Tri-State Beef Conference
August 12th, 2014 – Abingdon, VA
Pre-weaning calf management and its effects on post-weaning performance

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North Carolina State University
BOVINE RESPIRATORY DISEASE

✓ $800 to 900 million Losses annually
   (Chirase and Greene, 2001; Anim. Feed Sci 93:217-228)

Number or treatments and income loss

✓ 1 treatment = decrease return by $41
✓ 2 treatments = decrease return by $58
✓ 3 or + = decrease by over $292

### Effects of sickness on performance and profitability in the feedlot

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Preweaning factors:
- Prenatal nutrition
- Intake of colostrum
- Persistent BVD
- Preweaning health
- Temperament
- Preshipment management
- Preconditioning
- Vaccinations
- Nutritional status

Postweaning factors:
- Transportation/marketing stress
- Commingling
- Receiving period management
  - Castration, dehorning, etc.
  - Implant programs?
- Receiving diet nutrients
  - Energy (roughage)
  - Protein
  - Minerals (Cu, Se, Zn)
  - Vitamins (E, antioxidants)
- Prophylactic antibiotics

Immunity:
- +
- –
- ?

BRD:
- +

Feedlot performance
Feedlot health
Carcass quality

Agenda: Tri-State Conference, Abingdon VA
August 12th, 2014

1. Basics of immune system
2. Stress and immune system
3. Sources of stress in cattle
4. Creep-feeding
5. Fenceline weaning
6. Preconditioning
Immune System

**INNATE**
- First line of defense
- Act within hours
- Acute Phase Response

**ADAPTIVE**
- Second line of defense
- Act within days
Immune System

INNATE
- First line of defense
  - Act within hours

Adaptive
- Second line of defense
  - Act within days

Acute Phase Response
- Fever
  - Increased metabolism
- Liver function
- Cell synthesis
- Decreased feed intake
Acute-phase Response

Adapted from Carroll and Fosberg (2007)
Acute-phase Response

Adapted from Carroll and Fosberg (2007)
Acute-phase Response

Adapted from Carroll and Fosberg (2007)

Tissue repair, coagulation, metal binding and transport proteins
Haptoglobin, mg/mL

Day relative to immunological challenge

Immunological challenge
Acute-phase Response

Adapted from Carroll and Fosberg (2007)

Antigen

Activated Macrophage

Stress

IL-1

TNF-α

IL-6

Liver

Acute-phase proteins

Tissue repair, coagulation, metal binding and transport proteins

APP
Acute-phase Response

Adapted from Carroll and Fosberg (2007)

- Muscle AA mobilization
- Dietary amino acids (AA)

Antigen

Stress

IL-1
TNF-α
IL-6

Liver

Acute-phase proteins

APP

Tissue repair, coagulation, metal binding and transport proteins
Stress and immune function
“Fight or Flight response”

Cortisol  Provide energy  Escape predator
Stress in cattle

Psychological stress
- Fear
- Commingling
- Novel environment
- Loud or unusual noises
- Restraint

Physiological stress
- Nutrient deficiency

Physical stress
- Injury
- Heat or cold stress
- Fatigue
- Disease
- Hunger and thirst
Weaning
Inflammatory response

Days relative to stress

Weaning

Days relative to stress

-7  0  1  3  7  14  21  28

Inflammatory response

0.0  0.2  0.4  0.6  0.8  1.0  1.2
Creep-feeding

Pre-weaning performance
Unlimited and limited creep-feeding increased weaning weights

Stricker et al., 1979
Hixon et al., 1982
Lusby and Wettemann, 1986
Faulkner et al., 1994
Sexten et al., 2004
Moriel and Arthington, 2013a,b

Which one to use?
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<td>Cost of added gain, $/Lb</td>
<td>$0.56</td>
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<td>Income, $/calf</td>
<td></td>
<td>$1,016.70</td>
<td>$1,103.19</td>
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<tr>
<td>Return, $/calf</td>
<td></td>
<td>$1,016.70</td>
<td>$1,067.69</td>
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Creep-feeding

