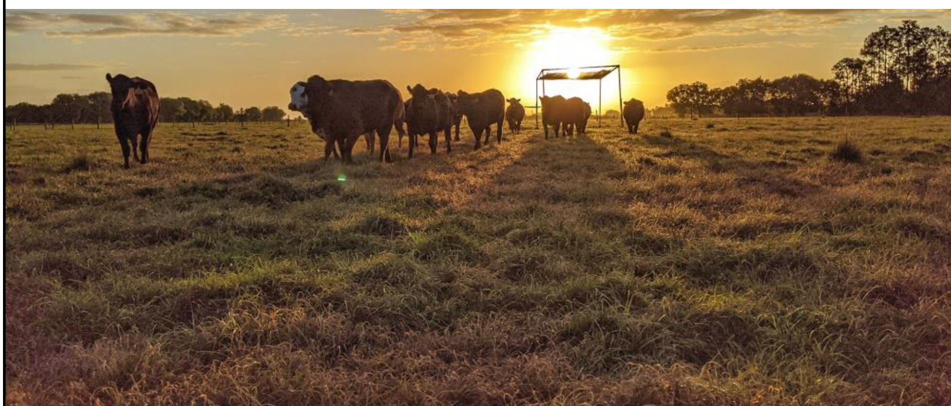
Nutritional management to optimize cow-calf production in Southeast

2024 Florida Ruminant Nutrition Symposium



Philipe Moriel - Associate Professor
Range Cattle Research & Education Center - University of Florida, Ona, FL

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Introduction

Retrospective analyses of cow BCS vs. nutrition
- BCS at calving vs. post-calving BCS change
- BCS at weaning vs. precalving supplementation

Precalving supplementation strategies
- Timing, frequency, feed additives

Nutrition of heat stressed heifers
- Stair-step strategy to offset heat stress

Heat stress in pregnant females
- Unexpected results in cow vs. offspring

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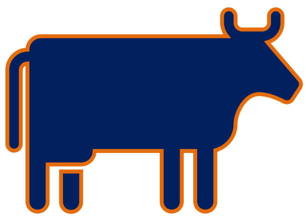

Mature Cows

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Studies across United States

$^{abc}P < 0.05$

BCS at calving vs. Pregnancy Rate, %

	Body condition score at calving		
	4	5	6
Spitzer et al. (1995)	56^{a}	80^{b}	96^{c}
Lake et al. (2005)	64^{a}	-	89^{b}
Lents et al (2008)	56^{a}	88^{b}	-
Bohnert et al (2013)	79^{a}	92^{b}	-
Average	**63.8**	**86.7**	**92.5**

BCS at calving	Days to resume estrus
3	89^{a}
4	70^{b}
5	59^{b}
6	52^{b}
7	31^{c}

Houghton et al. (1990) JAS 68:1438

Item	Calving distribution			SEM	*P*-value
	First 21 days	Second 21 days	Third 21 days		
Weaning body weight, lb	482^{a}	469^{b}	434^{c}	10.8	<0.01
Body weight start of breeding, lb	652^{a}	643^{b}	608^{c}	9.2	<0.01
Pubertal at start of breeding, %	70^{a}	58^{b}	39^{c}	9.35	<0.01
Pregnancy rate, %	90^{a}	86^{b}	78^{c}	5.62	0.02

Funston et al. (2012; JAS 90:5118)

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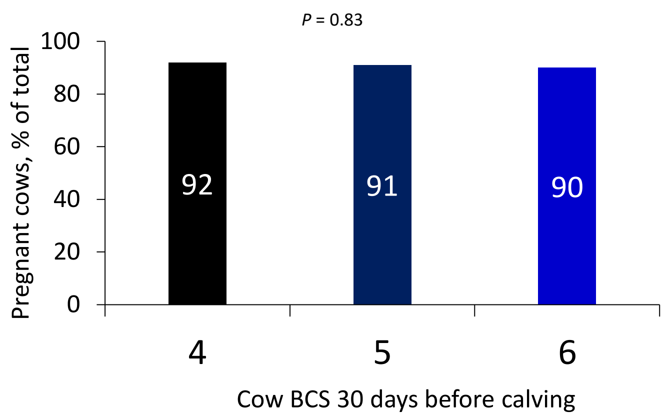
351 spring-calving, Angus & Angus x Hereford cows (2 and 3 years of age) in New Mexico



Mulliniks et al. (2012) J. Anim. Sci. 90:2811

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Retrospective data analyses

Moriel et al. (2024) Anim. Rep. Sci. *in press*

- 6 studies from 2017 to 2022
  - UF/IFAS Range Cattle Research & Education Center, Ona, FL
- 1,188 Brangus crossbred mature cows (8 ± 3 years of age)
- Day 0 = 2 weeks after weaning
  - 92 ± 37 days before calving
  - Received or not supplementation of protein and energy from day 0 until calving (90 ± 35 days of supplementation)

Palmer et al. (2020) Livest. Sci. doi:10.1016/j.livsci.2020.104176
Palmer et al. (2022b) J. Anim. Sci. doi:10.1093/jas/skac003
Izquierdo et al. (2022) Trans. Anim. Sci. doi:10.1093/tas/txac110
Palmer et al. (2022a) J. Anim. Sci. doi:10.1093/jas/skac022
Vedovatto et al. (2022) Trans. Anim. Sci. doi:10.1093/tas/txac105
Izquierdo et al. (2023) J. Anim. Sci. doi:10.1093/jas/skad244

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Retrospective data analyses

Moriel et al. (2024) Anim. Rep. Sci. *in press*

2 statistical analyses:

Maternal BCS at calving and postpartum BCS change

- Calving: **BCS < 5** or **BCS ≥ 5**
- Within each calving BCS group, cows that lost (**LO**), maintained (**MA**), or gained (**GA**) BCS from calving until the start of the breeding season

Maternal initial BCS and prepartum supplementation

- Weaning: **BCS < 5** vs. **BCS ≥ 5**
- Within each initial BCS group, cows that received (**SUP**) or not (**NOSUP**) prepartum supplementation

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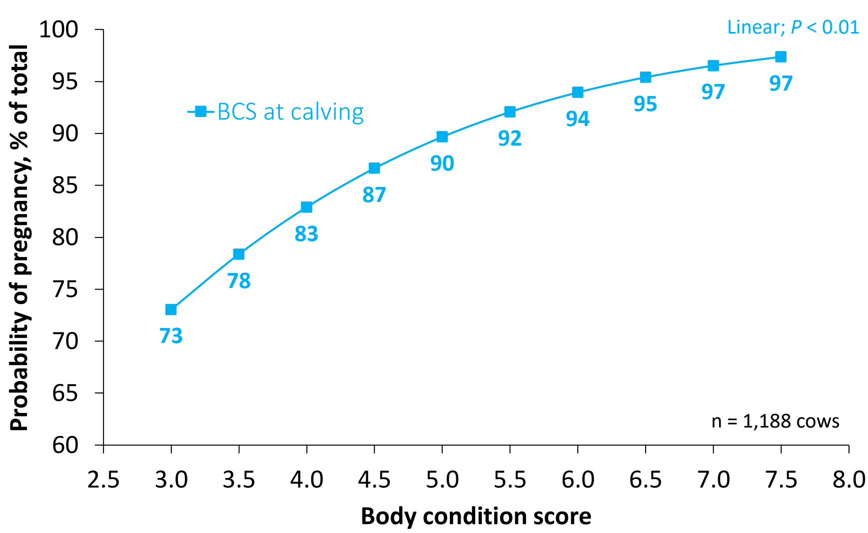
Body condition score at calving vs. Pregnancy %

Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)
1,188 Brangus mature cows grazing bahiagrass



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Body condition score at calving

Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)
1,188 Brangus mature cows grazing bahiagrass

	BCS at calving			
	BCS < 5	BCS > 5	SEM	*P*-value
n	208	980		
Cow BCS				
Calving	4.51	5.56	0.078	<0.01
Start of breeding season	4.51	5.51	0.082	<0.01
End of breeding season	4.27	5.15	0.105	<0.01
Weaning	4.77	5.59	0.065	<0.01
First calf crop				
Body weight at birth, lb	75.2	79.3	1.12	<0.01
Body weight at weaning, lb	524	541	14.4	0.04
Pregnant with 2nd calf, %	81	91	2.53	<0.01
Calved live 2nd calf, % of total	73	82	2.95	0.005
Calving interval, days	371	364	2.4	0.02
Calving distribution, % of total calves				
First 30 days	57	63	4.0	0.18
Second 30 days	34	29	4.8	0.23
Third 30 days	9	8	2.5	0.65

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Body condition score change post-calving

Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)
1,188 Brangus mature cows grazing bahiagrass

	Post-calving BCS change				
	LOST	MAIN	GAIN	SEM	P-value
n	757	271	160		
BCS change from calving to breeding	-0.69	-0.02	0.51	0.05	<0.01
Cow BCS					
Start of breeding season	4.57[a]	4.96[b]	5.51[c]	0.08	<0.01
First calf crop					
Body weight at weaning, lb	536	529	533	15.7	0.47
Pregnant with 2nd calf, % of total	82[a]	87[b]	88[b]	2.8	0.07
Calving distribution, % of total calves					
First 30 days	52[a]	66[b]	63[b]	4.5	0.03
Second 30 days	39[b]	25[a]	31[ab]	4.9	0.03
Third 30 days	9	9	6.5	2.6	0.71

$^{ac}P < 0.05$

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BCS at calving vs. Post-calving BCS change

Cow BCS at calving	Cow BCS change from calving to breeding	Pregnant, % of total	Calving within first 30 days of calving season, % of total
Below 5	Lost (n = 93)	74.5[a]	35.0[a]
	Maintained (n = 55)	84.8[b]	67.2[b]
	Gained (n = 60)	83.7[b]	68.4[b]
Above 5	Lost (n = 664)	88.3[bc]	64.2[b]
	Maintained (n = 216)	90.4[c]	68.1[b]
	Gained (n = 100)	93.2[c]	57.6[b]

BCS at calving determines the pregnancy rate and calving distribution.

