DIVISION OF AGRICULTURE
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University of Arkansas System

Agriculture and Natural Resources

FSA8022

Managing Summer Ventilation Systems in Broiler Houses

Yi Liang
Associate Professor - Air Quality

Thomas Tabler
Extension Professor
Mississippi State University Extension

F. Dustan Clark
Professor/
Extension Veterinarian

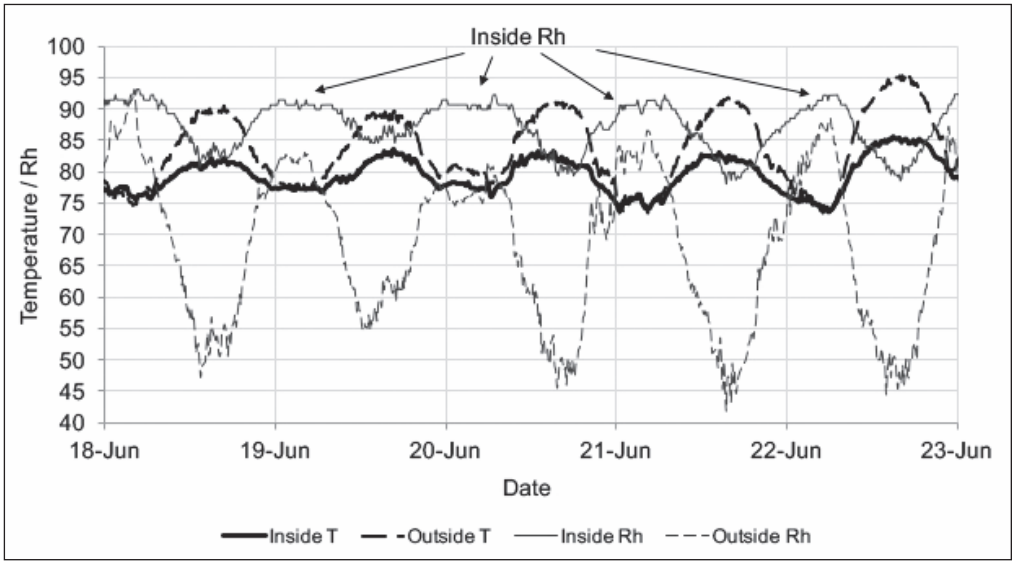
Michael T. Kidd
Director - Center for Excellence in Poultry Science

Increasing Evaporative Cooling Pad Set Point Temperature

Research and field studies have proved that air speed in a tunnel house produces the vast majority of cooling, rather than the house's evaporative cooling pads. Though a pad system may decrease a house temperature 10˚F, the relative humidity will increase 25 percent correspondingly. Operating evaporative cooling pads below 82˚F significantly increases the house humidity and hinders a bird's primary method of heat loss in the summer – evaporation of water from its own respiratory system. It is generally recommended that evaporative cooling pads should not be operated at night because the relative humidity of the outside air tends to run high at night.

Limiting the use of the evaporative cooling system and reducing house humidity has an immediate benefit – drier litter. In most poultry growing areas during July and August in the southern U.S., the relative humidity at night is well above 80 percent (see Figure 1, thin solid line). When an evaporative cooling pad system runs at low set temperature, the litter does not have any chance to dry up due to the high daytime and nighttime humidity. Growers frequently observe wetter litter in the pad end of a tunnel-ventilated house. This is because the pad end is the most humid area as air is saturated while traveling though the wet pads (in general 5˚F cooler

Figure 1. Inside conditions in house using evaporative cooling pads, and outside conditions. Note the 90 percent inside Rh at daytimes and about 80 percent relative humidity at nighttimes.



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but 12 percent higher relative humidity than the fan end).

