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Poultry Housing Tips

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Fogging Pad Cooling Systems... A First Look

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Until recently, producers with tunnel-ventilated houses have used either fogging nozzles or evaporative cooling pads to reduce the temperature in their houses during hot weather. Both systems have proven successful in limiting heat stress and each has advantages as well as disadvantages. Evaporative cooling pads are capable of reducing the temperature in the house up to 20°F, but are relatively expensive and can require frequent maintenance. Fogging systems are fairly inexpensive but don't produce as much cooling (10°F) and often contribute to wet litter and dirty equipment. Within the last year, a new type of evaporative cooling system has been developed which is a hybrid of the two systems, a fogging- pad system, that may offer producers the best of both types of systems.

A fogging-pad system consists of either an air filter-like material or a traditional paper evaporative cooling pad placed over the inlet openings of a tunnel-ventilated house. Two to four lines of fogging nozzles, on 1' to 2' centers, are placed a couple of feet outside each of the inlet openings. The fog generated by the nozzles is drawn into the pads by the suction created by the exhaust fans. The pads catch the water droplets preventing them from entering the house.

As air is drawn through the wetted pads, water droplets on the pads evaporate and air temperature is reduced. To evaporate water, heat (energy) is required. In fact, evaporating a gallon of water requires almost 8,700 Btu's of heat (burning a gallon of propane produces about 90,000 Btu's of heat). Where does this heat come from? From whatever the water comes in contact with as it evaporates, namely the air. As heat is removed from the air, the temperature of the air is obviously decreased.

It is important to realize that the temperature of the water has very little effect on the amount of cooling produced by fogging-pad systems. In fact, by spraying 10°F cooler water on the pads would only produce approximately 1% more cooling (0.1°F). It is the evaporation of the water which produces the cooling, not the temperature of the water (What is...Evaporative Cooling? June, 1991).

During hot weather, fogging-pad systems can reduce the temperature of incoming air by 9 to 20°F. The amount of cooling produced depends partially on the type of pad material used. Two-inch fiber and cellulose pads can produce between 9 and 13°F cooling while four-inch cellulose pads can reduce incoming air temperature by as much as 20°F.

The difference in potential cooling of the pads is related to the surface area of each pad. Generally speaking, the thicker the pad, the greater the number of water droplets that can be captured and

suspended. This means the air traveling through the pad contacts more water, increasing the amount of water evaporated into the air. Increasing evaporated water, results in increased cooling.

But, the aforementioned cooling can only take place if enough water is sprayed on the pad. To obtain 10°F cooling, approximately 20 gallons of water must be added to the pads per hour for each 48" fan operating. For example, approximately 140, 1 gal./hr. nozzles would be required for a 2" pad system in a 400' tunnel-ventilated house (seven 48" fans). Since more cooling is produced by a 4" pad system, 280 1 gal./hr. nozzles would be required. Bottom line, the more cooling the system produces, the greater the amount of water which has to be sprayed on the pads. It is important to remember that as water pressure increases, water output per nozzle increases and the number of nozzles needed decreases.

The amount of pad area a house requires depends on the number of fans and the type of pad used. The objective is to provide enough pad area that the fans don't have to work too hard to draw air in through the pads. Ideally, house static pressure should not exceed 0.07". In a conventional tunnel-ventilated house with fogging nozzles, this is easy to accomplish because air is basically being drawn unrestricted through holes in the side walls. Since placing a pad on the house is like placing an air filter over the inlet, more opening has to be provided. For example, with a traditional tunnel- ventilated house with fogging nozzles, 40 ft2 of curtain opening per 48" fan results in a static pressure of less than 0.05". But with most fogging-pad systems, 65 ft2 of pad per 48" fan can cause a static pressure of over 0.07".

If less than the recommended amount of pad is used, the static pressure will increase and fan performance will decrease. This will result in the fans moving less air, reducing the wind chill effect and causing the fan end of the house to heat up. In one extreme example encountered in the field, so little pad area was used that static pressure exceeded 0.15" with all the fans operating. This resulted in the fans moving 30% less air than they should have. When it comes to pad systems it is always better to have too much pad than not enough.

