The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

Increasing Evaporative Cooling Pad Set Temperatures

Volume 26 Number 5 **June, 2014**

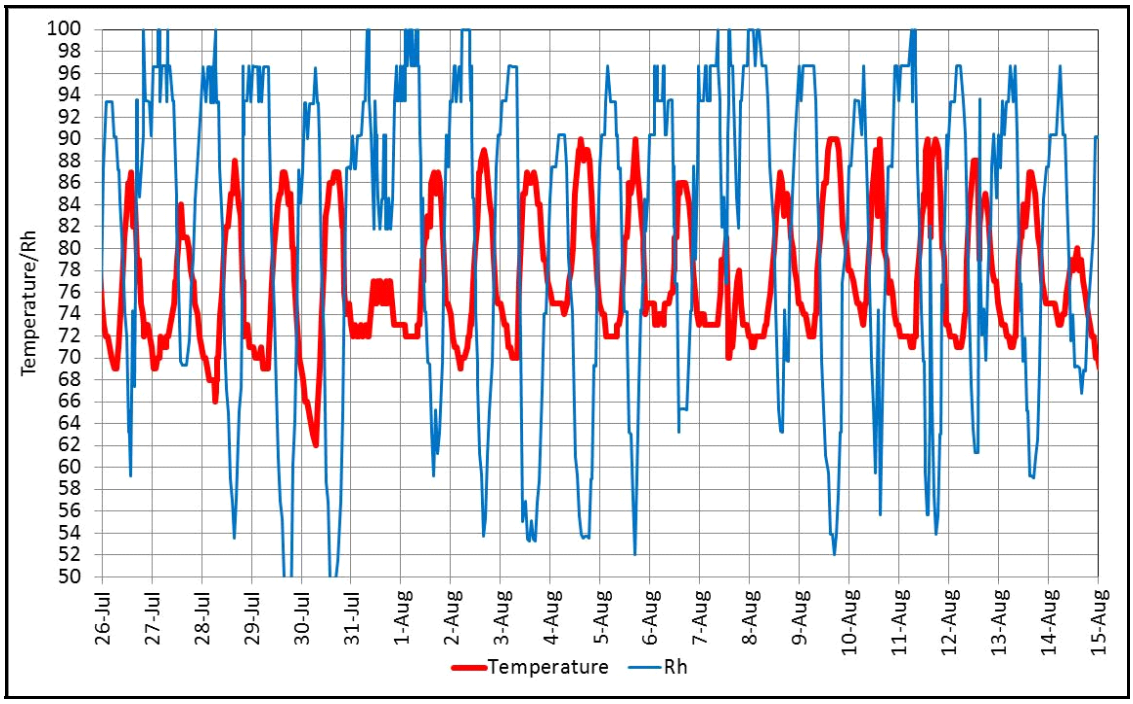

Figure 1. Outside temperature and Rh during the last three weeks of the flock.

Figure 1 shows the outside temperature and relative humidity during the last three weeks on a farm growing a 56-day-old broiler during the month of August in 2013. Though the weather was relatively mild, outside temperatures still reached between 86°F and 90°F during the day with relative humidity running between 55 and 60%. Typically, with older broilers, evaporative cooling pads would be set to operate a little above 80°F, resulting in the house temperature running in the mid to low eighties and the evaporative cooling system operating approximately six to eight hours a day during this type of weather. But, on this particular farm the grower set his evaporative cooling pad to operate between 85°F and 90°F, which resulted in the evaporative cooling systems only operated for approximately 12 hours over the course of the entire 56 day flock. Conventional thinking would lead one to believe that by not aggressively using evaporative cooling when growing 8 lb+ bird that performance would be lost. The fact is the grower finished number one for the week: the second to the highest weight (within 0.02 lbs of the highest), the lowest feed conversion (seven points lower than any other farm), and the lowest mortality (less than 3%).

