ACCELERATED CALF FEEDING AND SUBSEQUENT PRODUCTION

Stacey Hamilton, PhD
State Dairy Specialist

Scott E. Poock, DVM, DABVP
Associate Extension Professor
Colostrum

- essential for first day of life
- rich in nutrients

- Total solids 23.9%
- Fat 6.7%
- Protein 4.8%
- Calcium 0.26%
- Vitamin A 295
- Vitamin E 84
- IgG 48mg/ml
- Immunological active cells
- Lactoferrin
WHOLE MILK

- Whole milk
  - Nature’s food for calves
  - Pasteurizer

- Bulk Tank---29.9-32.7% Fat, 24.2-27.8% Protein (DM)

- Waste Milk---11.5-55.5% Fat, 20.6%-34.9% Protein (DM)
Milk Replacer

- Calf milk replacer
  - Usually consistent quality
  - 20-28% Protein
  - 15-25% Fat
  - 0.15% Crude Fiber
Intensified feeding of calves for accelerated growth is a hot topic in calf management (10 years).

These programs involve feeding more milk replacer than in conventional programs, such that calves 1.5-3X the dry milk replacer solids.

Calves will grow faster (lean muscle and skeletal growth) and attain breeding size earlier, and may even produce slightly more milk.

Dairy Calf and Heifer Association (DCHA) Gold Standard is to double the weight of the calf from birth to 60 days of age

- Holsteins ~ 1.5# per day
- Jerseys ~ 1# per day
WHY INVESTIGATE?

- 1) Maintenance (Metabolizable Energy) is not small
- 2) For calves to grow fast they need to consume more (milk or starter)
- 3) Calf protein (amino acid) needs are low for maintenance but increase rapidly for growth
- 4) Protein needs for growth plateau around 28%, in regard to milk or milk replacers
- 5) Simply feeding more 20/20 will not provide enough protein and will have relative excess energy, which can lead to fat accumulation.
Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

- Calf Body Weight: 90 lbs
- Temperature: 75.0 degrees F
- Diet ME: 2.10 (Mcal/kg)
- Diet N\text{\textsubscript{ME}}: 1.31 (Mcal/kg)
- Diet N\text{\textsubscript{E}}: 1.45 (Mcal/kg)

Calculation of Young Calf Requirements

Allowable Gain

- Energy Allowable ADG: 
- AD\text{\textsubscript{ME}} Allowable Gain: 

Maintenance Requirement Calculations

- Total Milk Dry Matter Intake: 1.25 (lbs/day)
- Total Starter Dry Matter Intake: 0.00 (lbs/day)
- Net Energy Based Maintenance Requirement: 0.086 (Mcal/day/8\textsuperscript{0.75})
- Temperature Multiplier: 1.00
- Net Energy Required for Maintenance: 1.38 (Mcal/day)
- Dry Matter Intake Required for Maintenance: 0.77 (lbs/day)
- Efficiency of use of ME for N\text{\textsubscript{E}}: 0.86
- Metabolizable Energy Required for Maintenance: 1.62 (Mcal/day)
- Apparently Digested Protein Required for Maintenance: 27 (g/day)
- Crude Protein Required for Maintenance: 29 (g/day)

Growth Requirement Calculations

- Intake Available for Growth: 0.48 (lbs/day)
- Net Energy Available for Growth: 0.20 (Mcal/day)
- Efficiency of use of ME for N\text{\textsubscript{E}}: 0.69

Page 1 of 1

Zoom: 75%
Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

- Calf Body Weight: 90 lbs
- Temperature: 32.0 deg. F
- Diet ME: 2.10 (Mcal/lbs)
- Diet NEm: 1.81 (Mcal/lbs)
- Diet NEd: 1.45 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

- Energy Allowable ADG:
- ADG Allowable Gain:

Maintenance Requirement Calculations

- Total Milk Dry Matter Intake: 1.25 (lbs/day)
- Total Skim Dry Matter Intake: 0.85 (lbs/day)
- Net Energy Basis Maintenance Requirement: 0.086 (Mcal/day) @ W^0.75
- Temperature Multiplier: 1.54
- Net Energy Required for Maintenance: 2.14 (Mcal/day)
- Dry Matter Intake Required for Maintenance: 1.18 (lbs/day)
- Efficiency of use of ME for NEm: 0.86
- Metabolizable Energy Required for Maintenance: 2.45 (Mcal/day)

