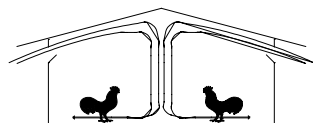




# The University of Georgia Cooperative Extension Service

College of Agricultural and Environmental Science/Athens, Georgia 30602-4356



## Poultry Housing Tips

### *Minimizing wet litter problems in houses with evaporative cooling pads*

Volume 15 Number 5

June, 2003

The primary cause of wet litter in the vicinity of the tunnel curtain is simply evaporative cooling pads being set to operate at too low of a temperature. The fact of the matter is that evaporative cooling pads should not be used when outside air temperature is below 80°F. This is because for the vast majority of poultry growing areas in the U.S. whenever outside air temperature is below 80°F the relative humidity is above 80% (Figure 1). When 80% Rh air is drawn through an evaporative cooling pad very little cooling is produced and the relative humidity of the incoming air will tend to rise to near saturation (Figure 2). When this super humid air is pulled across the litter very little if any moisture is removed from the litter. Considering the fact that in the typical house with older birds around 300 gallons of water is added to the litter by the birds in the vicinity of the tunnel curtain each day, it doesn't take long for the water to build-up in the litter and the floors to slick over.

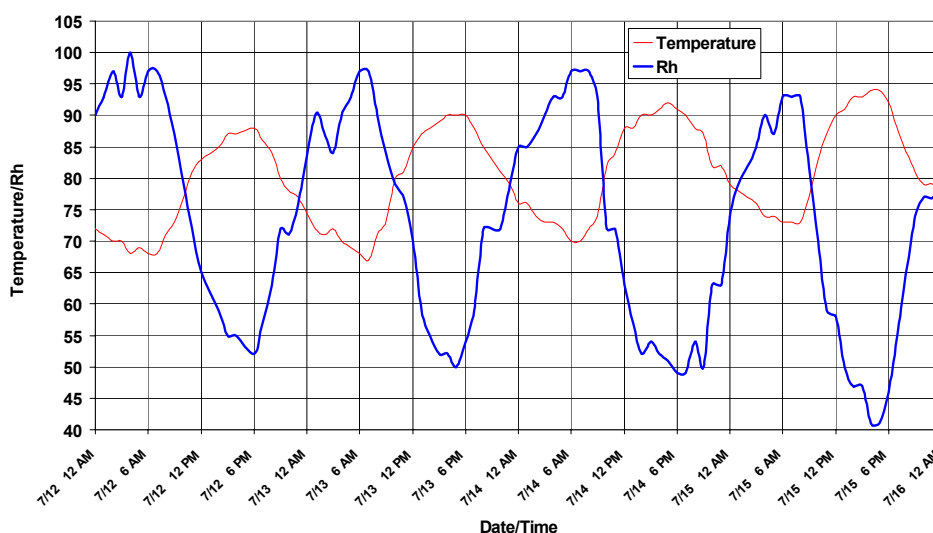


Figure 1. The relationship between outside air temperature and relative humidity

Complicating matters is that many producers may be operating their evaporative cooling systems when the outside temperature is well below 80° F and not even be aware of it. In the early morning house, with all the fans running and older birds in the house, there will be approximately a three degree temperature rise as the air moves from the tunnel inlet to the fans. If a producer has their evaporative cooling set at 80° F and the thermostat/sensor controlling the evaporative cooling pads is near the tunnel fans, the pads will come on when the outside temperature is only 77°F. This

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situation can be made even worse if all the fans are not running prior to the evaporative cooling pads coming on. For instance, let's say that only five of eight tunnel fans are operating before the evaporative cooling pads are set to come on. Since less fans are operating the temperature difference between the tunnel inlet and fans could be as much as seven degrees (Figure 3). This means it could be 80° F in the rear of the house when the incoming/outside air temperature is 73°F. The net result is that you could have evaporative cooling pads operating all night long in a house saturating the incoming air with moisture all night long.

