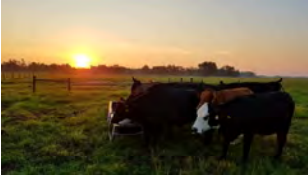


UF UNIVERSITY OF FLORIDA

Fetal Programming studies in Florida

Ona Webinar
Tuesday, October 8th, 2019



Philippe Moriel - Assistant Professor
Range Cattle Research & Education Center - University of Florida, Ona, FL

BCS at calving vs. Pregnancy Rate, %





Photo Source: Dr. Matt Hersom and John Arthington

	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


^{abc}P < 0.05



BCS at calving vs. days to show estrus

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

^{abc}P < 0.05

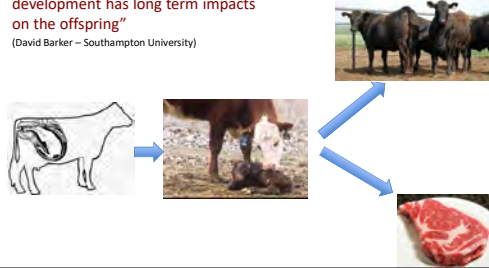


Houghton et al. (1990) JAS 68:1438

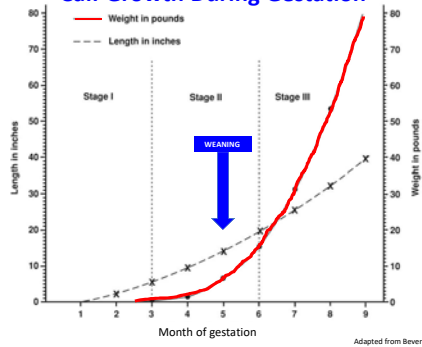
Fetal Programming?

“Maternal stimuli or insult at a critical period in fetal development has long term impacts on the offspring”

(David Barker – Southampton University)

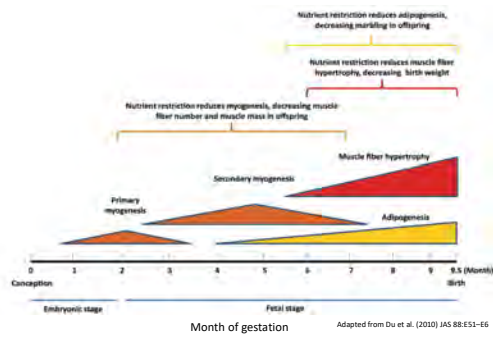


Calf Growth During Gestation



Adapted from Beverly (2008)

Calf Growth Timeline



Adapted from Du et al. (2010) JAS 88:451-66

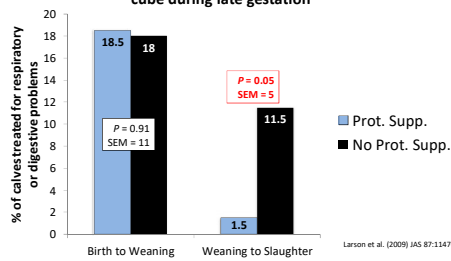
Growth performance of STEERS born to cows receiving no supplementation (No Supp.) or 1 Lb/day of 42% crude protein cube during late gestation

	Stalker et al. (2007)		Stalker et al. (2006)		Larson et al. (2009)	
	No Supp.	Supp.	No Supp.	Supp.	No Supp.	Supp.
Weaning weight, Lb	441*	463*	465*	480*	518*	531*
Carcass weight, Lb	764*	804*	800	813	802*	819*
Choice, %	-	-	85	96	71*	86*
Marbling	449	461	467	479	444*	493*

*P < 0.05

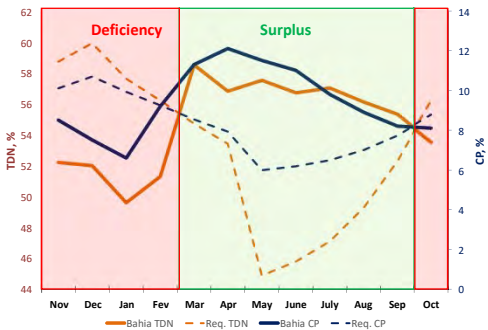
Stalker et al. (2006) JAS 84:2582-2589
Stalker et al. (2007) Range, Ecol. Manage. 165:795-807
Larson et al. (2009) JAS 87:1147-1155

Immune response of STEERS born to cows receiving no supplementation (No Supp.) or 1 Lb/day of 42% crude protein cube during late gestation



Larson et al. (2009) JAS 87:1147-1155

Nutrient Requirements of a mature beef cow (1100 lb) producing 16 lb/d of milk



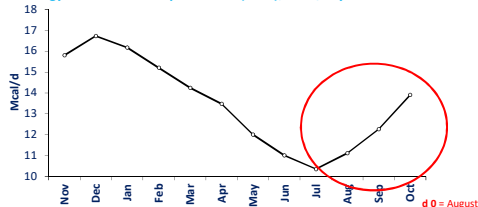
**Range Cattle REC - Fetal Programming Studies
2017 / 2018 / 2019**

**Study #1 - Effects of timing of prepartum supplementation
on cow and calf performance**

**Studies #2 - Prepartum supplementation with or without
methionine fortification**

Studies #3 – Year-round supplementation

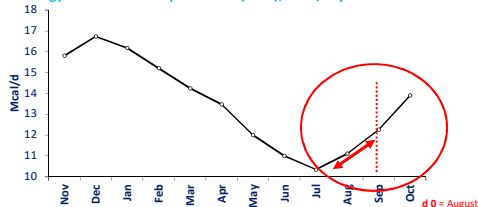
Net energy maintenance requirements (NEM), Mcal/day



