Department of Poultry Science
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Poultry Housing Tips

Using Interval Timers to Control Evaporative Cooling Pads

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Though it may not seem like it, each one-foot section of a five-foot-tall, six-inch pad has a tremendous surface area...well over 300 square feet. As a result, a house with two 70' X 5' evaporative pad systems has over 42,000 square feet of pad surface area from which water can evaporate and cool the incoming air. When we look at a 70' X 5' pad system, we can only see the 350 square feet of surface area, not the over 21,000 square feet of (60 times) interior pad surface area. It is important to realize that it's not the water circulating over the pad's exterior surface that cools the incoming air, it is the water evaporating off the vast interior surfaces of the pad that does the majority of the cooling. The problem is that pads are often managed by looking at the exterior surface of the pad rather than the interior surfaces. The exterior surface of a pad can be dry, but the interior of the pad can remain wet and continue to cool the incoming air for a surprisingly long time.

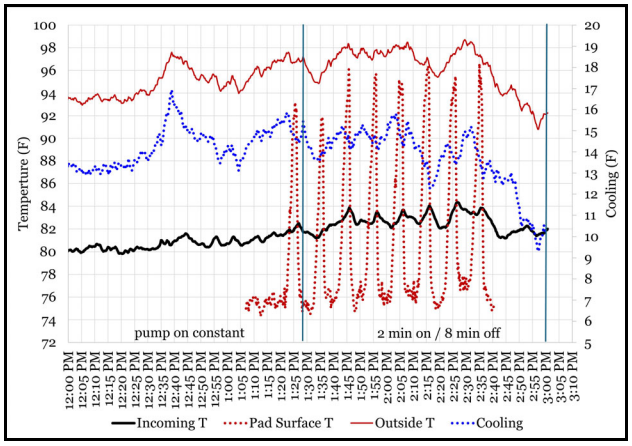

Figure 1. Evaporative cooling system performance on a very hot, dry afternoon (RH=35%) - https://youtu.be/ne21iUN6ALw

A dry five-foot tall section of a six-inch evaporative cooling pad weighs approximately 2.5 lbs. Once saturated with water, this weight can increase to 7.5 pounds or more. This means that if a house had two 75' long pad systems, they would be capable of holding over 90 gallons of water, which would be theoretically capable of decreasing the incoming air temperature on a 90°F day (50% RH) to 79°F for nearly 15 minutes without any water being added to the pads. In reality, of course, the incoming air temperature would increase over time as the pads dried, but the fact remains that thanks to the high water-holding capacity of paper pads, a wetted pad continues to cool and humidify the incoming air long after the water circulation pump is turned off and the surface dries. In fact, while the leading edge of a pad may start to dry within a few minutes of the pump being turned off, the interior of the pads often remains fully wetted for ten minutes or more, resulting in the temperature and RH of the incoming air remaining essentially the same for ten minutes or more (Figures 1 and 2). The high water-holding capacity of paper pads is further demonstrated by the fact that, during the day, it can take 30 minutes or more for the pads on a house to fully dry (Figure 3). In the evening, when the air is cooler and more humid, it can take hours for a pad to fully dry after the pumps are turned off for the day.

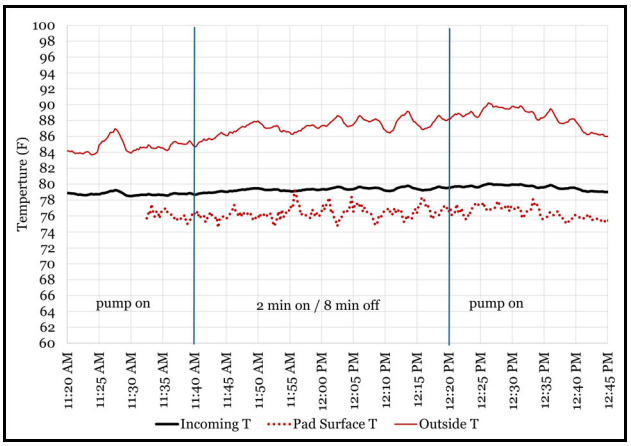

Figure 2. Evaporative cooling system performance on hot, humid afternoon (RH=55%) - https://youtu.be/ido4nzWj5MA