Recover BCS after calving does not fully compensate for thin BCS at calving.

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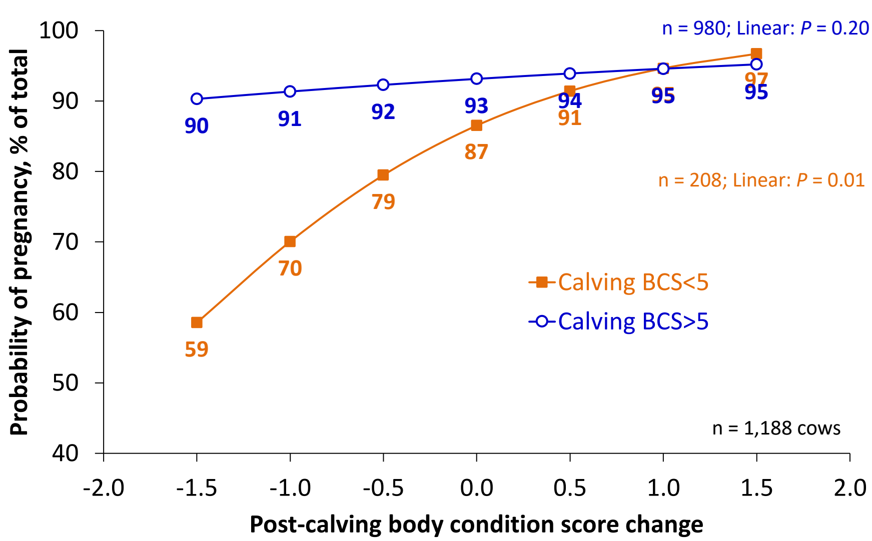
Body condition score change post-calving vs. Pregnancy %

Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)
Brangus mature cows grazing bahiagrass



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frontiers in Animal Science

REVIEW
published: 20 October 2021
doi: 10.3389/fanim.2021.728635

https://doi.org/10.3389/fanim.2021.728635

Improving Beef Progeny Performance Through Developmental Programming

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Maternal nutritional management during gestation appears to modulate fetal development and imprint offspring postnatal health and performance, *via* altered organ and tissue development and tissue-specific epigenetics. This review highlighted the studies demonstrating how developmental programming could be explored by beef producers to enhance offspring performance (growth, immune function, and reproduction), including altering cow body condition score (BCS) during pregnancy and maternal supplementation of protein and energy, polyunsaturated fatty acids (PUFA), trace minerals, frequency of supplementation, specific amino acids, and vitamins. However, this review also highlighted that programming effects on offspring performance reported in the literature were highly variable and depended on level, duration, timing, and type of nutrient restriction during gestation. It is suggested that maternal BCS gain during gestation, rather than BCS *per se*, enhances offspring preweaning growth. Opportunities for boosting offspring productive responses through maternal supplementation of protein and energy were identified more consistently for pre- vs. post-weaning phases. Maternal supplementation of specific nutrients (i.e.,

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Precalving supplementation of protein/energy in Florida

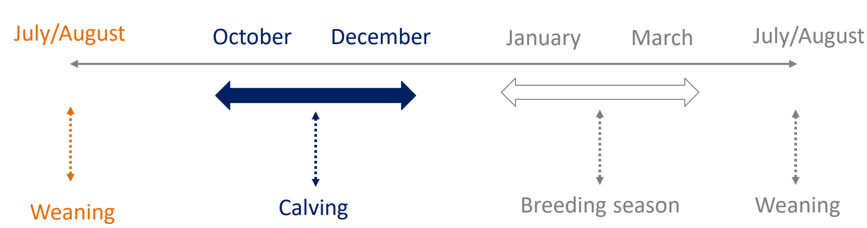
Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)

Brangus mature cows on bahiagrass and supplemented ***on average at 2.5 lb/day for 70 days before calving***

n = 1,188 cow-calf pairs

BCS at weaning (July/August) × ***Precalving supplementation***

BCS > or < 5 *NOSUP vs SUP*



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Precalving supplementation of protein/energy in Florida

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Brangus mature cows on bahiagrass and supplemented ***on average at 2.5 lb/day for 70 days before calving***

n = 1,188 cow-calf pairs

BCS at weaning (July/August) × ***Precalving supplementation***
BCS > or < 5 *NOSUP vs SUP*

	BCS < 5		BCS ≥ 5			
Item	**NOSUP**	**SUP**	**NOSUP**	**SUP**	**SEM**	**P-value**
n	106	125	557	400		
Cow BCS						
Weaning (July/August)	4.59^{a}	4.64^{a}	5.81^{c}	5.72^{b}	0.075	<0.01
Calving	4.51^{a}	5.29^{b}	5.37^{b}	5.97^{c}	0.172	
Start of breeding season	4.18^{a}	4.82^{b}	5.02^{c}	5.35^{d}	0.108	
End of breeding season	4.11^{a}	4.54^{b}	4.84^{c}	5.08^{d}	0.104	
Weaning (Following year)	4.56^{a}	4.79^{b}	5.37^{c}	5.45^{c}	0.087	

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Precalving supplementation of protein/energy in Florida

Summary of 6 studies at the Range Cattle REC (2017 to 2022; Ona, FL)
Brangus mature cows on bahiagrass and supplemented ***on average at 2.5 lb/day for 70 days before calving***

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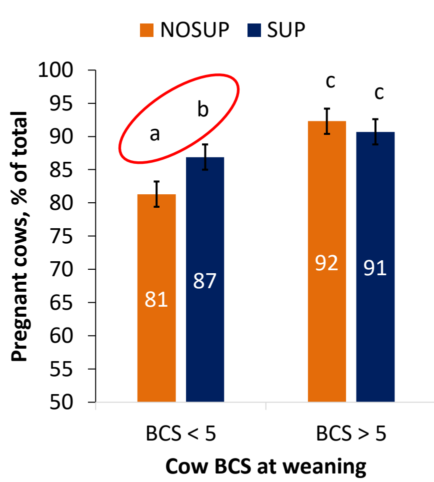

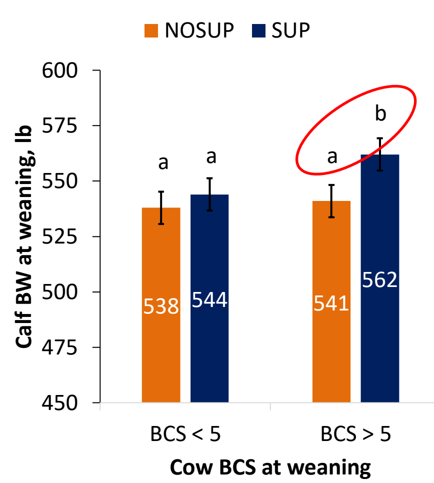

$^{ac}P < 0.05$

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Precalving supplementation of protein/energy in Florida

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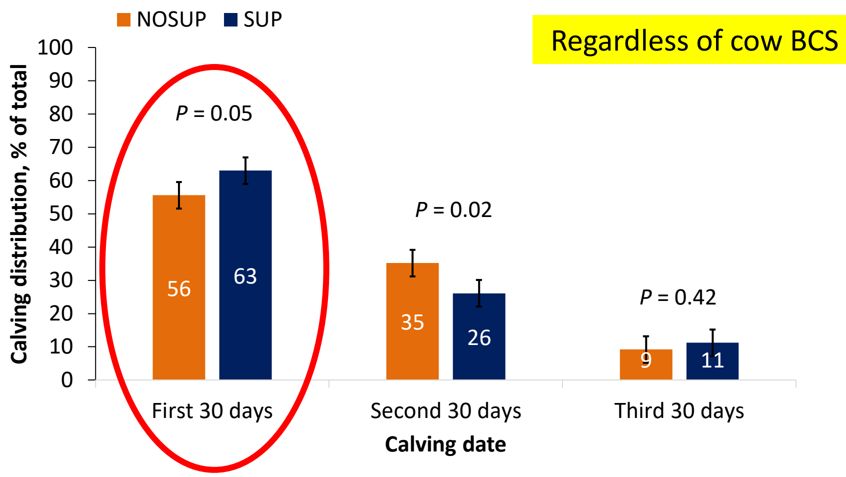

