The Alabama Poultry Engineering and Economics
Auburn University NEWSLETTER No 17, May 2002

Feature article

Getting Broiler Houses Ready for Hot Weather

We all know that broiler chickens must be kept within a comfortable temperature range if we expect to achieve good flock performance. For the past 20 years geneticists have worked diligently to improve the breed of today's broiler to maximize performance. One of the traits that has had to be traded off to get this better performance is the ability of the birds to withstand temperature extremes. As a result, the range of temperatures suitable for maximum performance has become narrower and narrower. Especially, the modern broiler chicken does not perform well when subjected to a too-warm environment.

When the weather is hot outside we must maintain an environment inside the poultry house that allows the bird to dissipate excess body heat in order to remain comfortable. This can be done by keeping the ambient temperatures surrounding the bird at the absolute (thermometer) values that are recommended. Or it can be done by tunnel ventilation, increasing the speed of the air flowing over the bird to accelerate the dissipation of heat from the bird's body, sometimes called "wind-chill" cooling. Tunnel ventilation does nothing more than increase the rate of heat removal from a bird so that even at warmer than recommend absolute (thermometer) temperatures the bird feels as if it is in a cooler environment.

Modern broiler birds are capable of greater performance, but must have optimum environment to deliver on their performance potential.

With tunnel ventilation we now have another variable to look at when it comes to measuring bird comfort. The thermometer alone does not any longer tell us if the bird is comfortable. What determines bird comfort is the combination of absolute temperature plus speed of air over the bird. We have ways of estimating this "effective" temperature experienced by the bird, based on university research and field experience (see wind-chill graph on page 3). It must be realized, however, that while these estimated cooling effects are highly educated guesses, there are many other variables that come into play in any real-world situation – including age of birds, sex, flock uniformity, and condition of birds. The best way to evaluate bird comfort is still actual observation of the birds. Their eating and drinking habits, their activity and their resting habits reveal whether they are in their comfort zone or not. (See the "10-Point Guide to Successful Tunnel Ventilation Management" insert in this issue for details.)

In most modern broiler houses, at least in warmer climates, we now add evaporative cooling to our technology mix. With in-house foggers or pad cooling systems added to our tunnel house, we can both lower the absolute thermometer temperature of the air in the house and deliver the tunnel airflow that causes the bird to feel as if it is in an even cooler environment. Under good conditions in a well-designed and equipped evaporatively-cooled tunnel house, we can expect to make fully-feathered birds feel and perform as if the temperature was in the low 70s (Fahrenheit) when the outside air temperature approaches 100 degrees.

Flock performance in hot weather depends greatly on the performance of our equipment and our houses.

The industry is rapidly adopting recirculating pad cooling, for good cooling performance with relatively modest management and maintenance requirements. However, spray-on pad and inside fogger systems can also be effective if properly designed, managed and maintained.

Clearly, broiler performance in hot weather depends greatly on the condition and performance of our equipment and our houses. It is very important to carry out all equipment maintenance according to manufacturer recommendations, and to have equipment and the house ready for the coming summer heat. The insert "10-point Guide" outlines both the major maintenance and the most important management steps needed for successful hot weather ventilation management, and is well worth reviewing as part of any getting ready strategy. The following items provide a little more in-depth information on the most important maintenance preparations needed for getting maximum bird performance in hot weather.

Service fans and fan belts before hot weather arrives

Fans are the pumps that pump heat from the poultry house. If the pumps are not pumping at maximum capacity, their ability to change air and remove heat is decreased. Clean fan blades and shutters, and make sure belts are tight. A loose fan belt will not spin the blade at maximum rpm, and it also will wear out the pulley. Repeated studies in the field show that dirty shutters can reduce airflow by as much as 30%. That means it is well worth the time to keep shutters clean.

Fans are the first and most essential defense against heat. They cannot do the job without proper maintenance.

Fan belts should normally be replaced once a year, and a belt should certainly be replaced if you can see that it is riding low in the motor pulley. As a fan belt wears, it becomes thinner and rides deeper in the pulley than when new. When this happens, the fan rpm speed is reduced. The effect is exactly the same as installing a smaller motor pulley. Tightening a worn belt does not cure the problem. Field studies conducted in Georgia, North Carolina and Alabama have found a surprising number of farms where growers have kept fan belts tight but the rpm's of the fan blades have been reduced because the pulleys and the belts were worn. If belts (or pulleys) are worn, replace them. The only way to check the fan for proper rpm is to get the manufacturer's data and check the fan with a tachometer.

