

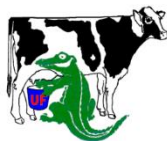


Effects of heat stress in dairy cattle on the performance of their offspring

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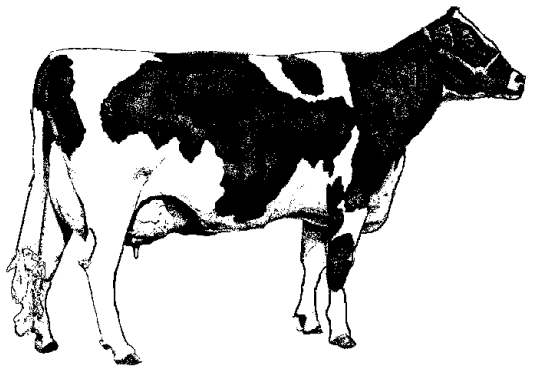


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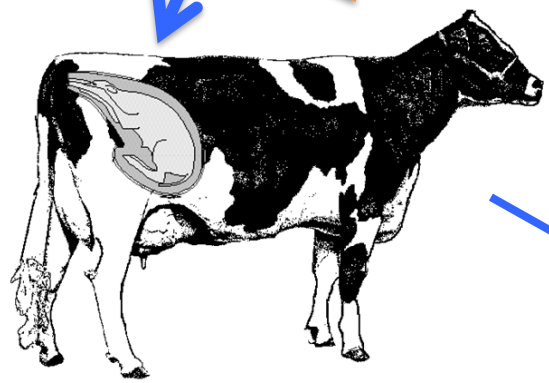


Milk yield?
Metabolism?
Immune function?



Late gestation

DAM
vs.
DAUGHTER



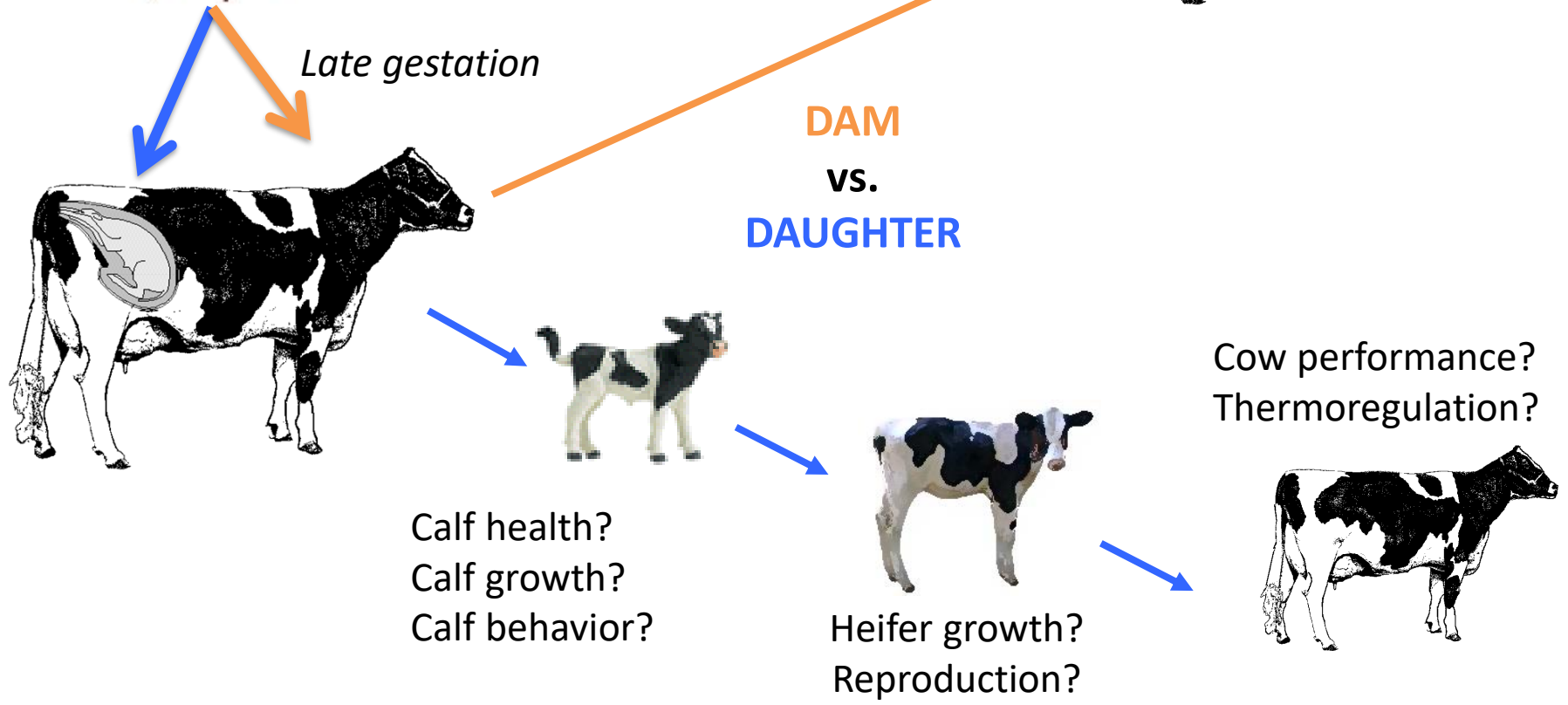
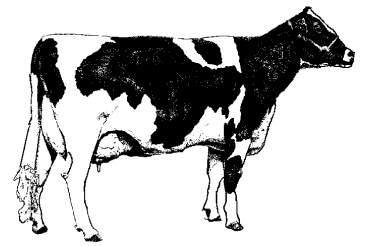
Calf health?
Calf growth?
Calf behavior?



Heifer growth?
Reproduction?



Cow performance?
Thermoregulation?

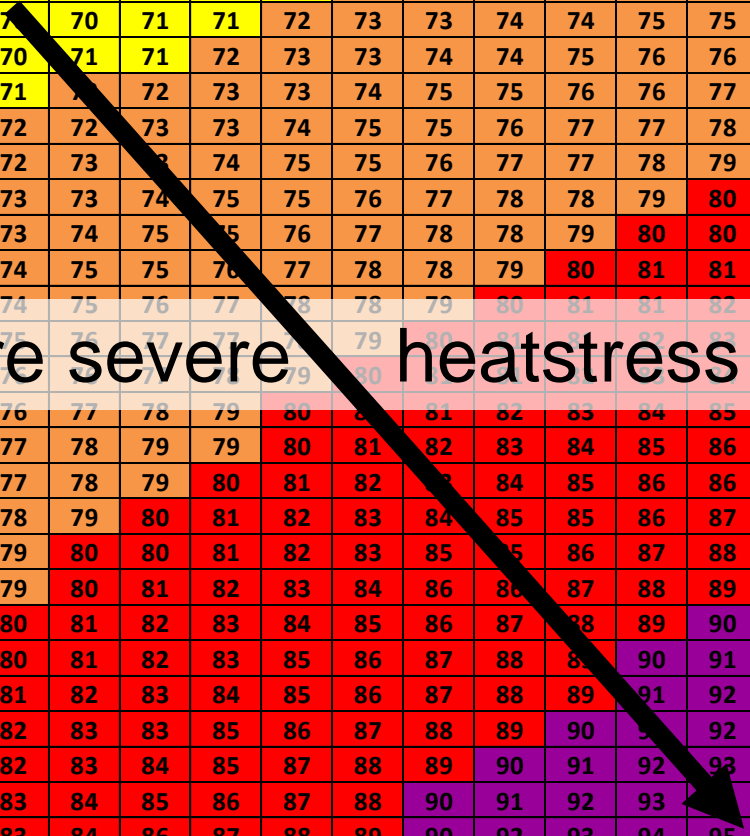


Agenda

1. Heat stress and lactating cows
2. Dry cows: Heat stress during her own dry period
3. Calves: Heat stress during mom's dry period
4. Offspring: Effect on milk production, survival
5. Cows: Heat stress when she was conceived
6. Summary

