
Bird Cooling Methods
Brian Fairchild
University of Georgia

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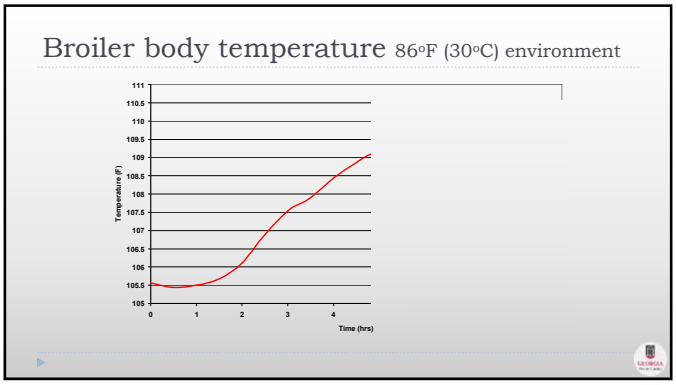
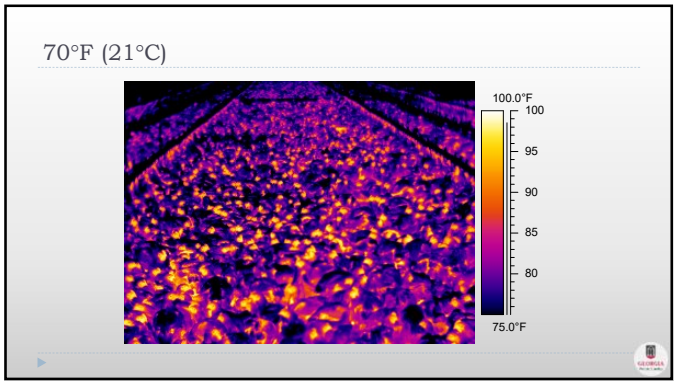
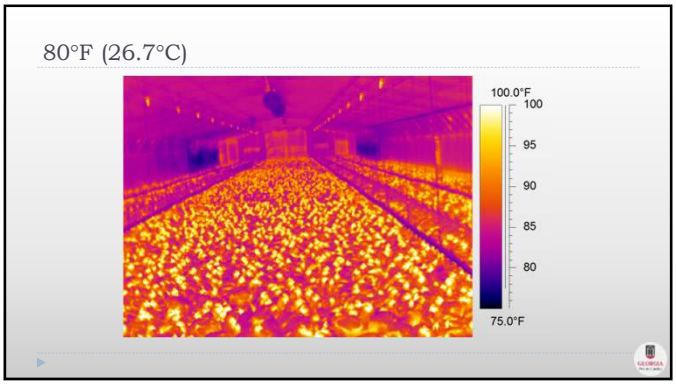

Broiler body temperature 86ºF (30ºC) environment
Temperature (F)
111
110.5
110
109.5
109
108.5
108
107.5
107
106.5
106
105.5
105
0
1
2
3
4
Time (hrs)

