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Poultry Housing Tips

Are you cooling your birds at night?

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Though tunnel ventilation is the most effective method of keeping birds cool during hot weather, there will be those afternoons, that even with all your tunnel fans and evaporative cooling pads operating at peak efficiency, your birds will show signs of heat stress. This does not necessarily mean that bird performance will suffer. The fact of the matter is that how well birds cope with heat stress situations in tunnel-ventilated houses depends heavily not on the actions you take during the day, but those you take the following evening.

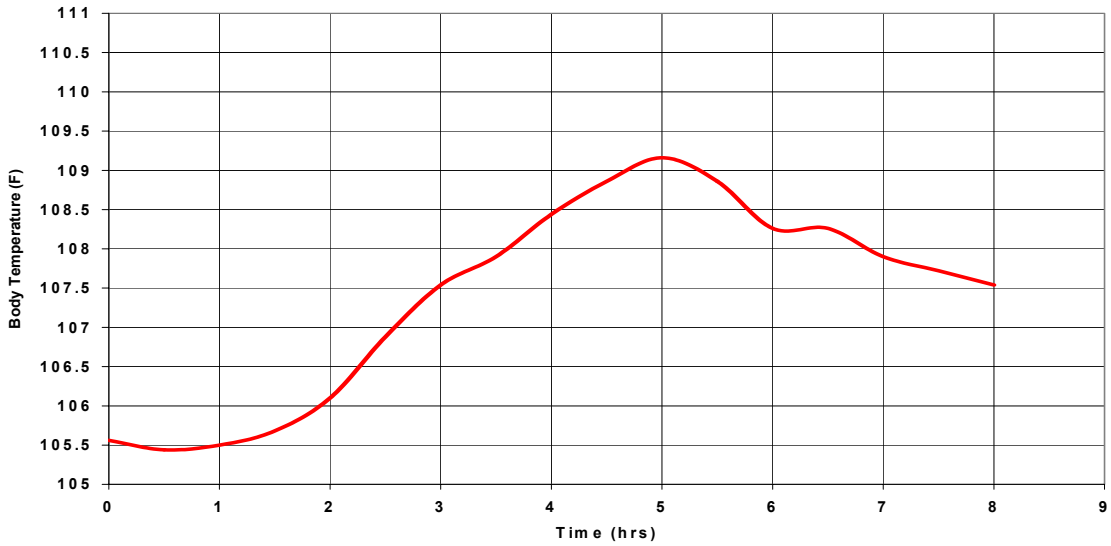

Figure 1. Bird body temperature in warm room with and without 100 ft/min wind speed

Panting, a bird spreading its wings away from its body, and excessive water consumption are indications that a bird has an elevated body temperature. Elevated body temperatures lead to reduced feed consumption as birds try to reduce the production of internal heat caused by the digestion of feed. Reduced feed consumption of course leads to reduced weight gains. The quicker you can bring a heat stressed bird's body temperature back to normal, the quicker it will get back on feed and the more likely performance will not suffer.

As you probably suspect, a bird's body temperature does not automatically go down as soon as the sun goes down. It takes time. How much time depends on air temperature, humidity, and most importantly air movement. As you

might expect, the higher the nighttime temperature and humidity, the greater amount of air movement required and the longer it takes. Considering the fact that during the heat of summer temperatures at night are often in the high seventies and the relative humidity is near 100%, cooling birds can easily require all the tunnel fans to operate all night long.

Figure 1 is from a study on wind speed effects on body temperature of heat-stressed birds. A single bird was placed in a room where the air temperature was in the mid-eighties and there was no air movement. Over the course of five hours the bird's body temperature rose indicating the bird was unable to get rid of all the heat it was producing. Five hours into the study a fan was turned on providing approximately 100 ft/min wind speed over the bird. As the air moved over the bird's body, heat was pulled from the bird, slowly lowering its temperature.