Temperature		% Relative Humidity																				
°F	°C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	72	72
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72	72	73	73
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	77
78	25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77	77	78
79	26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77	78	78	79
80	26.5	68	69	69	70	70	71	71	72	73	73	74	75	75	76	76	77	78	78	79	79	80
81	27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79	80	80	81
82	28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81	81	82
83	28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	82	83
84	29.0	70	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84
85	29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
86	30.0	71	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86
87	30.5	71	72	73	74	75	75	76	77	77	78	79	80	81	81	82	83	84	85	85	86	87
88	31.0	72	72	73	74	75	76	76	77	78	79	80	80	81	82	83	84	85	86	86	87	88
89	31.5	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	87	87	88	89
90	32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	87	88	89	90	90
91	33.0	73	74	75	76	77	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	91
92	33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	92
93	34.0	74	75	76	77	78	79	80	80	81	82	83	84	85	86	87	88	89	90	91	92	93
94	34.5	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	35.5	75	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93	94	95	96
97	36.0	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	97
98	36.5	76	77	78	80	80	82	83	83	85	86	87	88	89	90	91	92	93	94	95	96	98
99	37.0	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	95	96	98	99
100	38.0	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	95	96	98	99	100	100
101	38.5	77	79	80	81	82	83	84	86	87	88	89	90	92	93	94	95	96	98	99	100	101
102	39.0	78	79	80	82	83	84	85	86	87	89	90	91	92	94	95	96	97	98	100	101	102
103	39.5	78	79	81	82	83	84	86	87	88	89	91	92	93	94	96	97	98	99	101	102	103
104	40.0	79	80	81	83	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101	103	104
105	40.5	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102	103	105
106	41.0	80	81	82	84	85	87	88	89	90	91	93	94	95	97	98	99	101	102	103	104	106

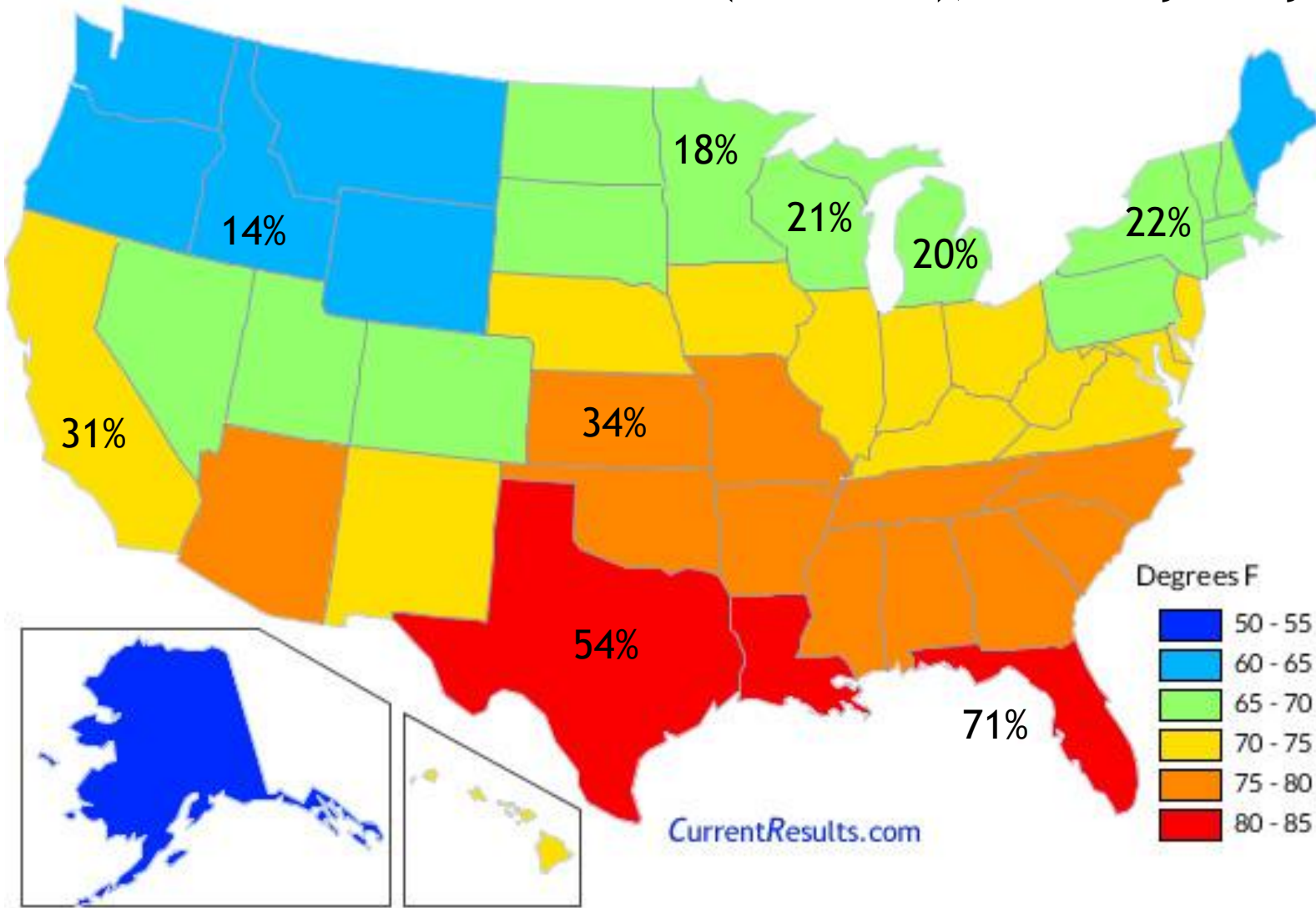
More severe heatstress



Temperature Humidity Index for lactating dairy cows

Average summer temperatures (Fahrenheit)

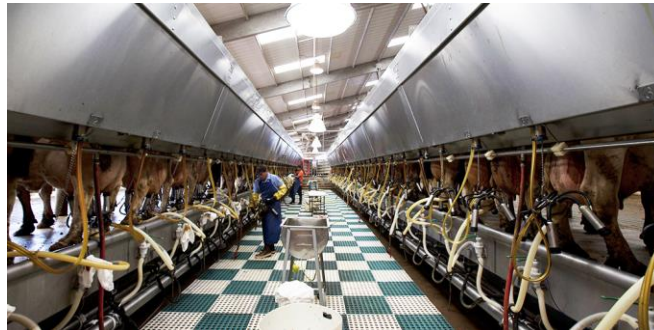
Heat stress (THI > 68), % of days in year



CurrentResults.com

Heat stress during lactation

- Depresses dry matter intake
- Reduces milk yield
- Additional metabolic effects beyond dry matter intake
- Lower reproduction
- Recovery dependent on duration