Supplementation offered to cows:
Pre-calving (d 0 to 84) = dried distillers grains (DDG)
Post-calving (d 84 to end of the breeding season) = Sugarcane molasses + urea

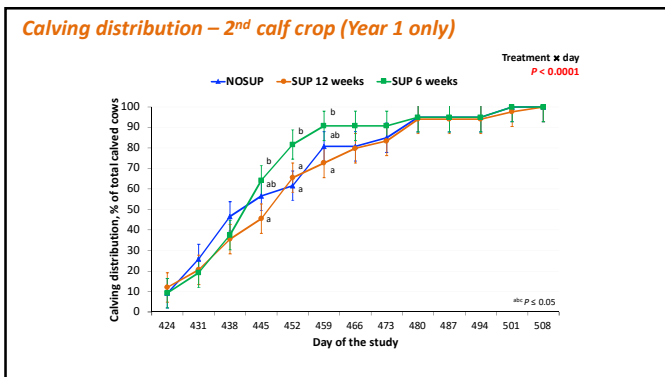
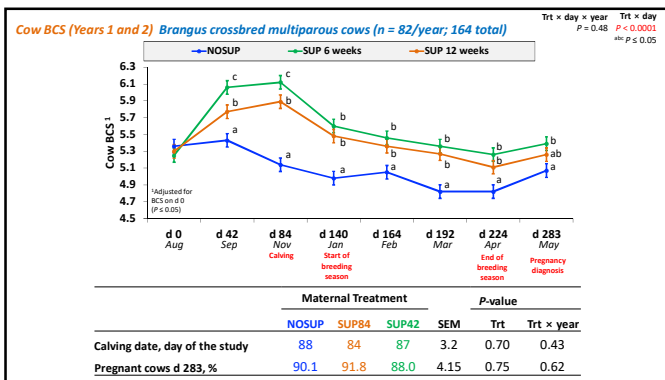
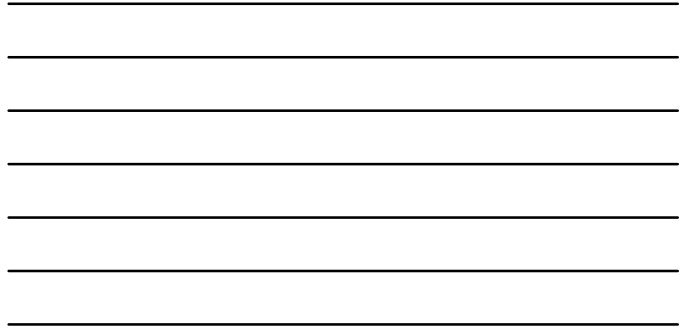
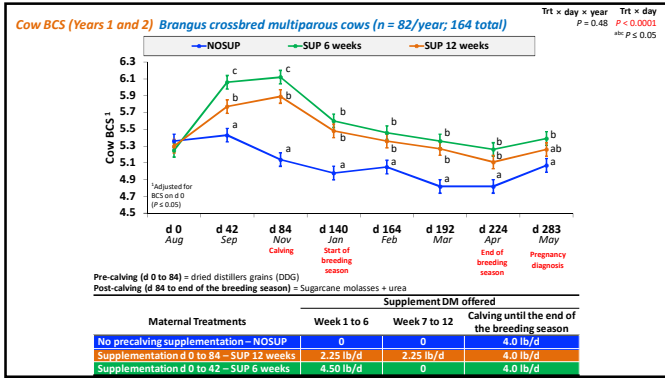
Maternal Treatments	Supplement DM offered		
	d 0 to 42	d 42 to 84	d 84 until the end of the breeding season
No precalving supplementation – NOSUPP	0	0	4.0 lb/d
Supplementation d 0 to 84 – SUP 12 weeks	2.25 lb/d	2.25 lb/d	4.0 lb/d