Poultry scientists and engineers at the University of Arkansas have been studying the use of sprinkler systems as an alternative to traditional evaporative cooling pads in tunnel-ventilated houses on a commercial broiler farm. A sprinkler system, unlike a fogging system, operates at low pressure and generates very large water droplets. The objective of the system is to help cool the birds, not as much by reducing house temperature, but more through the light wetting of the birds. As water evaporates from the surfaces of the birds it lowers the surface temperature of the birds, which in turn increases heat loss from the birds. This is not to say that a sprinkler systems does not reduce house temperature. The combination of the water droplets partially evaporating as they fall to the floor of a house with that water evaporating off the bird surfaces does in fact reduce house temperature from one to five degrees, far less than seen in the typical house equipped with evaporative cooling pads. Conventional thinking would lead one to believe that the resulting higher house temperatures would result in a decrease in bird performance during hot weather. The fact is that over the course of two summers there have been no significant differences seen in bird performance between the houses with sprinkler systems compared to those with traditional evaporative cooling pads.

There is a growing trend in the commercial layer industry of building tunnel-ventilated houses without evaporative cooling pads. The high air velocity (well over 600 ft/min), padless houses tend to perform as well as those equipped with evaporative cooling pads during hot weather. The only time performance tends to be reduced is during extended periods of very hot weather (95ºF+).

What these studies/trends have in common is that they show that evaporative cooling is not as crucial in obtaining optimal bird performance during hot weather as many believe. The fact is that it is the air speed in a tunnel house that produces the vast majority of the cooling...not a house's evaporative cooling pads. When it comes to bird cooling the use of evaporative cooling pads comes at a high price...increased humidity. As humidity increases, a bird's primary method of heat loss, evaporation of water off of it's own respiratory system, is reduced. So, though a pad system may decrease a house temperature 10ºF, the relative humidity will increase 25%, which will harm, a bird's natural ability to rid itself of excess heat. Conversely, from a bird performance standpoint, there really is no downside to increasing air speed over older birds during hot weather - essentially... the more, the better.

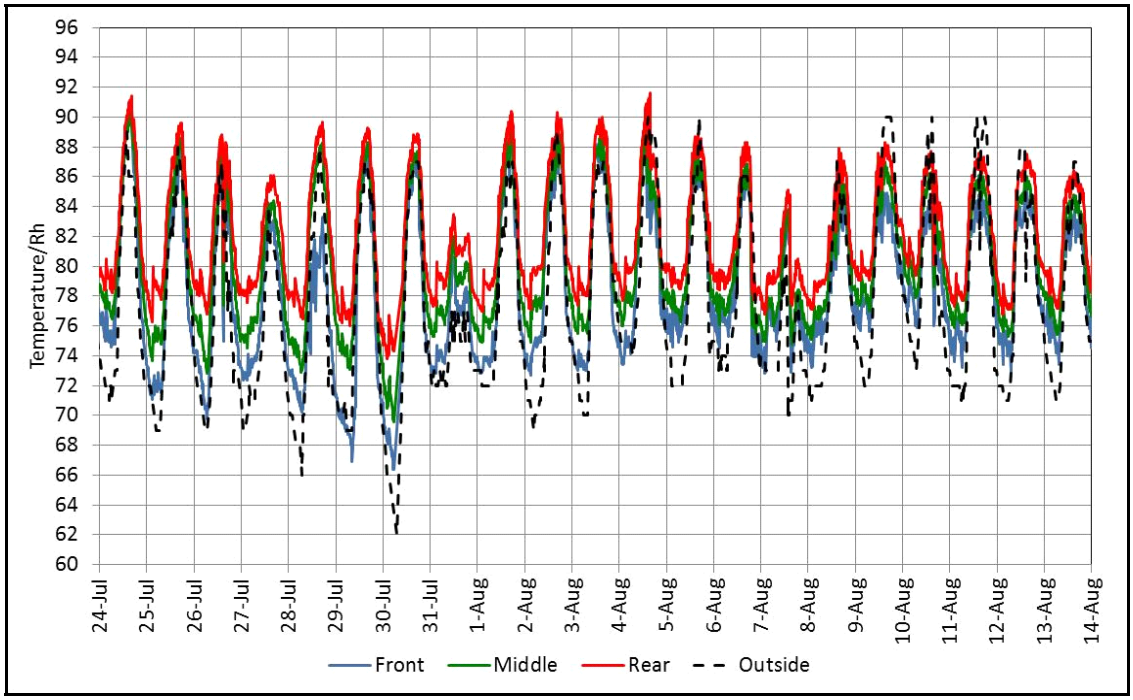

Figure 2. Inside and outside temperatures for the last three weeks of the flock.

