

Broiler Litter Storage

ANR-839

Broiler litter production in Alabama has been estimated at nearly 2 million tons annually. Major uses of broiler litter include:

- Fertilizer and soil conditioner for crop and pastureland.
- Feed supplement for beef cattle.
- Soil amendment or potting medium for nursery, ornamental horticulture, and lawn and garden markets.

When handled properly, poultry manure is the most valuable of all manures produced by livestock. If broiler litter is properly stored or applied to an actively growing crop, then nutrients are used efficiently and contamination of surface water and groundwater is minimal. On the other hand, if broiler litter is not managed properly after removal from the broiler house, then valuable nutrients can be lost and surface water and groundwater can be contaminated.

Estimating Broiler Litter Production

Broiler litter is a combination of bedding material, such as wood shavings or peanut hulls, and manure. Estimating the amount of litter produced by broilers is difficult. Type of bird, market weight, number of flocks, field conditions, time of year, and litter moisture are all variables that must be considered. However, some Alabama poultry industry managers have long used a rule of thumb that for each pound of meat produced there will be approximately 0.5 to 0.7 pounds of litter produced.

To determine if this rule of thumb is accurate, a field test was conducted on the Charles Conner farm in Marshall County, Alabama. A detailed, accurate record of pounds of manure produced and pounds of meat produced was maintained for 1 year.

Pounds Of Broiler Litter Produced. Mr. Conner has 40 by 500 foot chicken houses. Pine shavings were used as the bedding material. The shavings were placed at an approximate depth of 2½ inches at the beginning of the first growout period. Between batches, additional shavings were placed in the house in the brood area.

Manure weight was obtained from a single test house after total cleanout to the ground. The amount of litter removed by a housecleaning machine between batches was accounted for. After the eight batches of chickens were grown, a total cleanout to the ground was performed and manure was weighed. A total of 502,600 pounds of litter was removed from the house after the field test. The manure had a moisture content of 19.2 percent. On a dry weight basis, the manure contained 4.16 percent N, 4.24 percent P₂O₅, and 2.93 percent K₂O.

Pounds Of Meat Produced. Mr. Conner markets birds at an average weight of 4.4 pounds. In just slightly over 1 year, he grows eight batches of birds. During eight consecutive growouts, a total of 221,160 birds were produced which yielded 973,104 pounds of meat produced.

Pounds Of Litter Produced Per Pound Of Meat. Under typical Alabama conditions as represented on the Conner farm, the average amount of litter produced per pound of live weight was approximately 0.52 pound.

$$\begin{aligned} \text{Lb. of litter per lb. of meat produced} &= \frac{\text{lb. litter}}{\text{lb. meat}} \\ &= \frac{502,600}{973,104} \\ &= 0.516 \text{ lb.} \end{aligned}$$

Estimating Storage Requirements

The rule of thumb for estimating broiler litter production is useful for determining storage requirements and sizing storage structures. Also useful for determining storage requirements and sizing storage structures is the pounds per cubic foot of broiler litter.

During the manure production study on the Conner farm, litter was weighed at different locations in the broiler house in containers of known volume. Results indicated that broiler litter weighs 31 pounds per cubic foot based on the conditions at Mr. Conner's farm. Field work at other locations in Alabama confirmed this figure.

Estimating Storage Requirements: An Example

Here's how a typical grower may determine the size of a broiler litter storage structure based on the amount of litter produced annually on his farm. Suppose Farmer Brown has two 28,000 capacity houses. He raises 8 batches of 4-pound market weight birds per year.

$$\begin{aligned}
 \text{Lb. meat produced/yr.} &= \# \text{ birds} \times \# \text{ batches} \times \text{lb. mkt. wt. per bird} \\
 &= (2 \times 28,000) \times 8 \times 4 \\
 &= 1,792,000 \text{ lb.} \\
 \text{Lb. manure produced/yr.} &= \text{lb. meat produced/yr.} \times 0.5 \text{ to } 0.7 \\
 &= 1,792,000 \times 0.5 \text{ to } 0.7 \\
 &= 896,000 \text{ to } 1,254,400 \text{ lb.} \\
 \text{Cu. ft. required for storage of all litter produced} &= \frac{\text{lb. manure produced/yr.}}{\text{lb./cu. ft.}} \\
 &= \frac{896,000 \text{ to } 1,254,400}{31} \\
 &= 28,903 \text{ to } 40,464 \text{ cu. ft.}
 \end{aligned}$$

Farmer Brown needs a litter storage facility that could hold between 28,903 and 40,464 cubic feet of litter if he wants to store all litter produced. If Farmer Brown uses litter for other purposes at the time of cleanout or his cleanout is staggered for some reason, then he can reduce the size of the storage facility.

