Benefits and Challenges of Reusing Broiler Litter

One of the most important aspects of commercial poultry production today is the effective management of litter material. Litter management practices will become even more critical as much of the broiler industry moves toward antibiotic-free production to meet consumer demand. Poor-quality litter can have serious negative consequences on bird health and overall flock performance. Litter plays an important role in managing the moisture level within the broiler house. The **litter acts as a huge sponge** by absorbing large amounts of moisture and diluting the fecal material. However, depending on how good your management program is, litter can become overwhelmed by the amount of moisture in the house, resulting in wet or caked litter.

Wet or caked litter tends to be at risk for higher ammonia levels, increased incidence of footpad dermatitis, and increased numbers of pathogenic organisms such as bacteria, molds, viruses, coccidia, and intestinal worms. Having adequate litter depth, which appears to be **around 3–6 inches** for optimal bird performance, will allow for greater water retention and will help pull water away from the surface of the litter where it is in contact with the birds. Litter should be able to absorb a lot of moisture from within the broiler house but should also have a quick drying time to get rid of the moisture it absorbs.

Emphasis on Paw Quality

Wet litter is likely the major contributor to condemned chicken paws because wet litter causes footpad dermatitis issues. Chicken paw prices have skyrocketed in recent years due to an increased demand for high-quality paws to export overseas. Prior to the mid-1980s, paws were of little economic value and were rendered along with the rest of the offal including blood, feathers, and the other unsaleable parts of the broiler. Things have changed dramatically since then—to the point that **paws are now the third-most important economic part** of broiler chickens behind the breast and wings.

Paw quality is also used today as an assessment of bird welfare. Footpad dermatitis not only costs the poultry industry millions of dollars each year in lost revenue, it is also currently used as an **indicator of welfare practices** in animal welfare audits. Therefore, the emphasis today on improving foot health and reducing the incidence of footpad dermatitis offers the opportunity for dual benefits: 1) increased profit from a greater number of exportable paws, and 2) having management practices in place that allow the poultry industry to meet current animal welfare standards. There are **benefits to reused litter where paw quality is concerned**. Paw quality seems to be better on built-up litter that is well maintained and has proper moisture content than on new bedding or even second- or third-flock litter. New bedding that may be of inadequate depth, inferior quality, or contain large chunks or sharp edges does not lend itself well to maintaining acceptable paw quality. After a year or more of growing flocks on new bedding, the litter is deeper and softer, with fewer sharp edges, and paw quality improves if the litter remains dry. Therefore, even though there are challenges associated with reusing litter, such as the potential for increased ammonia and pathogen levels, there are also benefits, such as improved paw quality and cost savings from not having to purchase new bedding materials (which may be expensive and difficult or perhaps impossible to secure) quite as often.

Litter Management

Most bedding materials used by the poultry industry have become more expensive in recent years as **competing markets offer more for the materials** than is feasible for the poultry industry. This increased demand from competing markets may also mean a shortage of available material even if the price is favorable to the poultry industry. This may lead to situations where inadequate amounts of bedding materials are placed in broiler houses. In addition, spreader trucks may not spread bedding material uniformly, resulting in material being thicker in the middle of the house and much thinner near the walls. Often, this will result in litter slicking over near the walls because the material is not deep enough at the walls to

handle the moisture load in the house. It is **critical that the litter is evenly spread** throughout the house, end-to-end and side-to-side.

The goal of litter management is to ensure that the litter stays dry and friable throughout the flock. Two of the most common challenges to keeping litter dry are **inadequate ventilation** (especially during cold weather) **and poorly managed drinker lines**. Houses where the drinker lines are adjusted too low or the water pressure is adjusted too high will almost always have wetter floors. In addition, water supplies that carry a high particulate load or water lines that have issues with biofilm growth will often cause nipples to leak, increasing litter moisture. Frequently flushing and sanitizing the drinker and supply systems may help reduce water waste from leaking nipples. Feeder and drinker lines are high-traffic areas, and it is critical to maintain dry litter in these areas to improve its quality, which, in turn, will improve paw quality, lessen the risk of hock burns and breast blisters, and maintain a better welfare environment. Increased water excretion can result from health issues, such as necrotic enteritis, or from other factors, such as medications used to treat disease, nutritional imbalances, and certain feed ingredients. All of these situations will challenge growers in their efforts to keep litter dry.

Inadequate ventilation also challenges growers and greatly reduces the chance that litter will remain dry and friable. Growers may reduce ventilation rates during cold weather to save on gas use. However, as a result, the litter is soon overwhelmed by the increased moisture load in the house and begins to slick over and form cake. Relative humidity levels of greater than 70 percent for any extended length of time will result in wet litter. Once the litter has gotten wet, it will take a lot more heat to dry it back out than it would have taken to maintain it with adequate ventilation in the first place.