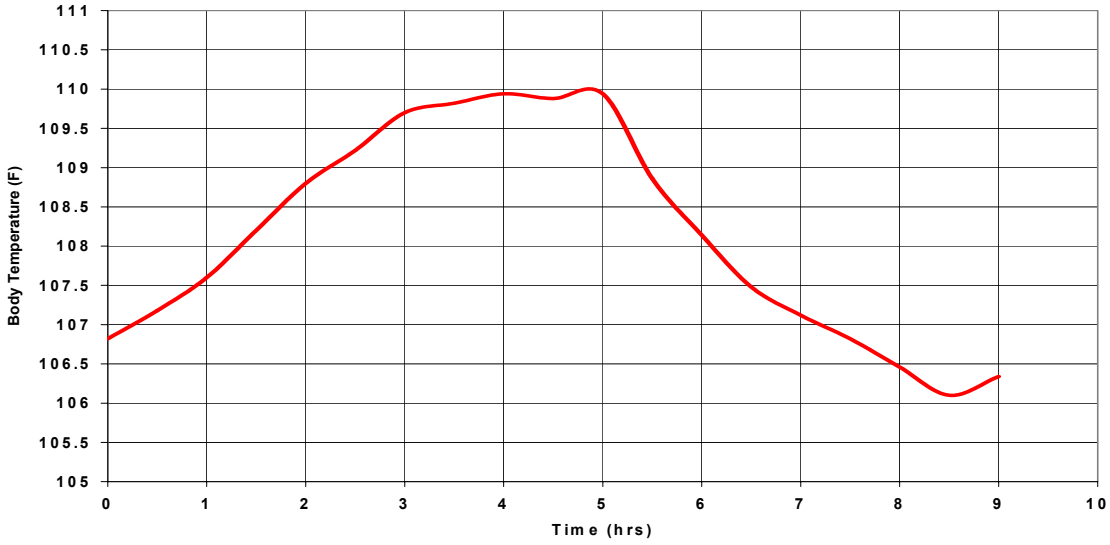

Figure 2. Quickly decreasing bird body temperature with 400 ft/min wind speed blowing over it.

Figure 2 illustrates how increasing the air speed to 400 ft/min dramatically increases bird cooling. Whereas, 100 ft/min wind speed decreased the heat-stressed bird's temperature approximately 0.3 degrees per hour, 400 ft/min wind speed decreased body temperature over 0.7 degrees per hour. From this study it can be deduced that with 100 ft/min wind speed it would take approximately 10 hours to bring a mildly heat-stressed bird's body temperature (110°F) down to normal levels (104 to 106°F) where a bird would begin to eat again, while if the air speed were 400 ft/min it would take a little over three hours.

It is important to note that these studies were done in a laboratory with an individual bird. Had this study been done in an actual poultry house, where air movement at floor level is reduced and bird crowding is likely to be an issue, cooling rates would have been decreased significantly. As a result, even in a house with 400 ft/min wind speed it could easily take over an hour to drop a bird's body temperature a half a degree. At this cooling rate it could take over eight hours to bring a mildly heat-stressed bird's body temperature back to normal.

As indicated in the above study, to insure proper nighttime cooling of older birds it is crucial that environmental controllers/thermostats are set so that tunnel fans run long enough into the night that bird body temperatures are brought down to normal. The sad fact is that on many farms producers are not only not taking advantage of nighttime cooling, but due to improper environmental controller settings, the birds are actually made warmer at night than they were during the day.

Figure 3 is a good illustration of how conditions can be worse at night than they were during the day. On the afternoon of July 26th outside temperatures were in the nineties. There were nine 48" cone fans operating during the day pulling air through a 6" pad system. The average air speed was a little over 500 ft/min producing a wind chill effect of approximately ten degrees. The house temperature ranged between 78°F at the pad end of the house and 82°F at the tunnel fan end. The combination of the 500 ft/min wind speed and relatively low air temperatures produced effective air temperatures in the low seventies throughout the house.

At night the picture was quite different. Over the course of the night the number of tunnel fans operating decreased from nine to five fans. As the number of fans operating decreased, the temperature difference between the pad and fan ends of the house increased from four degrees to nearly ten degrees. Since the number of fans operating decreased, so did the wind speed and therefore wind chill. Whereas there was around a ten-degree wind chill effect during the day, the 300 ft/min air speed at night produced only a four-degree cooling effect. Last but not least, inside relative humidity increased to above 90 percent in response to increasing outside relative humidity, further decreasing the birds' ability to cool themselves.