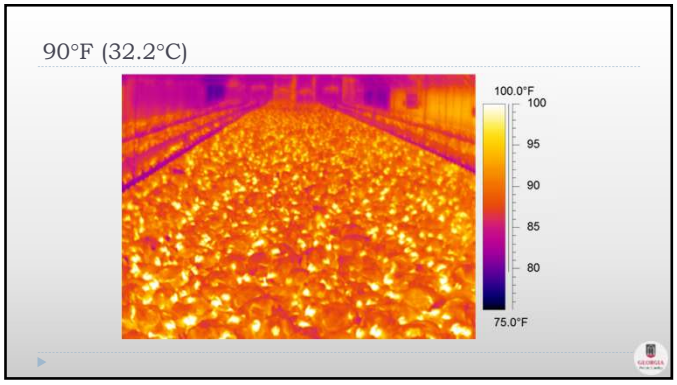
2


70°F (21°C)
100.0°F
100
95
90
85
80
75.0°F

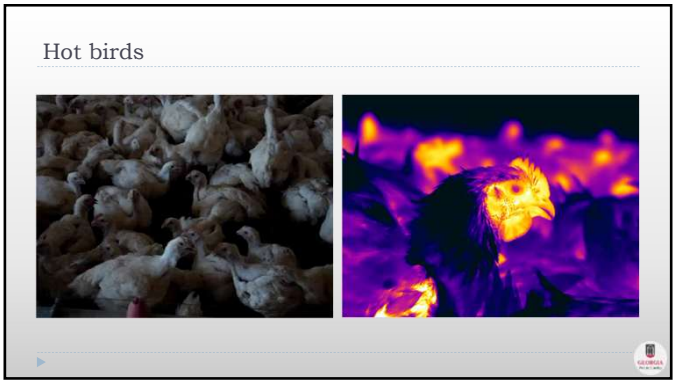
3


80°F (26.7°C)
100.0°F
100
95
90
85
80
75.0°F

4


90°F (32.2°C)
100.0°F
100
95
90
85
80
75.0°F

5


Hot birds

6

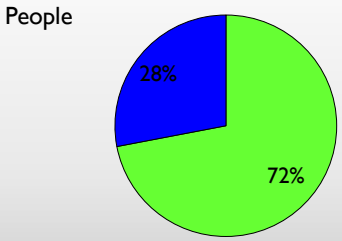
Let's take a closer look at how air temperature and humidity affect bird heat loss…

7

Poultry vs People

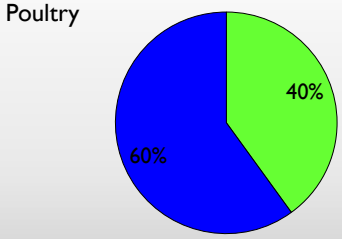
8

This is a very significant difference…



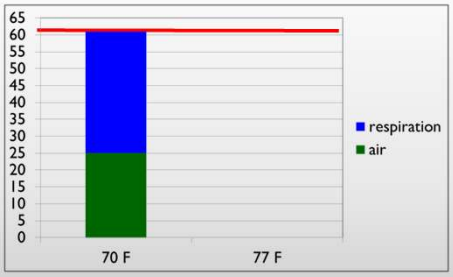
9

This is a very significant difference…



10

Heat loss from a 5 lb broiler at 70°F and Rh=50%



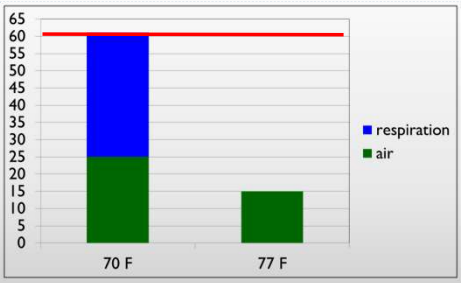
Levent, & Portier, 2005

11

What happens when air temperature is increased to 77°F

12

Heat loss from a 5 lb broiler at 70°F and 77°F, Rh=50%



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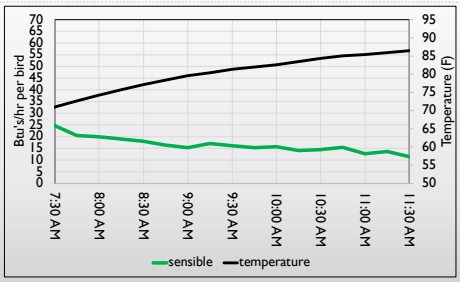
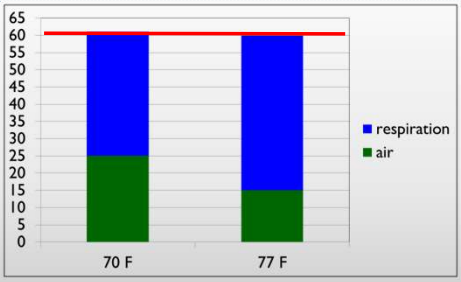
4 lb broiler heat loss



14

Heat loss from a 5 lb broiler at 70°F and 77°F, Rh=50%



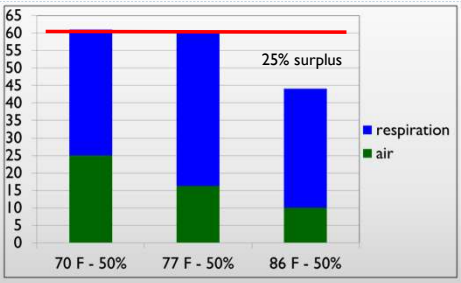
Levent, & Portier, 2005

15

What happens at even higher house temperatures?

