Feeding growing herds for fertility

Finbar Mulligan, Luke O’Grady, Michael Doherty
School of Agriculture, Food Science and Veterinary Medicine
University College Dublin
How important is dairy herd fertility??

**Cost of fertility problems**

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving interval (£3.08 per day)</td>
<td>365</td>
<td>390.2</td>
</tr>
<tr>
<td>Services per conception (£29.80 service)</td>
<td>1.82</td>
<td>2.37</td>
</tr>
<tr>
<td>Infertile culling % (£960.7 per cow)</td>
<td>6.0</td>
<td>13.8</td>
</tr>
</tbody>
</table>

Total cost of infertility problem for 100 cow dairy herd = **£16,894.60**


Good fertility is vital for herds trying to increase cow numbers!!
Nutrition for better dairy cow fertility

- Nutrition around calving
  - Rebreading happens soon after calving
  - Nutrition has a huge influence on health around calving

- Nutrition in early lactation
  - Negative energy balance
    - Monitoring energy balance in your dairy herd?
  - Protein feeding
Nutrition and dairy cow health around calving

Difficult calving
Retained placenta
Metritis / Endometritis
Laminitis
Acidosis
Ketosis
Fatty liver
Milk fever
Displaced abomasum
Mastitis
Dairy Cow Health Around Calving

1. Body Condition Score Management

The most important thing you can do to ensure good dairy cow health around calving is to manage BCS properly!!
**Target BCS for dairy cattle at different points of the lactation cycle**

<table>
<thead>
<tr>
<th>Time Point</th>
<th>BCS Target</th>
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<tbody>
<tr>
<td>Drying off</td>
<td>2.75</td>
</tr>
<tr>
<td>Calving</td>
<td>3.0 (90% of cows 2.75 – 3.25)</td>
</tr>
<tr>
<td>Breeding</td>
<td>&gt;2.5</td>
</tr>
<tr>
<td>150 DIM</td>
<td>2.75</td>
</tr>
<tr>
<td>200 DIM</td>
<td>2.75</td>
</tr>
<tr>
<td>250 DIM</td>
<td>2.75</td>
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Where BCS at calving is 3.25, 30% of cows lose ≥ 0.5 units of BCS in early lactation.

Where BCS at calving is 3.5, 47% of cows lose ≥ 0.5 units of BCS in early lactation.

Buckley et al., (2003)
We often find over-conditioned dry cows and heifers on Irish dairy farms

Pre-calving

Long period of reduced feed intake pre-calving (Hayirli et al., 2002)

Increased chances of fatty liver, ketosis, difficult calving, retained placenta, displaced abomasum (Cameron, 1998, Kaneene, 1997)

Post-calving

30% lower feed intake in early-lactation (Garnsworthy et al., 1982)

Reduced fertility: longer calving intervals (Mayne et al., 2002)
Forage dry matter intake for BCS 3.25 and 4.04 at calving

<table>
<thead>
<tr>
<th>Calving BCS</th>
<th>DRY</th>
<th>WK1</th>
<th>WK2</th>
<th>70days</th>
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<tr>
<td>3.25</td>
<td>6.06</td>
<td>12.07</td>
<td>13.17</td>
<td>13.90</td>
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<tr>
<td>4.04</td>
<td>6.07</td>
<td>10.56</td>
<td>11.50</td>
<td>13.21</td>
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<tr>
<td>P</td>
<td>0.98</td>
<td>0.06</td>
<td>0.04</td>
<td>0.27</td>
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</table>
### BCS and BW loss for BCS 3.25 and 4.04 at calving

<table>
<thead>
<tr>
<th>Calving BCS</th>
<th>BCS loss</th>
<th>BW loss</th>
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<td>3.25</td>
<td>0.64</td>
<td>43.30</td>
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<tr>
<td>4.04</td>
<td>1.12</td>
<td>55.52</td>
</tr>
<tr>
<td>P</td>
<td>0.001</td>
<td>0.065</td>
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</table>
If BCS loss is > 1 unit in early lactation conception rate may be as low as 17 to 38%

**Moorepark data**

<table>
<thead>
<tr>
<th>BCS loss calving to 1\textsuperscript{st} service</th>
<th>Pregnant at d 42 (%)</th>
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<tbody>
<tr>
<td>≤0.25</td>
<td>67</td>
</tr>
<tr>
<td>0.25 to 0.5</td>
<td>59</td>
</tr>
<tr>
<td>&gt;0.5</td>
<td>47</td>
</tr>
</tbody>
</table>

(Butler, 2000)

(Buckley et al. 2001)
On-farm approach for BCS monitoring

1. The most important thing you can do to ensure good dairy cow health around calving is to manage BCS properly!!

All farmers can BCS cows!!

