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Range Cattle REC
Beef Cattle Nutrition
Program Highlights

May 9th, 2017

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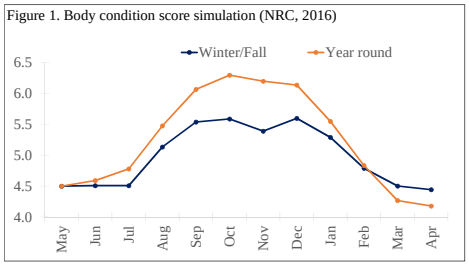
Topics covered in this webinar

- ✓ Florida Cattlemen's Association
  - ✓ 2017 studies
- ✓ Preconditioning studies
  - ✓ Gradual reduction of supplementation frequency
  - ✓ Supplementation frequency and timing of vaccination

2016 Florida Cattlemen's Proposal #1

Can we modulate the future health of beef steers and reproductive performance of beef heifers by improving the plane of nutrition and trace mineral status of their dams during gestation?

Figure 1. Body condition score simulation (NRC, 2016)

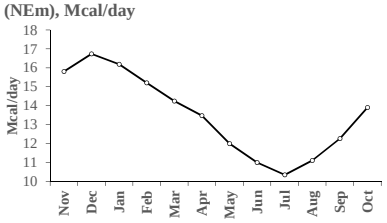


Treatments	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
	lb of dry matter/cow daily											
Year-round Molasses supp.	0.5	0.5	0.5	1.5	1.5	1.5	2.5	2.5	2.5	2.5	2.5	1.5
Fall/Winter supp.							3.3	3.3	3.3	3.3	3.3	3.3

2016 Florida Cattlemen's Proposal #2

Evaluating cost-effective supplementation programs for cows during late-gestation

Figure 1. Total daily energy requirements (NEm), Mcal/day



Treatments	May	Jun	Jul	Aug	Sep	Oct	Nov
	lb of dry matter/cow daily						
No supplementation				0	0	0	
Supp. 90 days				1	1	1	
Supp. 30 days				3	0	0	

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BOVINE RESPIRATORY DISEASE (BRD)

- ✓ $ 800 to 900 million Losses annually
  (Chirase and Greene, 2001; Anim. Feed Sci 93:217-228)
- ✓ In US feedlots
  - ✓ 70 to 80 % of all feedlot morbidity
  - ✓ 40 to 50 % of all mortality
  - ✓ 16.2% of all feedlot cattle are treated for BRD

2011 USDA's National Animal Health Monitoring System (NAHMS)

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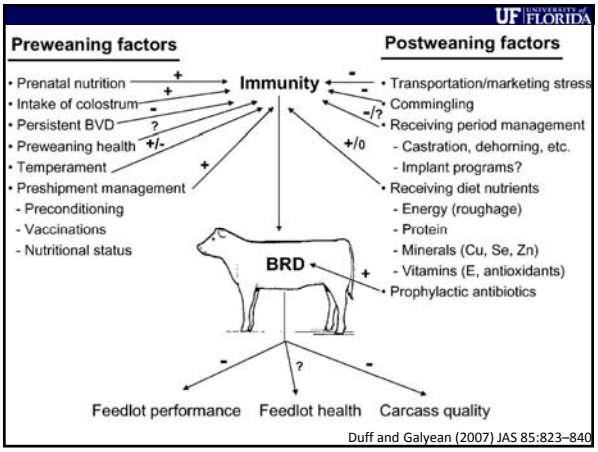

Duff and Galyean (2007) JAS 85:823–840

Preconditioning (PC)

Source: phertzler.wordpress.com

- Eating and drinking water in troughs
- Feeding concentrate
- Vaccination

Source: cattlenetwork.com

Reduce stress
Enhance growth
Promote health

(Thrift and Thrift, 2011. Prof. Anim. Sci. 27:73)

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Frequency of concentrate supplementation during preconditioning

- Major concern: Feeding costs and labor
- Concentrate supplementation
  - 3 vs. 7 days per week

	Mon	Tue	Wed	Thru	Fri	Sat	Sun	TOTAL
	---------- *Concentrate offer* ----------							
Supp. 7x	3 lb	3 lb	3 lb	3 lb	3 lb	3 lb	3 lb	21 lb
Supp. 3x	7 lb		7 lb		7 lb			21 lb

Project #2014-1885
"The effects of frequency of energy supplementation during preconditioning on growth and immunity of beef steers"
Role: PI Period: 1/1/2014 to 12/31/2014
Agency: NC Cattlemen's Association Amount: $6,888
Agency: Zoetis Animal Health Amount: $5,000

