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Poultry Housing Tips

Using fogging nozzles in houses with six-inch pad systems

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When properly installed and maintained, a six-inch evaporative cooling pad system can do an excellent job of cooling incoming air during hot weather. As hot outside air is drawn through the pads, the heat (energy) in the incoming air is used to evaporate water from the pads, thereby reducing the temperature of the incoming air. Six-inch pad systems produce more cooling than traditional two-inch fogging pad systems simply because they are more efficient at evaporating water into the air.

There is a fairly consistent relationship between evaporative cooling and humidity. For every one degree cooling produced by a pad, or fogging system for that matter, the relative humidity of the air will increase approximately two and a half percent. More cooling equals more humidity. So on a hot dry day when a six-inch pad system may be producing five degrees more cooling than a two-inch pad system, the relative humidity will be around 13% higher in the house with a six-inch pad system.

The amount of cooling produced by any pad system is determined to a large extent by outside temperature and relative humidity. The good news is that the two are inversely related. In the afternoon when temperature is at its highest, relative humidity is at its lowest, and the cooling produced by a pad system will be at its highest. In the morning when temperatures are low and the relative humidity is high, the amount of cooling produced by a pad system is rather limited (Figures 1 & 2).

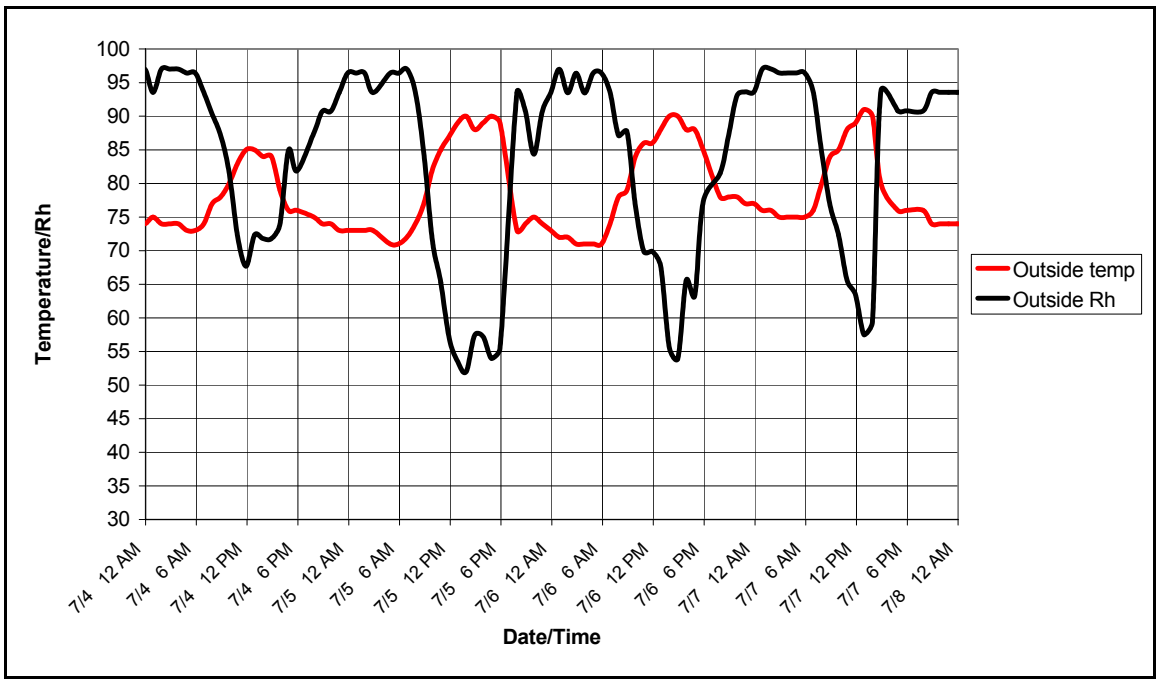

Figure 1. Outside Temperature and Relative Humidity (Alma, Georgia 2003)

In a way, a pad system's objective is to saturate the incoming air with water. The more the pad can saturate the incoming air with water the greater the amount of cooling which can be produced. In general, six-inch pad systems tend to increase the level of saturation (relative humidity) of the incoming air to about 80%, while two-inch pads bring the level of saturation to around 70%. The relative humidity of the incoming air also has an effect on how saturated the air will become after moving through a pad. The more humid the incoming air, the easier a job the pad has saturating the air with water. For instance when a six-inch pad system is used early in the morning the relative humidity of the incoming air can be brought up to around 90%. Conversely, in the afternoon when the relative humidity is lower, the pad system has a harder time saturating the relatively dry air with water and as a result the incoming air will be slightly less humid, more like 75%.

