Impacts of Early Calf Weaning on Reproduction of Primi- and Multi-Parous Beef Cows

#### 2015 Florida Beef Cattle Shortcourse

John Arthington Professor and Center Director University of Florida – IFAS Range Cattle Research and Education Center, Ona, USA

## FLORIDA

#### IFAS Range Cattle Research and Education Center

## Outline

- Overview of early weaning in beef cattle production
- The early-weaned primi-parous cow
- The early-weaned calf
  - Management
  - Feedlot and heifer development
  - Early weaning and inflammation
- The early-weaned multi-parous cow

#### Early Weaning More than an emergency alternative

Early weaning at the start of the breeding season is a management practice used to reduce the nutritional requirements associated with lactation in first-calf cows.

- Increase cow BCS
- Decrease voluntary forage DM intake
- Increase pregnancy rate
- Elicit estrus in post-partum, anestrous cows
- Targets optimal calf market prices



#### Body condition score



#### Nutrient intake





### Calf Withdrawal

- Some producers may be unwilling or unable to permanently separate cows and calves at the start of the breeding season.
- Interval weaning involves multiple 48 hour calf withdrawals.
- Two year study
  - Early weaning at 70 90 days of age
  - Single 48 h calf withdrawal
  - Multiple 48 h calf withdrawal (n = 4; 21 days apart)

#### Interval Weaning multiple 48-h calf withdrawal



#### Nutrition and Management of Early-Weaned Calves



#### Alternative management systems

#### Ryegrass

- 5 to 6 calves/A
- Continuous, fixed stocking
- 1% BW supplementation

#### Bahiagrass

- 5 to 6 calves/A
- Continuous, fixed stocking
- 2% BW supplementation

#### Feedlot

- Drylot or feedlot
- Free-choice or 3.5% BW





# 1000 17 1 January



## February



#### Ryegrass IVOMD, % DM



#### Variability in annual calf nursery ryegrass yield



Year	Winter grazing <sup>b</sup>		
2000	1.89 ± 0.04		
2001	2.08 ± 0.06		
2002	1.35 ± 0.07		
2003	1.60 ± 0.06		
2004	1.73 ± 0.11		
2005	2.15 ± 0.10		
Average	1.80 ± 0.07		

#### **Calf Performance**





Gasser et al. (2006) JAS 84:2035-41





#### Effect of early-weaned heifer management on attainment of puberty Moriel, P. et al. 2014. J. Anim. Sci. 92:3096-3107

-NW -EW - Feedlot -EW - Pasture



Day after early weaning (d 180 = normal weaning

## Effect of early-weaned heifer management on age at puberty



#### Management systems

#### **Treatments**<sup>1</sup>

ltem	RG	BG	Drylot	SEM
ADG, lb	<b>1.70</b> <sup>a</sup>	<b>1.69</b> <sup>a</sup>	<b>2.40</b> <sup>b</sup>	0.080
Suppl. Intake, lb	<b>3.5</b> <sup>a</sup>	<b>5.1</b> <sup>a</sup>	<b>11.3</b> <sup>b</sup>	0.15
Feed cost <sup>2</sup>	0.41	0.60	2.26	
Value of gain <sup>3</sup>	383	380	540	
Return <sup>4</sup>	320	288	337	

<sup>1</sup>RG = Ryegrass, 1% BW supplementation, BG = Bahiagrass, 2% BW supplementation, Drylot, 3.5% supplementation
<sup>2</sup>\$/Ib of BW gain
<sup>3</sup>\$2.50/Ib BW gain
<sup>4</sup>Return = value of BW gain (\$/calf) – feed costs

a,b; P < 0.05

#### Post-weaning Feedlot Performance of Early-Weaned Calves

117

the start of the

#### Weaning and Transport



#### NCSU Research Butner Feedyard



#### Body weight change



Day of study

Arthington et al. JAS. 2005



#### Serum Cortisol Concentrations in Military Subjects Undergoing Parachute Jump Training



\* = P<.05 vs. Control

Aloe et al., 1994

#### CRP Concentrations in Serum of Military Subjects Undergoing Parachute Jump Training



\* = P<.05 vs. Control

Aloe et al., 1994

Blood samples collected prior to transport (d 0) and on d 1, 3, 7, 14, 21, and 28.

 No overt signs of morbidity were detected.

(Arthington et al., 2005)



Day following entry into feedlot

Figure 6. Effect of early calf weaning on the acute phase protein response folloiwng transportation and feedlot entry. Pooled SEM = 1.92 and 0.75 for ceruloplasmin and haptoglobin, respectiveluy. \*P < 0.05.