Growth Requirement Calculations

- Intake Available for Growth: 0.07 (lbs/day)
- Net Energy Available for Growth: 0.09 (Mcal/day)
- Efficiency of use of ME for NEd: 0.69

90 # calf
1.25 # of milk replacer per day
32 degrees F

0.16 #/day
Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

- Calf Body Weight: 90 lbs
- Temperature: 72.0 deg. F
- Dot ME: 2.10 (Mcal/lbs)
- Dot NEm: 1.81 (Mcal/lbs)
- Dot NEg: 1.45 (Mcal/lbs)

Calculation of Young Calf Requirements

- Allowable Gain
  - Energy Allowable ADG
  - ADG Allowable Gain

Maintenance Requirement Calculations

- Total Milk Dry Matter Intake: 1.89 (lbs/day)
- Total Starter Dry Matter Intake: 0.09 (lbs/day)
- Net Energy Basal Maintenance Requirement: 0.066 (Mcal/day x BW^0.75)
- Temperature Multiplier: 1.00
- Net Energy Required for Maintenance: 1.39 (Mcal/day)
- Dry Matter Intake Required for Maintenance: 0.77 (lbs/day)

Efficiency of use of ME for NEm: 0.86
- Metabolizable Energy Required for Maintenance: 1.62 (Mcal/day)
- Apparently Digested Protein Required for Maintenance: 28 (g/day)
- Crude Protein Required for Maintenance: 30 (g/day)

Growth Requirement Calculations

- Intake Available for Growth: 1.12 (lbs/day)
- Net Energy Available for Growth: 1.82 (Mcal/day)

1.74 #/day
32 Degrees F
1.18 #/day

90 # calf
1.88 # of milk replacer per day
1.74 #/day
32 Degrees F
1.18 #/day
THERMONEUTRAL ZONE FOR CALVES

- < 3 weeks of age
- 59-77 degrees F
- > 3 weeks of age
- 41-77 degrees F
WHAT'S THE DIFFERENCE?

**Conventional**
- Protein – 20-22%
- Fat – 15-20%
- Feed 1-1.25#/day or 8-10 ounce per feeding
- 2 quarts volume
- Free choice water and grain (20-22% protein)
- Maximize starter intake

**Accelerated**
- Protein – 26-28%
- Fat – 15-20% (Jersey 25%)
- Feed 1.88-2.5#/day or 15-20 ounces per feeding
- 3-4 quarts volume
- Free choice water and grain (20-22% protein)
- Varying amount of milk replacer depending on age
- Maximize milk/milk replacer
**How Do You Implement?**

- As you increase solids, you must be **increased fluid**
- Use only high protein milk replacers
- Mix one batch of liquid for all calves (no individual bottles) to avoid errors in weighing and allow for more thorough mixing.
- For large breed heifers, feed 2 to 2 ½ quarts per feeding (twice a day) for week one.
- Feed 3 to 4 quarts per feeding twice a day from week two to 1-2 weeks before weaning.
- Decrease the amount fed the last 1-2 weeks of feeding milk or milk replacer.
- Water and starter feed should be available free choice at all times starting at day two.
IMPACTING RUMEN DEVELOPMENT: GRAIN EFFECT

A.J. Heinrichs, The Pennsylvania State University

Lance Fox, DVM Diamond V
WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

The major difference in growth rate is in the first 2-3 wk of life, and after that growth rates generally are parallel.

Katie TerMeer
WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

- **Reproduction**
  - reach puberty at a younger age
  - age at conception lower
  - age at calving (14-27.5 days)
WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

- **Health**
  - University of Minnesota (whole milk)
    - decreased death loss during winter (2.8% vs 21%)
  - Cornell University (Milk replacer)
    - Cryptosporidium
      - maintained hydration better, less days of diarrhea, grew faster, and feed efficiency was better
  - Other studies
    - some show increased immune system
WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

- Milk Production (1st lactation)
  - 1000-2000# of increased milk in first lactation
  - Parent adjusted milk was greater
  - Most studies showed an advantage with over $\frac{1}{2}$ statistical or a trend
WHY INVESTIGATE FOR PASTURE-BASED SYSTEMS?