To be clear, this does NOT mean that evaporative cooling systems are not required to maximize bird performance during hot weather. Numerous studies have shown that at high air temperatures (i.e. +90ºF), broiler performance suffers even with high air velocities. It is not a matter of whether a tunnel-ventilated broiler house requires an evaporative cooling system, but rather to what extent it is used. Producers with older broilers are often tempted to operate evaporative cooling pads as soon as house temperatures climb into the high seventies to low eighties. Though the house temperature may decrease a little, the fact is that the relative humidity quickly climbs to near saturation, limiting a bird's ability to cool itself through the evaporation of

moisture off its respiratory system. The situation is exacerbated if the producer doesn't fully utilize all their tunnel fan capacity before turning on their evaporative cooling pads. Air velocity should always be thought of as the primary method of bird cooling; evaporative cooling pads are a distant second.

Figure 2 is a graph of outside and inside temperatures during the last three weeks of the flock on the broiler farm noted previously where the evaporative cooling pads were used very sparingly. During the day, inside temperatures were only lower than outside temperature August 10th through 12th, indicating that the evaporative cooling pad system was operating for a significant portion of the day. For most the last three weeks of the flock, house temperatures were between 85°F and 90°F for a significant portion of the day. Since the evaporative cooling pads did not operate for most of the flock, though daytime temperatures were in the mid to high eighties, relative humidity was relatively low, running between 50 and 60% (Figure 3). On those days where the evaporative cooling pads were used (August 10 -12th), the temperature was in the mid-eighties and the relative humidity did not drop below 80%. Though the air temperature was a little lower on the days the evaporative cooling pads were used the fact that the relative humidity was 20 to 30% higher would have resulted from a bird's perspective much higher effective temperatures.

