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

2015 Florida Beef Cattle Shortcourse

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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

Body condition score, 1-9 scale

Early Weaned  Normal Weaned

Days following early weaning

0  21  42  70
Nutrient intake

TDN intake, kg/d

- Early Weaned
- Normal Weaned

Weeks following early weaning

Initial 1 2 3 4 5 6 7 8 9 10
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
January
Ryegrass IVOMD, % DM

May vs. all
P < 0.05
Variability in annual calf nursery ryegrass yield

![Graph showing the variability in annual calf nursery ryegrass yield from 2000 to 2005.](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>Winter grazing $^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.89 ± 0.04</td>
</tr>
<tr>
<td>2001</td>
<td>2.08 ± 0.06</td>
</tr>
<tr>
<td>2002</td>
<td>1.35 ± 0.07</td>
</tr>
<tr>
<td>2003</td>
<td>1.60 ± 0.06</td>
</tr>
<tr>
<td>2004</td>
<td>1.73 ± 0.11</td>
</tr>
<tr>
<td>2005</td>
<td>2.15 ± 0.10</td>
</tr>
<tr>
<td>Average</td>
<td>1.80 ± 0.07</td>
</tr>
</tbody>
</table>

$^b$Winter grazing data in lb DM/Acre.
Calf Performance

Calf ADG, lb/d

Year 1:
- Early-weaned: 2.05
- Normal-weaned: 1.48

Year 2:
- Early-weaned: 1.46
- Normal-weaned: 1.90

Overall:
- Early-weaned: 1.74
- Normal-weaned: 1.70
Effect of early-weaned heifer management on attainment of puberty


Day after early weaning (d 180 = normal weaning)
Effect of early-weaned heifer management on age at puberty

Age at puberty, d

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Median Age (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW</td>
<td>429</td>
</tr>
<tr>
<td>EW - Feedlot</td>
<td>298</td>
</tr>
<tr>
<td>EW - Pasture</td>
<td>418</td>
</tr>
</tbody>
</table>

P < 0.0001

Note: NW = Non-weaned, EW = Early-weaned
### Management systems

<table>
<thead>
<tr>
<th>Item</th>
<th>RG</th>
<th>BG</th>
<th>Drylot</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADG, lb</strong></td>
<td>1.70(^a)</td>
<td>1.69(^a)</td>
<td>2.40(^b)</td>
<td>0.080</td>
</tr>
<tr>
<td><strong>Suppl. Intake, lb</strong></td>
<td>3.5(^a)</td>
<td>5.1(^a)</td>
<td>11.3(^b)</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Feed cost(^2)</strong></td>
<td>0.41</td>
<td>0.60</td>
<td>2.26</td>
<td>----</td>
</tr>
<tr>
<td><strong>Value of gain(^3)</strong></td>
<td>383</td>
<td>380</td>
<td>540</td>
<td>----</td>
</tr>
<tr>
<td><strong>Return(^4)</strong></td>
<td>320</td>
<td>288</td>
<td>337</td>
<td>----</td>
</tr>
</tbody>
</table>

\(^1\)RG = Ryegrass, 1% BW supplementation, BG = Bahiagrass, 2% BW supplementation, Drylot, 3.5% supplementation  
\(^2\)$/lb of BW gain  
\(^3\)$2.50/lb BW gain  
\(^4\)Return = value of BW gain ($/calf) – feed costs  
a,b; P < 0.05
Post-weaning Feedlot Performance of Early-Weaned Calves
Weaning and Transport
NCSU Research
Butner Feedyard
Body weight change

BW relative to WW, %

- Early Weaned
- Normal Weaned

* P < 0.05

Day of study

Arthington et al. JAS. 2005
Receiving period

Arthington et al. JAS. 2005

Feed Intake, lb/d

- Early weaned: 11.7
- Normal weaned: 10.8

Feed:Gain

- Early weaned: 6.4
- Normal weaned: 13.0

P = 0.36
SEM = 0.26

P = 0.01
SEM = 1.07
Serum Cortisol Concentrations in Military Subjects Undergoing Parachute Jump Training

