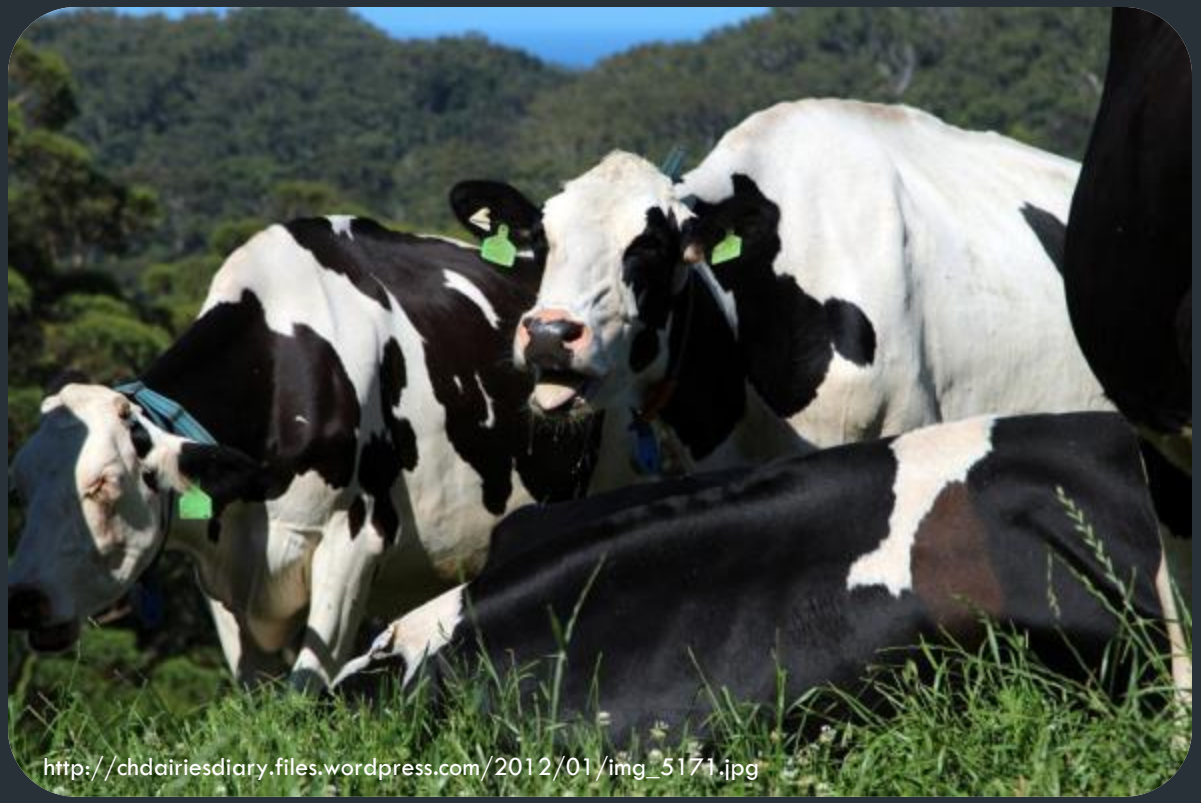


http://chdairiesdiary.files.wordpress.com/2012/01/img_5171.jpg

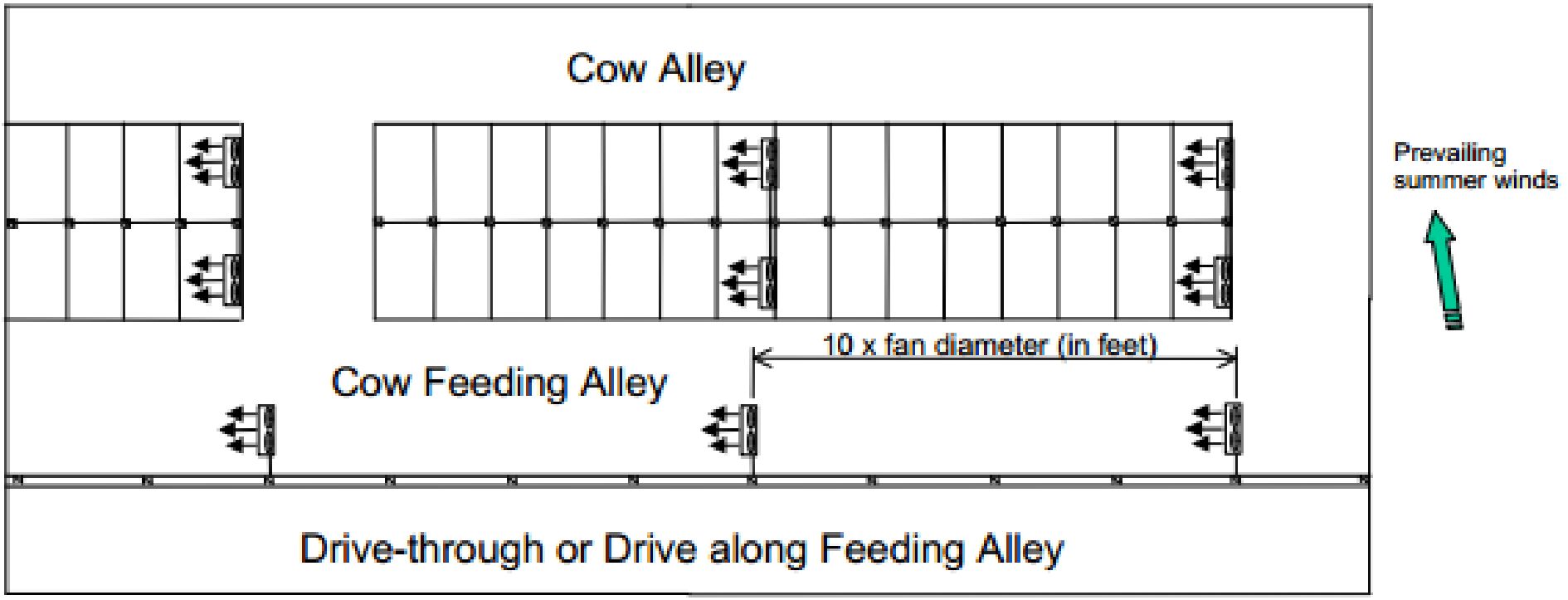
HEAT STRESS – EXPERIENCES FROM THE USA

The Dairy and Beef Producers' Conference 2019

Peter Krawczel and Randi Black
University of Tennessee – Department of Animal Science

Signs and impacts of heat stress

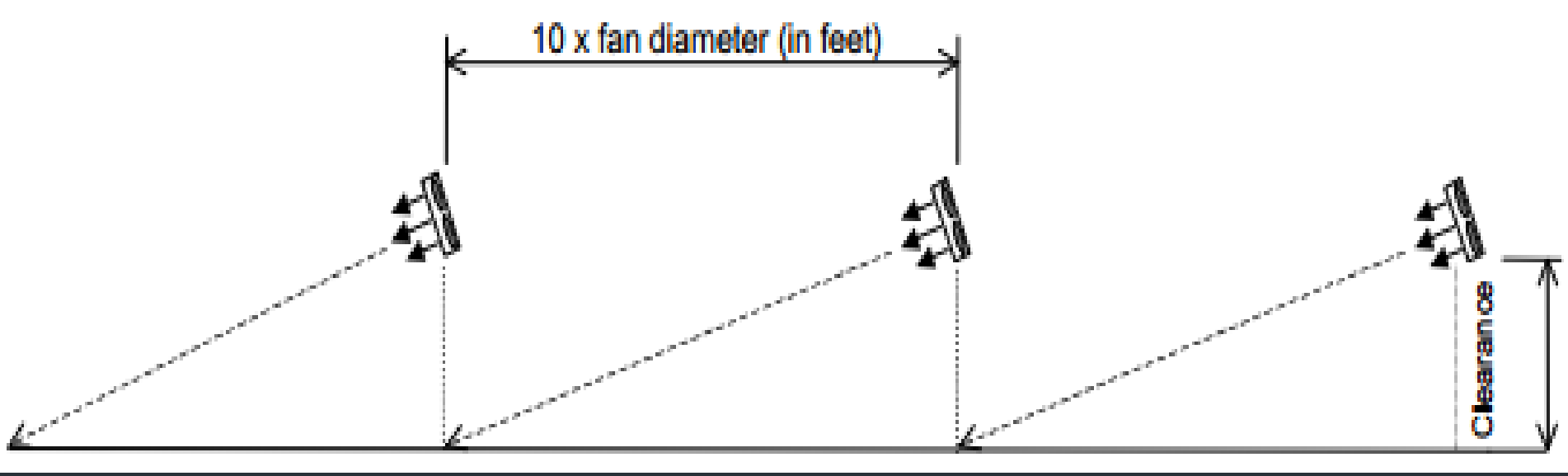
- THI at temp of 22° C and relative humidity of 45 = start of heat stress
- As milk per d increases from 35 kg to 45 kg, threshold drops by 5° C
- Milk losses of 2.2 kg occurred after 17 h when THI = 68
- Cows increase standing time… May lead to lameness increases
- Cows seek out areas with lower ambient temperatures



- Fans 91 cm in diameter – spacing = 110 m
- Fans 122 cm in diameter – spacing = 146 m
- Allocate costs towards cooling stall area before feedbunk

http://www.ansci.cornell.edu/pdfs/fancool.pdf


Issue with the fan?



