The *Poultry Engineering, Economics & Management*
NEWSLETTER

Critical information for Improved Bird Performance Through Better House and Ventilation System Design, Operation and Management

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Feature article

Getting Best Broiler Performance in Hot Weather

With summer here again in the US poultry belt, growers are facing the challenge of keeping birds comfortable under often extreme conditions, and we are getting lots of questions on how to best operate modern tunnel houses in hot weather. This newsletter will focus on the most commonly asked questions that we hear from growers on the finer points of managing a pad-cooled tunnel house in summer.

First, however, a note on electronic controllers, which have helped many growers do a better job of house management, but are perhaps still not fully understood by many growers. A key point in controller management is to realize that it is impossible to write one controller program that can run a house year round. That is, we must have different controller program setups to match bird needs in different seasons and different stages of bird growth.

At a minimum we would recommend using four controller program setups, to cover winter brooding and growout, and summer brooding and growout. However, even within the summer growout phase, for example, we need to tweak the program differently for three week old birds than for six or seven week old birds. Staying with an "average" program for summer growout risks either over ventilating young birds by going into tunnel too soon, or under ventilating older birds by not getting into tunnel soon enough.

Now, let's consider the questions growers are asking. (Note: The basic principles described in the following discussion apply as well to controller and thermostat operation.)

How many degrees above my set target temperature should I change from inlet mode ventilation to tunnel ventilation?

We switch to tunnel ventilation when vent box mode can no longer keep the temperature in the house close enough to the desired temperature and we need wind chill cooling. Bird size, age, breed, and feathering all affect the decision as to how many degrees above target should be the switch point. Generally, with big birds we can go to tunnel at 5 degrees F above target because research has indicated it is beneficial to the birds. With younger birds we might want to hold off tunnel to 8 degrees F above target because younger birds more readily dissipate heat and early tunnel has not been shown to be beneficial.

Across the broiler belt we see quite a range of numbers being used, showing there might be some misunderstanding on what we are trying to accomplish. Some growers and companies go to tunnel at 5 degrees F above target and others at as much as 10 degrees F above target. If we want to use one number, without adjusting for bird age, etc, both these numbers are probably a little on the extreme side. A good compromise on this for most companies might be to go to tunnel at 7 degrees F above target.

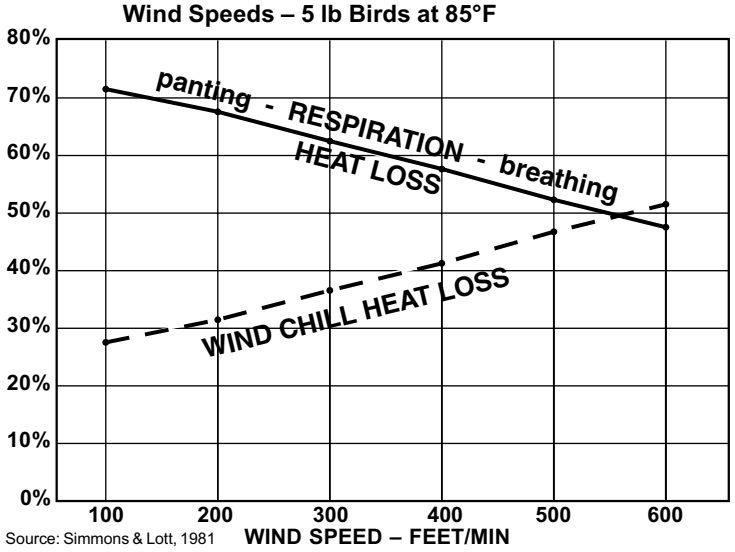
How much wind speed should I install on a 43 x 500 foot house growing 7 lb birds?

The research of Dr. Berry Lott at Mississippi State University clearly showed that after the 5th week of age big hot birds benefited from wind speeds of 600 fpm at bird level. In a modern house, to get a feel for what average wind speed is we should take at least three readings across the house at bird level: one near the water line, another reading in the center and another near the other water line on the other side, and average these together. You might want to do this in the front and back of the house as well. Allowing for some reduction in velocity as a house ages, 600-650 fpm would not be out of the question for design-

ing a new house for big birds. Economic benefits of velocities higher than 600 fpm are not documented. Note also that although a 43 x 500 foot house will have more total fan capacity installed than a 40 x 400 foot house, we want the same wind speed in both houses.

