

PROTECTING GROUNDWATER BY MANAGING ANIMAL WASTE

Animal waste is a valuable fertilizer and soil conditioner. When managed properly, the nutrients in manure can be an ideal substitute for commercial fertilizers, saving money and protecting groundwater and surface water. Animal waste, or manure, can contain organic matter – which can improve soil’s water-holding capacity – and valuable nutrients that can increase soil fertility, including nitrogen, phosphorus, potassium, and sulfur.

Animal waste can also contain microorganisms that can cause disease in humans and young livestock. Fortunately, groundwater is largely protected from organic matter and microorganisms, as these are filtered by the soil before they reach the groundwater. However, when not properly managed, animal waste can contaminate groundwater with nitrate.

Methods to help keep animal waste from reaching groundwater include:

1. Appropriate application of waste as fertilizer
2. Preventing animals and their waste from coming into contact with runoff and water sources
3. Proper management of pastures

Proper Application of Manure

Proper application of manure as fertilizer involves proper amounts, placement and timing to ensure maximum nutrient uptake by plants and crops. Other considerations include whether the manure has been composted, and the characteristics of the soil.

How much manure do I need?

Nitrogen is usually the nutrient needed in the largest quantity for crop growth. Nitrogen availability from manure varies greatly, depending on the type of animal, type and amount of bedding, and age and storage of manure. To determine the appropriate amount of manure to apply, you need to know the amount of nitrogen in your manure, the amount of nitrogen already available in the soil and the amount of nitrogen your crop requires.

Laboratories are available that can test your soil and manure for nutrient content. Your state or local Cooperative Extension Office can provide you with a list of soil- and manure-testing laboratories in your area. Test for total nitrogen, ammonium nitrogen, total phosphorus, total potassium, electrical conductivity, and solids. If the manure is old or has been composted, you may also want to test for nitrate, total carbon, and pH.

Fresh manure is not a good choice for root crops (such as carrots and radishes), leaf crops (such as lettuce or spinach), or other crops that are eaten raw (such as strawberries). Since the edible part touches the soil, it is more likely to be contaminated by bacteria.

Nitrogen requirements for specific crops can be obtained through a Cooperative Extension Office in your area. To find your nearest Cooperative Extension Office, visit the U.S. Department of Agriculture Co-op Research and Extension Service website at <https://www.usda.gov/topics/rural/cooperative-research-and-extension-services>.

Once you know the nitrogen requirements for your crop and the nitrogen content of your soil and manure, you can calculate manure application rates. A Pacific Northwest Extension Publication, "Fertilizing with Manure and Other Organic Amendments" includes a worksheet for calculating manure application rates and is available at https://s3.wp.wsu.edu/uploads/sites/411/2016/07/Paper_FertManure2016.pdf.

If you apply too much manure, nitrogen that isn't used by the crop will accumulate in the soil and convert to nitrate, which can contaminate groundwater. High nitrate levels can lead to health problems for high risk individuals, as well as for young livestock. For more information on health effects of nitrate, see our wellcare® information sheet on [Nitrate and Nitrite & Well Water](#).

Where do I apply manure?

Apply manure at the root level, rather than at the surface, to maximize nutrient intake and minimize losses through runoff. You may want to consider crop rotation to enhance crop yields and economic benefits, while also minimizing fertilizer and pesticide needs. For example, deep-rooted crops can be rotated with shallow-rooted crops, since the deep-rooted crops will scavenge nitrogen left in the soil by shallow-rooted crops.

When do I apply manure?

Apply manure at the time of maximum crop uptake. In general, the best time to apply is in the spring. This helps ensure that nutrients aren't lost and decreases the risk of leaching and runoff on the environment. If you apply manure in the fall, apply it early and plant a cover crop like rye or oats to help capture nutrients and prevent runoff. Apply manure uniformly with calibrated equipment.

Manure shouldn't be applied to land during extended periods of bad weather. In fact, some states have rules discouraging the application of wastes when the ground is frozen or saturated. Avoid applying manure on steep slopes during rainy seasons.

