

Dry Period Heat Stress: Carryover Effects on Dam and Daughter

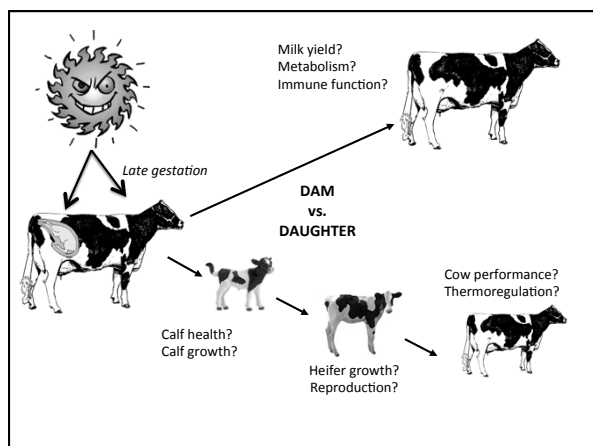
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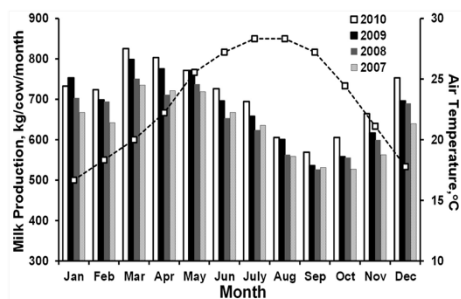
Heat Stress During Lactation

- Depresses DMI
- Reduces milk yield
- Recent studies suggest additional metabolic effects beyond DMI
- Recovery dependent on duration

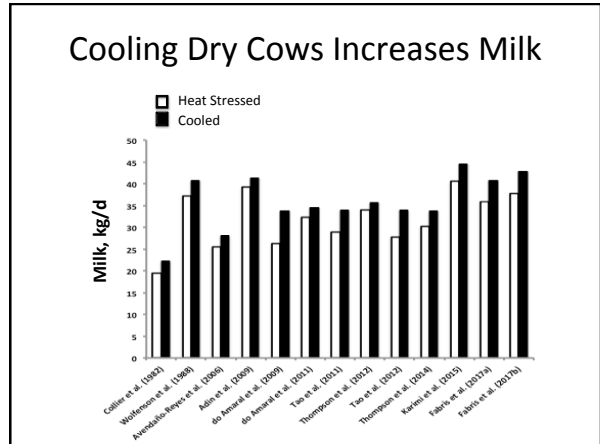
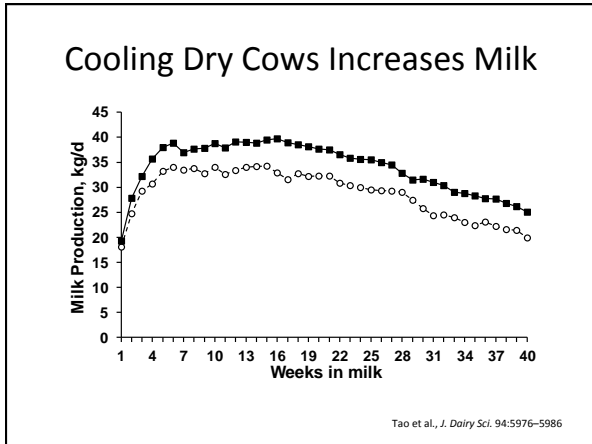
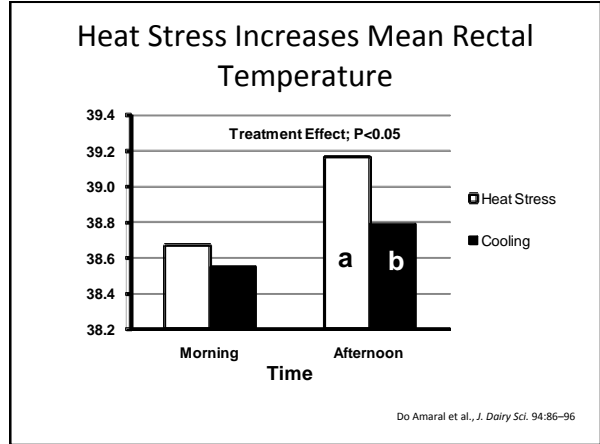
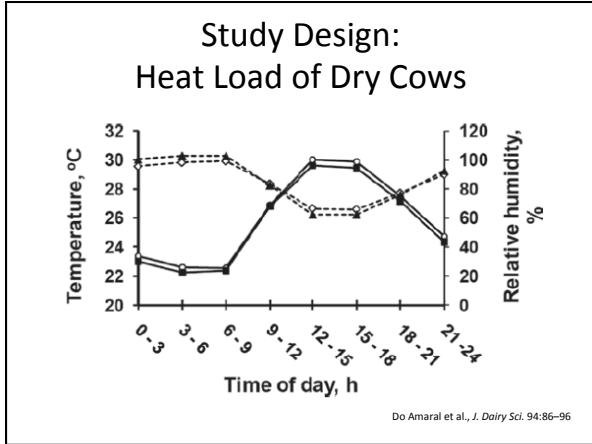
What about dry cows?

