Keeping Birds Cool During Hot Weather

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The key to keeping bird cool during hot weather is to realize that...

How does a broiler use this feed energy?

- Roughly 35% of the energy is used to power the basic functions of life:
  - Grow, move around, breath, pumping blood, maintain body temperature, etc.

Heat stress is essentially an internal problem,

How does a broiler use this feed energy?

- The remaining 65% is essentially put off in the form of heat.
  - Heat a bird must rid itself in order to maintain a proper body temperature and survive.
Whether it is winter or summer they must get rid of this heat to survive

Heat loss breakdown

- Five pound bird at 70°F – 50% Rh
  - 24 Btu's/hr is lost to the air surrounding the bird (40%)
  - 36 Btu's/hr is lost through the evaporation of water off of its respiratory system (60%)

How does a bird rid itself of this excess heat?

- A bird rids itself of this excess heat primarily in two ways:
  1. To the air around it
  2. Through the evaporation of moisture off of its respiratory system

40’ X 500’ Broiler house (23,000 – 8 lb birds)
Seated at rest the average adult male will produce approximately 340 Btu's/hr

- 28% is lost due to the evaporation of water from our respiratory system and skin (perspiration)
- 72% is lost to the air surrounding us

This is a very significant difference

### People
- Evaporation: 40%
- Respiration: 60%

### Poultry
- Representing the heat generation and sensitivity to humidity compared to humans.

**How do we compare?**

**Poultry**
- Generate a lot more heat and are MUCH more sensitive by humidity than we are.
How does changing the humidity affect the heat loss from a bird?

- Study at looking at how relative humidity affects heat loss from a five pound bird at 77°F
  - Rh 50%, 70% and 90%

Increasing Rh from 50 to 70 % when it is 77°F

- Feels the same to the bird as raising the air temperature from 77 to 86°F when the Rh is 50%
If a bird cannot get rid of all the heat it is producing...

- Body temperature will increase,
- Feed consumption will decrease,
- Growth rate will decrease,
- Feed conversions will increase,
- Eventually mortality will increase.

What happens at high house temperatures (86°F) with high relative humidity?

- Study at looking at how relative humidity affects heat loss from a 5 lb bird at 77°F
  - Rh 50%, 70% and 90%

Heat loss from a 5 lb broiler

- 70°F - 50% 77°F - 50% 86°F - 50% 86°F - 90%

Levent, & Portier, 2005

So how do we help remove heat from the birds?

- Lower the air temperature!
Evaporative cooling

- Pads/fogging nozzles produce cooling through the evaporation of water into the air which increases relative humidity of the air.

6” evaporative cooling pad in operation

As a result when we use evap. cooling we tend to get conditions like these...

Heat loss from a 5 lb broiler with and without evaporative cooling

For every 1°F cooling produced by the evaporation of water, the relative humidity will increase approximately 2.5%.

Heat loss from a 5 lb broiler with and without evaporative cooling

Levent, & Portier, 2005
Evaporative cooling

- The PRIMARY reason we can use evaporative cooling pads to keep our birds cool during hot weather is because of the amount of air movement we have in our tunnel houses.

Simmons & Lott 1981

Five pound bird 85°F

Body temperature vs. Air speed
(individual bird at 85°F – Drury Siegel, 1968)
More air movement, more heat removal, panting rate decreases...

The net result is that air movement lessens the negative effect of high relative humidity

This doesn’t mean that evaporative cooling is not important

High density layer house (tunnel ventilated without pads)

Outside temperature and Rh

Front to rear temperature difference (22, 52” fans operating at all times)
Per bird heat removal by air movement

Per bird heat removal through air movement AND evaporation

Total per bird heat removal

50 X 560’ broiler house

Heat removal and air temperature

Weekly weight gain
86°F Day – 77°F Night
Evaporative cooling keeps air movement effective

Growers should not underestimate the importance of nighttime cooling
- Though temperatures are at their lowest...
- Rh is at its highest

Heat removal in 50’ X 560’ house
Bird heat removal in 50’ X 560’ house

But air speed was not a constant...

Lowest heat removal occurred when air temperatures were at their lowest

It was significantly lower at night because fans were shutting off

But Rh is at its highest

Which resulted in a 20% decrease in daily heat removal
Heat removal chart was developed from data collected from this particular house.

Heat removal as a function of air speed and house temperature.

Air speed and heat removal:
- Increasing air speed from 500 to 600 ft/min increases heat removal by 20%.

Typically during hot weather the house may only be 4 to 6 degrees cooler at night!

Air temperature and heat removal:
- Decreasing house temperature 4°F increases heat removal by 6%.

If we decrease our air speed because the air is “cooler”...
During the day...

![Graph showing heat removal per square foot vs. air speed for different temperatures (80 F, 76 F, 84 F).]

At night...

![Graph showing heat removal per square foot vs. air speed for different temperatures (80 F, 76 F, 84 F).]

The net result is 20% decrease in daily heat removal.

86°F day – 77°F night

![Bar chart showing weekly weight gain (lbs) for day 37 to 44 and day 44 to 51 for different conditions (still air, 550/300 ft/min, 550 ft/min).]
86°F day – 77°F night

So Far...
- Air speed provides more cooling than temperature reduction
- Birds lose less heat as RH increases
- When RH increases, air speed is critical

Nighttime evaporative cooling operation?

Typical hot weather
- Pads only operating during the day
- Pads operating 24 hours a day
Nighttime pad operation can increase heat stress

- One way to reduce the possibility of pads operating at night is to set a pad operating temperature of approximately 83°F.
- Another way is to set a lower pad operating temperature AND put them on a time clock so they will not operate between the hours of 10 pm and 9 am.

But during extremely hot weather old rules of thumbs may not hold true...
What happens if the pads are not allowed to operate from 10 pm to 9 am?

Normal hot weather

Next day it is hotter... Inside house temperatures

The next day hotter yet
Pad operation should be based on house temperature...not time of day

- Set to turn on at 83°F.
- If you are going to use a time clock you may have to make adjustments during very hot weather.