Artioli et al. (2015). J. Anim. Sci. doi: 10.2527/jas2015-9457

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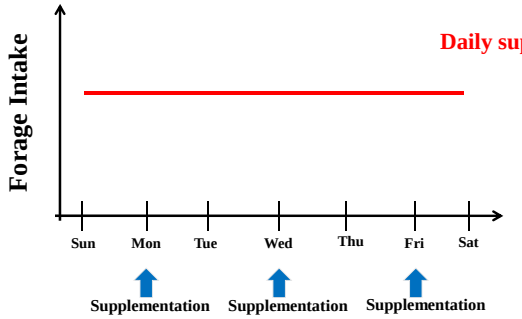
Frequency of concentrate supplementation during preconditioning



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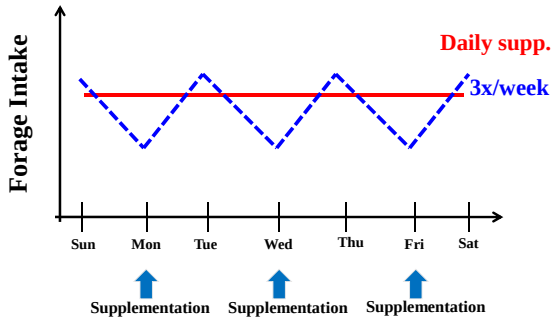

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Frequency of concentrate supplementation

Item	Supp 7x/wk	Supp 3x/wk	SEM	*P-value*
Initial weight (d 0), lb	480	480	15	0.94
Final weight (d 42), lb	601	575	18	0.34
ADG, lb/day	**2.86**	**2.27**	**0.15**	**0.01**
Total dry matter intake, lb	419	366	18	0.02
Feed:Gain	3.48	3.84	0.11	0.09

Artioli et al. (2015). J. Anim. Sci. doi: 10.2527/jas2015-9457

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Frequency of concentrate supplementation

Item	Supp 7x/wk	Supp 3x/wk
ADG, lb/day	2.86	2.27
Body weight gain, lb	121	95
Feed cost, $/calf	$ 30.80	$ 26.83
Labor cost, $/calf	$ 6.00	$ 3.00
Vaccine cost, $/calf	$ 9.00	$ 9.00
Total cost, $/calf	**$ 46**	**$ 39**
Income, calf gain @$1.30/kg	$ 157	$ 124
Return, $/calf	**$ 111**	**$ 85**

*$P \leq 0.05$

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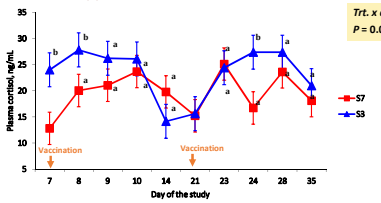
Frequency of concentrate supplementation



Item	Treatments S7	Treatments S3	SEM	*P*-value
Bovine viral diarrhea virus type 1b				
Seroconversion, %				Trt. x day
d 21	12.8[a]	20.5[a]	8.81	0.06
d 42	100.0[b]	78.8[a]		
				Treatment
Mean titers, log_2	2.51	1.46	0.306	0.03

[a,b] Within day, means without a common superscript differ ($P \leq 0.05$)

Artioli et al. (2015) J. Anim. Sci. doi: 10.2527/jas2015-9457

Study 1 – Gradually reducing the supplementation frequency

Objective

Evaluate growth performance and measurements of innate and humoral immunity of beef calves offered different supplementation frequencies during a 42-day preconditioning period.

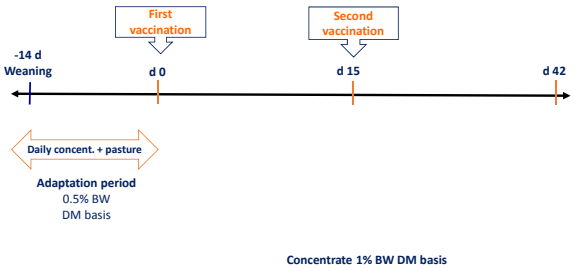
Study 1 – Gradually reducing the supplementation frequency

Mountain Research Station (Waynesville, NC)

- May to July 2016
- Angus steers
  - n = 42; 440 ± 11 lb of BW; 175 ± 4 d of age
- 1 of 14 drylot pens (3 steers/pen)

