The University of Georgia

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Cooperative Extension

Poultry Housing Tips

Nighttime Cooling Pad Operation During Extremely Hot Weather

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Rule of thumb: A useful principle having wide application but not intended to be strictly accurate or reliable in every situation.

It is generally recommended that evaporative cooling pads should not be operated at night because the relative humidity of the air outside a poultry house tends to run 80% or higher at night. Operating pads when the outside relative humidity is above 80% produces little cooling (less than 3°F) and tends to saturate the income air with moisture making it more difficult for the birds to cool themselves.

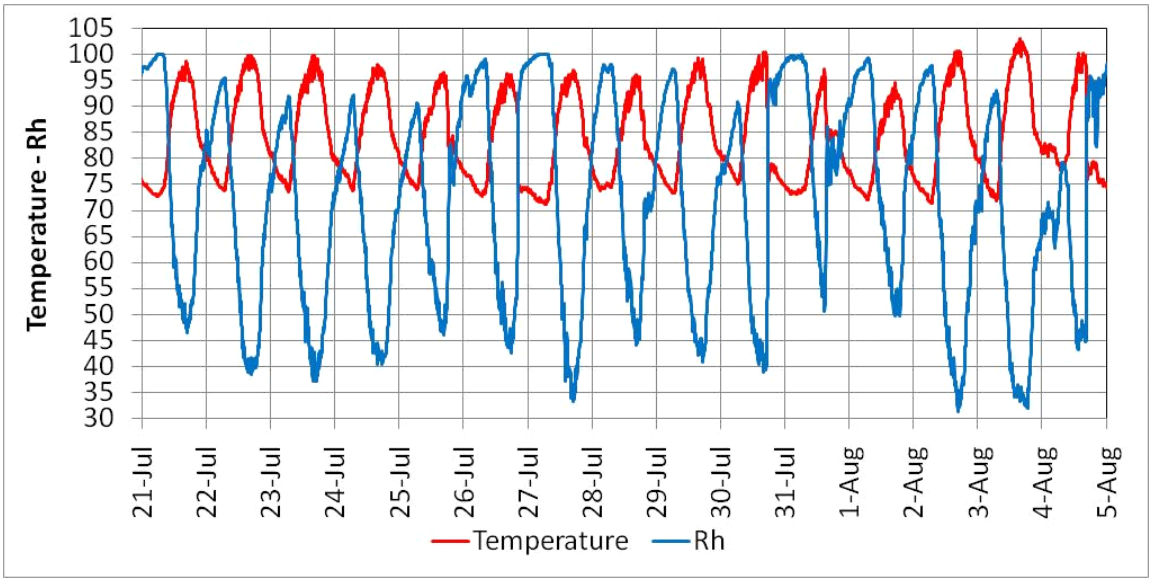

Figure 1. Outside air temperature and relative humidity (Athens, Georgia)

Outside air temperature and relative humidity are inversely related. This means that as outside temperature rises in the morning, the relative humidity decreases. Conversely, when air temperature in the evening falls, the relative humidity of the air increases. If you graph outside temperature and humidity over a 24 hour period you will find that the two typically "cross-over" around 80°F and 80% Rh (Figure 1). As a result, poultry producers will find that in the morning when temperatures climb above 80°F, the relative humidity will fall below 80 % and their evaporative cooling systems are able to produce a significant amount of cooling without saturating the incoming air with moisture. In the evening when the outside temperature falls below 80°F, the humidity increases above 80%, and the cooling produced by an evaporative cooling system becomes very limited.