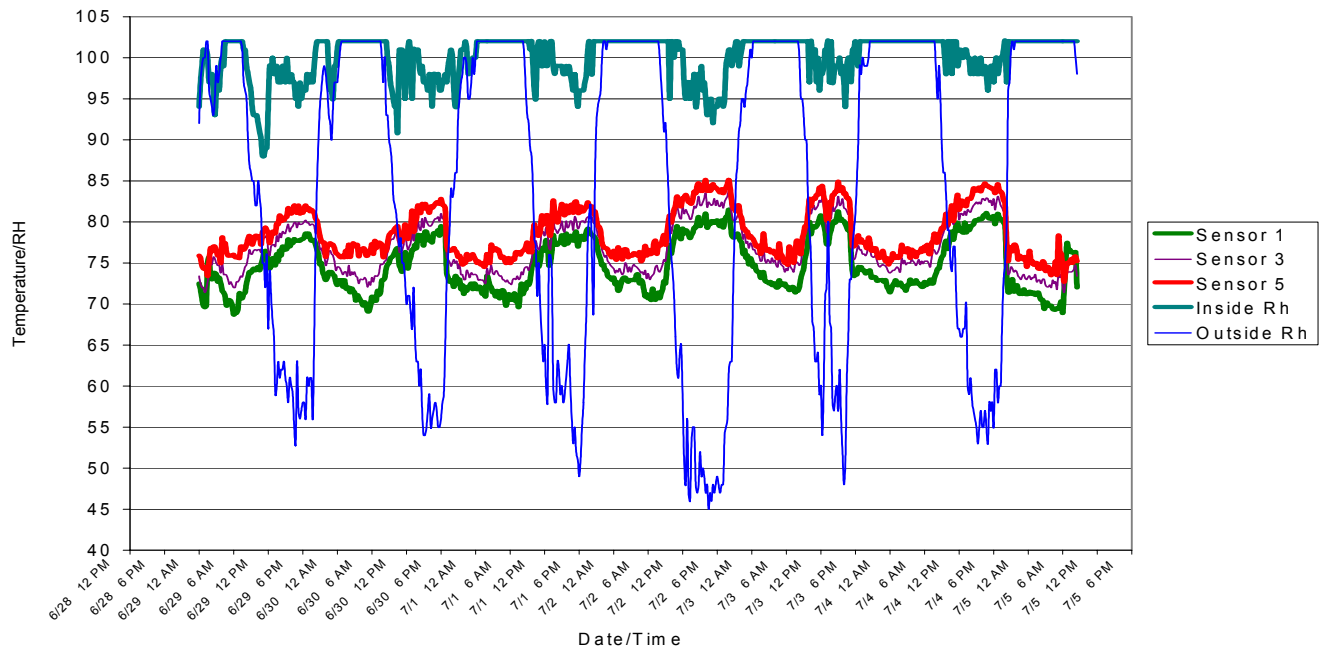


Figure 2. House temperature and Rh (center of house) where evaporative cooling pads are set to come on at 78°F.

