The University of Georgia
Cooperative Extension Service
College of Agricultural and Environmental Science/Athens, Georgia 30602-4356

Poultry Housing Tips

Six Inch Pad Systems Will Use More Water Than Fogging Pads

Volume 13 Number 6 **May, 2001**

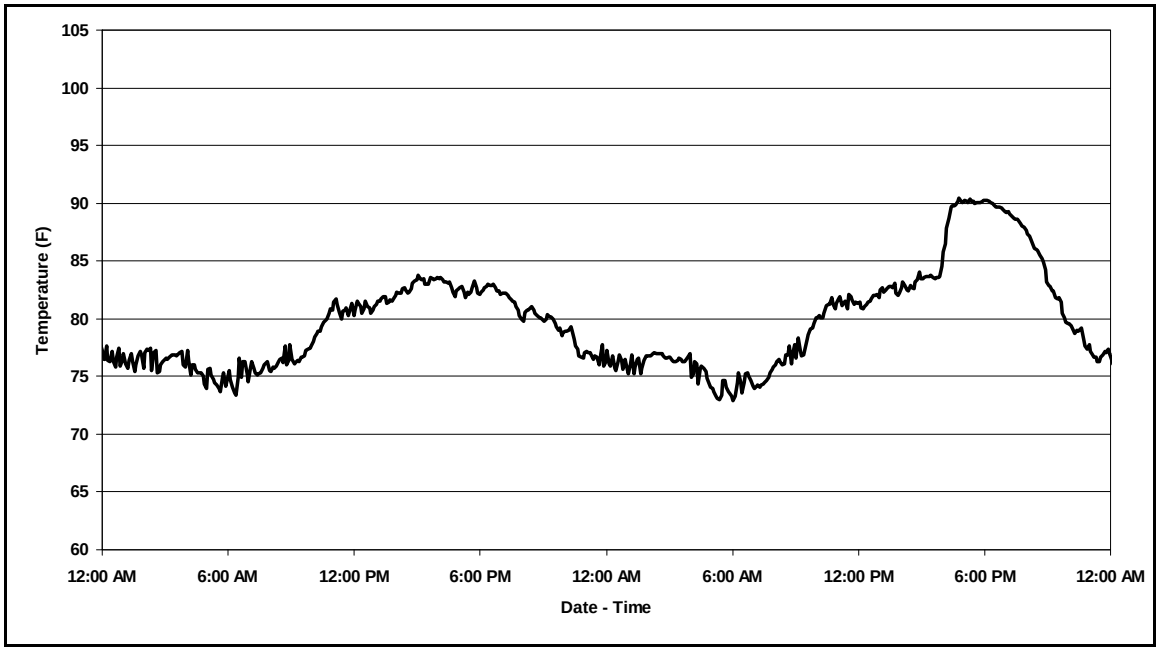

Figure 1. Loss of water to a two inch fogging pad system (5 p.m. the second day)

First there was tunnel ventilation with interior fogging nozzles where producers could reduce the air temperature by about ten degrees during hot weather. Fogging nozzles when combined with air speeds of 400 ft/min or more kept the birds fairly comfortable. Then in a quest to minimize house wetting, as well as to increase cooling, producers next turned to fogging pad systems for their tunnel-ventilated houses. Though fogging pad systems virtually eliminated house moisture problems and increased cooling by as much as five degrees, producers discovered that if they were not closely managed water runoff from the pads could be excessive and maintaining nearly 300 fogging nozzles was a very time consuming task on farms with poor water quality. Today, many producers are installing what is considered by

most experts to be the "ultimate"evaporative cooling system, six inch pad with water recirculation. With six inch pad systems, water wastage/runoff is eliminated while increasing a producer's ability to cool the air is to 20°F or more. Six inch pad systems may sound problem-free at first, but one thing to keep in mind if you are planning to install one: even though they may produce a substantial amount of cooling and do not "waste" any water, they can "use" a lot of water when it is hot and dry outside.