Dairy discussion groups must focus on BCS??
Dairy cow health around calving

2. Negative energy balance pre-calving

- Cows loosing weight pre-calving

- Related to:
  - Retained placenta
  - Fatty liver and Ketosis (Bertics et al., 1992)
  - Displaced abomasum (Le Blanc et al., 2005)
  - Immunosuppression (Goff, 2003)
  - Uterine infections: reduced fertility

Fatty liver (Up to 50% of cows in early-lactation)
Negative energy balance pre-calving

- Over-conditioning
- Group stress
- Poor silage quality
- Use of night feeding only
- Larger numbers of cows in dry cow pen
Dairy cow health around calving

3. Milk Fever and subclinical hypocalcaemia
• 5-10% of cows get clinical milk fever (Houe et al., 2001)

• Expanding herds may retain older cows which means more milk fever

• 20 – 40% get Sub-clinical milk fever:
  ▪ Retained placenta / Slow calvings
  ▪ Low feed intakes after calving
  ▪ Reduced immune system competence (Goff, 2003)
  ▪ Reduced fertility: sub-clinical hypocalcaemia significantly delays first ovulation after calving (Jonsson et al., 1999)
Milk Fever Cascade

↓ Smooth muscle function

↓ Rumen and GIT motility
↓ Feed Intake
↓ Energy balance ↓ Rumen fill ↓ Milk Yield
↑ Ketosis
↑ Fatty liver
↓ Reproduction

↓ Uterine motility
↑ Dystocia ↑ RFM
↑ Metritis
↓ Uterine involution
↓ Reproduction

↓ Immune function

↓ Teat sphincter contraction
↑ Mastitis

↑ Ketosis
↑ Fatty liver
↓ Reproduction
↑ Displaced abomasum

Adapted from Wilde (2005)
# Subclinical hypocalcaemia in grazing New Zealand dairy cattle

<table>
<thead>
<tr>
<th>Day Relative to Calving</th>
<th>-14</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of cows clinical milk fever</td>
<td>1</td>
<td>4.8</td>
<td>1.9</td>
<td>1.2</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>% of cows subclinical milk fever</td>
<td>1</td>
<td>33</td>
<td>25</td>
<td>18</td>
<td>9.4</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Plasma Ca < 1.4mmol/l clinical milk fever
Plasma Ca 1.4 - 2.0 mmol/l subclinical hypocalcaemia
n = 224

Roche (2003)
Practical control strategies for milk fever

- Identify milk fever control strategy used (often none)
- BCS management critical

- Ensure Mg supplement fed (15 - 20g per dry cow per day)
- Have blood Mg assessed in the close-up dry period

- Limit access to high K / high N pasture
- Only use forages with < 1.8% K (Irish silage on average 2.3% K)

- Carefully review the incidence of retained placenta, displaced abomasum, difficult calving, clinical milk fever
  - Review this data minus the heifers in the herd
Dairy cow health around calving

4. Maintaining a Healthy Rumen
Sub-acute ruminal acidosis reported in 20 to 40% of US dairy cows (Kleen et al., 2003)

Implications for:
- Lameness / Laminitis
- Negative energy balance
- Excess BCS loss in early lactation

There are reports that SARA may be a problem for pasture fed dairy cattle (Woodward et al., 2003) (Bramley et al., 2005)
Sub-Acute Ruminal Acidosis

- Alteration in Rumen Flora
  - Increase in Rumen Osmolarity
  - Altered SCFA Production
    - Low milk Fat Syndrome
      - Laminitis (Lameness)
      - Abomasal and Caecal Displacement
        - Reduced Reproductive Performance
  - Reduced Rumen Motility
    - Depressed Feed Intake
      - Negative Energy Balance
        - Ketosis
        - Reduced Reproductive Performance

- Decrease Rumen pH
  - Rumenitis
    - Altered SCFA Adsorption
      - Liver Abscessation
        - Caudal Vena Cava Syndrome
      - Immunosuppression
        - Mastitis Endometritis Pneumonia
UCD dairy herd health SARA pilot study summer 2006 in Meath, Kildare and Wicklow (O’Grady et al., 2006)

- Rumen pH samples in 12 dairy herds
- Average yield 8114kg (sd 733kg)
- Average herd size 95 (sd 38 cows)
- Average concentrate fed 3.3kg/d (sd 1.5kg/d)
- Cows sampled were 80 to 150 DIM