16

Heat loss from a 5 lb broiler



Levent, & Portier, 2005

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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%

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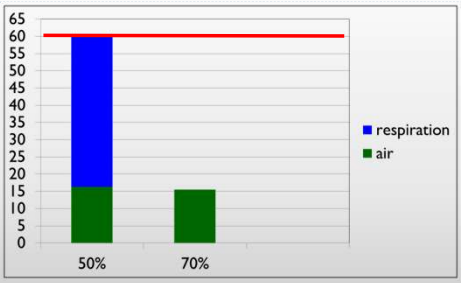
Heat loss from a 5 lb broiler at 77°F



Levent, & Portier, 2005

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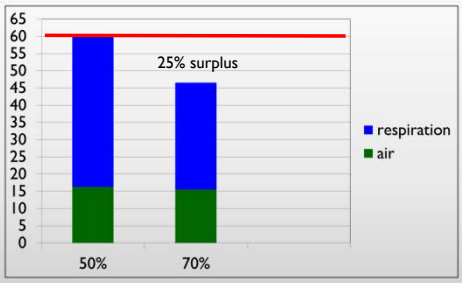
Heat loss from a 5 lb broiler at 77°F

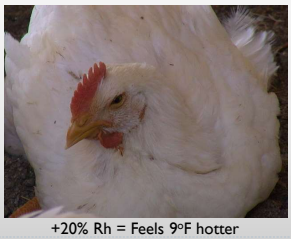


Levent, & Portier, 2005

20

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

- Feels the same to a bird as raising the air temperature from 77 to 86°F when the Rh is 50%



+20% Rh = Feels 9°F hotter

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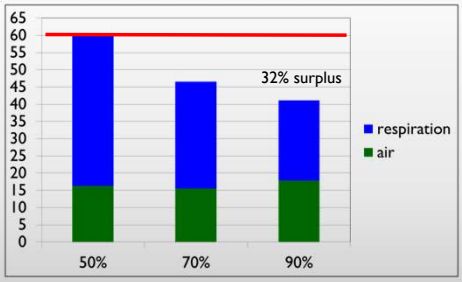
Heat loss from a 5 lb broiler at 77°F



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22

Increasing Rh from 50 to 90% when it is 77°F

- Feels the same to the bird as raising the air temperature from 77 to 90°F when the Rh is 50%

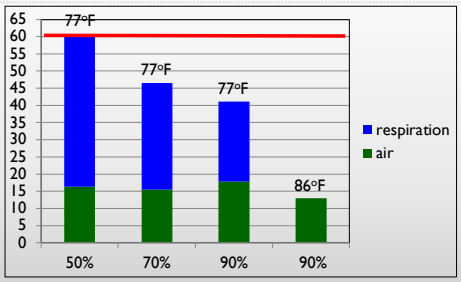
+40% Rh = Feels 13°F hotter

23

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

24

Heat loss from a 5 lb broiler at 77°F



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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

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Evaporative cooling is often used to decrease house temperature

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

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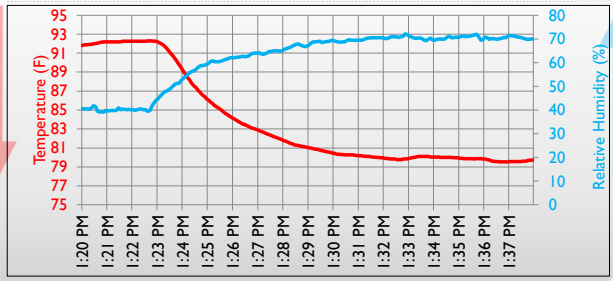
6" evaporative cooling pad in operation