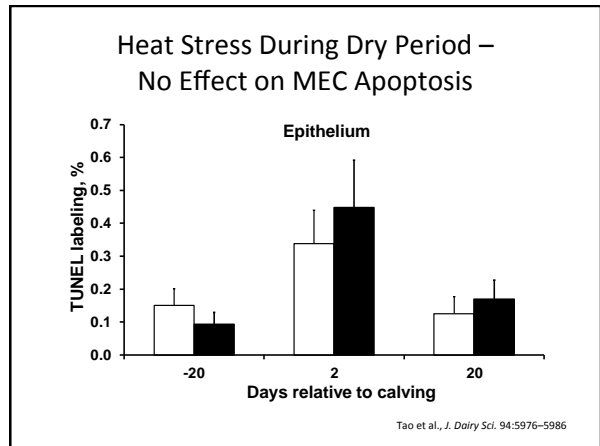
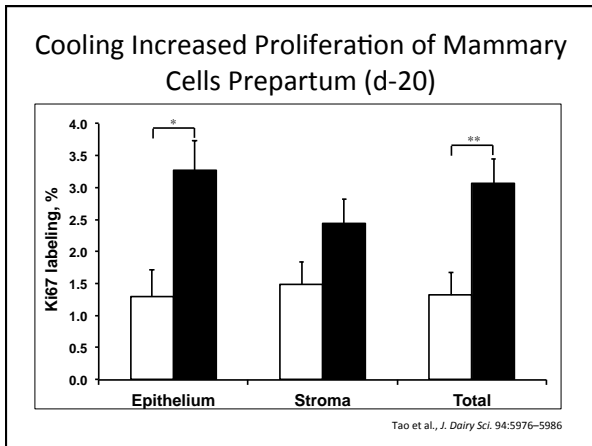
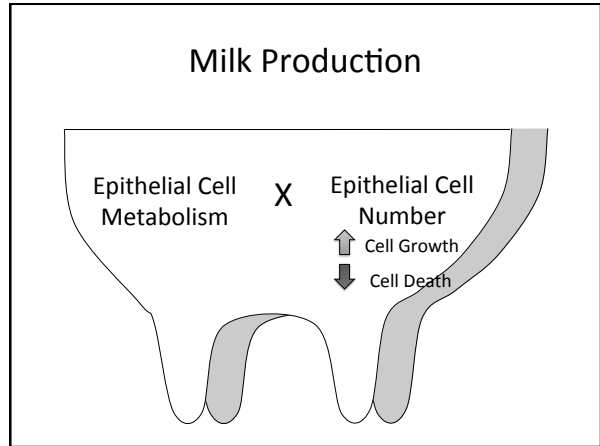
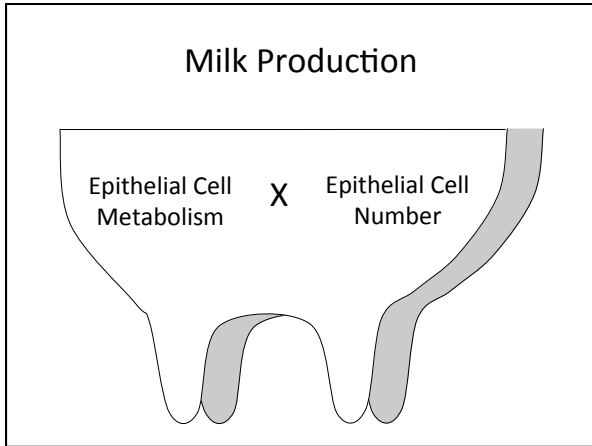


