Keeping Birds Cool During Hot Weather

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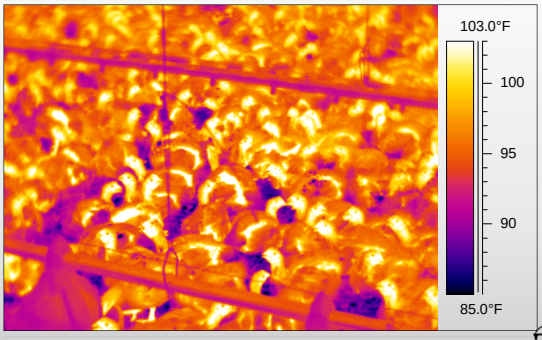
caused by the consumption of feed

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

How does a broiler use this feed energy?

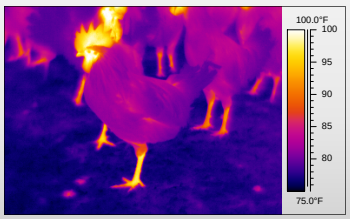
- Roughly 35% of the energy is used to power the basic functions of life:
  - Grow, move around, breath, pumping blood, maintain body temperature, etc.

heat stress is essentially an internal problem,

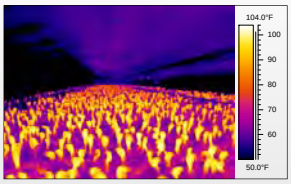


How does a broiler use this feed energy?

- 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



Winter

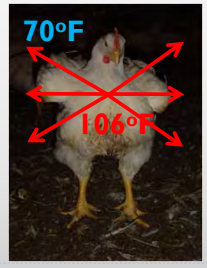
Summer

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%)

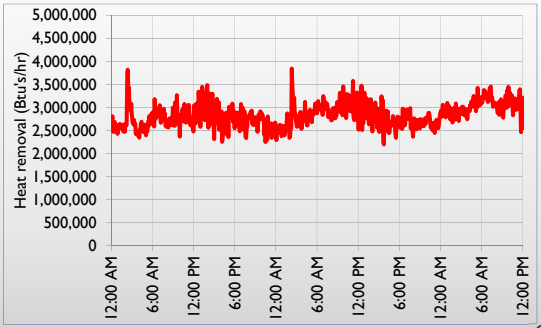
How does a bird rid itself of this excess heat?

- A bird rids itself of this excess heat primarily in two ways:
  1) To the air around it



40' X 500' Broiler house

(23,000 – 8 lb birds)

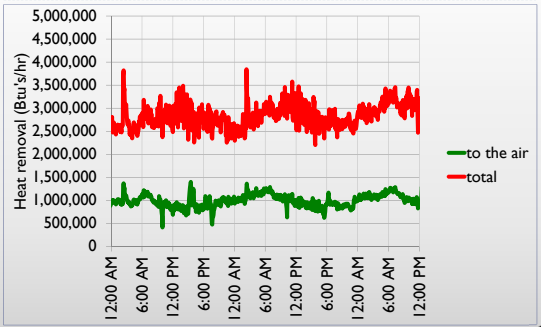


How does a bird rid itself of this excess heat?

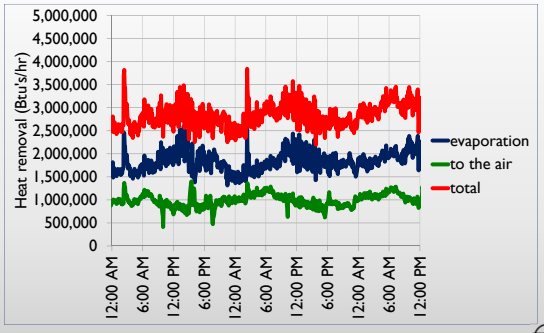
- A bird rids itself of this excess heat primarily in two ways:
  1) To the air around it
  2) Through the evaporation of moisture off of its respiratory system

40' X 500' Broiler house

(23,000 – 8 lb birds)



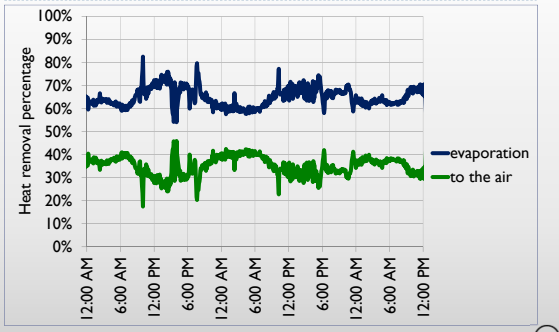
40' X 500' Broiler house
(23,000 – 8 lb birds)



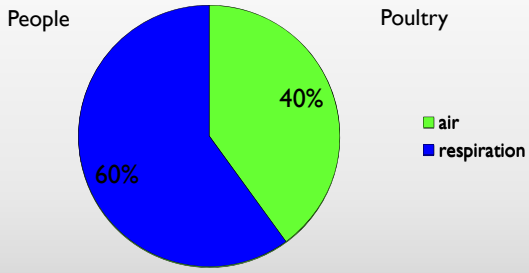
Seated at rest the average adult male will produce approximately 340 Btu's/hr

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

40' X 500' Broiler house
(23,000 – 8 lb birds)



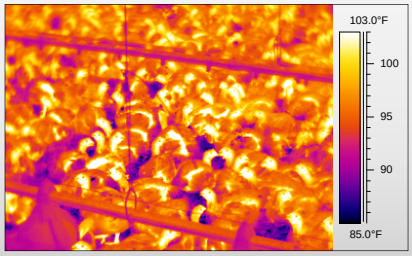
This is a very significant difference



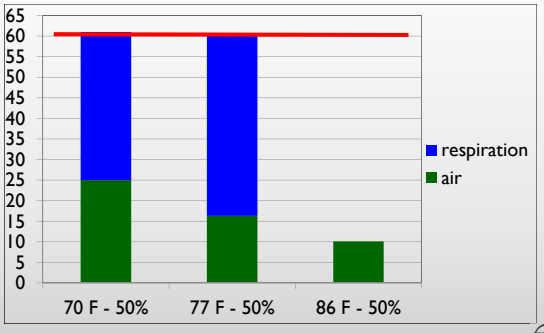
How do we compare?

