INFO SHEET

Managing Moisture in the Brooder House

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Wet litter can be one of the most costly environmental conditions that can occur in a turkey barn, both from a financial and bird comfort/animal welfare standpoint. Increased litter moisture negatively impacts air quality and can provide favorable conditions for pathogenic microorganisms to grow. Both of these impact bird health as they reduce feed intake and birds begin to eat litter. The resulting low-grade enteritis also adds to the increase litter moisture pushing it to an unacceptable level. Poor environment and litter conditions invariably exacerbate one another – birds remain "loose", litter moisture continues to rise, which stresses the birds, reduces their resistance and increases the severity of the enteric problems.The end results can include poor feed conversion and weight gain, flock unevenness, poor carcass quality (including breast blisters and buttons), footpad dermatitis, enteritis and respiratory issues. In addition to the performance issues mentioned, there is also a higher energy cost related to reducing the environmental impact.

As managers, we need to understand why this is occurring in order to determine which environmental management techniques would be most appropriate to "halt this vicious cycle from spiraling out of control. This article will address some of the key management factors to control environmental conditions, including understanding the digestive process, ventilation (air flow and heat) and litter management.

Effects of ventilation on barn environment and litter conditions

Cold weather ventilation is most critical in controlling litter condition and barn environment. Typically, ventilation rates are reduced or sacrificed to maintain adequate temperatures to keep birds comfortable. As energy prices increase, the fuel used to keep birds comfortable becomes more critical. This fuel is not limited to the propane typically used in North America, but also includes the feed energy that birds consume. The thermal neutral zone for adult turkeys is between 13°C and 24°C (55°F and 75°F). Therefore, when the effective temperature (what the bird feels) is above or below this temperature, feed energy is used to maintain metabolic function rather than body weight. For young turkeys, this zone is more critical and the minimum temperature is increased. Not only is whole barn temperature critical in cold weather, but temperature uniformity from end to end and side to side within the barn can mean the difference between birds eating for body weight gain or eating and huddling for survival. Therefore, it is critical to maintain proper air flow and temperature throughout the barn during the entire growing cycle.

When it comes to ventilating turkey barns during cold weather, 95% of the time we are primarily trying to manage barn/litter moisture levels. It is well understood that as litter moisture increases so do the levels of a) ammonia which damages the respiratory tract, b) bacteria such as salmonella and c) leg issues due to footpad dermatitis.

In general, for every 0.45kg (1 lb) of feed intake, a bird will drink approximately 0.91kg (2 lbs) of water. Water is added into the environment through bird respiration and fecal output plus heating.

At 2 weeks of age, 47 litres of water are produced per 1,000 male turkeys and dumped into the barn.

At 4 weeks of age, this increases to 188 litres per day and by 6 weeks of age 300 litres per day.

An additional 10 to 18 litres per 1,000 birds is added daily during brooding as a byproduct of propane heating. Most of this moisture must be removed from the barn in order to maintain litter quality and acceptable humidity levels. This is achieved by replacing the warm damp air in the barn with cold dry air from outside the barn, without chilling the birds and wasting fuel.

One of the most efficient methods for removing moisture in poultry barns is through negative pressure/minimum ventilation. Exhaust fans and inlets are designed to create a negative pressure in the barn, allowing the moisture to be removed (controlled), while at the same time conserving fuel and using the heat produced by the birds and artificial heat to maximum capacity. Proper minimum ventilation starts with a tight barn with little air leak, so that all air enters the barn through the designed inlets. When this occurs and the correct static pressure (Pascals) can be achieved, then the cold air can mix with the warm moist air concentrated at the ceiling .Remember : warm air from birds and heaters will concentrate at the ceiling as warm air rises and cold air falls.

Shown here is the use of a smoke generator to evaluate air flow; which in this case is poor. You can see cold air dropping directly onto the floor. Proper minimum ventilation allows for mixing of cold air with warm moist air.

This accomplishes two goals.

First, the cold air does not drop directly on the floor resulting in

a) birds that are chilled which leads to huddling, missed meals and subsequent binge eating

b) condensation on the floor from the cold air, and

c) reduction of the amount of heat required to warm the incoming cold air.

Second, the warm air at the ceiling tempers the incoming cold air, expanding this air, allowing it to increase its water holding capacity. When air is warmed by 11°C, the water holding capacity of the same air volume doubles. So when 1000 m^3 of air holding approximately 6 L of water is warmed from 5°C to 16°C, the same 1000 m^3 of air can hold 12 L of water. When air is preheated and expanded to be able to carry moisture, it can then mix with the air near the floor, picking up moisture and removing it through the negative pressure fans. After birds are old enough to produce a significant amount of moisture, humidity levels should be maintained to 60% or less.

