Manure management in pastures depends primarily on getting good distribution of manure across the pasture. To avoid manure concentration in isolated spots in a pasture, distribute grazing evenly. Rotational grazing is one of the best ways to achieve this goal; however, horse owners may not have large enough pastures for rotational grazing.

On the other hand, pastures can be split, and the livestock moved back and forth between both parts of the pasture to distribute the manure more uniformly. Availability of several watering facilities and moving feeding facilities periodically will encourage better manure distribution.

Avoid grazing during rainy periods when soils are saturated, to avoid soil compaction and manure runoff. Restrict access to streams to avoid manure deposition in or near water bodies. This can be done by fencing or providing shade away from the streams. Refrain from excessive stocking rates that lead to overgrazing. Damaging the grass stand increases manure runoff potential from pastures.

Reduce Stall Waste

Simply use less bedding. Only use enough bedding to soak up urine and moisture. You can also use less bedding if stall cleaning is done carefully. Try only to remove soiled bedding and manure.

Rubber mats are another option, they provide cushioning so that you do not have to use as much bedding. The initial investment will produce long-term savings in bedding material. Rubber mats also prevent horses from ingesting dirt or sand when eating off the stall floor; makes stall cleaning easier; decreases dust; prevents a pawing horse from digging holes; and gives the animal an even surface to stand on.

There are many new alternative-bedding products on the market like newspaper bedding and wood pellets that are more absorbent than shavings. As a result, you will end up using far less bedding, having less to dispose of, and less to buy. These products

can create less dust, reduce odors, and compost better than shavings or traditional wood based products. Besides the other advantages, newspaper bedding is a great way to recycle. Be selective in the type of newspaper you use as bedding, only select clean newspaper that has soy based ink that won't rub off on the hair or harm the livestock.

STORAGE, TREATMENT, & DISPOSAL

Marketing Plan

Livestock owners have a responsibility to manage the manure that is a byproduct of their industry. Use it on croplands, arena surfaces, trail surfaces, and landscaping. If you don't plan to use the manure yourself, develop a marketing plan so others can make use of it.

Contract or donate manure or compost to crop farmers, community landscapers, parks, and neighborhood gardeners. Offer a discount to boarders if they dispose of manure. The people who come to watch others ride are another potential market for manure or compost sales. Before you can market the product, it must be completely and properly composted and free of foreign material such as beverage cans, wire, and needles.

Most small scale livestock owners bed their animals with little consideration to the relationship of the quantity of wood waste to the volume of manure and urine removed from the housing and paddock areas.

Many manure piles contain a very high ratio of bedding material to manure resulting in a less desirable product for use as a fertilizer. The higher the bedding ration, the longer the breakdown time, due to a high carbon:nitrogen ratio (C:N). This is important when applying such material to growing crops. The bedding material robs the growing crops of much needed nitrogen to break down the carbon found in the wood products. An ideal ratio is between 20:1 to 40:1 for break down. Table 2 shows examples of the carbon:nitrogen ratio of various materials used on livestock operations.

Table 2:

MATERIAL	C:N RATIO
Fresh grass clippings	12:1
Average Barnyard Manure	14:1
Horse Manure without bedding	25:1
Straw	50-100:1
Timothy Hay	60:1
Leaves	70:1
Sawdust	500:1
Woodchips	100-500:1

Selective removal of manure when mucking out, and removal of less bedding will help to reduce the C:N ratio. Less bedding will also mean fewer trips to the field to spread manure, smaller storage facilities, and less cost to remove the manure pile.

Stockpiling

Once you have collected the manure and soiled bedding from stables, turnout areas, and riding arena you need to decide what to do with the manure. Many small scale livestock operations do not have enough land to apply the manure directly to fields so they need to plan for storage.

Adequate storage area allows for greater flexibility in timing of manure use. Therefore, be sure you have a large enough storage area to accommodate the manure produced. Over time, the manure shrinks from decomposition and moisture loss.

Stock piled manure can be applied to pastures and crop fields at least twice yearly. If you do not have adequate land to apply the manure, check with local farmers. They may be willing to apply the manure to their land. On average, one horse can produce about \$150 worth of fertilizer yearly.

You should avoid spreading on pastures if you cannot keep the livestock off for a few days. This method should also be avoided if your waste contains a lot of shavings or other bedding material. In this case the decomposing bedding robs the soil of valuable nitrogen.

When considering putting in a waste storage structure you should follow these few considerations:

- Locate it at least 35 feet (check with local regulations) from any watercourse and at least 100 feet (check with local regulations) from wells or domestic water sources.
- Size to provide enough storage to prevent having to spread manure during the fall and winter or any time runoff is likely to occur.
- Avoid areas where high runoff is expected.
- Locate out of sight and downwind from public places and neighboring residences.
- Cover the storage to prevent rainfall from entering and causing leaching from the manure pile.

Manure Application

Applying the manure produced on your operation to crop fields is one option for disposing of the manure. However, a large land base is the key element to applying manure at proper rates. The area for manure application must be large enough to accommodate the nutrients in all manure produced at the operation. To promote crop production and soil improvement while minimizing any hazard to the environment, manure must be applied at rates and times of year that:

- Are compatible with the nutrient requirements and growing characteristics of the crop.
- Take into account soil characteristics, drainage, and the slope of the land.
- Recognize the need to protect the quality of surface water and groundwater.

The amount of manure applied yearly should be governed by the amount of nutrients that are removed in the harvested portion of the crop. Before applying manure you should determine the following information:

- Amount of nitrogen in the manure
- Quantity of manure added to the field the previous years

- Amount of nutrients already present in the soil
- Length of time manure is left on the soil surface before incorporation

Some fall and winter manure applications may be necessary. This type of spreading should only be considered under the following conditions:

- The land is not subject to flooding or runoff.
- Do not spread on frozen, snow covered or saturated land.
- There is a crop growing in the field (cover crop usually in the late fall and winter)
- The application of manure does not harm the crop that is growing in the field.