Heat Stress Effects on Yield Linger



Tao & Dahl, *J. Dairy Sci.* 96:4079-4093

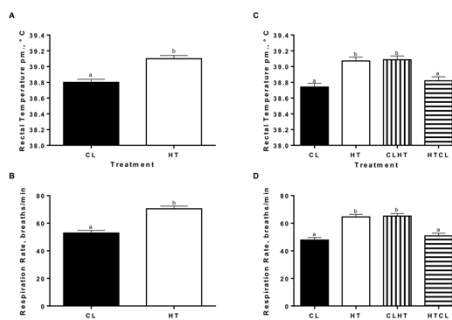




Dry Period Cooling Duration

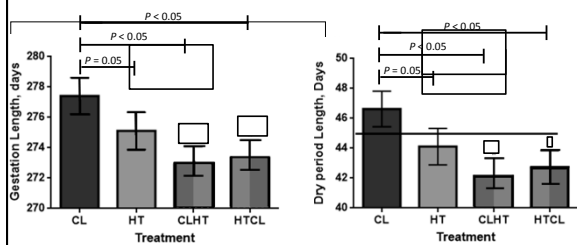
- Do I have to cool cows the entire dry period?
- Can I just cool during the close-up phase?

Heat Stress Increases Rectal Temperature and Respiration Rate



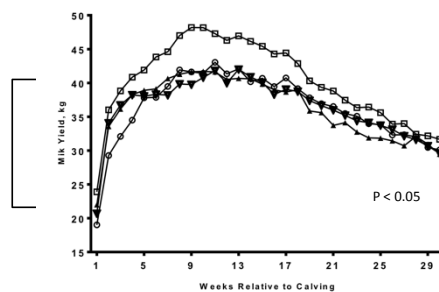
Fabris et al., *J. Dairy Sci.*, 102:5647-5656

Heat Stress Decreases Gestation Length and Dry Period Length at Any Time



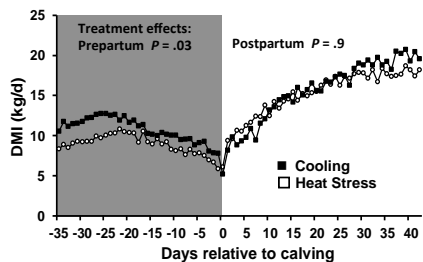
Fabris et al., *J. Dairy Sci.*, 102:5647-5656

Heat Stress Imposed at Any Time in the Dry Period Reduces Milk Yield



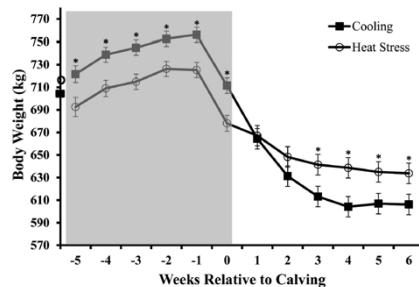
Fabris et al., *J. Dairy Sci.*, 102:5647-5656

Heat Stress Reduces DMI Prepartum But Not Postpartum



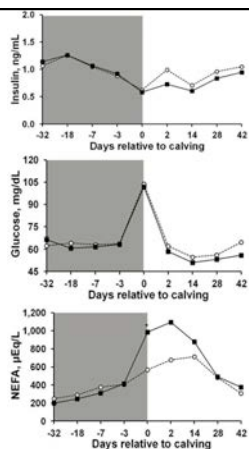
Tao et al., *J. Dairy Sci.* 94:5976-5986

