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Cooperative Extension Service

Backyard Chickens as Garden Fertilizer Generators

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Having backyard chickens can be a fun, educational, and rewarding experience. There are many reasons why people keep backyard chickens, including the availability of fresh, colored eggs; food security; and enjoyment of the birds as pets. However, for some, the goal is to obtain the rich manure that chickens produce for use as garden fertilizer. There is no better farmyard manure for the garden, as far as the nitrogen content, than poultry manure.

The amount of manure the birds generate is a function of multiple factors, including number, weight, breed, and growth stage of the birds. Nutrient management software packages can estimate the volume of manure produced and its nutrient value. However, the calculated volume of manure produced is not nearly as important as the volume that can be collected, especially when backyard birds spend time ranging freely outside of confinement areas. Backyard chicken keepers who value manure should build housing that includes a manure handling system to maximize manure collection.

The ideal components of a manure handling system include:

- Collection
- Transport
- Storage
- Processing
- Treatment
- Utilization

Several proven and cost-effective manure handling systems can be implemented for backyard poultry facilities. However, these systems are typically absent in most backyard operations, likely because they are not considered practical or cost-effective by backyard poultry producers. Backyard poultry operators may also be unaware of manure handling practices and how these practices can improve the quality of life for the birds as well as reduce the drudgery associated with manure management. This document provides technical information for those interested in obtaining manure to improve their gardens while also improving the quality of life for themselves and their chickens.

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Collection

An effective manure handling and collection system starts with the flooring. Several flooring materials are used for chickens. The most common in a backyard setting is dirt. There is a saying: "If you want something dirt cheap, then build it out of dirt." Dirt, or technically an earthen floor, is not a suitable flooring material, especially for manure handling. Earthen floors for permanent structures do not have the strength required to support the foot traffic, scratching, and digging performed by confined birds. Earthen floors also drain poorly, and they eventually subside into a muddy puddle. Poor drainage will also reduce the integrity of wood-constructed housing that is in direct contact with the ground. To that end, the bulk of manure deposited on an earthen floor system is lost to the environment. This is not only a loss of nutrients for beneficial reuse but also a potential threat to water quality if lost to leaching or surface runoff. In addition, unsuitable flooring may subject birds to diseases.

Ideally, flooring used to house poultry and livestock should adhere to the following principles:

- Floors should not be the cause of injury to livestock. They should provide a non-slip, non-abrasive surface and should have no sharp, exposed, or protruding edges.
- Floors should not contribute to ill health by harboring bacteria or parasites. Surfaces should be impervious and readily cleaned.
- Floors should not contribute to stress or discomfort, which might manifest itself in depressed growth, poor feed conversion or abnormal behavior.
- Floors should be matched thermally to the needs of the livestock housed on them.
- Floor materials and structures should not deteriorate or deform during their planned life, nor should they require maintenance during this period.
- Floors should comply with the previously mentioned requirements at the lowest cost possible.
- In regard to perforated designs, the floors should not retain feces or urine for periods of time that would necessitate cleaning or scraping.

Earthen floors do not meet several of the ideal flooring design principles, and therefore, they are *not* a suitable flooring material. In addition, many flooring design principles are not addressed by prefab or DIY coops. Most poultry housing designs focus on the walls and roof. However, the floor is the only part of a house with which poultry are in contact all the time.

A more suitable flooring option for backyard poultry houses is an impervious or perforated flooring system incorporated as a component of the overall design. Wood and concrete are impervious surfaces that have been used successfully on poultry operations. A sealed wooden floor is economical, but it needs to be elevated off the ground by at least a foot to avoid rot. A concrete floor will not rot. Concrete is more expensive to install, but it facilitates manure removal. Impervious surfaces also require bedding in order to provide physical and thermal comfort for the birds. (Bedding is discussed in more detail in the *Treatment* section of this document.)