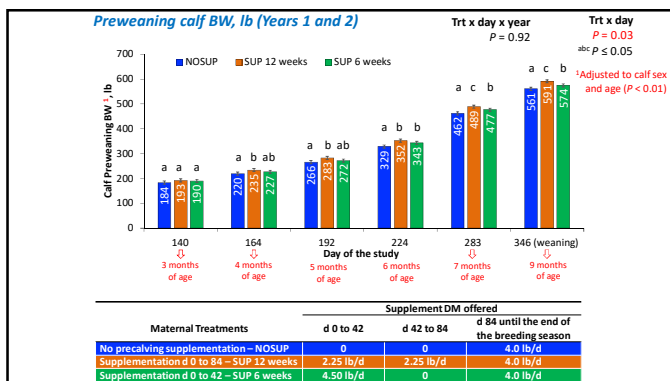
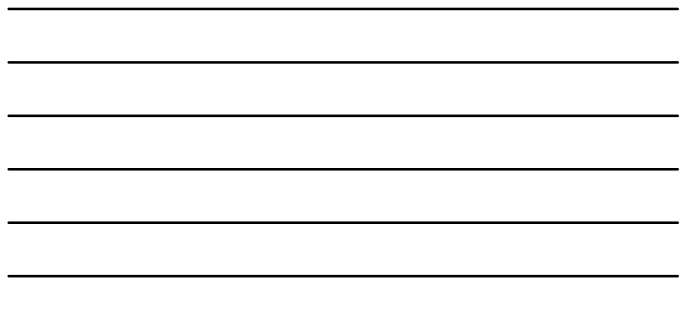
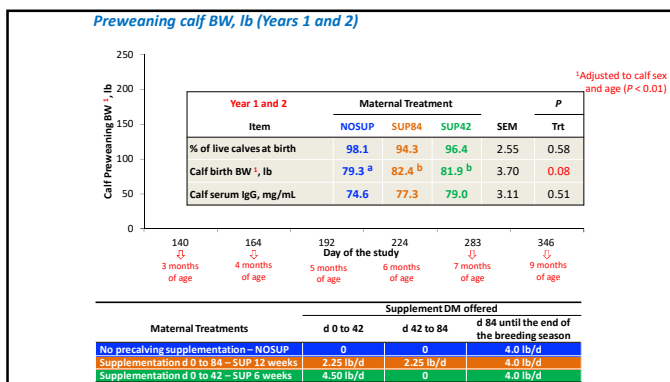
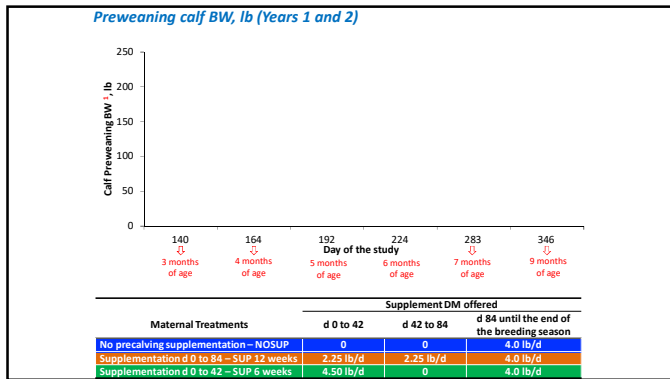
Net energy maintenance requirements (NEM), Mcal/day

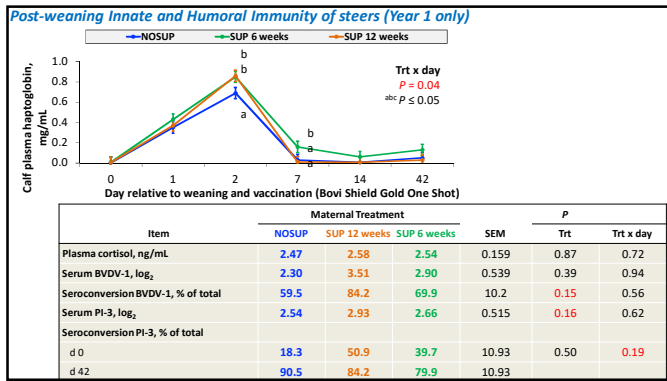


Supplementation offered to cows:
Pre-calving (d 0 to 84) = dried distillers grains (DDG)
Post-calving (d 84 to end of the breeding season) = Sugarcane molasses + urea

Maternal Treatments	Supplement DM offered		
	Week 1 to 6	Week 7 to 12	Calving until the end of the breeding season
No precalving supplementation – NOSUPP	0	0	4.0 lb/d
Supplementation d 0 to 84 – SUP 12 weeks	2.25 lb/d	2.25 lb/d	4.0 lb/d
Supplementation d 0 to 42 – SUP 6 weeks	4.50 lb/d	0	4.0 lb/d







Post-weaning feedlot performance of steers (year 1 only)

Feedlot performance	NO SUP	SUP 12 weeks	SUP 6 weeks	SEM	P-value	Contrast 'NOSUP vs. SUP'
Dry matter intake, lb/d						
Growing	14.5	14.4	14.4	0.27	0.93	0.71
Finishing	21.1	23.1	22.9	1.41	0.59	0.34
Total	17.8	18.7	18.7	0.78	0.69	0.42
ADG, lb/d						
Receiving Phase	0.66	0.72	-0.20	0.521	0.47	0.57
Growing phase	3.54	3.38	3.47	0.057	0.16	0.11
Finishing phase	3.13	3.25	3.18	0.132	0.82	0.61
Growing to Finish	3.32	3.31	3.31	0.066	1.00	0.94
Receiving to Finish	3.16	3.16	3.11	0.080	0.87	0.77
G:F						
Growing	0.19	0.18	0.17	0.011	0.59	0.42
Finishing	0.17	0.16	0.15	0.005	0.26	0.12
Total	0.18	0.17	0.16	0.008	0.42	0.25
Dry matter intake, as % BW						
Growing	1.89	1.85	1.95	0.053	0.37	0.89
Finishing	1.80	1.93	2.00	0.127	0.57	0.35
Total	1.87	1.94	2.02	0.097	0.59	0.42

Carcass quality of steers (year 1 only)

Carcass Measurements	NO SUP	SUP 12 weeks	SUP 6 weeks	SEM	P-value	Contrast 'NOSUP vs. SUP'
Hot Carcass Weight, lb	773	783	768	17.1	0.81	0.92
Dressing percent, %	60.0	59.8	60.5	0.46	0.45	0.80
12 th rib fat, cm	1.99	1.80	1.77	0.16	0.61	0.33
REA, cm ²	82.23	83.01	84.60	2.32	0.75	0.59
KPH	3.00	2.75	2.70	0.22	0.60	0.32
Yield grade	3.94	3.71	3.54	0.24	0.50	0.31
Marbling score	552	585	589	24	0.53	0.27
Quality Grade, % choice	9	33	47	12.9	0.13	0.07
Quality Grade, % low choice	91 ^a	58 ^{ab}	40 ^b	13.0	0.03	0.02
Quality Grade, % select	0	8	13	7.8	0.48	0.28

