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The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

Broiler Breeder Cool Cell Operation

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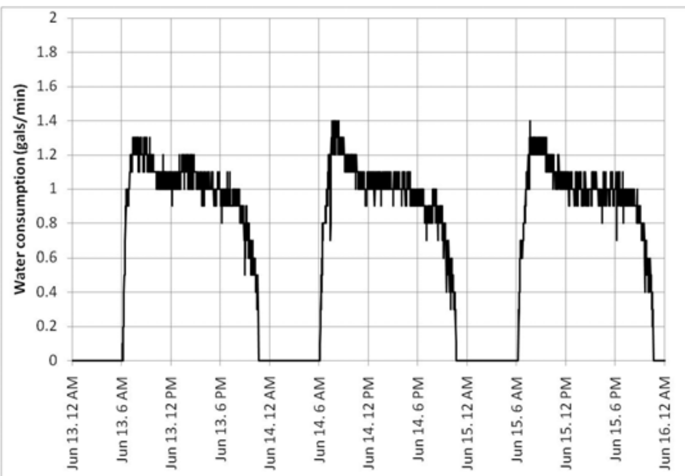

Figure 1. Typical water consumption pattern.

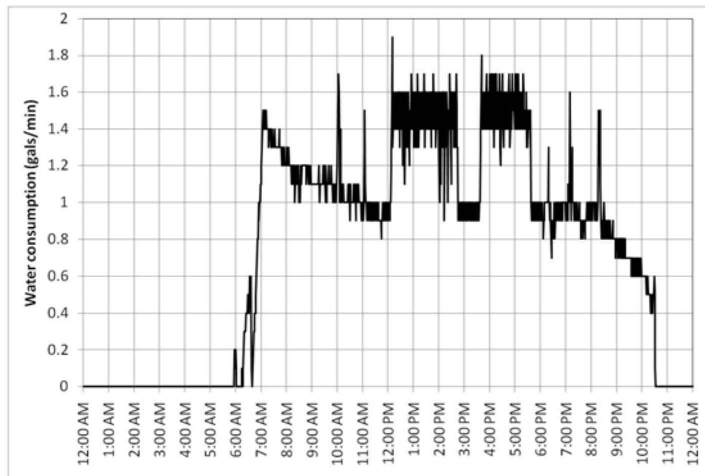

Figure 2. Water consumption pattern of heat stressed birds.

Figure 1 illustrates a fairly typical water consumption pattern for a 40' X 500' broiler breeder house with approximately 10,000 birds. When the lights are off at night the birds drink little if any water. When the birds are fed first thing in the morning there is a peak in water consumption that lasts a couple of hours. Water consumption plateaus for the remainder of the afternoon then slowly drops off as the birds gradually stop drinking water in anticipation of the lights shutting off at 10:30 pm (11:30 DST). Figure 2 illustrates a not so typical pattern. There is the usual peak in water consumption in the morning, but then there are two additional periods of very high water consumption during the afternoon. These periods of high water consumption are the birds' response to a heat stress situation.

In broilers water consumption does not necessarily increase in a heat stress situation. This is because with a broiler water consumption is heavily influenced by feed consumption. The more a bird eats, the more it drinks. So when a bird becomes heat stressed it will tend to back off of feed which will tend to decrease water consumption. With a broiler breeder the birds are fed a fixed amount of feed each day which is typically consumed within the first few hours of the day. When they become heat stressed there will tend to be an increase in water consumption as the birds consume more water to offset moisture loss which occurs when panting. The hotter they become, the more they will pant in an effort to cool themselves, the more water they will drink.

This relationship is illustrated in Figure 3 which is a graph of daytime water consumption (10 am - 6 pm) versus the average inside house temperature humidity index (THI, sum of the inside temperature and relative humidity). The graph is based off of data collected over an eight day period for the same 40' X 500' breeder house whose daily water consumption pattern is illustrated in Figure 2. As one would expect there is a fairly clear relationship between THI and bird water consumption. The higher the daytime THI, the more heat stressed the birds are likely to be, the higher the daytime water consumption. The day illustrated in Figure 2 (June 27th) is represented by the data point in Figure 3 with the highest THI as well as water consumption (167 THI, 608 gallons).