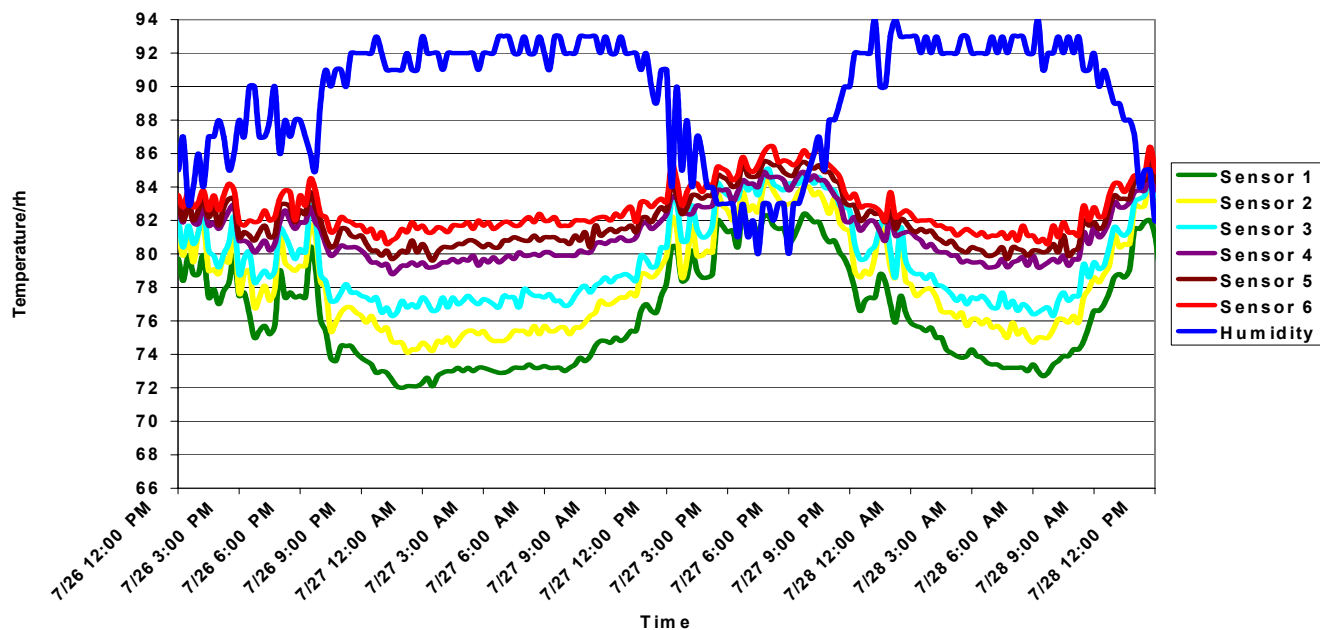


Figure 3. Air temperature and relative humidity in 500' tunnel-ventilated broiler house (seven-week-old birds) running too few tunnel fans at night

It is important to note that this doesn't mean that you always have to operate your tunnel fans before using evaporative cooling pads. The truth is that with younger birds using evaporative cooling pads before all the tunnel fans are operating doesn't lead to the same litter moisture problems commonly experienced with older birds. First, the small birds are producing less heat so there is not a large temperature rise as the air moves from the inlet to the fans. Secondly, since set temperatures are significantly higher with younger birds the evaporative cooling pads typically turn on at much higher temperatures (i.e, 85 - 90° F) so we don't have to worry about pads running excessively (Figure 4).

Temperature	Temperature	Fans
Inlets	78 F	-
	80 F (+2 F)	2
	82 F (+4 F)	1
	83 F (+5 F)	1
Tunnel	85-86 F (+8 F)	-
Evap. cooling	87 F (+9 F)	-
	89 (+11)	2
	91 (+13)	2

Figure 4. Tunnel fan and evaporative cooling setting example for three to four week-old broiler.

Making sure your evaporative cooling pads do not come on until outside temperature reaches 80°F doesn't eliminate the possibility of wet litter in vicinity of the tunnel curtain. The problem is that whenever a six inch pad is used, it will tend to increase the incoming relative humidity of the air to around 80% (two-inch fogging pads around 70%). The cooler and more humid the incoming air the more the pads will tend to raise it toward 90% . The warmer and drier it is outside the more the inside humidity will be toward 70%. For instance, when it is 100°F with a relative humidity of 30% a properly sized and maintained 6" pad system will cool the incoming air to 81°F and increase the relative humidity to 73%. But, if the incoming air temperature was only 85°F with 60% Rh the incoming air would be 77°F and the relative humidity would be 87%. Since as outside temperature increases throughout the day the relative humidity of the air decreases (Figure 1), the sooner the pads comes on in the morning when temperatures are low and the relative humidity is high the more likely you will be pulling 90% humidity air into the house. The later in the day the pads come on (higher temperatures, lower Rh), the more likely you will be pulling 70% humidity air into the house. So as you can see, the lower the temperature evaporative cooling pads are set to come on the more the incoming air will be saturated with water and the more likely you will have litter moisture problems.

How do you avoid all litter moisture problems? You could set your evaporative cooling pads to come on at 90°F. The pads would not run much and as a result you would have very dry litter. The downside is that you would have very hot birds. Obviously this is not a realistic solution. But it is important to keep in mind that you may not need to turn on your evaporative cooling pads as soon as you think. The primary benefit of a tunnel-ventilated house is the cooling effect of air rushing down the house at 500 ft/min. Research has shown that an air speed of 500 ft/min is around a 10 degree cooling effect. So even though the air temperature in the house may be 80 or 82° F that does not necessary mean that the birds feel like it is 80 or 82°F, with a ten degree wind chill effect they would feel like the temperature is 70 or 72°F.