Typical housing for lactating cows

Fans and soakers

Fans as low as possible,
but out of reach for
cows, people, equipment

Goal: Air velocity >8 km/hour
in direction of prevailing winds

Soakers above
the feed line

Sand bedded stalls



Traditional dry cow housing

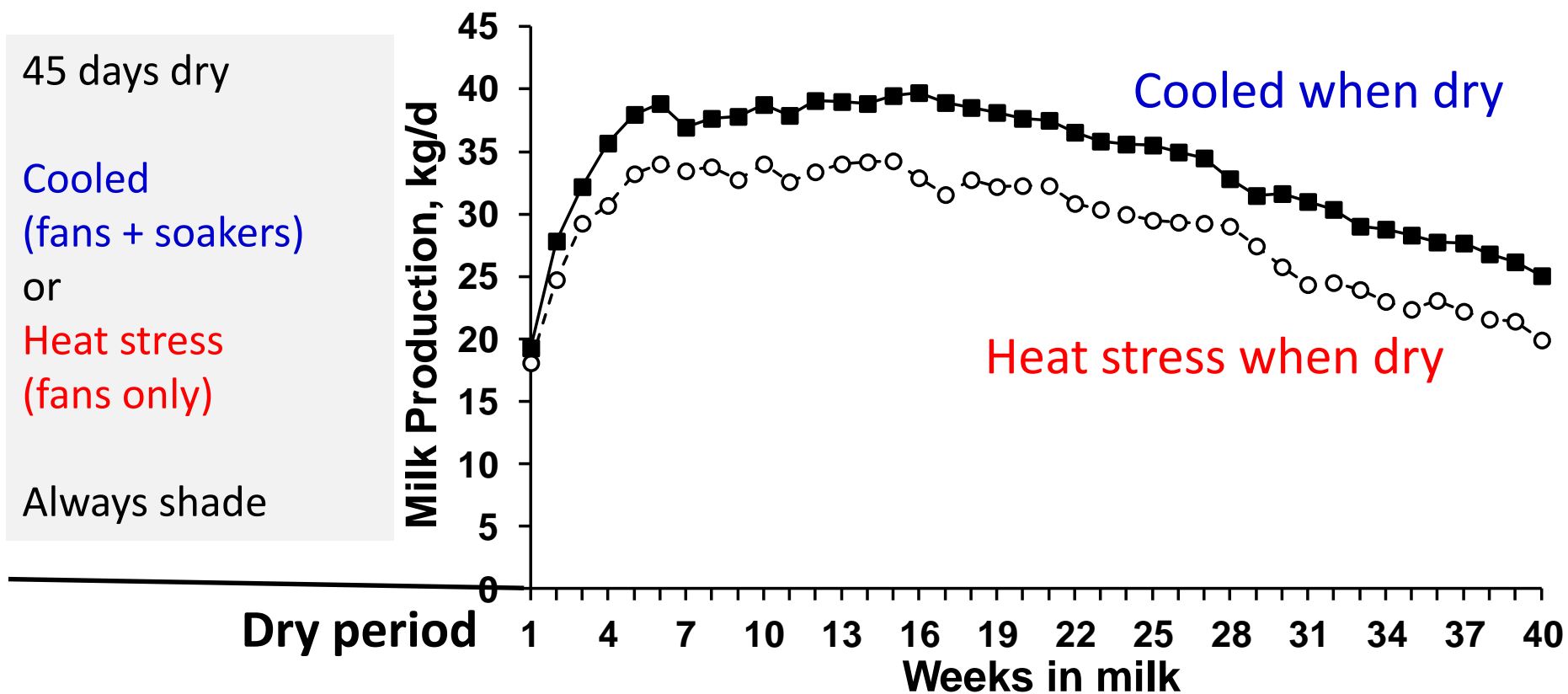
→ heat stress in the summer



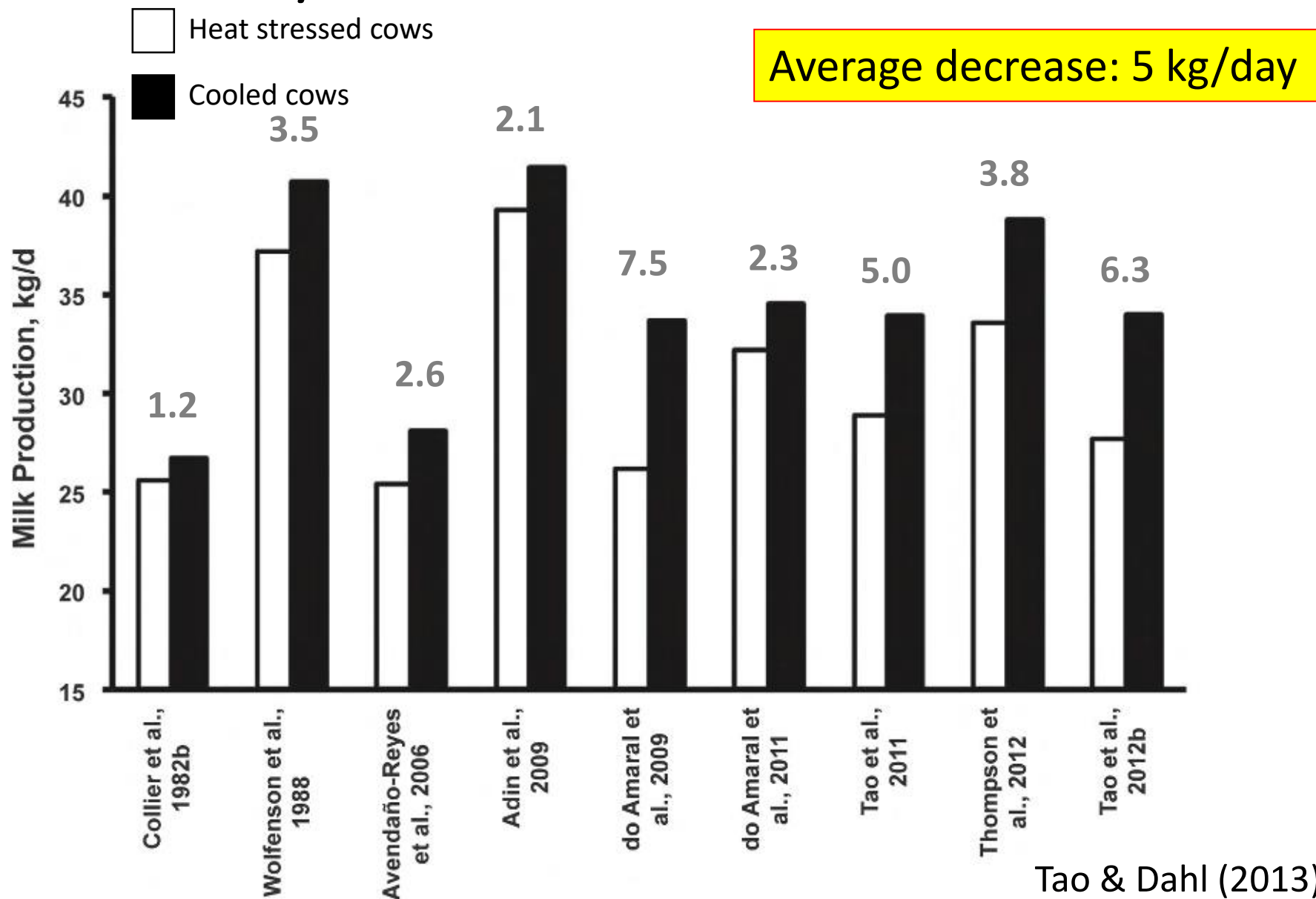
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Cooling dry cows increases milk yield after calving



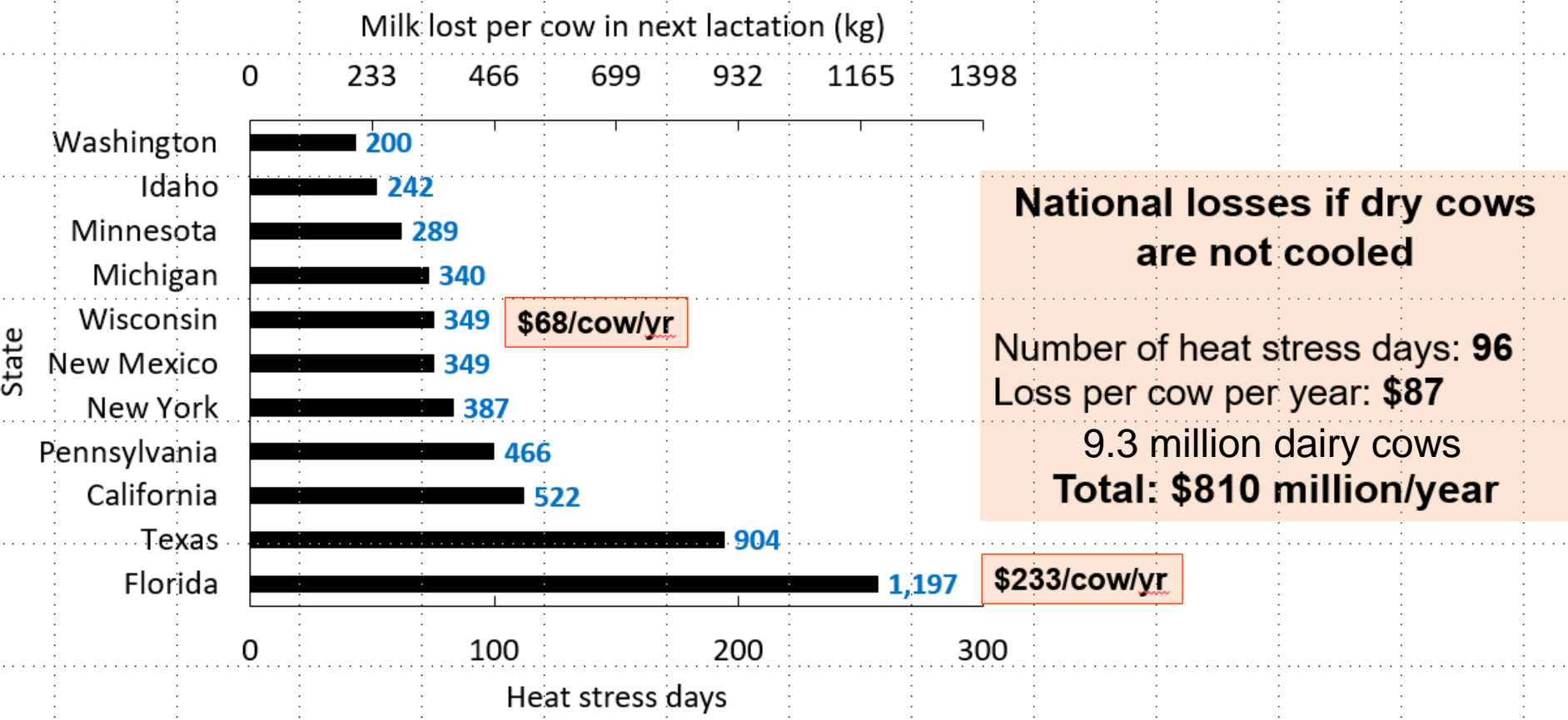
Heat stress during the dry period decreases milk yield in the next lactation