Under "normal" summer weather (daily high temperatures in the low to mid nineties) the crossover of temperature and relative humidity typically occurs midmorning (9 - 11 am) and late evening (9 - 11 pm). As a result, the commonly used rule of thumb that evaporative cooling pads should not be used between 10 pm and 10 am is appropriate. But, it is a rule of thumb...not a law. Though the crossover of temperature and relative humidity tends to consistently occur around 80°F and 80 % Rh, the time of day at which the crossover occurs is much more variable. During very hot weather (daily high temperatures in the high nineties) the crossover tends to occur much later at night (12 am - 2 am) and earlier in the morning (7 am - 9 am) and therefore pads can be effectively used earlier in the morning and later at night. Under very extreme circumstances (daily high temperatures above 100°F) the crossover may not occur at all because the outside temperature never falls below 80°F at night therefore it is possible to operate an evaporative cooling system nearly, if not all night long (Figure 2).

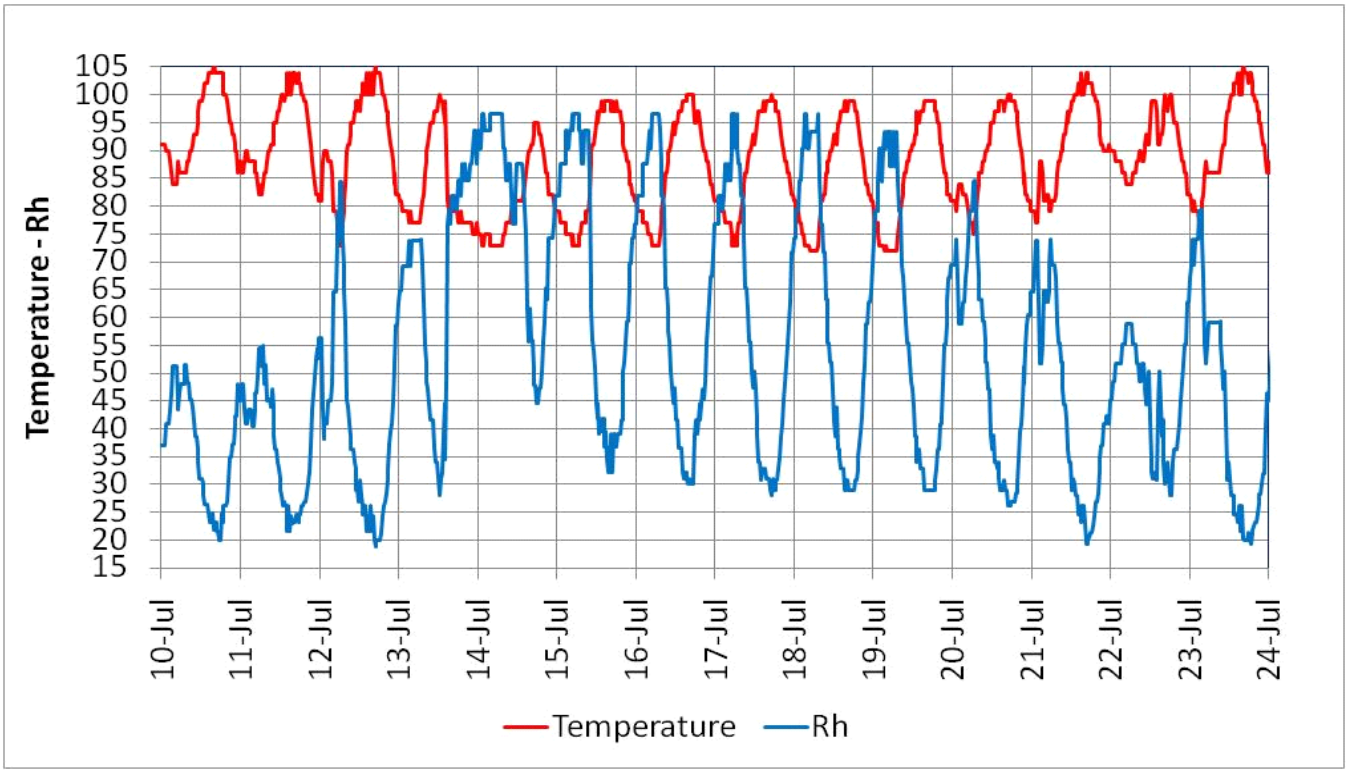

Figure 2. Outside air temperature and relative humidity (Mena, Arkansas)