Composted vs. Uncomposted Manure

Composted manure has fewer odors, is easier to spread, has less potential to harm water, and releases nutrients more slowly than uncomposted manure. Uncomposted manure usually has a higher nutrient content and is less expensive but is sometimes difficult to spread and has a higher potential to harm water quality.

Soil Characteristics

Determine the soil type in your area using the USDA Natural Resources Conservation Service website at <http://soils.usda.gov/survey/>. Apply less manure on loamy and sandy soils that are close to groundwater, because they tend to allow liquids to flow easily through them. If you need to apply manure to sandy soil, apply it as close to planting time as possible to minimize nitrate leaching, and consider split applications.

Finally, it is a good idea to record manure and chemical fertilizer applications and crop yields, as well as soil, well water and manure test results for each field and keep this information in a permanent file, to help with future planning and in case of a complaint.

Preventing Animals and their Waste from Reaching Groundwater

Methods to prevent animal waste from coming into contact with runoff and water sources include storage, clean water diversion and composting. When choosing the best option for your farm, the soil characteristics should be considered. The potential for livestock and poultry operations to affect groundwater is greatest if the facility site has sandy soil, shallow-rooted crops, high rainfall rates or excessive irrigation, shallow water tables and/or is located near a wellhead. More information on soil characteristics and water quality can be found in the [wellcare® information sheet, *Protecting Groundwater through Agricultural Best Management Practices*](#).

Storage

Manure storage is a good option when conditions are not favorable for applying manure to crops. Proper storage and treatment of manure from animal operations can help prevent animal waste from reaching water sources. Groundwater contamination can occur if the manure storage facility is not structurally sound, allowing waste materials to seep through the soil. Follow these tips for storing manure on your farm:

- Cover solid or semi-solid manure and store it on a concrete floor. Install a perimeter wall to contain drainage and rainfall. As a less costly alternative, the floor can be compacted impermeable soil.
- The storage facility should be located downslope from wells, not situated in a flood plain, and should comply with state and local requirements for minimum separation distances from nearby wells. In general, the distance between manure storage areas and wells should be at least 100 feet.
- A waste storage lagoon is another storage option. With lagoons, proper care should be used to ensure that the liner prevents seepage of the waste into groundwater.

Clean Water Diversion

Clean water diversion methods keep precipitation runoff clean by directing precipitation away from manure. Clean water diversion methods include:

- Rain gutters and downspouts on animal shelter roofs;
- Earthen ridges or diversion terraces built above the feedlot or barnyard that direct surface flow away from waste; and/or
- Installation of a catch basin with a pipe outlet above the yard.

Composting

Composting, which can eliminate pathogens and reduce the volume of manure, is perhaps the most common and least costly method of handling livestock waste. To avoid leaching, compost sites should be located away from drinking water wells and water sources and on fairly flat sites where water does not collect or runoff.

Pasture Management

Follow these guidelines to manage your pasture and minimize the risk of groundwater contamination:

- Space should be adequate to allow animals to move easily, without being so large as to generate more runoff.
- Abandoned livestock yards and poultry houses pose groundwater contamination risks. If you have such a lot or structure, collect all manure or litter and spread it on crop fields to create a manure/soil barrier over the compacted soil. Water moves slowly through these barriers, making rapid leaching of nitrate and bacteria unlikely.
- Feedlots should be cleaned or scraped regularly, preferably at least once per week.

Animal waste can be an asset or a liability. By following the guidelines in this information sheet, and any state or local regulations concerning manure application, you can minimize any negative effects of manure on the environment while maximizing crop nutrient intake on your farm.

For More Information on Protecting Groundwater by Managing Animal Waste

Contact your licensed well contractor, local extension office, health department, state environmental agency, or the [wellcare®](#) Hotline.



Information to help maintain and protect your water well system:

[wellcare®](#) is a program of the [Water Systems Council \(WSC\)](#). WSC is the only national organization solely focused on protecting the health and water supply of an estimated 23 million households nationwide who depend on private wells (according to the U.S. EPA).

This publication is one of more than 100 [wellcare®](#) information sheets available FREE at www.watersystemscouncil.org.

Well owners and others with questions about wells and well water can contact the [wellcare®](#) Hotline at 1-888-395-1033 or visit www.wellcarehotline.org to fill out a contact form or chat with us live!

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