Rearing heifers to calve at 24 months

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26th January 2012
Successful heifer rearing to increase herd profits

- Rearing heifers represents about 20% of dairy farm expenses
  - Minimal morbidity & mortality
  - Optimal growth rate
  - Excellent fertility
  - Calve at 24 months

- The return on the investment is not fully recovered until lactation 2
  - Long-lived
  - Capable of sustaining high milk yields
  - Conceive at the desired time of breeding
  - Healthy
Project methods

- 500 heifer calves recruited at birth from 19 dairy farms across southern England during 2003 & 2004 (~25 heifers / farm)

- Survival
  - Up to 1st calving
  - During 1st & 2nd lactation

- Growth
  - Weight, length, height & girth measured at 1, 6 & 15 months

- Fertility parameters
  - Age at 1st service & at 1st calving
  - Services per conception
  - Days to 1st service & conception
  - Calving interval

- Milk production
Calf losses at birth

- Monitored all calves born over 2 mo period, n = 1097 births
- Mean mortality at birth: **7.9%** (range 3 – 14% between herds)
- 200 cow herd = approx. 16 calves born dead every year
- Which calves were at the highest risk?
  - Assisted calvings (19%)
  - Twins (19%)
  - Calves born to primiparous dams (12%)

Increase observation of calving pen – heifers & those expecting twins

Brickell et al., 2009 Animal 3:8 1175-82
Heifer losses during the rearing period

15% of live-born heifers failed to reach their first lactation (data from 509 heifers from 19 farms)

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1d – 1mo</td>
<td>3%</td>
<td>0-12%</td>
</tr>
<tr>
<td>1 - 6 mo</td>
<td>3%</td>
<td>0-29%</td>
</tr>
<tr>
<td>6 – 15 mo</td>
<td>4%</td>
<td>0-19%</td>
</tr>
<tr>
<td>Breeding to 1st calving</td>
<td>4%</td>
<td>0-21%</td>
</tr>
</tbody>
</table>

Average price of freshly calved heifer £1672, Dec 2011

Recording losses will highlight which stage is the problem & help to identify the main causes

Brickell et al., 2009 Animal 3:8 1175-82
58% of live-born heifers failed to reach their 3rd lactation (herd range 20-68%)
Summary of losses up to 3\textsuperscript{rd} calving

Brickell and Wathes 2011 J Dairy Sci 94:1831-8

200 calves born

49 cows at 3\textsuperscript{rd} calving

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Loss Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-24h</td>
<td>8%</td>
</tr>
<tr>
<td>1d-1mo</td>
<td>3%</td>
</tr>
<tr>
<td>1mo-1st calving</td>
<td>11%</td>
</tr>
<tr>
<td>Lactation 1</td>
<td>19%</td>
</tr>
<tr>
<td>Lactation 2</td>
<td>24%</td>
</tr>
<tr>
<td>1d-3rd calving</td>
<td></td>
</tr>
</tbody>
</table>

Summary of losses up to 3\textsuperscript{rd} calving.
Less than half of live-born heifers calved for a 3rd time.

Animals become profitable during lactation 2.
Heifer growth

Heifers should calve for the 1st time at approx.
- 24 months of age
- body weight of 550 to 625 kg (85-90% mature BW)

Recommended body weight gain:
- 0.7 kg/d before puberty
- 0.8 kg/d after puberty

Rate of growth has a direct effect on age at first calving
Body weight growth varies considerably

- 506 Holstein-Friesian heifers measured at 1 & 6 mo of age
- 1 – 6 mo: mean **0.77 kg /d**

- Highest: 1.3 kg/d
- Target: 0.7 kg/d
- Lowest: 0.2 kg/d

Brickell et al., 2009 Domest Anim Endocrinol 36 67-81
### Target Growth Rates

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Target weight, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>36-40</td>
</tr>
<tr>
<td>1</td>
<td>55-60</td>
</tr>
<tr>
<td>3</td>
<td>95-110</td>
</tr>
<tr>
<td>6</td>
<td>180-200</td>
</tr>
<tr>
<td>15</td>
<td>340-375</td>
</tr>
<tr>
<td>22-24</td>
<td>550-625</td>
</tr>
</tbody>
</table>

Set a target growth rate for your farm

![Calf](image1.png)

- **40 kg**
- **510 kg**
- **730 d**

### Target growth rate, kg/d

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Target growth rate, kg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Up to 0.85</td>
</tr>
<tr>
<td>4-12</td>
<td>0.7</td>
</tr>
<tr>
<td>12-16</td>
<td>0.8-0.9</td>
</tr>
<tr>
<td>16-24</td>
<td>0.7-0.75</td>
</tr>
</tbody>
</table>