Cooling Dry Cows Increases BW Prepartum, Decreases Postpartum



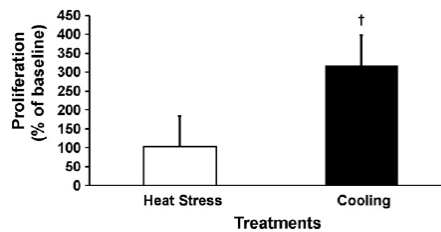
Thompson et al., *J. Dairy Sci.* 97:7426-7436

Effect of Cooling Dry Cows on Metabolic Profile

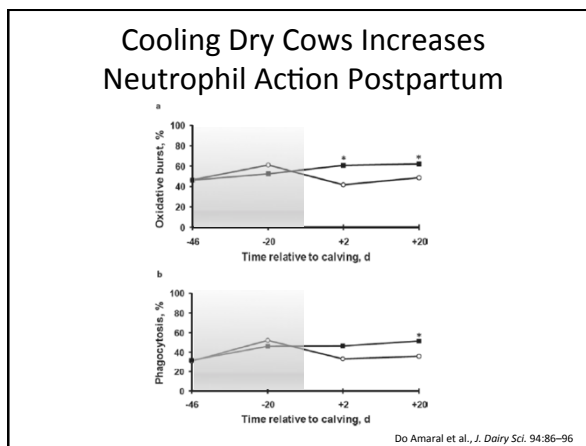
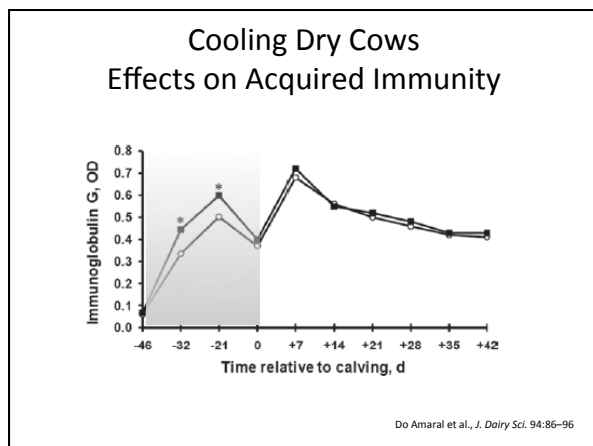


Tao et al., *J. Dairy Sci.* 95:5035-5046

Cooling Dry Cows Increases Lymphocyte Proliferation



Do Amaral et al., *Domest. Anim. Endo.* 38:38-45



Dry in COOL Months Improves Performance

Table 1. Milk production and occurrence of mastitis, digestive and respiratory problems, retained fetal membranes, and metritis in cows dried during HOT months (Jun, Jul, Aug) or COOL months (Dec, Jan, Feb) in the first 80 DIM of the subsequent lactation

Item	Dry during HOT months (Jun, Jul, Aug), n = 1,569				Dry during COOL months (Dec, Jan, Feb), n = 1,044				P-value
	Value	Disease ^a	n	%	Value	Disease ^a	n	%	
Milk production (kg)	10,351 ± 59.8				10,902 ± 73.3				0.01
Mastitis	0	1,286	82.0		0	950	91.0		0.01
	1	283	18.0		1	94	9.0		
Digestive	0	1,516	95.6		0	973	93.2		0.01
	1	53	3.4		1	71	6.8		
Respiratory	0	1,346	85.8		0	942	90.2		0.01
	1	223	14.2		1	102	9.8		
Retained fetal membranes	0	1,500	95.6		0	1,013	97.0		0.08
	1	69	4.4		1	31	3.0		
Metritis	0	1,500	95.6		0	1,007	96.4		0.35
	1	67	4.2		1	38	3.5		

^aDisease: 0 = cows without the disease; 1 = cows with the disease.