An elevated perforated flooring system, which does not require litter, is another proven alternative. However, perforated floors need to have a cleanable surface beneath them, like a dropping pit. The term "dropping pit" is somewhat of a misnomer, since it is not technically a pit. Typically, a dropping pit is an aboveground structure constructed with a concrete surface and sidewalls to contain the manure, whereas the back wall is used as a push wall to facilitate the removal of the manure. Figure 1 shows a plastic perforated floor implemented in a backyard poultry house. Figure 2 shows the accompanying dropping pit that has been constructed under the perforated flooring system shown in Figure 1. The materials used to create the dropping pit include two-inch-thick concrete cap blocks for the flooring and four-inch-thick cap blocks for the sides and push wall. Cap blocks or cinder blocks are a good material to use for backyard chicken houses as a dropping pit because the blocks are porous and absorb moisture from the manure. This is a benefit for individuals who want the manure for their gardens, since dry manure retains most of its nitrogen content. Having the dropping pit under the house and protected from weather also facilitates nutrient retention. Manure that is dry and remains dry will also have less mass, which makes it easier to remove than wet manure. A dropping pit separates the birds from their manure and serves as temporary storage.

Other practices can be implemented to capture smaller amounts of manure. A

Figure 1. A perforated chicken floor made from a plastic material, which is nonporous and should not harbor bacteria or rot.

Figure 2. A dropping pit placed under a perforated flooring system and used for collecting and storing manure.

dropping board placed under the roosting area is a common practice implemented in poultry housing (Figure 3). Typically, the materials used to create a dropping board involve wooden surfaces. Galvanized steel, aluminum, stainless steel, or plastic could also be used to build or cover a dropping board. Trays can also be fabricated to facilitate the collection of manure. Manure removed from dropping boards can be stored in a dropping pit until land application or composting. Regardless, dropping boards provide an opportunity to collect manure free of any bedding, which preserves bedding material. Manure handling systems that resist corrosion and preserve bedding are another example of how these systems reduce maintenance costs.

Bedding

Bedding is a necessary component for impervious floors. A common system used for housing birds on impervious surfaces is the deep litter system. A deep litter system is a manure handling system that collects, partially treats, and stores manure until land application or further treatment, such as composting.

Straight pine wood shavings are probably the most common bedding material throughout the year in backyard poultry facilities. (Cedar wood shavings should not be used, as the dust can irritate the respiratory system of birds.) Wood shavings are preferred because they are readily available and conveniently packaged. However, wood shavings will compact under foot traffic and require periodic stirring.

Sand is a bedding material that can be used in the summertime to evaporate moisture in the manure while helping to keep the birds cooler. However, in wintertime, sand will pull heat from the birds. Straw makes a good wintertime bedding material. This is attributed to the fluffiness of the material, which increases air voids that improve its insulative properties. For bedding straw to work effectively, it needs to be "chopped straw," with lengths that do not exceed one inch. This is needed to increase the surface area, as shorter lengths improve absorption and insulation while also improving breakdown during the composting process. However, as a straight bedding material, straw does not have the moisture-absorbing properties necessary to be an effective bedding material. Peat moss is very absorbent and has been suggested as an alternative to wood shavings. However, it is extremely dusty and is not considered to be a sustainable material.

Figure 3. A dropping board covered with galvanized metal that has been placed below a roosting area.

The deep litter system is effective because it encourages the breakdown of nutrients, the evaporation of moisture from the manure, and the reduction of harmful pathogens by beneficial bacteria. Certain bedding materials, like wood shavings, tend to compact under foot traffic. Beneficial microbes in the litter require fresh air. Stirring the bedding occasionally helps to add air to the bedding and incorporate manure at depth. Stirring the bedding is also a good practice to incorporate cecal droppings, which are greasy and have more odor than regular droppings.

The bedding materials discussed in this publication are the most common. Litter preference usually depends on what can be most readily and cheaply obtained locally. However, hay should not be used as a bedding material, although it does work well in nest boxes. It degrades too quickly because it has a low carbon content compared to other bedding materials.

