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Poultry Housing Tips

Maximizing Nighttime Bird Cooling

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Nighttime cooling is an important aspect of maximizing bird performance during hot weather. Even in the best houses there will be days when the birds will become heat stressed. If the ventilation system is well designed and maintained, increased bird mortality will not typically become an issue but weight gains and feed conversions can be adversely affected. How much performance will be affected on these days will depend to a large extent on how the ventilation system is managed at night. If the ventilation system is managed properly, bird performance will be minimally affected by hot weather. But, if the ventilation system is not managed properly birds can actually be made to feel hotter at night than they were during the day, thus aggravating hot weather performance problems.

The following are a few tips to consider when trying to maximize cooling of older birds at night during hot weather:

1) Using an evaporative cooling system at night does not increase cooling.

An important weather fact to keep in mind is that for the vast majority of poultry producing areas in the U.S., whenever the outside temperature falls below 80°F the relative humidity will tend to rise above 80%. Since the cooling produced by pads depends upon relative humidity, when pads are operated at temperatures at or below 80°F they tend to produce little cooling, but bring the relative humidity of the air entering the house to near saturation. For instance, most of the time when pads are operating during the day they bring the relative humidity in the house up to the low to mid eighties. But, when operated in the late evening, or early morning hours when outside temperature are below 80°F, they tend to increase the relative humidity of the incoming air to above 90%!

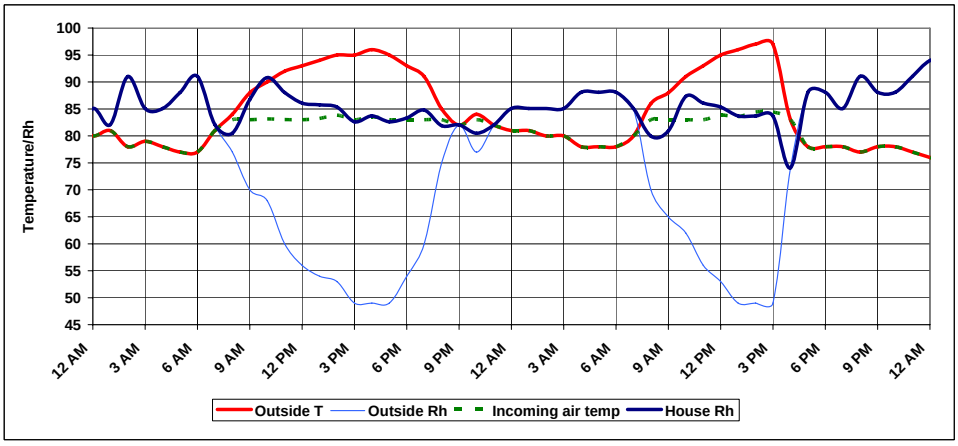

Figure 1. Evaporative cooling pads set to turn on at 83°F.

It is important to keep in mind that though air movement is very important when it comes to removing excess heat from a bird, a bird still relies to a large extent on evaporating water off of its respiratory system to rid itself of excess heat, regardless of air temperature. Even at an air temperature of 70°F a bird will loose roughly half of its excess heat through the evaporation of water off of its respiratory system. Though this can be a challenge for a bird when the relative humidity is 70 or 80%, when the air reaches near saturation it becomes nearly impossible. The fact is by operating an evaporative cooling system during the early morning or late evening hours you may get a few degrees cooling but you can end up pushing the relative humidity from 80 % to 90% and in the process not really producing any additional cooling for the birds. You might feel cooler, but the question is -- do the birds feel cooler?

Figures 1, 2, and 3 are graphical representations of what happens inside a poultry house when a six-inch evaporative cooling system is set to operate at 83°F, 78°F, and continuously. The first thing that becomes very clear when looking at the graphs is that setting the evaporative cooling pads to turn on at temperatures below 83°F does not significantly change house temperatures during the day. This is because during hot, humid weather, like that pictured in Figures 1, 2, and 3, a six-inch pad system is only going to drop the temperature into the low eighties no matter how low it is set. The biggest effect setting evaporative cooling systems to come on below 83°F will have will be on house relative humidity early in the morning and late in the evening. Setting pad systems to turn on at 78°F causes the relative humidity to rise to around 95% at night, whereas at a 83°F setting the relative humidity tends to be around 85%. By far the worst scenario is when the pads operate all night long and the relative humidity in the house stays around 95%+ all night long. There are many disadvantages to running a house with these conditions. The litter will become very wet, resulting in more ammonia production and increased condemnations at the plant due to down grades because of breast blisters. The wet litter will also increase the amount of dirt and litter adhering to the bird and will create microbial issues for the processing plant. When we combine 95% rh and air temperatures in the high seventies, the argument could easily be made that the "effective" temperature at night is higher than it is during the day.