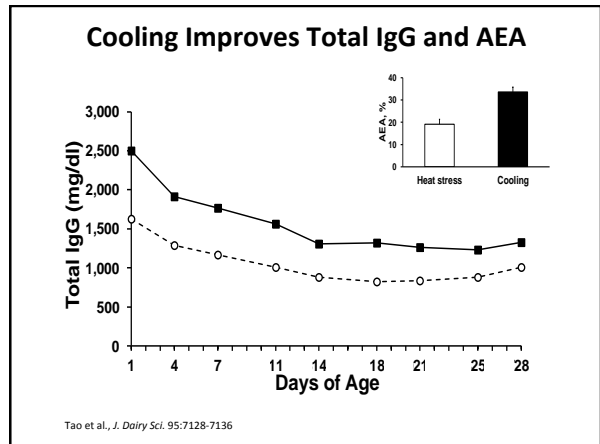
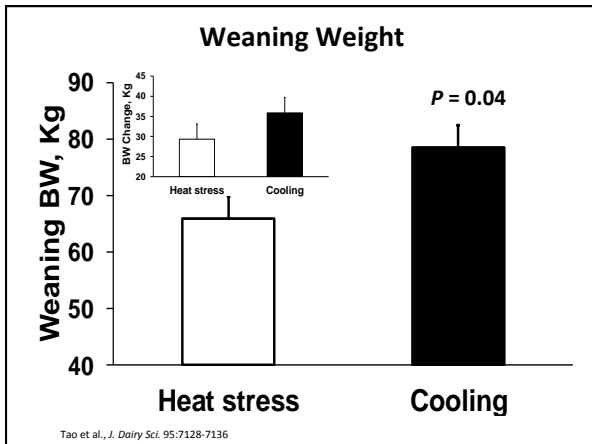
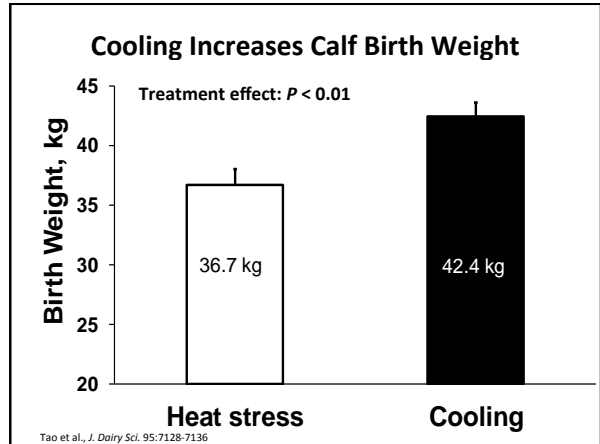
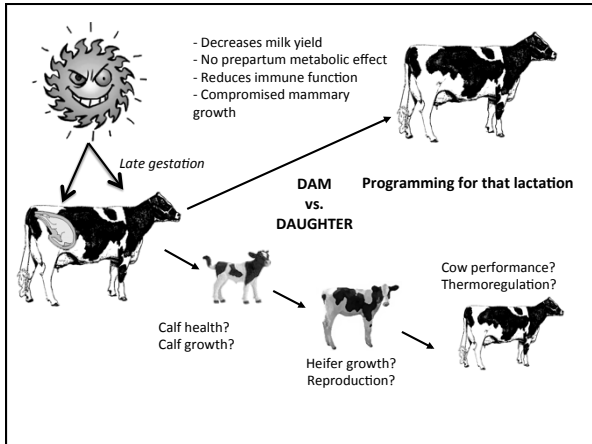
Thompson & Dahl, *Prof. Anim. Sci.* 28:628-631