Some manure decomposition should occur in deep litter systems. For the decomposition process to be effective, there needs to be a varied distribution of particle sizes (small, medium, and large) to provide adequate but not excessive airflow. Mixing material sizes increases the surface area and provides the proper amount of airflow to keep the beneficial bacteria working. Therefore, a combination of bedding materials (particle sizes) is most effective. An example of an effective deep litter system could start with a one-inch layer of peat moss, followed by three to four inches of wood shavings. Layering this way puts the peat moss, which is dusty, at the bottom, where it can function as an absorbent. Before wintertime, the litter can be top-dressed with two inches of straw (oat or wheat) to keep the birds warmer. Once the birds blend the materials, it should create a six- to eight-inch-deep litter.

Success in managing a deep litter sys-

tem is directly tied to stocking density. Table 1 provides the *minimum* space requirements for birds, excluding equipment like waterers, feeders, and dust baths. Problems with storage and treatment can occur if the stocking density is too high. Conversely, under stocking is a waste of space, which can increase housing costs. The data in Table 1 represents space requirements that are more in line with commercial stocking densities and recent welfare standards. However, the average stocking density for backyard poultry operations may provide more space per bird by several fold. Backyard chicken owners often have different welfare standards and generally want birds to have plenty of room. In some cases, backyard operations may incorporate outdoor runs that provide 15 to 20 square feet per bird. To that end, the initial cost of implementing a manure handling system for such oversized operations may be cost prohibitive. In addition, backyard poultry caretakers may not recognize that maintaining an earthen flooring system with bedding requires higher maintenance costs. Birds that are cold and wet due to a lack of good flooring will require more feed than birds housed with a planned and managed flooring system. Birds with feathered feet are a prime example. In an average Kentucky winter, birds with wet feathered feet will certainly be miserable.

Transport

Transport involves the removal of waste after collection. An efficient means of cleaning out the house is needed to eliminate drudgery when conducting this task. Efficiency requires ease of removal, a cleanable surface, and a lack of obstacles that interfere with cleanout. The dropping pit in Figure 2 is easy to clean with a flat shovel and does not involve disturbing the birds to remove the manure. Figure 4 shows a backyard poultry house that uses a deep litter system. The door spans the full width of the house to facilitate litter removal. Ideally, such a system would have clearance under the house so that the litter could be directly scraped into a wheelbarrow for transport. Both manure handling practices reduce the drudgery of transport, while providing a system that separates the birds from their manure.

Table 1. Minimum Space Requirements

Type of bird	Floor - wire mesh (sq. ft./bird)	Floor - deep litter (sq. ft./bird)	Chicken run (sq. ft./bird)
Bantam	1	2	4
Layer	1.5	3	8
Large Breed	2	4	10
1-4 weeks old	0.5	1	NA
4-10 weeks old	1	2	4
10-20 weeks old	1.5	3	6

Figure 4. A cleanout door for removing deep litter from a painted plywood floor.

Storage and Processing

How manure is stored affects nutrient retention. Table 2 shows the percentages of nutrient retention based on the kind of manure storage system. Deep litter systems (roofed storage) are a means of retaining the nutrient value of manure. As a rule, if the deep litter system is working properly, there is no reason to transport or remove it, which reduces the cost of replaced bedding. In addition, the nutrient concentration will be higher if the litter remains in place. A deep litter system should remain in place for at least a year, if not two, before the litter is removed and replaced. During the one- to two-year period, fresh bedding material can be blended periodically with existing bedding to help control moisture.

Deep litter systems have a lower overall cost than open "straw yards" when time, cost of materials, risk of health issues, and potential loss of nutrient value are taken into consideration. This is demonstrated by the nutrients that are not retained but instead lost to the environment due to unroofed storage. What the data does not quantify is the amount of bedding added periodically to an unroofed area (straw yard) that is also lost to the environment.