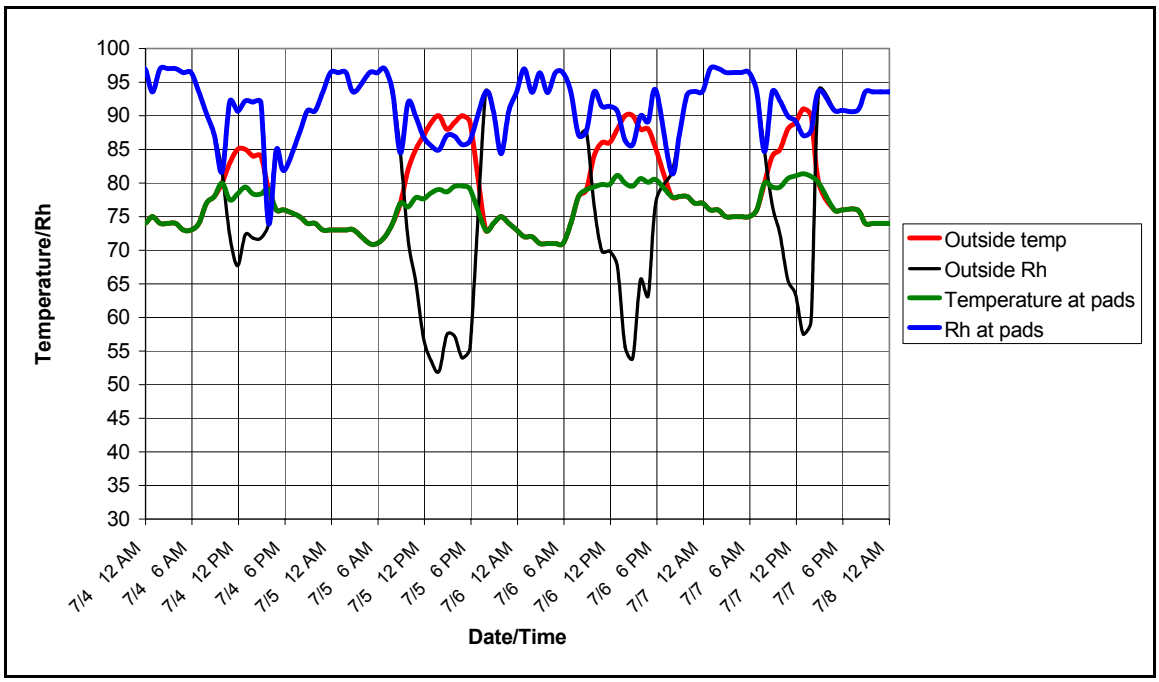

Figure 2. Inside and Outside Temperature/Rh in House with a Six-Inch Pad System (Alma, Georgia 2003)

Figure 2 illustrates incoming air temperature and relative humidity during relatively mild weather in a house with a six-inch pad system set to turn on when the house temperature reaches 82°F. When the pads first come on in the morning there is a sudden rise in relative humidity as the humid outside air is pulled through the wet pad. As the day progresses and outside temperatures rise becoming drier, the relative humidity of the air entering the house decreases slightly. In the evening as outside temperatures fall, the relative humidity of the incoming air starts to rise again just prior to the pads shutting off for the evening. Figure 2 is a good illustration of the fact that when a six-inch pad system is used during mild weather (outside temperature around 90°F) the incoming relative humidity will average around 85%.