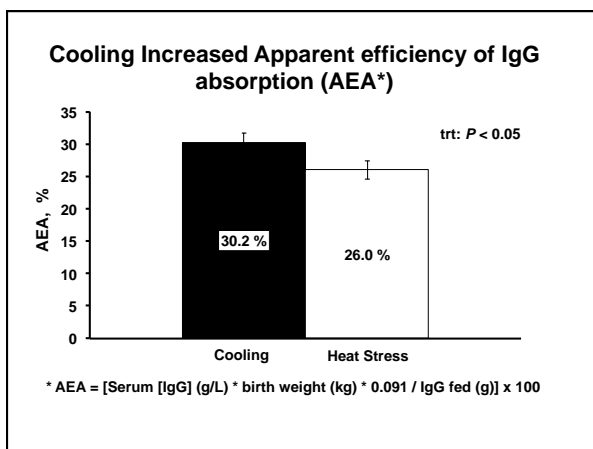
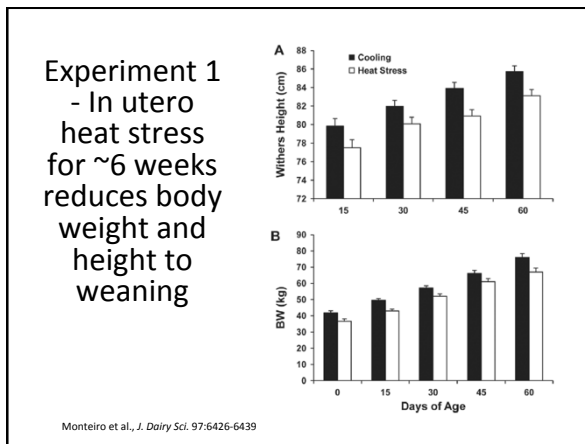
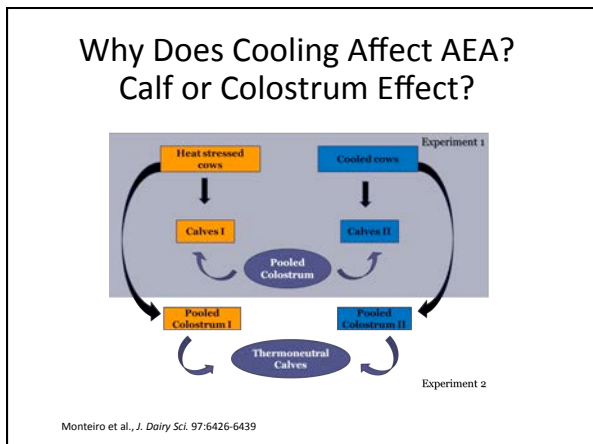
Dry in COOL Months Improves Reproductive Performance

Table 3. Milk production and reproductive performance of cows dried during HOT months (Jun, Jul, Aug) or COOL months (Dec, Jan, Feb) in the first 150 DIM of the subsequent lactation on a commercial farm in Florida

Item	Dry during HOT months (Jun, Jul, Aug)	Dry during COOL months (Dec, Jan, Feb)	P-value
Milk production (kg)	10,547 ± 67.0	11,005 ± 83.38	0.01
Number of breedings (n)	1,048	676	0.03
Mean (no.)	1.59 ± 0.02	1.51 ± 0.03	
DIM to breeding (n)	1,047	676	0.01
Mean (d)	97.0 ± 0.74	91.8 ± 0.92	
DIM to pregnancy (n)	1,051	679	0.01
Mean (d)	131.1 ± 0.85	125.9 ± 1.06	

Thompson & Dahl, *Prof. Anim. Sci.* 28:628-631





Experiment 2 – No Effect of Colostrum from Cooled or Heat Stressed Cows on Calf Performance

Growth performance of calves born to cows under thermoneutral conditions during the dry period and fed frozen colostrum from cows exposed to either heat stress or cooling during the dry period

Parameter	Heat Stress LSM ± SE	Cooling LSM ± SE	P-value
Birth Weight (kg)	38.8 ± 1.4	39.2 ± 1.5	0.8
Weaning Weight (kg) ¹	68.4 ± 2.5	64.8 ± 2.6	0.4
Preweaning BW Gain (kg) ²	29.6 ± 2.3	25.6 ± 2.4	0.3
Avg. Daily Gain (kg/d)	0.49 ± 0.7	0.43 ± 0.8	0.2
Weaning Withers Height (cm) ¹	84.3 ± 0.8	83.0 ± 0.9	0.4
Preweaning Height Increase (cm) ²	7.8 ± 1.1	6.2 ± 1.0	0.3

¹Weaning weight and weaning height were measured at d 60 of age.
²Preweaning BW gain and height increase was calculated by individually subtracting data at d 60 of age by data at birth.

