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Poultry Housing Tips

Controlling Cooling Produced By Six-Inch Pad Systems

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One of the challenges with six-inch evaporative cooling pad systems is controlling the amount of cooling they produce. With fogging systems or fogging-pad systems cooling can be controlled by simply limiting the number of fogging nozzles operating; i.e., half the nozzles, half the cooling. But with six-inch pad systems controlling cooling is not that simple. One problem is that a pad system's circulation pump can put a large amount of water on the pads in a very short period of time. For instance, the circulation pumps on the typical broiler house with six-inch pads can put approximately 100 gallons of water on the pads in less than one minute. 100 gallons of water is enough to drop the temperature of the incoming air ten degrees or more on most days. Further complicating matters is that just because the circulation pumps shut off doesn't mean that a pad stops cooling. In fact, cooling actually increases after circulation pumps turn off as the water which was previously placed on the pad slowly wicks throughout the pads increasing the percentage of the pad which is wet thereby increasing the cooling produced.

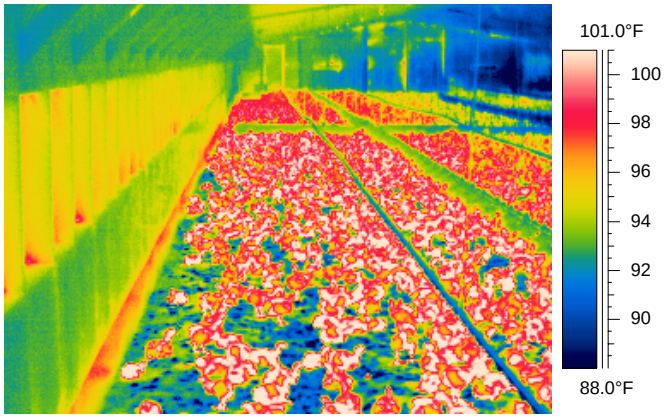

Figure 1. Side of house with dry pads.

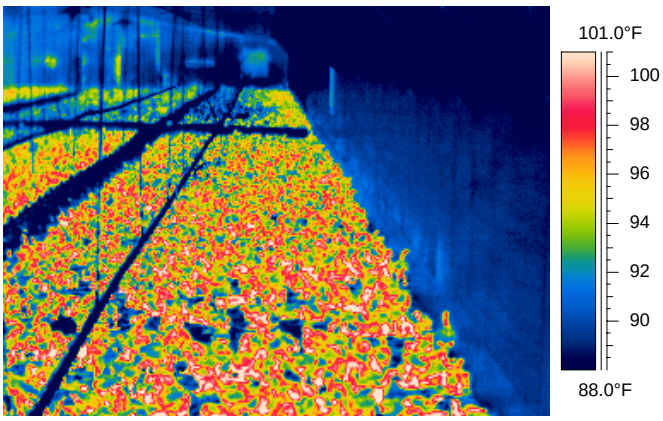

Figure 2. Side of house with wetted pads.

Being able to control the amount of cooling produced by a pad system is important for a couple of different reasons. First, younger birds do not often need the full cooling potential of a pad system. We may only need to decrease the house temperature three to five degrees on a hot day to produce the necessary level of cooling not the full 20°F or more most systems are capable of producing. Not only may 20°F cooling be unnecessary, but often can cause other problems. For instance, excessive cooling can cause an environmental controller to take a house out of tunnel ventilation back to inlet ventilation and turn on the brooders/furnaces. Not only is this wasteful from an energy stand point, but can be stressful for the birds in the house.

Another problem with not being able to control the cooling produced by the pads is that litter quality will tend to suffer. For every 1°F cooling produced by a pad system the relative humidity of the incoming air will increase 2.5%. As a result the more cooling a pad system produces the more humid the incoming air will be. With older birds when maximum cooling is a must the high humidity is difficult to avoid. But with younger birds when we limit the cooling produced by a pad system we will also be limiting the humidity of the air entering the house which over the long run will lead to better litter conditions. For instance, if we only want 5°F cooling from the pads the incoming air will be 12.5% more humid than air outside. But, if the cooling produced by a pad was not limited, and the pad system produced 20°F cooling the incoming air would be 50% more humid than the outside air. Overtime, bringing in nearly saturated air would do little to remove moisture deposited in the litter by the birds leading to caking problems.

So what is the best way to control cooling produced by a pad system? One way is to control pad system circulation pumps with an interval timer. By placing the circulation pumps on a timer, circulation pumps can be turned on for short periods of time then quickly shut off to assure too much water is not added to the pads. Though this method can be effective in limiting cooling there are a couple of potential problems. First, setting the interval timer to get the circulation pumps to run just long enough to cool the desired amount can be a challenge. Since the pumps move a tremendous amount of water in such a short period, small changes in circulation pump run time (i.e. 15 seconds) can make a sizable difference in the cooling produced by a pad system. Furthermore, the amount of time the circulation pumps need to run changes throughout the day as outside temperature increases and relative humidity decreases. The most successful way of using an interval timer to control cooling is through the use of a modern environmental controller. Many of the environmental controllers available today have specific software that slowly change circulation pump interval timer settings based on inside and/or outside temperatures. Though these systems have proven successful in limiting cooling produced by pad systems it is important to realize that the downside of running a pad system off an interval timer is that it can lead to reduced pad life.