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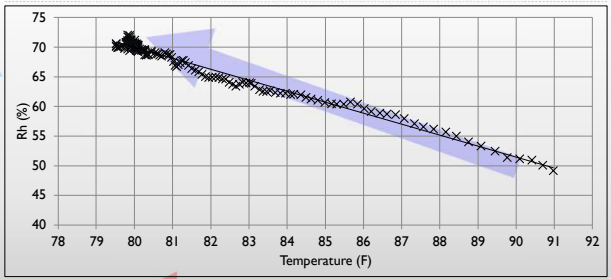
For every 1°F cooling produced by the evaporation of water the relative humidity will increase approximately 2.5%



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The greater the amount of cooling produced…

- The more the relative humidity will increase:
- 2°F cooling = +5% Rh
- 5°F cooling = +13% Rh
- 10°F cooling = +25% Rh
- 20°F cooling = +50% Rh

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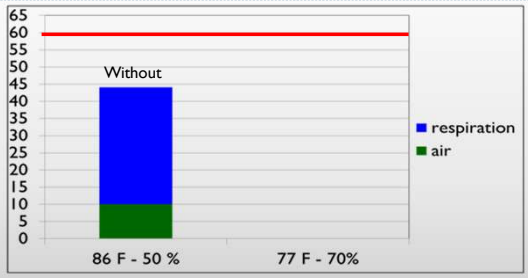
So we are left with a choice…



Levent, & Portier, 2005

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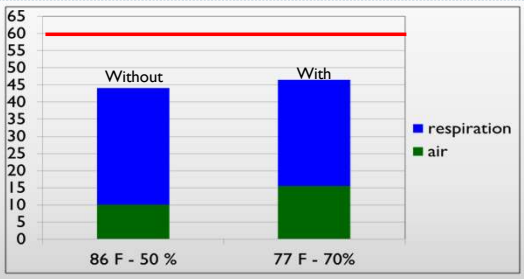
So we are left with a choice…



Levent, & Portier, 2005

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Evaporative cooling by itself doesn't actually increase bird cooling

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Concentrate first on air speed…

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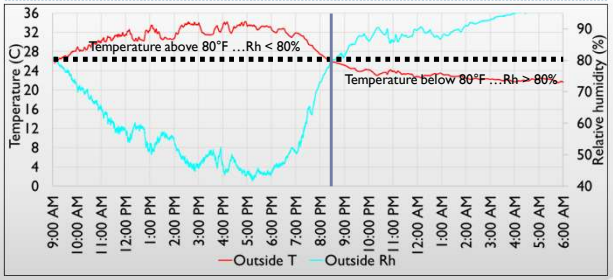
Temperature and Rh tend to "crossover" at 80°F – 80 % Rh



35

Using pads at temperature 80°F or lower will tend to result in little cooling…

- and push the relative humidity near saturation

- Which will result in increased heat stress

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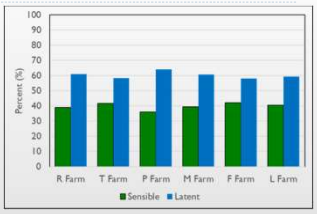
It is important to keep in mind that…

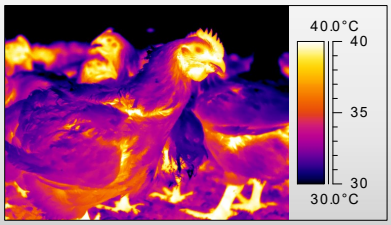


- Roughly 60% of a birds heat loss is through evaporation of water off its respiratory system…primary method of heat loss/cooling

37

The higher the humidity…

- The lower the amount of water evaporated off the birds respiratory system…
- The hotter the bird will feel



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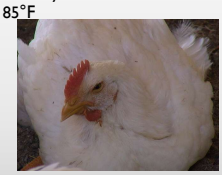
Research has shown that…

- Increasing Rh from 50 to 70 % when it is 75°F…
- Feels the same to the bird as raising the air temperature approximately 10°F
- So though the thermometer may indicate that the air temperature is only 77°F …the birds feel like it is 85°F



