MISSISSIPPI STATE UNIVERSITY EXTENSION

Managing Litter Moisture

in Broiler Houses with Built-Up Litter

Moisture is the key factor influencing litter quality in broiler houses. The higher the moisture level, the longer bacteria are able to survive in the litter. For example, in dry litter, bacteria may survive only a few hours or days, while in wet litter, survival may extend up to several weeks. Therefore, it is important to establish proper management strategies in order to properly control litter moisture.

The first step in this process should begin on the day the current flock is caught and removed from the house, before the next flock arrives. The **built-up litter** on the floor contains a large amount of heat at the time a flock is removed. This heat can be used to your advantage if you close the house immediately after the flock is removed and use it to help dissipate moisture and ammonia from the litter.

Many Mississippi broiler growers no longer practice annual cleanout schedules. This is a result of cost and availability issues associated with new bedding materials, along with increasing environmental concerns over disposal of old litter. Growers are finding it difficult or even impossible to do a complete cleanout annually. This has increased the need for growers to raise birds on built-up litter.

Broilers can be grown very successfully on built-up litter, although it requires extra effort and careful attention to address issues not common with new bedding, such as caked litter and increased ammonia levels. In addition, birds grown on built-up litter are exposed to an increased number of potentially harmful microorganisms that may affect their health and performance without showing symptoms of illness or mortality. **Weight gain** and **feed efficiency** are two areas that may be negatively impacted by this increased pathogen load.

When a flock is removed from a house for processing, it is important to condition the litter, remove the cake, and/or windrow the litter as soon as possible in preparation for the next flock. Caked litter may be 40 percent or more moisture, and this moisture must be dissipated before the next flock arrives. Maintaining an optimum flock environment starts with having quality litter conditions. **Ideal litter** has the following characteristics (Watkins, 2001):

- Loose and not caked over
- Not too dry or too wet (20 to 30 percent moisture is ideal)
- Low ammonia level (less than 20 parts per million)
- Uniform particle size (no large clumps)
- Minimum insect load

Adequate minimum ventilation during the first 7 to 10 days of the flock must be maintained to control moisture—even with ideal litter and even when litter amendments are used to control ammonia. Thereafter, ventilation rates increase enough so that excess heat removal should be adequate to cover moisture removal needs as well.

Many broiler growers have discovered the benefits that litter amendments provide for controlling ammonia early in a flock. The most commonly used amendments contain sulfuric acid or sulfate and work by acidifying the litter and decreasing litter pH from ≥ 7 to ≤ 4 during the first 10 to 14 days of a flock. This creates a neutralizing effect on ammonia release because most bacteria, including those responsible for producing ammonia, find this low pH an unfavorable environment. Therefore, ventilation rates can be minimal during this period because bacterial activity and ammonia levels remain low while litter pH is reduced. After about 14 days, litter pH will rise again as bacterial activity increases, but, at this age, birds are large enough that the ventilation rates should have increased to handle moisture removal.

Maintaining proper moisture level is critical with built-up litter, and adequate ventilation is the only practical way to remove excess moisture. **The amount of moisture that air can hold is relative to the temperature of the air.** For example, warm air can hold much more moisture than cold air. Cold air has most of

the moisture squeezed out of it, allowing it to cool rapidly. Warm air is warm, in part because it is moisture-laden, which prevents it from cooling (recall how little the outside temperature drops overnight when conditions are very humid and muggy).

Minimum ventilation rates for broiler houses are based on the amount of moisture added to the house by birds at different ages and the amount of moisture that a given volume of air can absorb. Also, initial temperature and moisture content (outside conditions) and moisture holding capacity (relative humidity) of the air at the temperature it will be warmed to as it is brought into the broiler house affect minimum ventilation (Donald et al., 2009). **Table 1** lists ounces of water in 1,000 cubic feet of air at different temperatures and relative humidities. From this table, we can see that 40°F air at 50 percent relative humidity contains 3.2 ounces of water; however, if the temperature is increased to 80°F, that same air can now hold 12.2 ounces of water (almost four times as much!).

