

# Department of Animal Science

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## Changing Seasons: Cooler Fall Temperatures Challenge Poultry Growers' Management Skills

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As scorching summer temperatures at last give way to the cyclic up-and-down climate rhythm of early fall and the soon-to-follow cold days and even colder nights of winter, the cooler temperatures associated with changing seasons always challenge the ventilation management skills of even the best Tennessee poultry producers. Wide cyclic temperature swings mean growers must stay alert to rapidly changing weather conditions as the seasons transition to fall and then winter as the year begins to wind down. Heat stress is behind us until next summer, but when outside temperatures drop and gas prices increase, maintaining the desired inside house temperature and ventilating to meet litter and air quality needs can be a difficult task to accomplish. We can ventilate less in cooler weather once the heat of summer is gone but we can't stop ventilating altogether. We have three ventilation options (minimum ventilation, transitional ventilation and tunnel ventilation) to choose from; we do not have a zero ventilation option. Ventilation is necessary (even in bitterly cold weather) to remove moisture from the house and provide the environmental conditions (humidity between 50 and 70 percent; litter moisture between 20 and 25 percent) needed for birds to thrive. Adequate ventilation is often a balancing act between increased gas use and growing birds too cool. While managing the gas bill is important, growing birds too cool will prove disastrous to flock performance by forcing birds to consume excess feed to maintain body temperature. Feed used for body maintenance cannot be used for growth, is detrimental to feed conversion and, in the end, the settlement check.

## Stable Environment Is Critical

A broiler chicken has the potential for its most rapid growth rate during the first few days of life (Fig. 1). At this time, the chick is small and requires very little feed energy for body maintenance, allowing most of the feed energy to go for growth, more so than at any other time during the grow-out period. Missed opportunities and management mistakes (such as growing chicks too cool or failure to provide adequate ventilation) during the early days of the flock cannot be compensated for later and will haunt you throughout the remainder of the flock.



*Figure 1. Broiler growth is most efficient when birds are small and maintenance energy needs are at their least.*

Growers must maintain a stable house environment (temperature, humidity, litter quality) to achieve optimal bird performance. Genetic improvements over the past few decades have produced a bird that performs quite well under the right conditions. However, if conditions aren't right, performance will suffer. This highlights the importance of constant in-house environmental management for today's fine-tuned genetic broiler chickens. Consequently, if ventilation and temperature are not ideal for any part of the day, the potential for optimum growth for that part of the day is lost and can never be compensated for (Blakely and Simpson, 2007). Perhaps that wasn't the case years ago when birds grew slower and took longer to reach a specific target weight. Today, however, broiler production is more of a sprint than a marathon. There just isn't enough time during the flock to make up or compensate for lost performance.

Maintaining the constant in-house environment needed for peak performance depends in large part on the proper management of the ventilation system. Optimizing the ventilation program to provide good air quality, the proper temperature, low dust and ammonia levels, correct humidity and dry litter is critical for today's broilers to reach their genetic potential. Most poultry houses today have modern technologies such as controllers and safety backup systems (Fig. 2) that prevent large fluctuations in daily temperatures. However, growers must have the correct program loaded in the controller for the technology to manage the house environment appropriately. **Controllers can only do what they are programmed to do.** Growers must program and manage the controller and adjust the emergency backups regularly for the system to perform correctly. Proper management will allow the house to transition smoothly through large outside temperature fluctuations that often occur in the fall and again in the spring.



*Figure 2. Controllers are critical tools for modern poultry production.*

As outside temperatures cool in the early fall, growers may face a minimum ventilation situation at night with near-market-age birds where ammonia buildup may be a concern, and 12 hours later be in tunnel ventilation mode as summer tries to hang on just a little longer. Such wide

outside temperature variations can make house environmental management challenging. However, fall and spring offer some of the best chicken growing weather conditions if growers know how to take advantage of it. During the fall, the worst of summer's heat has passed, and the high fuel bills of winter are still well off down the trail. In the spring, high fuel bills and the cold, dark days of winter are behind us, and the blazing heat of July and August is still months off in the distance. If we take advantage of what Mother Nature provides, fall and spring offer the potential for maximum flock performance at minimum costs (Donald et al., 1999).

Precision Livestock Farming (PLF) technologies are positioned to play an increasing role in poultry production in the future. However, technology is only as good as the person managing it. When programmed correctly, house controllers can transition the house smoothly from minimum to transitional to tunnel ventilation and back again as needed, with minimal stress on the birds. In the end, however, it is the chickens that determine their comfort level and tell the grower whether conditions are adequate or not. For that to happen, growers must be in the chicken house and paying attention to the chickens. **CONTROLLERS CANNOT GROW CHICKENS!** It takes an alert and observant grower spending time in the chicken house and watching the chickens to make the necessary management adjustments in a timely manner to maintain the optimum environment the birds need to perform at their best. Maintaining the correct in-house environment throughout the life of a flock is a lofty goal, but a doable one if growers stay on top of things.