Figure 3. Interval timer or environmental controller to limit pad system cooling.

Another method of limiting pad cooling is only wetting the pads on one side of the house. Though on the surface this seems like a good idea the problem is that in most cases there is limited mixing of the air entering the house from the two pad systems. Therefore, if the pads are wetted on the north side of the house and not on the south side of the house, the cooled air entering the north side of the house will tend to stay on the north side of the house and the hot air entering the south side of the house will tend to stay on the south side of the house resulting in two significantly different environments within the same house.

The magnitude of the difference when only the pads on one side of a house are wetted was recently documented on a broiler farm with three-week-old birds. Outside air temperature was in the low nineties and the producer was operating approximately half of his tunnel fans producing an air speed of just under 300 ft/min. Pads were being wetted on just one side of the house in an effort to temper the incoming air temperature. The temperature of the air entering through the wetted pads was approximately 84°F and 93°F for air entering the dry pads. Air temperature measurements taken at 250 feet from the pads showed that the air temperature was 91°F on the dry pad side of the house and 86°F on the wetted pad side of the house indicating very little of mixing of the two air streams had taken place.

Pictures taken with a thermal imaging camera confirmed the fact the birds on the dry pad side of the house were significantly warmer than those on the wetted pad side of the house. Average head temperature of the birds on the dry pad side of the house was 102.8ºF, while average head temperature of the birds on the wetted pad side of the house was 101.1ºF(Figures 1 and 2). Though head temperature is not a direct measure of deep body temperature it is a good indicator that the birds were significantly hotter on the side of the house with the dry pads. It is important to note that a difference in head temperature between the two sides of the house was also observed for birds 400' from the pad end of the house.

In an effort to improve mixing of the two air streams the tunnel curtains were partially closed. Though the speed of the air entering the house was increased and mixing improved the temperature differences between the two sides of the house were only minimally affected.

Figure 4. Circulation pump in center of system with cut-off valves

Figure 5. Cut-off valves to control cooling.

Figure 6. Pad system with a circulation pump on each end.

A better method of limiting cooling on those houses where the circulation pump is located in the center of the pad system is to only use one half of the pad on each side of the house. Through the use of a valve, the pads nearest the end wall can be wetted while those nearer the tunnel fans could be left dry (Figure 7). Another option would be the pads nearest the end wall could be wetted while those furthest from the end wall on the system on the opposite side of the house are also wetted (Figure 8). By introducing both cool and hot air on both sides of the house better mixing of cool and hot air will take place leading to more uniform temperatures across the width of the house. A

producer can turn off half the pad system for the first three or four weeks of the grow out and then when the birds are older and more cooling is required the valves can be opened and the entire pad system can be utilized.

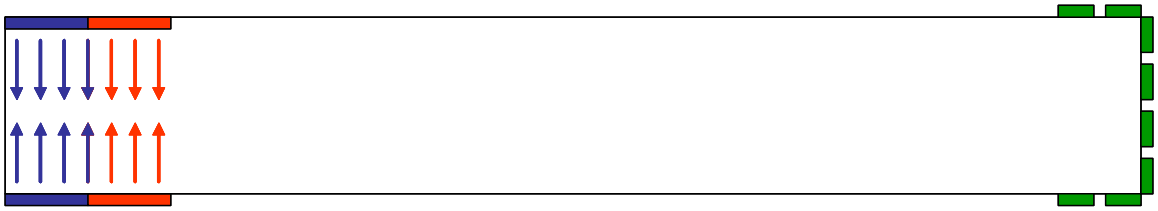

Figure 7. Split evaporative cooling pad system - Method 1.

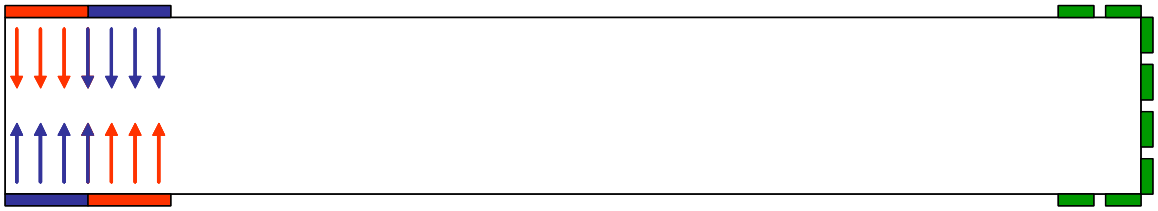

Figure 8. Split evaporative cooling pad system - Method 2.

An improvement to opening and closing valves manually to control cooling is to actually install four circulation pumps instead of two. Though at first this may seem like a significant increase in cost, the fact is that it is often less expensive to install two smaller circulation pumps on each side of the house than one larger pump. By installing four circulation pumps the pad system on each side of the house could be split into two independent systems. For moderate cooling the one circulation pump on each side of the house could be turned on. As the amount of desired cooling is increased the second pump on each side of the house could be turned on. This method of controlling cooling pad systems could be automated even further by allowing one circulation pump at a time to be turned on providing producers with a very high level of control over house temperature. Another advantage of having four pumps is that if a single pump goes out you would only lose one quarter of your cooling not one half.

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