Frequently, broiler growers, who are storing litter for later use as fertilizer or feed, size their storage structure to hold about 50 percent of their total manure production with the other 50 percent being spread on the land at the time of cleanout. Based on this example, Mr. Brown's storage needs for 50 percent of this manure would be between 14,452 cubic feet and 20,232 cubic feet ($0.5 \times 28,903$ to $40,464$). For a 40 foot wide storage structure where manure is piled an average of 6 feet throughout, the size of the structure would be:

$$\begin{aligned}
 \text{Length} \times \text{width} \times \text{height} &= \text{Volume in cu. ft. of manure to be stored} \\
 \text{Length} \times 40 \text{ ft.} \times 6 \text{ ft.} &= 20,232 \\
 \text{Length} &= \frac{20,232}{40 \times 6} \\
 \text{Length} &= 84.3 \text{ ft.}
 \end{aligned}$$

Mr. Brown needs a 40 foot by 80 foot structure to handle 50 percent of his storage requirements.

Managing The Broiler House To Reduce The Need For Litter Storage

Proper broiler house management can reduce the need for litter storage. By scheduling cleanouts and minimizing water spills, producers can reduce the need for litter storage.

Cleanouts can be scheduled so that broiler litter can be applied directly to cropland without being stored. Direct field application reduces handling costs, allows nitrogen to be used efficiently, and avoids potential environmental problems caused by leaching and runoff. See Extension Circular ANR-580, "Poultry Waste Management And Environmental Protection Manual."

Watering systems that minimize spills or leaks on the floor can be selected. Broiler litter that becomes

saturated with water spilled around bird watering systems is called "cake" and must be removed from the broiler house during and between flocks.

Trough-type watering systems produce 20 to 30 cubic feet of cake per 1,000 birds. Bell-type waters produce 15 to 23 cubic feet of cake per 1,000 birds. Closed watering systems produce less than 1 cubic foot of cake per 1,000 birds. Nipple waterers can reduce leaks and spills and, consequently, reduce the need to remove cake.

Reducing water spills will:

- Save water.
- Improve bird quality.
- Improve production environment.
- Reduce ammonia release from litter.
- Reduce volume of cake.
- Extend time between litter cleanout.

Storing Broiler Litter

Broiler litter can be stored in a variety of ways. No matter how it is stored, however, it must be protected from prolonged contact with rainwater to retain nutrients and to prevent leaching or runoff. This requires a surface that sheds water. A stockpile of broiler litter left uncovered during the winter can lose up to 80 percent of its available nitrogen. Nitrogen lost from broiler litter can be carried by runoff water to surface streams or into groundwater sources. A protective surface can be provided by constructing a stockpile of compacted litter, by covering the pile with plastic sheeting, or by providing a permanent roofed structure.

There are several alternatives for constructing litter storage structures. These include:

- Open stockpile.
- Covered stockpile.
- Stockpile with temporary ground liner.
- Stockpile with permanent ground liner.
- Roofed storage structure.

Open Stockpile. An open stockpile is the least acceptable method of storing poultry litter. It should only be used for temporary storage. If litter must be stored without being covered, use extreme caution to avoid runoff contamination and possible surface water and groundwater pollution.

Proper location of an uncovered stockpile is important. Choose a high, well-drained area away from drainage ditches.

Construct the pile by dumping litter to form a narrow pile. Drive over this litter with a tractor, truck, or other heavy wheeled vehicle to compact it. Drive over and dump additional litter on top of the compacted pile and compact again. Widen the pile on each side as it is made deeper. Continue this procedure until the stockpile has a deep, well-rounded top surface with sloping sides of compacted litter. Because slightly wet litter will compact better than dry litter, apply the wetter material to the pile last to form a compacted surface crust.

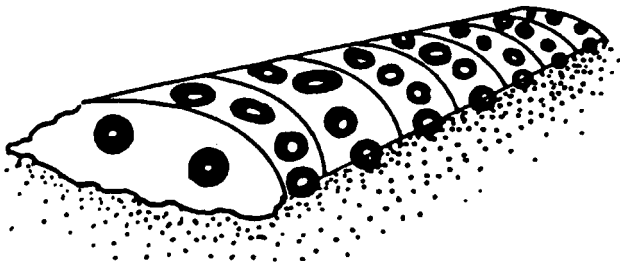


Figure 1. Covered stockpile.

Covered Stockpile. Select a high, well-drained site located away from drainage ditches and near a natural windbreak. Compacting the litter is not necessary; however, compacting will allow more litter to be stored in a small area and reduce the amount of plastic sheeting necessary. Cover the stockpile with heavy gauge (6-mil) plastic sheeting. Heavy gauge plastic sheeting can last one or two seasons; lighter gauge material is not recommended. Take care while applying the plastic to prevent tearing. Anchor the edges by laying the sheeting edge across a small trench approximately 12 inches deep; then backfill the trench with soil. Anchor the sheeting with earth and used tires. Used tires will keep the plastic anchored on top of the pile (Figure 1).

Stockpile With Temporary Ground Liner.