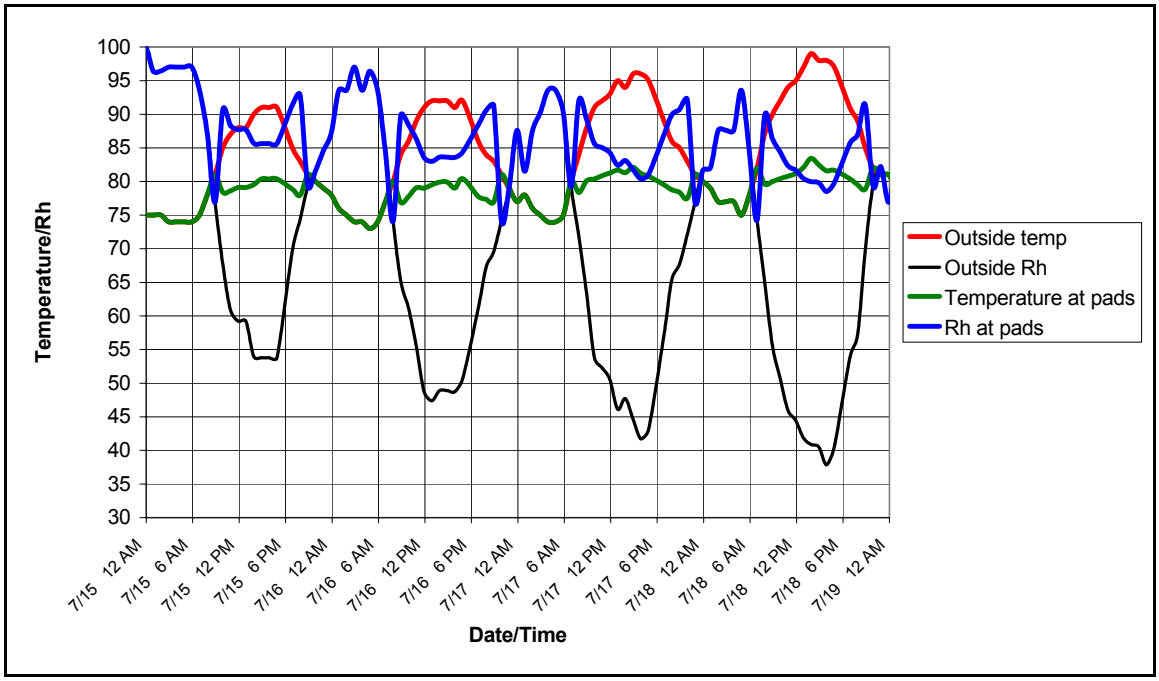

Figure 3. Inside and Outside Temperature/Rh in House with a Six-Inch Pad System (Alma, Georgia 2003)

During hotter weather when the relative humidity is lower, the relative humidity of the incoming air will be slightly lower. In Figure 3 it can be seen that when the outside temperature reached 90°F on the 15th of August the relative humidity of the air entering the house was around 85%. But, when the outside temperature reached 100°F on the 18th and the relative humidity was very low, the relative humidity of the air entering the house was a little below 80%. Figures 2 and 3 are both good illustrations of the fact that regardless of when six-inch pad systems are used the relative humidity of the incoming air will be around 80%.

Though the relative humidity of the air entering through a six-inch pad system will be always around 80% it is important to realize that it decrease as it moves towards the tunnel fans. As the air moves from the pads to the fans it picks up heat from the birds which lowers the relative humidity of the air (warm air can hold more moisture than cool air). The greater the temperature rise the greater the decrease in relative humidity. It is important to note that though the birds are adding some moisture to the air as it moves toward the fans, it is a relatively small amount, and therefore doesn't change the fact that the relative humidity will always be lower on the tunnel fan end of a house.

How much will the relative humidity change? In a tight, well insulated house, with properly maintained fans, the air temperature should be at most five degrees higher on the tunnel fan end of the house. A five degree rise in air temperature, taking into account the moisture added by the birds, will result in a decrease in relative humidity at the exhaust fan end of the house of about five percent. As can be seen in Figure 4, when outside temperature was in the low nineties the relative humidity at the inlet end was a little less than 85%, while at the fan end it dropped to under 80%. When the outside temperature was near 100°F, the relative humidity at the inlet end dropped to 78% at the fan end dropped to approximately 72%.