Heat stress in dry period:

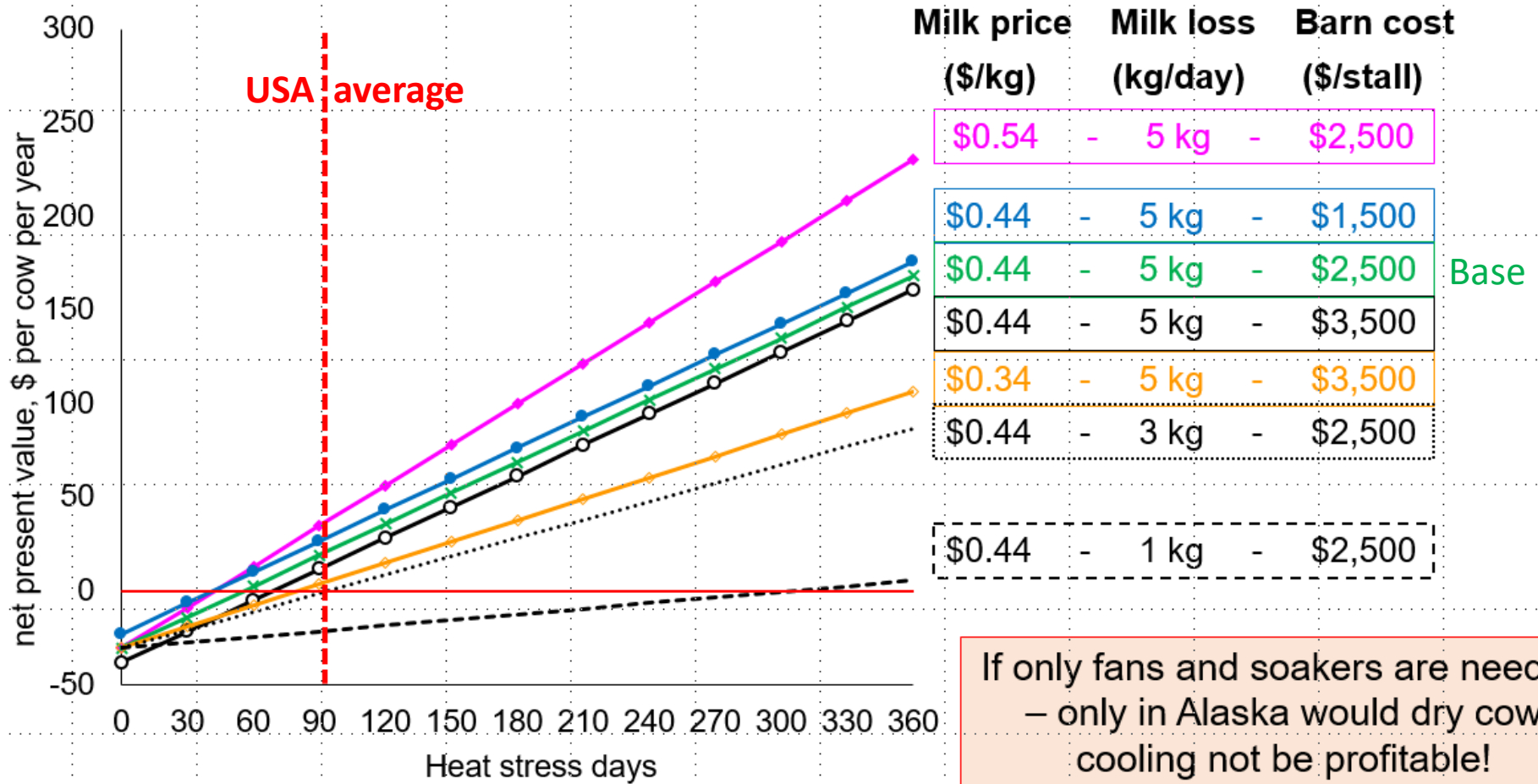
- Increases mean rectal temperature
- Decreases proliferation of mammary cells before calving
- Has no effect on mammary epithelial cell apoptosis
- Reduces dry matter intake before calving but not after calving
- Decreases loss of body weight after calving
- Decreases lymphocyte proliferation

Milk and profitability losses in next lactation in the 10 states with the most dairy cows and Florida



It almost always pays to cool dry cows

Net Present Value per cow per year when building a new dry cow barn

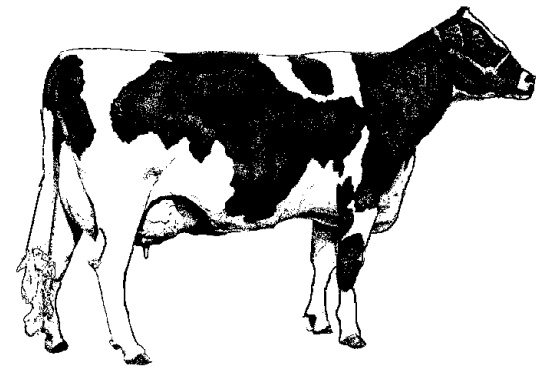


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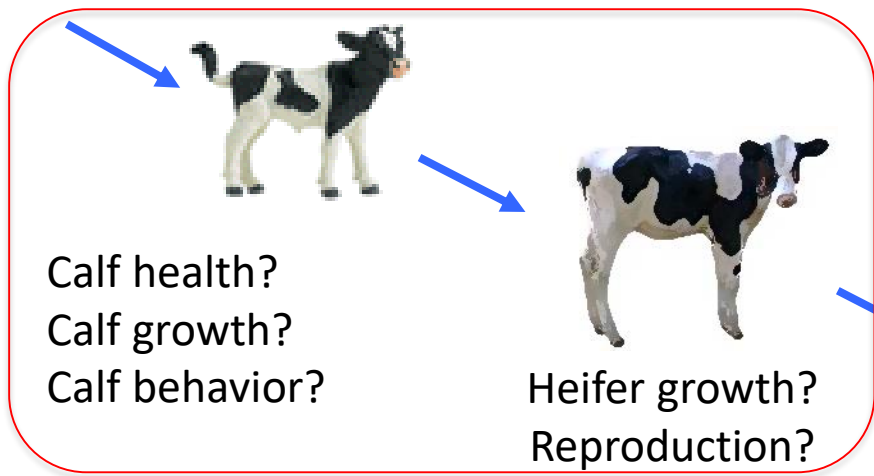
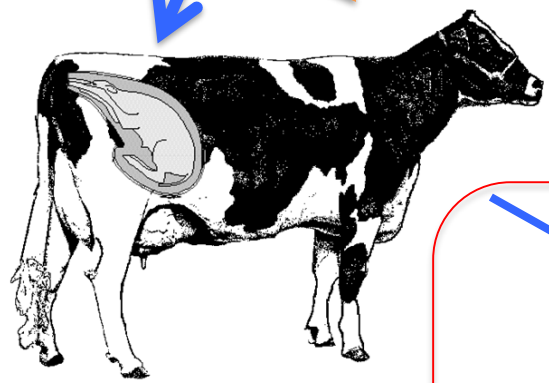


Milk yield?
Metabolism?
Immune function?