The litter on the floor acts like a sponge. If ventilation rate and direction of air movement is not adequate to remove the additional moisture added daily, the sponge gets full.

This process may take days and can go unnoticed. Once the sponge is full, either though poor digestion, enteritis, poor drinker management, or poor ventilation techniques, the litter is saturated and then cakes. We then see high ammonia condition related to poor air quality, litter burns on footpads, and high humidity levels. Before this occurs, humidity levels can be monitored and maintained to less than 60%, in most cases, and will alert managers when minimum ventilation rates are insufficient to remove excess moisture. There are tables available to be used as a guideline for minimum ventilation capacities, based on bird age, water consumption, and indoor and outdoor temperature and humidity levels (www.poultryventilation.com or www.poultryhouse.com). During warm weather, ventilation to remove moisture is not a problem as temperature is the major concern and ventilation rates are high. Litter can be caked due to enteric issues at this time.

Managing additional gases

In addition to controlling humidity in turkey barns, Carbon Dioxide (CO2) and Carbon Monoxide (CO) can have profound effects on bird performance, if they are not controlled. According to research by Frame (2010), CO levels above 25 ppm and CO2 levels above 2,500 ppm have been proven to increase roundheart and reduce thyroid activity in young turkeys. Christensen et al (1995), showed that CO2 levels above 4,000 ppm resulted in altered metabolism, depleted glycogen reserves, and lower blood glucose levels. Lower metabolism negatively impacts feed and water consumption resulting in poor gut health and performance over time. Therefore, it is critical to monitor and maintain CO levels to less than 25 ppm and CO2 to less than 2,500 ppm.

Brooder house negative pressure minimum ventilation set-up

1. Tight test the house

- Close curtains and/or inlets
- Make sure all holes are closed around walls, end doors, etc.
- Turn minimum fans on. This would equal as close to 1.0 cfm per square foot (18 cmh/m^2) as possible.
- Static pressure (SP) should be .15-.20" SP (34-50 Pa) if house is tight.

2. Now begin to open inlets. Keep in mind the minimum inlet opening should be approximately 2-3" (5-8 cm) wide (anything smaller will choke the inlet and not allow air to 'throw' correctly).
   - Approximate total inlet opening should be near 80-85 sq in per 1,000 cfm (515-550 cm^2 per 1700 cmh fan capacity).
   - Open inlets until the SP is .10-.12" (25-30 Pa) for 50' (15 m) or wider and .08-.10" (20-25 Pa) for less than 50' (15 m)wide. This will be the minimum number of inlets to be used with the minimum fans.
   - The minimum fans will be on timer and the first fans to come on simultaneously by thermostat if the house temperature warms.
3. Minimum timer setting will be enough to maintain humidity to less than 60% or Carbon Dioxide (CO2) levels to less than 2,500 ppm (preferable less than 1,800 ppm within the first 5 days of brooding). Typically, one half minute per week of age on a five minute cycle timer (one minute for a ten minute cycle timer) is sufficient. However, depending on brooder type, temperature and barn tightness, this may not be enough air volume to control the humidity and CO2 parameters mentioned above. If this is the case, then increase the cycle time in 15 second intervals until air quality parameters improve.
4. Set the thermostat to the minimum fans 1°C (2°F) above the target temperature. Any minimum fans should be tied together on a thermostat to keep SP constant.
5. Additional thermostat fans will be set 0.5°C (1°F) above the minimum fan settings to come on as the house warms. For houses with auto inlets, the inlets will open automatically based on increased SP with more fans. For houses with manual inlets, they will have to be opened manually or the curtain lowered manually to reduce SP as more fans come on thermostat.
6. Timer fans – additional timer fans may need to be added as birds get older. This should be done only when the minimum fans have reached 4 out of 5 minute cycle. Additional inlets may need to be opened to compensate for increased SP with more fans.

Conclusions

Environmental management of commercial turkeys is certainly a topic that encompasses volumes of information. Turkey production managers need to be able to recognize these issues. Ventilation, litter condition, and drinker management are daily tasks that we can control as farm managers. In cold weather, it is critical to maintain humidity levels to less than 60% in order to keep environmental and litter moisture in check. At the same time, if minimum/ negative pressure ventilation is done correctly, we can reduce energy use, keep litter dry, and improve air quality. Litter and drinker management can assist keeping litter dry and cake free. Managers must monitor and ensure that ventilation and air quality are consistently good to produce ideal litter quality and stimulate feed intake and good gut health. As turkeys continue to become more efficient and heavier, maintaining dry litter will be increasingly important to improve bird health, maintain good carcass quality, and provide an optimum environment for both performance and turkey well-being.

For more information please feel free to contact Hybrid turkeys at **hybrid.sales@hendrix-genetics.com**

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