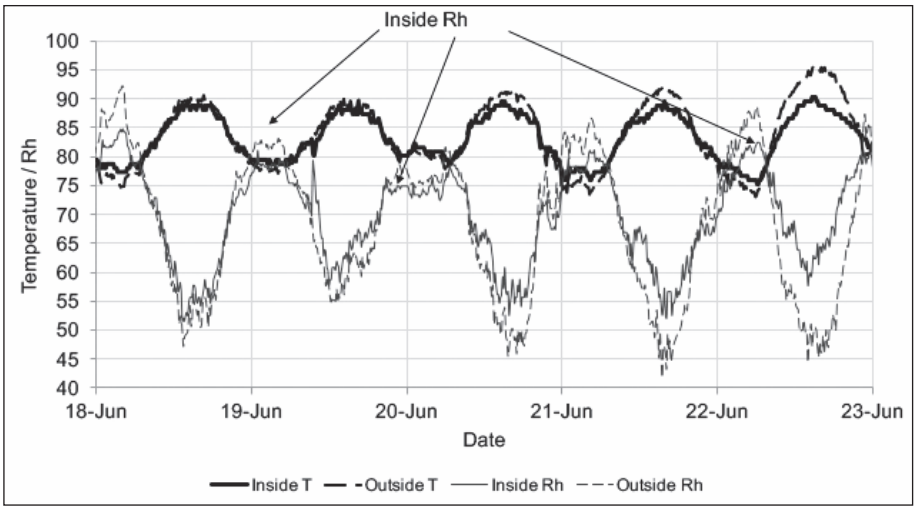
Raising evaporative cooling pad set point temperature worries a lot of people because the houses are warmer (Figure 2). Poultry scientists and engineers at the University of Arkansas and Mississippi State University have been studying the use of sprinkler systems as an alternative cooling method. Although the house had high temperature under the sprinkler system (Figure 2) in comparison with the evaporative cooling pad house (Figure 1), the sprinkler house had much lower relative humidity in daytimes and nighttimes. The evaporation of water from the bird surface lowers the surface temperature of the birds and increases heat loss from the birds.

Over the course of three summers, there have been no significant differences in bird performance seen between the houses with sprinkler systems compared to those with traditional evaporative cooling pads. With the sprinkler system doing the early stage of cooling, the grower can set the evaporative cooling pad to operate between 85˚F and 90˚F, keeping the house humidity in moderate level (below 80 percent).

Maximize Nighttime Cooling by Fans

Birds partition their heat production between sensible and latent depending on the environmental conditions. In summer when temperatures are above 80˚F, a bird relies largely (60 percent) on evaporating water from its respiratory system to rid itself of excess heat. When air reaches near saturation, this evaporation becomes nearly impossible. Operating the evaporative cooling pad at night pushes the relative humidity into the 90 percent level, with no additional cooling.

Figure 2. Inside conditions in house using sprinkler system, and outside conditions. Note the upper 70 percent inside Rh at daytime and lower 60 percent Rh at nighttime.



Instead, maximize nighttime cooling by operating tunnel fans all night long when birds are at least 37 days old. This ensures the birds receive plenty of air speed for cooling throughout the night and gain some relief from potential heat stress during the day. Airflow at high velocity causes a proportional shift from latent to sensible heat loss when temperature is above 80˚F.

The most widely used method of making sure that the birds receive adequate nighttime cooling is to lock on tunnel fans at night. However, one should make sure not to run into cool nights when the controller tries to transition to inlet ventilation, leading to a high static pressure situation and get an alarm.

Another method is to lower the controller set temperature by 3 to 5 degrees, which typically will keep the tunnel fans operating all night long. Thirdly, setting tunnel fan OFF temperatures several degrees (instead of two degrees) below ON temperature will allow the fan to delay turning off as outside temperature drops into the night.

Printed by University of Arkansas Cooperative Extension Service Printing Services.

YI LIANG, PhD, is an associate professor - air quality, Biological and Agricultural Engineering, with the University of Arkansas System Division of Agriculture in Fayetteville. **THOMAS TABLER**, PhD, is an Extension professor with Mississippi State University Extension Service, Poultry Science, in Mississippi State, Mississippi. **F. DUSTAN CLARK**, DVM, PhD, is professor and Extension veterinarian with the University of Arkansas System Division of Agriculture and associate Poultry Center director of Extension with the Center of Excellence for Poultry Science, University of Arkansas, Fayetteville. **MICHAEL T. KIDD**, PhD, is director of the Center of Excellence for Poultry Science, University of Arkansas, Fayetteville.

FSA8022-PD-11-2018N