Maintaining optimal litter conditions early in the flock during cold weather requires fuel and associated costs. During cold weather, when minimum ventilation fans run on their time cycle, the brooders will generally come on shortly thereafter. Running brooders will increase the fuel cost, and growers may be tempted to reduce the minimum ventilation rate, but this should not be attempted. Moisture, CO_2, and ammonia levels quickly rise in an underventilated house, rapidly deteriorating the house environment and litter quality. However, by providing adequate ventilation and maintaining good litter quality, much of the fuel cost can be recaptured through improved bird performance throughout the flock.

Litter Treatments

Acidifiers are the most commonly used litter treatments. Acidifiers convert ammonia to ammonium. Unlike ammonia, ammonium does not easily convert to the gaseous form and tends to remain bound in the litter. Acidifiers also reduce the pH of the litter generally to between 4.0 and 7.0, thereby creating a hostile environment that inhibits the growth of ammonia-producing bacteria and other potentially harmful bacteria such as *Clostridia*, *Salmonella*, and *E. coli*. Acidifiers generally have a short lifespan in the broiler house—usually 2 weeks or fewer. However, they do a good job during the early brooding period at keeping ammonia levels in check and helping to minimize fuel use. The most common dry acidifiers are sodium bisulfate, aluminum sulfate, and sulfuric acid clay. A combination of sulfuric acid and aluminum sulfate is a common liquid acidifier. **Sodium bisulfate** is a dry acid salt that is activated by moisture in the environment. It lowers litter pH, thus reducing ammonia, and the sodium component helps to reduce litter pathogen levels. Ammonia is bound by the sulfate, preventing it from being released as a gas. Sodium bisulfate works best when top-dressed onto the litter close to bird placement (within 24 hours). **Aluminum sulfate** is similar to sodium bisulfate in that it is a dry acid salt, but it is different in that the acid is produced through the reaction with water in the litter instead of environmental moisture. Aluminum sulfate has the added benefit of binding phosphorus, making it unavailable. The amount of litter moisture is critical if aluminum sulfate is used. Aluminum sulfate is most commonly top-dressed onto litter 3–7 days before chick placement, depending on litter conditions. Application time depends on level of litter moisture. Apply the product 3-4 days ahead of placement with "wet" litter (20–35 percent moisture) and 6–7 days ahead of placement with "dry" litter (<20 percent moisture).**Sulfuric acid** is commonly incorporated into a clay bead that looks similar to cat litter for ease of application and safety purposes. Sulfuric acid is a very strong acid and does not require moisture for activation. Similar to sodium bisulfate and aluminum sulfate, ammonia is converted to ammonium and bound to sulfate. Application works best 1–3 days before chick placement.The liquid **combination of aluminum sulfate and sulfuric acid** is sprayed on the litter 2–3 days before chick placement. It **must be allowed to form a "crust" for 24 hours** to be effective. You should not walk on or disturb the litter while the "crust" is forming. It must be applied by a licensed applicator. You may purchase and apply the dry products yourself, but you must have a license and special equipment to handle the liquid product.

Windrow-Composting Litter

In many parts of the U.S., the poultry industry faces issues with the cost, quality, and availability of acceptable bedding materials. As a result, **many locations reuse broiler litter** to grow multiple flocks of birds over an extended period (sometimes several years). This extended reuse of litter cuts costs and avoids issues with quality and availability of bedding; however, birds grown on built-up litter over numerous flocks or years may be exposed to higher pathogen loads. Windrowing litter is a management practice that, when done correctly, is beneficial and can lower the pathogen load in reused broiler litter.

Windrowing is not without challenges, however. You must have sufficient downtime between flocks to windrow correctly. Any fewer than 10 days of downtime likely will not lend itself to windrowing. Also, you can't waste time. If you are going to decake, do it within 1–2 days of flock removal. Some complexes allow growers to leave the cake in the house, if there is not too much, to help the windrow produce heat, especially if the litter is very dry. If done correctly with enough moisture in the litter, the **windrows should heat to 130°F or more** (**Figure 1**). The first windrow should be constructed within 2 days of flock removal and allowed to stay windrowed for 3 days. Then, turn the first windrow and form a second windrow that also stays in place for 3 days. After 3 days, level this second windrow and allow 3–4 more days before chicks are placed. Make sure litter is level from side to side and end to end of the house! Otherwise, it will be very difficult to manage your feeder and drinker height throughout the house.

Be sure to **pull all the litter from the sidewalls and expose as much of the floor** as possible to the air (**Figure 2**). If you have a thick hardpan next to the floor, it may take multiple flocks of windrowing to eventually bust through this hardpan and incorporate it into your windrows. Many growers simply use a tractor and a pivoting blade to form the windrows, but several equipment companies now make specialized equipment to form the windrows. These specialized implements work well and may save time compared to a blade, but they are also more expensive. The implement you use will be dictated to a degree by the unique situation on your farm.