A common question is when should I use interior fogging nozzles in a house with a six-inch pad system? First it is important to realize that fogging nozzles will do little cooling in a house when the relative humidity is much above 80%. When the relative humidity is above 80% the air is so saturated with water that there is very little potential for cooling. Furthermore, when the relative humidity is this high it takes a long time for the droplets to evaporate, thus increasing the possibility of house wetting. So when can you expect to see the relative humidity of the air in a house with a six-inch pad system drop below 80%? When it is very hot and dry outside. For instance, in Figure 4 on July 17 outside temperature reached 100°F, the air temperature at the fan end of the house rose to approximately 87°F (82°F + 5°F temperature rise), and the relative humidity decreased to around 75%. At this point using interior fogging nozzles could be argued appropriate. This is a common trend. When the temperature of the air in the house is above 87°F, the relative humidity is typically below 80% and interior fogging nozzles can produce a little cooling. Realize that in houses with six-inch pad systems, air temperature should rarely reach 87°F.

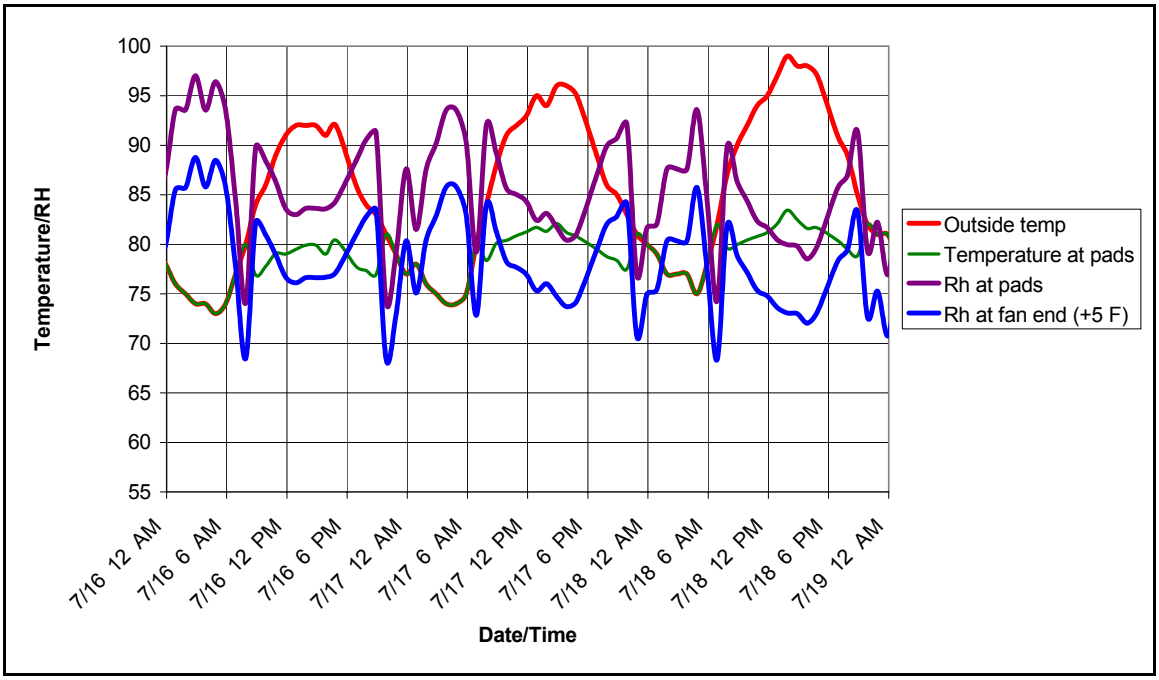

Figure 4. Conditions in a House with a Six-Inch Pad System (5°F temperature rise)

What is the downside of using interior nozzles in a house with a six-inch pad system when air temperature in a house is much below 87°F? First, since the relative humidity will be high, very little moisture that the nozzles introduce into the house will actually evaporate which will lead to wet birds, fans, and litter. Wetting birds when the humidity is high does not produce as much bird cooling as many think. When you walk into a house and your skin gets wet, heat is pulled from your body to evaporate the water thus producing cooling. But, keep in mind when chickens get wet, their skin will remain dry and as a result they do not benefit from getting wet nearly as much as you or I do. Think of it. How much cooler do you think you would feel if on a hot summer day you were wearing a heavy winter coat and some one sprayed a little water on you?