Post-weaning performance
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<th>No Creep</th>
<th>Unlimited creep (45 days)</th>
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<tbody>
<tr>
<td>ADG, Lb/d (29 days post-weaning)</td>
<td>1.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.31&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<th>Concentrate intake, % of BW</th>
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<tr>
<td>Week 1</td>
<td>1.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.62&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Week 2</td>
<td>2.04</td>
<td>2.13</td>
</tr>
<tr>
<td>Week 3</td>
<td>2.28</td>
<td>2.26</td>
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<th>Hay intake, % of BW</th>
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<tr>
<td>Week 1</td>
<td>0.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.42&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Week 2</td>
<td>0.57</td>
<td>0.47</td>
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<td>Week 3</td>
<td>0.47</td>
<td>0.45</td>
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Adapted from Arthington et al. (2008) JAS 86:2016-2023
Carcass weight and quality grade
Creep vs. non-creep fed steers

Lancaster et al. (2007a,b)
• Greater for creep-fed in year 1, but not year 2

Faulkner et al. (1994)
• Greater for creep-fed

Similar for creep-fed and non-creep fed
• Tarr et al., 1994
• Myers et al., 1999
• Shike et al., 2007
Fenceline weaning
### Observation, % of total calves

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<tr>
<td>Eating</td>
<td>41.1(^a)</td>
<td>37.3(^a)</td>
<td>23.7(^b)</td>
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<tr>
<td>Walking</td>
<td>8.6(^a)</td>
<td>10.1(^a)</td>
<td>28.1(^b)</td>
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<tr>
<td>Lying down</td>
<td>22.9(^a)</td>
<td>23.3(^a)</td>
<td>16.0(^b)</td>
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Adapted from Price et al. (2003) JAS 81:116-121
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<td>216.7&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>2 weeks</td>
<td>44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>29&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>10 weeks</td>
<td>143&lt;sup&gt;a&lt;/sup&gt;</td>
<td>110&lt;sup&gt;b&lt;/sup&gt;</td>
<td>91&lt;sup&gt;c&lt;/sup&gt;</td>
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Adapted from Price et al. (2003) JAS 81:116-121
Preconditioning
Beef Calves
Precondition = “to condition, train, or accustom in advance” American Heritage Dictionary

- No standardized definition as it applies to beef cattle before, during, and/or after weaning and shipping

- Management practices around weaning time
  - Optimize animal’s immune system and health
  - Minimize stress

Lalman and Smith ANSI-3529
Concentrate Intake, % of Body Weight

Week after feedlot entry

- Weaned and transported
- Preconditioned

Arthington et al. (2008) JAS 86:2016-2023
PRECODITIONING VS. NON-PRECONDITIONING

Adapted from Roeber et al. (2001) Prof. Anim. Sci. 17:39–44
Benefits for producers

✓ Greater weight gain before shipping

✓ Reputation for high quality cattle

✓ Management skills and feed resources that add value to calves

✓ Opportunity to capture larger revenues by retaining ownership

Lalman and Smith ANSI-3529
Figure 2. Estimated Premiums over Time for VAC34, Weaning, and Age-and-Source Verification for Steers by Year, 2001-2010.
Figure 3. Percentage of Pens of Steer Calves Sold on Superior Livestock Auction that were Weaned, had a Certified Health Program (VAC24, VAC34, VAC34P, VAC45, or VACPC), or were ASV, by Year, 2001-2010.
Ongoing research
Protein requirement
550 Lb Steer gaining 2.2 lb/day

Fluharty and Loerch (1995) JAS 73:1585-1594
Experiment 1 – Dietary Protein Concentration

✓ July 2014
✓ Increasing protein concentration
✓ 45-day preconditioning program

✓ Increase Weaning weights??
✓ Pay for extra cost of increase protein concentration??
Experiment 1 – Dietary Protein Concentration

MP = Metabolizable Protein requirements

[Bar chart showing body weight and ADG (Average Daily Gain) for different dietary protein concentrations (85MP, 100MP, 115MP) over different periods (days 7-22 and days 7-49).]

Body weight, Lb

ADG, Lb/d

Days relative to weaning

[Graphs showing the relationship between body weight and ADG over time for different dietary protein concentrations.]
Experiment 2 – Frequency of concentrate supplementation

✓ Major concern: Feeding costs and labor

✓ Concentrate supplementation
  ✓ 3 days vs. 7 days per week

✓ Similar Weaning weights??
✓ Decrease labor and feeding costs possibly??
Contact Information

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Mobile: (352) 682-2904

Email: pmoriel@ncsu.edu

Website: https://sites.google.com/a/ncsu.edu/philipemorielncsu/