- Fans just out of reach of cows and out of way of barn chores
- 15 to 20º angle
- Control using thermostat
- Program to come on when temperature ~23º C or higher

http://www.ansci.cornell.edu/pdfs/fancool.pdf

Fans key for eliminating heat stress

- Need to move a *minimum* of 14 cubic m of air per min for each cow
  - Up to 28 cubic m per min per cow may be needed
  - Closeness of barns dictates when more likely needed
- Air velocity should equal 1 to 2.5 m/s
- Fans should be located ~3.5 m high and angled at 20°

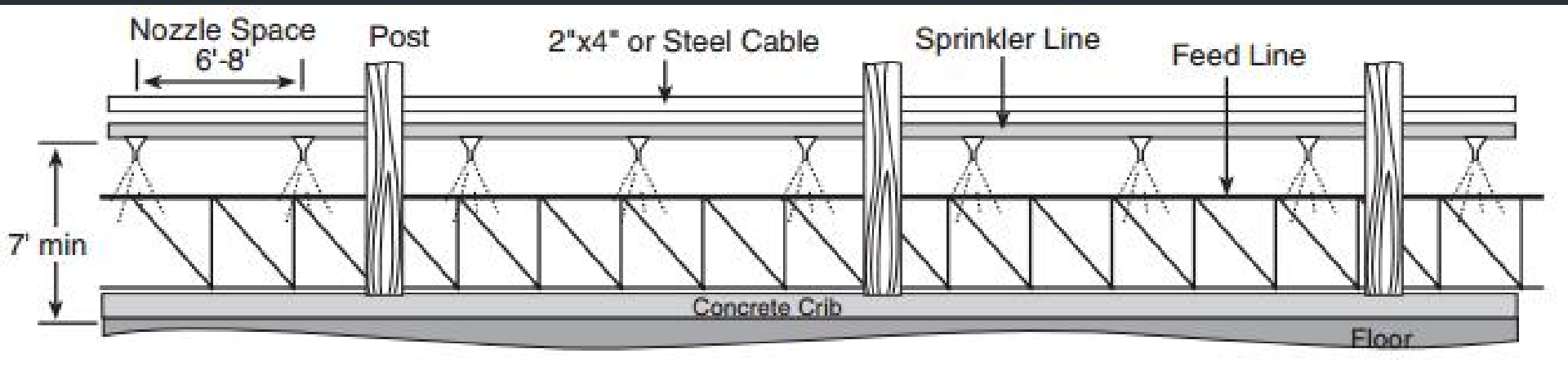
Sprinklers and fans

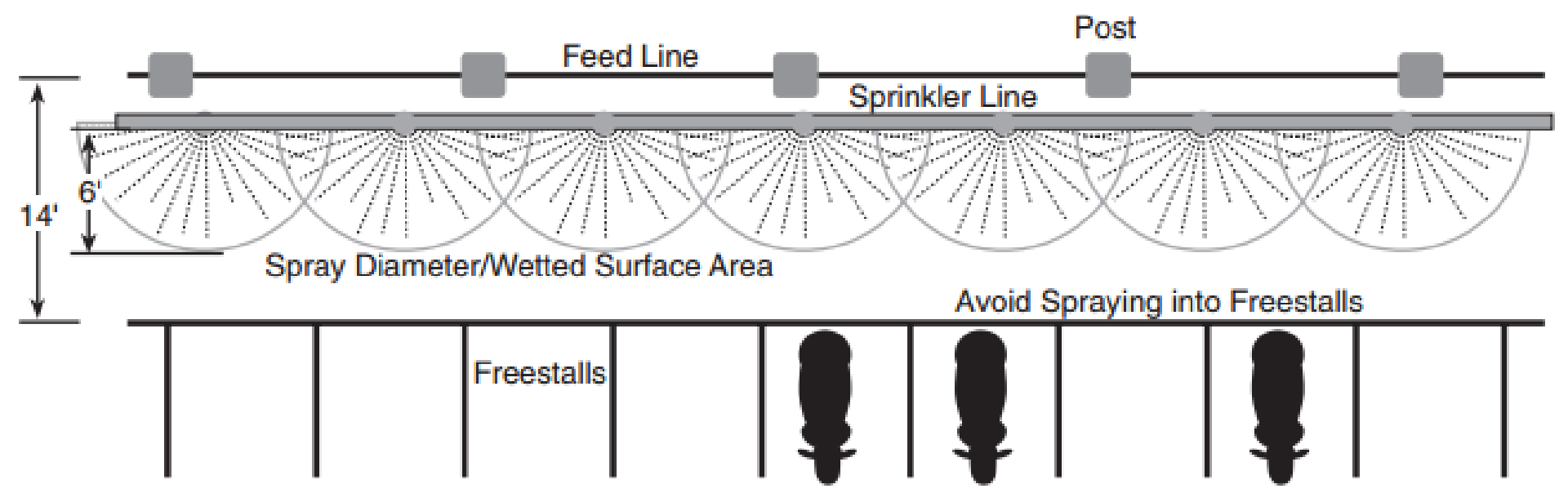
- Soaking cows combined with air movement
- Sprinklers “ON” 1 to 3 min per every 10 to 15 min “OFF”
  - Fans evaporate water during “OFF” period
- Improved feed intake, production efficiency, and respiration rate, and reduced rectal temperature