Cost vs. return (Experiment 1 – Mature cows)

84 days of precalving supplementation of dried distillers grains (189 lb/cow)

	NO Supplement	Supplement 12 weeks	Supplement 6 weeks
Cow precalving labor cost, \$/cow	\$ 0	\$ 5.00	\$ 2.50
Cow precalving supplement cost @ 230/ton, \$/cow	\$ 0	\$ 21.74	\$ 21.74
Cow labor + supplement cost, \$/cow	\$ 0	\$ 26.74	\$ 24.24
Calf extra weaning BW, lb	0	30	13
Income extra weaning BW @ \$1.40/lb, \$/calf	\$ 0	\$ 42.00	\$ 18.20
Net return of precalving supplementation, \$/cow	\$ 0	\$ 15.27	- \$ 6.04

Pregnant Brangus replacement heifers (n = 36/yr; 4 pastures/treatment; 2 yr)

- o NOSUP = No Molasses + urea supplementation
- o MOL = 2.2 lb/d of Molasses + urea (DM)
- o MOLMET = 2.2 lb/d of MOL + 18 g/d of methionine hydroxy analog (Alimet, Novus)
 - o Sugarcane Molasses + Urea
 - o 20% CP and 70% TDN (DM)
 - o Offered 2x/week (Tuesdays and Fridays)
 - o Supplementation period
 - o 56 d prepartum = **d 0 of the study**
 - o Ended when all cows within each pasture have calved = **d 74 of the study**
- o **d 75 until the end of the breeding season (d 164)**
 - o 3.5 lb DM/d of Molasses + urea



Calf Early-weaning

- o **d 147...**
 - o Start of the breeding season
 - o Early-weaning
- o **d 154 until 201**
 - o Individual drylot pens
 - o High concentrate-based TMR (3% of BW; DM)
 - o 75% TDN and 22% CP (DM)
 - o 2.2 lb/d of ground stargrass (*Cynodon nlemfuensis*) hay
- o **d 160 and 188**
 - o Vaccination against bovine respiratory disease
 - o Bovi Shield Gold 5 + One Shot

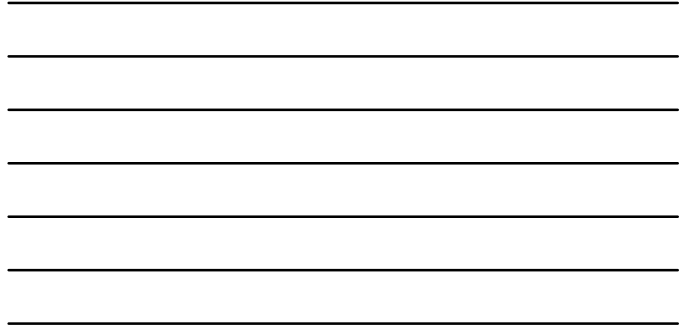
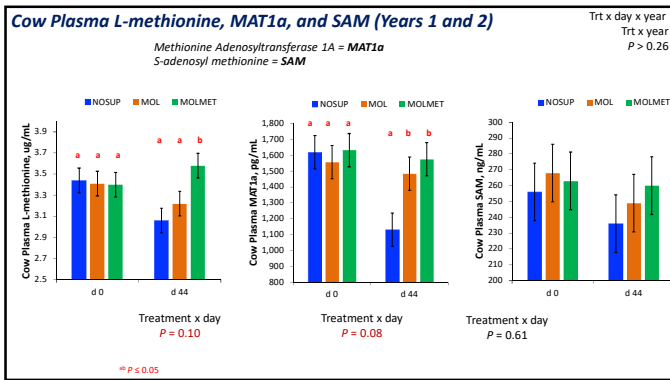


Cow pre- and post-partum performance (Years 1 and 2)

Trt x day x year
Trt x year
P > 0.17

Item	Treatments			SEM	P	
	NOSUP	MOL	MOLMET		Trt.	Trt. x day
Days on treatment						
Prepartum	59	57	55	5.1	0.85	
Post-partum	18	15	18	4.6	0.42	
Cow BCS (1-9 scale)						
d 0	5.67	5.65	5.69	0.084	0.04	0.10
d 44 (near calving)	5.77 ^a	6.10 ^b	6.17 ^b			
d 147 (early weaning)	4.85	4.95	5.01			
BCS change						
d 0 to 44	0.09 ^a	0.42 ^b	0.49 ^b	0.081	0.002	
d 44 to 147	-0.93 ^b	-1.16 ^b	-1.17 ^b	0.099	0.10	
Pregnant cows d 288, %	83.3	90.0	90.9	10.1	0.82	
Calving date 2 nd calf, day of the study	453	452	445	7.4	0.68	