On the following page is a listing of some of the types of fogging-pad systems on the market. Listed along with the manufacturer's recommendation on the amount of pad required per fan and the potential cooling ability of the fan, is the typical static pressure which will exist with the system. Again, it is important to remember the higher the static pressure the harder it is for fans to pull air through the pad, and the lower the amount of air moved by each fan.

Over the past few months many of the pad system manufacturers have increased their original recommendation of the amount of pad area required per fan. The increased pad area has reduced the static pressure on the houses increasing air flow, temperature reduction and creating more uniform house temperatures.

Preliminary studies have been conducted on both the two inch, rubberized fiber pad and the two inch paper pad fogging- pad systems. Both systems produced similar cooling and fan performance. The maximum temperature reduction (measured near the pad) achieved was 13°F, but the lowest incoming air temperature achieved was in the low eighties (Figures 1 & 2). In other words, when it was 84°F outside fogging-pad systems reduced incoming air by 2°F to about 82°F. When it was 92°F outside the systems reduced incoming air temperature by 10°F to approximately 82°F. But, when it was 105°F, incoming air temperature was reduce by 13°F. At outside air temperature below 80°F, very little if any cooling will be produced under most circumstances. The following graphs illustrate the cooling produced by two different fogging-pad system over the course of a day.

Type of fogging-pad system	Square foot of pad per 48" fan (19,000 cfm)	House static pressure	Approximate maximum temperature reduction (all fans on)
	Manufacturer's recommendation	All fans operating	Outside conditions: temperature > 90°F Rh < 50%
2" green rubberized fiber pad 1 nozzle per running foot of pad (1 gal/hr)	65* 75	0.08" 0.06"	11°F 13°F
1" foam-fiber pad 1 nozzle per running foot of pad (1 gal/hr)	60* 70	0.12" 0.10"	11°F 13°F
2" paper pad 1.4 nozzles per running foot of pad (1 gal/hr)	60	0.05"	13°F
4" paper pad 2.8 nozzles per running foot of pad (1 gal/hr)	60 75	0.08" 0.06"	20°F