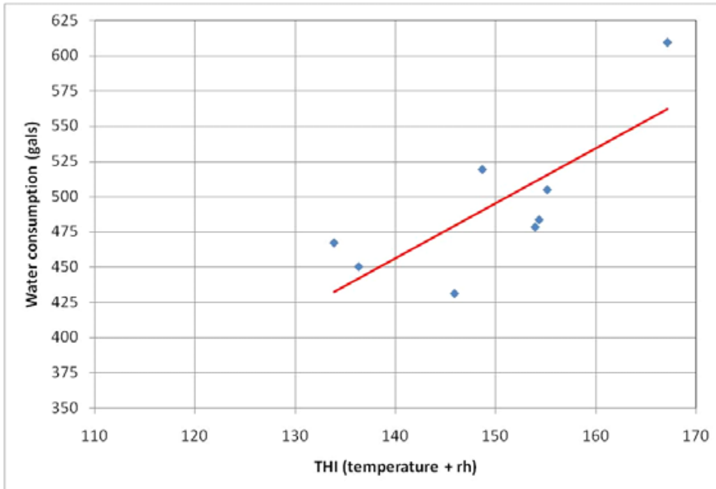

Figure 3. THI vs. water consumption.

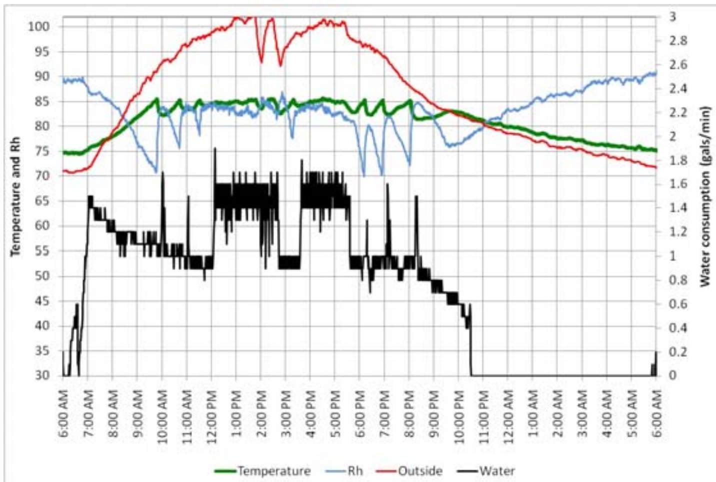

Figure 4. House temperature, Rh and water consumption (June 27).

Figure 4 is a graph of house temperature, relative humidity, bird water consumption as well as outside air temperature for the house in question on June 27th. From this graph the reason for the high bird water consumption becomes clear; the afternoon outside temperature was approximately 100°F. Though the house's evaporative cooling pads were capable of decreasing house temperature (measured at the tunnel fan end of the house) to approximately 85°F, it came at a cost. The cost being an inside relative humidity of nearly 85%. The combination of the high inside temperature with a high relative humidity created a stressful situation for the birds.

