Department of Animal Science

LITTER MANAGEMENT KEY TO BROILER PERFORMANCE

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Litter management on a broiler farm operation is an ongoing process, and how litter is managed before, during and after a flock is key to performance, bird health and animal welfare. In today's "No Antibiotics Ever" (NAE) environment, good litter management both during and between flocks is critical for success. Litter conditions do not change overnight, and litter management is a continuous, time-consuming process that takes great effort on the part of the grower. Good litter management is a two-part process that requires reducing the amount of moisture that enters the litter and increasing the amount of moisture evaporation from the litter (Liang and Tabler, 2020).

Moisture and built-up litter

Wet litter in the poultry house has been a known problem for almost 100 years (Dann, 1923). Despite our best efforts, litter moisture concerns and wet litter conditions continue to plague the poultry industry even with a century of advancements in selective breeding, production practices, housing designs, feeding and drinking systems, and ventilation improvements (Dunlop and Stuetz, 2016). How much is too much moisture in broiler litter? Because of all the variability involved, there is likely no one single moisture value that is the trigger that initiates problems with wet litter, just as there is no one single source of moisture that creates wet litter. Collett (2012) suggested that 25 percent moisture is the limit above which cushioning, insulating and water holding capacity become compromised. Tabler et al. (2015) found the average moisture content of Mississippi broiler litter to be approximately 27 percent.

Photo: Tom Tabler

Reusing built-up litter for multiple flocks is a common practice throughout the US broiler industry. However, it comes with potential risks such as:

- High ammonia levels during the early brooding period.
- Moisture challenges that can lead to wet litter/poor flock welfare conditions.
- Increased energy (propane and electricity) use to maintain proper air quality.
- Possible pathogen carryover resulting in birds breaking with the same disease over and over.

Ammonia and other factors

Ammonia (NH_3) generation is a major issue when using built-up litter, particularly if the litter becomes wet. High NH_3 levels in broiler houses can be both a human and animal welfare concern and often results in flock health issues, poor bird performance, and a loss of income to the grower and the integrator. In today's antibiotic-free production landscape, reducing stress throughout the grow-out period is critical to achieving welfare standards and maintaining a low cost-per-pound at harvest time. Ammonia volatilization depends on four main factors: 1) house temperature, 2) litter pH, 3) litter moisture and 4) air movement. Moisture evaporation rate depends on litter moisture content and airflow/ventilation rate over the litter.

A variety of factors contribute to wet litter, including properties of the initial bedding material, condition of the litter (moisture content, friability), bird activity level, manure moisture content and deposition rates, ventilation program, and house environment (Dunlop, 2017). The amount of water added to the litter from manure deposition is huge. Dunlop et al. (2015) estimated the rate to be 1.5-3.2 L/m^2/day (0.04-0.08 gals/ft^2/day). Over the course of a flock, the total amount of water added to the litter is more than 100 L/m^2 (2.4 gals/ft^2). That's over 79,000 gallons in a 33,000 ft^2 house. Modern housing design and adequate ventilation can handle this amount if management practices are adequate. However, this highlights the necessity of proper evaporation and moisture removal by a well-managed ventilation program.

Moisture control

Grower management practices are largely responsible for moisture control in broiler litter. Practices of major importance include:

- Checking on water systems to prevent/repair leaks and constant ventilation monitoring.
- Adjusting drinker height and regulator pressure appropriately as birds grow.
- Increasing ventilation rate as the flock ages to meet moisture removal requirements.
- Ensuring uniform bird density throughout the house and properly using migration fences.
- Using circulation fans in the ceiling to break up temperature stratification and gently move airflow across the litter.
- Ensuring stormwater diversion away from the house and pad to prevent standing water from seeping into the pad and wicking up from the bottom into the litter inside the house.

Floor moisture from the pad or hardpan (if one is present) can be a factor in creating excess ammonia levels in the house. Maintain sufficient uniform litter depth (at least 3-4 inches) throughout the house. It will be difficult to maintain proper feeder and drinker height if the litter depth is uneven.

Moisture content is a major factor in litter quality, but not the only factor. Friability is also important, not only from a welfare standpoint, but apart from welfare considerations. Litter greater than about 25 percent moisture begins to lose friability as the litter particles start sticking together because the water acts as a natural binder. Ventilation rate is a critical factor in maintaining friability. Winter is always a difficult season for proper ventilation rates because growers often cut back on ventilation to lessen heating costs. However, this reduced ventilation rate often leads to wet litter, reduced welfare standards and increased ammonia levels.

Causes of wet litter

Products used as bedding materials should have good water holding capacities and quick drying times. However, without proper management, there are a host of factors that can overwhelm even the best bedding materials and lead to wet and caked litter (Dunlop, 2017):

- Normal drinker spillage.
- Excess drinker spillage (issues such as mismanagement, drinker height, regulator pressure).
- Stocking density.
- Moisture wicking up from the hardpan/pad.
- Season (winter and summer are often more challenging than spring and fall).
- High in-house humidity level.
- Increased water excretion (disease, water quality issues, increased water consumption).
- Litter moisture content/water holding capacity.
- Litter/bedding material properties.
- Insufficient ventilation.

Prevention of wet or caked litter requires that growers spend time in the chicken house, monitor litter conditions and continuously increase ventilation as the flock ages. It is less expensive to prevent wet litter from occurring than to try to address litter that has become wet and caked.

Odor

Odor itself is a complex mixture of odorous ingredients composed of volatile organic compounds (VOCs) and non-VOCs such as hydrogen sulfide, NH_3 and other compounds. Odor is a natural part of broiler production resulting from aerobic and anaerobic microbial activity in the litter (Pillai et al., 2012). However, wet litter tends to generate more odor than dry litter. Keeping litter dry can greatly reduce odor generation and lessen the chances for nuisance complaints. Litter is the primary source of odor from broiler houses. Broilers deposit moisture-laden organic matter (manure) onto the litter surface and then gradually mix it into the litter. Some of the generated odors are from nutrients in the manure, while others are from the manure itself. Microbial decomposition processes fuel the release of odors. The rate of microbial growth and diversity helps determine odor release, and this growth and diversity is influenced by multiple factors, including original bedding material, pH, litter temperature, stocking density and litter moisture.

Litter management is key to successful broiler production. Moisture and odor are two of the greatest challenges that broiler growers face daily. These challenges continue to grow in significance as growers and integrators face increasing pushback from neighbors and communities that would rather see poultry farms somewhere else. A growing concern is how we

will feed the estimated 10 billion people on the planet by 2050 with a "not-in-my-backyard" mindset related to agricultural operations and livestock farming that we see in many locations today.

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