http://agenvironment.blogspot.com/2010/07/hazy-hot-and-humid.html
http://www2.ca.uky.edu/agc/pubs/aen/aen75/aen75.pdf

Strategies for cooling
Soaking and supplemental airflow

- Can reduce
  - respiration rates by 65 to 81%
  - Body temperature by 46 to 59%
- Recommended approach:
  - Soak skin with 1 l of water within 1-1.5 min
  - Dry for 3.5-4 min (6-8 mph)
  - Repeat



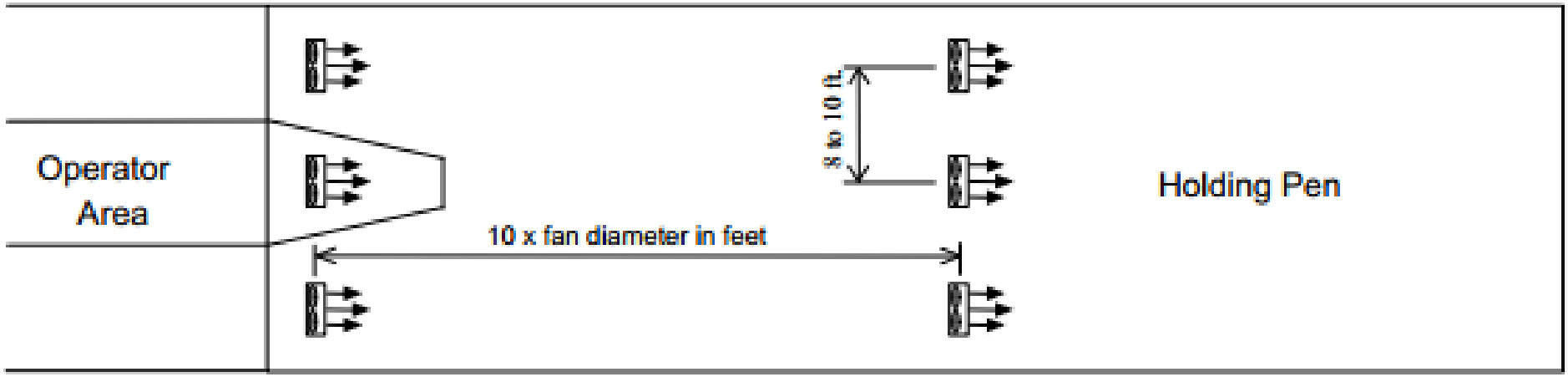


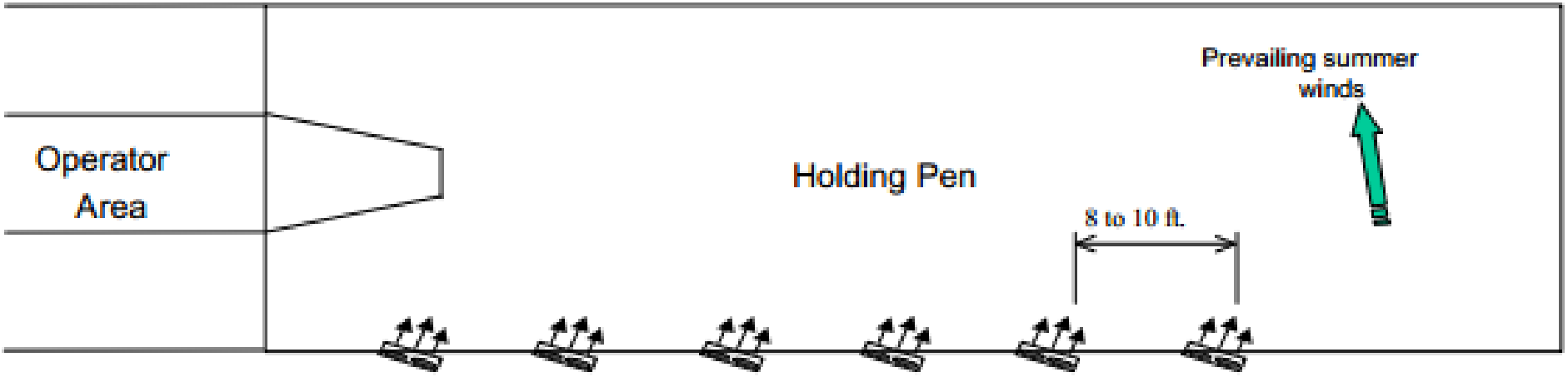
http://www.ksre.ksu.edu/bookstore/pubs/MF2401.pdf


Where is the barn hotter???