#### Acute Phase Protein Concentrations at Transport as a Predictor of Calf Performance

Study	Description	Pearson Corr.; R = (Protein¹ x 30 d ADG)
Arthington et al., 2005; J. Anim. Sci.	40 crossbred steers early- weaned at 90 d of age.	Cp; -0.59; P < 0.01 Hp; -0.40; P < 0.01
Qiu et al., 2007; J. Anim. Sci.	482 steer calves; multiple breed comparison study. Calves pre-weaned prior to transport.	Cp; -0.31; P < 0.08
Araujo et al., 2010 J. Anim. Sci. (In Press)	48 Braford steer calves; pre-weaned on the ranch 45 days prior to transport.	Cp; -0.26; P < 0.05 Fb; -0.26; P < 0.05

#### Pro-inflammatory cytokines in cattle

- In the period of these studies, research in proinflammatory cytokines in cattle were based on bioassays and cross-reactivity ELISA assays of other species.
- Pro-inflammatory cytokines were profiled in LPS challenged beef calves (Dr. Jeff Carroll; USDA-ARS).
- These new assays formed the basis for our continued investigation of stress x acute phase reaction in calves.

### Early weaning alters the acute-phase reaction to an endotoxin challenge in beef calves

Carroll, J.A., J.D. Arthington, and C.C. Chase, Jr.

J. Anim. Sci. 87:4167-4172



Time, h

## Early weaning alters the acute-phase reaction to an endotoxin challenge in beef calves

Carroll, J.A., J.D. Arthington, and C.C. Chase, Jr.

J. Anim. Sci. 87:4167-4172



## Effects of parity and response to early weaning

- Is there a difference among primi- and multi-parous cows in their response to weaning at 70 to 90 d?
- Current study;
  - 8 pastures, 20 cows/pasture
  - Early or normal weaned (4 pastures/treatment)
  - 3 consecutive production years.



## Effect of early weaning on date of pregnancy attainment among mature beef cows











Day of calving season (3 d intervals)

Percentage of calf crop



Day of calving season (3 d intervals)

#### Early-weaned

#### Normal-weaned





#### Summary

- Early weaning primi-parous beef cows at 70 to 90 days of age results in improved nutritional and reproductive efficiency.
- Early weaned calves have a high nutritional requirement but efficient BW gain in multiple production systems.
- Early weaning offers advantages in both feedlot and heifer development systems.
- Caution should be exercised when implementing early weaning systems with mature cows.



#### Thank you for your attention



John D. Arthington University of Florida jarth@ufl.edu

#### Ryegrass CP, % DM



#### **Sources of inflammation**

- Pathogenic . . .
- Mental
  - Social structure disruption
    - i.e. Commingling
  - Depression
    - i.e. Weaning
  - Anxiety





## Effects of early- versus normal-weaning age on calf feedlot performance

Item	Early- weaned	Normal- weaned	SEM	Ρ =
Receiving (d 0 to 28)				
Initial wt., kg	221	269	10.6	0.03
ADG, kg/d	0.87	0.40	0.10	0.03
DMI, kg/d	5.65	5.27	0.28	0.36
G:F	0.157	0.081	0.010	0.01
Overall (d 0 to 250)				
ADG, kg/d	1.23	1.25	0.11	0.82
Total BW gain, kg	295	267	9.3	0.10
Total DMI, kg	1919	1976	74.9	0.62
G:F	0.155	0.136	0.004	0.02

Effects of early weaning on performance of beef calves

- Forty crossbred steers:
  - Early-weaned; 89 days of age
  - Normal-weaned; 300 days of age
- Shipped together 1,200 km
- Stress response and performance measured from time of receipt to slaughter.

(Arthington et al., 2005)

## Early Weaning

- Wean calves at the start of the breeding season (70 to 90 d of age).
  - Allows full expression of the reproduction advantages of calf removal.
- Maintain in secure facility for 1 week.
- Turn onto a nursery pasture:
  - High-quality forages, which may be non-traditional options for normal cowherd grazing (i.e. winter annual ryegrass in southern Florida)
  - Perennial pastures with 2% body weight supplement.
- Control of internal parasites is critical.

Effect of weaning age on the proinflammatory response to LPS injection in beef calves

- Early- and normal-weaned calves (89 and 250 d, respectively).
  - LPS challenge (1.0 ug/kg, i.v.)
- Blood collected on 30 min intervals from -2 to 8 h.
- Pro-inflammatory cytokines measured



160 US Ranches with > 2,500 beef cows 60% of these ranches reside in 4 states; FL (24%), TX (18%), NE (12%), and NM (6%)

Okeechobee, FL to Amarillo, TX FL

NE

TX

NM

-- 0 -0

2,650 km