- Raising the Rh from 70% to 90% feels makes the bird feel even hotter

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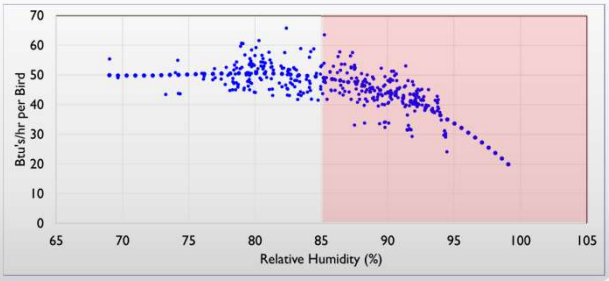
Respiratory heat loss decreases rapidly when Rh increases above 85%



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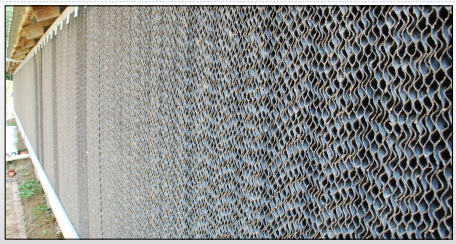
Concentrate on air movement until 85°F…



- Then use the pads

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Air movement

- Moving air over a hot object removes heat from that object...

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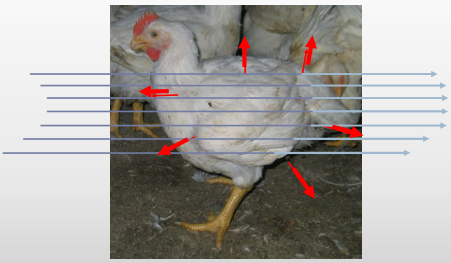
Bird heat loss



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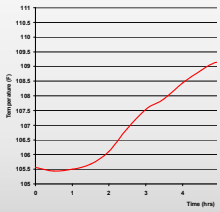
Increasing air movement 86°F (30°C)

- Lowers body temperature…



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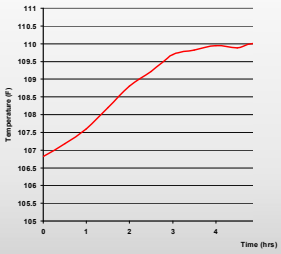
More air speed…

(air temp = 86°F or 30°C)



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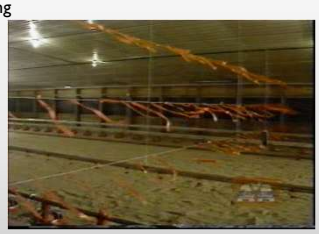
Increasing air movement

- Lowers body temperature…
- Decreases panting



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Research on air movement & broiler performance

- USDA Poultry Research Lab
  - Mississippi
  - Explore the relationship between air temperature, relative humidity, wind speed
- Grow birds from three to seven weeks of age at 85°F (29°C)/77(25°C) with different amount of wind speeds
- Monitored bird weights and feed conversion
- Estimate effective temperatures

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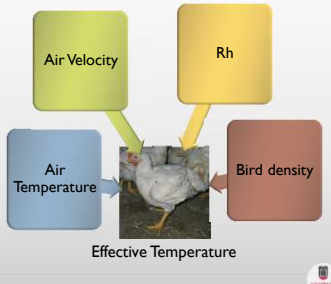
Effective temperature

- What it feels like to the bird
- A combination of several factors



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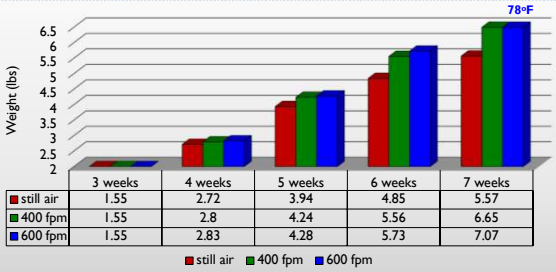
85°F Day – 77°F Night