Figure 1 shows why wind speed is important: with good wind speed a larger portion of the heat that must be removed from the birds is coming from the wind chill on the bird's skin and a lesser portion of the needed heat removal is from respiration (breathing or panting). Lower wind speed causes less heat removal from the skin and thus causes the bird to pant, which wastes feed, so we need good wind speed to stop or at least minimize panting.

Figure 1. Heat Loss to Wind Chill vs. Respiration at Different Wind Speeds – 5 lb Birds at 85°F



Source: Simmons & Lott, 1981

When should I bring on my pads and should all fans be on before the pads are brought on?

These are both very frequently asked questions. The facts are:

1) When relative humidity (RH) outside is 80% or more, pads don't do much good.
2) In most locations in the broiler belt the outside air temperature must get to 80° F before RH drops to 80% or less (the 80/80 rule).
3) Turning pads on much before 10:00 am or after 9:00 pm won't produce much benefit.
4) Pads need a period of time each day to dry out.

In a small bird grow out program with a target temperature of 70° F during the last week (week 5), going to tunnel at 77° F (+7) and bringing the pads on at 82° F(+12) would be acceptable. One or two fans might come on after the cooling is turned on as the day progresses in very hot weather. In a big bird program with a target temperature of 65° F (+7), bringing on pads at 77° F (+12) will create a wet house.

We often see wet floors during summer in big bird programs because pads are brought on too soon. With a big bird program you should bring on most or all of the air before the pads. Waiting until the air can accept evaporated moisture will make the house run drier, with no compromise in bird performance.

Should I consider turning off evaporative cooling in my house if humidity gets too high, maybe using a humidistat?

The short answer, assuming that we're talking about daytime hot weather, is that during normal conditions in the broiler belt in a house *with good wind speed*, there are NO cases of relative humidity rising high enough to warrant turning off the pads. Outside relative humidity drops as daytime temperature rises. Note that having good wind speed is essential. In a well designed tunnel house the effects of high humidity on a bird are greatly reduced because we are relying on the air speed to remove a larger portion of the heat from the bird. With wind speed in the neighborhood of 600 fpm, we can keep even big birds fairly comfortable even at higher humidities.

Another point to keep in mind is that most commercial humidity sensors are not very accurate at higher RH levels. As a result, you might set a humidistat to shut down pad cooling at 85% RH, but the humidistat may actually shut it off at, say, 78%, thus leading to unnecessarily high house temperatures. Use of humidistats has much more application under cold weather conditions than during hot weather.

When should I turn on mid house foggers in my tunnel houses?

Many modern houses have been equipped with 6 or 7 lines of mid house fog. These fogger lines should be utilized sparingly and only when we are in full tunnel with pads and we begin to notice a drastic tem-

perature rise from one end of the house to the other. Most tunnel houses under normal conditions will run at around 5 degrees or less difference from front to back. If the front to back temperature difference goes much above 5 degrees F, mid house foggers can help. In a tight and properly equipped house, having the temperature difference go to 7 or 8 degrees will usually only occur with big birds under extreme hot weather conditions.

In the field, we often see that mid house foggers are treating the symptom and not the root problem. Temperature differences greater than 5 degrees are typically caused by excessive air leakage or reduced tunnel fan air moving capacity. When a house is loose, much of the air the tunnel fans pull into a house enters through cracks in the side walls and not through the pads. This leads to a large temperature difference as the hot air coming through the cracks warms the cool air that entered through the pads before it reaches the tunnel fan end. Though mid house fogging nozzles will reduce the temperature rise, in the long run you will be much better off by tightening up the house.

Another drawback with midhouse foggers is that when turned on too soon they will wet fans and shutters and cause dust and dirt to build up on them.