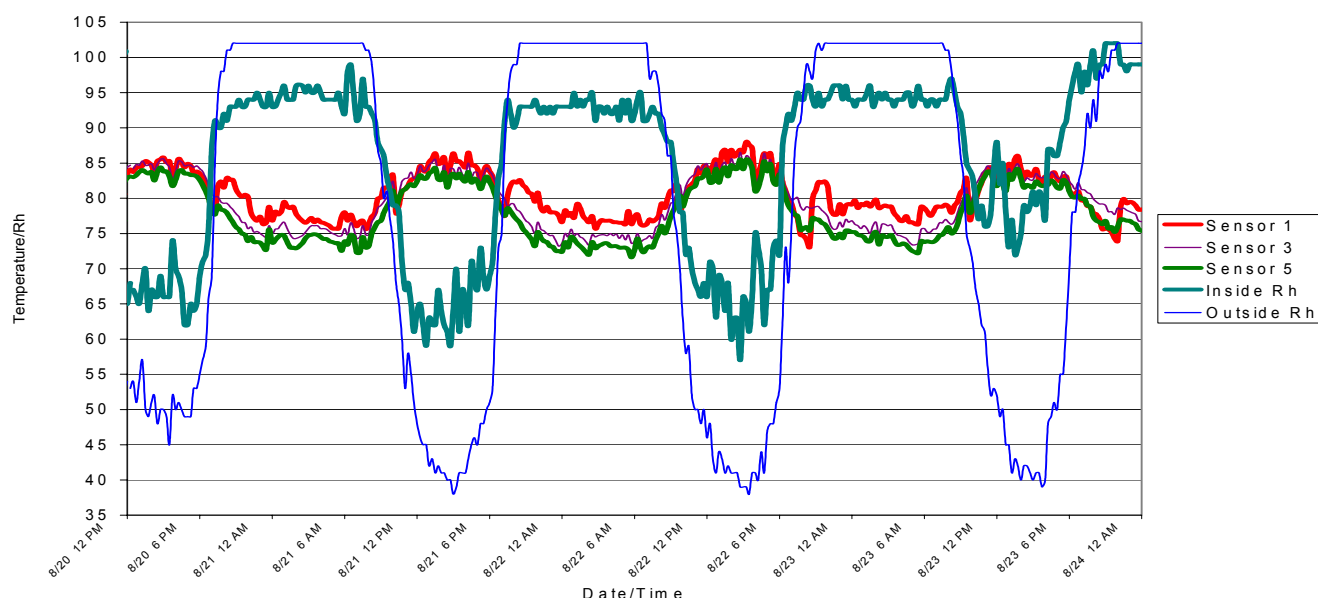


Figure 5. House temperature and Rh (center of house) in a house where the pads were set to turn on at 82°F and there were plenty of tunnel fans operating at night.

This brings up another cause of excessive litter moisture in the pad area of a house, poor fan maintenance. When fans are not maintained properly air speed can be reduced 20% or more. With reduced air speed the birds will become heat stressed at lower air temperatures tempting producers to turn on their evaporative cooling pads before they should. For instance, in a 78°F house with 500 ft/min air speed the birds will probably be very comfortable and as a result most producers would see little need in turning on their evaporative cooling pads. But if the air speed was only 300 ft/min due to lack of fan maintenance a significant amount of wind chill is lost (approximately six degrees) and the birds are likely to show signs of heat stress at temperatures as low as 78° F. In this situation many people may be tempted to turn on the evaporative cooling pads in an attempt to cool the birds. Though very little cooling if any will be produced by the pads at such a low air temperature their excessive use will increase the likelihood that excessive litter moisture will become a problem.

Temperature	On Temp	Off Temp	Fans	Sensors
Inlets	70 F		-	
	72 F	70 F	2	1,2,3,4,5,6
	74 F	70 F	1	1,2,3,4,5,6
	75 F	74 F	1	1,2,3,4,5,6
Tunnel	78 F	75 F	-	
	79 F	76 F	2	5,6
	80 F	77 F	3	5,6
Evap. cooling	83 F	82 F	-	4,5,6

Figure 6. Fan and evaporative cooling settings for maximum cooling of older birds and minimal litter wetting (500' tunnel house with nine fans and six sensors three on tunnel inlet end, three on tunnel fan end).