[ac]$P < 0.05$

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Opportunities

- Nutrient restriction
  - *Long- vs. short-term?*
- Nutrient excess?
- Diet composition?
- Energy source?
- Protein source and amount?
- Minerals and fatty acids?
- Timing of supplementation?
- Frequency of supplementation?
- Feed additives
  - *Monensin & Probiotics*

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Beef Enhancement Funds

Florida Cattlemen's Association

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Fetal Programming

Timing of supplementation

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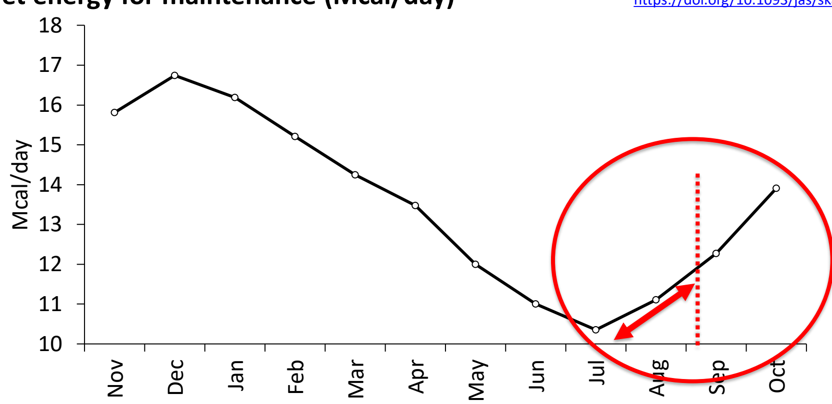
Net energy for maintenance (Mcal/day)

Palmer et al. (2022) J. Anim. Sci. **100**:1–17
https://doi.org/10.1093/jas/skac022



Supplementation offered:
Day 0 to 84 = dried distillers grains (DDG)
Day 84 end of breeding season = Molasses + urea

Day 0 = Start of study
Day 84 = start of calving
Day 140 to 224 = Breeding season

Treatments	Day of the study		
	Day 0 to 42	Day 42 to 84 (*Calving*)	Day 84 until end of breeding season
NO precalving supplementation	0	0	4 lb/day
Supplement day 0 to 84 – SUP84	2.2 lb/day	2.2 lb/day	4 lb/day
Supplement day 0 to 42 – SUP45	4.4 lb/day	0	4 lb/day

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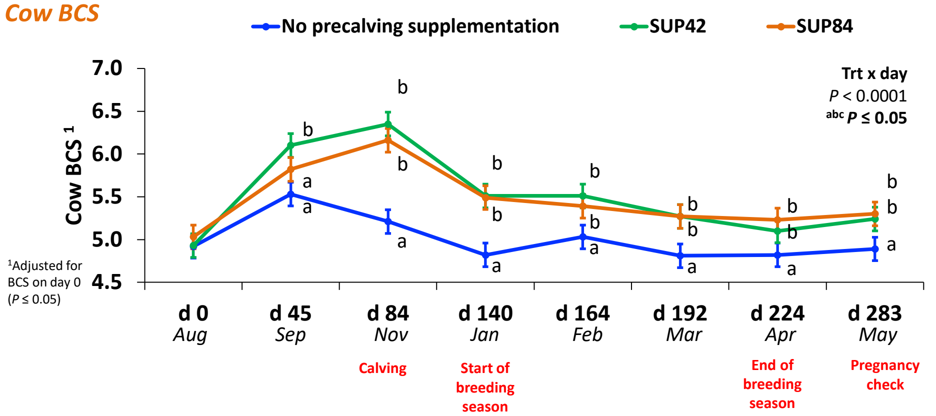
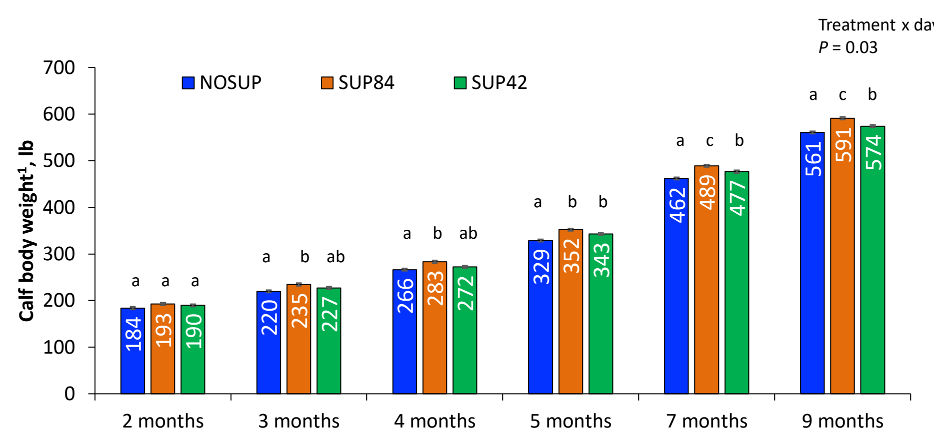
Results
Cow BCS



	Treatment				P - value
	NO Sup	SUP84	SUP42	SEM	Treatment
Calving date, day of the study	82	83	86	4.7	0.76
Pregnancy rate (day 283), % of total	96.3	96.2	88.0	4.81	0.39

Results – Preweaning calf body weight



[1]Adjusted for calf sex and age ($P < 0.01$)

Treatments	Day of the study		
	Day 0 to 42	Day 42 to 84 (*Calving*)	Day 84 until end of breeding season
NO precalving supplementation	0	0	4 lb/day
Supplement day 0 to 84 – SUP84	2.2 lb/day	2.2 lb/day	4 lb/day
Supplement day 0 to 42 – SUP45	4.4 lb/day	0	4 lb/day

Results – Post-weaning immune response of steers

Steer innate and humoral immune response

	Treatment				*P* - value	
Item	CON	SUP42	SUP84	SEM	Trt	Trt × Day
Plasma cortisol, µg/dL	2.13	2.29	2.15	0.16	0.76	0.79
Plasma haptoglobin, mg/mL	0.25	0.30	0.28	0.02	0.40	0.78
Serum BVDV-1						
Titers, $\log_2$	3.46	4.41	3.91	0.38	0.21	0.87
Seroconversion, % total	78	85	88	7.2	0.64	0.27
Serum PI3						
Titers, log2	2.53[a]	4.30[b]	3.73[ab]	0.44	0.07	0.51
Seroconversion, % total						
day 347	21[a]	63[b]	54[b]	11	0.32	0.01
day 389	80	82	83			

[ab]*P* ≤ 0.05

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Results – Steer carcass characteristics

	Treatment				
Item	CON	SUP42	SUP84	SEM	*P* - value
Hot Carcass Weight, kg	337	338	338	5.5	0.98
Dressing Percent, %	59.7	60.5	59.8	0.30	0.12
12th rib fat thickness, cm	1.77	1.69	1.62	0.089	0.49
Longissimus muscle area, cm^2	79.2	80.8	80.7	1.58	0.74
KPH, %	2.92	2.62	2.67	0.13	0.20
Yield Grade	3.8	3.6	3.5	0.14	0.33
Marbling	521[a]	570[b]	545[ab]	15	0.07
Average choice, %	5[a]	36[b]	17[ab]	9.3	0.10
Low choice, %	72	46	58	10	0.17
Select, %	23	19	25	8	0.87

[ab]*P* ≤ 0.05

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Beef Enhancement Funds
Florida Cattlemen's Association

Fetal Programming

Frequency of supplementation

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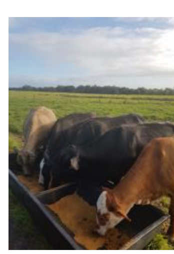
Frequency of precalving supplementation

80 days before calving:
120 Brangus cows (20 bahiagrass pastures; 6 cows/pasture)

NOSUP *= no precalving supplementation*
1X *= 14 lb of DDG offered on Monday (14 lb of DDG/cow/week)*
3X *= 4.66 lb of DDG offered on Monday, Wednesday and Friday (14 lb of DDG/cow/week)*
7X *= 2 lb of DDG offered daily (14 lb of DDG/cow/week)*

