

# Storage of Broiler Litter<sup>1</sup>

R. A. Bucklin, J. P. Jacob, R. A. Nordstedt, D. R. Sloan, R. S. Tervola, and F. B. Mather<sup>2</sup>

With the introduction of new environmental regulations, poultry producers are being challenged to develop environmentally friendly means of utilizing broiler litter. Broiler litter has value as a fertilizer source and as a stock material for compost production.

Broiler flock schedules determine when litter is cleaned from the houses. This does not always coincide with the best time to apply the litter as fertilizer on cropland. Litter must be stored under proper conditions in order to receive the best return. Storage techniques can determine whether you have a low or a high quality fertilizer. Litter must be stored in a manner that keeps it dry to maintain quality and also in a way that eliminates the possibility of nutrients leaching to the groundwater. Stockpiling litter uncovered on the soil can result in a fivefold reduction in the nitrogen content of the manure. The nitrogen lost from the manure can be carried by water to surface streams or ditches and into the groundwater.

## Storage Location

Flies, odors, water quality, and the perceptions of neighbors are factors that must be considered when designing and constructing any litter storage structure. The first critical consideration in the design of any structure is location. This is particularly important with litter storage structures. Litter should be stored in locations not easily seen by neighbors or traffic. Avoid sites that have prominent elevation or front on well-traveled roads unless they are shielded from view

by visual barriers. Avoid sites that have the potential to cause odor problems for neighbors. Litter storage systems must be located away from streams and bodies of water. Consideration must be given to groundwater levels. Storage structures should be located on elevated, well-drained sites so that flooding will not be a problem.

## Structures for Storage

Litter from broiler production is handled dry. The large volume of litter produced when a house is cleaned out requires the use of proper procedures or the quality of the litter can be adversely affected. A concrete pad should be provided at the end of each house for temporary storage. For longer term storage, an open-sided roofed structure is strongly recommended.

Broiler litter contains both wet and dry organic materials that produce heat when stored in confined piles. Storage structures with confining walls may be subject to the heat produced by spontaneous combustion within the manure. Limit manure contact with wood or use concrete wall construction.

## Open Concrete Slabs

Concrete is the most widely used construction material for the floors of litter storage structures. Concrete offers the advantages of ready availability, ease of construction and relatively low cost. Open concrete slabs should have a

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2. R. A. Bucklin, professor, Agricultural and Biological Engineering; J. P. Jacob, poultry Extension coordinator, Dairy/Poultry Sciences; R. A. Nordstedt, professor emeritus, Agricultural and Biological Engineering; D. R. Sloan, associate professor, Dairy/Poultry Sciences; R. S. Tervola, retired Extension director, UF/IFAS Extension Suwannee County; and F. B. Mather, associate professor emeritus, Animal Sciences, UF/IFAS Extension, Gainesville, FL 32611.

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slight slope of 1% toward the center. If spillage of litter is a potential problem at the edges of an open slab, provide a 6- to 8-inch curb. Slabs should be 6 inches thick. Slabs should be poured using air entrained concrete. Air entrainment improves the weathering ability and acid resistance of concrete by several hundred percent and also improves workability.

Concrete always shrinks as it cures. Because of this shrinkage, cracks will form at about 25-foot intervals in unreinforced concrete. The location of cracks can be controlled through the use of expansion or control joints that force the concrete to crack along the straight joints. Cracks can be eliminated by adding reinforcing steel equal to 0.65% of the cross-sectional area, but this is seldom economically practical. Instead of attempting to totally eliminate cracks, welded wire fabric reinforcing material can be used to keep cracks from expanding so that they can be sealed.

Concrete slabs should be reinforced with welded wire fabric placed 2-inches below the top surface. Table 1 gives the size of welded wire fabric needed for several common slab widths. If loaded trucks or heavy equipment will drive on the slab, the slab should be reinforced with steel rebar. All slabs should be poured over well-packed earth. If a portion of a slab settles, no amount of reinforcing will prevent cracking.

## Covered Slabs

Litter can be stored temporarily at the ends of houses on open concrete slabs. However, if the litter is to be stored for any significant time, it should be covered with a permanent structure. A structure for storage of litter compost should consist of a roof over a concrete slab as shown in Figure 1.

The slab should be the same whether it is open or covered, except that a covered slab should have 4-foot side walls to prevent spillage of litter. The structure should have an eave height of at least 10-feet. The bottom of the eaves should be at least 2-feet higher than the top of the litter pile. The roof must be clear span so that interior columns do not interfere with handling of litter. The roof should be constructed with at least a 6-inch-wide ridge vent to allow moisture and corrosive gases to escape.

Wood can be used in the construction of the columns and roof, but the wood should be pressure treated if it is in contact with the ground or if it will be damp. It should be noted, however, that a considerable amount of heat can be generated by the stored litter. Wood posts in contact with

a litter pile, therefore, are in danger of charring or even igniting.

Steel also can be used for the main structural elements of building frames, but the greatest use of steel is in the form of galvanized roofing material. The corrosive gases ammonia and hydrogen sulfide are present at high levels around litter handling and storage operations. Steel structural elements and fasteners must be galvanized to prevent corrosion problems.

Aluminum should not be used for structural or roofing material for litter storage. Ammonia is corrosive to aluminum and will quickly cause aluminum building materials to deteriorate.