### Bird Comfort

The comfort range of broilers is very narrow (only a few degrees) and changes a little each day as the flock ages. This is why the controller *slowly* ramps house temperature down and minimum ventilation rate up a little each day. Chickens do not like big or quick changes in temperature. Avoiding large fluctuations in house temperature is important to bird health, comfort and performance. Birds will divert feed energy from growth to maintenance if they are unhappy with the house temperature, costing the grower money when the flock goes to market. Birds will use additional feed energy to stay warm and maintain body temperature if they are cold (which reduces the growth rate, increases the feed conversion ratio, and decreases the settlement check) and for evaporative respiration (panting) to assist with cooling if they are hot. Panting is work for the bird and requires additional feed energy for body maintenance, reducing the feed energy available for growth, which drives up the feed conversion ratio and decreases the settlement check. Gas may be expensive, but using feed energy to keep chickens warm is even more expensive.



*Figure 3. Bird comfort is critical for the flock to reach its genetic potential.*

The ideal house temperature for a broiler chicken changes daily from placement to harvest. Modern poultry house controllers are designed for this, however, and will automatically adjust the set point temperature and minimum ventilation rate each day, provided the controller has been programmed correctly. Therefore, the proper temperature and minimum ventilation

parameters must be programmed into the controller for it to function accurately. If a controller is accidentally programmed with temperature settings that are 5 F cooler than recommended, it will grow the flock 5 F cooler than recommended, which will likely be detrimental in terms of bird health, feed conversion ratio and flock performance. Growers should verify that their integrator's recommended control program is installed correctly in their controllers. If in doubt, **ask your service technician to verify the program setup in the controller.**

To maintain bird comfort, the controller and ventilation system manages the house conditions through set points; brooders; min vent, tunnel, and stir fans; vent doors; cool cells; tunnel inlets; etc. Improper ventilation (too little or too much) has detrimental effects at any time during the flock. Ventilating too little may result in poor air quality (high ammonia, carbon dioxide and humidity levels) and wet litter conditions, leading to health, animal welfare, and flock performance issues. Ventilating too much may lead to drafty conditions and dusty litter, in addition to excessive fuel use and high gas bills. Keep in mind that the temperature you feel walking through the house will likely not be the same temperature that the birds feel down on the floor. Warm air rises and cold air falls, so what the birds feel may be colder than what you feel. Also recognize that the temperature the bird "feels" is more important than actual air temperature. This is especially true for younger birds that may not be fully feathered. Air movement over the birds creates a wind-chill effect; this is what makes tunnel ventilation so valuable to older birds in hot weather. However, too much wind-chill (especially on younger birds) can cause cold stress and discomfort (Donald, 1999). Maintaining the proper in-house environment as the seasons transition is a balancing act between heat use and air flow (Figure 4).



**Figure 4a-d.** Managing the transition to fall weather requires both heat and air flow to keep birds in their comfort zone.

Exercise caution running in tunnel ventilation mode with younger birds as temperatures cool heading into fall and winter. Generally, cooler air has a greater wind-chill effect than warmer air. This makes it important to use minimum and transitional ventilation as long as possible before switching to tunnel ventilation. Tunnel ventilation is designed for older birds in hot weather when maximum cooling and air movement are required. However, for much of fall, winter, and spring weather conditions, maximum air flow is not necessary, making minimum or transitional ventilation better options. Minimum ventilation brings in only limited amounts of fresh air up high on the sidewall or at ceiling level (not directly on the birds) to prevent a wind-chill effect on younger birds. Aviagen (2010) offers the following key points associated with minimum ventilation:

- The purpose of minimum ventilation is to bring in just enough fresh air to exhaust excess moisture and ammonia in cold weather or during brooding.

- All minimum ventilation setups bring outside air in high up in the house to avoid putting cold air directly on the birds.
- To get the airflow pattern needed in minimum ventilation, the number of air inlets must be matched to the fan capacity being used.
- Using cool-weather adjustable air inlets actuated by a static pressure controller gives the best minimum ventilation air flow.
- **Minimum ventilation is timer-controlled, not temperature-controlled.**

In between minimum and tunnel ventilation is transitional ventilation, which carries much of the ventilation load as seasons transition in the fall and again in the spring. Transitional ventilation is basically the switchover from timer-driven to temperature-driven ventilation (Aviagen, 2010). Transitional ventilation uses static pressure-controlled air inlets (vent doors) and a portion of the large tunnel exhaust fans to remove excess heat and bring in additional cool air without putting a draft directly on the birds. In transitional ventilation mode, it is possible to remove as much heat as being in tunnel mode, while running roughly half the tunnel fans (Donald, 1999). In addition, the birds are not chilled because outside air is coming through the vent doors high up on the sidewall or in the ceiling instead of through the tunnel inlets and is not being directed over the birds. Aviagen (2010) has listed key points to transitional ventilation:

- Transitional ventilation is temperature driven and removes heat when needed without putting cold air directly onto birds.
- When the need for heat removal requires a higher air exchange rate than minimum ventilation setup can handle, a portion of the tunnel fans can be used to bring in large amounts of air through sidewall or ceiling inlets.
- As with minimum ventilation, the transitional ventilation inlet area should be matched to fan capacity, and inlet opening adjustments should be made by an automatic static pressure-operated controller.

