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Poultry Housing Tips

Managing Fogging-Pad Runoff

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Fogging-pad systems are quickly becoming the preferred method of reducing air temperature in tunnel-ventilated poultry houses during hot weather. They can cool incoming air 12 degrees or more while keeping the birds, litter, and equipment relatively dry. Overall, producers have reported minimal problems with fogging-pad systems, as compared to traditional fogging systems.

One of the few problems that producers have reported is excessive water runoff from their pads. If operated improperly, more than four gallons per minute can run off a fogging pad onto the ground, creating a mess around a poultry house in a relatively short time. Conversely, if too little water is placed on a pad in an effort to reduce runoff, cooling will be reduced.

Managing runoff is fairly easy if you understand how a fogging-pad system works. Fogging pads produce cooling through the evaporation of water. This is because heat is required to evaporate water. This heat can come from a flame, a hot sidewalk, or in the case of fogging pads, from the air traveling through the pad. As hot air moves through a wet pad, heat is removed from the air to evaporate the water on the pad. As a result, the temperature of the air is reduced.

Temperature	Relative Humidity					
	30%	40%	50%	60%	70%	80%
80 F	*12*	*9.9*	*8*	*6.2*	*4.5*	*3.0*
85 F	*12.8*	*10.6*	*8.6*	*6.6*	*4.9*	*3.1*
90 F	*13.7*	*11.3*	*9.1*	*7.0*	*5.1*	*3.3*
95 F	*14.6*	*12*	*9.6*	*7.4*	*5.3*	*3.4*
100 F	*15.4*	*12.6*	*10.1*	*7.7*	*5.6*	*3.6*
105 F	*16.3*	*13.3*	*10.6*	*8.1*	*5.9*	*3.8*

Table 1. Temperature Reduction from a 2" Paper Fogging Pad Under Different Weather Conditions.
(broiler house with eight 48" fans, 60 ft^2 of pad per fan, three rows of nozzles, 18" on center, 100 psi)

How much cooling a fogging pad can produce is affected by how much heat, as well as water, is in the air. Generally, the warmer and drier the air, the more cooling a fogging-pad system will produce.

The amount of cooling the typical 2" paper fogging-pad system can produce under various weather conditions is shown in Table 1 (for a 4" fogging pad multiply table values by 1.25). As you would expect, the greatest amount of cooling is produced when it is hot and dry. Regardless of the air temperature, when humidity is above 80 percent, the amount of cooling produced is fairly limited because very little moisture can be evaporated into the humid air.

Table 2 illustrates how much water will be evaporated from a 2" paper fogging pad in a typical tunnel-ventilated broiler house with eight 48" fans operating under various weather conditions (for a 4" fogging pad multiply table values by 1.25). As is clear from the table, the greater the cooling produced, the greater the amount of water evaporated from the pad.

Temperature	**Relative Humidity**					
	30%	**40%**	**50%**	**60%**	**70%**	**80%**
80 F	***3.4***	***2.9***	***2.3***	***1.8***	***1.3***	***0.9***
85 F	***3.7***	***3.1***	***2.5***	***2***	***1.4***	***0.9***
90 F	***4.0***	***3.3***	***2.7***	***2.1***	***1.5***	***1.0***
95 F	***4.2***	***3.5***	***2.8***	***2.2***	***1.6***	***1.1***
100 F	***4.5***	***3.7***	***3.0***	***2.3***	***1.7***	***1.1***
105 F	***4.8***	***4.0***	***3.2***	***2.5***	***1.8***	***1.2***

Table 2. Water Evaporated (gals./min.) from a 2" Paper Fogging Pad Under Various Weather Conditions.
(broiler house with eight 48" fans, 60 ft^2 of pad per fan, three rows of nozzles, 18" on center, 100 psi)

The challenge with a fogging-pad system is to get the cooling with minimal water runoff. Table 3 shows the typical amount of runoff a fogging-pad system would produce under various weather conditions if all the nozzles were used (100 psi). Under hot, dry conditions, runoff would be relatively minimal. But, on more typical humid days the runoff can be significant.

Temperature	**Relative Humidity**					
	30%	**40%**	**50%**	**60%**	**70%**	**80%**
80 F	***1.4***	***1.9***	***2.5***	***3.0***	***3.5***	***4.0***
85 F	***1.1***	***1.8***	***2.3***	***2.9***	***3.4***	***3.9***
90 F	***0.8***	***1.5***	***2.1***	***2.7***	***3.3***	***3.8***
95 F	***0.6***	***1.3***	***2.0***	***2.6***	***3.2***	***3.7***
100 F	***0.3***	***1.1***	***1.8***	***2.5***	***3.1***	***3.7***
105 F	***0***	***0.9***	***1.6***	***2.3***	***3.0***	***3.6***

Table 3. Water Runoff (gals./min.) from a 2" Paper Fogging Pad Under Various Weather Conditions.
(broiler house with eight 48" fans, 60 ft^2 of pad per fan, three rows of nozzles, 18" on center, 100 psi)

You could put the fogging nozzles and pump on a five-minute timer. Though this can work, the problem is that the timer setting would have to be manually changed throughout the day as conditions changed. As illustrated in Table 4, air temperature and humidity change constantly on a typical hot summer day. The humidity is highest at night when the temperature is at its lowest, while during the hottest part of the day, the humidity is relatively low.