^{a,b} P ≤ 0.05



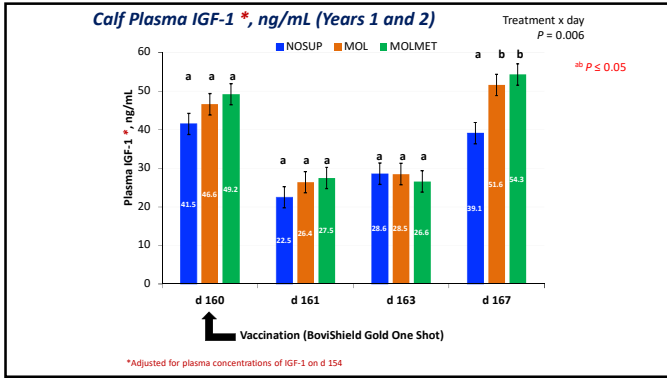
Years 1 and 2

Trt x day x year
Trt x year
P > 0.23

Item	Treatment			SEM	P	
	NOSUP	MOL	MOLMET		Trt.	Trt. x day
Calf birth Body Weight ¹ , lb	55.5	61.6	58.2	2.2	0.13	
Body Weight¹, lb						
d 147 – Early weaning	174 ^a	185 ^b	189 ^b	7.0	0.54	0.10
d 154 – Drylot entry	178 ^a	194 ^b	196 ^b	7.0		
d 201 – Drylot exit	275 ^a	293 ^b	293 ^b	7.0		
ADG, lb/day						
Birth to early weaning (d 147)	1.28	1.26	1.37	0.064	0.48	
Drylot (d 154 to 201)	1.85 ^a	2.00 ^b	2.18 ^b	0.068	0.02	
Birth to d 201	1.41 ^a	1.59 ^b	1.65 ^b	0.081	0.10	
Drylot (d 154 to 201)						
Total DM intake, lb/d	8.22	8.63	8.63	0.249	0.41	
G:F, d 154 to 201 ¹	0.246	0.243	0.236	0.006	0.51	

¹Adjusted for calf sex (P ≤ 0.05)
^{a,b} P ≤ 0.05





Innate and humoral immune response of calves (Years 1 and 2)

Item	Treatment			SEM	P	
	NOSUP	MOL	MOLMET		Trt.	Trt. x day
Plasma glucose, mg/dL	89.0	90.2	90.4	1.13	0.66	0.72
Plasma cortisol, ug/dL	2.05	1.99	1.87	0.15	0.71	0.99
Plasma haptoglobin, mg/mL	0.56	0.51	0.50	0.044	0.56	0.33
Serum BVDV-1						
Titers, log ₂	2.45	3.20	2.42	0.306	0.13	0.11
Seroconversion, % of total	56.1 ^a	84.2 ^b	78.7 ^b	7.16	0.02	0.11
Serum PI-3, log₂						
Titers, log ₂	4.72	4.67	4.74	0.266	0.99	0.22
Seroconversion, % of total	83.9 ^a	100 ^b	94.3 ^b	4.15	0.01	0.27

Trt x day x year
Trt x year
P > 0.15

*P < 0.05

Cost vs. return (Experiment 2 – First calf cows)
74 days of precalving supplementation of molasses+urea (2 lb/cow/day)

	Mineral	Mineral + Molasses+urea
Cow precalving labor cost, \$/cow	\$ 0	\$ 2.50
Cow precalving Molasses+urea @ 240/ton, \$/cow	\$ 0	\$ 17.76
Cow labor + supplement cost, \$/cow	\$ 0	\$ 20.26
Calf extra weaning weight, lb	0	18
Income extra weaning weight @ \$1.40/lb, \$/calf	\$ 0	\$ 25.20
Net return of precalving supplementation, \$/cow	\$ 0	\$ 4.94

Experiment 3 – Multiparous Brangus Cows – 70 d prepartum

MIN

2 oz/d Trace mineral salt

MIN + MOLASSES

2 oz/d trace mineral salt
+
3 lb/d MOLASSES + UREA

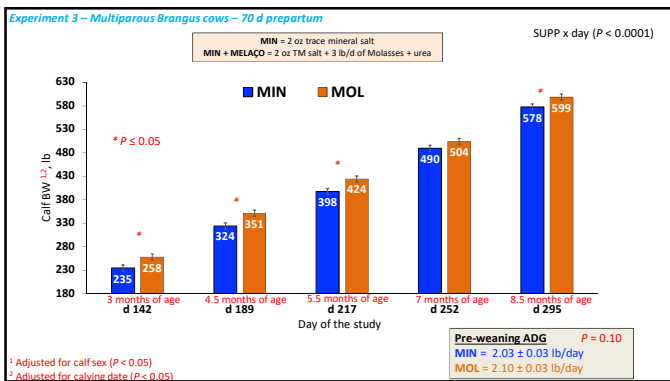
Experiment 3 – Multiparous Brangus cows – 70 d prepartum

Item	Supplement type		SEM	P	SUP x day
	MIN	MIN + MOLASSES			
Cow BCS					
d 0	5.49	5.50	0.071	0.96	<0.001
d 70 (near calving)	4.99	5.45	0.071	<0.001	
d 142	4.86	5.15	0.071	0.003	
d 189 (end of breeding)	4.66	4.77	0.071	0.21	
% of male calves	57.4	60.8	11.5	0.80	
Calving date, day of the study	54	46	2.45	0.02	
Calf birth BW ¹, lb	83.7	79.0	6.54	0.62	
Pregnant cows, d 252	72.9	80.2	8.41	0.55	

MIN = 2 oz trace mineral salt
MIN + Molasses = 2 oz TM salt + 3 lb/d of Molasses + urea