As a general rule, **increasing the air temperature by 20°F doubles the moisture-holding capacity of the air.** This is what allows us to remove moisture from the broiler house. We bring in relatively cool, dry air from outside, heat it up so that it now holds much more moisture than it did when it entered the house, and remove this moisture-rich air with minimum ventilation fans. This cycle continues every 5 minutes or each time the minimum ventilation fans run. If fan run-time settings are adequate for the age of the bird, then moisture build-up should not occur, because more moisture-rich air is being exhausted than pulled in. If settings are inadequate, moisture levels may continue to build in the house until the litter becomes saturated and begins to slick over and form cake.

Many Mississippi broiler growers experienced this situation during Hurricane Isaac when 14-plus inches of rain fell over a 2-day period. When outside humidity levels are high for an extended period, it is difficult (even if ventilation rates are increased) to maintain house humidity levels at a desirable range. This is because the incoming air may be just as saturated with moisture as the air being exhausted. This situation makes it difficult or impossible to lower humidity levels inside the broiler house until outside conditions improve. Often, this results in the litter caking over before outside conditions change.

During cold weather, whenever minimum ventilation fans run, the brooders come on shortly thereafter. Naturally, this increases fuel costs, and growers may be tempted to reduce minimum ventilation rates; however, this should not be considered because moisture, CO_2, and ammonia levels rapidly increase in an under-ventilated house. Maintaining normal ventilation rates, even during cold weather, is very important. This will improve the environment and, consequently, bird performance, which will offset some of the additional fuel costs.

Litter management has always been challenging, but the increased use of built-up litter makes it an even more difficult task. Litter that has been windrowed must be uniformly spread back out and given at least 4 to 5 days to finish drying before chick placement. Partial-house cleanout also presents a situation where the litter must be leveled back out evenly throughout the house (not just in the brooding area). Uneven litter results in an uneven floor, and ultimately uneven feeder and drinker lines. Birds will struggle throughout the flock with uneven feeder and drinker lines, causing serious management issues. For example, as birds attempt to drink from lines that are too low, excess water will be deposited in the litter, resulting in increased cake formation. Uneven feeder and drinker lines also can result in flock uniformity issues at harvest.

Summary

Managing moisture is a key factor in maintaining ideal conditions with built-up litter. Litter moisture greater than about 25 percent will result in increased ammonia production. Ventilation that fails to keep the humidity level between 50 and 70 percent will likely lead to increased litter moisture, as well as an increased pathogen load that is detrimental to the health, welfare, and performance of the flock. Be aware that litter conditions on this flock have a carryover effect on litter conditions during the next flock. Also, good litter quality at the beginning of a flock must be maintained with management strategies throughout the flock. The only sure way to manage moisture levels and maintain the quality of built-up litter is to continuously increase the ventilation rate as a flock ages to compensate for the increasing amount of moisture added daily by the birds.

References

Donald, J., J. Campbell, G. Simpson, & K. Macklin. 2009. Ten steps to drier houses and good paw quality. National Poultry Technology Center Newsletter. No.62, Dec. Auburn Univ. Auburn. AL.

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Table 1. Ounces of water in 1,000 cubic feet of air at different temperatures and relative humidities.[1]

Relative humidity	Air temp: 30°F	Air temp: 40°F	Air temp: 50°F	Air temp: 60°F	Air temp: 70°F	Air temp: 80°F	Air temp: 90°F
10%	0.4	0.6	0.9	1.3	1.8	2.4	3.3
20%	0.9	1.3	1.8	2.6	3.5	4.9	6.6
30%	1.3	1.9	2.7	3.8	5.3	7.3	9.9
40%	1.7	2.5	3.6	5.1	7.1	9.7	13.2
50%	2.1	3.2	4.5	6.4	8.9	12.2	16.5
60%	2.6	3.8	5.4	7.7	10.7	14.6	19.8
70%	3.0	4.4	6.3	8.9	12.4	17.0	23.0
80%	3.4	5.0	7.2	10.2	14.2	19.5	26.3
90%	3.8	5.7	8.1	11.5	16.0	21.9	29.6
100%	4.3	6.3	9.0	12.8	17.8	24.3	32.9

[1]Chart adapted from Donald et al. (2009).

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By Tom Tabler, PhD, former Extension Professor, Poultry Science; **Jessica Wells**, Assistant Clinical/Extension Professor, Poultry Science; and Wei Zhai, PhD, former Assistant Professor, Poultry Science.

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