Litter Management

Tom Tabler[1], Shawn Hawkins[2], Yang Zhao[1], and Pramir Maharjan[3]
[1]University of Tennessee Animal Science Department, [2]University of Tennessee Biosystems Engineering and Soil Science Department, and [3]Tennessee State University College of Agriculture

Good litter management before, during, and after a flock is a key factor for improved broiler performance, animal welfare, and bird health. Successful growers realize that proper litter management during and between flocks is critical in today's "No Antibiotics Ever" (NAE) environment. These growers recognize that litter management starts with the previous flock, not the current one. If you wait until a new flock of chicks arrives to start a litter management program, you've waited too long, and it will likely be the next flock before the fruits of your labor become apparent. Litter conditions do not change overnight, but they do change, and you must stay ahead of those changes. Litter management is an ongoing, time-consuming process that requires great effort on the part of the grower. Fortunately, various options exist to help growers with litter management. For example, litter conditioning, de-caking, and windrowing are all methods to help growers better manage litter between flocks. Good litter management involves reducing the amount of water going into the litter and increasing the amount of water evaporation from the litter (Liang and Tabler, 2020).

Litter and moisture concerns

Price and availability of bedding materials are causing shortages and competition for traditional materials such as pine shavings, rice hulls, and peanut hulls. Managing land application of litter is always a challenge given requirements from NRCS and state environmental quality departments. In addition, pathogens may build up in used litter which could infect current and future flocks. However, reusing litter over multiple flocks is a common practice across the U.S. broiler industry but it comes with potential risks such as:

- high ammonia levels during early brooding
- moisture challenges that must managed to prevent wet litter/poor welfare issues
- increased energy (gas and electricity) use to maintain proper air quality
- pathogen carryover that could result in birds breaking with the same disease flock after flock

Moisture is a key factor influencing litter quality in broiler houses (Tabler et al., 2012). Litter moisture is associated with a multitude of factors such as broiler house environment (temperature, ventilation rate, humidity, etc.) and litter properties (bedding material, new vs. built-up litter, litter depth, moisture content, etc.). Wet litter in the poultry house has been a known problem for almost 100 years (Dann, 1923). Litter moisture concerns and wet litter conditions continue to plague the poultry industry despite well over 90 years of advancement in terms of selective breeding, housing design, ventilation systems, and production methods (Dunlop and Stuetz, 2016).

Determining how much moisture in broiler litter is too much is not an easy task. Tabler et al. (2015) found the average moisture content of Mississippi broiler litter to be approximately 27 percent. Collett (2012) suggested that 25 percent moisture content is the limit above which cushioning, insulating, and water holding capacity become compromised. Abd El-Wahab et al. (2012) reported that the critical moisture content for onset of footpad dermatitis was approximately 35 percent. In truth, there is no single value of moisture content that describes conditions that initiate problems associated with wet litter (Dunlop and Stuetz, 2016). Just as there is no one single source of moisture that contributes to wet litter.

There are a variety of multidimensional factors that contribute to wet litter, including bedding material properties, litter conditions (moisture content, friability, stickiness), manure

deposition rates, bird activity, house environment, and ventilation program (Dunlop, 2017). Dunlop et al. (2015) estimated the amount of water added to litter from manure deposition is 1.5-3.2 L/m^2/day (0.04-0.08 gals/ft^2/day). Over the course of a grow-out, the total amount of water added to the litter is over 100 L/m^2 (2.4 gals/ft^2). This translates to 60,000 gals in a 25,000 ft^2 house, which is several times more water than the litter can hold (Dunlop and Stuetz, 2016). This highlights the critical importance and necessity of evaporation and moisture removal by proper ventilation.

Ammonia (NH_3) generation is a major issue with reused or built-up litter, particularly if the litter gets wet. High NH_3 level in broiler houses is an animal welfare concern and often results in poor bird performance and flock health conditions and a loss in profits to the grower and the integrator. Reducing stress throughout the grow-out period is critical to maintaining welfare standards and crucial for achieving a low cost-per-pound of live weight at harvest time. Ammonia volatilization depends on 1) temperature, 2) litter pH, 3) litter moisture, and 4) air movement. Note that the water evaporation rate also depends on litter moisture content and airflow/ventilation over the litter.

Moisture control

Moisture control depends largely on management practices. This means regular checks on water systems to avoid leaks and continuous ventilation monitoring. Adjusting drinker height and water pressure appropriately as birds age is critical to prevent excessive water spillage into the litter. Continuously increasing ventilation rate as the flock grows is a necessity to meet moisture removal requirements. A uniform bird density throughout the house is also vital to moisture control. This means timely movement of birds from half to full house and uniform bird numbers in both brood and off ends. Individual water meters for the brood and off ends will

assist in determining when bird numbers are uniform throughout the house. Or, with enough practice, it becomes easier to “eyeball” each end and determine when numbers are uniform. Once numbers are equal, migration fences should be used to maintain this uniformity.

Use of small circulation fans in the ceiling during the flock help remove moisture from the litter. These fans may run continuously during the flock or growers may program them to run whenever the minimum ventilation tunnel fans are not running. Circulation fans provide a gentle air movement (not a draft; chickens don’t like drafts) that helps break up temperature stratification in the house and assists with litter drying. It’s also important to divert stormwater away from the house and pad. Standing water can seep into the pad and wick up from the bottom into the litter inside the house.