¹ Adjusted for calf sex (P < 0.05)
² Adjusted for calving date (P < 0.05)

Breeding season = d 132 to 222



Cost vs. return (Experiment 3 – Mature cows)

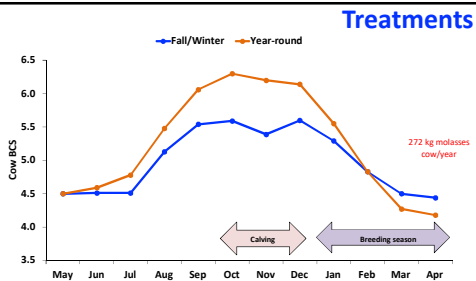
70 days of precalving supplementation of molasses+urea (3 lb/cow/day)

	Mineral	Mineral + Molasses/urea
Cow precalving labor cost, \$/cow	\$ 0	\$ 2.50
Cow precalving Molasses+urea @ 240/ton, \$/cow	\$ 0	\$ 25.20
Cow labor + supplement cost, \$/cow	\$ 0	\$ 27.70
Calf extra weaning weight, lb	0	21
Income extra weaning weight @ \$1.40/lb, \$/calf	\$ 0	\$ 29.40
Net return of precalving supplementation, \$/cow	\$ 0	\$ 1.70

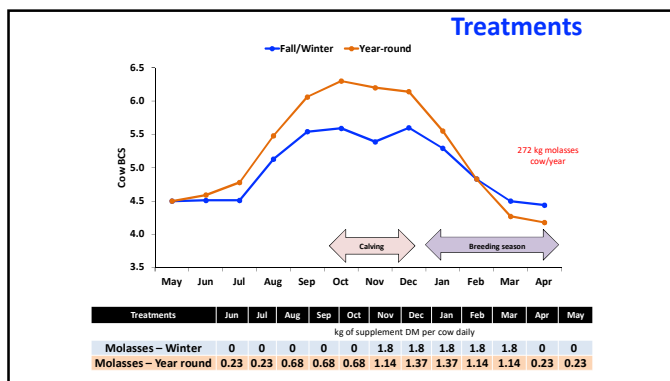


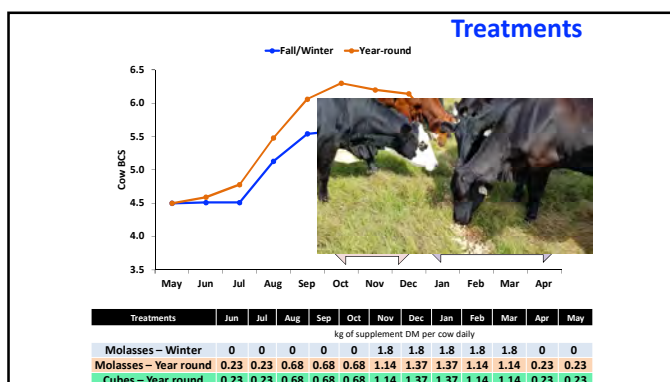
Beef Enhancement Funds
Florida Cattlemen's Association

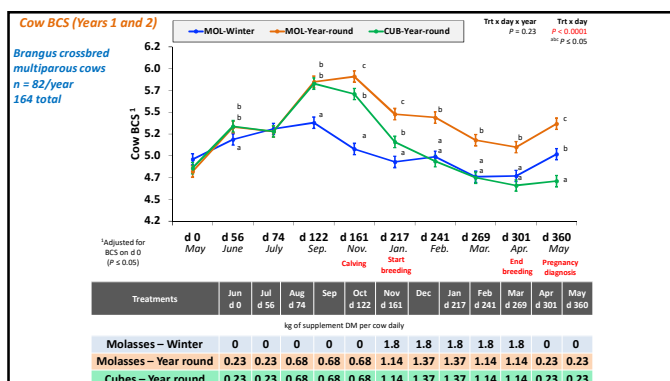
Study #4 - Year-round supplementation



Treatments	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Molasses – Winter	0	0	0	0	0	1.8	1.8	1.8	1.8	1.8	0	0
Molasses – Year round	0.23	0.23	0.68	0.68	0.68	1.14	1.37	1.37	1.14	1.14	0.23	0.23







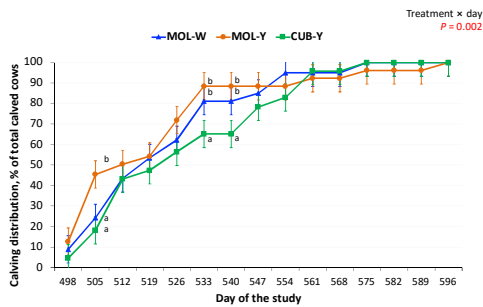
Calving data and pre-weaning calf performance