	Relative Humidity								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
70 F	17.4	17.7	12.8	10.5	8.3	6.8	5.3	3.0	1.5
75 F	19.0	16.4	13.9	11.3	9.0	7.1	5.3	3.4	1.5
80 F	20.6	17.7	15.0	12.0	9.8	7.5	5.3	3.8	1.5
85 F	22.4	19.1	16.1	13.1	10.5	8.3	5.6	3.8	
90 F	24.1	20.4	17.3	14.3	11.3	9.0	6.0		
95 F	25.8	21.8	18.4	15.0	12.0	9.4			
100 F	27.8	23.3	19.5	15.8	12.8				
105 F	29.4	24.8	20.3	16.5					
110 F	31.1	26.0	21.0						

Figure 2. Cooling produced by a 6" pad system under various outdoor conditions (°F).

Evaporative cooling systems reduce air temperature through the evaporation of water into the air. The more water you can evaporate into the air the more cooling you can produce. Your ability to evaporate water into the air depends on two factors: the temperature and relative humidity of the air and the "cooling efficiency" of the evaporative cooling system (believe it or not, water temperature has a negligible effect on cooling). When the temperature is high and the humidity is low, all evaporative cooling systems do a much better job because there is less water in the air and more evaporation and therefore cooling can take place. The amount of cooling the various evaporative cooling systems can produce depends on their ability to transfer water into the air. For instance, a six inch pad system is much better at "transferring" water into the air than a two inch pad. As a result, it will produce more cooling. Likewise, a two inch pad will produce more cooling than a low pressure fogging system because it is better at transferring water into the air than a low pressure fogging system. So, what happens when you take a system like a six inch pad which is really good at evaporating water into the air, and run it on a day when there is very little water in the air (i.e., a hot, dry day)...a lot of cooling, and high water usage results.

Figure 2 illustrates the cooling a six inch system is capable of producing under different weather conditions. As you can see, when it is humid outside the pad system produces little cooling because it is hard to evaporate water into air that already has a lot of water in it. But, as temperatures rise and humidity falls a six inch system could produce more than thirty degrees cooling. This is not to say you should expect thirty degrees of cooling, because the humidity rarely drops below 20% in most poultry producing areas of the U.S. Typically when temperatures are in the low 100's producers will see humidity in the twenties and therefore expect to see a maximum temperature reduction somewhere in the mid twenties.

	Relative Humidity								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
70 F	6.2	6.3	4.5	3.7	2.9	2.4	1.9	1.1	0.5
75 F	6.7	5.8	4.9	4.0	3.2	2.5	1.9	1.2	0.5
80 F	7.3	6.3	5.3	4.3	3.5	2.7	1.9	1.3	0.5
85 F	8.0	6.8	5.7	4.7	3.7	2.9	2.0	1.3	
90 F	8.6	7.2	6.1	5.1	4.0	3.2	2.1		
95 F	9.2	7.7	6.5	5.3	4.3	3.3			
100 F	9.9	8.3	6.9	5.6	4.5				
105 F	10.4	8.8	7.2	5.9					
110 F	11.0	9.2	7.5						

Figure 3. Six inch pad system water usage (gallons per minute) for a typical 40' X 500' broiler house under various outdoor conditions.