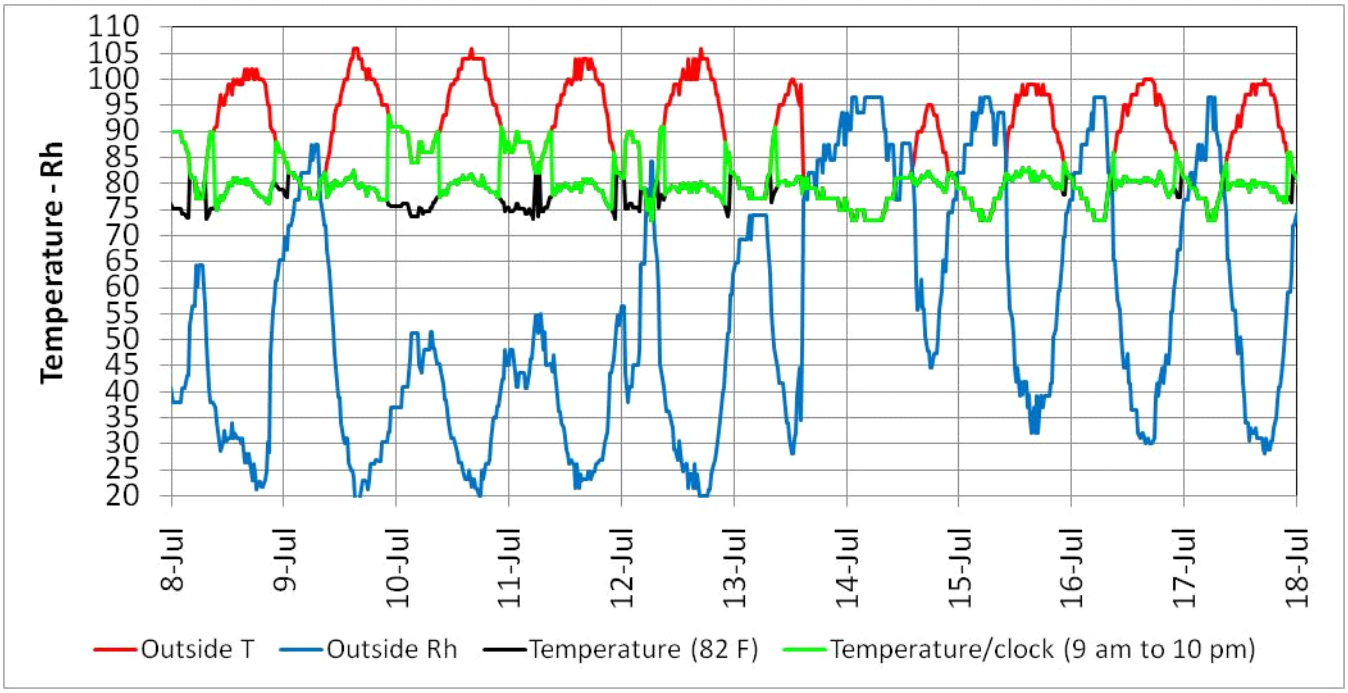

Figure 3. Comparison of house air temperatures with different evaporative cooling pad control schemes.

To insure that birds during hot weather are not unnecessarily subjected to high nighttime temperatures evaporative cooling pads should be primarily operated based on house temperature and not time of day. If evaporative cooling pads are set to operate at a house temperature of approximately 82°F the pads will tend to shut off in the evening when outside temperatures fall below 80°F and humidity increases above 80%. But, if the pads are shut off in the evening regardless of house temperature nighttime house temperatures can on rare instances exceed those seen during the day.