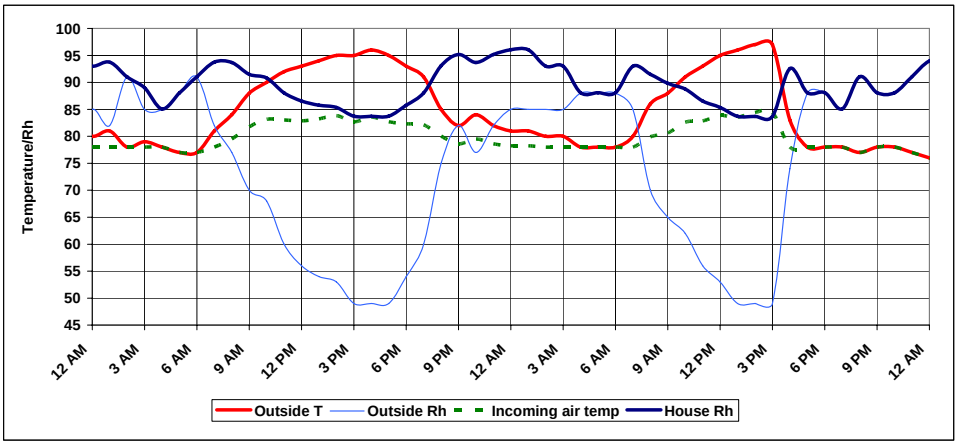

Figure 2. Evaporative cooling pads set to turn on at 78°F.

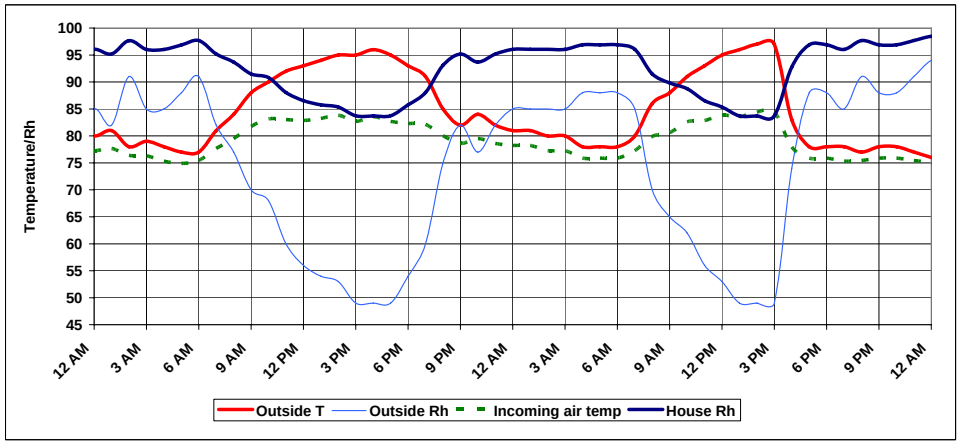

Figure 3. Evaporative cooling pads set to run 24 hours a day.

2) Lower controller set temperature five degrees at night.

Lowering a controller's target temperature will typically result in the tunnel fans operating all night long, insuring that the birds will receive plenty of air speed and therefore cooling throughout the night. Care must be taken in lowering target temperatures if nighttime temperatures are going to fall into the sixties because you could run into bird chilling problems. Make sure in the process of lowering your target temperature you do not end up setting your evaporative cooling system to turn on below 82°F!

3) Locking on tunnel fans at night.

Locking on tunnel fans at night is probably the most widely used method of making sure that the birds are receiving adequate nighttime cooling. One word of caution though is that some environmental controllers can become "confused" when fans are locked on. If it becomes too cool at night the house may transition to inlet ventilation. If there are too many fans operating for the inlets to handle you might run into a high static pressure situation and get an alarm. If you manually lock the house in tunnel ventilation, the controller may not realize it and transition back to inlet ventilation so you could end up with a situation where both the inlets and the tunnel curtain would be open, which would reduce air speed moving across the birds and would not increase your cooling at night. Because of these as well as other scenarios, it is typically best to use some other method of maximizing bird cooling at night, such as simply lowering your controller set temperature by five degrees. If you are going to lock on fans you may want to contact the manufacturer of your controller to see what types of problems you may encounter.

4) If you have very dirty pads, consider opening end wall door at night.

Dirty pads can increase the static pressure the tunnel fans are working against, lowering their air moving capacity by 15% or more. By opening the end wall doors near the tunnel curtain at night when the pads should not be operating anyway, provided there are screens on the doors, the static pressure will decrease, and air speed will increase. Furthermore, since you are not pulling air through a damp pad the relative humidity in the house will be minimized.

