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Heat Stress and Nighttime Ventilation

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During the summer months a significant amount of time and money is spent trying to keep birds comfortable. Traditionally, most effort has been concentrated during the hours when mortality usually occurs, namely the late afternoon and early evening. In most poultry houses it is not uncommon by mid-afternoon for all circulation fans to be on, the fogging system to be running, the feed system to be cut off, and the producer to be walking slowly through the house encouraging the birds to get up and get a drink of water.

Though combatting heat stress during the daylight hours is crucial, there is another time of the day that is just as, if not more, important - nighttime. A number of studies have shown that a bird's ability to cope with hot weather is largely determined by how cool it gets at night. In fact, studies have found that poultry can tolerate air temperatures up to 104°F without increased mortality, provided that it is at least 30°F cooler at night than during the day. As you might expect, if mortality is affected by daytime-to-nighttime temperature differences, so are bird weight and feed conversion. One study in particular found that birds exposed to a daytime high of 95°F and a nighttime low of 70°F had 1/4 lb. better weight and a 2 point better feed conversion than those exposed to a nighttime low of only 80°F.

Why is nighttime temperature so important? To answer this question it is necessary to examine what causes a bird to become heat stressed. When a bird digests feed, heat is produced, much as a car engine produces heat when fuel is consumed. Some of the heat is used to maintain the bird's proper body temperature. The rest is not needed; it's a waste product. The bird is constantly trying to rid itself of this excess heat. During cold weather, getting rid of excess heat does not present much of a problem because the air surrounding the bird is much cooler than the bird's body temperature. But, as house air temperature increases, it becomes more and more difficult. As temperatures continue to rise, the bird will actively remove heat from it's body by panting. A bird will also spread out its wings in an effort to increase heat loss from its body and wing surfaces. If a bird cannot rid itself of the excess heat, the bird will eventually die.

The interesting thing about birds is it seems like they have some ability to "store" excess heat. Let's say it's a hot day, house temperature rises and the bird becomes heat stressed. Despite all the bird's efforts it is not able to rid itself of all the heat that is being produced within its body. As the day progresses, heat begins to slowly build-up within the bird. This build-up of heat is reflected in the fact that the bird's body will increase a degree or two

during periods of heat stress. When evening comes, house air temperature begins to fall. The cooler air enables the bird to more easily rid itself of excess heat. The bird becomes more comfortable and begins to eat. The next morning the cycle begins again.

But, what happens if it is not cool enough at night? The bird may not lose all the surplus heat it stored. The next day is begun with a surplus of heat. As the day progresses more and more heat is added. Since the bird already has some excess heat stored, it obviously cannot store as much that next day. By the next evening the bird basically becomes "overfilled" with heat and dies. This, of course, is a worst case scenario. In many cases, the bird doesn't get rid of the excess heat early enough in the evening to encourage eating, and therefore weight gain is decreased.

So it appears the goal should be to make the house 25 to 30 degrees cooler at night than it was during the day. The problem facing poultry producers, however, is that in the Southeastern United States there is usually only a 20 degree temperature swing from night to day during hot weather. To make things worse, at night air temperature in a poultry house is usually 5 degrees or more above outside temperature. Thus, it may be only 10 to 15 degrees cooler at night than it was during the day in a poultry house.

What is a producer to do? Evaporative cooling systems (pads or foggers) are not the answer because the humidity at night is near 100 percent. No additional water can be evaporated, and therefore, no cooling can take place. The one tool a producer has to help out is air movement. By continuing to move air over and around the birds at night, excess heat can be removed from the birds' bodies. Studies have shown that air movement alone can make birds feel as if it is 10 to 15 F below what the thermometer reads.

In traditional, curtain-sided houses, continuing air movement at night means circulation fans should be kept on well into the night. Traditional circulation fan thermostat settings of 80°F to 85°F may not be sufficient for older birds. After all, if it gets to 95°F during the day and only down to 80°F to 85°F during the night, that is only a 10°F to 15°F temperature difference (when the fans shut off). During periods of heat stress, it would be advisable to set circulation fan thermostats somewhere between 70°F to 75°F. This might well mean that the fans will run 24 hours a day. But, during the last week of production this may be what is required to insure maximum production efficiency.

A study was conducted at North Carolina State University on this very subject. In side-by-side curtain-sided broiler houses, circulation fans were set at either 80°F or 70°F. The main difference in operation was that fans in the house where the thermostats were set at 70°F ran almost continuously at night. Though more electricity was used, both weight gain and feed conversion were improved (15 and 2 points respectively) in the house with the lower fan thermostat settings.

Last summer, studies conducted by Extension Engineers and Poultry Scientists at the University of Georgia found that even though tunnel-ventilated houses are relatively cool during the day, birds lose almost twice as much heat during the night as they do during the day (provided enough exhaust fans are operating). This increased heat loss at night is probably responsible for a large part of the improved weight gain and feed conversions found in these types of houses.

To insure that the birds remain cool, a minimum of four to five 48" fans should run at night during periods of heat stress. This may increase electricity usage but if birds are not cooled off at night, the gains in bird weights and feed conversion won during the day will be lost at night.

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