Cow udder cistern storage capacity affects lactation performance in a NZ pasture based dairy system.

(Abstract # 17258)
Project Rationale

• Limited number of studies in NZ on role of the storage compartment of the udder (cistern) on milk secretion

• Ultrasound imaging of cow udder cisterns proven in barns using water baths (Bruckmaier & Blum, 1992; Bruckmaier et al., 1994) or by direct scanning (Ayadi et al., 2003), Guinard-Flament, Barillet

• Relationships shown between cisternal volume and milk yield and ability to tolerate longer milking intervals (Knight & Dewhurst, 1994; Stelwagen & Knight, 1997; Davis et al., 1998)

• Interest in increasing lactation persistency and milk yield while once-a-day milking
Project Aims

• Show that **ultrasonography** can measure various udder capacities in a NZ pasture based system (let down issue)

• Study relationship between **udder cistern size** and **lactation performance** + ability to sustain production when moved from twice- (TAD) to once- (OAD) daily milking in early lact.
Methodology

SELECTION GROUPS:

• **129 NZ dairy cows selected** from **520** (Holstein and Jersey cross; 3-10 yrs); grazed, supplemented, milked on a rotary parlour (Milfos, NZ) with auto data recording

• **4 groups** (n = 20) allocated according to previous season’s lactation:
  - Milk Yield, Lactation Persistency (LY-LP, LY-HP, HY-LP, HY-HP)
  + 30 heifers and 19 from previous trial

• **1 group** (n = 37) at **108 ± 43 DIM**
  - Once daily milking **(1 × )** for 10-12d.
  - rest controls **(2 × )**
  (similar yield, BW and parity)
DATA COLLECTION:

• **Ultrasonography** of rear udder quarters at 3 scanning sessions ($S_{1-3}$) (SonoSite M-Turbo, USA; sectorial probe, 5 MHz; 0 and 90°) 8 to 10h after last milking

  1) **1-3 day after calving**, no let down regulators
  
  2) **-Natural cistern size (NCS)** in the rotary **after blocking milk letdown before** heading to the rotary (atosiban, i.v. 5 mg/cow), followed by **-Distended cistern size (DCS) after milk letdown** (oxytocin, i.m. 20 IU/cow) followed by **-Milked cistern size (MCS)** after final cup fall. 12-82 DIM
  
  3) as for 2) but with 37 cows on OAD ~11d previously

• **NCS-DCS** (cisternal-alveolar milk); milk yield recorded and sampled for composition (LIC lab, NZ)
Schedule

Drought, feed events

Cow 306
Methodology

**IMAGE ANALYSIS:**

- Scan images visually scored (0 to 5; accuracy ±0.5) using a template with std images

Score = 0

Score = 2

Score = 4

Internal black = cisternal milk
Grey = mammary parenchyma

Automated algorithms developed and data analyzed using MATLAB R2008b
### Results

- **Average Milk yield 10d pre OAD varied by group**

<table>
<thead>
<tr>
<th>Group</th>
<th>Avg MY</th>
</tr>
</thead>
<tbody>
<tr>
<td>LY, LP</td>
<td>16.5</td>
</tr>
<tr>
<td>LY, HP</td>
<td>16.5</td>
</tr>
<tr>
<td>HY, LP</td>
<td>21.6</td>
</tr>
<tr>
<td>HY, HP</td>
<td>22.3</td>
</tr>
</tbody>
</table>

- **Persistency varied by group**

<table>
<thead>
<tr>
<th>Group</th>
<th>Persist</th>
</tr>
</thead>
<tbody>
<tr>
<td>LY, LP</td>
<td>0.37</td>
</tr>
<tr>
<td>LY, HP</td>
<td>0.51</td>
</tr>
<tr>
<td>HY, LP</td>
<td>0.38</td>
</tr>
<tr>
<td>HY, HP</td>
<td>0.48</td>
</tr>
</tbody>
</table>

- **Changing to 1× (10d) caused milk loss of 5.5 L/d (28.2% on average), being greater in LY,LP cows than in other groups.**
Success rate with atosiban

<table>
<thead>
<tr>
<th></th>
<th>Round 2</th>
<th>Round 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Count</td>
</tr>
<tr>
<td>OAD</td>
<td>19</td>
<td>50%</td>
</tr>
<tr>
<td>TAD</td>
<td>111</td>
<td>64%</td>
</tr>
</tbody>
</table>

More cows on OAD overrode ATO

Cows in which ATO worked had 23% milk loss on change to OAD

Cows in which ATO did not work (milked out) had 28% milk loss on change to OAD
**Results**

- **Scans 1-3d Post Calving** - no relationship between Cistern Score and season performance
- Scans round 2, 3. Groups were reassigned according to how they turned out in the new season. **Trend** for increasing NCS score through LY,LP LY,HP HY,LP HY,HP

Using 2013 grouping, cisternal/alveolar ratio <42% (not milked out)
Results

No significant differences in resistance to, or recovery from OAD by group
Regrouping according to yield and persistency alone

A significant difference in natural cistern size, where ATO worked, seen between high/low yield cows, but not for persistency.
Residual cisternal milk

• After milking, scans showed that cows left the parlor with 5 to 15% total milk left in cistern (score, ~1)
• Demonstrate that ultrasonography can measure udder capacities in a NZ pasture fed system

• **Larger cistern, higher milk yield**

• Confounders, cows - small cisterns compared to other species, selection against large cisterns in NZ cows

• Low yield/persistency cows have greater loss of milk production on transition to OAD (1 × ) milking (prev. trial)

• **Udder cistern size could be used as a tool for dairy management decisions**

• Quantification of residual cisternal milk presence is a practical outcome

• 5 to15% of “total milked out volume” still in the udder after milking – inhibition- teats
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Tokanui Farm Staff

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BE-DGR 2011
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