Again caution must be taken when considering this option. Depending on the controller and how it is set you could run into a strange situation. If the tunnel curtains are operating off of static pressure they may close partially or remain open depending on how the controller is set. If the house transitions back to inlet ventilation the inlets may open or may not depending on controller settings. The best and safest solution to a high static pressure due to dirty pads is to simply clean the pads.

5) Set tunnel fan off temperatures well below on temperatures.

The traditional way environmental controllers stage fans is that if a tunnel fan turned on two degrees above a certain set temperature it would shut off when the house temperature drops two degrees. One instance would be if you had six tunnel fans operating at 78°F and there were a one-degree differential before the next two fans turn on (Table 1). The problem with this type of fan staging is that if the birds are heat stressed during the day, as temperatures begin to fall in the evening the tunnel fans shut off before the birds' body temperatures have been brought back down to normal levels and the birds remained stressed.

Temperature	On Temp	Off Temp	Tunnel Fans
Inlets	70°F		-
	71°F	70°F	2
	73°F	71°F	3
	74°F	73°F	4
Tunnel	77°F	74°F	4
	78°F	77°F	6
	79°F	78°F	8
Evap. cooling	83°F	82°F	-

Table 1. Traditional tunnel fan staging

A good way to increase bird cooling is illustrated in Table 2. Though the last two fans would turn on at 79°F, instead of turning off at the stage below (78°F), the house temperature would have to fall all the way to 76°F before they would turn off. Likewise, the two fans that turned on at 78°F would not shut off at 77°F but rather 75°F.

Temperature	On Temp	Off Temp	Tunnel Fans
Inlets	70°F		-
	71°F	70°F	2
	73°F	71°F	3
	74°F	73°F	4
Tunnel	77°F	74°F	4
	78°F	75°F	6
	79°F	76°F	8
Evap. cooling	83°F	82°F	-

Table 2. Tunnel fan staging to increase nighttime bird cooling.

There are other advantages to this type of controller setup in addition to running fans later into the night. First, if it does get cool at night, the fans will shut off before the house becomes too cool. A more significant advantage is that tunnel fans are not likely to turn off when the evaporative cooling pads start to operate. With the fan staging in Table 1, if the pads drop the house temperature to 78°F, a couple of tunnel fans will turn off. Though on the surface this may seem like a plus it is important to keep in mind that the loss of 100 to 150 ft/min air speed could result in not only a four-degree drop in wind chill, but more trapped heat between the birds, and an increased temperature differential between the pad and fan ends of the house. So even though the thermometer may indicate that the house temperature has decreased, the pads shutting off a couple of fans could actually result in an increase in effective house temperature. With the fan staging illustrated in Table 2, the evaporative cooling pads would have to drop the air temperature to 76°F to shut off the last two tunnel fans, which would not tend to happen during hot humid weather, thus reducing the likelihood of any fans shutting off when the pads are operating.

6) Make sure tunnel fans operate off of thermostats/sensors no further than 100' from the tunnel fan end wall.
During the day when all the tunnel fans are operating, there is typically less than a five degree difference in temperature between the pad and fan ends of a house. But, in the evening this temperature difference can increase to harmful levels if the house's environmental controller is not set properly. For instance, let's say we had two identical houses, one where the tunnel fans operated off the average of the sensors located throughout the house and the other where the tunnel fans operated only off the sensors nearest the tunnel fans (the controllers in both houses are set to operate according to Table 1). With tunnel fans operating off the average of all the sensors it is fairly likely if the outside temperature dropped into the low seventies that you could end up with the situation where the inlet end of the house is 72°F, the center is 76°F and the tunnel fan end is 80°F. This is because the average house temperature is 76°F and the controller is set to operate only half the tunnel fans at 76°F which would tend to lead to large temperature differences between the two ends of a tunnel house when older birds are present. Though 72°F is not a problem for the birds near the tunnel inlet, the birds on the tunnel fan end would not receive adequate nighttime cooling because they would be subjected to an 80°F environment with high humidity and very little air speed. Conversely, if tunnel fans were set to operate off the sensors on the tunnel fan end of the house, the higher air temperature at the tunnel fan end of the house would have resulted in more fans operating, resulting in significantly cooler temperatures for the birds in the back half of the house. Though it is true that operating the tunnel fans off of the sensors on the tunnel fan end of the house will tend to result in lower air temperatures at the inlet, the fact of the matter is that during hot, humid weather we are not that concerned with overcooling the birds at the inlet end because temperatures will tend to stay in the seventies.

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