Calving to weaning:
All cows and calves managed similarly

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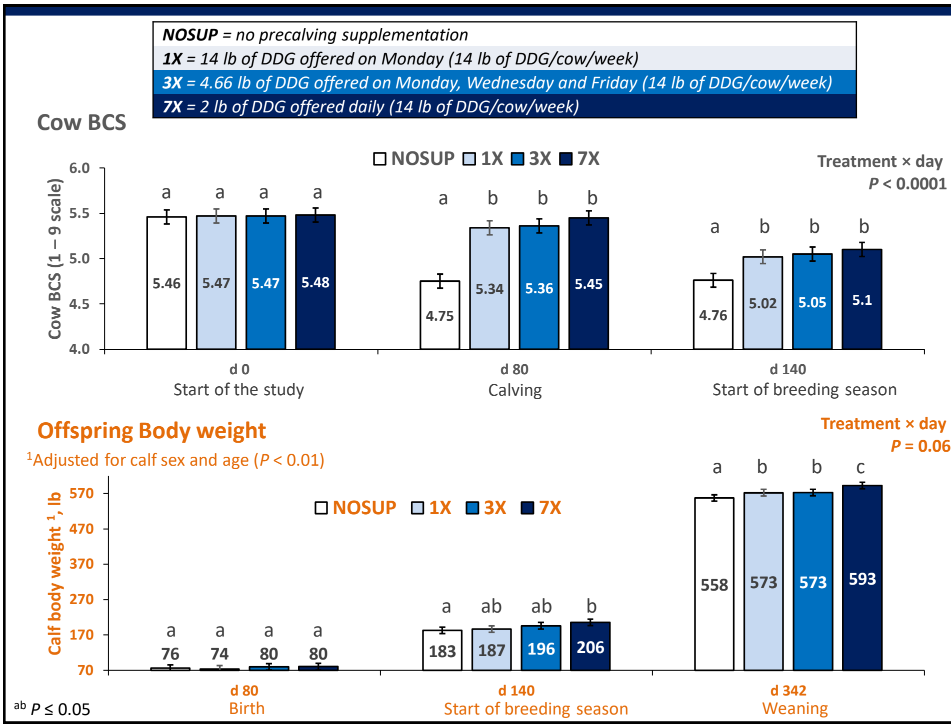

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FETAL PROGRAMMING

Monensin

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Inclusion of monensin into precalving supplementation

70 days before calving:

160 Brangus cows (16 bahiagrass pastures; 10 cows/pasture)

Treatments :

NO SUP = No precalving supplementation

SUP = 2 lb of DDG daily

SUP + MON = 2 lb of DDG daily + 200 mg de monensin daily

Calving to weaning:

All cows and calves managed similarly!

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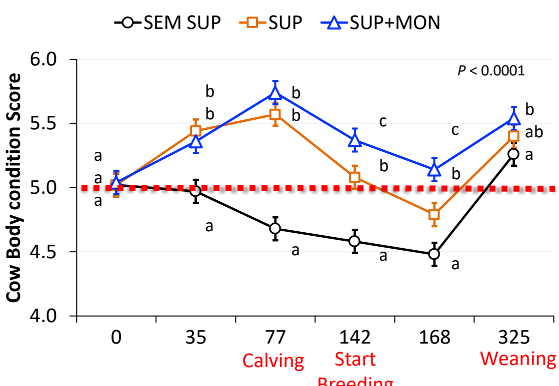

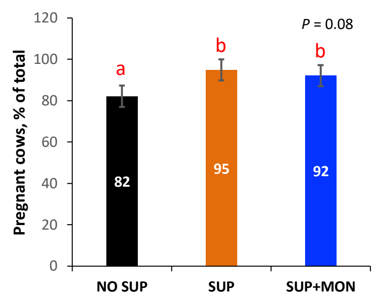

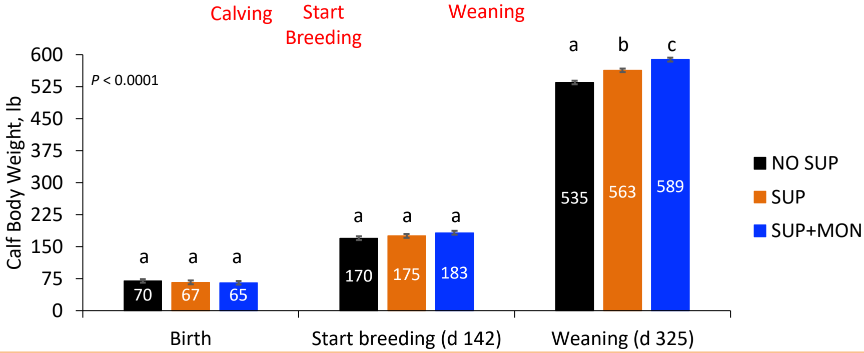

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FETAL PROGRAMMING

Probiotics

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Introduction

- Direct-fed Microbials
  - *Modulate rumen fermentation characteristics*
  - *Promote establishment of beneficial rumen microflora*
  - *Enhance fiber and overall nutrient digestibility* (Krehbiel et al., 2003; Pan et al., 2022; Cappellozza et al., 2023)

- *Bacillus* spp.
  - *Inhibition of harmful pathogens*
  - *Biofilm and mucin formation*
  - *Enhance production of wide variety of fibrolytic, amylolytic, proteolytic, and lipolytic enzymes* (Copani et al., 2020; Segura et al., 2020; Santano et al., 2020; Elshaghabee et al., 2017; Luise et al., 2022)

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Experimental Design

- Range Cattle Research and Education Center
  - May 2022 to March 2023
- 72 pregnant Brangus heifers (21 months)
  BW = 431 ± 31 kg
  BCS = 6.0 ± 0.36
- 1 of 12 bahiagrass pastures (6 heifers/pasture)
- Treatments (6 pastures/treatment)

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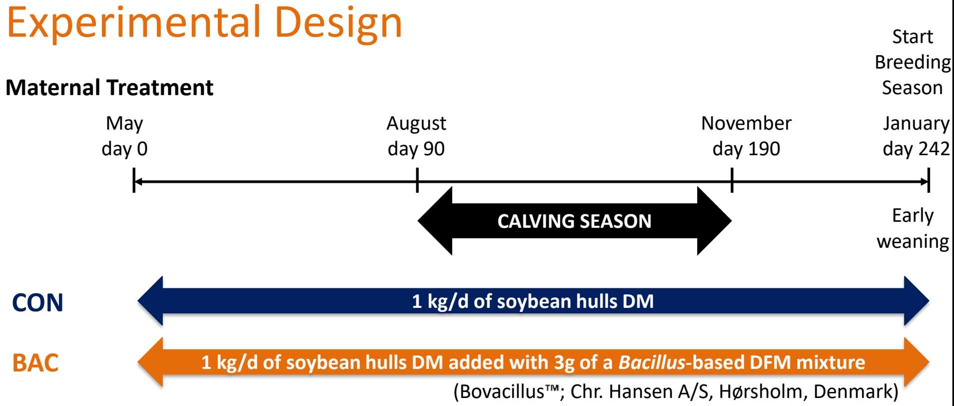
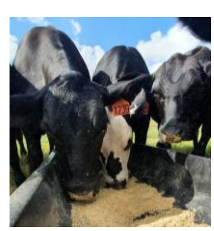
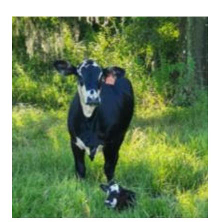
Experimental Design



Bacillus subtilis and *Bacillus licheniformis*

Target: 6.6 × 10^9 CFU





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Experimental Design

Offspring Management

January day 242 — Early Weaning
day 258 — Drylot Entry
day 271
day 287
March day 319 — Drylot Exit

- 60 Calves (96 ± 30 d of age)
- 1 of 12 drylot pens (4 to 6 calves/pen)
    - Same distribution of the maternal treatment
- Soybean hulls-based diet (3.25% DM of BW)
    - CP = 21%
    - TDN = 73%

Vaccinated against pathogens associated with respiratory disease and *Clostridium*