Cooling within the holding pen

- Holding pen may be the most stressful situation for lactating dairy cows
- Recommendations
  - Fans running at 2 to 3 m/s
  - Deliver limited amount of water (just enough to soak to skin)





http://www.ansci.cornell.edu/pdfs/fancool.pdf

For cows on pasture
Shade is critical

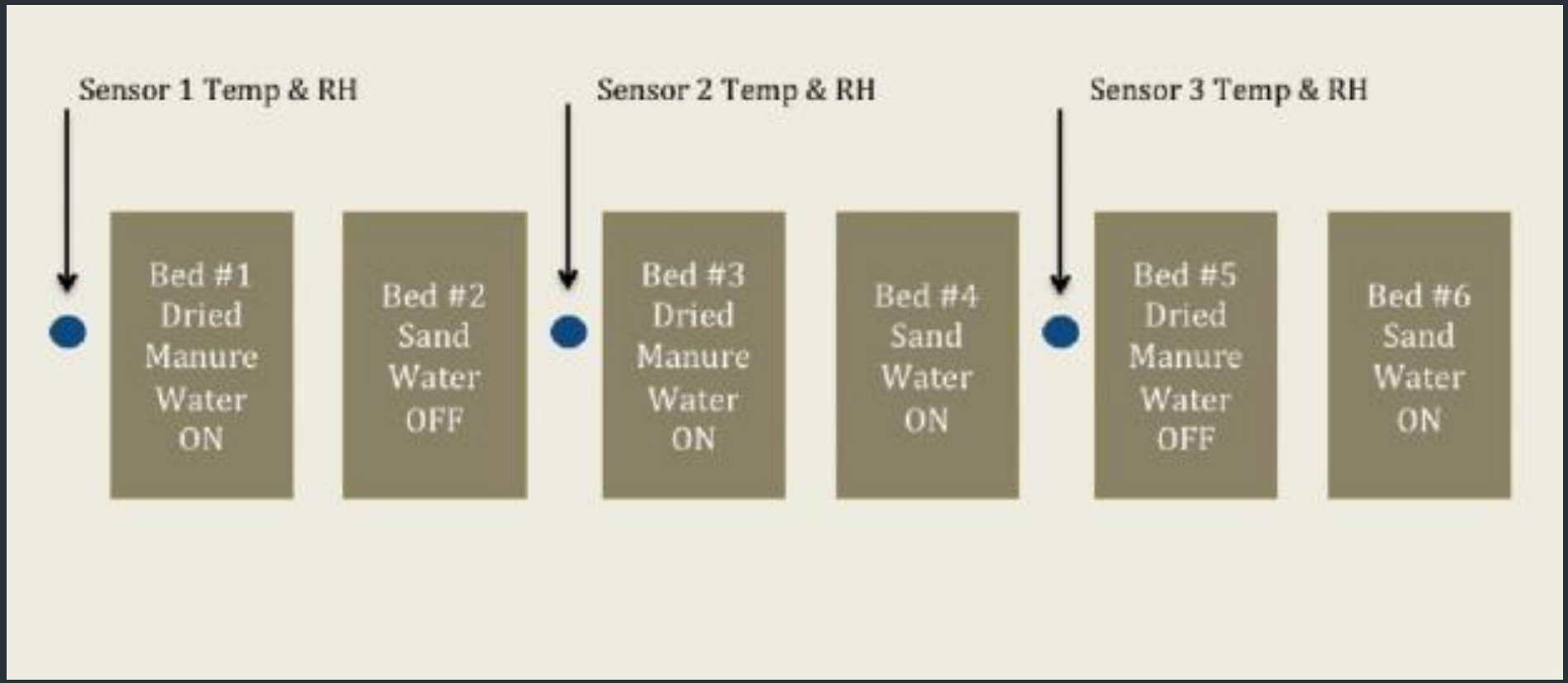
More on shade….