Another interesting consequence of the high water-holding capacity of paper pads is that operating a circulation pump off an interval timer often has a minimal effect on the temperature and relative humidity of the incoming air. The typical pad system

circulation pump can circulate between ½ and one gallon per minute over each linear foot of pad, which is approximately ten times the typical water evaporation rate from a pad. As a result, the typical circulation pump is capable of saturating the pads with water within a couple of minutes of it turning on. Since a saturated pad is typically capable of producing essentially the same level of cooling for ten minutes or more, turning off a pump for six, seven, or eight minutes will typically result in very little change in the temperature and/or relative humidity of the incoming air. Yes, the leading edge may start to dry after the pump is off for a few minutes (Figure 4) but since the pad's interior remains damp, the cooling as well as the humidity produced by the pad will tend to be minimally affected during the pumps off time (Figure 1). This is not to say that cooling produced by a pad cannot be limited by operating a pad system's pump off an interval timer. If a pump is set to operate less than a minute and it is hot and dry enough outside, the cooling and humidity produced by a pad will be reduced. How much is very difficult to estimate because the amount of water that will evaporate will change constantly as outside temperature and humidity vary over the course of a day.

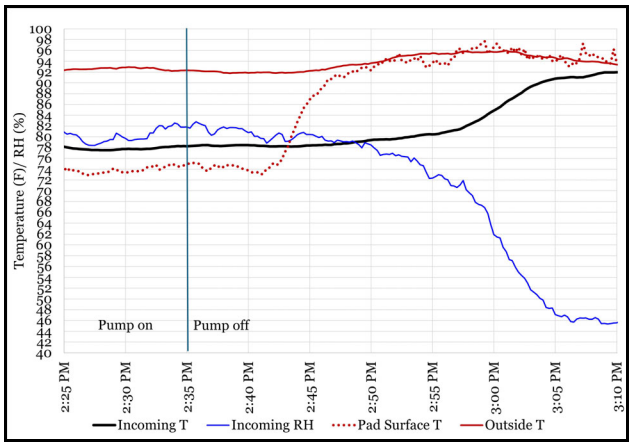

Figure 3. Evaporative cooling system performance on hot, dry afternoon (RH=35%)

Figure 1 illustrates the incoming air temperature as well as the pad surface temperature on an afternoon when the outside temperature was approaching 100°F and the RH was approximately 35%. Figure 2 illustrates the same variables for the same house a few days later when the outside temperature was in the high eighties and the RH was much higher, 55%. On the "cooler" more humid day there was minimum pad surface drying during the eight minutes the circulation pump was off and no difference in the incoming air temperature whether the pump was operating continuously or on an interval timer. Even on a very hot and dry day, though the surface of the pad was dry approximately five minutes after the pump turned off, the cooling produced by the pad was minimally affected, a degree or less, during the eight minutes the pump was off. In both instances, whether the pump was operating continuously or on an interval timer, the cooling produced by the pad system (and therefore the humidity produced by the pad system) was very similar.

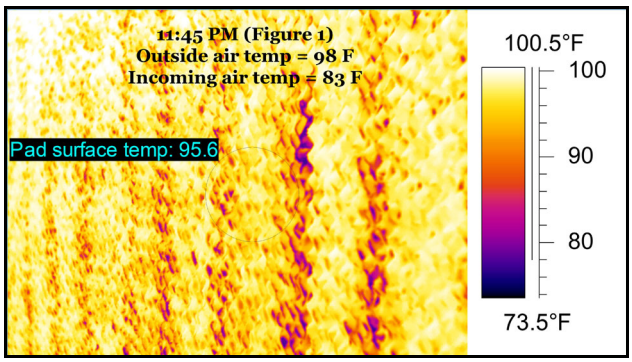

Figure 4. Pad surface temperatures six minutes after pump was turned off on a very, hot and dry afternoon (98°F / 35% RH)

It is sometimes thought that the use of an interval timer increases the cooling with less humidifying of the incoming air and/or makes it easier for the fans to pull air into a house because there is less water flowing over the surface of the pad. The fact is if a pad is relatively clean, water flowing over the surface of the pad has a minimal effect on pressure (0.005") and therefore a minimal effect on house air flow. Furthermore, whether there is a lot of water flowing over the surface of a pad or if the pump is off and there is no water flowing over the pad, the amount of cooling produced by a pad system is essentially the same because again the vast majority of the cooling is produced within the pad and not the exterior surface of the pads (Figure 2). Since evaporative cooling of the incoming air and humidification of the incoming air go hand in hand, if the cooling is unchanged, then the humidification of the incoming air is the same.

Can interval timers be used to control the operation of evaporative cooling system pumps? Sure. But the fact remains that due to a pad's ability to hold a substantial amount of water and having a massive interior surface area, doing so often has much less of an effect on the cooling and humidification of the incoming air.

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