Time	Temperature	Relative Humidity	Fogging-Pad Temperature Reduction	Water Required (gals/min)
6 a.m.	70 F	95%	-	-
9 a.m.	75 F	75%	-	-
12 p.m.	86 F	60%	6.6 F	2
3 p.m.	94 F	50%	9.6 F	2.8
6 p.m.	96 F	30%	14.6 F	4.2
9 p.m.	82 F	70%	4.5 F	1.3
12 a.m.	75 F	80%	-	-
3 a.m.	70 F	95%	-	-

Table 4. Typical Daily Summertime Temperature and Humidity Fluctuations.

An easier way to adjust the amount of water being added to a pad is by changing line pressure and changing the number of lines operating. For example, let's say there was a broiler house with eight fans and 50' X 5' of pad on each side of the house. There were three rows of nozzles (0.7 gal/hr), 18" on center, on each side of the house. Table 5 illustrates the amount of water which would be sprayed onto the pad using different numbers of lines at various pressure.

Water Pressure	Number of Lines of Nozzles		
	1	2	3
40 psi	0.9	1.7	2.6
100 psi	1.6	3.2	4.8
160 psi	2	3.9	5.9

Table 5. Water Output (gals/min) of Different Number of Rows of 0.7 gal/hr Plastic Nozzles

It would be fairly easy to set up the fogging-pad system so that a thermostat would first turn on the top two rows of nozzles at line pressure (Table 6). When it became a little hotter, the bottom row would be added by a second thermostat. The pump would be controlled by a third thermostat set slightly higher than the second thermostat. The pressure could be limited by allowing some of the water on the high-pressure side of the pump to flow back to the intake side of the pump.

Though cooling produced by a fogging pad is affected by water pressure, the effect is relatively minimal. When a little cooling is required, i.e., first thing in the morning, two fogging lines at line pressure will do a good job of wetting the pad. The reduction in cooling due to the fact that the pump is not used will not be noticeable. During hotter times of the day, the pump will increase the amount of water flow to the pad as well as produce a finer mist which will increase the amount of cooling produced. Though in the above example the full 160 psi capacity of the pump was not used on extremely hot days, the added water pressure can have a significant effect on cooling. The increased pressure also enables the producer to place a few nozzles halfway down the house to minimize the amount of temperature rise between the pad and fan ends of the house with minimal house wetting.

Time	Outside Temp.	Relative Humidity	Fogging-Pad Temperature Reduction	Water Required (gals/min)	Fogging Lines Used and Pressure	Runoff (gals/min)
6 a.m.	70 F	95%	-	-		
9 a.m.	75 F	75%	-	-		
12 p.m.	86 F	60%	6.6 F	2	2 lines (40 psi)	-0.3
3 p.m.	94 F	50%	9.6 F	2.8	3 lines (40 psi)	0.2
6 p.m.	96 F	30%	14.6 F	4.2	3 lines (100 psi)	0.6
9 p.m.	82 F	70%	4.5 F	1.3	2 lines (40 psi)	0.4
12 a.m.	75 F	80%	-	-		
3 a.m.	70 F	95%	-	-		

Table 6. Fogging Line Setup to Minimize Runoff.

There are a number of advantages to varying the number of lines and pump pressure to control water sprayed on a pad instead of using a timer. First, as illustrated above, it is fairly easy to automate, freeing up a producer's time for other things. Second, it reduces the number of hours a pump is needed. Finally, the pump is not turning on and off every five to ten minutes, thus reducing wear and tear on the PVC pipe.

The above charts are approximations of cooling, water evaporation and runoff. The type and size of nozzle, type of pad, and water pressure used will affect the values given. In general, four-inch pads will produce more cooling, require more water, and can have more runoff than two-inch pads. In either case, runoff can be more easily and more effectively controlled by varying water pressure and the number of fogging lines operating than by using interval timers.

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Other newsletters on Fogging Pads:
Fogging Pads...A First Look. May/June, 1993.
Fogging-Pad Installation. August, 1994.
How Much Evaporative Cooling Pad Do I Need? February, 1996.
Evaporative Cooling Options for Tunnel-Ventilated Houses...an Overview. March, 1996