Aloe et al., 1994

* = P<.05 vs. Control
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)

Figure 6. Effect of early calf weaning on the acute phase protein response following transportation and feedlot entry. Pooled SEM = 1.92 and 0.75 for ceruloplasmin and haptoglobin, respectively. *P < 0.05.
# Acute Phase Protein Concentrations at Transport as a Predictor of Calf Performance

<table>
<thead>
<tr>
<th>Study</th>
<th>Description</th>
<th>Pearson Corr.; R = (Protein[^1] x 30 d ADG)</th>
</tr>
</thead>
</table>
| 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 pro-inflammatory 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
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
2/3 of cows are cycling at the time of early weaning.

Pregnancy Attainment
EW = 92%
NW = 93%

Graph showing the percentage of calf crop over the day of the calving season with 3 d intervals.
Year 2

Percentage of calf crop

Day of calving season (3 d intervals)
Year 3

- Early-weaned
- Normal-weaned

Percentage of calf crop vs. Day of calving season (3 d intervals)
2/3 of cows are cycling at the time of early weaning.

Pregnancy Attainment
- EW = 92%
- NW = 93%
Normal weaning and stocking rate adjustment.

Early weaning:
- EW = 4.8
- NW = 5.0

Normal weaning:
- EW = 7.7
- NW = 6.0

Early weaning:
- EW = 5.3
- NW = 6.6

Normal weaning:
- EW = 8.2
- NW = 6.6

Early weaning:
- EW = 6.5
- NW = 5.5

Stocking rate (acres/pair):
- Early weaning (EW): 2.0
- Normal weaning (NW): 2.0

25% Change:
- EW = 4.8
- NW = 5.0

Early weaning adjustment:
- EW = 5.3
- NW = 4.9

Early weaning:
- EW = 7.7
- NW = 6.0

Early weaning:
- EW = 8.2
- NW = 6.6

Early weaning:
- EW = 6.5
- NW = 5.5
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

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Ryegrass CP, % DM

Linear; $P < 0.01$
Sources of inflammation

- Pathogenic . . .
- Mental
  - Social structure disruption
    - i.e. Commingling
  - Depression
    - i.e. Weaning
  - Anxiety
    - i.e.
      Hunger/Processing
## Effects of early- versus normal-weaning age on calf feedlot performance

(Arthington et al., 2005)

<table>
<thead>
<tr>
<th>Item</th>
<th>Early-weaned</th>
<th>Normal-weaned</th>
<th>SEM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving (d 0 to 28)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial wt., kg</td>
<td>221</td>
<td>269</td>
<td>10.6</td>
<td>0.03</td>
</tr>
<tr>
<td>ADG, kg/d</td>
<td>0.87</td>
<td>0.40</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>DMI, kg/d</td>
<td>5.65</td>
<td>5.27</td>
<td>0.28</td>
<td>0.36</td>
</tr>
<tr>
<td>G:F</td>
<td>0.157</td>
<td>0.081</td>
<td>0.010</td>
<td>0.01</td>
</tr>
<tr>
<td>Overall (d 0 to 250)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG, kg/d</td>
<td>1.23</td>
<td>1.25</td>
<td>0.11</td>
<td>0.82</td>
</tr>
<tr>
<td>Total BW gain, kg</td>
<td>295</td>
<td>267</td>
<td>9.3</td>
<td>0.10</td>
</tr>
<tr>
<td>Total DMI, kg</td>
<td>1919</td>
<td>1976</td>
<td>74.9</td>
<td>0.62</td>
</tr>
<tr>
<td>G:F</td>
<td>0.155</td>
<td>0.136</td>
<td>0.004</td>
<td>0.02</td>
</tr>
</tbody>
</table>
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 pro-inflammatory 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
2,650 km