From day 0 to 42

- Ground tall fescue hay (**57% TDN, 13% CP** of DM basis)
- Concentrate 1% BW **(71% TDN, 15% CP of DM; DM basis)**
  50:50 soybean hulls and Corn Gluten Feed



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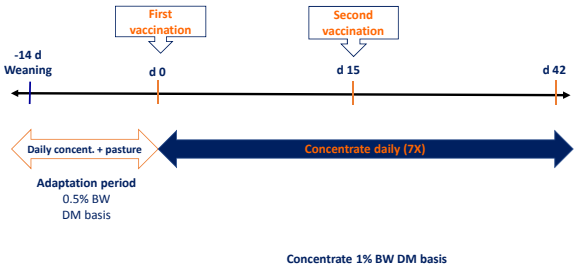

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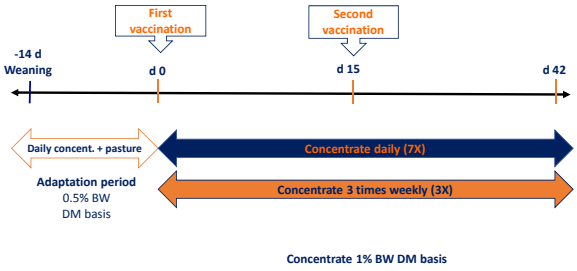

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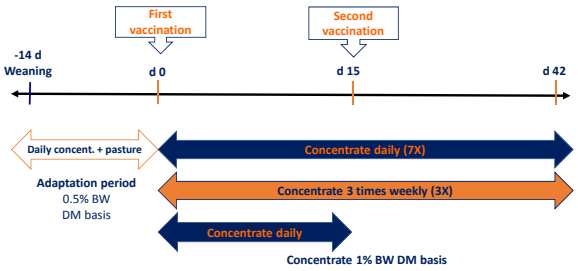

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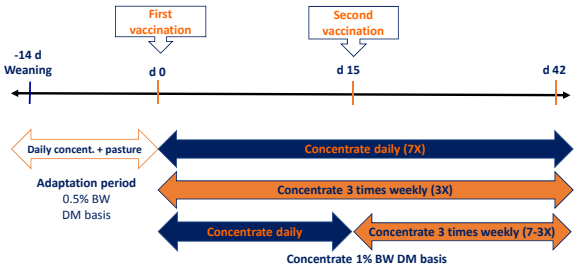

Body Weight and ADG

Item	Treatment 3X	7-3X	7X	SEM	*P*-value Frequency
Body weight[1], lb					
day 15	493	502	507	5.5	0.59
day 42	509	522	520		
ADG, lb/day					
day 0 to 15	4.16	4.63	4.60	0.262	0.36
day 15 to 42	0.73	0.88	0.59	0.126	0.28
day 0 to 42	1.87	2.11	1.96	0.028	0.44

[1]Least squares means covariate-adjusted to BW on d 0 ($P < 0.0001$)

Innate immunity

Freq. x day $P = 0.57$

Item	Treatment 3X	7-3X	7X	SEM	*P*-value Freq.
Plasma cortisol, ng/mL	20.6[x]	19.2[xy]	15.7[y]	1.68	0.10
Plasma haptoglobin, mg/dL	0.44[a]	0.37[b]	0.37[b]	0.026	0.04

[a-b] Within a row, means without a common superscript differ ($P \leq 0.05$)
[x-y] Within a row, means without a common superscript differ ($P > 0.05$ and ≤ 0.10)

Humoral immunity

Item	Treatment 3X	7-3X	7X	SEM	*P*-value Freq.	Day	Freq. × day
Parainfluenza-3 virus							
Serum titers, log_2	3.54	4.46	3.66	0.606	0.52	<0.0001	0.81
Seroconversion [2], %							
d 15	36.0[a]	76.6[b]	57.0[b]	8.24	0.09	<0.0001	0.04
d 42	100.0[a]	98.0[a]	98.9[a]				
Infectious bovine rhinotracheitis virus							
Serum titers, log_2	0.29[a]	0.88[b]	0.79[b]	0.179	0.05	<0.0001	0.24
Seroconversion, %	22.2	33.1	30.6	8.51	0.60	<0.0001	0.76

[a-b] Within a row, means without a common superscript differ ($P \leq 0.05$)

Study 1 - Conclusion

A gradual reduction in frequency of energy supplementation during a 42-day preconditioning period:

- Did not reduce growth
- Alleviated inflammation and stress
- Prevented detrimental effects on vaccine response against respiratory disease pathogens compared to steers fed 3 times weekly during the entire study.