Poultry

- Generate a lot more heat and are MUCH more sensitive by humidity than we are

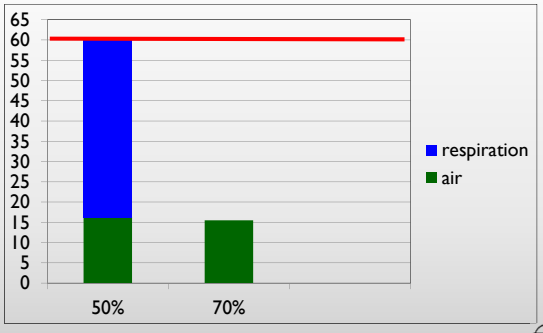


Heat loss from a 5 lb broiler



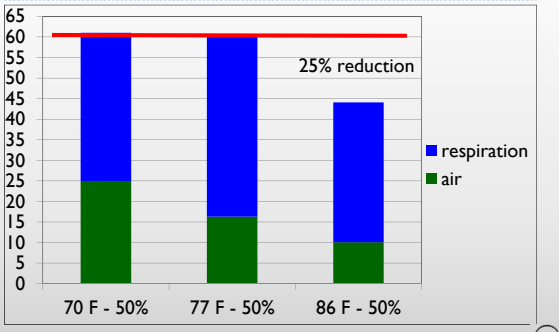
Levent, & Portier, 2005

Heat loss from a 5 lb broiler at 77°F



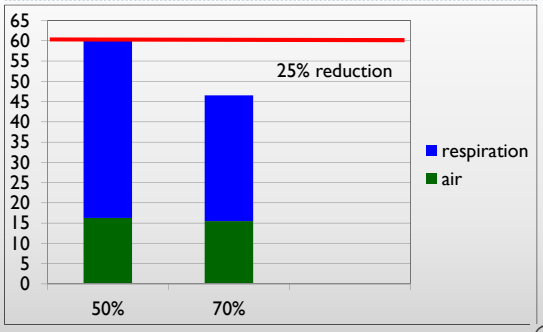
Levent, & Portier, 2005

Heat loss from a 5 lb broiler



Levent, & Portier, 2005

Heat loss from a 5 lb broiler at 77°F



Levent, & Portier, 2005

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…

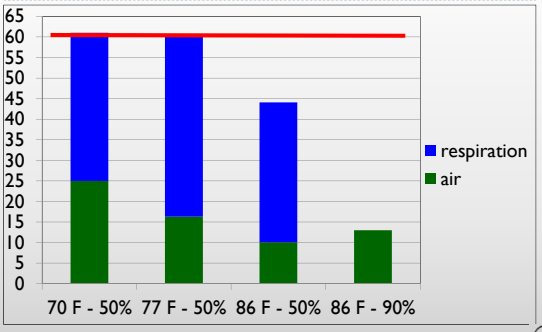
- Body temperature will increase,
- Feed consumption will decrease,
- Growth rate will decrease,
- Feed conversions will increase,
- Eventually mortality will increase.

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

How does changing the humidity affect the heat loss from a bird?

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

Heat loss from a 5 lb broiler



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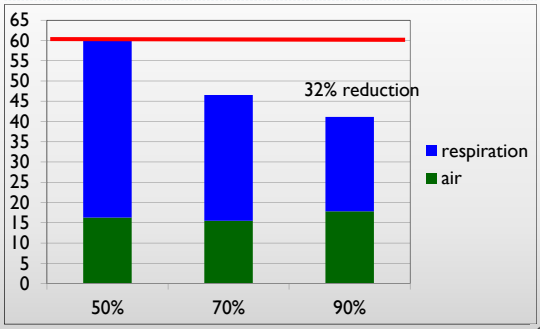
Heat loss from a 5 lb broiler at 77°F



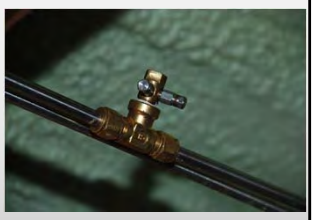
Levent, & Portier, 2005

So how do we help remove heat from the birds?

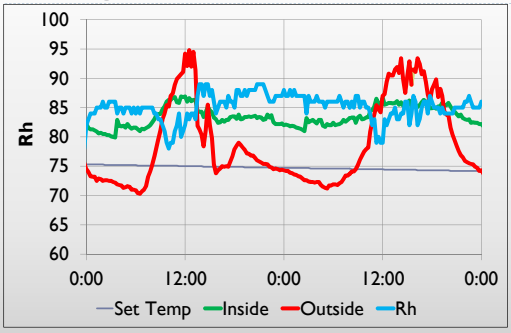
- Lower the air temperature?