Results
- 3 out of 12 herds had a significant diagnosis of SARA
- 11% of cows had a rumen pH < 5.5 = SARA
- 53% of cows had a rumen pH < 5.8 = Too low for optimal feed digestion and intake
Monitoring rumen health

- % of resting cows ruminating should be > 80%
- Individual mid-lactation cows with milk fat% less than milk protein% by 0.2% (Hutjens, 2001)
- 10% of Herd with milk fat < 2.5% (Nordlund et al., 2004)

- Faecal consistency scoring

- Rumenocentesis: 12 cows 2 to 4 hours after concentrate meal if 3 have ruminal pH < 5.5 there is a SARA problem (Nordlund et al., 2004)

Rumenocentesis (Enemark et al., 2002)
Nutrition in Early Lactation

1. Negative Energy Balance
Energy Balance in Early Lactation: Wattiaux Babcock Institute

Figure 1: Energy balance of dairy cows in early lactation
Early lactation nutrition and fertility

- Reasons for excessive negative energy balance
  - Over conditioned cows at calving
    - Reduces feed intake
  - Under-feeding relative to energy output
    - Management: feed trough space; grass allowance
    - Diet quality
    - Climatic / soil conditions
  - Ill health
    - Lameness, ruminal acidosis, metritis reduce feed intake
To Ensure Negative Energy Balance is Not Excessive
In Early Lactation Maximising Feed Intake is Critical!

Herds with higher conception rates to first insemination had significantly higher mean intakes of DM and ME during the first 100 days of lactation

Mayne et al. 2002
Grazing cows NEB and fertility

- **Group 1.** Many dairy herds will have acceptable levels of energy balance with grazing only or mostly grazing diets
  - Cows have low energy output
  - Farmers / soil and climatic conditions on that farm make for high grass intakes

- **Group 2.** However many herds will experience excessive negative energy balance when the diet is grazing only or grazing with minimal levels of concentrate supplementation
  - Cows have high energy output
  - High intakes of grazed grass are not achieved for various reasons
Grazing cows NEB and fertility

- Many people believe that the fertility of grazing dairy cows will not be improved by feed supplementation in absolutely all circumstances.

- **However:**

- It has been shown that higher levels of concentrate supplementation reduce BCS loss in early lactation (ie. improve energy balance) (Horan et al., 2005; McCarthy et al., 2007)

- It has been shown that when grass supply is reduced fertility is increased after concentrate supplementation.
### Grazing cows NEB and fertility (Kennedy, 2001)

**Concentrate supplementation and fertility – Adequate Grass Supply**

<table>
<thead>
<tr>
<th>Concentrate kg/cow/day</th>
<th>0</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to 1\textsuperscript{st} oestrus</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>Cows served in 1\textsuperscript{st} 3 weeks</td>
<td>92</td>
<td>89</td>
</tr>
<tr>
<td>Calving to conception days</td>
<td>91</td>
<td>93</td>
</tr>
<tr>
<td>Pregnancy rate 1\textsuperscript{st} service</td>
<td>51</td>
<td>54</td>
</tr>
<tr>
<td>Pregnancy rate 2\textsuperscript{nd} service</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>Pregnant %</td>
<td>85</td>
<td>88</td>
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</table>
## Grazing cows NEB and fertility (Dillon, 1999)

Concentrate supplementation and fertility – Reduced Grass Supply

<table>
<thead>
<tr>
<th>Concentrate kg/cow/day</th>
<th>0</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Submission rate % 1\textsuperscript{st} 3 weeks</td>
<td>91</td>
<td>95</td>
</tr>
<tr>
<td>Calving to service interval (days)</td>
<td>60</td>
<td>56</td>
</tr>
<tr>
<td>Calving to conception interval (days)</td>
<td>80</td>
<td>68</td>
</tr>
<tr>
<td>Pregnancy to 1\textsuperscript{st} service %</td>
<td>41</td>
<td>64</td>
</tr>
<tr>
<td>Pregnancy to 2\textsuperscript{nd} service %</td>
<td>68</td>
<td>86</td>
</tr>
<tr>
<td>Services / cow</td>
<td>2.10</td>
<td>1.50</td>
</tr>
<tr>
<td>Not in calf %</td>
<td>18</td>
<td>9</td>
</tr>
</tbody>
</table>
Does my herd have an acceptable level of energy balance in early lactation??

- What percentage of cows have BCS loss > 0.5 units in early lactation?