	3 weeks	4 weeks	5 weeks	6 weeks	7 weeks
still air	1.55	2.72	3.94	4.85	5.57
400 fpm	1.55	2.8	4.24	5.56	6.65
600 fpm	1.55	2.83	4.28	5.73	7.07

still air 400 fpm 600 fpm

Simmons et al., 1997

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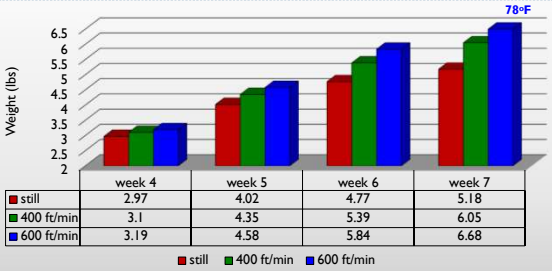
85°F day – 77°F night



	week 4	week 5	week 6	week 7
still	2.97	4.02	4.77	5.18
400 ft/min	3.1	4.35	5.39	6.05
600 ft/min	3.19	4.58	5.84	6.68

still 400 ft/min 600 ft/min

Dozier et al, 2005

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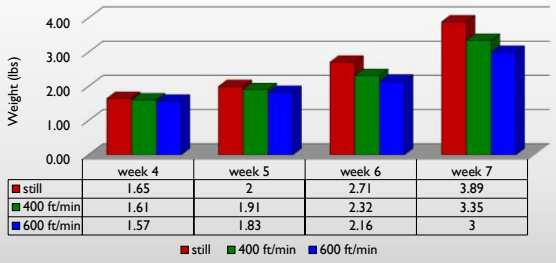
85°F day – 77°F night (broilers)



	week 4	week 5	week 6	week 7
still	1.65	2	2.71	3.89
400 ft/min	1.61	1.91	2.32	3.35
600 ft/min	1.57	1.83	2.16	3

still 400 ft/min 600 ft/min

Dozier et al, 2005

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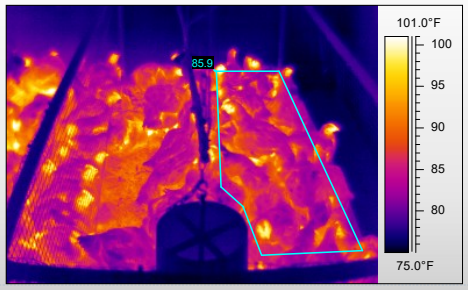
Still Air – 78°F(25.6°C)



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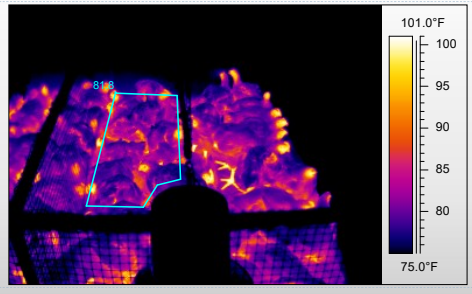
300 ft/min – 78°F(25.6°C)



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The effect of air movement on turkeys

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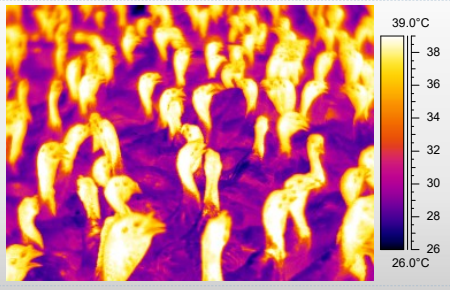
150 ft/min 80°F (26.7°C)



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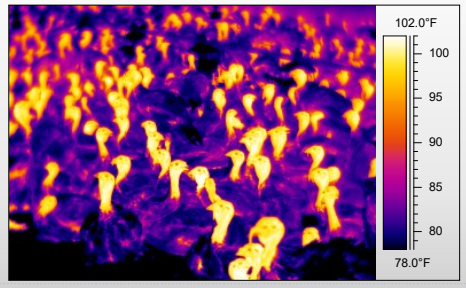
400 ft/min 80°F (26.7°C)



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Cooling through air movement

- Dr. Lott - USDA Poultry Research Lab
  - Mississippi State University
- Grew birds from three to seven weeks of age at 85 F with different amount of wind speeds
  - 0 ft/min
  - 400 ft/min
  - 300, 400, 600 ft/min