Link belts are a relatively new and improved type of belt requiring less maintenance. After a new link belt has been run 100 hours, you remove one link from the belt, and after that there is no further need to replace any links or adjust the belt. Fans using the link type belt may not even have a tightening adjustment.

Service evaporative cooling systems

We need to get good wind-chill cooling from all tunnel houses. But air speed alone will not do the job in very hot weather. When we cannot make the birds totally comfortable with wind-chill cooling, we need to get real cooling in combination with wind-chill cooling.

Effective evaporative pad cooling requires thoroughly wetted pads with clear flute passages for airflow.

If your house uses pad-type evaporative cooling, realize that the purpose of the pad is to maximize the wetted surface area for air to pass over and through, thus maximizing the cooling of the air. It is imperative to check pad plumbing, and especially the distribution header holes in recirculating systems, to make sure water is flowing properly. We must have completely wetted pads to get the cooling we need. At the same time, we must have clear flute passages for the air to flow through. The required maintenance is to check and unclog as many of the flute holes in evaporative cooling pads as possible. One of the best ways to unclog channels in a cooling pad is just to spray a lot of water on them. Use normal water pressure only. High pressure systems can cut or damage pads. Several products are available that help loosen dirt on pads. These are normally sprayed onto the pads with a garden type sprayer and allowed to soak. Then loose material can be flushed out with just plain water. Be certain that whatever material you use to clean your pads does not contain chlorine and is approved for use on the pads.

If you have a spray pad system be certain that worn or clogged nozzles are cleared or replaced. A dry spot on any pad system is nothing more than a place for hot air to enter the house. Dry pad areas allow hot air to cancel the cooling benefits of areas that are being wetted. If you have in-house foggers, you also need to make sure all nozzles are clear and in good condition, and that pressure regulation and fogging coverage are adequate.

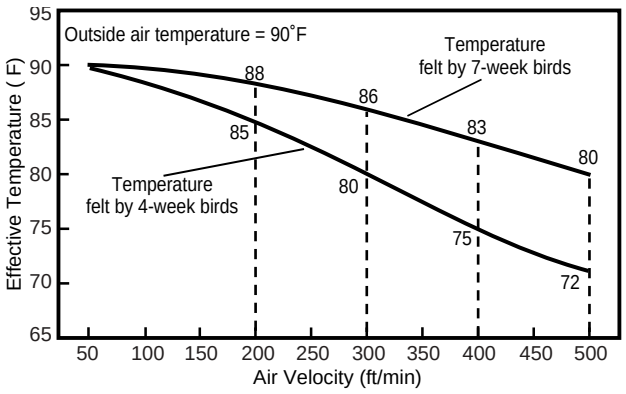
House air leaks lower tunnel wind-chill by cutting air velocity, and allow hot air to bypass cooling pads.

If your evaporative cooling system includes a filter, be sure to inspect and clean or replace the filter element regularly. Even a partially clogged filter can seriously reduce the cooling capability of your system.

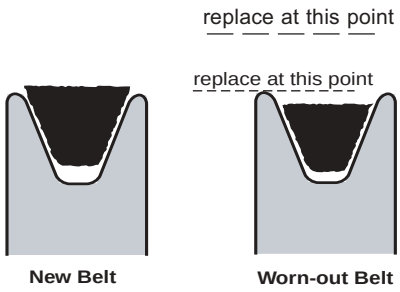
Keep a tight house

House tightness is just as important in hot weather as it is in cold weather. We work diligently in cold weather to plug up all the leaks to save propane. But in hot weather hot air leaking into a house is working directly against the evaporative cooling systems. It is not uncommon on houses that do not have curtain flaps or are very loose to operate at temperatures five or more degrees hotter than we would see in a house that is tight.

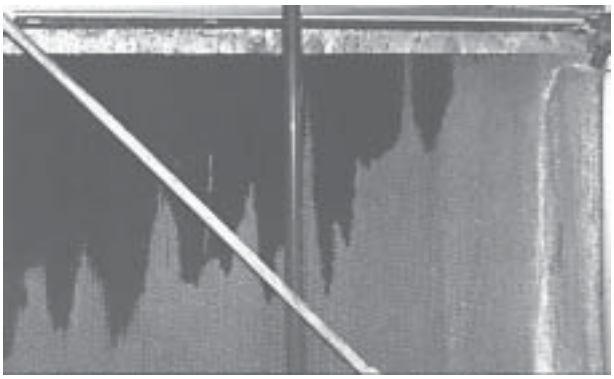
A house tightness test can be performed by checking static pressure after turning on one 48-inch fan and closing all doors, inlets, and tunnel curtains. A good reading on the photohelic gauge on a tightness test is a 0.15 static pressure. If you are below 0.10 you really need to do some work. The single most important step