Figure 3 illustrates the amount of water a house with two 55' X 5' X six inch pad systems (with 183,000 cfm of exhaust fan capacity) will use under different weather conditions. As you might expect, when it is humid the system will use relatively little water. But, when the system is producing twenty degrees or more of cooling the water on those 100°F days, water usage can rise to nearly ten gallons per minute. Now under "normal" summertime conditions, temperatures in the 90's and humidity around 40% or so, a six inch pad system will not use a tremendous amount of water, about five gallons per minute. In fact this will be significantly less than a poorly managed two inch fogging pad system, which if a producer was using all the nozzles and a booster pump running at 150 psi, would be using six and a half gallons per minute (300 nozzles @ 1.3 gallons per hour equals 390 gallons per hour or six and a half gallons per minute). But, let the temperature increase ten degrees and the humidity fall about 20%, then your water usage with a six inch pad can increase by more than 50% to over eight gallons per minute. This is more than the fogging pad system will use because the fogging pad system is limited in the water it can use by the pressure and number of nozzles installed. Thus, it is generally recommended that if you are planning to install a six inch pad system, you have a well capacity of at least ten gallons per minute per house. Ten gallons per minute in a typical worst case scenario (large birds on a 100°F day with 20% Rh) would allow approximately eight gallons per minute for the pad system and two gallons per minute for the birds. Now the fact of the matter is that a producer may be able to go years without needing ten gallons per minute of water per house, but nothing is worse than spending $10,000 or more for a six inch pad system and having birds die on that 100°F day because you do not have enough water. One word of caution, if you live in an area where temperatures are above 100°F on a fairly regular basis, it is advisable to have a minimum of 12 gallons per minute of well capacity per house.

Though Figure 3 is for a 55' X 5' pad system, it can be used to get an idea of how much water other six inch pad systems will use if you keep in mind the that water usage is proportional to pad area. The amount of evaporative cooling pad a house requires depends on the air moving capacity of the tunnel fans (for six inch pads approximately one square foot of pad is required for every 350 cfm of exhaust fan capacity). Therefore, if a house had 220,000 cfm of exhaust fan capacity, approximately 15% more pad area would be required and water usage would increase 15%. As a result, a grower with 220,000 cfm of exhaust fan capacity should plan for at least 12 gallons per minute of well capacity per house. Of course, the converse is true, a smaller house with fewer fans, would require less pad and as a result water usage would be lower.

What about four inch pad systems? When properly sized, a "four inch system" is just as effective at evaporating water into the air as "six inch system" and therefore will produce the same amount of cooling and use the same amount of water. The key word here is "system". Due to differences in construction, namely flute angles, a four inch system requires approximately 40% more pad area (one square foot of four inch pad for every 250 cfm of tunnel fan capacity) than a six inch system. As result, four inch systems are longer than six inch systems, but use the same amount of water.

The following steps should be taken to help insure adequate water flow to six and four inch cooling pad systems:

1) Make sure you have a well (or wells) capable of supplying ten gallons per minute per house. Smaller houses with less pad require less, larger houses more.
2) Make sure water supply pipes running from the well to the house are properly sized to insure that you can get the proper amount of water from the well or city water supply to your houses (see: *Are your water supply pipes large enough, Poultry Housing Tips, August 1998*)
3) Make sure water supply pipes running from the center of the house to the pads are at least 3/4" in diameter, ideally 1".
4) Keep water filters clean and replace as needed.
5) Check with the cooling system manufacturer to insure float valves are capable of suppling at least five gallons per minute (there are typically two pad systems per house).
6) To minimize the risk of running out of water, have two sources of water for your poultry houses that can be easily switched.
7) Consider installing a water storage tank. Worst case scenario the typically 500' house would require 600 gallons of water for each hour of operation.
8) Make sure you have at least 40 psi of water pressure flowing to the pad system.

If you run into a water availability crisis (i.e., big birds, hot dry weather, inadequate water supply) you may want to consider the following. Keep in mind that most of these steps will reduce cooling.

1) Turn off the lights in dark curtain houses.
2) Run the pads off a five minute timer (i.e., 2 ½ minutes on, 2 ½ minutes off). This is for emergency purposes only. Continual cycling of water reduces pad life.
3) Partially close the valve running to the water distribution pipe on top of the pads.
4) Turn off the bleed-off valve.
5) Inspect for leakage around the gutter, water tank, and distribution pipe.

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Publication of this newsletter is supported by funds granted to the DOE pursuant to the provisions of public law 94-163