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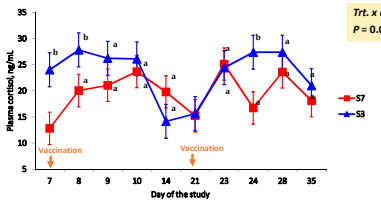
Frequency of concentrate supplementation



Item	Treatments S7	S3	SEM	*P*-value
Bovine viral diarrhea virus type 1b				
Seroconversion, %				Trt. x day
d 21	12.8[a]	20.5[a]	8.81	0.06
d 42	100.0[b]	78.8[a]		
				Treatment
Mean titers, log_2	2.51	1.46	0.306	0.03

[a,b] Within day, means without a common superscript differ ($P \leq 0.05$)

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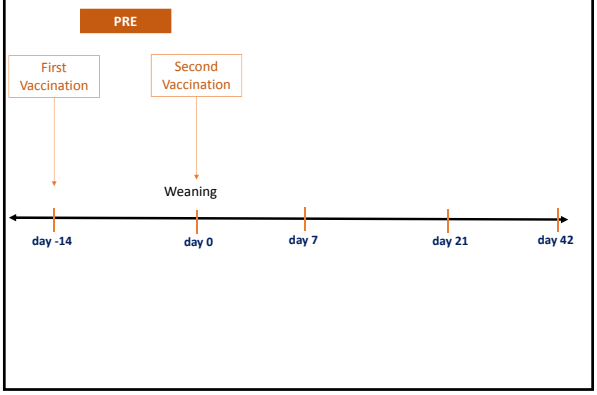
Study 2 – Timing of vaccination & frequency of supplementation

Objective

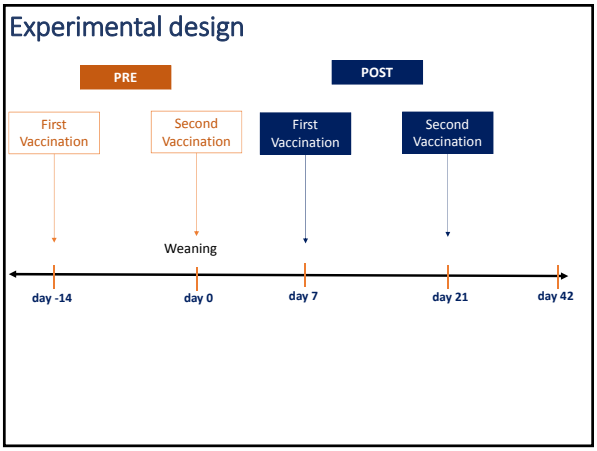
Evaluate the impact of **pre**- vs. **post**-weaning vaccination and different post-weaning frequency of energy supplementation (**daily** vs. **3x weekly**) on growth and immunity of beef calves.

Experimental design

Experimental design



Experimental design



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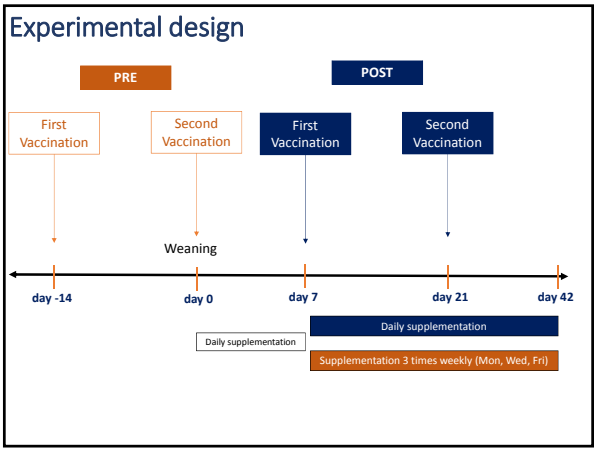

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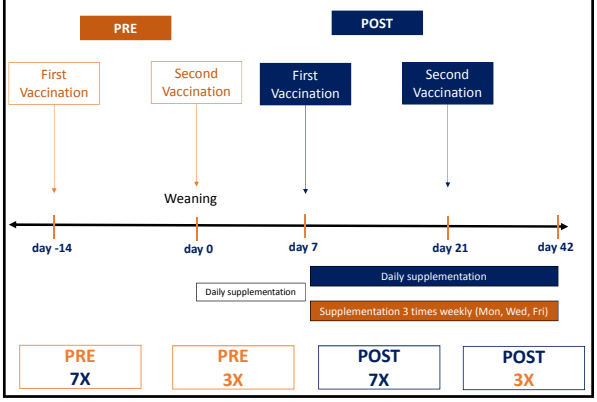
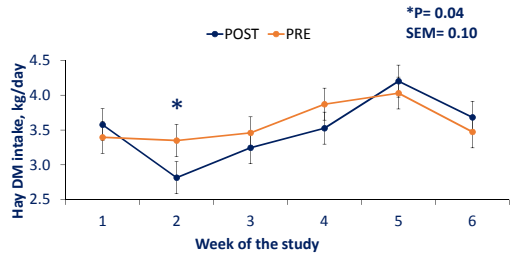


