

Storing and Handling Poultry Litter

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Introduction

In recent years, large concentrations of poultry on small parcels of land have made the manure disposal problem more critical. When nutrients from manure or commercial fertilizers exceed the ability of crops to utilize them, surface runoff and groundwater pollution problems develop. This fact sheet outlines management steps to take advantage of the fertilizer value of poultry litter while minimizing potential damage to Virginia's water resources.

Is Litter Storage Necessary?

Direct movement of litter from house to field will minimize handling costs and – if synchronized with a cropping plan – will usually allow more efficient utilization of manure nutrients. Many growers, however, either don't have enough land to spread all litter properly or aren't able to coordinate poultry house cleanout with times that litter can be directly spread. In such cases, the grower might contract with neighbors or other potential users who can use the litter when houses are cleaned.

Frequently, cleaning of houses does not coincide with available open cropland or with proper field conditions that permit operation of equipment or desirable nutrient uptake. Storage must then be provided until conditions are suitable for application on land, or until litter can be picked up for use by others as fertilizer or animal feed, or can be composted.

Types of Litter Storage

Storages are classified into three main types: (1) temporary, or "stockpiling"; (2) open storage; and (3) permanently roofed storages. Each type provides flexibility for the grower, either for utilizing litter for fertilizer or for holding litter until such time as it can be sold or donated to someone else.

The storage method must protect litter from contact with water from rainfall or snow. Nitrogen is the nutrient that will be lost easily from stored litter. The nitrogen lost may be leached or washed into surface drains or streams or into groundwater, or it can be volatilized into the air as ammonia, creating other ammonia-related environmental concerns such as (1) undesirable nitrogen deposition in nutrient-sensitive ecosystems, (2) formation of light-scattering aerosols resulting in haze and visibility impairment, and (3) formation of respirable aerosol particles, which are a health concern. (For more details on ammonia emissions, see *Ammonia emissions and animal agriculture*, VCE publication 442-110; <http://pubs.ext.vt.edu/442/442-110/442-110.html>.)

So, improper storage not only results in an economic loss due to reduced fertilizer value, but it has great potential for water quality reduction when dissolved nutrients or litter solids are carried to surface or groundwater. Cover for storage requires a surface on the manure stockpile that sheds water; it is usually provided by plastic or other membrane covering, or by a roofed structure.

Storage sites should be located on high ground that has good surface drainage, is not subject to ponding or flooding, and is located at least 100 feet from flowing streams or drainage ways. Avoid normally wet areas and other areas with slopes toward running or standing water. Where a concrete base is not used, stockpile on an impermeable base such as well-compacted clay to minimize leaching into the soil and groundwater table. A minimum of 4 feet (vertical) is recommended between the base of the pile and the seasonal high groundwater table. Storages should be located at least 100 feet away and preferably down slope from wells or other sources of drinking water.

When properly designed, located, and managed, storages should not have runoff or leachate. If runoff or drainage from the storage is expected, it should be

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routed (1) to a runoff retention pond and used for irrigation, (2) into an infiltration terrace at least 100 feet long, or (3) into an overland flow-filter area that is at least 50 feet long and seeded with fescue, orchard grass, or other suitable varieties recommended by local Extension or Natural Resources Conservation Services personnel. The effectiveness of infiltration areas depends on good plant/grass cover and root systems and, therefore, must be maintained by clipping and weed control.

To control diseases and to avoid the threat of spreading fire should spontaneous combustion occur within the storage pile, locate storages at least 150 feet away from dwellings or production houses. Practice recommended fly and rodent control around the production houses and in the vicinity of the storage area. Bird carcasses should not be added to litter storage piles; use only accepted dead bird disposal practices.

Short-Term Storage: Covered Stockpiles

If the litter is to be temporarily stockpiled, it should be covered with plastic sheeting (6 mil minimum thickness) held in place with weights, such as old tires or cinder blocks, with the edges of the sheeting buried, or by other anchoring systems (figure 1). If this practice will be used often, a reinforced, ultraviolet-resistant cover will last longer and may be a good investment.



Figure 1. Short-term storage: covered stockpiles

Covers should be selected carefully. Locations near windbreaks will help protect the covering, whether plastic or reinforced cover. Compacting of litter is not necessary, but more manure can be stored in a small area with less plastic sheeting if compaction is provided. Sheeting must be applied with care to prevent tearing. Anchor sheeting by laying the edges across a small trench approximately 12 inches deep and backfilling with soil. Lay used tires over the sheeting – similar to methods used on bunker silos – to prevent loosening and damage in the wind. It is preferable to leave the pile

sealed until all litter can be spread or otherwise utilized, thereby reducing nitrogen loss.

Long-term Storage: Stockpiles with Ground Liners

Litter must not be stored on high water table soils or on shallow soils over rock outcropping without a ground liner to prevent nitrogen leaching and bacterial contamination of the groundwater. The most satisfactory ground liners are made of concrete. Plastic ground liners are generally not recommended for the following reasons: (1) debris, rocks, and other sharp objects must be removed before the sheeting is placed to prevent puncture and subsequent leaching of nitrogen; (2) loose soil must be compacted before sheeting is placed and litter is piled to prevent tearing or puncture; and (3) when the stockpile is spread, plastic may be shredded, tangled in machinery, or otherwise become a general trash or nuisance problem.

Concrete ground liners are recommended for permanent manure storage structures. A permanent liner greatly reduces the likelihood of leaching to groundwater and makes operation of equipment within the pile much easier. Construct a concrete ground liner that is 6 inches thick, reinforced with wire mesh, and placed on a well-compacted grade over 6 inches of compacted gravel. Low, reinforced concrete walls around the perimeter will help contain litter on the concrete. Prevent cracking failure by thickening the perimeter of the concrete to form a footer where traffic enters and exits.