- Importance
  - Cows deprived of lying for 12 h continued to stand to gain access when >30° C
  - Body temperature reduced by 46 to 59%
- Recommended approach:
  - Min = ~2.5 m^2 per cow
  - Better = ~4.6 m^2 per cow

Standing times will increase due to heat loss from underside

Tucker and Shultz, 2009

Taking advantage of conductive cooling in hot, humid conditions



Ortiz et al., 2015

Effect on performance

Treatment	CBT, 24 h	DMI, kg/d	Milk yield, kg/d	Resting time, h/d
Sand + water	38.6[a]	43.2[a]	31.0[a]	10.7[a]
Sand without water	38.7[b]	42.3[ab]	29.6[b]	10.6[a]
DRM + water	38.9[c]	40.2[bc]	28.7[b]	9.2[b]
DRM without water	39.1[d]	39.3[c]	29.7[b]	8.9[b]

Ortiz et al., 2015

Considerations for water

- Cow may consume up to 50% more water
- Recommendations
  - In confinement, place waterers every ~15 m
  - In pasture, place it close to shade
  - Flow rate = 11 to 19 liters per min
  - Min depth = ~7.5 cm
  - Locate water troughs close to milking parlor exit
  - Provide at least 10 cm of water space per cow; More is better
  - Ideally provide more than 1 waterer per group of cows
  - Access to cool, clean water is key!

Pennington and VanDevender, 2011

Cows will crowd around water and increase water consumption

Water issue across farms

Management strategies can also affect how cows respond to heat stress

Cooling dry cows has long-term benefits

Providing relief from the heat will lead to greater milk production in the next lactation

Heat Abatement in Dry Cows – Positive Effect on Milk Yield

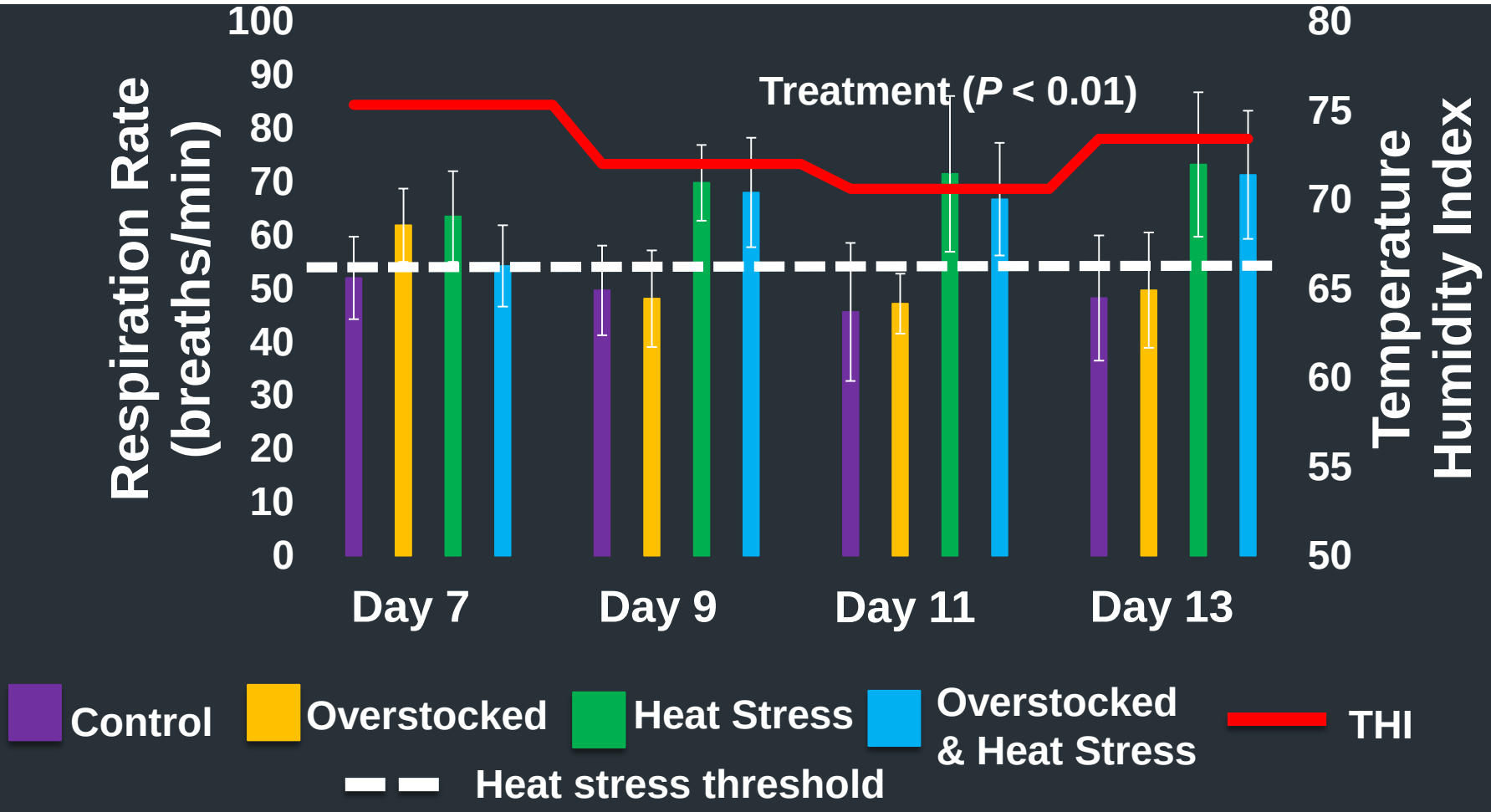
Study	Method	Milk (kg) cows not cooled	Milk (kg) cows cooled
Avendaño-Reyes et al., 2006 (Mexico; 56 DIM)	Fans and water spray (mist ring)	25.4	28.1
Urdaz et al., 2006 (CA; 60 DIM)	Fans/shades sprinklers over feed	38.7	40.1
Amaral et al., 2009 (FL; 210 DIM)	Fans and sprinklers	26.2	33.7
Adin et al., 2009 (Israel; 90 DIM)	Fans and foggers along feed bunk	39.3	41.4