Figure 3 illustrates theoretical house temperatures over a 10 day period for two different scenarios: 1) Evaporative cooling pads are turned on when house temperature reaches 82°F, 2) Evaporative cooling pads are turned on when house temperature reaches 82°F and only allowed to operate between the hours of 9 am to 10 pm. From June 14th - 18th (fairly typical hot weather) there is little difference between the two evaporative cooling pad control strategies because the outside temperature drops below 80°F around 10 pm around the same time a clock would shut off the pads. But, from July 8th to the 13th during a period of extreme hot weather, nighttime temperatures didn't drop below 80°F until very late at night and on some days not at all. Since the nighttime temperatures were very high the relative humidity was much lower than normal at night and as a result evaporative cooling pads could produce a significant amount of cooling without over saturating the air with moisture. On the nights of July 10th and 11th if the pads were shut off at night, house temperatures would have been 10°F higher than if the pads were operated based solely on house temperature.

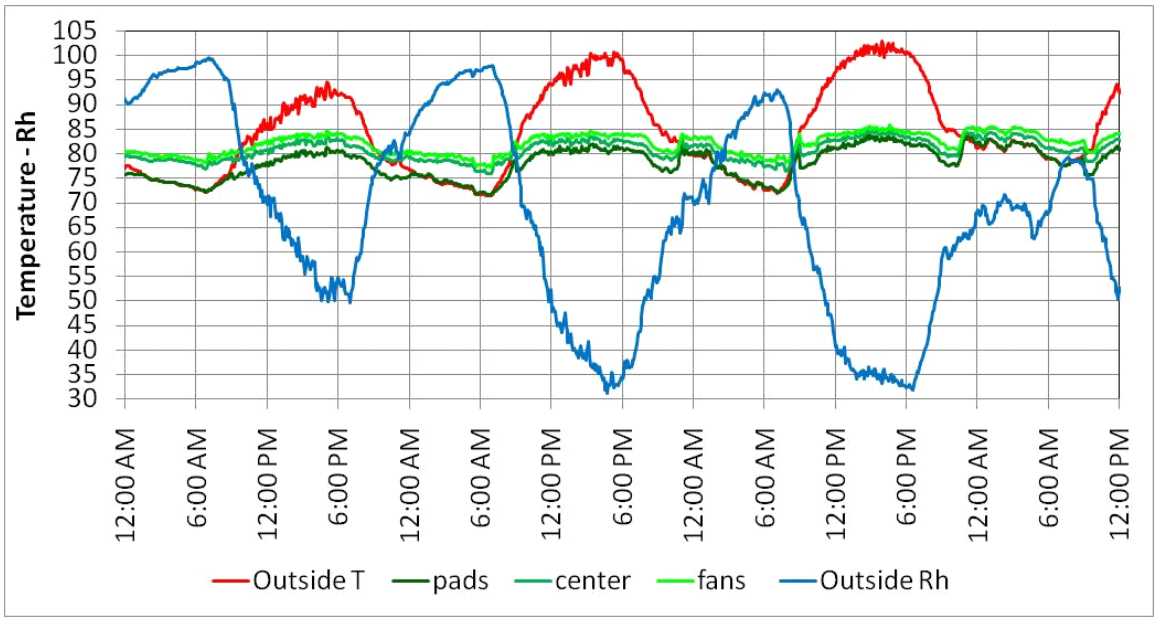

Figure 4. House temperatures in house where the pads are shut off between the hours of 10 pm and 10 am (Athens, Georgia August 1 - 3).