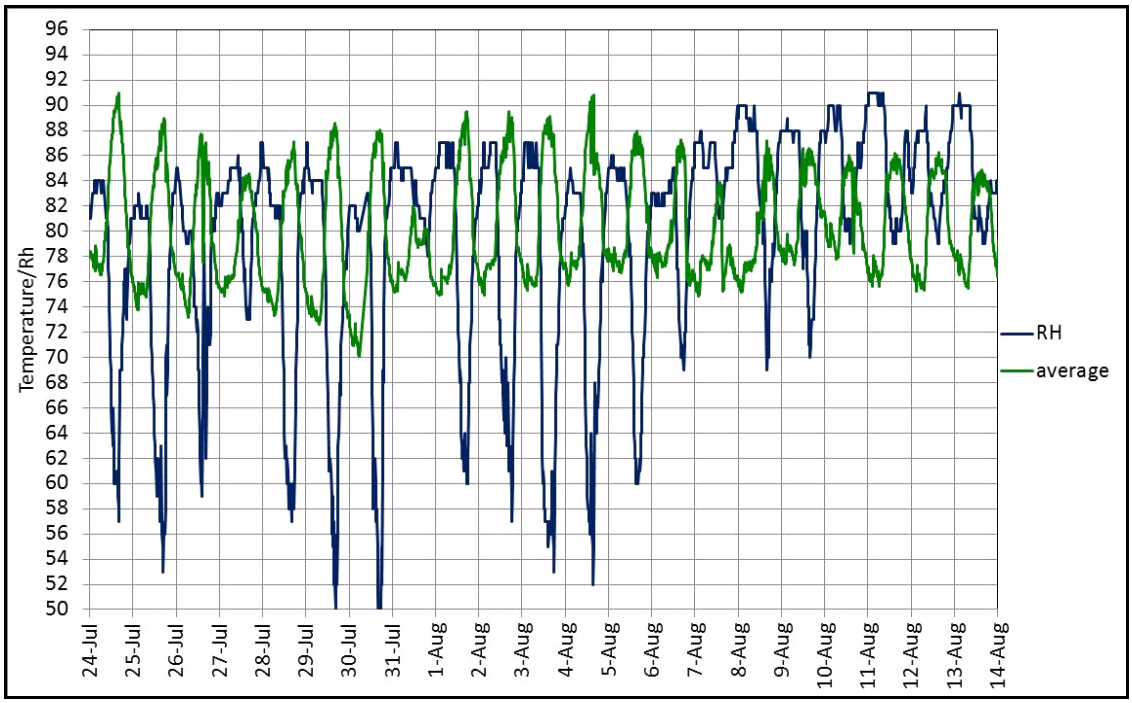

Figure 3. Average inside temperature and Rh for last three weeks of the flock.

Another benefit of the limited use of the evaporative cooling system was that the litter was extremely dry and the birds were very clean (Figure 4). Even in the vicinity of the evaporative cooling pads the litter was dry and friable (Figure 5). The bird's paws were clean and there were very few signs of trauma.

Figure 4. Very clean birds.

Figure 5. Litter in front of evaporative cooling pads.

A house that uses evaporative cooling sparingly is not only is the house/litter drier during the day, but at night as well when high humidities can be just as problematic as they are during the day. In most poultry growing areas the relative humidity at night is well above 80%. The lower an evaporative cooling pad system is set to operate the later into the evening it will operate, and the more likely the pad system will cause very high nighttime humidities. In study conducted by the University of Arkansas comparing pad systems to sprinkler systems, even though the pad systems did not operate at night the inside relative humidity at night was five to ten percent higher than it was in the house utilizing sprinklers (Figures 6 and 7). Though a difference of five to ten percent relative humidity most of the time would not be considered significant, the closer the relative humidity in a house is to 100%, the more problematic a small change in relative humidity would be. In fact, Levent, & Portier (2005) found that 77°F and 90% relative humidity heat loss from a five-pound broiler is reduced by approximately 32%. So even though nighttime temperatures may be in the seventies, if the pads continue to saturate the air with moisture the birds in a house may not be able to get rid of a large portion of the heat they are producing, resulting in elevated body temperatures and reduced performance.

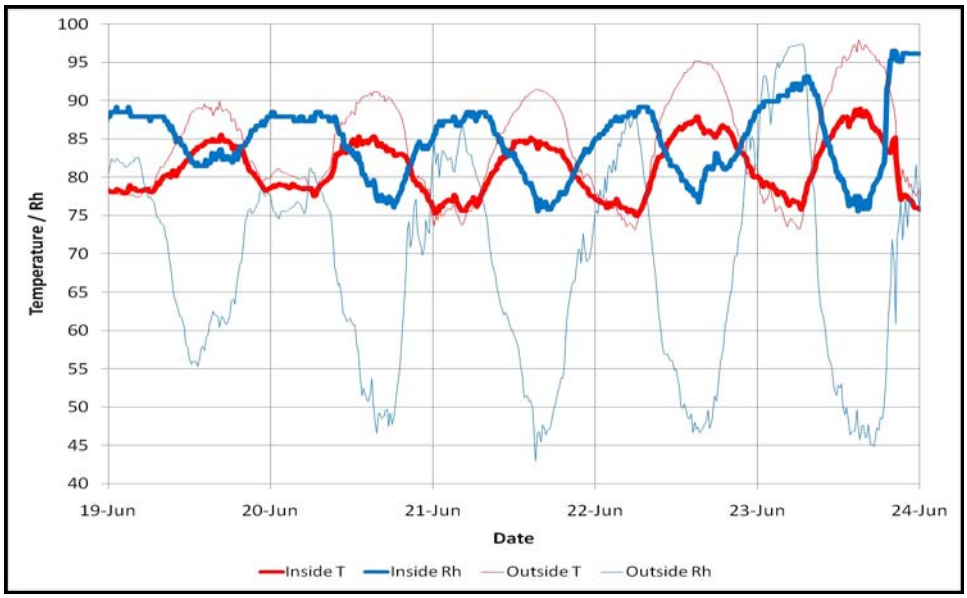

Figure 6. Inside conditions in house utilizing evaporative cooling pads.