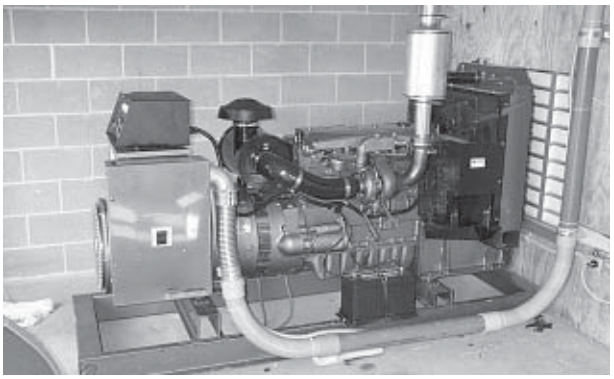
Estimated wind-chill cooling effects at 90°F air temperature. Young birds feel greater wind-chill effect than older birds. Observe birds for signs of discomfort, and avoid too much velocity at too early an age.



Fan belt wear: thinner, worn belt rides lower in the pulley sheave, which causes fan to run slower. Tightening worn belts does not cure the problem. Replace belts once a year, or whenever the top of a belt is at or below the edge of the pulley sheave.



The distribution header at the top right portion of this cooling pad is clogged. Holes in header pipes must be kept clean or parts of the pad will receive no water. Any dry area on a cooling pad (recirculating or spray-on) will allow hot air to enter the house, canceling the effect of evaporative cooling. Pads must be kept thoroughly wet.



Standby generators are critically important for modern tunnel-ventilated broiler houses, since power failure can cause catastrophic losses within minutes. To insure they are ready and available, generator sets should be operated on automatic transfer switches, serviced regularly, and test-run for 30 minutes once a week.

Migration fencing is essential to keep birds from crowding toward the inlet end of a tunnel house. If fences are not used, flock performance will suffer. Crowding birds are not able to dissipate heat from their bodies as well, and will not be able to get as easily to feed and water.

Curtain flaps such as shown here are extremely important to block air leaking around the curtain. Curtain leaks allow large amounts of hot outside air to enter the house and at the same time steal from airflow through the tunnel air inlets and through the cooling pads (if used).

that can be taken to improve house tightness is to put curtain flaps on sidewall curtains. If this does not bring the house tightness test reading at least near 0.15, you should do smoke-bomb testing to find where caulking is needed to seal air leaks.

Use migration fences

We do everything we can in design and operation of houses to keep the inlet end and fan end environments as close to identical as possible. The hard facts, however, are that there will be at least some difference in temperature from inlet end to fan end, and that birds will tend to migrate toward the inlet end of the house where the air coming in is slightly cooler. Unless migration fences are installed to prevent this crowding, the result will be decreased weight, higher conversion, higher condemnations, etc. Fences should be clear (not solid) and clean so air can move through them. It is important to get the fences in early. We often are slack on management of fences during the winter but we must use these tools to be successful with tunnel ventilation during the heat of summer.

If utility power fails, nothing stands between the grower and catastrophe but reliable standby generators, backups and fail-safes.

Have backups and fail-safes ready

Since not only the performance but at times even the survival of our flocks depends so heavily on performance of our equipment, it is essential to protect against breakdowns and power failures by keeping back-up thermostats set, checking and maintaining curtain drops, and keeping standby generators and electrical systems in good shape. It's a good idea to visually check all electrical systems and wiring for damage. Have spare circuit breakers on hand, and check breakers to see if they are running hot (do not touch exposed wiring!). Especially check main breakers – a breaker too warm to keep your finger on is a break-down on the way.

It is critical to keep backup generators in good shape. On a hot day, a utility power failure can cause massive mortalities in a tunnel broiler house within minutes – unless your backup generator kicks in. This means the generator must be on an automatic power transfer switch and must be in good starting condition. A generator set that isn't fueled or that won't crank is useless. All standby generators should be tested and run for 30 minutes once a week. Also check to make sure local horn alarms and/or remote pager alarms are working.

The bottom line

The broiler industry is fortunate to have today's high-performing birds, and the technology that can help our flocks achieve the top performance they are capable of – even in scorching hot weather. Getting that performance, however, absolutely requires thorough and timely attention to equipment and houses. Growers who take the time to get their houses and equipment ready are the ones who will most realize the summertime returns that are potentially available.