- Determine if intensified milk feeding in smaller framed dairy heifers will result in:
  - Younger weaned calves at similar weights as traditionally fed calves
  - Decreased breeding and calving age
  - Increase milk production in first lactation
WHAT DID WE DO?
Active Drug Ingredient

Neomycin Sulfate 1300 grams/ton
Oxytetracycline (from oxytetracycline dihydrate base) 1300 grams/ton

Guaranteed Analysis

**Crude Protein, min** 28.50%
**Crude Fat, min** 15.00%
**Crude Fiber, max** 0.15%
**Calcium, min** 0.75%
**Calcium, max** 1.25%
**Phosphorus, min** 0.60%
**Vitamin A, min** 7500 IU/lb
**Vitamin D₃, min** 2500 IU/lb
**Vitamin E, min** 50 IU/lb

Active Drug Ingredient

Neomycin Sulfate 1600 grams/ton
Oxytetracycline (from oxytetracycline dihydrate base) 1600 grams/ton

Guaranteed Analysis

**Crude Protein, min** 20.0%
**Crude Fat, min** 20.0%
**Crude Fiber, max** 0.15%
**Calcium (Ca), min** 0.75%
**Calcium (Ca), max** 1.25%
**Phosphorus (P), min** 0.7%
**Vitamin A, min** 30,000 IU/lb
**Vitamin D₃, min** 10,000 IU/lb
**Vitamin E, min** 150 IU/lb
PARAMETERS

- 32 Holstein, Jersey or Crossbred heifers assigned to Milk Formula 1 as the traditional milk replacer program

- 43 Holstein, Jersey or Crossbred heifers assigned to Velocity as the accelerated feeding program

- Calves were assigned as groups of 8 and “mob-fed” using 10 nipple feeders

- **Birth weight:**
  - MF1 = 70.6 #
  - Velocity = 69.0 #

- **Average age of start of treatment**
  - MF1 = 9.7 days
  - Velocity = 7.0 days
# Protocol for Feeding Traditional vs. Accelerated Milk Replacers

<table>
<thead>
<tr>
<th>Milk Formula 1 - Traditional MR</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oz powder/feeding</td>
<td>7.5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Warm water (Pints)/feeding</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Milk Formula 1 - traditional milk replacer – 68#

<table>
<thead>
<tr>
<th>Velocity - Accelerated MR</th>
<th>Oz powder/feeding</th>
<th>7.5</th>
<th>12.5</th>
<th>15</th>
<th>15</th>
<th>15</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm water (pints)/feeding</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Velocity - accelerated milk replacer – 66#
SOUTHWEST CENTER 2012 BORN CALVES

Body Weight Comparison
Accelerated vs. Traditional Milk Replacer

MF1
Velocity

Stacey Hamilton, PhD University of Missouri
BODY WEIGHT DIFFERENCES AFTER WEANING BETWEEN HEIFERS FED ACCELERATED OR TRADITIONAL MILK REPLACER: 2012 BORN CALVES
WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

- **Growth**
  - Same advantage as with the confinement Holsteins for preweaning
  - Variable at breeding and calving (depending on year)
**WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?**

- **Reproduction** (year of breeding)

<table>
<thead>
<tr>
<th></th>
<th>2013 and 2014 combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MF1</td>
</tr>
<tr>
<td></td>
<td>32 heifers</td>
</tr>
<tr>
<td>First Service</td>
<td>21 / 65.6%</td>
</tr>
<tr>
<td>Second Service</td>
<td>5 / 15.6%</td>
</tr>
<tr>
<td>Third Service</td>
<td>6 / 18.8%</td>
</tr>
<tr>
<td>Cull</td>
<td>6 / 18.8%</td>
</tr>
</tbody>
</table>
WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

