Economics of Successful Heifer Feeding Approaches

Missouri Dairy Profit Seminars

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The Heifer Enterprise

- Not a profit center on most dairy farms currently; 3rd highest cost of production on dairy farms after feed and labor.
- Risks (2007 national survey)
  - Stillbirth/dead on arrive 6.5%
  - Calf death (< 2 mo of age) 7.8%
  - Death after weaning 2.0%
  - Age at calving (mo) 25.2
Cost of Raising Heifers
(33 WI operations in 2013)

- Feed costs $1046
- Labor and mgmt costs $ 333
- Variable costs $ 274
- Fixed costs $ 209
- Total $1,862

(Add calf value and calf costs of $363)
# Economics of Age and Weight

<table>
<thead>
<tr>
<th>Weight</th>
<th>Age (mo)</th>
<th>Total Cost/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>2.5</td>
<td>$2.15</td>
</tr>
<tr>
<td>400</td>
<td>5.5</td>
<td>$2.79</td>
</tr>
<tr>
<td>610</td>
<td>10.0</td>
<td>$2.63</td>
</tr>
<tr>
<td>840</td>
<td>13.5</td>
<td>$3.08</td>
</tr>
<tr>
<td>1050</td>
<td>18.0</td>
<td>$3.37</td>
</tr>
<tr>
<td>1170</td>
<td>22.0</td>
<td>$3.93</td>
</tr>
</tbody>
</table>
Points to Ponder

- Do you raise all female replacement heifers?
- Does genomics allow identification of superior animals?
- Do you use sexed semen on the best heifers and cows?
- Do you breed the bottom 1/3 cows to beef bulls?
Focus on Calves
GOALS FOR THE CALF REARING PROGRAM

• Build colostrum immunity
• Encourage early starter intake to stimulate rumen development
• Avoid exposure to disease
• Optimize feed and labor costs
• Wean calves at an optimal age (5 to 6 weeks)
• Achieve optimal growth (>1.5 lb / day)
Colostrum Quality

• 6% immunoglobulin (antibodies)
• 14% protein (3.0% normal)
• 6.7% fat (3.6% normal)
• 2.7% lactose (5.0% normal)
• 24% total solids (13% normal)
• Higher levels of vitamin A and E
Colostrum Facts and Figures

• Provide passive immunity via antibodies absorbed first 24 hours after birth (closure)

• Feed one gallon immediately (use an esophageal feeder if needed)

• Test with a colostromometer

• Older cows have higher quality colostrum

• Feed colostrum from Johne’s free cows
Measuring Immunity

• 41% of calves have adequate acquired immunity from colostrum

• Target >5 mg/ml of blood serum protein
Liquid Diet Choices

- **Soured colostrum** (best quality, handling concerns, and top management needed)
- **Waste milk** from treated cows (cheap, risk of disease, and drug residue)
- **Whole milk** (most expensive, best quality)
- **Milk replacer** (cheaper, lower quality, no Johnes risk, and contains added mineral, vitamins, coccidiostat and/or antibiotics)
Pasteurized Milk

- Raise milk to 145 degrees for 30 minutes (batch process)
- Raise milk to 161 degrees for 15 seconds (flow system)
- Cost ($3000 to $7000)
- Keys: clean equipment, post pasteurized contamination, correct time and temperatures, cooling, curdling, and high contamination levels
Encouraging Calf Starter Intake

- Calf starter is cheaper than milk or milk replacer
- Calf starter leads to the development of the rumen through volatile fatty acids produced by bacteria
- Fewer digestive upsets and scouring (loose feces) occurs when calves consume starter
- Calves grow faster when starter is consumed
Starter Guidelines

- Coarse textured or pellet form
- Adding 5 to 8% liquid molasses can improve intake (sticky consistency)
- Minimum of 18% protein (feed tag value)
- Complete calf starter (no forage fed, contains a fiber source such as oats or soyhulls)
- Water must be available free choice
An Example Calf Starter

- 50% shelled corn or barley
- 23% fibrous grain source (oats, soy hulls, citrus pulp, sugar beet pulp)
- 20% protein source (soybean meal, cottonseed meal, canola, sunflower meal)
- 5% molasses
- 2% minerals, vitamins, and additives
### Calf Starter Feed Tag