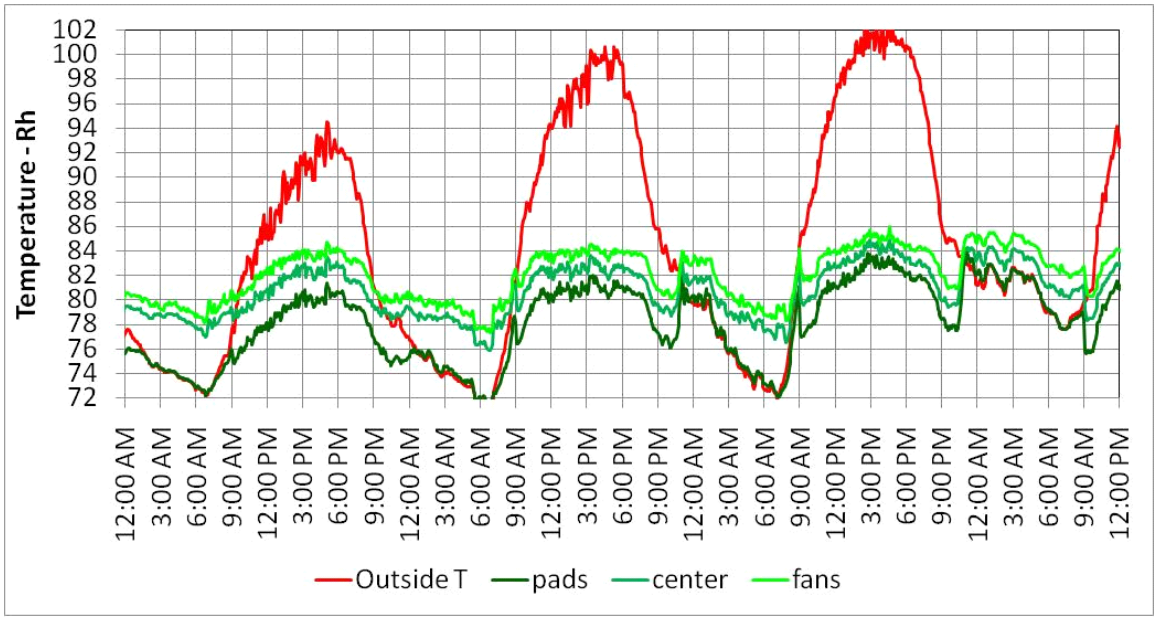

Figure 5. House temperatures in house where evaporative cooling pads are shut off between 10 pm and 10 am (August, 1 - 3).

Figures 4 and 5 are based on air temperatures taken inside and outside a poultry house with 49 day old broilers in which the pads were programed to shut off between the hours of 10 pm and 10 am. On August, 1st there was little effect on house temperature when the pads were shut off at 10 pm. On August 2nd, when outside temperature reach 100°F, the house temperature began to fall around 8 pm but when the pads shut off at 10 pm house temperature increased approximately five degrees. On August 3rd the outside temperature did not drop below 80°F until 6 am the following morning and as a result the relative humidity stayed below 70% most of the night. When the pads were turned off at 10 pm the house temperature increased five degrees and remained in the mid eighties for most of the night. Had the pad been allowed to operate at night (based on an operating temperature of 82°F) temperatures would have likely remained below 80°F for the entire evening.

It must be stressed that for +90% or more of the time evaporative cooling pads should NOT be operated at night because of the outside relative humidity is 80% or higher. But, on those relatively rare occasions where nighttime temperatures remain in the mid to high eighties it is possible to use evaporative cooling pads to reduce the incoming air temperature to below 80°F without over saturating the incoming air. The keys to effective evaporative cooling pad operation is not necessarily placing them on a time clock so they can't operate at night but rather setting them to operate at a proper temperature. Evaporative cooling pads should be set to turn on somewhere in the low to mid eighties with older birds, not in the seventies. Setting pads to operate in the high seventies will allow the pads to operate in situations where very little cooling would be produced and they would tend to increase the incoming relative humidity to 90% or higher. Setting pads to operate in the low to mid eighties will insure that the cooling produced through air movement is maximized while causing the pads to shut off at night during normal hot weather and to continue to operate into the late evening during periods of extreme weather.

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