Hay Dry Matter Intake



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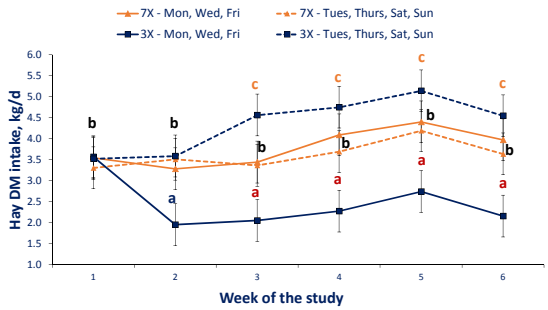


Growth Performance

Item	Timing of vaccination POST	PRE	SEM	P-value VAC	Supplementation frequency 3X	7X	SEM	P-value FREQ	P-value VAC x FREQ
ADG, lb/day									
day -14 to 0									0.12
day 0 to 7									0.49
day 7 to 21									0.15
day 21 to 42									0.17
day 0 to 42									0.69
day -14 to 42									0.04

Growth Performance

Item	Timing of vaccination POST	PRE	SEM	P-value VAC	Supplementation frequency 3X	7X	SEM	P-value FREQ	P-value VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03					0.12
day 0 to 7									0.49
day 7 to 21									0.15
day 21 to 42									0.17
day 0 to 42									0.69
day -14 to 42									0.04

Growth Performance

Item	Timing of vaccination POST	PRE	SEM	P-value VAC	Supplementation frequency 3X	7X	SEM	P-value FREQ	P-value VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03					0.12
day 0 to 7									0.49
day 7 to 21									0.15
day 21 to 42									0.17
day 0 to 42	1.61	1.59	0.088	0.90					0.69
day -14 to 42									0.04

Growth Performance

	Timing of vaccination			P-value	Supplementation frequency			P-value	P-value
Item	POST	PRE	SEM	VAC	3X	7X	SEM	FREQ	VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03					0.12
day 0 to 7	6.24	6.47	0.388	0.70					0.49
day 7 to 21	1.10	1.53	0.176	0.10					0.15
day 21 to 42	0.39	0.01	0.108	0.03					0.17
day 0 to 42	1.61	1.59	0.088	0.90					0.69
day -14 to 42									0.04

Growth Performance

	Timing of vaccination			P-value	Supplementation frequency			P-value	P-value
Item	POST	PRE	SEM	VAC	3X	7X	SEM	FREQ	VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03	1.63	1.22	0.216	0.21	0.12
day 0 to 7	6.24	6.47	0.388	0.70	6.00	6.70	0.397	0.24	0.49
day 7 to 21	1.10	1.53	0.176	0.10	1.21	1.42	0.179	0.43	0.15
day 21 to 42	0.39	0.01	0.108	0.03	0.20	0.19	0.111	0.97	0.17
day 0 to 42	1.61	1.59	0.088	0.90	1.50	1.70	0.039	0.10	0.69
day -14 to 42									0.04

Growth Performance

	Timing of vaccination			P-value	Supplementation frequency			P-value	P-value
Item	POST	PRE	SEM	VAC	3X	7X	SEM	FREQ	VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03	1.63	1.22	0.216	0.21	0.12
day 0 to 7	6.24	6.47	0.388	0.70	6.00	6.70	0.397	0.24	0.49
day 7 to 21	1.10	1.53	0.176	0.10	1.21	1.42	0.179	0.43	0.15
day 21 to 42	0.39	0.01	0.108	0.03	0.20	0.19	0.111	0.97	0.17
day 0 to 42	1.61	1.59	0.088	0.90	1.50	1.70	0.039	0.10	0.69
day -14 to 42	1.62	1.43	0.067	0.04	1.51	1.54	0.061	0.71	0.04