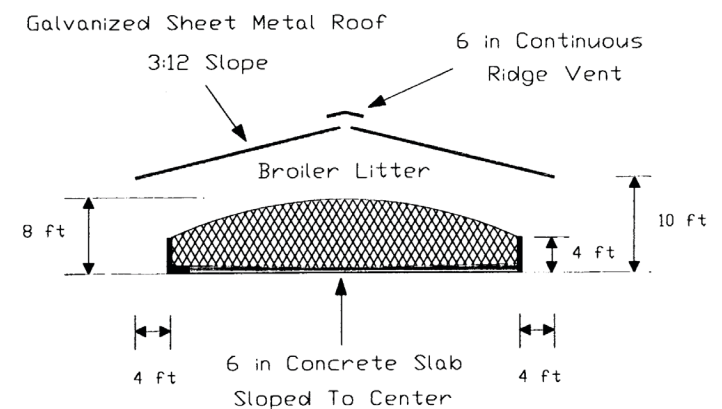


Figure 1. Covered slab.

## Management General

A storage structure is one part of an overall litter management system. Litter is a cost of production that requires a sound management system which will give a producer accountability and flexibility. To provide accountability, a producer should have a written litter management plan. Litter is a variable material and the producer must know the nutrient content of the stored litter. The producer must keep accurate records of litter production and litter application. Custom clean-out firms must follow the same guidelines as producers.

## As a Fertilizer

Litter stockpiled on an open concrete slab can be protected by covering it with plastic sheeting, which is anchored with earth and used auto tires. The pile should be dome-shaped to allow rainwater to run off. The litter pile does not need to be compacted, but compacting will allow more litter to be stored in a small area and reduce the amount of plastic sheeting necessary. Take care while applying the plastic to prevent tearing. Make sure the plastic is flat on the pile to

prevent water pockets. Improperly anchored plastic will become loosened in the wind and tear or blow off the pile. Heavy gauge (6-mil) plastic can last one or two seasons. Lighter gauge material is not recommended.

## Deep Staking Processing

The storage of broiler litter has two functions: 1) to serve as a holding facility from the time the house is cleaned until feeding and 2) to eliminate disease-causing bacteria and prevent the growth of molds.

The easiest and most cost effective way of processing broiler litter is deep stacking for 4- to 6-weeks. During deep stacking, the litter undergoes a combined composting-ensiling process. The action of bacteria generally heats the stack to a temperature of between 140°F and 160°F. This is sufficient heat to kill any pathogens, such as *E. coli* and *Salmonella*, that may be present in the raw litter. The final product is drier, but nitrogen and other nutrients are retained in the litter.

Deep stack processing of litter helps curtail mold growth. Molds that produce mycotoxins do not grow well in litter because it is alkaline, it releases ammonia that is toxic to molds, and because the growth of molds is limited to surfaces exposed to air.

For proper heating, litter should contain 20% to 30% moisture and should be stacked 6 to 8 feet deep. Broiler litter that is dry may need to have water added prior to storage or it may not heat. Litter with moisture levels of 20% to 25% usually result in a good heat.

Litter is stacked 6- to 8-feet-high (at the peak of the stack) to ensure a critical mass that promotes acceptable heating. To minimize the possibility of spontaneous combustion, caution should be taken not to stack litter higher than 8-feet.

The stack should be packed with a heavy-wheeled vehicle as the material is layered. If the building does not lend itself to compacting the stored litter, the heating process sometimes will not proceed in a uniform manner and may result in overheating. If packing is not possible, cover the litter with plastic to limit oxygen availability and prevent overheating. Storing broiler litter in an upright silo has been shown to be an excellent storage procedure, but litter is abrasive to silage handling equipment.

The deep stacked litter stabilizes following the initial heating, and the material is not turned and allowed to reheat as is done with composted litter. Thoroughly composting the

litter would reduce the carbohydrate and nitrogen availability in the material.

**It is important to avoid overheating the litter during storage.** Overheating (more than 160°F) may occur occasionally and reduces the feeding value by damaging both protein and carbohydrates. This problem can be controlled by packing the stack, covering the stack with plastic, or both.

Broiler litter should be deep stacked and stored for a minimum of 3-weeks before use: but 4- to 6-weeks is recommended. Once the litter has undergone the heating process, it will retain its value for an extended period of time, often for as long as 5 years.

How can you tell the quality of the deep stacked product? The process should result in a product that has a fine texture and an odor that resembles that of caramelized chocolate. It is important that it be free of an ammonia smell. It should not be black with a burnt smell. This is an indication of overheating. Gray-colored material with a strong manure smell indicates underheating. Monitoring the stockpile temperature in several locations with a probe thermometer will help determine if the stockpile has been heated properly.

## Summary

Litter stockpiled for later use as a fertilizer should be stored covered to keep it dry. Rain can wash away valuable nutrients, thus reducing the value of the litter and possibly contaminating surface or groundwater.

Deep stacking is the most common method of processing broiler litter. During deep stacking, the stack of litter will produce heat which eliminates potential pathogens and improves the palatability of the litter. For proper heating, litter should contain 20% to 30% moisture and should be stacked 6- to 8-feet-deep for at least 4- to 6-weeks.

Table 1. Welded wire reinforcement for 6-inch thick concrete slabs.

Slab width (feet)	Size of welded wire reinforcement spacing (diameter)
10	6" x 6" (W1.4 x W1.4)
20	6" x 6" (W1.4 x W1.4)
30	6" x 6" (W2.1 x W2.1)
40	6" x 6" (W2.9 x W2.9)