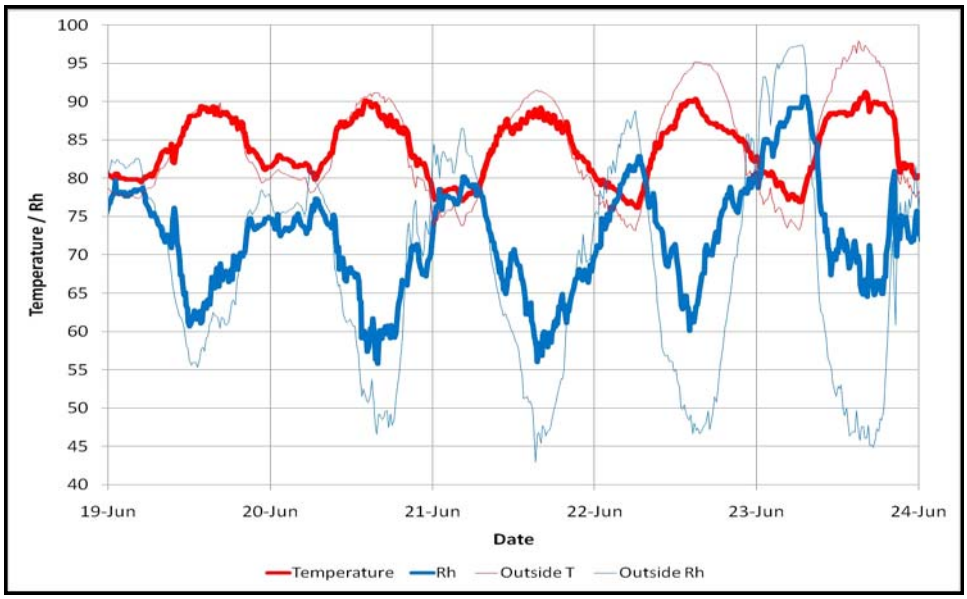

Figure 7. Inside conditions in house utilizing sprinkler system.

It is important to note that on the farm where the pad set temperatures were 85°F or higher, the average air speed in the houses was just over 700 ft/min, with less than a 100 ft/min variation from side wall to side wall. The higher-than-average air speed makes it easier to remove heat from the birds at higher house air temperatures. This is not to say that in houses where the air

velocity may be as high, pads should be turned on in the high seventies low eighties, but rather that air speed should be utilized to its fullest extent before using evaporative cooling and when it is used it should be turned on at a house temperature closer to 85ºF than 80ºF.

Equally important is the fact that in order to maximize bird cooling air speeds should be kept at their maximum late into the evening, if not all night. This will help to ensure that there is adequate heat removal from older birds when their ability to lose heat through the evaporation of water off their respiratory system is compromised due to the very high humidities that typically occur after the sun goes down. The fact is, air speed is most effective at removing heat from the birds at night when air temperatures are low. So, not only does maintaining a high nighttime air speed help to offset the negative effects of the high humidity, but it will also help to remove the excess heat that builds up in broilers over the course of a hot day.

When it does come to operating the latest generation of tunnel houses where air speeds commonly exceed 600 ft/min, it is important to keep in mind that old rules of thumb when it comes to operating evaporative cooling systems may no longer apply. Whereas in older houses it was often tempting to utilize evaporative cooling systems at air temperatures of 80ºF or lower, in higher air speed houses, the use of pads may be delayed without necessarily resulting in a reduction in bird performance.

Michael Czarick
Extension Engineer
(706) 542-9041
mczarick@uga.edu
www.poultryventilation.com

Yi Liang
Extension Engineer
University of Arkansas
yliang@uark.edu

Brian Fairchild
Extension Poultry Scientist
(706) 542-9133
brianf@uga.edu

Levent, Genc and Kenneth M. Portier. 2005. Sensible and Latent Heat Productions from Broilers in Laboratory Conditions. Turkish Journal of Veterinary & Animal Sciences. Vol. 29 Issue 3, p635-643.