Growth Performance

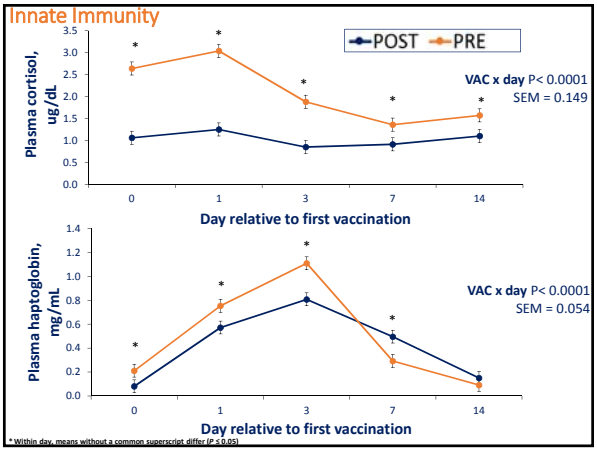
	Timing of vaccination			P-value	Supplementation frequency			P-value	P-value
Item	POST	PRE	SEM	VAC	3X	7X	SEM	FREQ	VAC x FREQ
ADG, lb/day									
day -14 to 0	1.79	1.06	0.212	0.03	1.63	1.22	0.216	0.21	0.12
day 0 to 7	6.24	6.47	0.388	0.70	6.00	6.70	0.397	0.24	0.49
day 7 to 21	1.10	1.53	0.176	0.10	1.21	1.42	0.179	0.43	0.15
day 21 to 42	0.39	0.01	0.108	0.03	0.20	0.19	0.111	0.97	0.17
day 0 to 42	1.61	1.59	0.088	0.90	1.50	1.70	0.039	0.10	0.69
day -14 to 42	1.62	1.43	0.067	0.04	1.51	1.54	0.061	0.71	0.04

ADG day -14 to 42, lb/d

PRE-3X	1.33[a]	
PRE-7X	1.54[b]	± 0.086
POS-3X	1.71[b]	
POS-7X	1.55[b]	

*,b Within day, means without a common superscript differ ($P \leq 0.05$)

Innate Immunity



* Within day, means without a common superscript differ ($P \leq 0.05$)

Overall Plasma Cortisol and Haptoglobin

	Supplementation frequency			P-value
Item	3X	7X	SEM	Frequency
Cortisol, ug/dL	1.67	1.46	0.087	0.10
Haptoglobin, mg/mL	0.49	0.43	0.031	0.17

Humoral Immunity – *Parainfluenza 3 virus*

	Day of sample collection				
	First vaccination	Second vaccination	End of study	SEM	P-value
Serum PI-3 titers, log2					**FREQ x day**
3X	0.00	0.63	4.94	0.269	0.09
7X	0.01	0.61	5.91	0.269	
P-value	0.98	0.97	0.01		

Humoral Immunity – *Parainfluenza virus 3*

	Day of sample collection				
	First vaccination	Second vaccination	End of study	SEM	P-value
Serum PI-3 titers, log2					**FREQ x day**
3X	0.00	0.63	4.94	0.269	0.09
7X	0.01	0.61	5.91	0.269	
P-value	0.98	0.97	0.01		
					VAC x day
PRE	0.00	0.61	4.54	0.269	0.0007
POST	0.10	0.63	6.31	0.269	
P-value	0.98	0.97	<0.0001		

Humoral Immunity - *Bovine Viral Diarrhea Virus 1-b*

	Supp. Frequency			P-value	Timing of vaccination			P-value
	3X	7X	SEM	Freq.	PRE	POST	SEM	Vac. Timing
Serum titers								
BVDV-1, log2	2.41	2.65	0.11	0.10	2.56	2.49	0.11	0.68

Study 2 Conclusion

- Pre-weaning vaccination associated with reduced post-weaning frequency of supplementation caused the least overall calf growth performance.
- Post-weaning vaccination and daily concentrate supplementation alleviated inflammatory response and improved humoral immune response compared to pre-weaning vaccination and reduced post-weaning supplementation frequency.

Overall Conclusions

Study 1: A gradual reduction on frequency of energy supplementation, during a 42-d preconditioning period:

- Did not impact growth
- Alleviated inflammation
- Prevented detrimental effects on vaccine response against respiratory disease pathogens compared to steers fed 3 times weekly during the entire study.

Study 2: Pre-weaning vaccination associated with reduced post-weaning frequency of supplementation

- caused the least overall calf growth performance.
- Post-weaning vaccination and daily concentrate supplementation alleviated inflammatory response and improved humoral immune response

Thank you

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