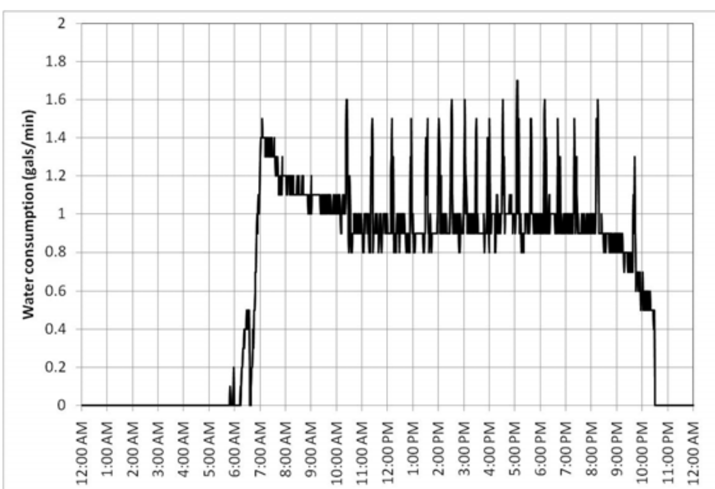

Figure 5. Broiler-Breeder water consumption (June 28).

A key to possibly solving this problem may lie in the momentary spikes in water consumption which occurred at approximately 10:00 am, 11:00 am, 6:20 pm, 7:10 pm, and 8:15 pm (Figure 4). This spiking pattern was seen on other days on this particular farm (Figure 5) and when closely examined corresponds with the cycling of the house's evaporative cooling system (Figure 6).

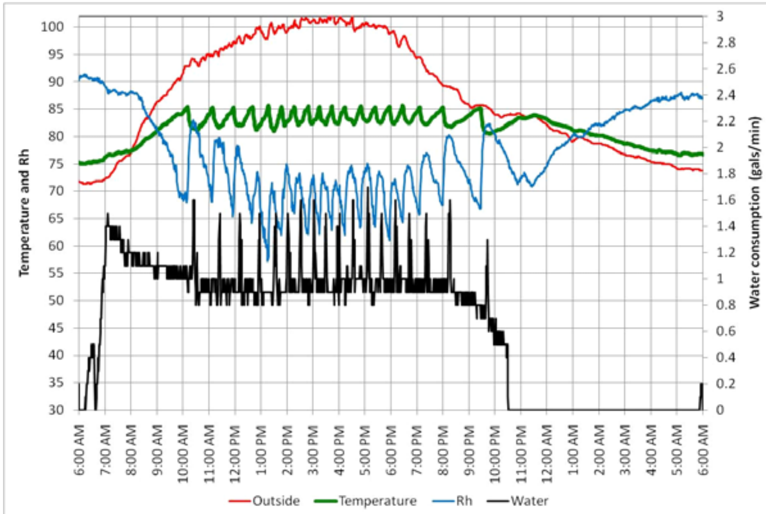

Figure 6. House temperature, Rh and bird water consumption.

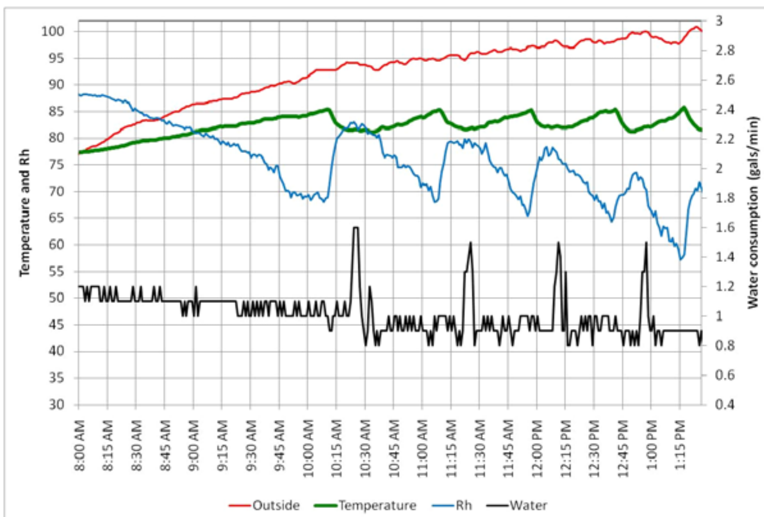

Figure 7. House temperature, Rh and bird water consumption.