ALABAMA COOPERATIVE Extension SYSTEM

The Alabama Poultry Engineering and Economics Newsletter provides up-to-date information on topics of interest to poultry production personnel, focusing on most effective and efficient uses of modern technology and equipment, with a special emphasis on economic implications. The Newsletter is published six times a year, or as needed to address emerging or special issues. Contact: Jim Donald, Extension Biosystems Engineering, 228 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-4181, fax (334)-844-3548, jdonald@acesag.auburn.edu. Published by:

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POST ON WALL OF BROILER HOUSE CONTROL ROOM

A 10-Point Guide to Successful Tunnel-House Ventilation Management

1. Tunnel ventilate only when cooling birds is the goal.

Tunneling when air temperature is not high enough, or birds are too young, can chill birds and hurt performance. Most common mistake is to allow tunnel to stay on past nightfall.

2. Turn on the right number of fans for cooling needed, depending on the age of the birds.

For a given air flow, wind-chill is greater with cooler air, and less with warmer air; greater for smaller birds, less with larger birds. Effective temperature must be estimated.

Rules of thumb for wind chill effect created by the air movement from 48-inch fans are: Fully feathered birds – about 1.0-1.5 degrees of wind chill is created by each 48-inch fan running (the larger the birds, the lower the number). Young birds – about 10 degrees of wind chill is created by running one 48-inch fan for each week of age, plus one additional fan.

Example: For 3-week-old birds, 3 + 1 = 4 fans create 10 degrees of wind chill.

3. Watch the birds, not just the thermometer, to see how much (if any) cooling is needed.

The temperature the birds experience is not the same as the thermometer reading. We can calculate or estimate the *effective* temperature, but we must also see what the birds have to say:

Steady-state behavior, with all birds dropping to the floor, usually indicates too much air movement. (Birds may also bed down in extreme heat.) Panting, lifting wings, and stopping feeding indicates birds are feeling too warm. Differences in bird behavior from one end of the house to the other usually indicate inadequate air flow, or need for more fans to be running.

4. Don't run fewer than half of the installed tunnel fans if you intend to be tunnel ventilating.

Tunnel ventilating with less than 50% of fan capacity (4 of 8, 5 of 10, etc) can result in a rise in house air temperature of 10 or more degrees from inlet end to fan end. If you need to exhaust built-up house heat, and fewer than half of the tunnel fans need to be on to do this, you should be in power (transitional) ventilation mode and drawing air through the sidewall vent boxes.

5. Monitor and maintain adequate airflow – the most important factor in hot weather.

Always keep tunnel inlets fully open. Partly closing tunnel inlets does not increase air velocity in the house, it severely reduces needed airflow. Keep fans and shutters clean and belts tight. Close all doors and seal all leaks or other openings, so all incoming air enters through tunnel inlets only.

6. If running evaporative pad cooling, monitor static pressure – should be 0.05 to 0.10.

In a pad cooled house, static pressure rising to 0.10 or above during full tunnel operation usually indicates insufficient pad area or clogged pads, and results in inadequate air exchange, air speed, and cooling. Consult your flock or area supervisor if this condition exists.

7. If pad cooling, monitor air temperature drop – should be 10-12 degrees F on a hot day.

If not, check key points 5 and 6 first. Then:

Make sure any possible air intake area not covered by pad is closed tight – including vent boxes, ceiling traps, leaks, sidewall curtains, pad room ceilings, and end or side doors.

Check for and correct dry areas on pads. More air will flow through dry areas, and we must evaporate water to get good cooling. Check booster pump pressure for a minimum of 180-200 PSI (spray pads only).

8. If supplementary in-house foggers are used in a pad cooled house, start fogging only after all tunnel fans are on and temperature rise is 5°F or more from one end of the house to the other.

Each fogging line should be equipped with an independent cut off valve. If birds or floor start to get wet, individual lines may be cut off.

9. Protect your flock against power outage or major ventilation breakdown.

Heat and humidity levels during a power outage will rise rapidly and reach lethal levels within 10 to 20 minutes, depending on the age of birds. Set all curtain minders and monitor thermalarm settings carefully. Check and service back-up generators regularly. Keep spare breakers, belts, tips, etc on hand.

10. Install migration fences as soon as birds are in whole house.

Birds will migrate toward the air inlet end, and crowding will hurt performance. Migration problems can cancel the production advantage of the tunnel environment. Install fences not later than day 21.

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