Evaporative cooling

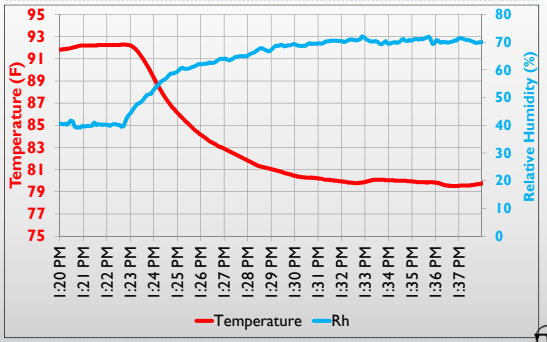
- Pads/fogging nozzles produce cooling through the evaporation of water into the air which increases relative humidity of the air



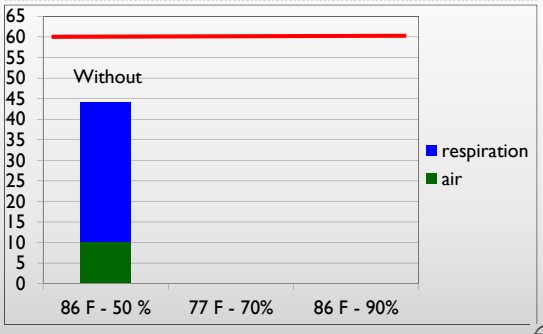
As a result when we use evap. cooling we tend to get conditions like these…



6" evaporative cooling pad in operation



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



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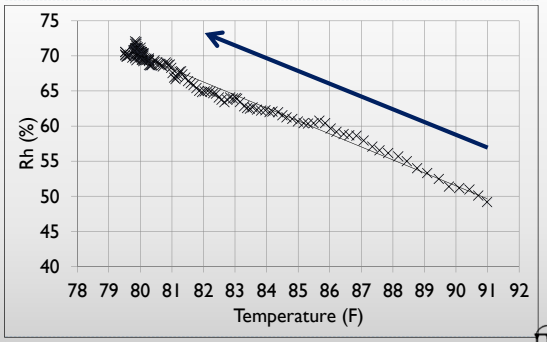
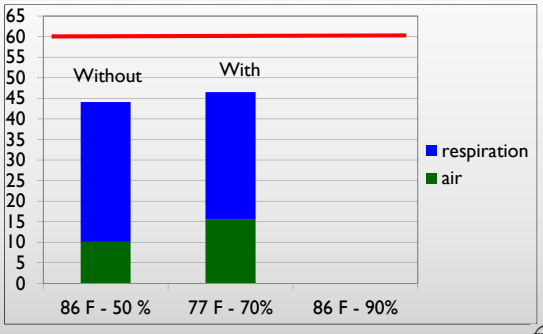
For every 1ºF cooling produced by the evaporation of water, the relative humidity will increase approximately 2.5%



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



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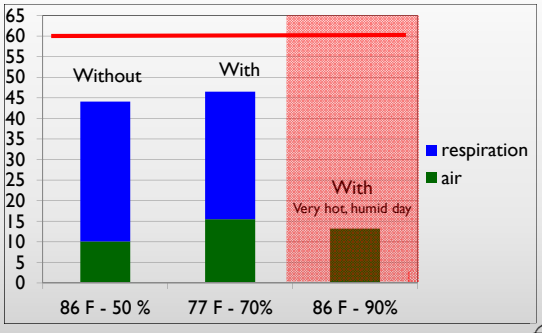
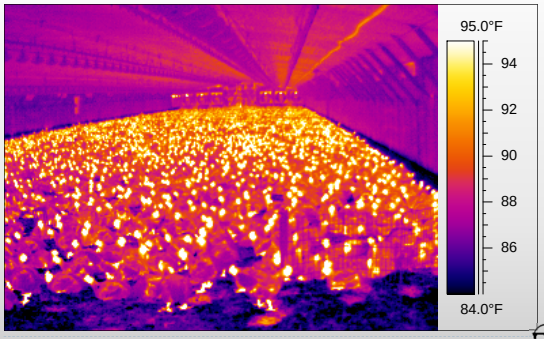
Heat loss from a 5 lb broiler with and without evaporative cooling



Levent, & Portier, 2005

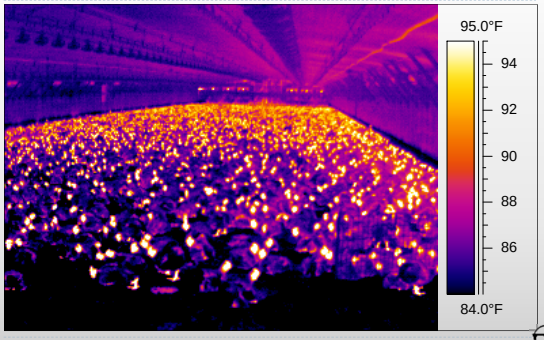
Broilers (85°F – 250 ft/min)



Evaporative cooling

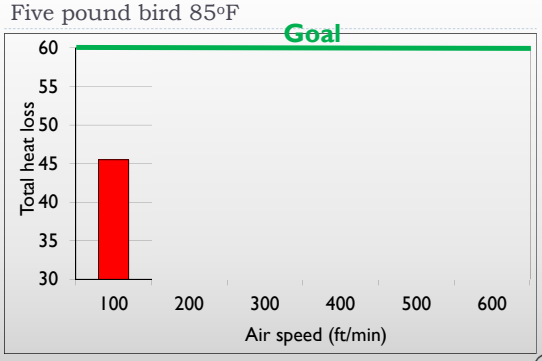
- The PRIMARY reason we can use evaporative cooling pads to keep our birds cool during hot weather is because of the amount of air movement we have in our tunnel houses.