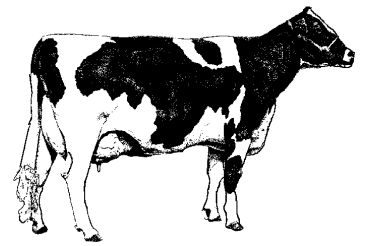


Late gestation

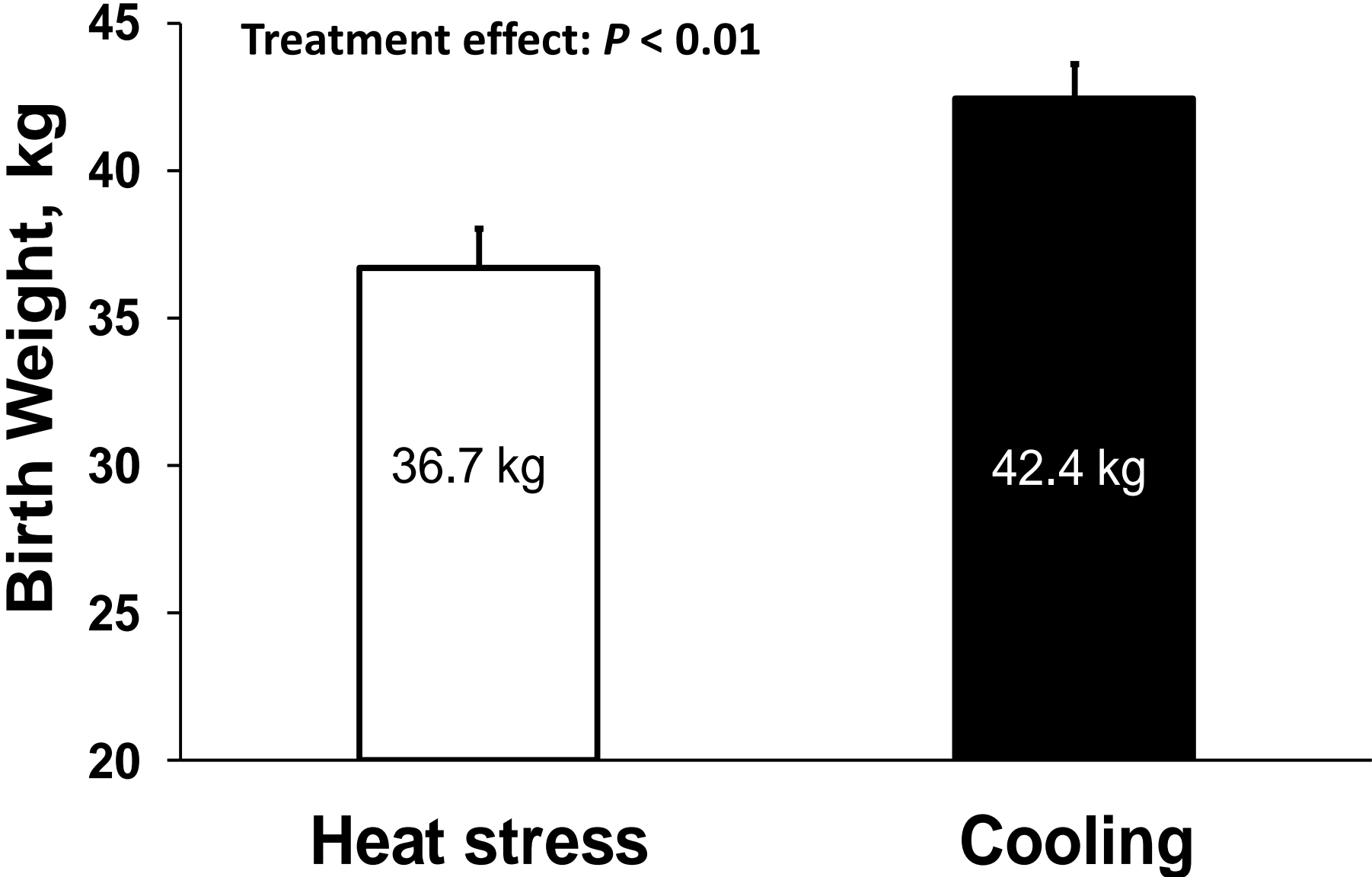
DAM
vs.
DAUGHTER



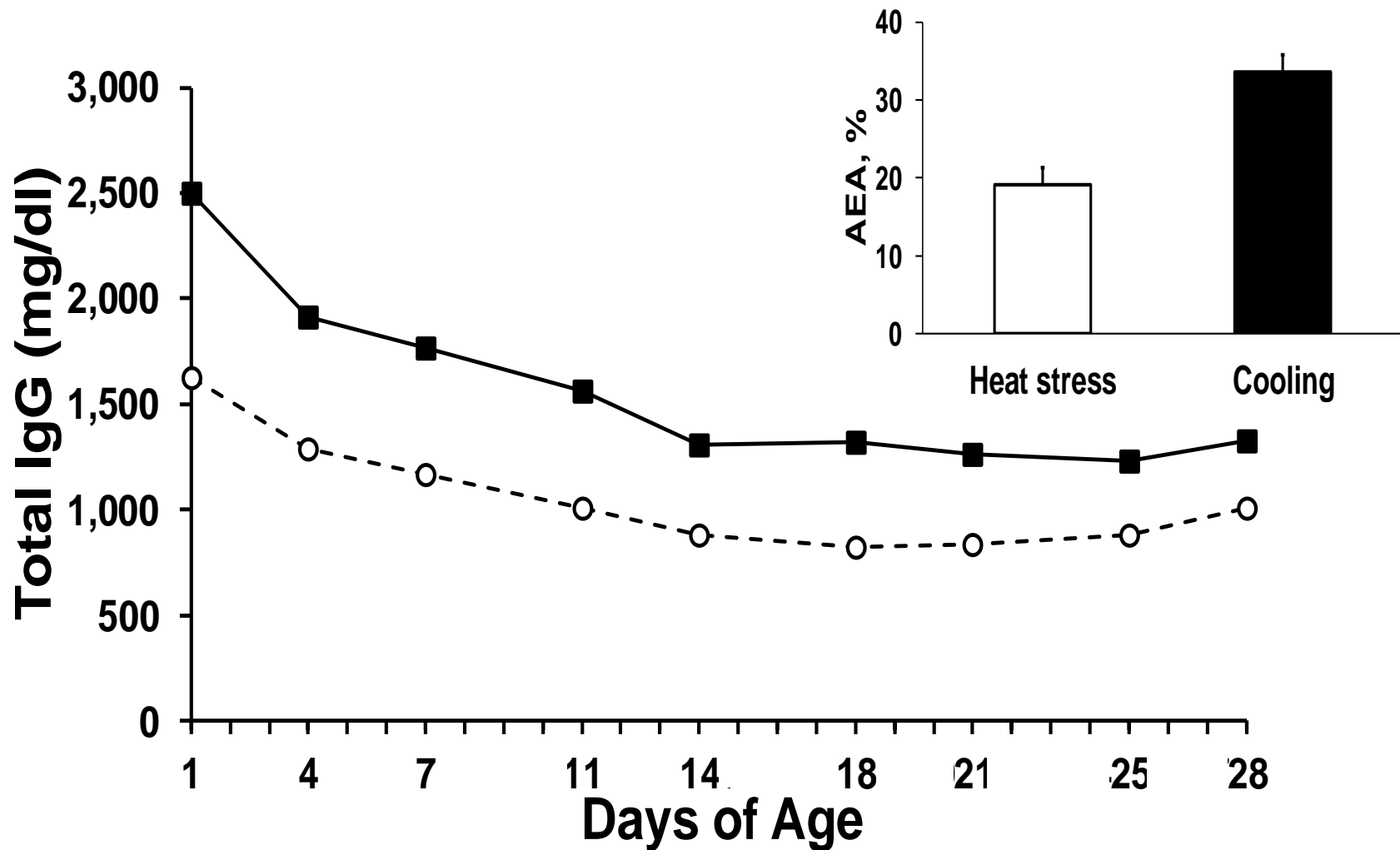
Cow performance?
Thermoregulation?