- What percentage of cows have BCS of < 2.5 at breeding?

- What percentage of cows have a Milk fat : protein ratio of more than 1.5? (Heuer et al., 1999)

- What percentage of cows have a milk protein of less than 3.05% (increases calving to conception interval)? (Heuer et al., 2002; Mayne et al., 2002)

- What percentage of cows have a decline in milk yield of more than 2.5% per week after peak milk yield (Chamberlain and Wilkinson, 2000)

- What percentage of early lactation cows have high levels of fatty acids (NEFA) or ketones (BHB) in blood (Whitaker, 1997; Oetzel, 2004)
Monitoring energy balance in early lactation cows

Figure 2: Body condition score loss in early lactation for cows of greater than third lactation indicating excessive negative energy balance (n=17). Many of the cows in this group had a BCS loss of 0.75 units in early lactation.
Monitoring energy balance in early lactation cows: milk recording data

21.3% at risk of ketosis

1% at risk of acidosis
Monitoring energy balance in early lactation cows: milk recording data

<table>
<thead>
<tr>
<th>Line No.</th>
<th>EarTag</th>
<th>Name</th>
<th>Lact No.</th>
<th>Date Calved</th>
<th>Ratio</th>
<th>Yield kg</th>
<th>Protein %</th>
<th>Fat %</th>
<th>Ketosis</th>
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<td>73</td>
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<td>UKS81493400436</td>
<td>4</td>
<td>06 Nov 2007</td>
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<td>2.58</td>
<td>6.24</td>
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<td>1</td>
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<td>3.06</td>
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<td>25.70</td>
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<td>26.40</td>
<td>4.11</td>
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Monitoring energy balance in early lactation cows: blood metabolite data

Figure 1: Non-esterified fatty acid concentrations in plasma of early lactation cows indicative of negative energy balance (acceptable threshold below blue line). In this case no over-conditioning existed in the dry period.
Possible implications of herd expansion on negative energy balance

- Higher stocking rates on grazing area reduce grass intakes
- Use of lower quality second-cut grass silage reduces feed intake for indoor fed cows
- Possible use of lower levels of maize silage on a per cow basis in early lactation reduces feed intake for indoor fed cows
- Increased number of animals subjected to group stress, e.g., heifers
Possible implications of herd expansion on negative energy balance

- Increased number of cows in front of the same feed trough space
- Less time for monitoring and treating sick or lame cows
- Increased time away from the feed trough or grass as milking takes longer
- Heifers often are too fat at calving
Nutrition in Early Lactation

2. Protein feeding and fertility for Irish dairy cows
Protein feeding and fertility for Irish dairy cows

- Irish dairy cows often fed excessive levels of protein, particularly rumen degradable protein
- What effect does excessive protein feeding have on fertility??
RDP and grazing dairy cows

Example: Dairy cow: 30 kg milk 3.2% protein; 4.0% Fat
Diet: 1st rotation grass and 4 kg unmolassed beet pulp

Excess of RDP is 692g (2513 - 1821)
Protein feeding and fertility

High levels of Rumen Degradable Protein (RDP):

- Delays the first ovulation or oestrus
- Reduce conception rate after first insemination
- Increase number of days open
- Lower overall conception rate
- Makes energy balance more negative
- It is possible that intermediate metabolites of RDP (ammonia and urea) have direct negative effects on fertility in dairy cattle experiencing negative energy balance (Tamminga, 2006)
Diet crude protein% and fertility (Data kindly made available by: Young et al., 2007; AFBI Hillsborough, NI)

Average Daily milk yield (weekly average kg) for cows and heifers from weeks 1 - 43 of lactation

- Low = 12% CP
- Med = 15% CP
- High = 18% CP

% of cows in calf after 100 days
- Low = 83%
- Med = 67%
- High = 62%
Protein feeding and fertility

- Feeding excess protein
  - Reduces fertility
  - It is almost impossible to avoid feeding excess RDP to grazing cows in Ireland in early lactation
  - However, grazing diets should be supplemented with low protein compounds for cows in early lactation
Summary and Conclusions

- Optimal nutritional status around calving is vital for good dairy herd fertility
  - Proper BCS management
  - Avoiding negative energy balance pre-calving
  - Avoiding milk fever or subclinical hypocalcaemia
  - Maintaining rumen health
Summary and Conclusions

- Energy balance is the most important factor of early lactation nutrition for fertility
  - Energy balance should be monitored for all dairy herds
  - Milk recording data
  - BCS data
  - Blood metabolite data
Thank you for your attention!