Broilers (85°F – 550 ft/min)



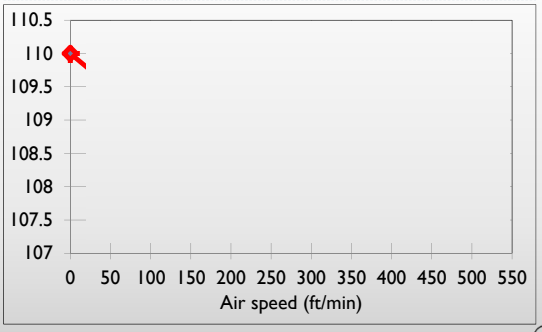
Simmons & Lott 1981

Five pound bird 85°F



Body temperature vs. Air speed

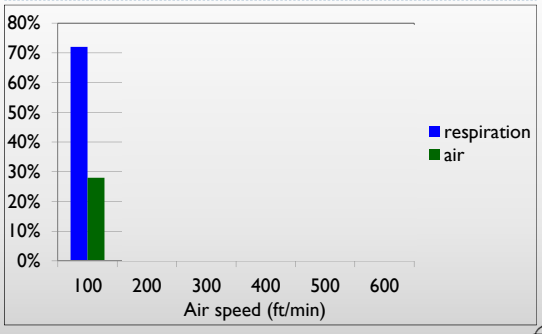
(individual bird at 85°F – Drury Siegel, 1968)



More air movement, more heat removal, panting rate decreases…

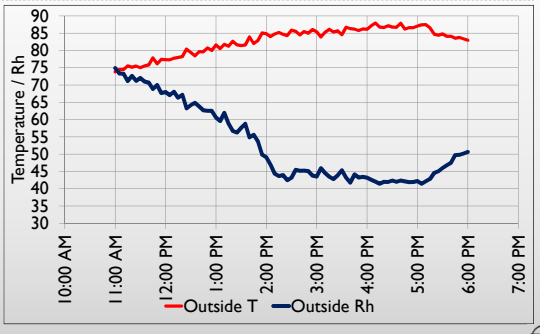
High density layer house
(tunnel ventilated without pads)

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



(Simmons & Lott 1981)

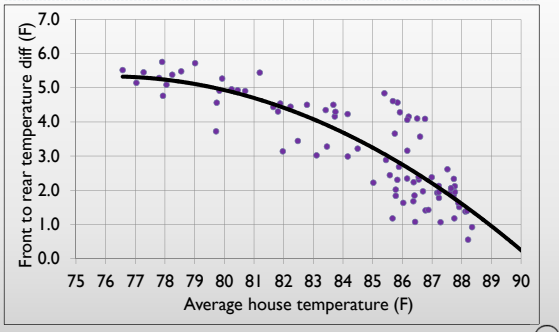
Outside temperature and Rh



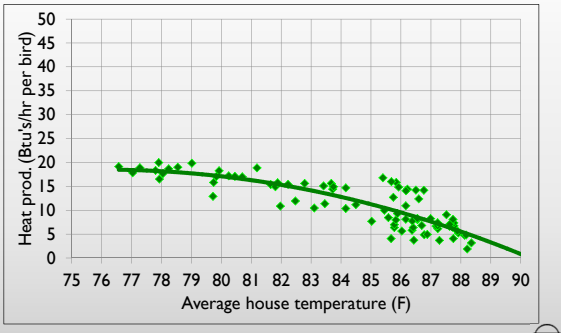
This doesn't mean that evaporative cooling is not important

- The closer the air temperature is to the birds body temperature the less heat removed from the birds.

Front to rear temperature difference
(22, 52" fans operating at all times)

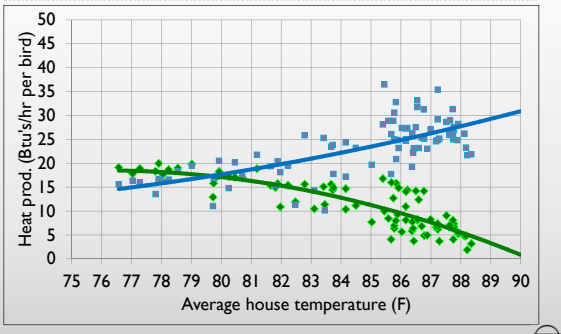


Per bird heat removal by air movement

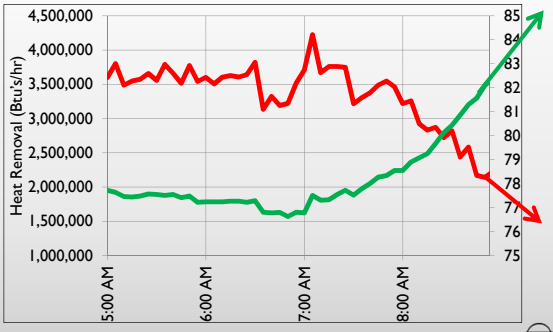


50 X 560' broiler house

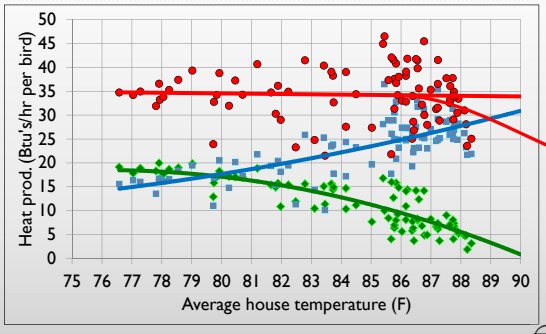
Per bird heat removal through air movement AND evaporation