![Cows](image2.png)
Monitoring heifer growth rates

- Measure at birth

- Weigh heifers each time they are handled (e.g. for vaccination, worming, insemination, pregnancy test)

- Use weigh scales, girth tape, tape measure, height stick

- Be consistent

If heifers are not achieving targets – look for causes of poor growth
Monitoring growth

Weigh scales

Height stick

Use a measure that is consistent between years to create a benchmark
Factors influencing mortality & growth

- Calf size / maternal parity
- Colostrum feeding
- Milk feeding (type, amount, temperature, system)
- Supply of concentrate/roughage
- Housing (ventilation, bedding, pen design)
- Weaning management (age, size, feed intake, stress)
- Post-weaning nutrition
- Vaccination

Likelihood of contracting:

- Enteric disorders (*E. coli*, salmonella, rotavirus, coronavirus, cryptosporidia)
- Pneumonia (RSV, IBR, PI-3)

Attention to detail is key
How much to feed for target growth

- Restricted feeding at 8-10% of birth BW (4-5L per day), typically 400-600 g/d solids, will support maintenance requirements plus an ADG of 0.2-0.3 kg/d under thermoneutral conditions.

MR reconstituted to 12.5% dry matter.

Bartlett et al., 2006 J Anim Sci 84:1454-67
Mixing concentration

- Amount of solids fed per day is key - know exactly how much you are feeding

Use scales to weigh milk powder

### Final concentration of mixed milk

- 875ml: 125g (12.5%)
- 1000ml: 125g (11.1%)
Always provide fresh water

- Provide the calf with fresh ad-libitum water from day 3 – essential for rumen development
- Milk is a feed – NOT a drink

A calf needs 4L of water for each 1kg dry feed
Crude protein needed in CMR for different rates of DLWG (g)

Protein requirements increase as rate of gain increases
Is growth rate important?

- Birth
- Puberty
- Inseminate
- Parturition
- Lactation
- GROWTH
- Display signs of heat
  - Well grown
- 9 mo
- 13 mo
- 24 mo

Inseminate
**Poor growth: delays breeding**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Rate 1-6 mo</td>
<td>1.1 kg/d</td>
</tr>
<tr>
<td>BW at 15 mo</td>
<td>372 kg</td>
</tr>
<tr>
<td>Age at 1st breeding</td>
<td>16 mo</td>
</tr>
<tr>
<td>Age at 1st calving</td>
<td>25 mo</td>
</tr>
<tr>
<td>1st lactation 305 d yield</td>
<td>7757 kg</td>
</tr>
<tr>
<td>Yield/d of life lactation 1</td>
<td>7.3 kg/d</td>
</tr>
</tbody>
</table>

Spent less time of its life in milk:
- Increased length of non-productive period
- Spent less time of its life in milk: lower yield per day of life
Age at 1st calving (AFC)

- Mean AFC for 431 heifers was $27 \pm 0.2$ mo (range 21 to 51 mo)
- Excluding 1 farm calving as 3 yr olds, AFC was 26 mo (range 21 to 51 mo)

Rearing costs:
- 24 mo: £988
- 30 mo: £1171

(Kingshay Trust)
## Effect of growth on age at 1\textsuperscript{st} calving

<table>
<thead>
<tr>
<th>Growth rate (1-6 mo) kg/d</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.6</td>
<td>0.7-0.9</td>
</tr>
<tr>
<td>0.6 – 0.8</td>
<td></td>
</tr>
<tr>
<td>&gt; 0.8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth rate (kg/d)</th>
<th>0.5\textsuperscript{a}</th>
<th>0.7\textsuperscript{b}</th>
<th>0.9\textsuperscript{c}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight at 6 mo (kg)</td>
<td>128\textsuperscript{a}</td>
<td>164\textsuperscript{b}</td>
<td>205\textsuperscript{c}</td>
</tr>
<tr>
<td>Age at 1\textsuperscript{st} service (mo)</td>
<td>18\textsuperscript{c}</td>
<td>16\textsuperscript{b}</td>
<td>15\textsuperscript{a}</td>
</tr>
<tr>
<td>Age at 1\textsuperscript{st} calving (mo)</td>
<td>28\textsuperscript{b}</td>
<td>26\textsuperscript{a}</td>
<td>25\textsuperscript{a}</td>
</tr>
</tbody>
</table>

- Heifers with higher growth rates are more likely to calve at 24-25 months.
AFC effects fertility & milk yield