Item	Treatments				P-value		
	MOL-W	MOL-Y	CUB-Y	SEM	Treatment	Year	Treatment x year
1st calf crop							
Calving date, d of the study	164	161	158	4.3	0.65	0.30	0.70
Calving live calf, % of total	99.9	92.4	96.4	2.57	0.12	0.37	0.45
Male calves, % of total	50.9	49.8	48.4	7.16	0.97	0.97	0.35
Calf birth BW, lb	77.3	78.5	82.4	2.25	0.31	0.13	0.90
2nd calf crop							
Pregnant cows on d 360, %	92.0	90.0	83.4	4.25	0.33	0.34	0.38
Calving date, d of the study	527	526	532	5.2	0.75	-	-
Male calves, % of total	43.7	38.8	56.8	13.05	0.70	-	-
Calf birth BW, lb	76.4	82.6	81.9	3.17	0.32	-	-

d 217 to 301 = Breeding season

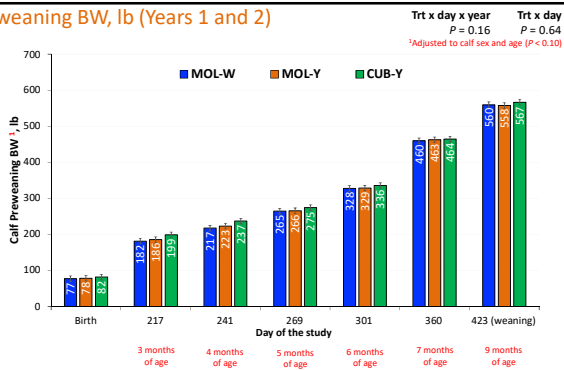
Treatments	Jun d 0	Jul d 56	Aug d 74	Sep	Oct d 122	Nov d 161	Dec	Jan d 217	Feb d 241	Mar d 269	Apr d 301	May d 360
kg of supplement OM per cow daily												
Molasses – Winter	0	0	0	0	1.8	1.8	1.8	1.8	1.8	1.8	0	0
Molasses – Year round	0.23	0.23	0.68	0.68	0.68	1.14	1.37	1.37	1.14	1.14	0.23	0.23
Cubes – Year round	0.23	0.23	0.68	0.68	0.68	1.14	1.37	1.37	1.14	1.14	0.23	0.23

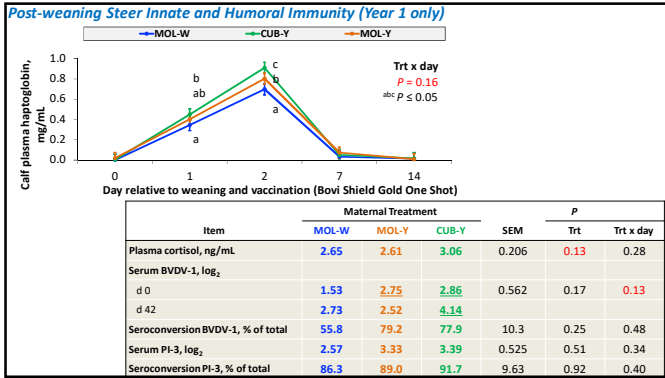
Calving distribution – 2nd calf crop (Year 1 only)



** P ≤ 0.05

Calf Preweaning BW, lb (Years 1 and 2)





Post-weaning feedlot performance of steers (year 1 only)

Feedlot performance	Mol-Winter	Mol-Year-round	Cube-Year-round	SEM	Treatment P-value	Contrast 'Winter vs. Year-round'	Contrast 'Mol Win vs. Mol Year'
Dry Matter Intake, lb/d							
Growing	14.5	14.1	14.3	0.30	0.76	0.55	0.50
Finishing	21.1	21.3	20.1	1.00	0.70	0.77	0.90
Total	17.8	17.8	17.2	0.64	0.78	0.72	0.96
ADG, lb/d							
Receiving Phase	0.66	0.34	0.78	0.735	0.60	0.82	0.46
Growing phase	3.55 ^a	3.50 ^a	3.15 ^b	0.046	0.04	0.0002	0.71
Finishing phase	3.13	3.13	2.95	0.069	0.56	0.30	0.97
Growing to finishing	3.33 ^a	3.30 ^a	3.04 ^b	0.046	0.05	0.01	0.85
Receiving to finishing	3.17 ^a	3.11 ^a	2.91 ^b	0.046	0.08	0.01	0.69
G:F							
Growing	0.19 ^{ab}	0.20 ^a	0.17 ^b	0.006	0.07	0.93	0.26
Finishing	0.17	0.17	0.18	0.011	0.63	0.59	0.92
Total	0.18	0.18	0.17	0.006	0.80	0.80	0.61
Dry Matter Intake, % of BW							
Growing	1.89	1.84	1.92	0.053	0.64	0.96	0.61
Finishing	1.80	1.82	1.81	0.095	0.98	0.86	0.84
Total	1.87	1.87	1.89	0.081	0.99	0.93	1.00

Carcass quality of steers (year 1 only)

Carcass Measurements	Mol-Winter	Mol-Year-round	Cube-Year-round	SEM	Treatment P-value	Contrast 'Winter vs. Year-round'	Contrast 'Mol Win vs. Mol Year'
HCW, lb	773	763	732	20.3	0.32	0.31	0.74
Dressing percent, %	60.0	59.2	59.8	0.52	0.61	0.46	0.33
12th rib fat, cm	1.99 ^a	1.57 ^b	1.53 ^b	0.13	0.03	0.01	0.04
REA, cm ²	82.2	82.0	80.8	2.41	0.90	0.78	0.95
KPH	3.00	2.89	3.00	0.23	0.93	0.86	0.76
Yield grade	3.94	3.48	3.43	0.21	0.16	0.06	0.14
Marbling score	5.52	5.78	5.82	0.24	0.62	0.34	0.46
Quality Grade, % choice	9	33	33	13.5	0.35	0.15	0.23
Quality Grade, % low choice	91 ^a	44 ^b	67 ^{ab}	13.8	0.08	0.04	0.03
Quality Grade, % select	0 ^b	22 ^a	0 ^b	7.13	0.07	0.21	0.04

Studies 2019/2020 & 2021/2022 **UF** UNIVERSITY OF FLORIDA

Study #5 – Frequency of concentrate supplementation during late gestation
 – 4 treatments offered during the last trimester of gestation:
 – Same weekly supplement amount

- No supplement
- Supplement offered daily (7X)
- Supplement offered 3 times weekly (3X)
- Supplement offered once weekly (1X)

Study #6 – Combining pre- and post-calving nutrition
 – Fetal programming + metabolic imprinting = Additive effects?