Floor moisture from the pad or the hardpan (if one exists) may be more important than we think in creating excess ammonia levels. Sufficient bedding depth is also important. A minimum depth of three inches should be maintained at all times. Four to six inches appears to be ideal. If litter depth variability exists throughout the house, this will be problematic with regards to maintaining proper feeder and drinker height.

Quality litter is about more than just maintaining a proper moisture content. It is also about friability, not only from a welfare standpoint, but friability also has certain advantages apart from welfare considerations. When litter is friable, it helps keep litter dry and enables birds to “work” the litter when they scratch, walk, dust-bathe, and forage (Dunlop and Stuetz, 2016). Bernhart and Fasina (2009) reported that litter moisture affects the amount of cohesion (stickiness) between litter particles. Bernhart et al. (2010) indicated that, as litter moisture increases above 20 to 30 percent, litter particles begin sticking together and form “clumps” because water acts as a natural binder.

Ventilation rate helps manage litter moisture, and seasonal changes in temperature require complimentary ventilation adjustments to maintain a proper house environment and help birds maintain the appropriate body temperature (Tabler et al., 2020). However, growers often significantly reduce winter ventilation rates to conserve fuel and lower heating costs (Gates et al., 1997). Unfortunately, decreased winter ventilation often leads to wet litter and increased NH_3 levels that can threaten flock health. As a result, welfare standards may be compromised, and increased ventilation rates and additional gas usage are often required to maintain acceptable NH_3 levels, which are generally higher than rates required for moisture removal alone (Xin et al., 1996).

NAE production changed things

No Antibiotics Ever production requires a different way of thinking about growing chickens. It requires much better management and going back to simple basics. New bedding material and NAE production do not work well together. It often appears that old, used litter may be more beneficial with NAE production. Some integrators have selectively moved old litter from one farm and top-dressed new bedding on another farm to seed new houses and help jump start chicks' immune system under antibiotic-free production.

No Antibiotics Ever programs have shown us that we had become lax in our management programs. A very little antibiotic covered up lots of management mistakes along the way. What was "clean" before NAE, isn't "clean" today. For some, that has been a hard lesson to learn. Without that little bit of antibiotic help, we've had to get better at:

- hatching egg quality
- hatchery cleanliness
- feed quality

- farm management
    - litter quality
    - air quality
    - ventilation control
    - temperature control
    - ammonia control

Best Management Practices must be in place at every step along the way including:

- Well-developed biosecurity program
- Well-developed vaccination program
- BMPs documented and in use
- Good nutrition program
- Consistent, high-quality feed
- Finely tuned breeder health program
- CLEAN hatcheries, chick boxes, and Smithway trucks
- On-farm management practices that better address litter quality, ammonia levels, temperature, ventilation, and humidity levels.

Stressed birds are not an option with NAE programs and we know that NAE production requires:

- Optimum stocking density
- Good litter management
- Ideal housing environment
- Quality pre-starter feed
- Good water quality and a sound water sanitation program

Litter management basics in winter

Several factors make litter management in winter challenging: 1) cold outside air; 2) brood chamber at 90-92°F for baby chicks; 3) minimum air flow rates that make uniform temperature distribution difficult; and 4) expensive propane. Again, moisture is the key factor influencing litter quality. Where does the moisture come from? 1) Birds – birds consume approximately two lbs of water for each one lb of feed consumed. Eighty percent of this water is added back to the house environment in the form of manure and respiration. 2) Brooders – for each gallon of propane burned, 6.8 lbs (0.8 gals) of water is produced.

We must control this moisture with ventilation and the amount of ventilation needed will vary almost continuously. The ventilation rate needs to be whatever is necessary to properly manage ammonia less than 25 ppm and maintain relative humidity in the 50-70 percent range. Waiting until the litter slicks over to properly ventilate is useless. By then, you've lost control of the moisture problem and you won't be able to ventilate your way out at that point.

Windrowing

Windrowing is an attractive litter management practice that is a reliable and cost-effective way to reduce the pathogen load in built-up litter. It is not true composting because the windrows aren't in place long enough for true composting but, when done correctly, heat buildup in the windrows will kill much of the microbial population. Windrowing is not without challenges, however. Litter moisture must be adequate (25-30 percent) or the windrow will not heat properly; and then you've wasted your time and diesel fuel. It takes time to learn how to use windrowing equipment. There must be enough down time between flocks to windrow properly. Less than 10 days is not long enough to properly windrow litter. Also, you'll get dirty because it's not clean work.

However, given enough time to do it correctly, and with the right moisture content for the windrow to heat to around 130°-140°F, many of the pathogens in the litter can be eliminated. Depending on litter moisture content, it may be necessary to leave the caked litter in place to have enough moisture to make the windrow heat. Discuss this with your service technician. After windrows are spread back out, give the litter 3-4 days to dry and cool off before applying a litter amendment. Otherwise, the amount of ammonia coming off the litter will quickly overwhelm the litter amendment and it will not do its job. Be aware that litter over six inches deep is difficult to windrow because of the volume in the house. Three to six inches of litter depth works best for windrowing.

Summary

Litter moisture is always a concern in poultry houses. Wet litter creates numerous problems such as increased bacterial load in the litter, high house ammonia levels, and increased footpad issues. No Antibiotics Ever production has made litter management a much more critical issue. Poor litter quality is stressful to the birds and can be an animal welfare issue; and NAE birds do not handle stress well. De-caking, litter conditioning, and windrowing are options to assist growers in managing litter. However, nothing works better than spending time in the chicken house. So, find a 5-gal bucket you like and just sit and watch what's going on. Used correctly, that 5-gal bucket will be worth more than all your other equipment combined.

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