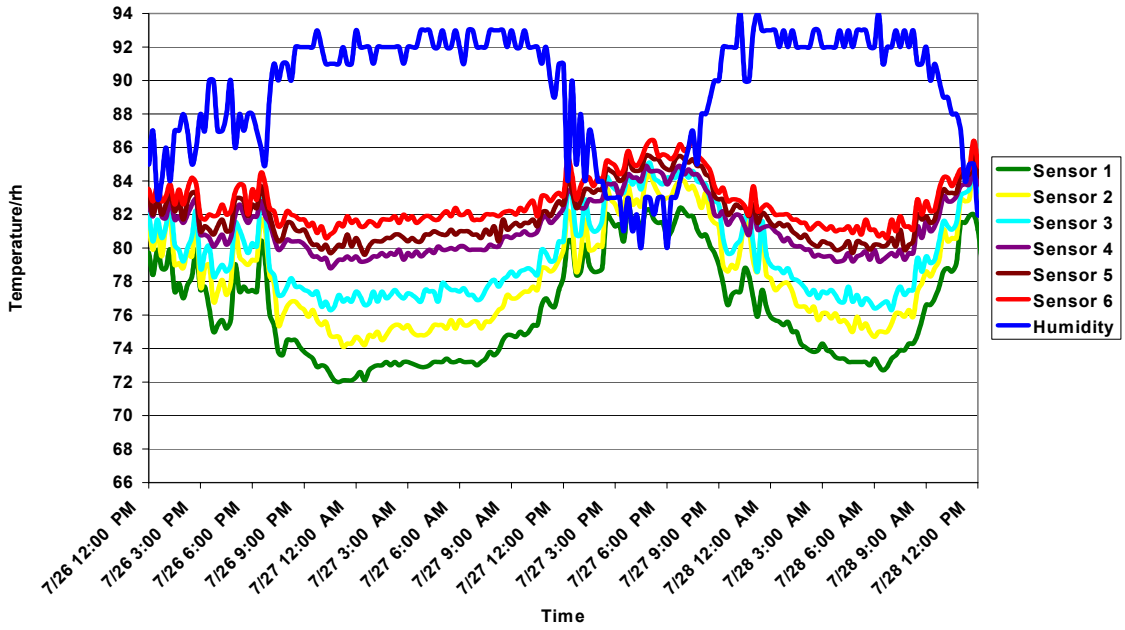

Figure 3. Air temperature and relative humidity in 500' tunnel-ventilated broiler house (six-week-old birds)

For birds at the tunnel inlet end of the house, the decreased number of fans did not present any significant problems. An air temperature in the low seventies with a few degrees wind chill created nearly ideal conditions. But what about the rest of the birds in the house? A good argument could be made that the birds in the rear half of the house were hotter at night than they were during the day. Whereas the air temperature at the pad end of the house was almost eight degrees cooler at night, on the tunnel fan end of the house it was at most two degrees cooler than it was during the day. But keep in mind that since the air speed at night was only around 300 ft/min there was six degrees less wind chill than there was during the day. So, even though a thermometer would indicate that the birds were two degrees cooler, in fact the effective temperature (the temperature the birds feel like it is) was four degrees warmer at night than it was during the day due to the reduced wind chill effect. Add to this the fact that the relative humidity was higher at night than it was during the day, and a couple of more degrees could have been added to the effective temperature. The net result of all of this is that the effective air temperature at night was probably six degrees higher than it was during the day for the birds at the tunnel fan end of the house.

To avoid this potentially harmful situation, as well as to provide maximum cooling of birds that have been heat stressed during the day, it is crucial that environmental controllers/thermostats are set with the nighttime environment in mind. The following are a few ideas on how to insure that older birds are receiving the cooling they require at night as well as during the day.

1) Make sure that tunnel fans operate off temperature sensors/thermostats located within 100' of the tunnel fans. Since the air heats up as it moves toward the tunnel fans this will insure that the tunnel fans are operating based on the birds in the hottest area of the house (Figure 4).

2) With older birds make sure that all your tunnel fans are set to operate at most ten degrees above your desired temperature. To maximize nighttime bird cooling this can be decreased to as little as seven degrees (Figure 4).

Temperature	On Temp	48" Fans	Sensors
Inlets	70°F	-	-
	71°F	2	1,2,3,4,5,6
	73°F	1	1,2,3,4,5,6
	74°F	1	1,2,3,4,5,6
Tunnel	77°F	-	6
	78°F	2	6
	79°F	3	6
Evap. cooling	82°F	-	4,5,6

Figure 4. 500' tunnel house with nine fans. The controller has three sensors on brooding end and three on the nonbrooding end. Though in this illustration tunnel fans are used for inlet ventilation, side wall 36" fans could have just as easily been used.