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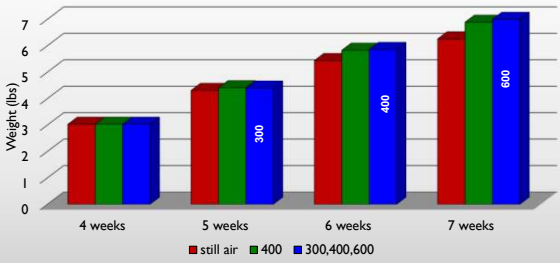
85°F day – 77°F night (broilers)



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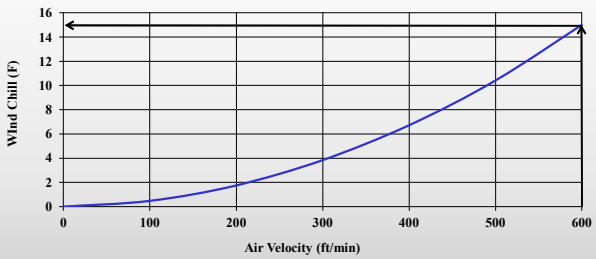
Wind-chill effect at 85°F (26



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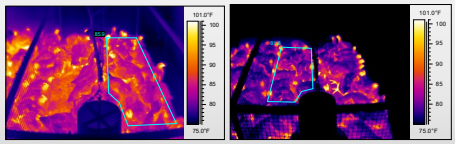
Small changes in wind speed can have a large effect on bird cooling

1) Greater temperature differences
2) More trapped heat between the birds
3) Reduction in wind-chill



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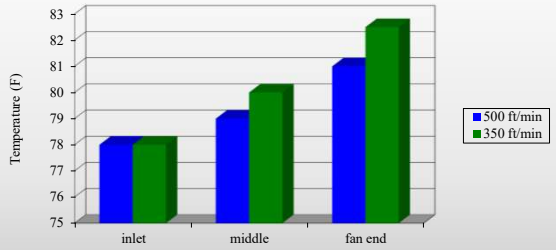
Temperature rise



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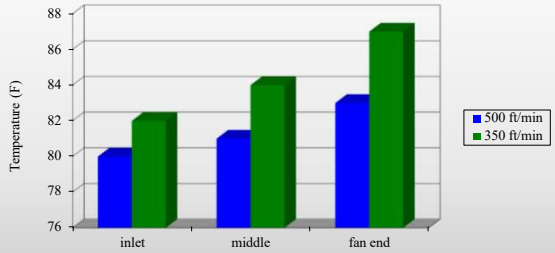
Air temperature at bird level



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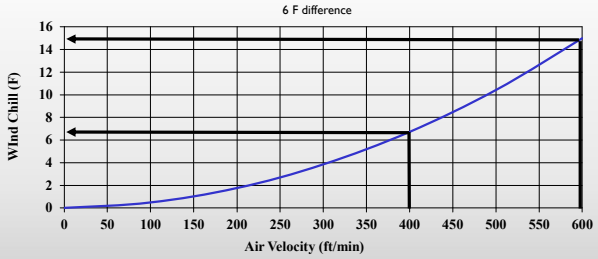
Wind-chill effect at 85 F



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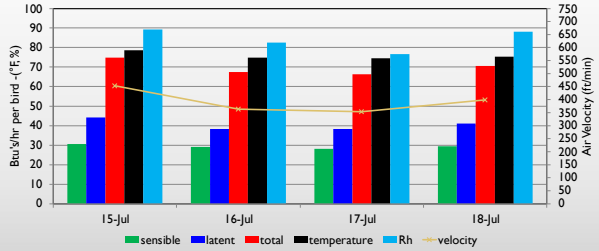
Heat production/loss



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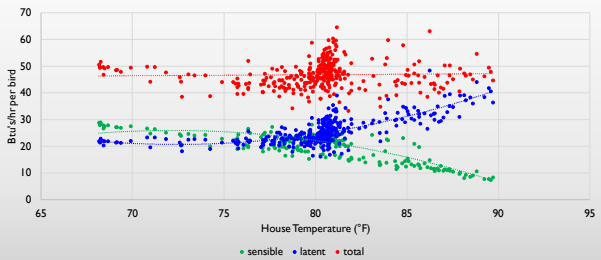
Heat production/loss



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