Odor control is also a consideration when land applying manure. Consideration of neighbors with respect to time of day and weather conditions when spreading manure can help to avoid conflict. The following techniques can be used to help reduce odors from manure applications:

- Apply manure early in the day (i.e. late morning) when the air is warming and rising and diluting odors, rather than later in the day when the air is settling, cooling, and concentrating odors.
- Try to spread on a cool day when odor production is lower.
- Try to spread the manure in as short of time frame as possible.
- Whenever possible avoid spreading on weekends and holidays. If necessary choose sites away from the neighbors.
- Incorporate manure.

Monthly Environmental Considerations when Spreading Manure

January, February, and March: In winter, try to avoid applying manure during these times. During this time of year many soils are too wet to have manure applied to. If you must apply manure during this time choose fields farthest from the homestead, and choose flat fields to avoid runoff problems. Try to apply to areas that have a cover crop or growing crop and avoid applying in areas that are frozen, snow covered, or saturated.

April and May: Collect manure from paddocks and storage areas and apply to crop land. Apply and incorporate the manure as soon as possible.

June, July, and August: If manure must be applied during this time apply to fields after hay is removed and small grains are harvested.

September and October: Collect manure from paddocks and storage areas and apply to crop land before planting winter crops. Apply and incorporate the manure as soon as possible. Avoid applying to areas that are prone to flooding and runoff.

November and December: With the onset of winter, try to avoid applying manure during these times. During this time of year many soils are too wet to have manure applied to. If you must apply manure during this time choose fields farthest from the homestead, and choose flat fields to avoid runoff problems. Try to apply to areas that have a cover crop or growing crop and avoid applying in areas that are frozen, snow covered, or saturated.

Composting

Composting produces a relatively dry end product that is easily handled and reduces the volume of the manure (40 percent to 65 percent less volume and weight than the raw manure). Composting at proper temperatures can kill fly eggs and larvae, pathogens and weed seeds. Compost has less of an odor compared to raw manure and is more easily marketed. Composted manure acts as a slow release fertilizer and an excellent soil conditioner.

To be done right, composting requires an investment of time and money. Machinery required includes a tractor, a manure spreader and a front-end loader. This process can be done without the tractor and front-end loader but it is time consuming and not very labor efficient.

Some ammonia-nitrogen is lost during the composting process, and an ammonia odor

may result for a short period. When composting is done on a large scale, additional land and machinery requirements exist.

Microbes that drive the composting process require optimum conditions of temperature, moisture, oxygen, and carbon: nitrogen (C:N) ratio. The C:N ratio should be between 25:1 and 30:1; livestock manure has an estimated C:N ratio of 50:1. With the addition of bedding material (high carbon content), the C:N ratio will be even higher. Therefore, N has to be added to the manure for it to compost properly. The addition of grass clippings, hay, or fertilizer 25 to 30 pounds N/ton of manure (75 to 90 pounds of ammonium nitrate or 50 to 65 pounds of urea) should bring the C:N ratio into the optimum range. When microbes work properly, the compost temperature will be between 120 and 160 F. Cooler temperatures result from a lack of N. When the composting process is complete, the temperature will cool naturally.

It is important to have the right balance of moisture and air for the microbes to process the manure. The compost should be moist but not soggy, and may need to be watered or covered with plastic to maintain moisture. Aerate the compost by turning it regularly. The manure and bedding particles should be about one-half inch to one and a half inches in size. Composting does require effort, but the resulting manure is a more easily used and economically valuable fertilizer.

Planning Your System

After you have chosen a high, level area on your property (away from streams, ditches, wetlands, or other bodies of water), decide on the number of bins you will need. A good rule of thumb is that two bins are usually adequate for one to five horses but you may want to add a third bin for convenience. Pile manure and stall waste into the first bin and leave it alone to compost, and start filling the second bin. In two to four months (depending upon conditions) the first bin should be done composting and ready to use.

Getting Air into the Pile

For composting to work you must have air introduced into your compost on a regular basis. This can be time consuming and even back breaking if you do not have a tractor and a loader. An easy way to introduce air into the pile without turning is to insert numerous five to six foot PVC pipes into the center of the pile like chimneys. Use a drill to put holes in the pipes –approximately a half inch in diameter at six inch intervals. The pile will still need occasional turning to get the outside of the pile into the center where the heat from the composting process can kill parasites and weed seeds.

Covering Your Bins

It is important for the compost pile to be covered with a tarp, plastic sheet or roof. This will prevent your piles from becoming too wet and too dry. This will also prevent rainwater from washing valuable nutrients out of the compost.

Building a Manure Composting System

A composting system can be built out of almost any spare material lying around. A simple compost bin can be constructed out of old wooden pallets and chicken wire. A more elaborate bin can be made from concrete blocks or treated landscape timbers. There are a variety of designs available for composting manure.

ALTERNATIVE MANURE USES

Nurseries – Shavings based stall waste can often be utilized by local nurseries. It is often not necessary to go through the complete composting process.

Mushroom Farms – Mushroom farms are a market option for horse facilities that produce straw based waste. It may be necessary for numerous small operators to pool their manure to make it beneficial for a mushroom grower.

Home Gardeners – Home gardeners, particularly rose growers, often like horse manure for their gardening efforts. Advertise in local newspapers and on gardening programs to attract customers.

With a little planning and a lot of management you can make your small scale livestock operation environmentally friendly and a happy home for your animals.

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