Where stockpiles must be located on high water table soils, use a ground liner to prevent nitrogen leaching into groundwater. The liner is a sheet of 6-mil plastic laid on the soil surface.

Prepare the soil surface by removing any debris that might puncture the plastic. If the soil is loose, compact it with a wheeled vehicle before laying out the plastic. Apply a 12-inch layer of litter over the majority of the plastic before forming the pile to minimize the possibility of tearing by equipment tires. Then form a compact pile. Fold the edges of the liner 1 to 2 feet up the sides of the pile, and anchor the liner in the litter. Apply the surface cover as described for a covered stockpile.

The ground liner will be torn during unloading of the pile, and new plastic will be required each year. Plastic liner debris may cause difficulties with spreading equipment.

Stockpile With Permanent Ground Liner. A permanent location for litter storage can be constructed on a concrete slab where a covered stockpile can be placed. Concrete solves the problems associated with using a plastic liner. Pour the concrete 6 inches thick on 6 inches of compact gravel and reinforce it with wire mesh. To prevent concrete failure, thicken the perimeter of the concrete to form a footer where traffic enters and exits. Grade the site to achieve maximum under drainage. Consider installing a gravel roadway to allow stockpile construction during wet weather. Construct the stockpile as described for the open stockpile. Anchor the cover sheet edges with wooden poles, concrete blocks, or other heavy objects on the concrete slab.

Roofed Storage Structure. Concrete slabs, bunkers, or other structures can be constructed with permanent roofs to eliminate the need for plastic covers (Figure 2). The roof structure must be a clear span supported by outside walls or perimeter posts. Interior posts will obstruct loading and unloading of

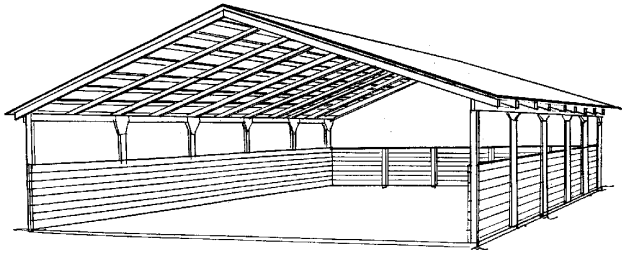


Figure 2. Roofed storage structure.

the structure. Wood posts within a litter pile might be ignited if spontaneous combustion conditions exist. Roof structures must be tall enough to allow litter to be piled and compacted. Roofs 12 feet or higher may require wall panels to protect the stored litter from excessive blowing rain.

Managing Broiler Litter For Use As A Cattle Feed

Used as a feed ingredient for cattle, broiler litter is worth approximately three times more than when it is land applied as a fertilizer. Of the 2 million tons of broiler litter produced annually in Alabama, about 35 percent is acceptable by the cattle-feeding industry.

Litter quality varies considerably among producers. Both the amount of bedding used and the number of flocks reared on the litter can affect litter quality. However, the type of litter material used in the growout house, whether pine shavings, sawdust, peanut hulls, or other material, has little effect on the quality of litter fed to ruminants.

The ash content of broiler litter is useful as a measure of the quality of litter and is made up of minerals from the feed, broiler manure, bedding material, and underlying soil. The average ash content of broiler litter in Alabama is 25 percent with a range from 10 to 50 percent. Broiler litter with an ash content greater than 28 percent is unacceptable as a feed ingredient for beef cattle.

Good management practices can improve the quality of broiler litter to be used as a feed ingredient. Practices to improve litter quality include:

- Excluding foreign material.
- Minimizing soil in the litter.
- Deep stacking litter to allow controlled heating that will eliminate pathogenic organisms.

Litter should not be contaminated with wire, glass, tools, or plastics that cattle may ingest. Material used for cattle feed should include only waste feed, manure, and bedding.

Any harvesting technique that minimizes the amount of soil incorporated into the litter during the cleanout operation will greatly improve litter quality.

A front-end loader can be used to harvest quality litter if the bottom of the loader bucket is kept above the dirt floor. If a rototiller or a housekeeping machine is used for conditioning or aerating litter between placement of flocks, gauge wheels should be properly adjusted to prevent the tines from contacting the dirt floor and incorporating it into the litter.

Since broiler litter poses a potential problem in association with certain pathogenic microorganisms, such as *Salmonella*, it should be deep stacked to eliminate pathogenic microorganisms. Following proper harvesting and deep stacking, broiler litter rations should be made according to methods outlined in Extension Circular ANR-557, "Feeding Broiler Litter To Beef Cattle."

Summary

Effective broiler litter storage prevents leaching and runoff, retains nutrients in the manure, and maintains environmental quality. County Extension agents can help with plans for effective broiler litter storage structures.

Cost sharing for construction of broiler litter storage facilities is available through both state and federal programs. However, structures must meet specific requirements to qualify for cost share money. Natural Resources Conservation Service offices have information on cost share program requirements.



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