Monteiro et al., *J. Dairy Sci.* 97:6426-6439

Heat Stress Summary – Short Term Effects on Calves

- Cooling increases weight at birth and weaning
- In utero heat stress reduces apparent efficiency of IgG absorption, but not an effect on colostrum quality
- In utero heat stress alters carbohydrate metabolism, consistent with greater fat deposition

J. Dairy Sci. 92:5988–5999
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Heat-stress abatement during the dry period: Does cooling improve transition into lactation?

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Retrospective analysis of records of calves from 5 studies between 2007 and 2011

Monteiro et al., *J. Dairy Sci.* 99:8443-8450.

J. Dairy Sci. 94:86–96
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Heat stress abatement during the dry period influences metabolic gene expression and improves immune status in the transition period of dairy cows

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Effect of heat stress during the dry period on mammary gland development

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J. Dairy Sci. 95:3035–3048
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Effect of cooling heat-stressed dairy cows during the dry period on insulin response

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Effect of cooling during the dry period on immune response after *Streptococcus uberis* intramammary infection challenge of dairy cows

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Heat Stress Experiments 2007 - 2011

	Bulls	Heifers	Total
Cooling	31	41	72
Heat Stress	30	44	74
Total	61	85	147

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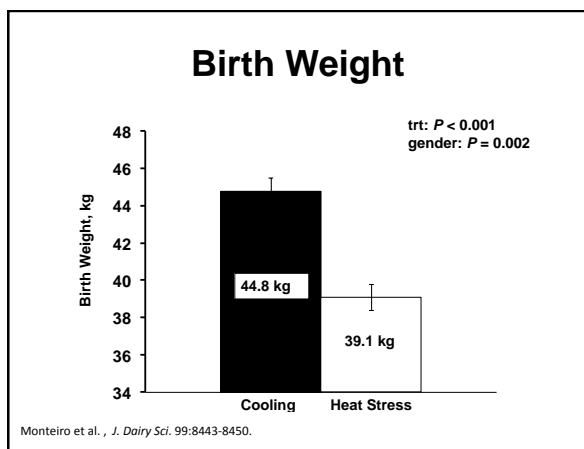
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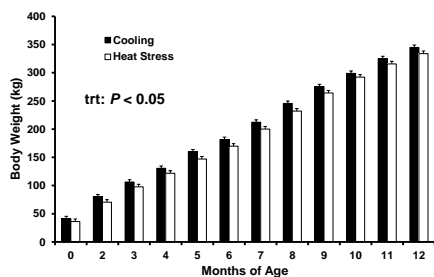
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In Utero Heat Stress Decreases Calf Bodyweight to Puberty



Monteiro et al., *J. Dairy Sci.* 99:8443-8450.

In Utero HS Decreases Calf Survival

Table 1. Effect of maternal heat stress (HT) or cooling (CL) during late gestation on calf survival

Parameter	CL				HT				P [†]
	AI	IVF [‡]	Total	% [§]	AI	IVF	Total	%	
Bull calves, n	30	1	31	---	28	2	30	---	---
Heifer calves, n	29	12	41	---	29	15	44	---	---
DOA [¶]	0	0	0	0.0	2	1	3	4.1	0.25
Males mortality by 4 mo of age	1	0	1	3.2	3	0	3	10.0	0.35
Heifers leaving herd before puberty	1	4	5	12.2	3	7	10	22.7	0.26
Due to sickness, malformation or growth retardation	1	0	1	2.4	3	5	8	18.2	0.03
Heifers leaving herd after puberty, before first lactation	1	0	1	2.4	3	0	3	6.8	0.62
Heifers completing first lactation	27	8	35	85.4	22	7	29	65.9	0.05

[†]IVF = in vitro fertilization.

[‡]Percentage of animals (AI + IVF) affected out of total animals (males or females) in the respective treatment.

[§]Treatment.

[¶]Dead on arrival. Includes male and female calves.