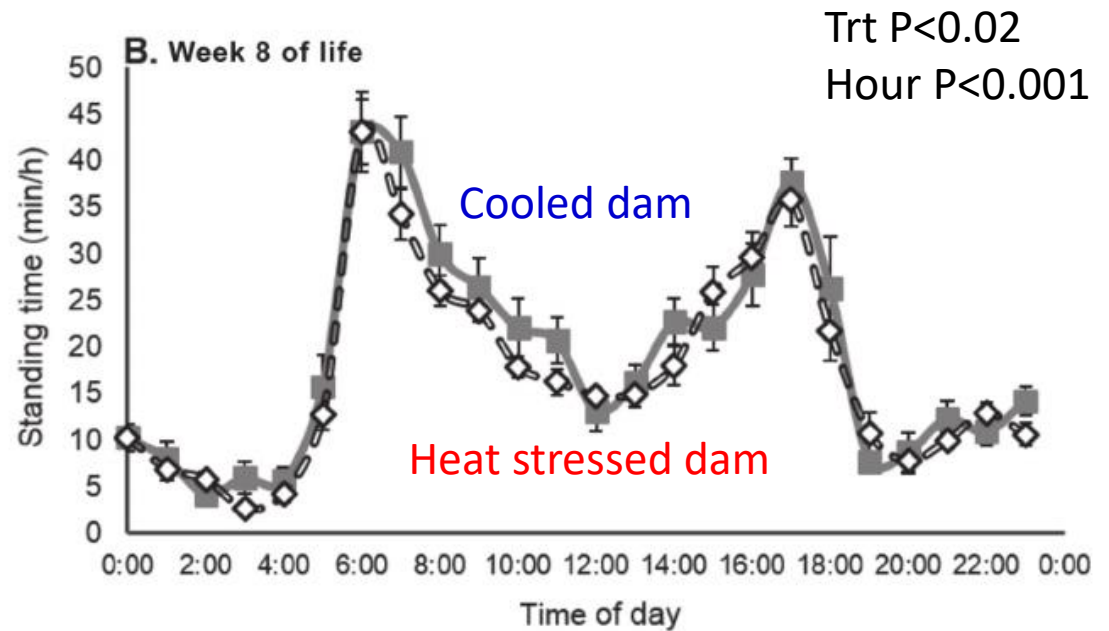
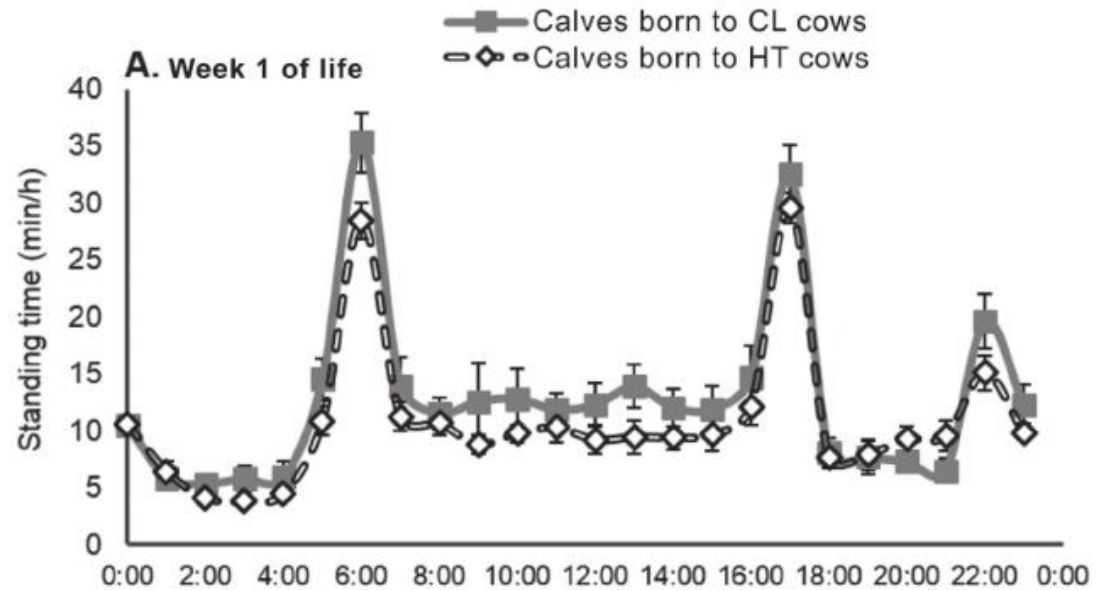
Cooling dry dam increases calf birth weight



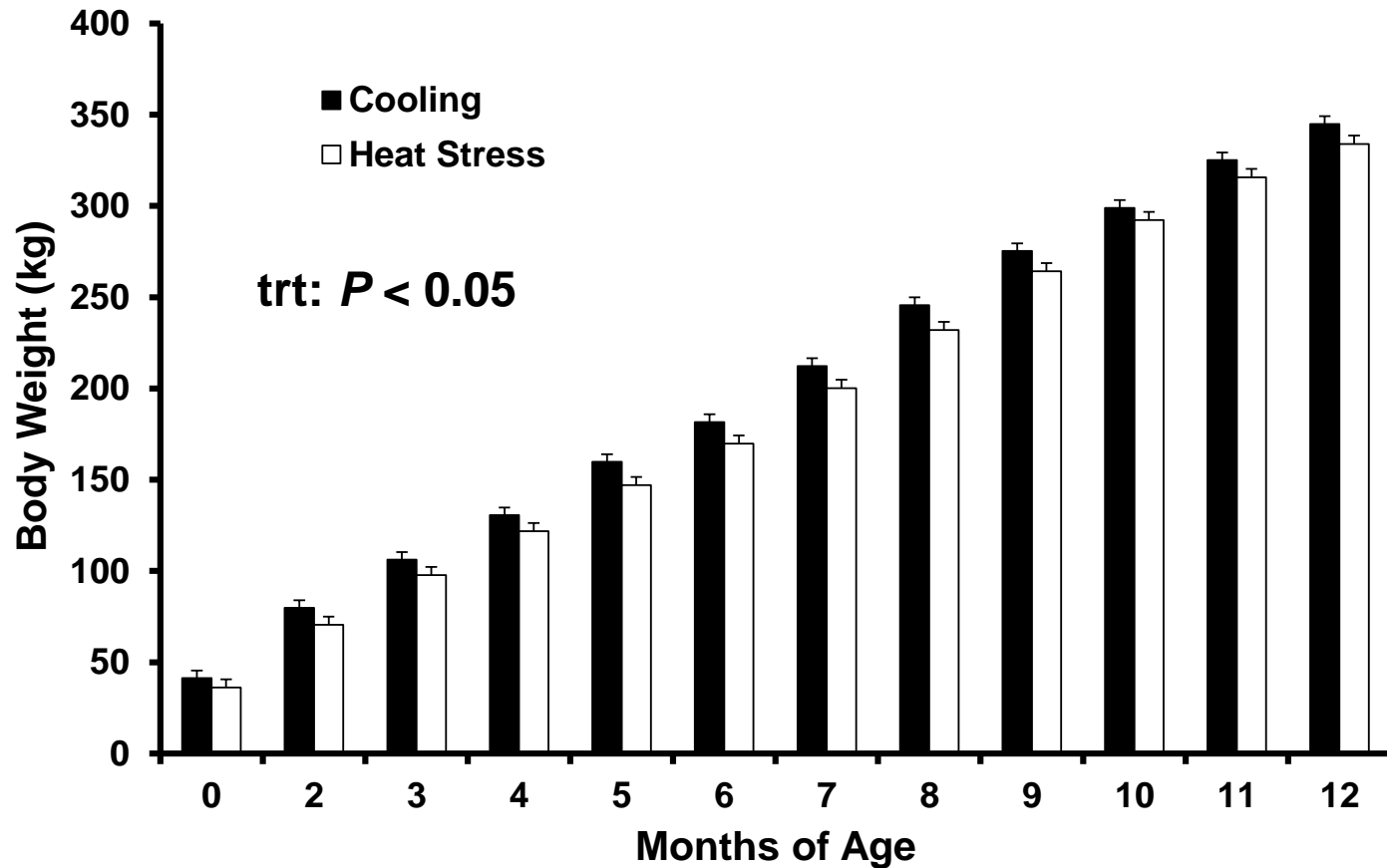
Cooling improves total IgG and apparent efficiency of absorption (AEA)