<table>
<thead>
<tr>
<th>Age at first calving, mo</th>
<th>&lt;23</th>
<th>23-25</th>
<th>26-30</th>
<th>&gt;30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lactation 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual AFC, mo</td>
<td>22&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>27&lt;sup&gt;c&lt;/sup&gt;</td>
<td>34&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>305d yield</td>
<td>8494</td>
<td>8811</td>
<td>9103</td>
<td>8914</td>
</tr>
<tr>
<td>Calving interval</td>
<td>410&lt;sup&gt;a&lt;/sup&gt;</td>
<td>402&lt;sup&gt;a&lt;/sup&gt;</td>
<td>425&lt;sup&gt;a&lt;/sup&gt;</td>
<td>451&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Lactation 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>305d yield</td>
<td>9340&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9908&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10546&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9633&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Calving interval</td>
<td>424</td>
<td>392&lt;sup&gt;a&lt;/sup&gt;</td>
<td>409</td>
<td>434&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Lactation 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk per d of life#</td>
<td>12.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.0&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

#total yield over 2 lactations/(cull date or calving 3 date-date of birth)

- Heifers calving at 23-25 mo have better fertility & give more milk per day of life

RVC study (Brickell and Wathes, unpublished)
AFC effects survival up to 3\textsuperscript{rd} lactation

For every 5 heifers calving at 23-25 mo, an extra 1 reached 3\textsuperscript{rd} lactation

More heifers calving at 23-25 months reach 3\textsuperscript{rd} lactation
Heifer mortality & calving age effects heifer gross margin

- After rearing costs, typical gross margin for each heifer calving at 120 weeks = £650 (value of fresh heifer = £1800, total rearing costs = £1150)

<table>
<thead>
<tr>
<th>Average rearing success</th>
<th>AFC (months)</th>
<th>25.5</th>
<th>28.5</th>
<th>31.5</th>
<th>34.5</th>
<th>37.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>670</td>
<td>500</td>
<td>236</td>
<td>28</td>
<td>-292</td>
<td></td>
</tr>
<tr>
<td></td>
<td>595</td>
<td>425</td>
<td>161</td>
<td>-47</td>
<td>-367</td>
<td></td>
</tr>
<tr>
<td></td>
<td>520</td>
<td>350</td>
<td>86</td>
<td>-122</td>
<td>-442</td>
<td></td>
</tr>
</tbody>
</table>

- RVC Trial data:
  - AFC range 22.9 to 36.5 mo
  - Rearing success to 1\textsuperscript{st} calving range 100 to 71%
    - Herd 1: 91% reared, AFC 25 mo = 50 x £595 = £29 750
    - Herd 2: 81% reared, AFC 28 mo = 50 x £350 = £17 500
    - Herd 3: 82% reared, AFC 36.5 mo = loss

Neil Howie, Nantwich Veterinary Group. In British Dairying Dec 2010
Calf & heifer losses

- 8% calves stillborn or die within 24 h
- 15% heifers never reach 1\textsuperscript{st} lactation
- 20+\% heifers reaching 1\textsuperscript{st} lactation only calve once
- Average lifespan 3 lactations per cow

200 cow herd = approx. 16 calves born dead every year

Average cost of a freshly calved heifer = £1670

Heifers do not become profitable until lactation 2
Conclusions – calf & heifer losses

- Record all calf & heifer losses from birth, & calculate the mortality rate during different stages of the rearing period

- Increase awareness - is there a problem during a particular period?

- Identify the main causes – prevention for next year is key
  - Colostrum management?
  - Nutrition?
  - Housing?
  - Infectious disease?
  - Accidents?

- Heifer mortality increases the cost of getting those surviving to the point of calving
Calf & heifer growth

- Body weight gain ranged from 0.2 to 1.3 kg/d
- Poor growth = delayed breeding & first calving
- 47% calved at >26 months

- More heifers have to be reared to replace same number of cows
- Fewer days in milk

Increased rearing costs

< 0.6 kg/d for 21% heifers
Conclusions – growth rate

- Measure the growth rate of heifers at ≥ 2 time points
  - Birth
  - 6 mo - make corrective changes before time of breeding for this group
  - 15 mo – make corrective changes to rearing regimes for next years cohort of heifers

- Ensure heifers do not grow too slowly but not too fast

- Low (<0.6 kg/d) – identify the main causes of poor growth:
  - Delays first calving
  - Small at first calving

- High (>0.9 kg/d) – reduce nutrient intake:
  - Expensive
  - Negatively associated with fertility

- Measure growth rate & establish an on-farm benchmark
The ideal heifer rearing system

- Reduce mortality
- Monitor growth
- First calving at 23-25 months

A healthy heifer results in a healthy & productive cow
Acknowledgements

- Royal Veterinary College, London
  - RVC project originator Professor Claire Wathes
  - RVC project funded by DairyCo & DEFRA

- Participating Farms & Veterinary Practices in RVC Trial