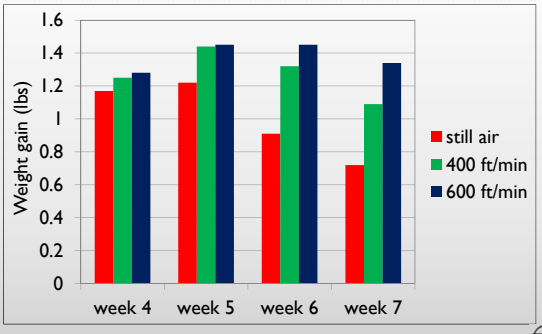
Heat removal and air temperature



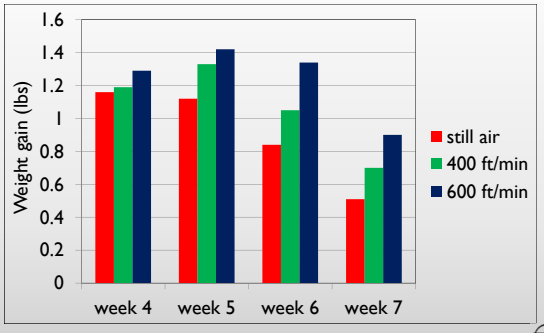
Total per bird heat removal



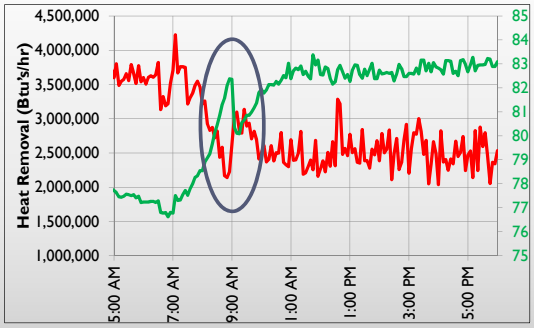
Weekly weight gain
86°F Day – 77°F Night



Weekly weight gain
95°F Day – 77°F Night



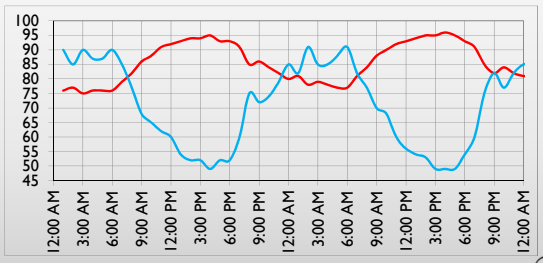
Heat removal and air temperature



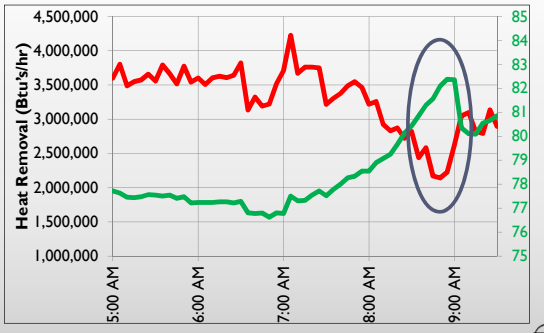
Evaporative cooling keeps air movement effective

Growers should not underestimate the importance of nighttime cooling

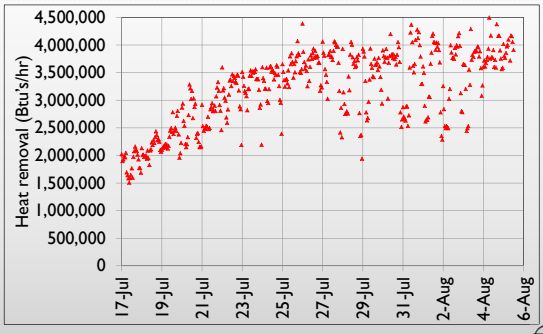
- Though temperatures are at their lowest…
- Rh is at its highest



Heat removal and air temperature



Bird heat removal in 50' X 560' house



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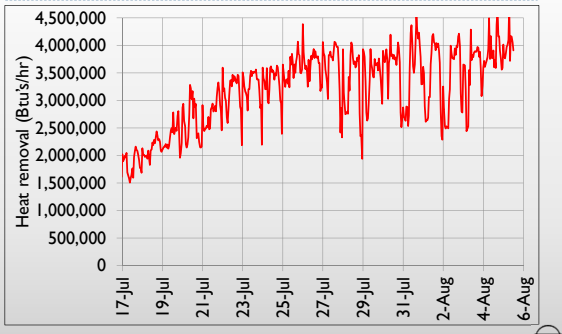
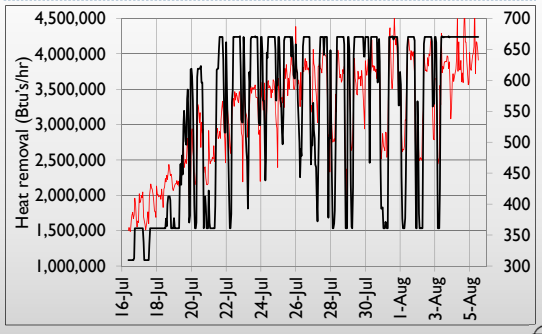
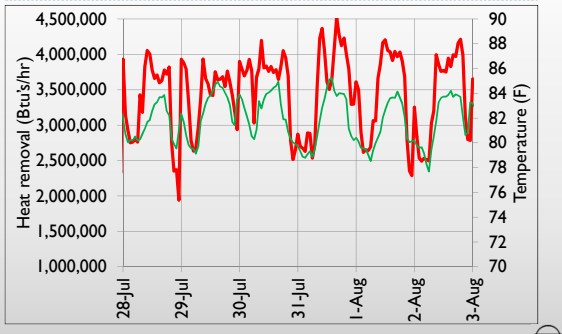


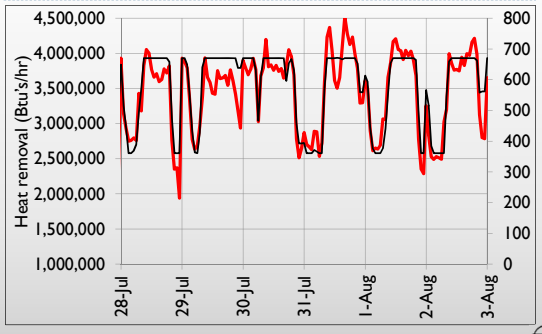
But air speed was not a constant…



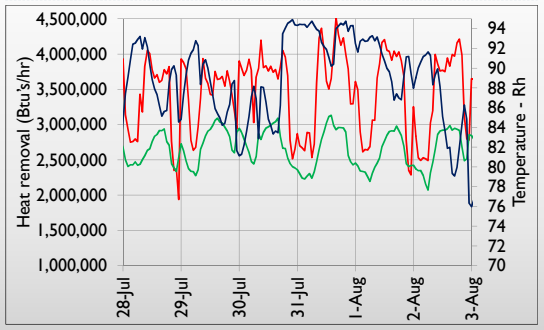
Lowest heat removal occurred when air temperatures were at their lowest