In-utero heat stress decreases amount of standing in calves



In Utero Heat Stress Decreases Calf Bodyweight to Puberty



Summary – Short term effects of dry dam's heat stress on their calves

- Lower weight at birth and weaning
- Reduced apparent efficiency of IgG absorption, but not an effect on colostrum quality
- Altered carbohydrate metabolism, consistent with greater fat deposition
- Decreases standing activity in calves



Heat Stress Summary – Longer term effects on calves before calving

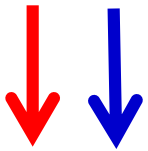
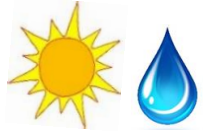
- Lower weight through first year of age
- Decreased survival
- Decreased reproduction → older at first calving



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How does exposure of dry pregnant dams to heat stress affect their adult offspring?



dams (N=214) cooled or hot dry period

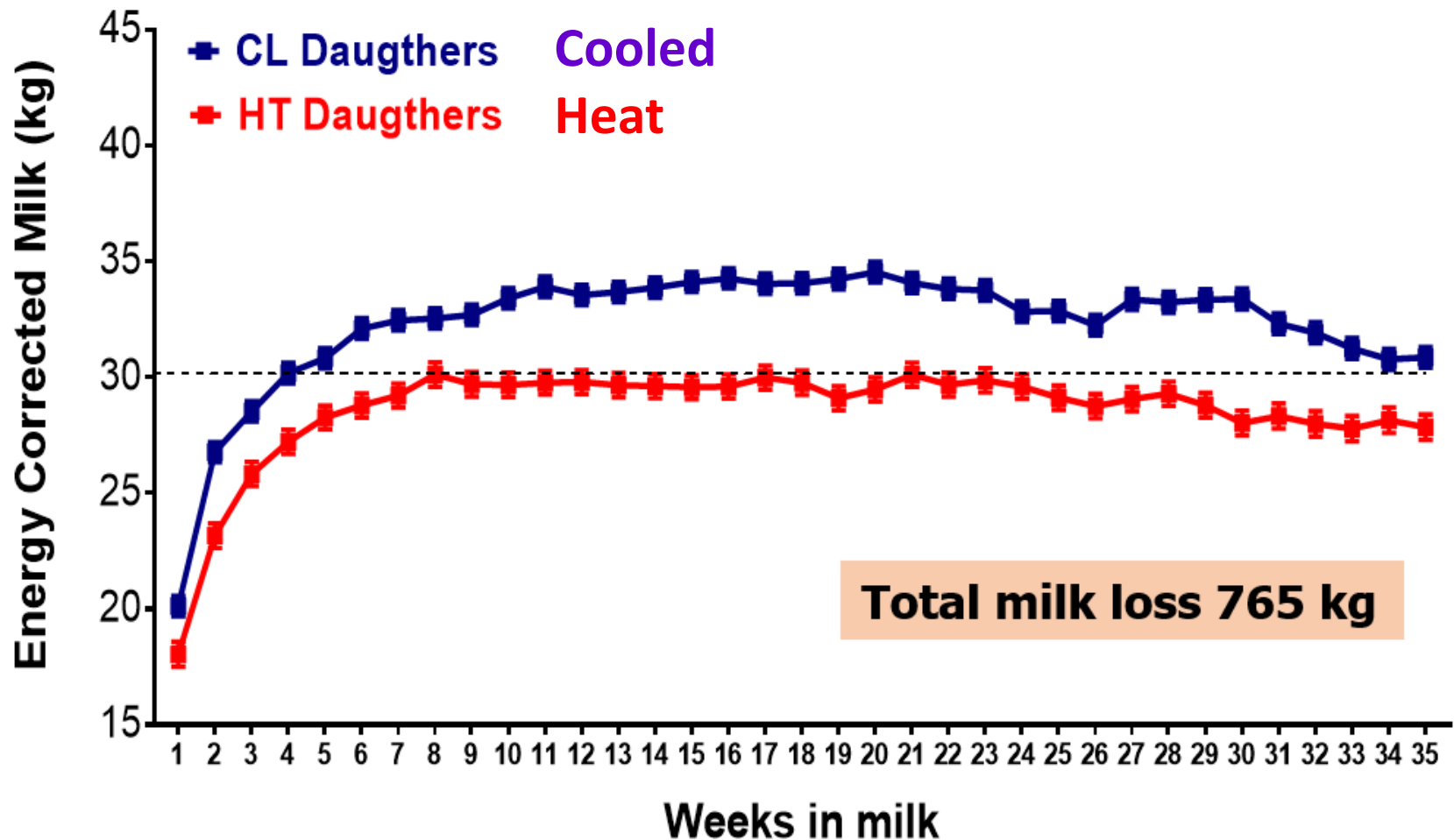


daughters (N=142)



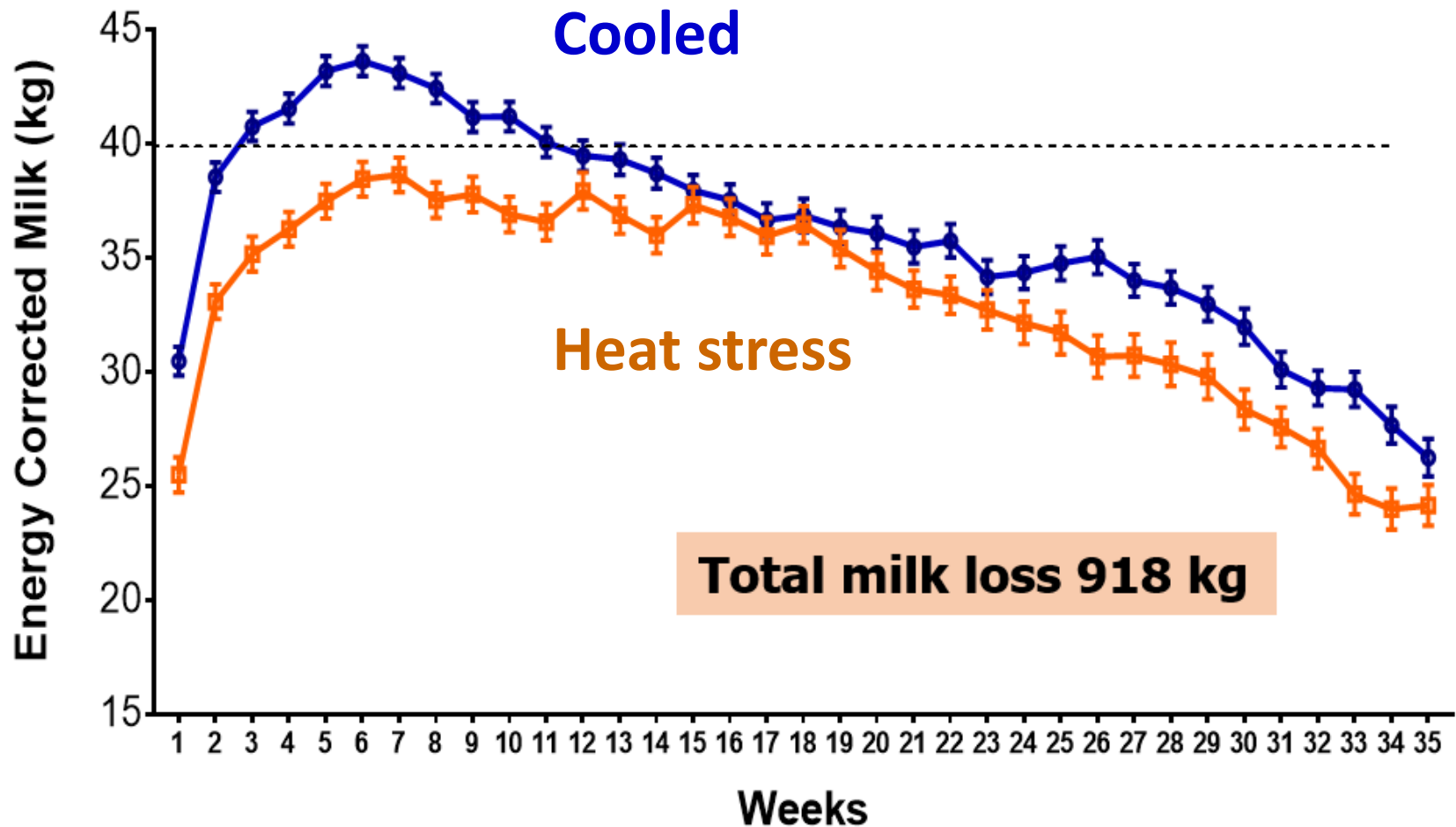
granddaughters (N=45)