Evaporative Cooling During the Dry Period Improves Colostrum and Lactational Performance (Adin et al., 2009)

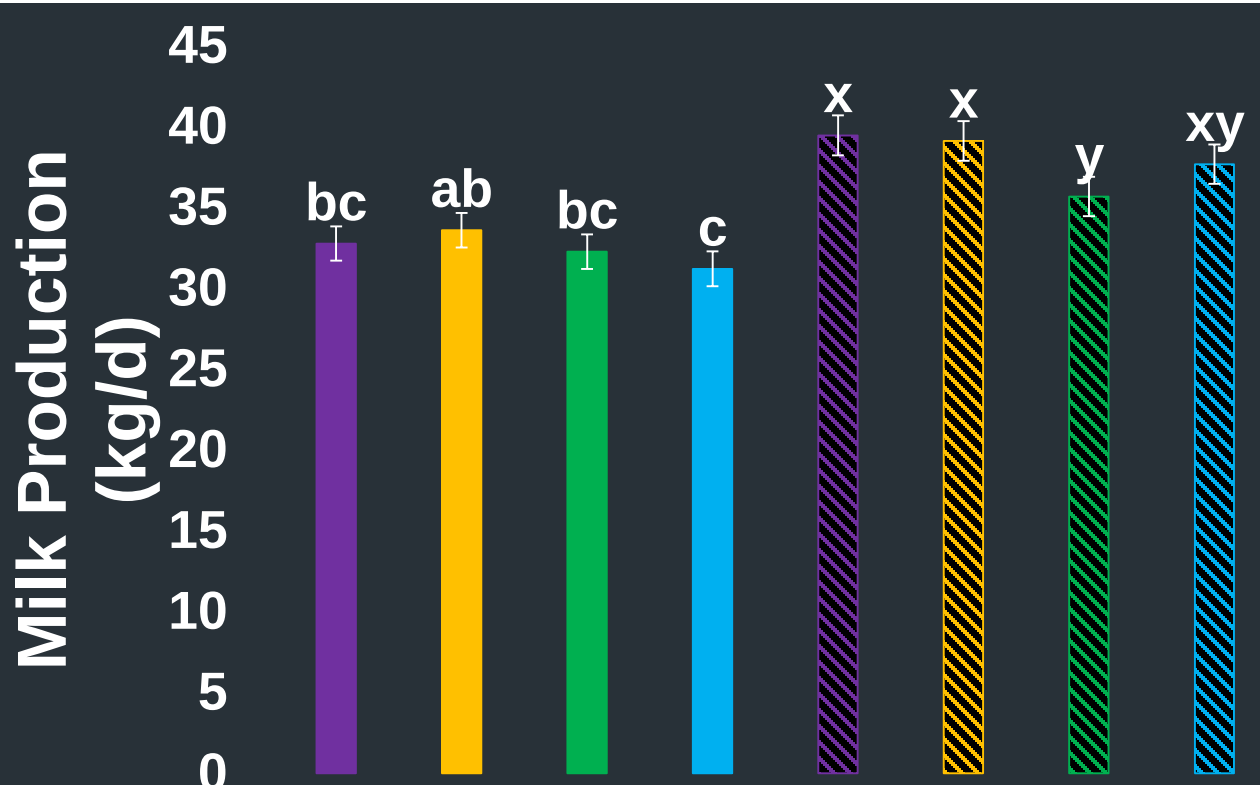
Item	Heat Stress	Cooling
Prepartum		
Temperature humidity index	79.9	79.8
Rectal temperature, °C	**38.5**	**38.8**
Respirations, #/min	**54.5**	**43.5**
Postpartum		
Colostrum, L	**6.1**	**8.6**
Colostrum IgG, g/L	**56.8**	**77.5**
Milk, kg/d (1st 90 DIM)	**39.3**	**41.4**
Milk fat, %	3.41	3.37
Milk protein, %	2.99	2.97


Stocking density might have a role as well

Respiration rate significantly more in heat stressed cows



Milk production was significantly lower among heat stressed cows



Fat % *P* = 0.96

Protein % *P* = 0.60

Lactose % *P* ≤ 0.04

Solids *P* = 0.61

SCS *P* = 0.18

Different letters are significantly different (*P* < 0.05).