The site should be graded to provide good under-drainage and to prevent frost heaving during cold weather. An improved gravel roadway will allow the stockpile to be used during bad weather. Construction of the actual stockpile should be done as described for the open and covered short-term stockpiles. Cover the stockpile with plastic (6 mil minimum) or a bunker silo cover anchored with wood poles, concrete blocks, or other anchoring systems. Sharp anchors such as concrete blocks may damage the cover and should be used with care.

Bunker-Type Storage Structures

Bunker structures, such as those used for storing silage on livestock farms, offer a good alternative for longer-term storage of poultry litter (figure 2). A bunker allows deeper piling and compaction of litter to reduce total area required for the storage. Concrete bunkers are

recommended to eliminate concerns about spontaneous combustion within the pile. An end wall can be constructed to slightly increase storage capacity. However, loading the storage is often easier without an end wall. As with the stockpiles previously described, plastic sheeting or reinforced fabric silo covers should be used to cover the manure. With careful use, silo covers should last many years.

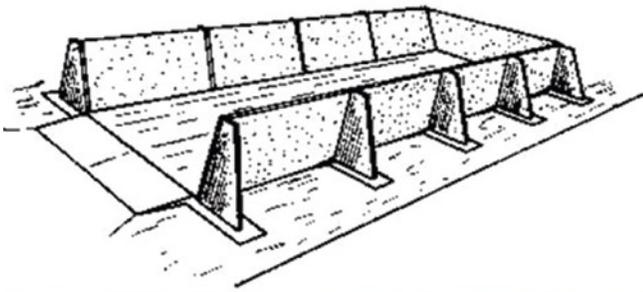


Figure 2. Bunker-type storage structure

Permanently Roofed Storage Structure

Covers may be constructed over bunkers, concrete slabs, or even over a well-compacted soil base to eliminate the need for plastic or silo covers. A roofed structure (figure 3) allows for continuous loading or unloading with a minimum of effort when compared to other dry-storage methods. These structures generally are more expensive than the other storage methods, and special attention must be given to planning and construction details to account for the special needs of handling litter, and they must also meet wind and snow load standards for other farm structures. The roof structure must be clear-span supported by outside walls or perimeter posts; interior posts will obstruct loading and unloading of litter, and they might be ignited if spontaneous combustion occurs. A roof height of 12 feet or higher is recommended to allow for loading and compaction of litter using front-end loaders, truck dump beds, and other equipment; the exact height must be determined after considering the equipment and management that

will be used. High roofs will require wall panels and/or a long overhang to protect the stored litter from excessive blowing rain and snow.



Figure 3. Permanently roofed storage structure

How Management and Storage of Litter Affect its Value

Proper management of litter in the house will reduce the need to move litter between flocks and will aid in developing a cleanout schedule that allows direct application of manure to cropland without intermediate storage. Greater efficiency is obtained if manure can be directly applied at the proper time, because handling costs are less and nitrogen will be more efficiently utilized. The primary key to good in-house management of litter is to keep the litter dry. Wet litter creates conditions where more nitrogen is released from the litter in the form of ammonia. Proper heating and ventilation of the poultry house and selection and operation of bird watering systems to minimize spillage on the litter will provide high-quality litter. Reducing water spillage will: (1) save water, (2) improve bird quality, (3) improve production environment, (4) reduce ammonia released from litter, (5) reduce volume of wet manure cake, and (5) extend time between litter cleanouts.

The method used to store the litter prior to land application can significantly reduce the nitrogen content of the litter, as shown in table 1. The moisture content of the litter can change substantially depending on the storage method used. If litter is stored in an uncovered pile, extra moisture will be added from rain. As a result, the litter weighs more, attracts more flies, has a stronger odor, and loses almost a third (30 percent) of its total nitrogen. Uncovered piles are not recommended for long-term storage of poultry litter. If poultry litter is to be stockpiled before land application for more than one or two days, it should be covered with a tarp. Not only will this practice conserve valuable nitrogen, reducing the storage losses to 17 percent, but it will also reduce odor, flies, and the potential for the generation of pol-

luted runoff. Some composting often occurs while the litter is in storage as indicated by heating of the litter. The composting activity results in a loss of moisture and approximately 26 percent reduction in total nitrogen. Flies and odor are less of a problem for litter stored in roofed sheds as compared to an uncovered pile. The amount of nitrate-N can be significant in poultry litter that has gone through several heating cycles in a roofed shed. Manure stored in roofed sheds should be tested for nitrate-N in addition to ammonium-N, and organic-N.

The storage method does not generally affect the amount of phosphorous or potassium on a dry matter basis. However, the concentrations of phosphorus (P₂O₅) and potash (K₂O), on an as-sampled basis (pounds per wet ton), will vary greatly with the moisture content of the litter.

Additional Resources

Ritz, C. W., P. F. Vendrell, and A. Tasistro. 2009. *Poultry litter sampling*. Bulletin 1270. University of Georgia Cooperative Extension; <http://pubs.caes.uga.edu/caes-pubs/pubs/PDF/B1270.pdf>.

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Chastain, J. P., J. J. Camberato, and J. E. Albrecht. 2001. *Nutrient content of livestock and poultry manure*. Clemson University; www.clemson.edu/cafls/departments/agbioeng/faculty_staff/research/chastain_nutrient_content_manure.pdf.

Table 1. Nitrogen losses from litter storage methods (calculated on a dry matter basis, pounds per dry ton) and typical moisture contents

Type of storage	Typical moisture content	Ammonia-N lost	Total-N lost
	-----%-----		
Uncovered pile	39-47	21	30
Covered pile	16-19	13	17
Roofed storage	7-15	11	26