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Maternal Results

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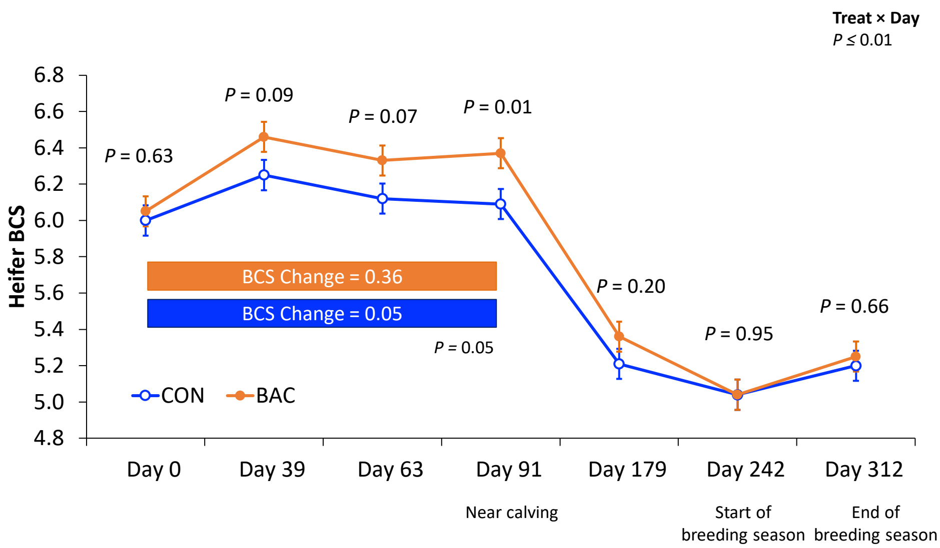
Maternal BW and BCS

BAC = 3g of *Bacillus*-based DFM from day 0 to 242
CON = No *Bacillus* supplementation from day 0 to 242



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Reproductive Data

BAC = 3g of *Bacillus*-based DFM from day 0 to 242
CON = No *Bacillus* supplementation from day 0 to 242

	Maternal treatment			*P*-value
	CON	**BAC**	SEM	**Treatment**
First offspring **(Calves in utero when treatments were provided)**				
Calving, % of total	96	91	4.22	0.45
Calving date, day of the study	142	135	4.10	0.22
Male calves at birth, % of total	48	54	9.21	0.63
Calf birth BW, lb	62	65	0.99	0.34
Second offspring **(Calves conceived from day 242 to 312)**				
Pregnant, % of total	89	89	5.35	0.97
Calving, % of total	84	88	7.83	0.76
Calving date, day of the study	554	556	4.60	0.61
Male calves, % of total	52	52	12.00	0.94

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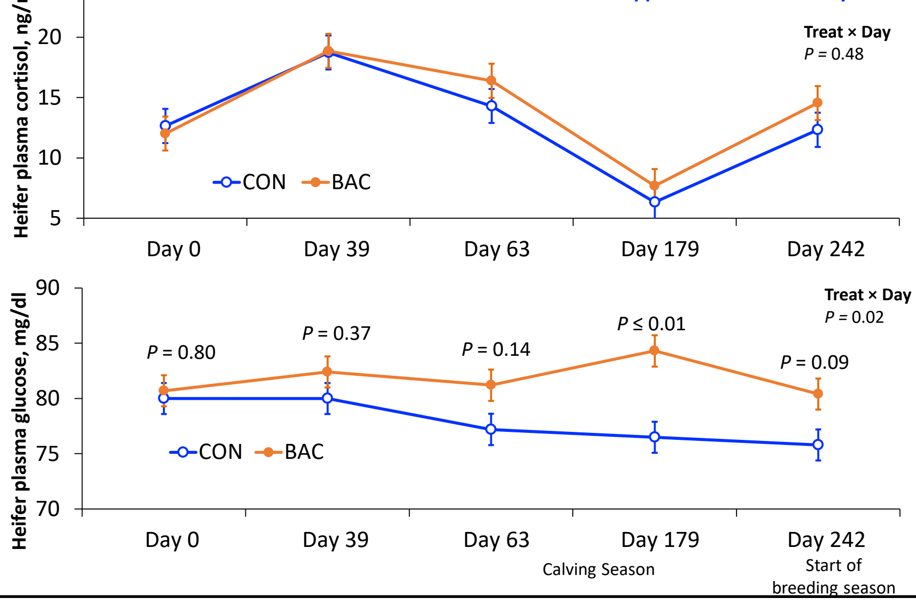
Maternal Blood Data

BAC = 3g of *Bacillus*-based DFM from day 0 to 242
CON = No *Bacillus* supplementation from day 0 to 242



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Offspring Results

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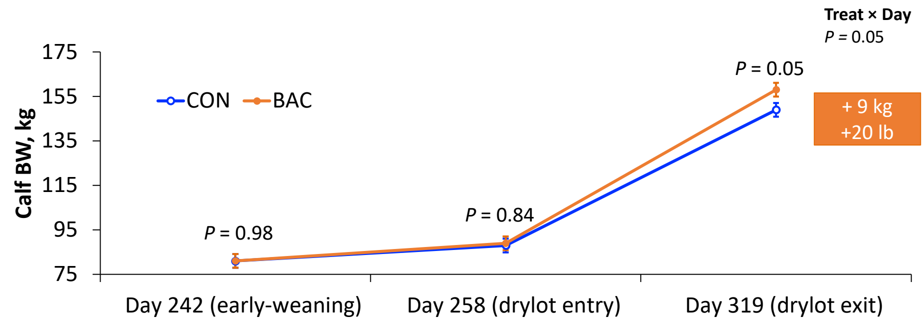
Offspring Performance



	Maternal treatment			*P*-value
	CON	**BAC**	SEM	**Treatment**
Calf ADG, lb/day				
Birth to drylot entry (day 242)	0.97	0.93	0.046	0.61
Drylot entry to exit (day 258 to 319)	2.22	2.44	0.077	0.04
Birth to drylot exit (day 319)	1.50	1.59	0.044	0.19
Total DMI, % of BW	3.24	3.27	0.038	0.73
Gain:Feed	0.25	0.27	0.004	0.05

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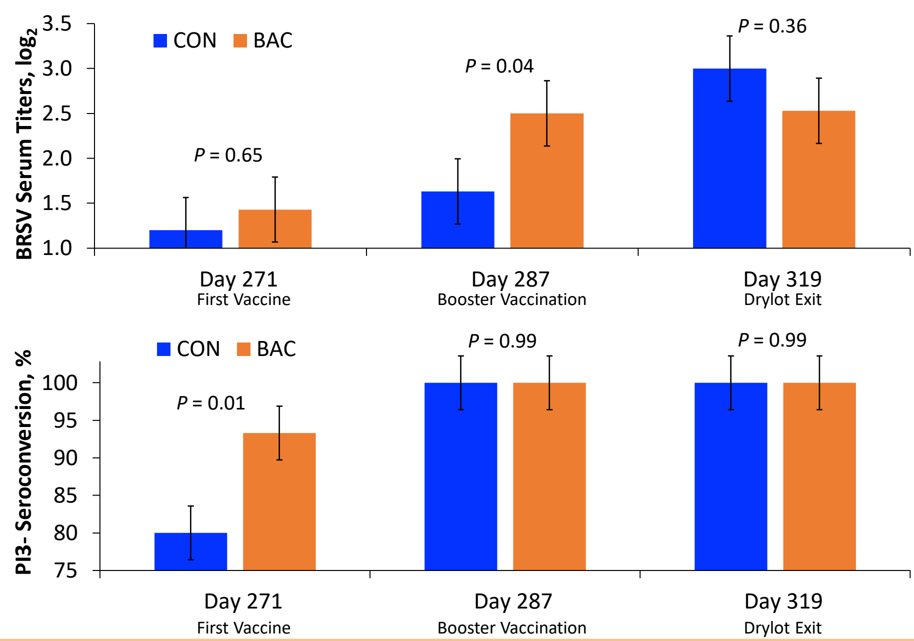
Offspring Performance



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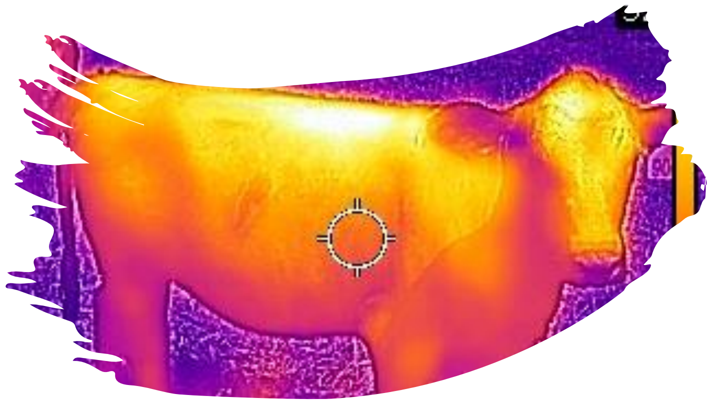

Shifting heifer nutrition to cope with heat stress

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Not pubertal vs. pubertal Brangus heifers at start of breeding season

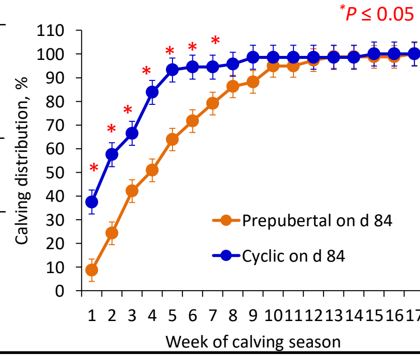
	Puberty status at the start of the breeding season			
Pregnant heifers, % of total	**Prepubertal**	**Pubertal**	**SEM**	***P-value***
Year 1	**33.9**	**78.2**	12.2	0.001
Year 2	**39.4**	**85.0**	6.1	0.005
Average	**36.2**	**81.6**	10.3	<0.0001