3) If you have an environmental controller set the fans "off temperature" well below their "on temperature". In the environmental controller set up below it can be seen that all the fans would operate until the air temperature at the tunnel fan end of the house dropped to 75°F at night, virtually insuring the birds throughout the house would be adequately cooled at night. Keep in mind this environmental controller setup is intended for use with older birds during hot weather. Using the same setup during cooler weather or with younger birds can lead to bird chilling and reduced performance (Figure 5).

Temperature	On Temp	Off Temp	48"Fans	Sensors
Inlets	70°F		-	-
	71°F	70°F	2	1,2,3,4,5,6
	73°F	71°F	1	1,2,3,4,5,6
	74°F	73°F	1	1,2,3,4,5,6
Tunnel	77°F	74°F	-	6
	78°F	74°F	2	6
	79°F	75°F	3	6
Evap. cooling	81°F	80 F	-	4,5,6

Figure 5. Tunnel fan off temperature set well below on temperature for maximum cooling of older birds

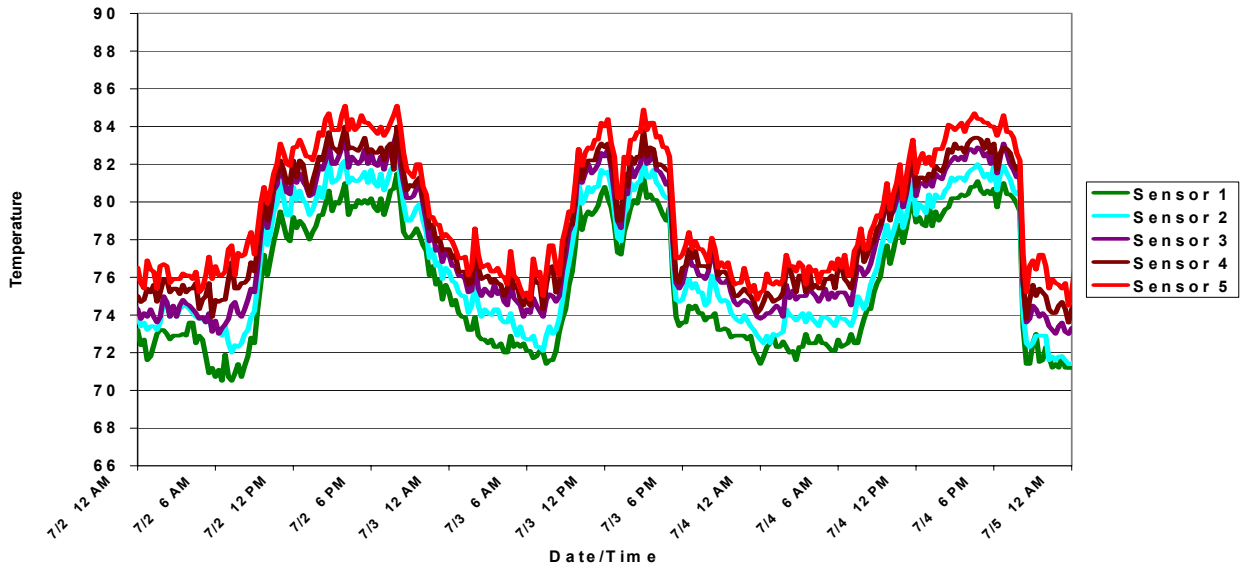

Figure 6. Tunnel house providing adequate bird cooling at night using controller setting similar to Figure 4. Note the difference in nighttime conditions compared to those in Figure 3. Not only are the nighttime temperatures lower but conditions are much more uniform from end to end indicated that all, or nearly all, of the tunnel fans are operating providing significant cooling throughout the night.

4) The simplest way of insuring your birds are cooled at night is simply dropping the "desired temperature" five degrees at night. Make sure that you raise the temperature at which your evaporative cooling system comes on by five degrees so that it does not operate all night long.

5) Just because the birds stop panting in the evening does not necessarily mean that it is safe to decrease the number of fans operating. It is important to keep in mind that even after a bird's body temperature is brought back to normal and they stop panting, that when they begin to eat again their body temperature will start to rise. If an adequate number of tunnel fans are not operating to remove the excess heat from the bird, feed consumption is likely to suffer.

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