- **Crude protein**: 18 to 20%
- **Energy (TDN)**: 74%–76%
- **Fat/oil**: 3 to 5%
- **Crude fiber**: 8 to 12%
- **Calcium**: 0.60–0.65%
- **Phosphorous**: 0.40 – 0.45%
Weaning Strategies

• Removal/limit liquid feed as a nutrient source from the calf (milk or milk substitute)
• Calves should be consuming 2 pounds of calf starter per day
• Age at weaning can vary from 5 weeks to 8 weeks
Electrolyte Strategies

- **Electrolyte** (oral rehydration agent containing essential minerals and nutrients)
- Feed electrolyte addition to the milk-based diet
- Offer/feed/force 1 quart 15 to 30 minutes after liquid diet was fed
- Intravenous electrolyte if calf is severe
- Continue until signs of dehydration disappear (firm manure, skin texture, eye sinking, and alertness of calf)
Examples of Electrolytes

• Commercial products
• Home made mixture
  – 1 package of MCP pectin (jelly)
  – 1 teaspoon of low sodium salt (KCl)
  – 2 teaspoons of baking soda (bicarb)
  – 1 can of beef consume
  – Add water to make 2 quarts
Management Strategies (cont)

• Feeding forage (after weaning while maintaining > 5 pounds of calf starter)

• Water must be available one week after birth to encourage calf starter intake and maintain fluid balance

• All calves should get a coccidiostat (controls a protozoal infection) such as Deccox, ionophore, or Corad

• Probiotics are recommended pre-weaning
Calf Additives

- Coccidiostat (control protozoa)
  - Deccoquinate
  - Ionophore
  - Ampolium
- Probiotics and DFM (direct fed microbials)
- Yeast culture
- Antibiotics
Focus on Accelerated Calf Programs
Accelerated calf program

- Developed by Cornell University / U of IL
- Free choice milk replacer (26% CP / 15% fat)
- Consumption can reach 3 gallons a day
- Average daily gains reach 2 lb /day
- Expensive (extra $50 a calf in feed)
- Starter (22% crude protein / complete—no forage)
- Milk yield could be 1100 lb higher
Effect of rate of body weight gain with constant initial body weight (100 lb) on energy and protein requirements

<table>
<thead>
<tr>
<th>BW gain (% of DM)</th>
<th>Energy (lb/d)</th>
<th>Protein (kcal/d)</th>
<th>Req. DMI (g/d)</th>
<th>CP(% of DM) (lb/d)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>1748</td>
<td>28</td>
<td>0.84</td>
<td>8.3</td>
</tr>
<tr>
<td>0.50</td>
<td>2296</td>
<td>82</td>
<td>1.11</td>
<td>18.1</td>
</tr>
<tr>
<td>1.00</td>
<td>3008</td>
<td>136</td>
<td>1.45</td>
<td>22.9</td>
</tr>
<tr>
<td>1.50</td>
<td>3798</td>
<td>189</td>
<td>1.83</td>
<td>25.3</td>
</tr>
<tr>
<td>2.00</td>
<td>4643</td>
<td>243</td>
<td>2.24</td>
<td>26.6</td>
</tr>
<tr>
<td>2.50</td>
<td>5532</td>
<td>297</td>
<td>2.67</td>
<td>27.2</td>
</tr>
</tbody>
</table>

Adapted from National Research Council, 2001
High-quality milk replacers result in similar growth as whole milk *if energy and protein intakes are equal*

<table>
<thead>
<tr>
<th>Feed</th>
<th>ME (Mcal/lb DM)</th>
<th>Expected ADG (lb)</th>
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</thead>
<tbody>
<tr>
<td>Whole milk</td>
<td>2.44</td>
<td>0.88</td>
</tr>
<tr>
<td>Milk replacer 22/10</td>
<td>1.93</td>
<td>0.48</td>
</tr>
<tr>
<td>Milk replacer 22/19</td>
<td>2.18</td>
<td>0.64</td>
</tr>
<tr>
<td>Milk replacer 20/20</td>
<td>2.19</td>
<td>0.64</td>
</tr>
</tbody>
</table>