Moriel et al. (2020) J. Anim. Sci. https://doi.org/10.1093/jas/skaa236

	Puberty status at the start of the breeding season			
Item	**Prepubertal**	**Pubertal**	**SEM**	**P**
Pregnancy %	**55.4**	**87.4**	11.7	<0.001
Calving %	**51.0**	**72.2**	11.6	0.009

Moriel et al. (2017) J. Anim. Sci. 95:3523–3531 https://doi.org/10.2527/jas.2017.1666

*$P \leq 0.05$



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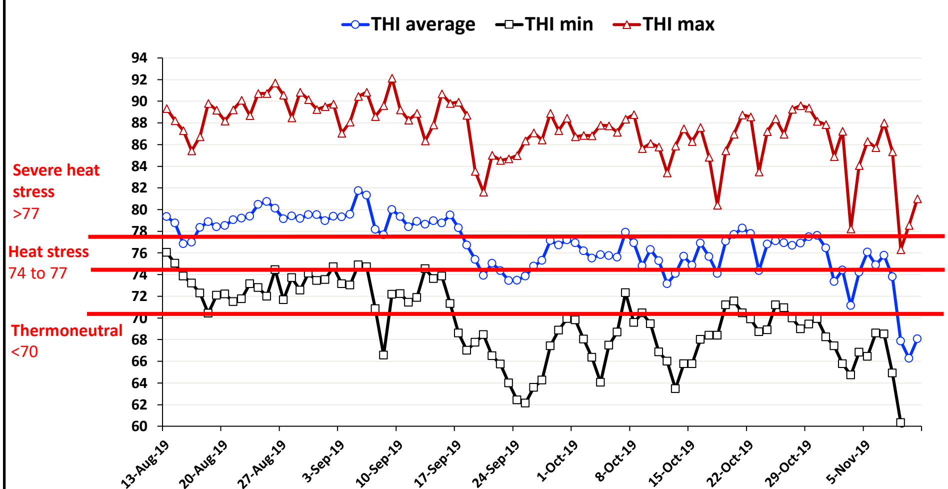
Thermal humidity-index (THI) - Ona 2019



NRC (1971): $THI = (1.8 \times T_{environ.} + 32) - [(0.55 - 0.0055 \times Relative\ Humidity) \times (1.8 \times T_{environ.} - 26)]$.

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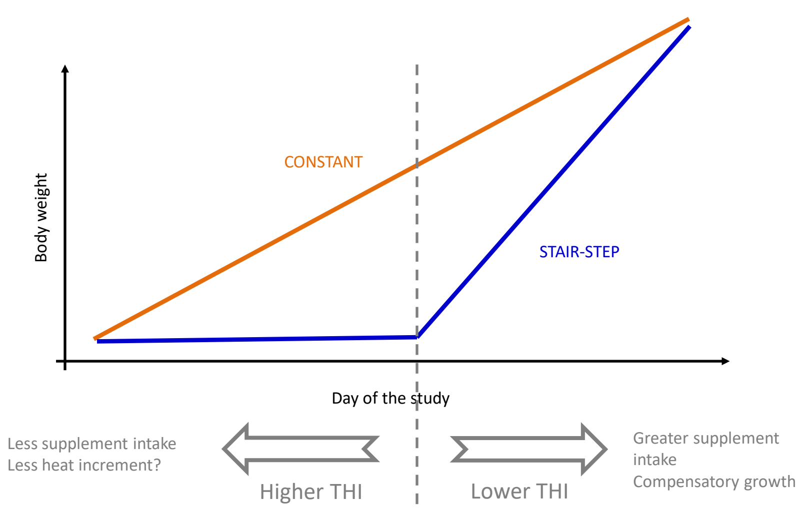
Constant vs. stair-step supplementation



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Boosting reproduction without increasing feed costs of beef heifers in Florida

Funded by Florida Cattlemen Enhancement Board - 2019/2020

Sep. 2019 to June 2020 (Yr 1) and Sep. 2020 to June 2021 (Yr 2)

- 64 Brangus heifers per year assigned to 16 bahiagrass pastures
- Treatments assigned to pastures (6 pastures/treatment/year):

CONTROL = concentrate supplementation at **1.50% of body weight** from September until the start of the estrous synchronization (November; day 0 to 100)

STAIRSTEP = concentrate supplementation at **1.05% of body weight** from Aug. to Sep. (day 0 to 49) + **1.95% of body weight** until the start of the estrous synchr. (day 50 to 100).

After day 100, all heifers were managed similarly:

AI from day 113 to 115; Timed-AI on day 115

Bulls from day 121-211

Concentrate supp. at 1.50% of BW until day 211

Moriel et al. (2022). J. Anim. Sci. 100(4):skac107. doi:10.1093/jas/skac107

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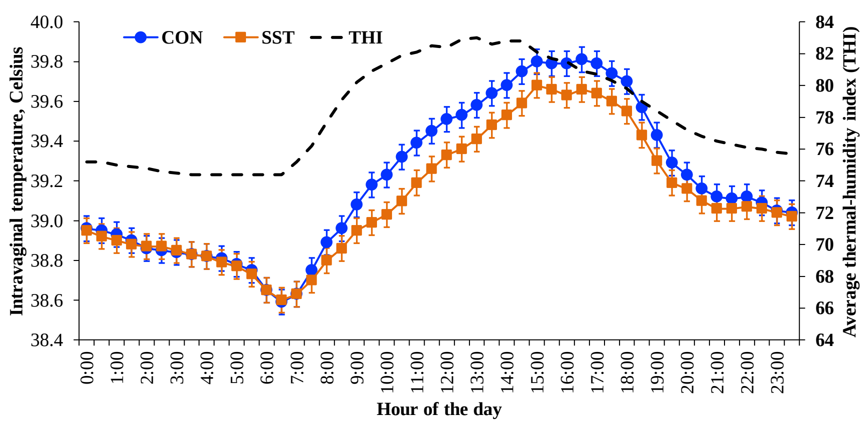
Intravaginal Temperature and Thermal Humidity Index

d 25-31 (Sep 7th to 13th)

CON = Suppl. 1.50% of BW d 0-100
SST = Suppl. 1.05% of BW d 0-49
Suppl. 1.95% of BW d 50-100

	Supplementation strategy			
Item	**CON**	**SST**	**SEM**	***P-value***
ADG, lb/day				
day 0 to 49	1.24	1.17	0.056	0.35
day 49 to 100				
day 0 to 100				



Moriel et al. (2022). J. Anim. Sci. 100(4):skac107. doi:10.1093/jas/skac107

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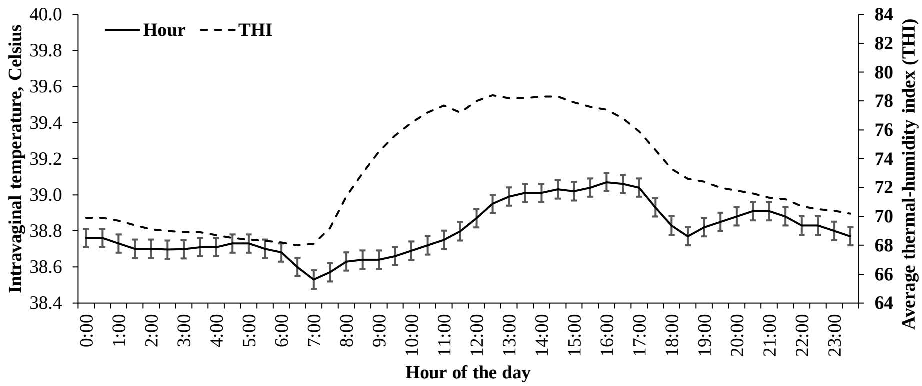
Intravaginal Temperature and Thermal Humidity Index

d 85-91 (Nov 6th to 12th)

CON = Suppl. 1.50% of BW d 0-100
SST = Suppl. 1.05% of BW d 0-49
Suppl. 1.95% of BW d 50-100

Item	CON	SST	SEM	*P-value*
	Supplementation strategy			
ADG, lb/day				
day 0 to 49	1.24	1.17	0.056	0.35
day 49 to 100	1.22	1.61	0.061	<0.001
day 0 to 100	1.23	1.39	0.043	0.01