- No pre-calving supplementation of cows + calf normal weaning at 9 months of age
- Pre-calving supplementation of cows (2 lb/day) + calf normal weaning at 9 months of age
- No pre-calving supplementation of cows + calf early-weaning at 3 months of age
- Pre-calving supplementation of cows (2 lb/day) + calf early-weaning at 3 months of age

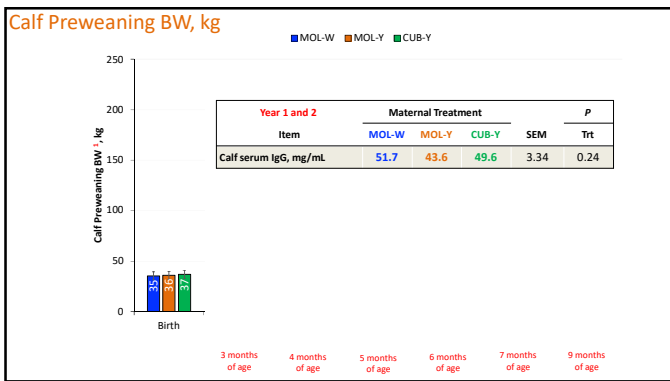
Study #7 – Monensin fortification of pre-calving supplements

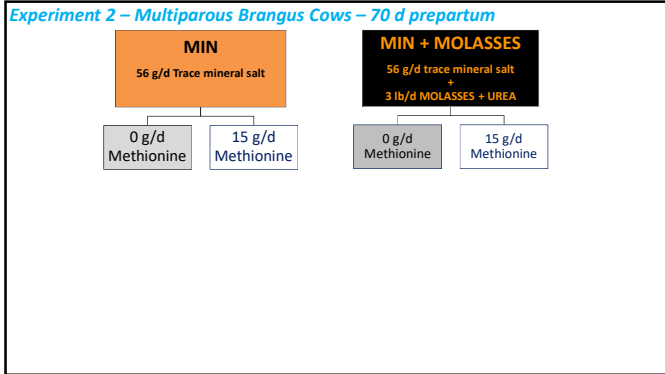
- No pre-calving supplementation of cows
- Pre-calving supplementation of cows (2 lb/day)
- Pre-calving supplementation of cows (2 lb/day) + Monensin fortification (20 ppm)



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Experiment 2 – Multiparous Brangus cows – 70 d prepartum

Item	Supplement type				P SUP x day	Methionine addition				P MET x day	
	MIN = 56 g trace mineral salt MIN + MELACO = 56 g TM salt + 3 lb/d of Molasses + urea		0 g/d of methionine 15 g/d of methionine			0 g/d		15 g/d			
	MIN	MIN + MOLASSES	SEM	P		g/d	g/d	SEM	P		
Cow BCS											
d 0						5.56	5.43	0.072	0.17	0.36	
d 70 (near calving)						5.23	5.21	0.072	0.78		
d 142						5.06	4.95	0.072	0.21		
d 189 (end of breeding)						4.74	4.70	0.072	0.67		
% of male calves						50.0	68.2	11.6	0.21		
Calving date, day of the study						50	50	2.43	0.92		
Calf birth BW ¹, lb						35.2	36.1	0.86	0.38	0.97	
Pregnant cows, d 252						69.7	83.3	8.38	0.28		

¹ Adjusted for calf sex (P < 0.05)
² Adjusted for calving date (P < 0.05) Breeding season = d 132 to 222

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	MIN = 56 g trace mineral salt MIN + Molasses = 56 g TM salt + 3 lb/d of Molasses + urea		0 g/d of methionine 15 g/d of methionine			0 g/d		15 g/d			
	MIN	MIN + MOLASSES	SEM	P		g/d	g/d	SEM	P		
Cow BCS											
d 0	5.49	5.50	0.071	0.96	<0.001	5.56	5.43	0.072	0.17	0.36	
d 70 (near calving)	4.99	5.45	0.071	<0.001		5.23	5.21	0.072	0.78		
d 142	4.86	5.15	0.071	0.003		5.06	4.95	0.072	0.21		
d 189 (end of breeding)	4.66	4.77	0.071	0.21		4.74	4.70	0.072	0.67		
% of male calves	57.4	60.8	11.5	0.80		50.0	68.2	11.6	0.21		
Calving date, day of the study	54	46	2.45	0.02		50	50	2.43	0.92		
Calf birth BW ¹, lb	83.7	79.0	6.54	0.62		82.6	80.2	6.48	0.79		
Pregnant cows, d 252	72.9	80.2	8.41	0.55		69.7	83.3	8.38	0.28		

¹ Adjusted for calf sex (P < 0.05)
² Adjusted for calving date (P < 0.05) Breeding season = d 132 to 222