*Original recommendations

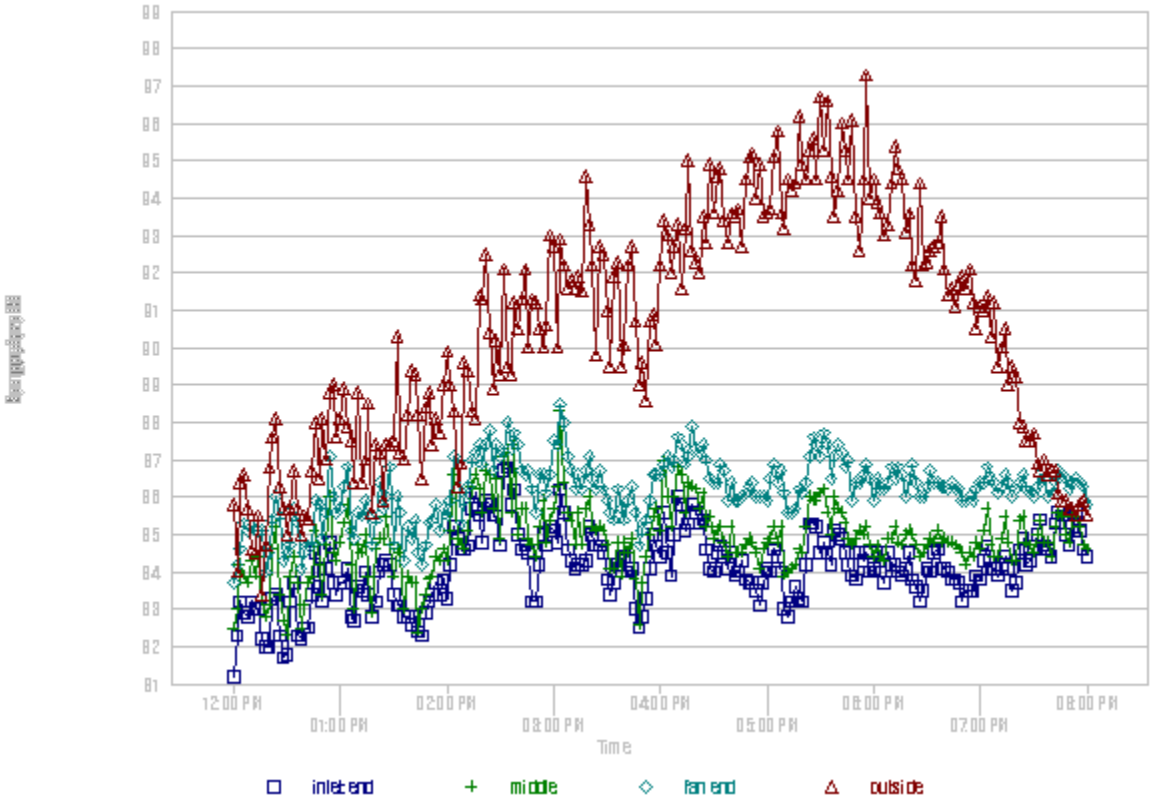

Figure 1. 2" Paper, Fogging-Pad System (500' broiler house 7 week old birds)