Moriel et al. (2022). J. Anim. Sci. 100(4):skac107. doi:10.1093/jas/skac107

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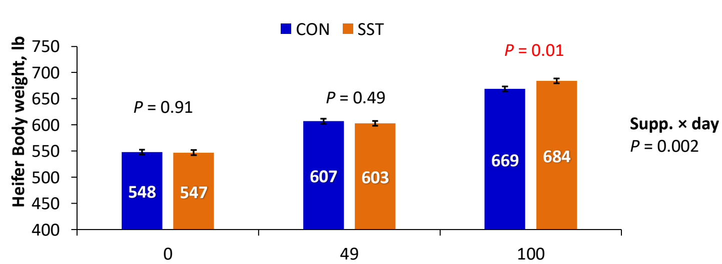
Growth performance and Supplement DM offered

d 0-100 (Aug 13th to Nov 21th)

CON = Suppl. 1.50% of BW d 0-100
SST = Suppl. 1.05% of BW d 0-49
Suppl. 1.95% of BW d 50-100

Item	CON	SST	SEM	*P-value*
	Supplementation strategy			
ADG, lb/day				
day 0 to 49 (Aug to Sep)	1.24	1.17	0.056	0.35
day 49 to 100 (Sep to Nov)	1.22	1.61	0.061	<0.001
day 0 to 100 (Aug to Nov)	1.23	1.39	0.043	0.01
Total supplement DM offered, lb/heifer				
day 0 to 100 (Aug to Nov)	925	933	13.5	0.66



Moriel et al. (2022). J. Anim. Sci. 100(4):skac107. doi:10.1093/jas/skac107

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Reproductive performance

d 100-211 (Nov 21th to Mar 11th)

CON = Suppl. 1.50% of BW d 0-100
SST = Suppl. 1.05% of BW d 0-49
Suppl. 1.95% of BW d 50-100

	Supplementation strategy			
Item	CON	SST	SEM	*P-value*
Pubertal heifers, % of total				
day 91	**69.2**	**66.1**	4.82	0.67
day 101	**73.5**	**75.7**	4.82	0.76
Reproductive tract score, day 101	**4.48**	**4.54**	0.119	0.71
Heifers in estrus, % of total				
day 101 to 105	**28.3**	**28.9**	5.78	0.94
day 113 to 115	**64.9**	**63.9**	5.78	0.90
Pregnant heifers, % of total				
AI (day 154; Dec)	39.1	47.1	6.11	0.36
Final (day 275; Apr)	84.4	94.8	3.62	0.04

Stair-step strategy reduced vaginal temperature during heat stress and improved growth and reproductive performance of heifers, without increasing feed costs

Moriel et al. (2022). J. Anim. Sci. 100(4):skac107. doi:10.1093/jas/skac107

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Gestational heat stress

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Gestational heat stress – Dairy Cattle

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- **Reduced fetal growth and birth weight by 9 lb** (Tao et al., 2019)
- **Reduced weaning weights by 18 lb** (Tao et al., 2019)
  - Remained after 1 year of age (Monteiro et al., 2016ab)
- **Reduced calf postnatal body weight, passive immunity**
  - Reduced apparent efficiency of IgG absorption (Tao et al., 2012b)
  - Reduced cellular immunity and proliferation rate of peripheral blood mononuclear (Tao et al., 2012a)
  - Suggestive of underdeveloped immune organs due to maternal in utero heat stress
- **Reduced milk production of dairy heifers by 8 lb/day during first and second lactations** (Laporta et al., 2018)
  - Transgenerational effects reducing milk yield of the dam's granddaughters (Laporta et al., 2020)

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Gestational heat stress – Dairy Cattle

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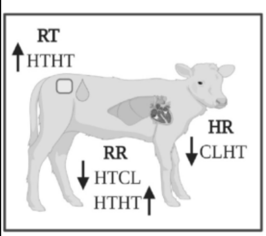
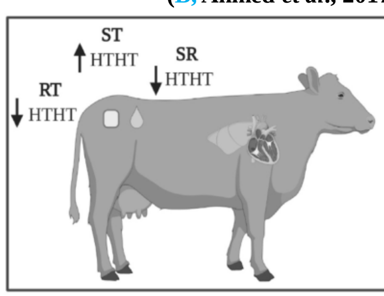
(A, Dado-Senn *et al.*, 2020a)



(B, Ahmed *et al.*, 2017)



Heat stress during late gestation decreased heat tolerance immediately after birth, but increased heat tolerance at maturity by increasing capacity to dissipate heat and maintain core body temperature.

(A) Calves exposed to in-utero heat stress then postnatal heat stress (HTHT) had a higher rectal temperature (RT) and respiration rate (RR). Calves exposed to in-utero cooling then heat stressed postnatally had the lowest heart rate (HR).

(B) Heifers exposed to in-utero heat stress and then heat-stressed during lactation had a lower RT and sweating rate (SR) but a higher skin temperature (ST).

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Impacts of pre- and postpartum heat stress abatement on physiology and performance of grazing Bos indicus-influenced cow-calf pairs

Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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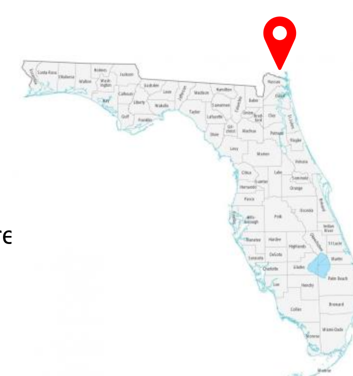
Experimental Design

- Range Cattle Research and Education Center
  - July 2021 to March 2022
- 64 pregnant Brangus heifers (21 months)
  - BW: 1000 ± 81 lb
  - BCS: 6.3 ± 0.28
- 1 of 16 bahiagrass pastures (4 heifers/pasture
- Treatments (8 pastures/treatment)



Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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Experimental Design

Maternal Treatment

July day 0 — August day 58 — November day 133 — January day 203

CALVING SEASON

Early wean

SHADE: ACCESS TO SHADE (3.7m²/Heifer) | ACCESS TO SHADE (3.7m²/Heifer)

NO SHADE: NO ACCESS TO SHADE | ACCESS TO SHADE (3.7m²/Heifer)

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Experimental Design

Offspring Management

January day 209 — March day 268

- 52 Calves (119 ± 19 d of age)
- 1 of 16 drylot pens (3 to 4 calves/pen)
    - Same distribution of the maternal treatment
- Soybean hulls-based diet (3.25% DM of BW)
    - CP: 21.0%
    - NDT: 71.5%

Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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Maternal Results

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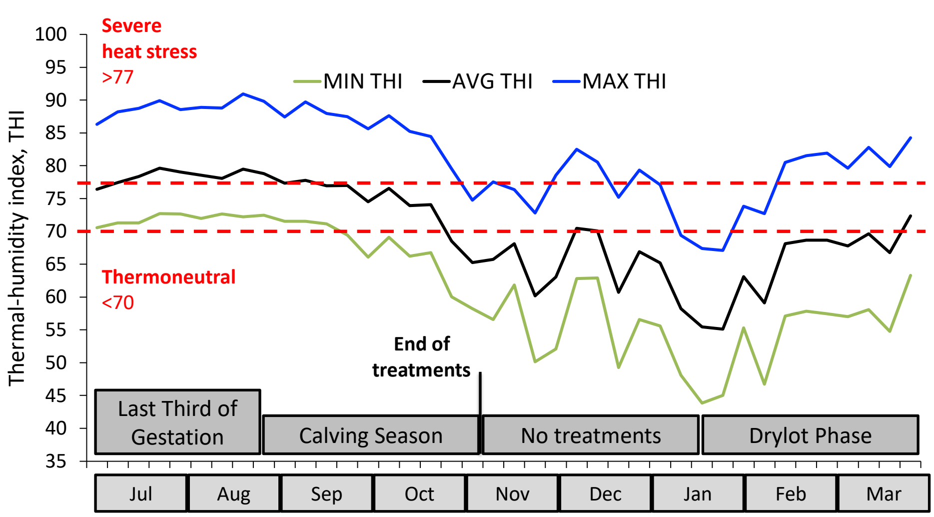
THI



Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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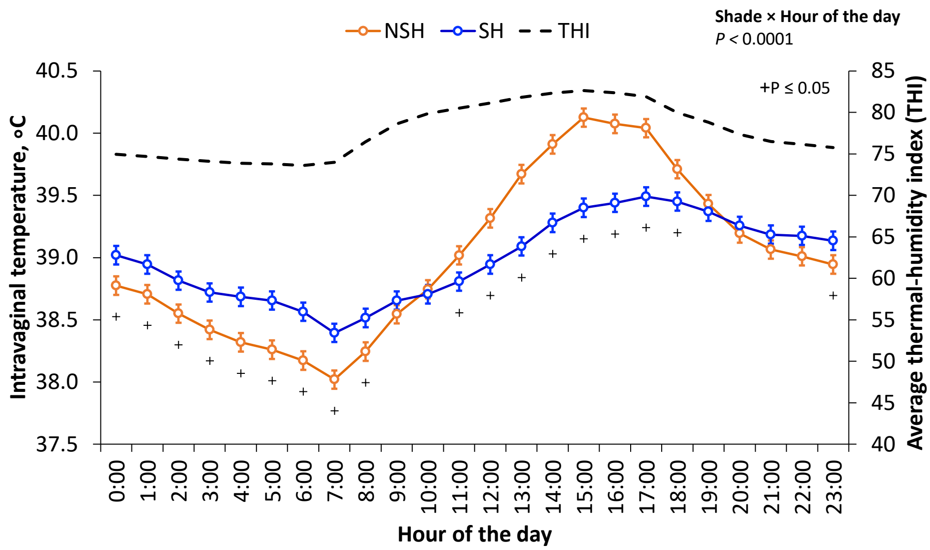
Intravaginal Temperature and Thermal Humidity Index

day 35-41 (Aug 4th to 10th)