## Nighttime Ammonia and Humidity

Ammonia buildup will likely not be an issue during the day throughout the fall as the days will still be warm, and there will be plenty of air flow through the house. However, it could be an issue at night when temperatures cool down and the house transitions back to minimum ventilation. High ammonia concentrations in the house at night can result in bird welfare concerns, poor feed conversions, reduced weight gains, increased respiratory problems, and possibly blind chickens. High ammonia levels also can affect the health and welfare of growers and other poultry house workers.

Ammonia production is difficult to predict because of the numerous factors involved, including management practices during and between flocks, litter pH, season, age and depth of litter, diet composition, etc. Only by closely monitoring the chicken house environment and making timely adjustments to the ventilation rate can ammonia concentrations be kept at acceptable levels (<20-25 ppm). Standard minimum ventilation rates for moisture removal only apply if ammonia levels are under control. Otherwise, ammonia overrides moisture removal and growers must over-ventilate for ammonia removal, likely leading to greater fuel use and increased production costs. This makes it important to keep the litter dry and reduce ammonia production to a minimum. Be especially aware of house conditions during your last check at night and first check early in the

morning. Increased ammonia and high humidity levels first thing in the morning may indicate that additional run time is needed on minimum ventilation settings during nighttime hours.

Humidity levels also must be kept in check to prevent wet and caked litter or dusty air conditions. Relative humidity in the 55-65 percent range is best. Humidity levels of 50 percent or less lead to excessively dry litter and high dust levels in the house, while levels of 70 percent or greater result in wet and caked litter. Growers often want to reduce the ventilation rate when outside conditions are cold and damp, but this is usually the wrong thing to do.

While it is true that ventilating during damp outside conditions does bring in some moisture, it usually removes, by way of the minimum ventilation exhaust fans, more moisture than is brought in. Therefore, the end result is an overall reduction of moisture level inside the house. Cold air cannot hold as much moisture as warm air. For example, 40 F air at 50 percent humidity will hold about 3 ounces of water for every 1,000 cubic feet of air. However, 90 F air at 60 percent humidity (typical brooding conditions) will hold about 20 ounces of water per 1,000 cubic feet of air (Donald et al., 2009). Therefore, for every 1,000 cubic feet of air exchange at these conditions, 3 ounces of water are brought in, but 20 ounces of water are exhausted out, resulting in a net reduction of 17 ounces of water per 1,000 cubic feet of air exchange.

### Summary

With fall on the horizon and winter not far behind, poultry growers must prepare for cooler temperatures and wide outside temperature swings. Large, cyclic fluctuations in temperatures present unique challenges to raising broilers as we transition into fall. Excess heat removal may still be required on warm afternoons, while minimum ventilation and perhaps even a small amount of supplemental heat may be required on chilly evenings and overnight. Wide temperature fluctuations require growers to be more vigilant when managing the in-house environment, especially regarding humidity and ammonia levels. Most integrators provide growers with minimum ventilation guidelines for controlling humidity and litter conditions throughout the flock. However, growers may need to increase minimum ventilation rates to manage ammonia levels if excess ammonia becomes an issue.

Temperature, humidity and ammonia levels are the most important air quality variables to control in a poultry house. Moisture removal is important, but ammonia overrides humidity, especially if levels increase to >20-25 ppm. It is tempting to reduce ventilation rates to save fuel in cold weather. However, **wet litter and blind chickens are not an option!** Flock comfort is vital as we transition into the cooler seasons of the year. Proper management of the ventilation (minimum, transitional and tunnel) and heating systems during cyclic weather conditions ensures the stable, consistent in-house environment the flock needs to perform at its best.

PLF and other technological advancements in poultry production have increased greatly in recent years. However, as we transition back into the cooler periods of the year, failure to properly manage the minimum ventilation system is a train wreck on the horizon. Air and litter quality are both dependent on your minimum ventilation program doing its job. Bird health, performance and paw quality all depend on in-house air and litter quality. Properly working equipment is a must, but in the end it's the grower who maintains the equipment and manages the ventilation program. Growers must grow the chickens, and control programs, technology and equipment are just useful tools.

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