*For 90-lb calf fed at 10% BW (12.5% solids) or approximately 1 gallon of liquid daily (NRC, 2001)
<table>
<thead>
<tr>
<th>BW (lb/d)</th>
<th>Temp (°F)</th>
<th>MR¹ (lb/d)</th>
<th>ADG (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>60</td>
<td>1.0</td>
<td>0.51</td>
</tr>
<tr>
<td>90</td>
<td>30</td>
<td>1.0</td>
<td>loss</td>
</tr>
<tr>
<td>90</td>
<td>30</td>
<td>1.15</td>
<td>0.0</td>
</tr>
<tr>
<td>90</td>
<td>0</td>
<td>1.0</td>
<td>loss</td>
</tr>
<tr>
<td>90</td>
<td>0</td>
<td>1.45</td>
<td>0.0</td>
</tr>
</tbody>
</table>

¹Assumes 20-20 milk replacer with 2150 kcal ME / lb and negligible starter intake.
U of I Trial 1: Body weights

Trt × week, $P < 0.001; n = 11$

Pollard et al., 2003
Trial 2: Body weights

Trt × week, $P < 0.001$; $n = 21$

Pollard et al., 2003
First lactation milk yields

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Enhanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at calving† (mo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 1</td>
<td>25.4</td>
<td>26.5</td>
</tr>
<tr>
<td>Trial 2</td>
<td>24.0</td>
<td>24.3</td>
</tr>
<tr>
<td>Calving BW (lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 1</td>
<td>1,238</td>
<td>1,284</td>
</tr>
<tr>
<td>Trial 2</td>
<td>1,243</td>
<td>1,238</td>
</tr>
<tr>
<td>305-d Milk*† (lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 1</td>
<td>20,340</td>
<td>23,269</td>
</tr>
<tr>
<td>Trial 2</td>
<td>19,351</td>
<td>20,104</td>
</tr>
</tbody>
</table>

*Diet, $P < 0.01$; Diet x trial, $P = 0.13$
†Trial $P < 0.05$.

Drackley, Pollard et al., 2007
Accelerated Strategies

- **Accelerate calf growth program is here**
- **Use 26% crude protein, 15% fat (summer), 20+ percent in winter**
- **Option 1:** Feed at conventional rate (1 lb powder/day)
- **Option 2:** Cap at 2% BW as replacer
- **Option 3:** Ad lib acidified milk replacer
Automated Calf Feeding

Nipples rotated and cleaned daily

R.F.I.D. Reader
Over view of an automatic feeder in MN

(Paulson, 2009)

- Cost about $22,000 with 2 nipple stations for 25 calves
- Bottle feed individually 3-7 days then adapt to the nipple station
- Calves spend 30-50 min/day at the station (4-8 feedings/day of 1-4 lb/feeding)
- Start weaning at 49 days and wean by 56
- Calf starter – bunk fed to the group
Automated Calf Feeder

The unit heats the milk to the desired temperature (101°F) and will deliver milk to calves in amounts programmed by the user.

**Feeding Program:**

- Days 6-14: 6-8 quarts
- Days 14-35: 8 quarts
- At Day 35: calves start getting weaned down to 5 quarts by day 42
Automated Calf Feeding

Can add liquid or dry additives to MR with purchase of separate attachment
Facilities: Automated Calf Feeding Barn

- Pens
- Feed Bunk
- Feeding Unit
- Housing
- Water
- Milk Pipelines
- Drain

(16 x 47) Pens

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Advantages or What I Like:

• Calves are able to socialize and exercise in pens
• Calves have access to milk and water 24 hr
• Less Labor
Challenges: Keeping it Dry

- Keeping the area dry is a challenge
- More drainage the better!
- Disease outbreak in the pens is a possibility
Focus on Heifers
Goals for Replacement Heifers

• Achieve optimal growth
• Calve at 23 to 24 months of age
• Use economical feeds
• Minimize labor needs and cost
• Develop a solid vaccination program
• Avoid disease exposure
### Impact of Growth on Milk Production