Monteiro et al., *J. Dairy Sci.* 99:8443-8450.

In Utero Heat Stress Decreases Reproductive Performance

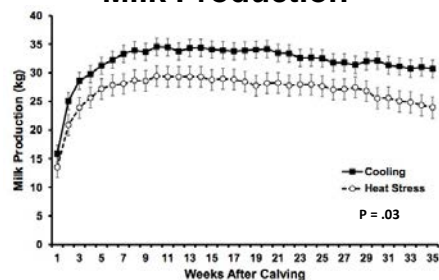
Table 2. Effect of maternal heat stress (HT) or cooling (CL) during late gestation on reproductive performance before first lactation of heifers born to HT or CL dams

Parameter	CL	HT	SEM	P
N	36	32	---	---
Age at first AI, mo	13.6	13.8	0.2	0.32
Services per pregnancy d ¹ 30	2.0	2.5	0.2	0.05
Age at pregnancy d ¹ 30, mo	16.1	16.9	0.3	0.07
Services per pregnancy d ¹ 50	2.3	2.6	0.2	0.32
Age at calving, mo	24.8	25.0	0.4	0.72

¹Days after insemination.

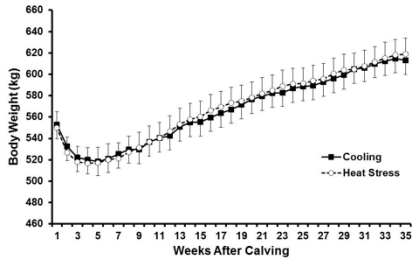
Monteiro et al., *J. Dairy Sci.* 99:8443-8450.

In Utero Heat Stress Reduces Milk Production

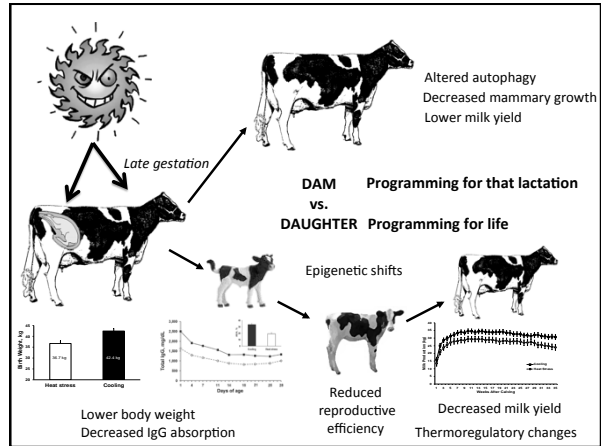


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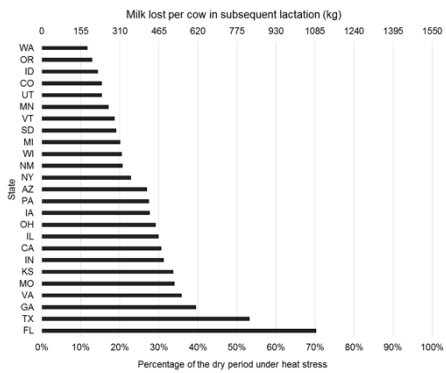
In Utero Heat Stress Does Not Affect Mature Bodyweight



Monteiro et al., *J. Dairy Sci.* 99:8443-8450.

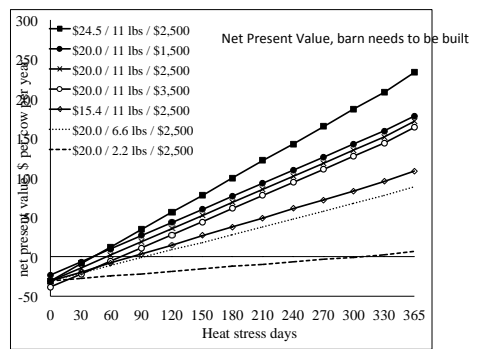


Does it Pay to Cool Dry Cows?



Ferreira et al., *J. Dairy Sci.* 99:9931-9941.

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Ferreira et al., *J. Dairy Sci.* 99:9931-9941.