Fan air moving capacity can be quickly reduced 20% or more by dirty fan shutters or worn belts. As the air moving capacity of the fans is reduced, the time it takes to exchange house air gets longer. The longer the air stays in the house the greater the end to end temperature difference will be. Proper fan maintenance will not only reduce the temperature differential but will of course improve wind chill.

Is it okay to tunnel a 1 or 2 week old bird? How do I do it and should I add water to the pads?

Under normal circumstances, any age bird, if hot, can be helped with wind chill cooling. Before going to tunnel with any age bird, the first step is to see if you can achieve comfort through vent box ventilation. If two or three tunnel fans pulling air through the vents will not achieve comfort for one or two week old birds, then going to tunnel ventilation with two tunnel (120 fpm) fans might be a good place to start.

In extreme weather it can be necessary to add evaporative cooling to slightly cool or temper the incoming air. A good idea here is to turn off the pump to the pads on one side of the house to limit the amount of cooling produced and allow non cooled air from one side of the house to mix with cooled air from the other. It is a good idea not to leave the farm under these extraordinary conditions.

If my birds sit down when I tunnel ventilate, does this mean that they are too cold?

Maybe, maybe not. Birds will sit down if they are too cool, or if they are comfortable. For younger birds excessive wind speed when the air temperature is below 80° F can result in excessive bird cooling and as a result the birds will sit to stay warm. A good indicator that he birds are too cool is that virtually all the birds will be sitting down. With older birds, when the air temperature is above 80° F and there is a high level of air movement, a good indicator that the birds are comfortable is that most of the birds will be sitting and about 10 to 20 percent of the birds will be up eating and drinking.

For older birds, research has indicated that in the last two weeks of the growout, it is virtually impossible to over cool the birds with air movement when the air temperature is above 80° F.

Can I save power by cutting back the number of tunnel fans that operate at night?

No. During hot weather one key to getting maximum bird performance is making sure the birds are cooled off at night. Even in a properly operated tunnel house bird body temperature will rise during the day if house temperature is in the mid to high eighties. If their body temperature is not reduced at night they will not eat properly the next day. With air speed at night of a couple hundred feet per minute it could take well over 8 hours to bring a bird's body temperature back to normal. But with an air speed of 400 fpm or higher this can be reduced to four or five hours. In addition, low tunnel air speed at night will cause large temperature differences from one end of the house to the other, thus hurting flock uniformity.

You should also keep in mind that the relative humidity of the air at night is often above 90%, which will interfere with the birds' ability to cool itself through breathing or panting. So even though the house

temperature may be in the high seventies at night, additional air speed will be required to help compensate for the birds' loss in respiration cooling ability.

Should I operate my 6-inch evaporative cooling pads on a timer?

No. For best cooling and maximum pad life, pads should operate more or less continually during daytime hot weather. Keeping the pads fully wetted helps keep the pads clean. When pads are operated on a timer, dust and minerals are much more likely to build up in/on the pads, which can reduce their life significantly. Any dust and mineral buildup also makes it more difficult for the fans to pull air through the pads, reducing air speed and therefore cooling. We are aware that procedures in some companies include using a timer on pad cooling. If a timer is used (still not best practice), off-cycles that do not allow the pads to completely dry out are best.

How do I keep my power bills to a minimum?

1) Buy energy efficient fans. When purchasing a fan make sure it has an energy efficiency rating of at least 20 cfm/watt.
2) Do not to use too many tunnel fans on younger birds. Don't be afraid to use your evaporative cooling pads to reduce the house temperature instead of turning on additional fans. Don't try to save power on older birds by limiting tunnel fan operating time. That will cost you a lot more than it will save you.
3) Keep fans properly maintained. A 20% reduction in air flow due to lack of fan maintenance will mean more fans will have to run and/or run longer to cool off the house.
4) Make sure your house is tight. In an older house you should be able to obtain at least 0.13 static pressure with one 48-inch fan operating and with everything else in the house closed up. Newer houses should be tight enough to get a reading near 0.20. Excessive air leakage leads to higher house temperatures, which in turn means that you have to operate more fans.

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