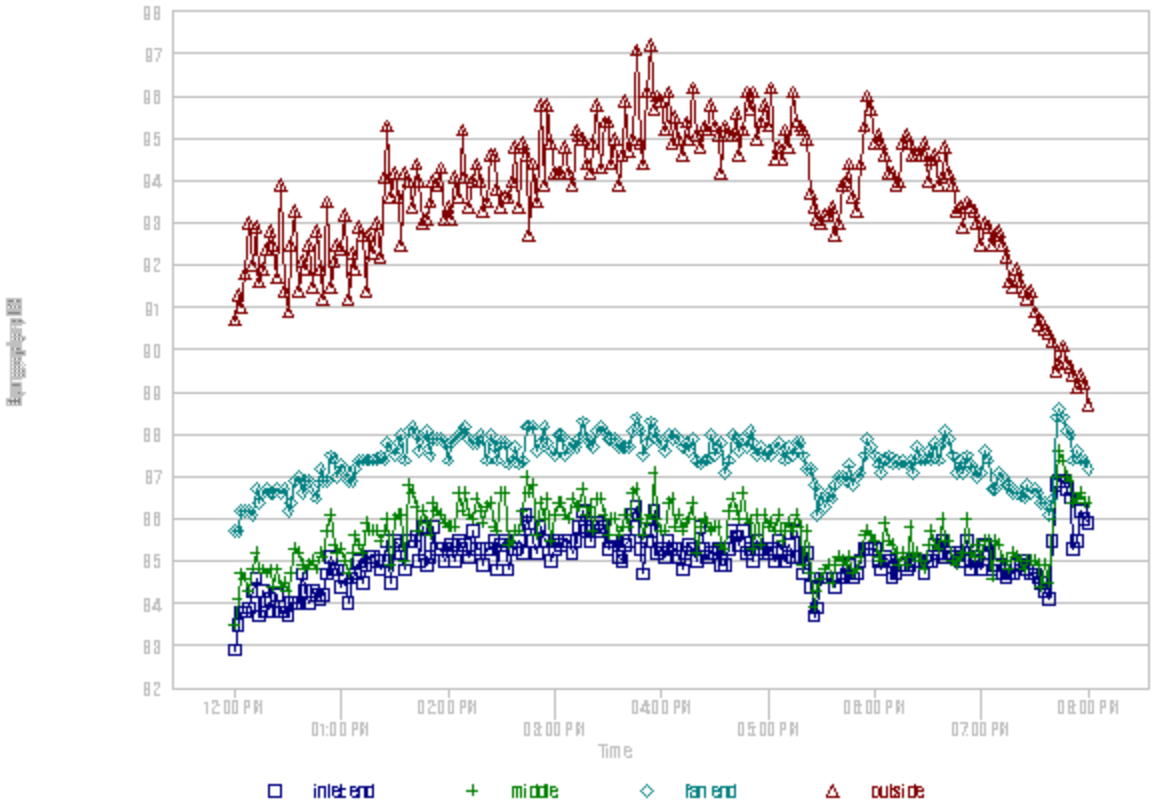

Figure 2. 2" Rubberized Fiber, Fogging Pad System

(400' broiler house, 7 week old birds)

Since outside temperature and humidity change throughout the day, the amount of water which evaporates off the pads changes. If all the nozzles are turned on when it is only 85°F outside there will probably be a lot of water running off the pad. Conversely, if only half the nozzles are on when it is 95°F there may be no runoff but maximum cooling will not be achieved. This problem can be limited by using only one line per side at low temperatures and a second line at higher temperatures. The amount of water sprayed on a pad can also be varied manually through the use of a five- minute interval timer. As outside temperature increases and humidity falls, a producer would increase the amount of time the system runs.

Care must be taken when selecting the type of pad material to be used on a house. One of the biggest questions to be asked is how easy will it be to clean the pad. The pads will act as air filters to some extent. Very dense pads may be very hard to clean when dirt gets built up within the pad. After only two growouts, the build up of dirt within pads has been found to restrict air flow so much that fan performance decreased 30%. Since the paper pads are more open, they should prove easier to keep clean.

Since fogging-pad systems are relatively new, there are more questions than answers about their operation at this time. If you have a fogging-pad system, consider the following:

1) Open the end wall doors when not spraying water on the pads. This will make it easier to pull air into the house and reduce the accumulation of dirt on the pads

2) The amount of cooling you can expect from a fogging-pad system is related to outside air temperature and the previous nighttime low air temperature. The temperature drop as air moves through the pad can be estimated by subtracting the previous nighttime low air temperature from the present outside air temperature and dividing by two (1" to 2" systems). For example:

#1) Nighttime low = 75°F

Outside temp.= 91°F

Air cooling = (91°F - 75°F)/2 = 8°F

Incoming air temperature = 83°F

#2) Nighttime Low = 74°F

Outside temp.= 106°F

Air cooling = (106°F - 73°F)/2 = 16°F

Since most systems on the market are limited to a maximum cooling of approximately 13°F (1" to 2" systems) incoming air temperature would be 93°F

#3) Nighttime low = 78°F

Outside temp.= 84°F

Air cooling = (84°F - 78°F)/2 = 3°F

Incoming air temperature = 81°F

3) Don't use evaporative cooling systems if outside temperature is below 82°F or relative humidity is above 80%

4) Don't operate evaporative cooling systems before 9 a.m. or after 10 p.m.

5) When the system is new, record the static pressure when all exhausts fans are on. If static pressure increases over time, pads are getting dirty and need cleaning. If static pressure decreases, fans are moving less air and probably require maintenance.

6) Many fogging-pad systems work fairly well with just line pressure. The amount of cooling produced is not as much as when a booster pump is used, but is often sufficient until the last week or two of the growout.

7) Clean pads after every growout.

8) Do not cut the grass next to a pad when it is in use.

9) It is probably best to remove the pads during those times of year when it is not going to be used, late fall to early spring. The 50 to 75 feet of pad makes it difficult to curtain ventilate a house. The pad will also collect a lot of feathers and dust when curtain ventilating

When considering buying a fogging-pad system ask:

- 1) What type of warranty does the system come with?
- 2) What is the expected life of the pad?
- 3) How easy is the pad to clean?
- 4) How much will it cost to replace the pad?
- 5) How much static pressure does the pad generate?
- 6) How is the amount of water sprayed on the pad regulated?

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