Treatment

While it is in place, a deep litter system will undergo some treatment by beneficial microbes, which will decompose the manure and destroy harmful pathogens. An optimum level of moisture is needed for this to be accomplished (40–60 percent moisture). When operators think about moisture and bedding, wet bedding is their primary concern. High moisture

Table 2. Percent of Original Nutrient Content of Manure Retained by Various Management Systems*

Management system	Nitrogen	Phosphorus	Potassium
Manure with bedding in roofed storage	70%	95%	95%
Manure with bedding in unroofed storage (leachate lost)	0%	0%	0%
Manure stored in pits beneath slatted floor	90%	95%	85%

* Adapted from 1992 NRCS Agricultural Waste Management Field Handbook

concentration in bedding is a problem. It can create high concentrations of ammonia in the air, which is an irritant to birds' eyes and respiratory systems. Birds on wet bedding can also suffer foot dermatitis and chest lesions. However, deep litter systems can also become too dry, especially during periods of low humidity and low stocking density. Water can be added to litter that is too dry using a watering can or something suitable to the task. Adding water to bedding is also a good management practice to reduce airborne dust, which is common when adding fresh kiln-dried wood shavings.

Ideally, manure and bedding removed from a house should be further treated by composting. Composting can be a passively or actively managed process through which the manure is broken down into readily available nutrients. An example of passive management would be dumping the manure/bedding onto a compost pile, whereas active management would be periodically mixing the contents of the pile to obtain a more uniform and effective composted product. Most pathogenic microorganisms will also be destroyed if enough heat is generated over a length of time.

Utilization

Plan ahead to maximize utilization of poultry manure in the garden. The standard recommendation for adding composted chicken manure to a garden bed is approximately three weeks before planting time in the spring to take advantage of the available nitrogen. However, there are exceptions. The issue with backyard chicken manure (raw or composted) is managing it for harmful bacteria like E. coli and salmonella. Manure applied to crops intended for human consumption should be applied and incorporated 90 days before the crop will be harvested. Manure applied to root crops and leafy greens, which come in contact with the soil, should have 120 days between land application and harvest. The key is to manage the manure for safety based on the type of vegetable or fruit crop produced.

Nitrogen is lost for every day that passes from the time of land application. Incorporating the manure immediately into the soil will retain more of the nitrogen and reduce runoff (Table 3). Manure and bedding that have not been composted can be applied in the fall after vegetable crops have been removed and before planting a cover crop.

Table 3 shows that fall-applied manure will lose most of the nitrogen unless a cover crop is planted, whereas phosphate and potash are readily available to the plant.

Nitrogen is readily leached from the soil and needs to be applied every spring. Two pounds of nitrogen is recommended per 1,000 square feet of garden area. Chicken manure is high in nitrogen compared to other farmyard manures. It should be applied sparingly to vegetable crops that may bolt, burn, or develop multiple roots (e.g. carrots).

Soil phosphorus and potassium are not as readily leached as nitrogen. The approximate amount of manure to be added per unit area can be determined by submitting a sample of the manure through the Cooperative Extension Service for nutrient analysis. The data should then be evaluated in conjunction with a soil sample analysis from the garden, using the Home Vegetable Gardening in Kentucky (ID-128) publication to determine the nutrient needs and land application rate.

Table 3. Percent of Nutrients from Manure Available to a Crop during the Year of Application

Nutrient	Application type	Available coefficient
Nitrogen	**Spring applied**	
	Incorporation: same day	75%
	Incorporation: 2 days or less	65%
	Incorporation: 3–4 days	55%
	Incorporation: 5–6 days	50%
	Incorporation: 7 days or more	45%
	Not incorporated	45%
	Fall applied	
	Without a cover crop	15%
	With a cover crop	50%
Phosphate		80%
Potash		100%

Source: *Using Animal Manures as Nutrient Sources* (AGR-146), August 2000, University of Kentucky.

Summary

Manure from backyard chickens can be an effective gardening tool if the manure is collected and utilized as garden fertilizer. Poultry manure is a superior manure source compared to other farmyard manures. However, for manure to be utilized efficiently in the garden, the poultry housing system must have a manure handling system. The ideal components of a manure handling system should include the ability to collect the manure, store it for processing, and provide for treatment before utilization.

There are several manure handling techniques that can be implemented for backyard poultry facilities. Some backyard poultry operators may believe that implementing these designs would not be practical or cost-effective. However, over the long run, these practices lower maintenance costs, reduce operator drudgery, create a better environment for the health and productivity of the birds, and produce a beneficial product for the garden.

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