Figures 5-7 show water consumption, inside relative humidity, inside and outside temperature for the same farm on June 28th. The outside relative humidity was significantly lower (20% vs 36% mid afternoon) which increased the cooling capability of the evaporative cooling pads. Whereas on June 27th, the pads could only decrease the air temperature at the tunnel fan end of the house to approximately 85ºF, on June 28th the pads dropped the house an additional five degrees to nearly 80ºF. Since the evaporative cooling pads were set to come on at 85ºF and to shut off at 83ºF, when the temperature dropped below 83ºF the pump circulating water over the pads would turn off. The thoroughly wetted pads would continue to cool for a period of time but eventually would dry out and house temperature would rise once again causing the pads to come on and the cycle to start once again (Figures 6 and 7).

What is important to note is that the spikes in water consumption did not occur when house temperatures were at their highest, but rather when house temperatures were their lowest. This would tend to indicate that the birds were more "uncomfortable" when the house temperature was at its lowest points in the cycle rather than when they were at their highest, which at first sounds counterintuitive. But, there were two other things happening in the house when the temperature was at its lowest point; relative humidity was at its highest and tunnel fans were shutting off (Figure 7). So, though air temperatures were relatively low, the higher relative humidity and decreased wind chill effect actually resulted in a higher effective air temperature. In this particular case four of the house's ten tunnel fans were set to shut off as house temperature approached 80ºF (Table 1). The accompanying decrease in air speed would have reduced air velocity by approximately 40% which in turn would have cut the wind chill effect by 75% or more! It is important to realize that it is the wind chill effect that allows us to use evaporative cooling systems in humid climates. Think of it this way. If you were to allow your house temperature to rise to 85°F and relative humidity to 80% during the wintertime you would likely have mortality issues in less than 30 minutes. The only reason we can not only get away with these same conditions during the summertime but actually do fairly well is due to the high air speeds that are produced by our houses' tunnel ventilation fans.

On	Off	
87°F	85°F	2 - 48"
85°F	83°F	Pads
84°F	82°F	2 - 48"
82°F	80°F	2 - 48"
77°F	75°F	Tunnel
75°F	74°F	1 - 48"
74°F	72°F	1 - 48"
72°F	70°F	2 - 48"
70°F Set Temperature		

Table 1. Example of problematic tunnel fan settings.

On	Off	
85°F	83°F	Pads
80°F	77°F	2 - 48"
79°F	76°F	2 - 48"
78°F	75°F	2 - 48"
77°F	75°F	Tunnel
75°F	74°F	1 - 48"
74°F	72°F	1 - 48"
72°F	70°F	2 - 48"
70°F Set Temperature		

Table 2. Example of tunnel fan/pad settings for improved bird cooling.

Without sufficient wind speed moving over the birds when the evaporative cooling system is operating, the pads may be less beneficial than one thinks, and possibly even hurt bird performance. This in no way means that evaporative cooling pads should not be used to keep our birds cool but simply they are the last step in the cooling process. But, if you want to insure maximum bird cooling, basically all of a house's tunnel fans should be operating before water is added to the evaporative cooling pads. And once a pad system is operating it is essential that none of the fans shut off until house temperature has dropped to the point where the birds are no longer in risk of becoming heat stressed. For example, during hot weather a house's evaporative cooling pads should typically be set to come on between 83°F and 85°F (setting the pads to operate much lower than this will typically produce little cooling and result in a relative humidity of 90% or greater). All the house's tunnel fans would be operating by approximately 80°F and set not to shut off until the house temperature (at the tunnel fan end of the house) dropped to 77°F, or lower (Table 2).

It is well documented that fertility, hatchability and shell quality are reduced in eggs from heat stressed breeders. Understanding how the breeder house environment affects the thermal conditions that a bird experiences throughout the day can help producers improve their efficiency. Optimum environments in hot weather for breeders ultimately depend on utilizing a house's evaporative cooling system only in combination with high tunnel air velocities (500 ft/min+).

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