Another potential problem with using fogging nozzles is that tunnel fan shutters can become wet. Wet fan shutters collect significantly more dust than dry shutters. The dust accumulating on fan shutters increases the weight of the shutters which can significantly decrease the air moving capacity of the fan. As the air moving capacity of the fans is decreased so is the wind speed in the house. Lower wind speed, lower wind chill effect . The net result is that using fogging nozzles when the humidity in the house is high can actually reduce bird cooling even if it decreases house temperature a degree or two.

This brings up an important point. The high relative humidity experienced in most houses with six-inch pad systems does not present a problem if a house has sufficient wind speed. With 500 ft/min wind speed the air moving across the body of the bird removes a substantial amount of heat so the bird has to rely less on panting to cooling itself. The less the bird relies on panting to cool itself the less important relative humidity is. But, as the air speed decreases the more the bird has to rely on panting to cool itself and the more important relative humidity becomes. So whereas 82ºF, 80% relative humidity in a house with 500 ft/min air speed is not a problem, let the air speed drop to 350 ft/min (possibly because of dirty fan shutters) and with the same temperature and relative humidity you now have a heat stress situation.

Last but not least, using fogging nozzles in a house where the relative humidity is above 80% can lead to wet litter. Wet litter not only can increase nighttime heat stress but can lead to condemnation, foot pad, and catching problems. All in all, running fogging nozzles in a humid house can lead to far more problems than benefits.

In which houses does using interior fogging nozzles have the greatest potential benefit? Quite simply, in houses that have ventilation/evaporative cooling systems that are not functioning properly. For instance, let's say that instead of a five-degree temperature rise that a house had a ten-degree temperature rise from the pad to the tunnel fan end of the house. In this case the air on the fan end of the house would be significantly drier and therefore using fogging nozzles would not pose nearly the risk of house wetting and all the associated problems (Figure 5).

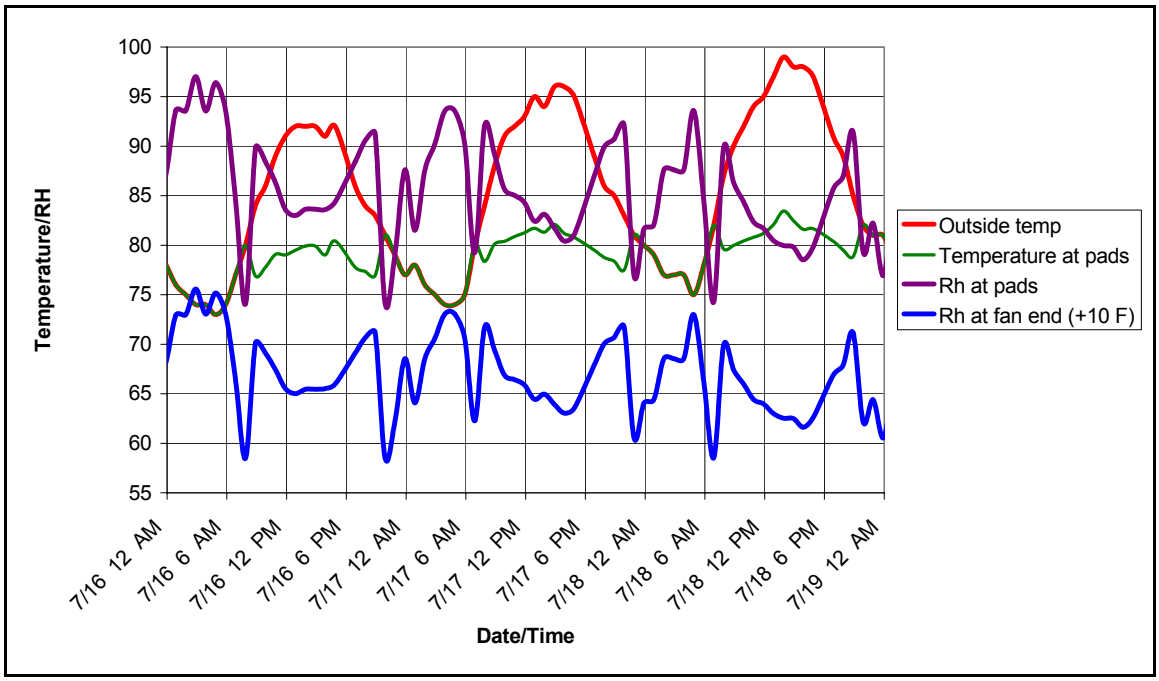

Figure 5. Conditions in a House with Six-Inch Pads (10ºF temperature rise)