If you hire a contractor to windrow your litter or share equipment with a friend or neighbor, **make sure equipment is cleaned and disinfected before it comes on your farm**! If you windrow your litter yourself, your level of expertise will determine how much time you will spend windrowing. It takes practice to become proficient at windrowing. With practice, you may be able to windrow a house in 30–45 minutes. If you are just starting out, it may take 2 hours or more to do a house. Spreading the windrows back out will take longer than building them. The **litter has to be level when you spread them back out**! Use of one of the litter treatments discussed above will likely be beneficial after the litter is leveled back out to help control ammonia during the brood period of the next

Figure 1. Windrows should heat to 130°F or more.

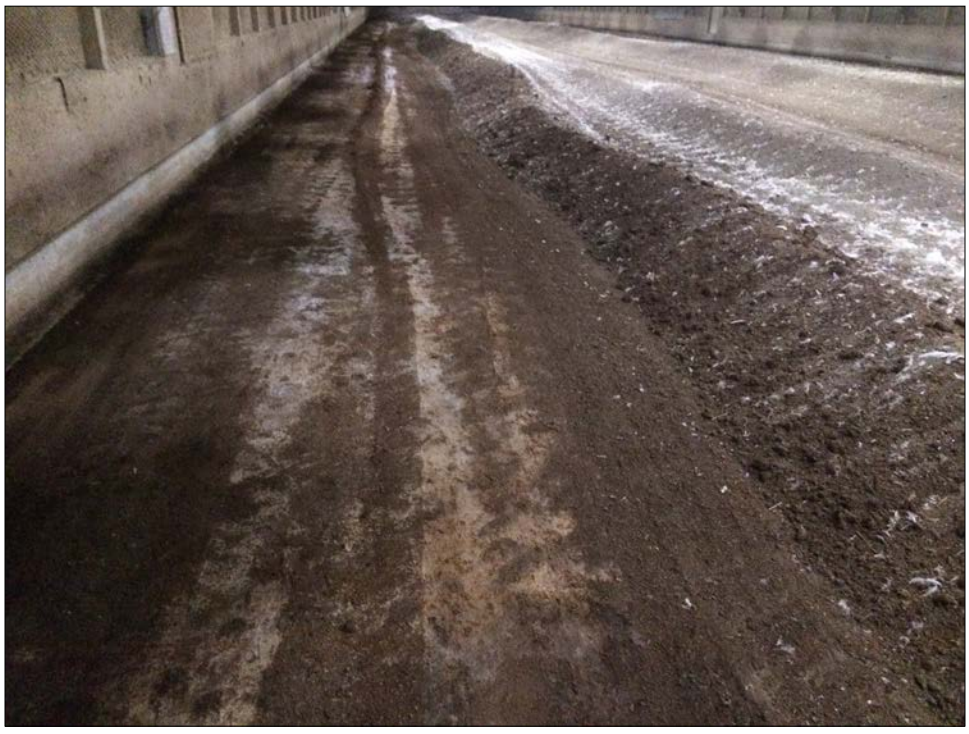

Figure 2. Pull all material away from the wall and expose the floor.

flock. Ventilate continuously from the time you build the windrows until you prepare to preheat for the next flock to keep ammonia pulled out of the house.

Keep the end doors closed to keep the varmints out and enhance biosecurity. Curtain-sided houses may drop the curtains if your complex allows this. For solid-walled houses, you may open the minimum ventilation inlets or slightly open the tunnel inlets and run one large or two smaller fans continuously during downtime. Litter depth is important when windrowing. Litter depth should be maintained at 3–6 inches for optimal bird performance. Litter that is 8–10 inches deep or more is difficult to manage, especially with a blade, and may not heat well if the litter is dry and you have little or no cake or hardpan to increase the moisture content.

Windrowing will not decrease the volume of litter by any significant amount. Only a small amount of time is actually spent composting, and it will not be long enough to affect the volume. You will eventually have to remove some litter when it gets too deep (more than 6–8 inches). Windrowing does appear to **benefit average or below-average growers** more than top growers. The reduced pathogen load in the litter appears to be the main benefit. However, this **pathogen reduction in litter is beneficial to everyone** (above or below average).

Summary

Reusing broiler litter to grow multiple flocks is a common practice that has both benefits and challenges. If litter can be kept dry, paw quality is generally better on reused litter than on new bedding. Reusing litter can also save money by preventing or delaying the expense of purchasing new bedding material if/when the houses are cleaned out. Litter treatments can be used to help manage ammonia levels during the brood period of a flock. Windrowing reused litter is a sound management practice that, when done correctly, is beneficial and can reduce the pathogen load in reused litter. However, reusing litter is not without challenges. There is greater potential for high ammonia levels with built-up litter than with new bedding material. Ammonia is a serious animal welfare and economic threat to the poultry industry and must be managed as such. Litter treatments are acidifiers, and growers should follow manufacturers' recommendations, guidelines, and precautions for their safe use and handling. Windrowing litter requires both time and expertise. In addition, it is dirty work that may require personal protective equipment such as masks, respirators, goggles, and so forth. Even so, most of the challenges can be overcome, and the advantages of reusing litter tend to outweigh the disadvantages. **Proper litter management is critical to success**, regardless of whether you use new bedding material or built-up litter.

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