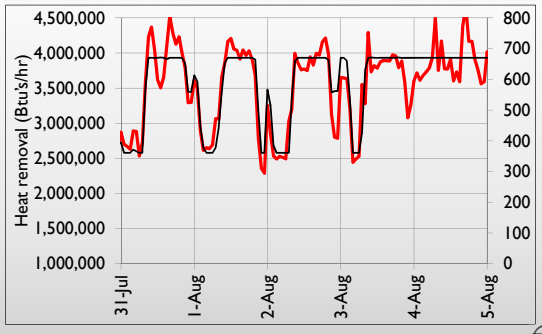
It was significantly lower at night because fans were shutting off



But Rh is at its highest

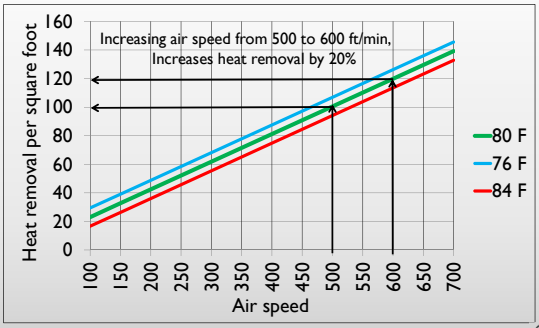


Which resulted in a 20% decrease in daily heat removal

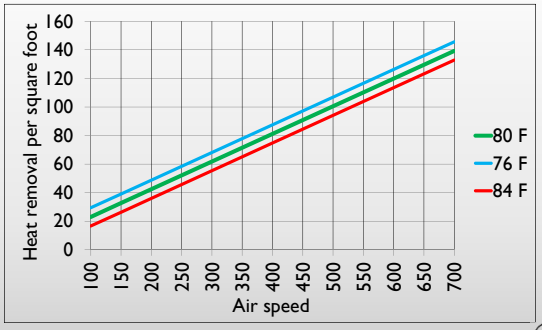


Heat removal chart was developed from data collected from this particular house

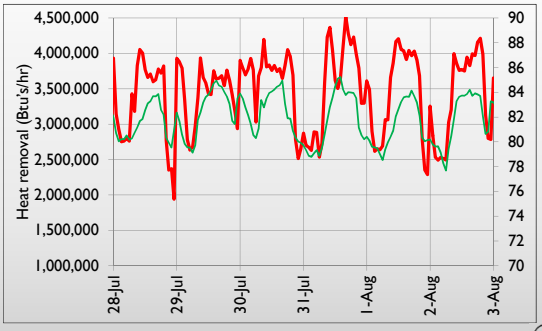
Air speed and heat removal



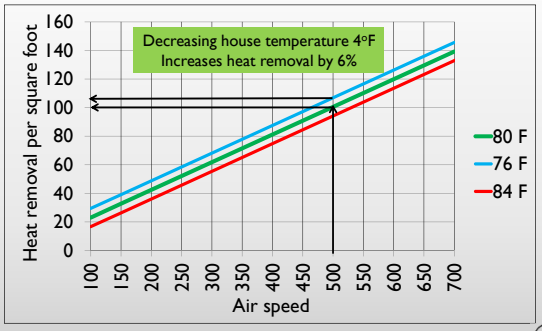
Heat removal as a function of air speed and house temperature



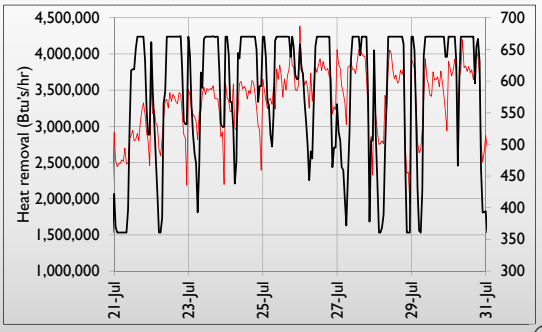
Typically during hot weather the house may only be 4 to 6 degrees cooler at night!



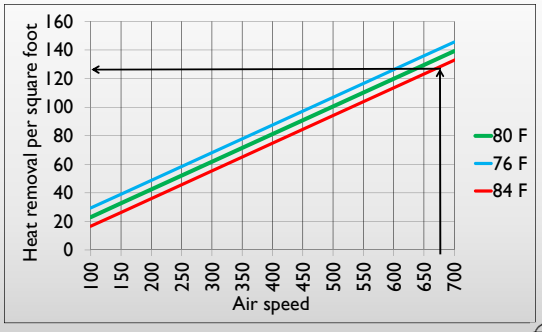
Air temperature and heat removal



If we decrease our air speed because the air is "cooler"….

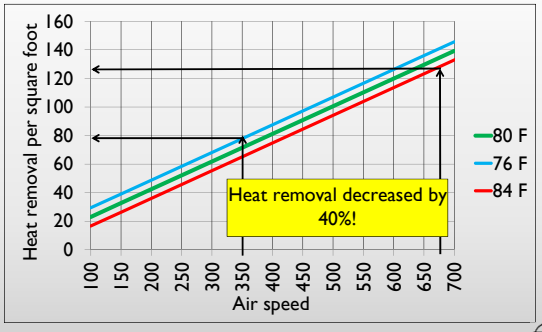


During the day....