Daughters (in-utero HT or CL, >2 yrs ago), 1st lactation milk yield



Total milk loss 765 kg

Daughters (in-utero HT or CL, >3 yrs ago), 2nd lactation milk yield



Granddaughters

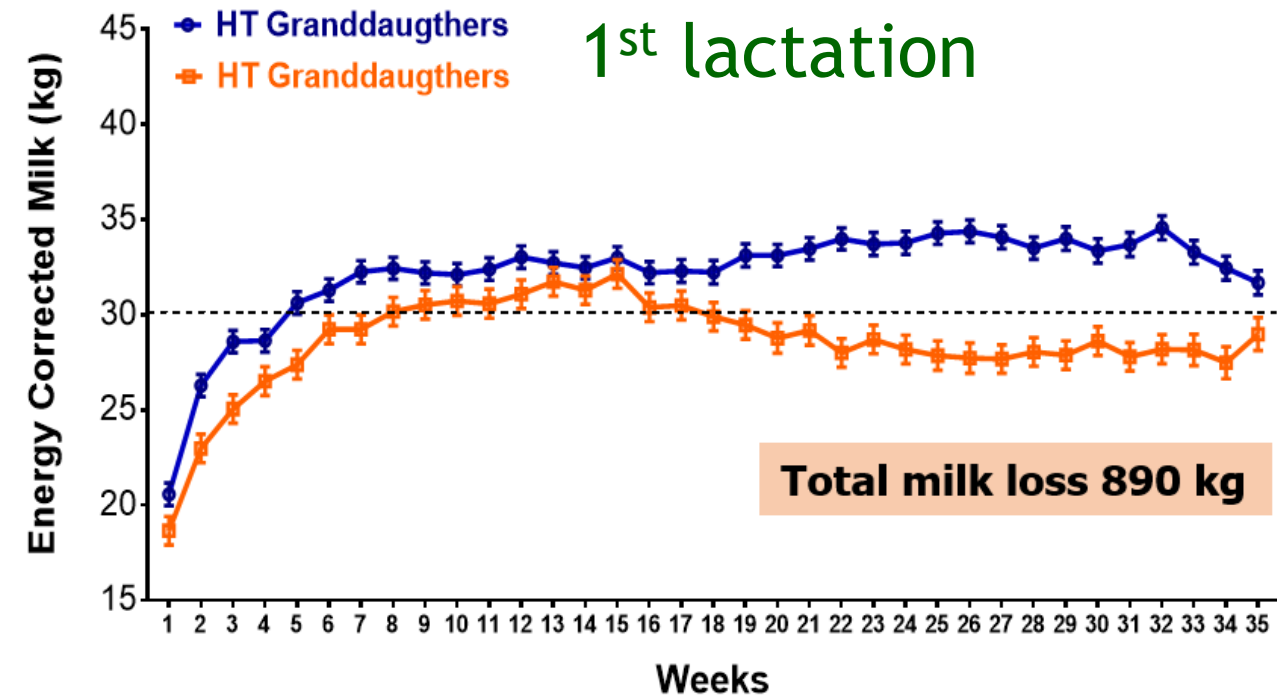


Cooled or
heat stressed
when dry

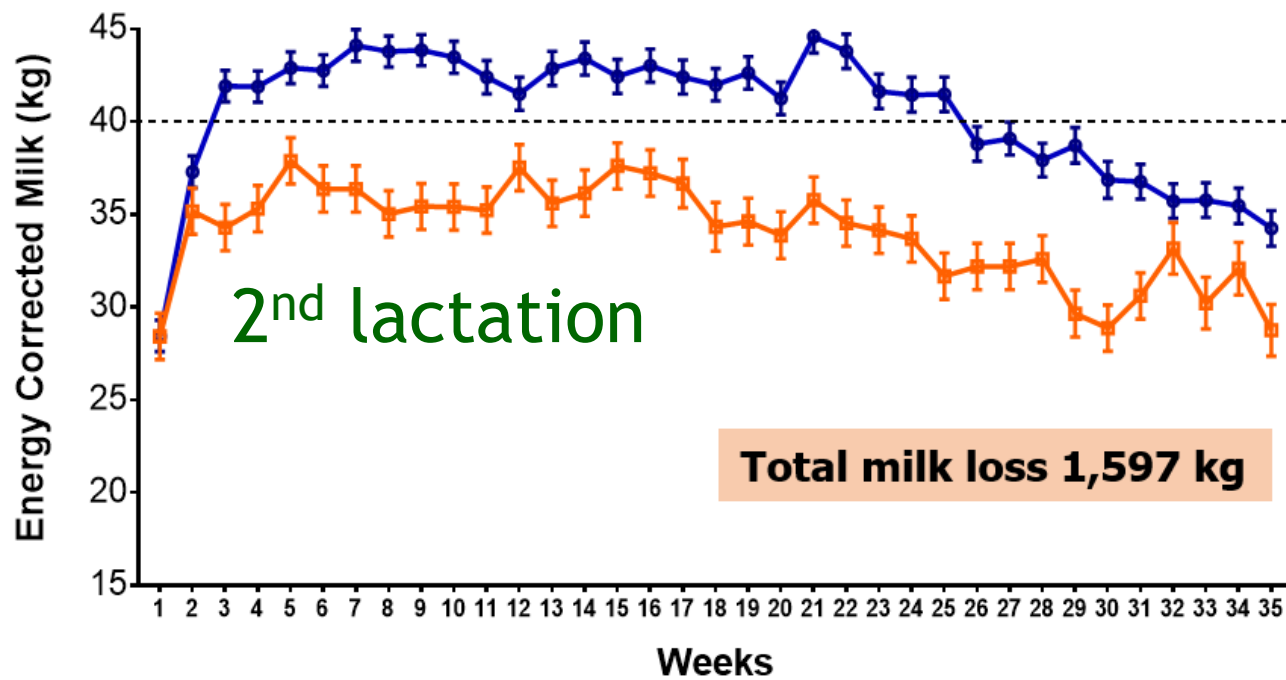


Grand
daughters

**1st & 2nd
lactation**



Granddaughters
of heat-stressed
dry cows
*produce less
milk*



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Season of conception is associated with future survival, fertility, and milk yield of Holstein cows

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†Department of Animal Sciences, University of Florida, Gainesville 32611

- Analysis of >300,000 Florida lactations
- Cows conceived during **winter** vs. **summer** (9 months before their birth, ≥ 30 months before first calving)
- Cows that were conceived in **summer**:
 - Greater age at first calving
 - More culling in first lactation
 - Lower reproduction
 - Lower milk production

Summary

- Dry cow heat stress affects the cow, her daughters and her granddaughters
- Limited data available on heat stress and offspring
- Dry cow cooling very profitable in most places

Thank you
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