So what is the correct temperature that pads should come on with older birds? Provided your house has sufficient air speed (500 ft/min), evaporative cooling pads should come on somewhere between 82 and 85°F with older birds. In houses with environmental controllers the average of all the sensors on the tunnel fan end of the house should be used which should minimize the possibility of the pads coming on at too low of a temperature. Furthermore, fans used exclusively for tunnel ventilation should operate off the sensor(s) nearest the tunnel fans to insure that with older birds all the tunnel fans come on before the evaporative cooling pads (Figure 6).

The effect of turning on pads at higher temperatures can be seen in Figure 5. The pad system in Figure 3 was set to come on at 82°F as opposed to the 78°F for the house in Figure 2. Though some credit for the lower house humidity has to go to the fact that it was a little less humid outside for the house in Figure 5, the fact remains that the higher evaporative cooling pad setting led to significantly lower house relative humidity both during the day and night (The relative humidity was lower inside than outside due to the heating of the air as it moved from the inlet to the center of the house).

Can humidistats or relative humidity sensors be used to control the evaporative cooling pads to prevent excessive operation? Though on the surface it may seem like a good idea the problem is that most humidity sensors tend to have accuracy problems when relative humidity is over 80%. As a result using a humidity sensor to control pad operation can easily lead to the situation where the environmental controller unnecessarily turning off the pad system. This doesn't mean that you shouldn't monitor relative humidity during the summer. If the relative humidity is 90% or higher you may want to evaluate if your pads really should be operating. But, again keep in mind that your humidity sensor /gauge could be giving you a false reading.

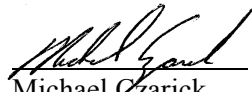
It is important to note that unless you never use your pads, the litter in the pad area will tend to be damp. The goal is to only use pads when they will do more good than harm. With proper wind speed you will find that if turning on your pads is delayed until house temperature reaches the low eighties, you will find that your litter will stay drier and your birds still be cool.

One last point...Why does litter caking tend to be worse in the vicinity of the pad? Quite simply as the air moves down the length of the house the temperature of the air increases. Since warmer air can hold more moisture than cooler air the relative humidity of the air tends to decrease as the air moves toward the fans. In fact, it is not uncommon for the relative humidity of the air near the tunnel fans to be 20% less than relative humidity near the evaporative cooling pads. Since the air can hold more moisture, some moisture will be drawn from the litter in the tunnel fan end of the house leading to drier litter.


Key points to keep when trying to keep the litter in the pad area of a tunnel ventilated house relatively dry:

- 1) Set evaporative cooling pads to come on no lower than 82°F.
- 2) In houses with environmental controllers set your evaporative cooling pads to operate off the average of all the sensors on the tunnel fan end of the house. By running off the average of the sensor on the tunnel fan end of the house this will help to insure that the pads do not come on prematurely.
- 3) Make sure that you do not have too many birds in the tunnel curtain area of the house. When there are too many birds in the vicinity of the tunnel curtain, the birds may be so tightly packed that very little air can make it down between the birds to the litter so very little moisture can be removed from the litter.
- 4) Make sure the tunnel fans operate off a sensor or thermostat near the tunnel fans. By operating the tunnel fans off the sensor/thermostat nearest them this will help insure that there is not a large temperature difference between the two ends of the house leading to the pads coming on prematurely.
- 5) With older birds make sure that all the tunnel fans are operating by the time the temperature on the tunnel fan end of the house reaches 80°F.

- 6) Consider placing your pads on a 24-hour time clock to make sure they shut off at 10 pm and will not turn on before 9 am. This will insure that your pads will not operate when outside humidity is typically above 80% when pads produce little cooling.
- 7) Make sure your tunnel fans are clean and their belts are tight to insure maximum you are able to move as much air as possible to not only to promote bird cooling, but to help insure maximum temperature uniformity and litter drying.
- 8) Clean your pads regularly. Dirty pads reduce the air moving capacity of your fans which increases the possibility of wet litter.



Michael Zarick  
Extension Engineer  
(706) 542-9041 542-1886 (FAX)  
[mczarick@engr.uga.edu](mailto:mczarick@engr.uga.edu)  
[www.poultryventilation.com](http://www.poultryventilation.com)



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

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