Another case where interior fogging nozzles would prove beneficial is if the pads were not being wetted properly. In this situation the cooling produced by the pads would be reduced and the air entering the house would be hotter and drier. So if fogging nozzles were used to cool the air more, the likelihood of house wetting would be low. This is the reason that interior fogging nozzles have traditionally been used in conjunction with fogging pads. Fogging pads produce less cooling than six-inch pad systems and therefore the air entering the house is drier, allowing the use of interior nozzles during hotter weather without the risk of house wetting (Figures 6 &7).

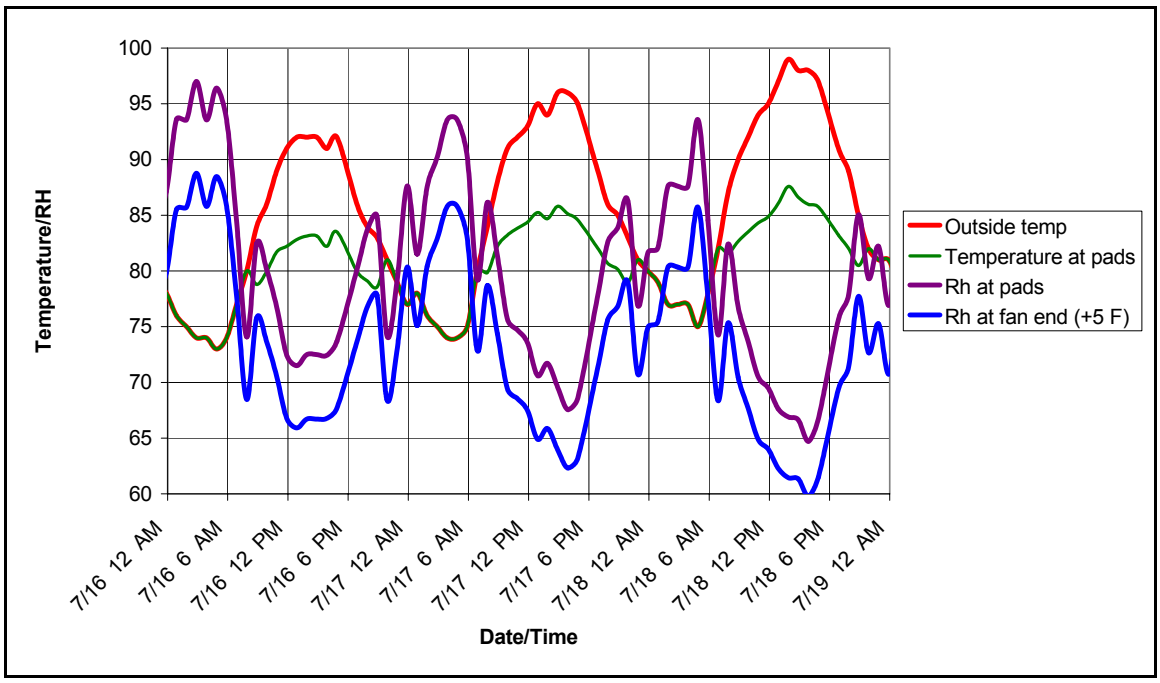

Figure 7. Temperature and Rh Throughout house with Fogging Pads or Improperly Wetted Six-Inch Pad System.