<table>
<thead>
<tr>
<th>Wt (lb)</th>
<th>Milk (lb) compared to 1,000 lb Heifer</th>
<th>Gain (lb/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Age (months)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>1100</td>
<td>+1250</td>
<td>1.46</td>
</tr>
<tr>
<td>1200</td>
<td>+1777</td>
<td>1.60</td>
</tr>
<tr>
<td>1300</td>
<td>+1949</td>
<td>1.74</td>
</tr>
<tr>
<td>1400</td>
<td>+1999</td>
<td>1.88</td>
</tr>
</tbody>
</table>
# Nutrient Guidelines (Michigan)

<table>
<thead>
<tr>
<th>Age (mo)</th>
<th>TDN (%)</th>
<th>CP (%)</th>
<th>RUP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>71</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>66</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>16</td>
<td>66</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>
Late Pregnant Heifer

• Gain over 2 pounds /day
  – Frame (1.5 lb)
  – Fetus and fluids
• Immune system (trace minerals and vitamins for the dry cow)
• Transition the rumen
• Adjust to the milking area
<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>Strategy</th>
<th>Strategy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 - 4</td>
<td>Ration 1</td>
<td>age</td>
</tr>
<tr>
<td>2</td>
<td>4 - 6</td>
<td>Ration 1</td>
<td>age</td>
</tr>
<tr>
<td>3</td>
<td>6 - 9</td>
<td>Ration 2</td>
<td>age</td>
</tr>
<tr>
<td>4</td>
<td>9 - 12</td>
<td>Ration 2</td>
<td>age</td>
</tr>
<tr>
<td>5</td>
<td>12 - 15</td>
<td>Ration 3</td>
<td>repro</td>
</tr>
<tr>
<td>6</td>
<td>15 - 21</td>
<td>Ration 3</td>
<td>bred</td>
</tr>
<tr>
<td>7</td>
<td>&gt; 21</td>
<td>Ration 4</td>
<td>preg</td>
</tr>
</tbody>
</table>
Goals

- 1.7 to 1.8 lbs ADG
- Over 54 inches (withers)
- 3.25 to 3.5 body condition
- 23 to 24 months of age
Measuring Heifer Growth
Pennsylvania State University
Calf and Heifer Growth Chart

Holstein Chart

Age in Months

Weight (lbs)
1760
1540
1320
1210
990
770
550
330
110
0

Height (inches)
59
55
51
47
43
39
35
31
27
0
2
4
6
8
10
12
14
16
18
20
22
24

Breeding Age

Height

Weight
Body Condition Scores (WI)

- 2 months: 2.25
- 11 months: 2.75
- 23 months: 3.25
Interest in Limit Feeding Heifers

• Restricting dry matter intake

• Avoid fat or heavy heifers

• Reduce feed costs
Limit Feeding Heifers

• Adding fiber to limit intake (South Dakota)
  
• Limit dry matter intake
  – Using typical ration
  – Using concentrates
  – Using by-products
South Dakota Plan

• Use of bulky ingredients to fill the heifer using free-choice consumption

• Corn stalks with wet distillers grain

• Could use straw or low quality forages
## Nutrient Profile

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Modified DG</th>
<th>Corn stalks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>51.3</td>
<td>12.1</td>
</tr>
<tr>
<td>CP</td>
<td>27.0</td>
<td>5.5</td>
</tr>
<tr>
<td>EE</td>
<td>15.7</td>
<td>1.1</td>
</tr>
<tr>
<td>ADF</td>
<td>8.41</td>
<td>46.5</td>
</tr>
<tr>
<td>NDF</td>
<td>16.0</td>
<td>77.7</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.04</td>
<td>0.35</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1.19</td>
<td>0.16</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td>TDN</td>
<td>79.5</td>
<td>55.3</td>
</tr>
<tr>
<td>$/ton</td>
<td>45</td>
<td>8</td>
</tr>
</tbody>
</table>
Corn Stalks
DG Diet