Shade = Access to shade from day 0 to 133
No Shade = No access to shade from day 0 to 133



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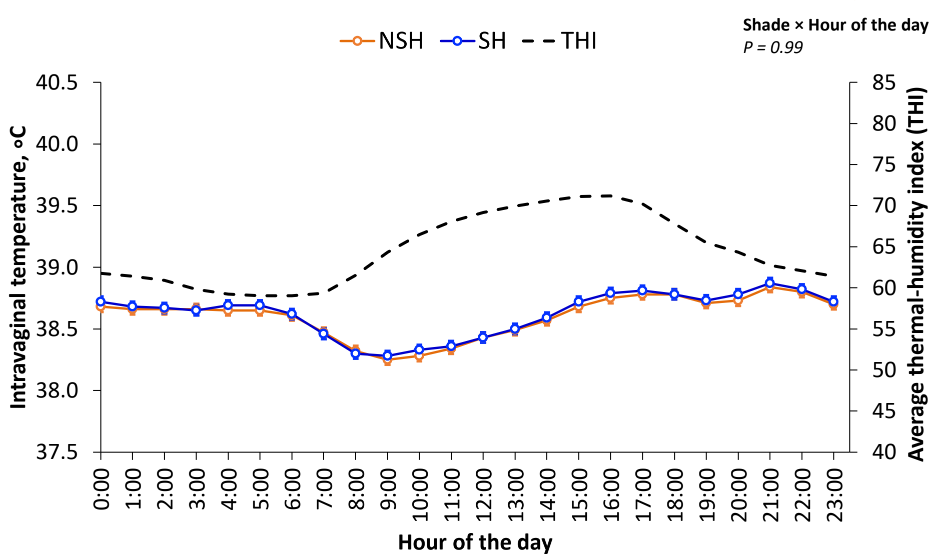
Intravaginal Temperature and Thermal Humidity Index

day 126-132 (Nov 3rd to 9th)

Shade = Access to shade from day 0 to 133
No Shade = No access to shade from day 0 to 133



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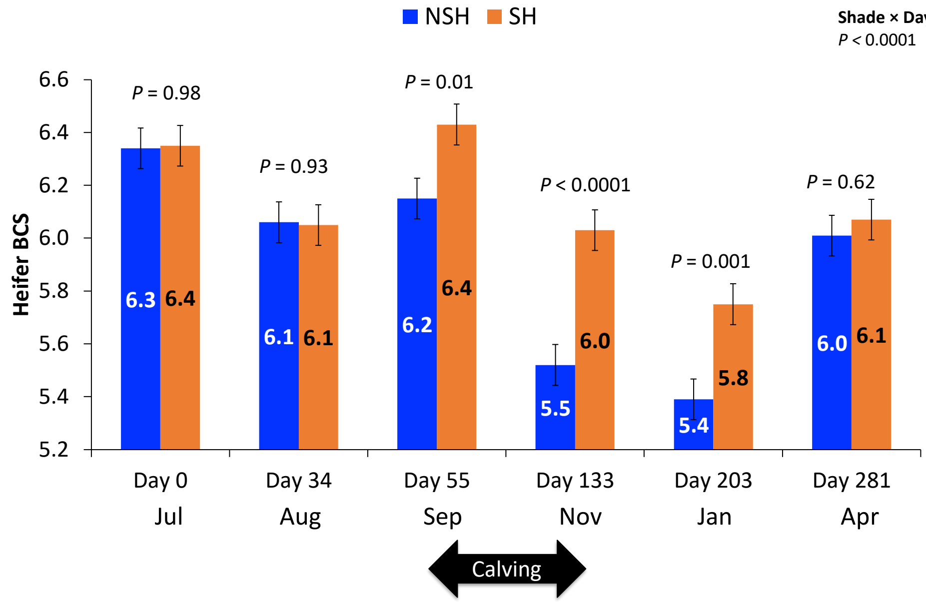
Maternal BCS



Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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Offspring Results

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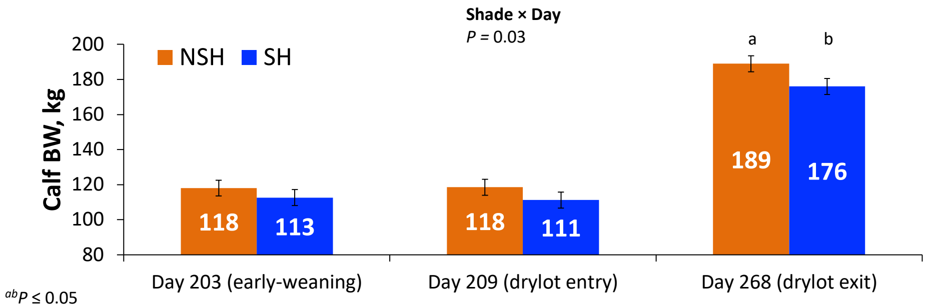
Offspring Performance



	Treatment			P-value
	NSH	SH	SEM	Shade
Calf birth BW, lb	62	66	1.8	0.05
Calves born alive, % of total	97	100	2.6	0.40
Calf ADG, lb/day				
Birth to early-weaning (day 203)	1.59	1.61	0.074	0.80
Drylot entry to exit (day 209-268)	2.60	2.40	0.079	0.07
Birth to drylot exit (day 268)	1.85	1.78	0.057	0.39

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Offspring Plasma Analyses

	Maternal treatment			P-value	
Item	**NSH**	**SH**	**SEM**	**Shade**	**Shade × day**
Plasma cortisol, ug/dL	2.43	2.42	0.149	0.93	0.15
Plasma Hp, mg/mL	0.405	0.468	0.0235	0.06	0.80

	Maternal treatment				P-value	
Item	**NSH**	**SH**	**SEM**	*P*-value	**Shade**	**Shade × day**
BRSV						
Seroconversion, % of total						
Day 222	77	50	8.57	0.02	0.23	0.01
Day 236	69	50	8.57	0.10		
Day 268	80	96	8.57	0.19		
Serum titers, log2						
Day 222	2.00	1.31	0.285	0.08	0.26	0.09
Day 236	1.85	1.27	0.285	0.15		
Day 268	2.69	3.00	0.291	0.44		

Izquierdo et al. (2023) J. Anim. Sci. 101:skad250. doi:10.1093/jas/skad250

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USDA Study – Combining heat stress mitigation strategies during pre- and postnatal phases: Impacts on cow and heifer offspring performance

320 Brangus, pregnant mature beef cows on bahiagrass pastures

Treatments (2 x 2 factorial design): Applied during gestation and then heifer development

(1) No heat abatement (CONTROL) = No access to artificial shade

(2) Heat abatement strategy (HAST) = Unlimited access to artificial shade (40 sq ft per animal)

July Calf weaning → **November** Calving → **March** End of cow breeding season → **July** Calf weaning at 8-9 mo of age → **November** Heifer estrus synchronization

Cow Gestational Treatments			Heifer Post-weaning
CONTROL *4 pastures per year ; 10 cows per pasture*	Bahiagrass grazing + 2.3 kg/day molasses	Bahiagrass grazing + no concentrate	CONTROL *4 pastures per year ; 4-5 heifers per pasture*
CONTROL *4 pastures per year ; 10 cows per pasture*	Bahiagrass grazing + 2.3 kg/day molasses	Bahiagrass grazing + no concentrate	HEAT STRESS ABATEMENT *4 pastures per year ; 4-5 heifers per pasture*
HEAT STRESS ABATEMENT *4 pastures per year ; 10 cows per pasture*	Bahiagrass grazing + 2.3 kg/day molasses	Bahiagrass grazing + no concentrate	CONTROL *4 pastures per year ; 4-5 heifers per pasture*
HEAT STRESS ABATEMENT *4 pastures per year ; 10 cows per pasture*	Bahiagrass grazing + 2.3 kg/day molasses	Bahiagrass grazing + no concentrate	HEAT STRESS ABATEMENT *4 pastures per year ; 4-5 heifers per pasture*

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Thank you

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