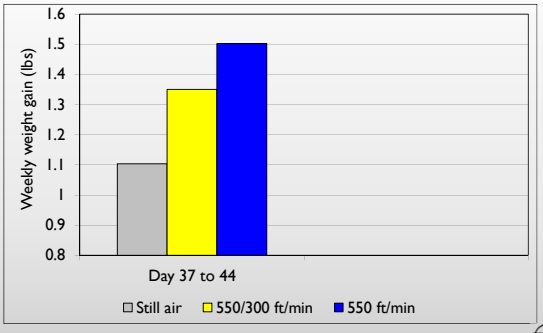


When we don't run all our fans at night we are going to have a loss in performance

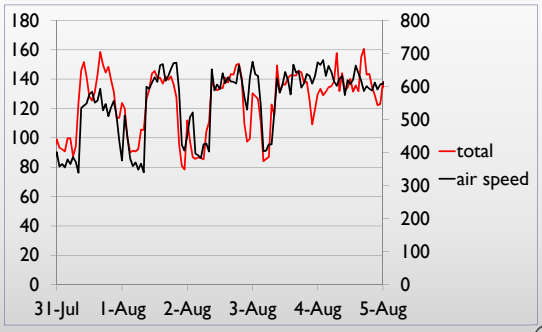
At night...



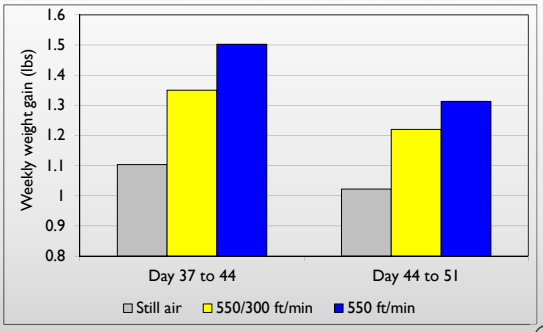
86°F day – 77°F night



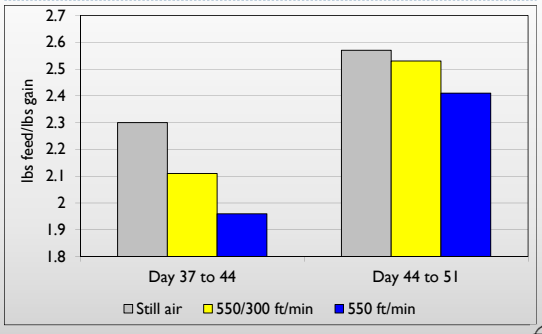
The net result is 20% decrease in daily heat removal



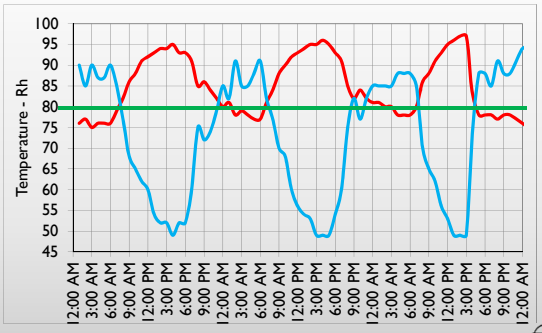
86°F day – 77°F night



86ºF day – 77ºF night



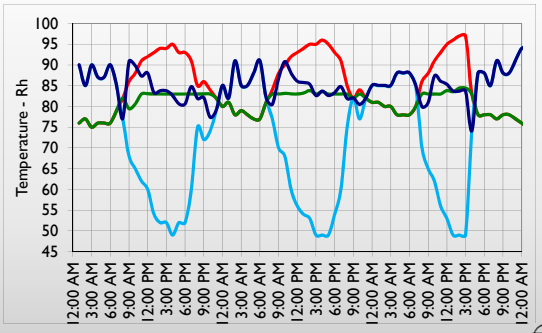
Typical hot weather



So Far…

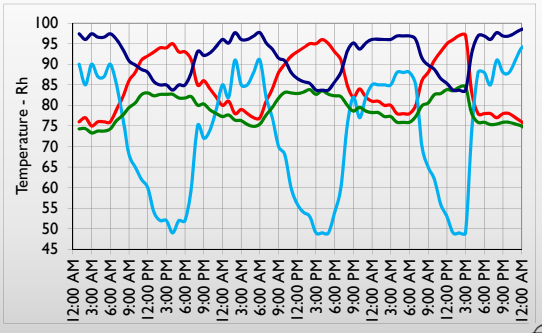
- Air speed provides more cooling than temperature reduction
- Birds loose less heat as RH increases
- When RH increases, air speed is critical

Pads only operating during the day



Nighttime evaporative cooling operation?

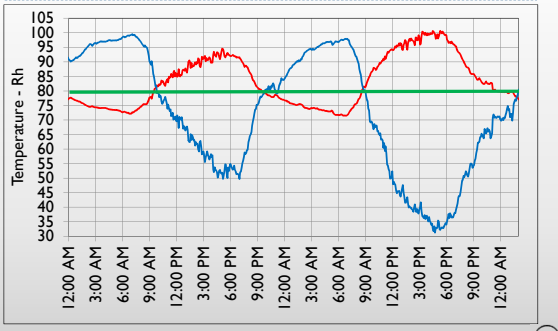
Pads operating 24 hours a day



Nighttime pad operation can increase heat stress

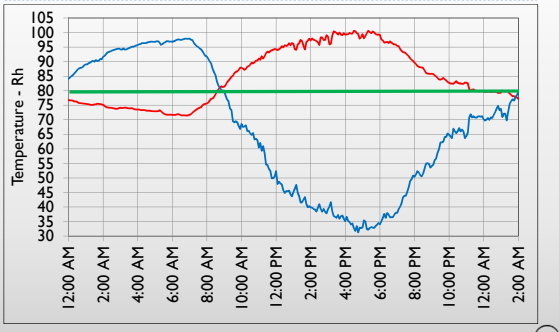
- One way to reduce the possibility of pads operating at night is to set a pad operating temperature of approximately 83°F.
- Another way is to set a lower pad operating temperature AND put them on a time clock so they will not operate between the hours of 10 pm and 9 am.