Diet (DM basis):
• WDG 30%
• Corn stalks 70%

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>12.0-14.0</td>
</tr>
<tr>
<td>EE</td>
<td>3.8-5.3</td>
</tr>
<tr>
<td>ADF</td>
<td>35</td>
</tr>
<tr>
<td>NDF</td>
<td>59</td>
</tr>
<tr>
<td>Ca</td>
<td>0.26</td>
</tr>
<tr>
<td>P</td>
<td>0.46</td>
</tr>
<tr>
<td>S</td>
<td>0.34</td>
</tr>
<tr>
<td>TDN</td>
<td>62.6</td>
</tr>
</tbody>
</table>
Additional nutrients to balance the diet

- Fermentable or soluble protein (urea)
- Limestone
- Vitamins
- Trace minerals
- Salt
Important Points

• Try to minimize sorting
• Check the feed moisture
• Adequate processing of the stalks
• Feed more than once a day
• Check amount fed, refusals, manure.
• Ensure water availability
Wisconsin/Penn State Plan

- Limit dry matter intake
- Use of conventional ration
- Use of high concentrate ration
## Wisconsin Approach (Limiting DMI)

<table>
<thead>
<tr>
<th>Nutrient intake, lbs/d</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C-100</td>
</tr>
<tr>
<td>DM</td>
<td>21.3</td>
</tr>
<tr>
<td>CP</td>
<td>2.42</td>
</tr>
<tr>
<td>NDF</td>
<td>10.06</td>
</tr>
<tr>
<td>Non-fiber carbohydrate</td>
<td>7.26</td>
</tr>
<tr>
<td>P</td>
<td>0.057</td>
</tr>
<tr>
<td>Ca</td>
<td>0.086</td>
</tr>
</tbody>
</table>

### Energy intake

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDN, lbs/heifer/d</td>
<td>14.4</td>
</tr>
<tr>
<td>$NE_g$, Mcals/d</td>
<td>9.4</td>
</tr>
<tr>
<td>$NE_m$, Mcals/d</td>
<td>13.7</td>
</tr>
</tbody>
</table>
## Effect of dietary regimen on body size and growth of replacement heifers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>C-100</th>
<th>R-90</th>
<th>R-80</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight, lbs</td>
<td>1036</td>
<td>1021</td>
<td>1011</td>
</tr>
<tr>
<td>Hip height, in</td>
<td>54.20</td>
<td>54.60</td>
<td>54.90</td>
</tr>
<tr>
<td>Body condition score</td>
<td>3.1</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Final</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight, lbs</td>
<td>1220</td>
<td>1234</td>
<td>1217</td>
</tr>
<tr>
<td>Hip height, in</td>
<td>56.0</td>
<td>56.3</td>
<td>56.4</td>
</tr>
<tr>
<td>Body condition score</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average daily gain, lbs/d</td>
<td>1.66</td>
<td>1.92</td>
<td>1.84</td>
</tr>
<tr>
<td>Feed efficiency, lbs DM/lb gain</td>
<td><strong>13.2</strong></td>
<td><strong>10.7</strong></td>
<td><strong>11.1</strong></td>
</tr>
<tr>
<td><strong>Excretion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM, lbs/d</td>
<td>7.7</td>
<td>6.9</td>
<td>5.8</td>
</tr>
</tbody>
</table>
## Effect of feeding regimen on voluntary behavior of replacement heifers

<table>
<thead>
<tr>
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<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>C-100</td>
</tr>
<tr>
<td>Eating, % of time</td>
<td>19.3</td>
</tr>
<tr>
<td>Standing, % of time</td>
<td>19.6</td>
</tr>
<tr>
<td>Lying, % of time</td>
<td>60.9</td>
</tr>
<tr>
<td>Vocalization, % of time</td>
<td>0.02</td>
</tr>
<tr>
<td>Eating, hrs/day</td>
<td>2.3</td>
</tr>
<tr>
<td>Standing, hrs/day</td>
<td>4.7</td>
</tr>
<tr>
<td>Lying, hrs/day</td>
<td>14.6</td>
</tr>
</tbody>
</table>
In Summary: Hutjens’ Biases

• Minimize pasture until 3 mo
• Limit corn silage until 3 mo
• Hay at weaning and/or haylage IF mold free and >40% DM
• Maximum of 5 lb grain/starter
• High group TMR (3-7 mo)
• All heifers on ionophore and force fed minerals