- Reproduction

Cows in 2014

<table>
<thead>
<tr>
<th>MF1</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Cows (16)</td>
<td>19 Cows (21)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MF1 # Preg</th>
<th>MF1 %</th>
<th>Velocity # Preg</th>
<th>Velocity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>First service</td>
<td>5</td>
<td>41.7%</td>
<td>11</td>
<td>57.9%</td>
</tr>
<tr>
<td>Second Service</td>
<td>6</td>
<td>50.0%</td>
<td>5</td>
<td>26.3%</td>
</tr>
</tbody>
</table>
WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

- **Health**
  - No advantage
  - Historically, calf health was excellent when dairy personnel raised the calves.
WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

**Milk Production (1\textsuperscript{st} lactation)**

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>Treatment</th>
<th>ME305 FCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Milk Formula 1</td>
<td>14,400</td>
</tr>
<tr>
<td>2012</td>
<td>Velocity</td>
<td>14,877</td>
</tr>
<tr>
<td>2013</td>
<td>Milk Formula 1</td>
<td>15,766</td>
</tr>
<tr>
<td>2013</td>
<td>Velocity</td>
<td>16,760</td>
</tr>
</tbody>
</table>

Total for Milk Formula 1: 15,110
Total for Velocity: 15,871
WHY INVESTIGATE FOR PASTURE-BASED SYSTEMS?

- Determine if intensified milk feeding in smaller framed dairy heifers will result in:
  - Younger weaned calves at similar weights as traditionally fed calves
    - **YES!**
  - Decreased breeding and calving age
    - **Yes, appears to be better reproduction**
  - Increase milk production in first lactation
    - **Yes, appears to be better production**
WHAT ARE DISADVANTAGES/NEGATIVES?

- Health

- Feces
- “milk scour”
WHAT ARE DISADVANTAGES/NEGATIVES?

- **Clostridial disease**
  - Clostridium perfringens C & D (maybe B)
  - Antitoxin (10 cc subQ shortly after birth)
  - Colorado Serum
  - Clostridium perfringens types C&D antitoxin
  - Boehringer Ingelheim
  - C & D Antitoxin
  - Novartis (Elanco)
  - Clostratox BCD Antitoxin
Intensified feeding programs will cost about $35 to $55 more in milk replacer and starter than traditional programs.

<table>
<thead>
<tr>
<th></th>
<th>Velocity (Accelerated)</th>
<th></th>
<th>MF1</th>
<th></th>
<th>Difference</th>
<th>Period Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost/Unit</td>
<td>Total Cost</td>
<td>Cost/Unit</td>
<td>Total Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost/Unit</td>
<td>66</td>
<td>$1.90</td>
<td>68</td>
<td>$1.43</td>
<td>$28.16</td>
<td>to weaning</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$125.40</td>
<td></td>
<td>$97.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter</td>
<td>315</td>
<td>$0.28</td>
<td>292.5</td>
<td>$0.28</td>
<td>$6.30</td>
<td>3 days to April 30</td>
</tr>
<tr>
<td>Cost/Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td>$88.20</td>
<td></td>
<td>$81.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grower</td>
<td>450</td>
<td>$0.27</td>
<td>450</td>
<td>$0.27</td>
<td></td>
<td>May 1-July 31</td>
</tr>
<tr>
<td>Cost/Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td>$121.05</td>
<td></td>
<td>$121.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer</td>
<td>675</td>
<td>$0.25</td>
<td>675</td>
<td>$0.25</td>
<td></td>
<td>Aug 1 to end of December</td>
</tr>
<tr>
<td>Cost/Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td>$167.40</td>
<td></td>
<td>$167.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Per Calf</td>
<td>$502.05</td>
<td></td>
<td>$467.59</td>
<td></td>
<td>$34.46</td>
<td></td>
</tr>
</tbody>
</table>
WHAT ARE DISADVANTAGES/NEGATIVES?

- Intensive management required for program success
- Increased costs during the milk feeding period ($30- $50 per calf)
- Delayed rumen development and poor transition at weaning
- Jerseys need more fat than Holsteins
SUMMARY OF POSITIVES

- Increased lean growth in pre-weaning stage
- Potential health benefits
- Earlier age at first calving
- More potential production in first lactation