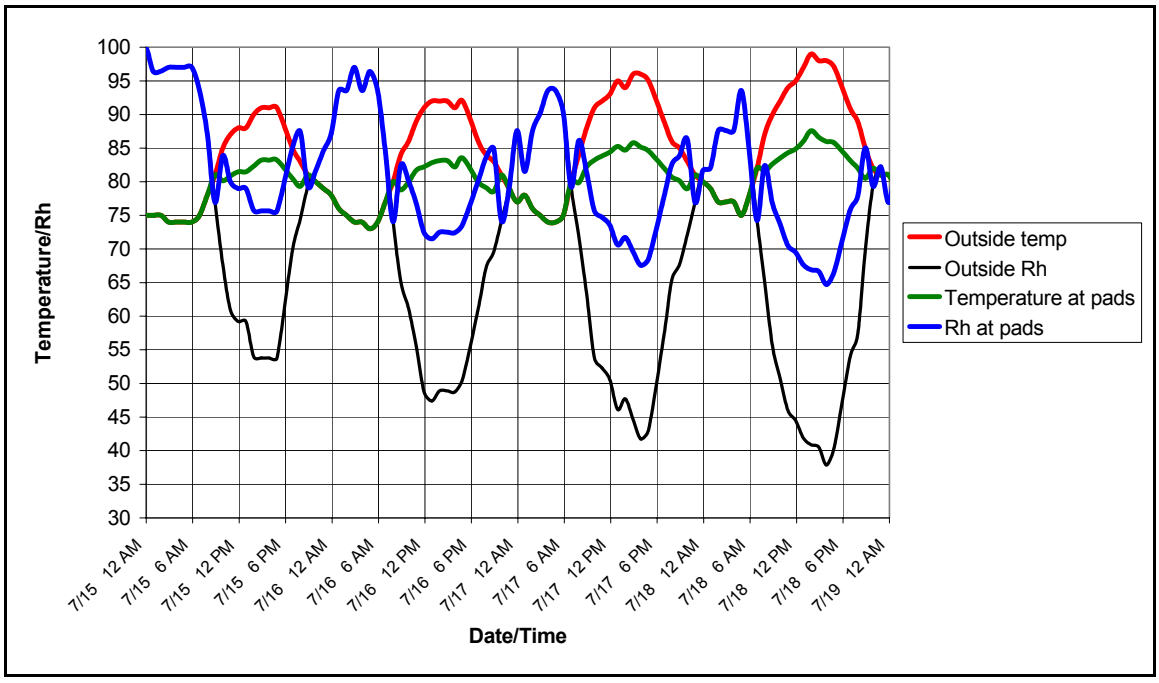

Figure 6. Temperature and Rh in house with Fogging Pads or Improperly Wetted Six-Inch Pad System.

The question is not whether you should be using interior fogging nozzles in six-inch pad system houses that have conditions like the ones depicted in Figures 5,6,7, but rather why those conditions exist. In a way, by using interior fogging nozzles in houses with six-inch pads you are attacking the symptom and not the problem. The problem is that your ventilation/cooling system is in need of maintenance and though using interior fogging nozzles will help

the birds in the short term you are not producing the cooling you could if the pads/fans were functioning proper and your house was tight.

In conclusion, if your house temperature rises above 87°F you should be able to use interior fogging nozzles sparingly without too much of a risk of wetting your house. But, the fact remains that in houses with six-inch pad systems where everything is functioning properly instances where the house temperature exceeds 87°F should be very rare. If house temperatures above 87°F are common, check the following.

1) Are your fans properly maintained? Belts tight, unworn? Shutters and screens clean?

2) Are your houses tight? Can you obtain a static pressure of at least 0.13" when the tunnel curtains and side wall inlets are closed an you operate one 48" fan?

3) Are your pads being throughly wetted? Check to see if your filters are clean, sump tank float is set properly, and header pipe holes are clean.

4) Are your pads clean and the tunnel curtain wide open?

When you find that you need to use interior fogging nozzles consider the following:

1) Fogging lines should be operating at a pressure of at least 150 psi. The higher the water pressure the finer the mist, the faster the droplets will evaporate, the less likely you will wet your house.

2) If you are wetting your fans you are adding too much fog. Turn off individual cross lines of fogging nozzles until the fog no longer reaches the fans.

3) Do not use fogging nozzles within 100' from the fans. Nozzles this close to the fans will tend to do more fan wetting than cooling.

4) Do not operate fogging nozzles off of an interval timer. Fogging nozzles tend to produce a very coarse mist as the pump comes up to pressure and drip a long time after each time the pump shuts off.

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