Farm management factors associated with the *Bacillus cereus* count in bulk tank milk

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Outline

• Introduction
• Study objective
• Sample and data collection
• Results
• Recommendations
• Future work
The infant milk formula market

“When you’re in the infant milk formula market you cannot afford the first mistake”

Jim Woulfe, CEO, Dairygold, National Dairy Conference, November, 2013
**Bacillus cereus**

Bacillus cereus is a Gram positive, rod shaped, motile, bacterium

- Ubiquitous in nature
- Ability to grow and multiply in biofilms on the milking machine
- Survives pasteurisation

(Andersson et al., 1995, Lewis, 2010)

Its presence in milk can limit the shelf life of dairy products and can cause **food poisoning** when present in large numbers

The Irish Agriculture and Food Development Authority
Prevalence of *Bacillus cereus* in infant milk formula

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample source</th>
<th>Sample size</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Becker <em>et al.</em>, 1994</td>
<td>Global infant milk formula</td>
<td>92</td>
<td>52%</td>
</tr>
<tr>
<td>Rowan <em>et al.</em>, 1997</td>
<td>UK</td>
<td>100</td>
<td>17%</td>
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<tr>
<td>Haughton <em>et al.</em>, 2010</td>
<td>Ireland</td>
<td>100</td>
<td>59%</td>
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Regulatory limits

- Dried infant formula – 5 samples
  - 4 must be <50cfu/g
  - Remaining can be between 50 and 500 cfu/g

- Raw milk promoted for infant milk formula manufacture has *B. cereus* count <60cfu/ml
Sources of *Bacillus cereus*

Contaminated teats

- Soil during the grazing period
- Bedding during the housing period
  - Bedding type and the frequency its changed
- Faeces via contaminated feed


Degree of contamination on teats is influenced by the dry matter content of the soil and wet weather conditions

(Christiansson *et al.* 1999)
Objective

1. Relevant management factors applicable to the Irish dairy system.

2. That influence the pre-pasteurisation *B. cereus* count

To identify the farm management practices associated with the *Bacillus cereus* count in bulk tank milk
Identification of farms

- 63 farms - Dairygold suppliers
- Recruited by milk quality advisor
- Between 4 and 8 samples BTM samples were collected from each farm two weeks prior to an on farm visit
- The last sample was collected within 24h of the on-farm visit
- Tested for *Bacillus cereus*
- Average of the four most recent results – *B.cereus* count on farm
Farm visits

- July – Aug 2012
- Milking time
- Unaware of the *B. cereus* count on the farm
- Farm visits were scheduled 12-48 hours prior to the visit via phone calls
- Pre-milking, milking, post-milking and grazing routines were observed during visits
Observations

- Paddock condition and grass height
- Hygiene of the dairy, parlour, holding yards, roadways and paddock was scored using predefined scoring systems
- Udder, leg, liner and filter hygiene scores
- Pre-milking teat preparation and post-milking teat dipping were recorded
- Equipment sanitation
Questionnaire

- Capture what we couldn’t observe at a milking
- Farm size – stocking density
- Mastitis management
- Milking machine service history
- Machine and bulk tank washes
- Water quality

The Irish Agriculture and Food Development Authority
Farms visited
Farm characteristics

- 66 cows
- 10 units
- 67% milk recorded
- 40% fed silage
- 21% housed cows

Hygiene Scores

<table>
<thead>
<tr>
<th>Hygiene Measure</th>
<th>&lt;2</th>
<th>&gt;2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Udder</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>Leg</td>
<td>6%</td>
<td>94%</td>
</tr>
<tr>
<td>Liner</td>
<td>29%</td>
<td>71%</td>
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</tbody>
</table>
Distribution of results

- *B. cereus* was not detected in 38% of all milk samples.
- 71% of all milk samples had a count <60 cfu/ml.
- 56% of farms had a mean count <60 cfu/ml.
Results

• Reuse detergent more than once
  • 53% farms had a deficit caustic working solution
• Detergent/steriliser wash start temperature
• Feeding silage
Results

• Fresh grass allocation 24 hours or greater vs. 12 hours – more than doubled the *B. cereus* count

• Housing cows – four times greater *B. cereus* counts
Recommendations

1. Present clean teats for milking
2. Minimise soil exposure
3. Clean milking and housing environment

75% clean or slightly dirty
4. Equipment sanitation

Simoes et al. 2010
Summary

- Equipment sanitation
  - High temperature washes
  - Appropriate caustic solution
  - Sterilizer
- Environmental conditions
  - Improved hygiene when indoors
  - Grazing management to limit soil exposure
- Adequate teat prep
  - Ensure teats are clean AND dry prior to unit application
Future work

• Identify *B. cereus* strains taken from various farm environments

Aim:

To identify a dominant strain and its route of transmission in BTM
Thank you for your time