Control

Overstocked

Heat Stress

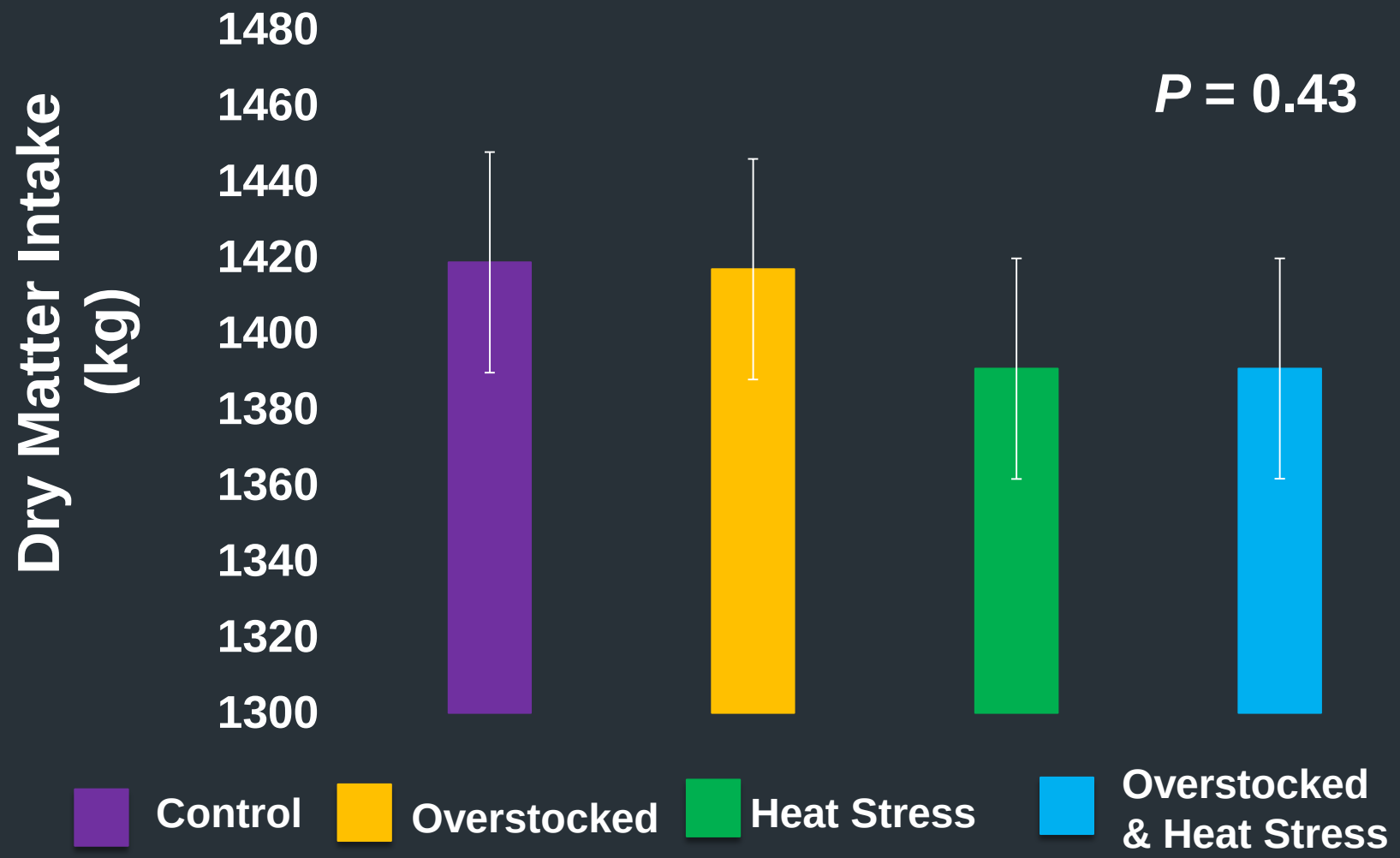
Overstocked & Heat Stress

Primiparous

Multiparous

Data was analyzed via ANOVA, using SAS 9.4, (Cary NC)

Dry matter intake was not significantly different by pen



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Acknowledgments

- USDA AFRI Foundational Grant #2016-67015-24733

Collaborators:

- Rick Grant and Mac Campbell (Miner Institute)
- Gina Pighetti and Amanda Lee (UT)

Questions?