Outside temperature and Rh

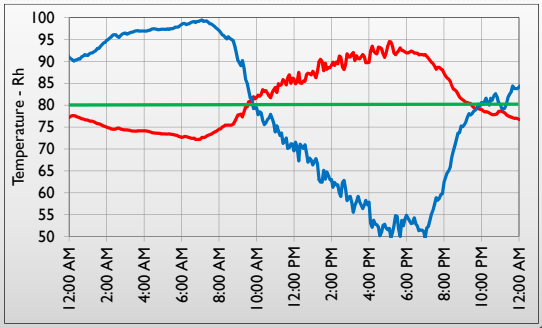


But during extremely hot weather old rules of thumbs may not hold true…

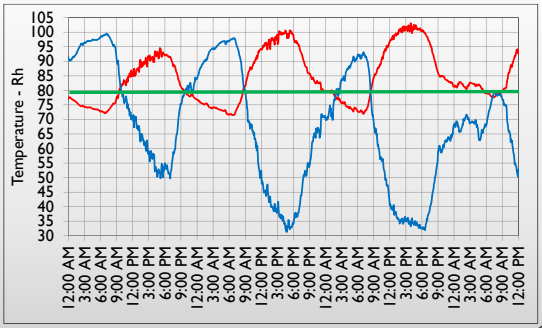
Outside temperature and Rh



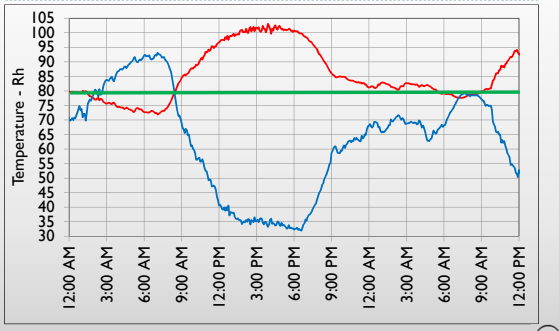
Outside temperature and Rh



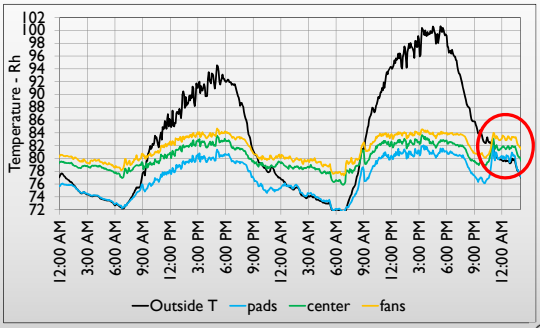
Outside temperature and Rh



Outside temperature and Rh

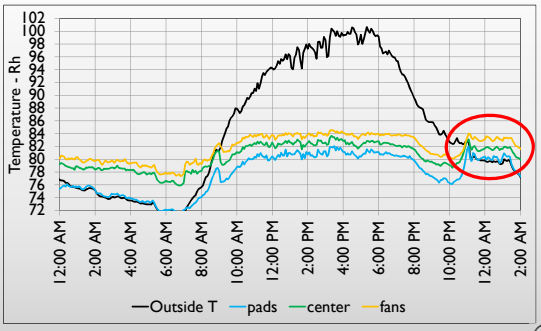


Next day it is hotter…

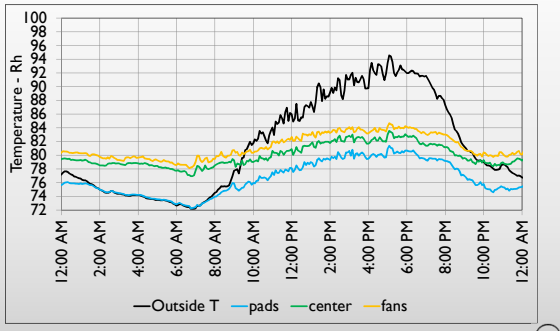


What happens if the pads are not allowed to operate from 10 pm to 9 am?

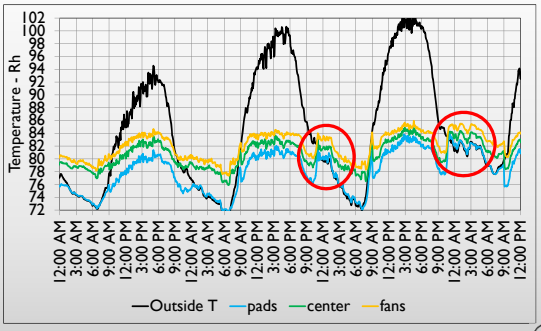
Inside house temperatures



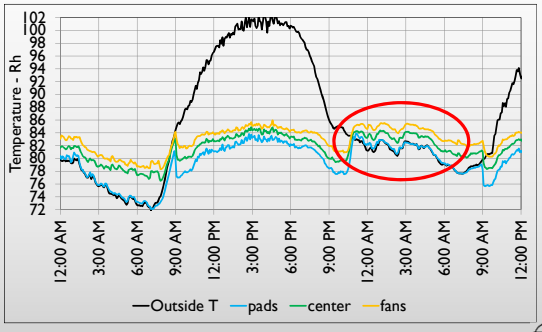
Normal hot weather



The next day hotter yet



Inside house temperatures



Pad operation should be based on house temperature…not time of day

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

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The University of Georgia

Cooperative Extension Service

College of Agriculture / Athens, Georgia

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