



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

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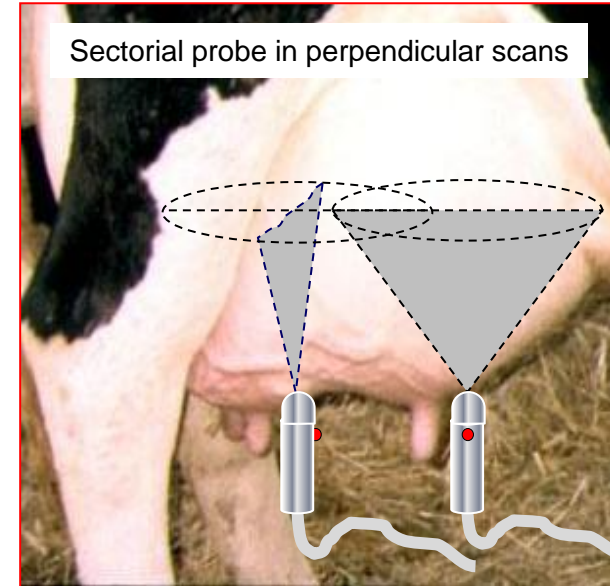
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Project Rationale

- 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



(Ayadi et al., 2003)

- 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

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)



Methodology

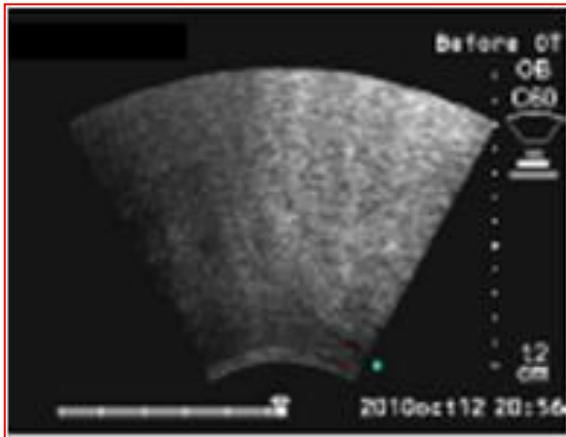
IMAGE ANALYSIS:

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

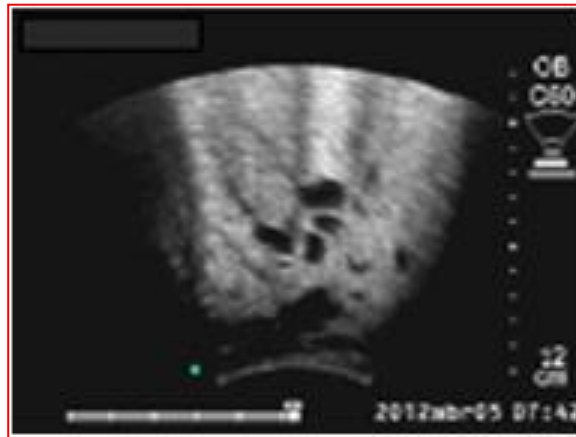
Catamam scans linear scoring for a 5 MHz sectorial probe (0 to 5, with 0.5 points accuracy) GC v.2 10/4/2012

Score	Description	eg. 1	eg. 2	eg. 3
0	Absent (A) The image appears mainly grey (mammary parenchyma) without black cavities identifiable as gland cisterns (mammary ducts). The occasional presence of very small round black cavities will be considered as large ducts or mammary blood vessels.			
1	Very small cisterns (VS) The presence of very small cisterns (black) is detectable within the dominant image of the parenchyma (grey). No more than 1/8 to 1/10 the of image surface can be considered as a cistern. Add 0.5 points if required.			
2	Small cisterns (S) The presence of clearly defined small cisterns (black) is visible within the dominant image of the parenchyma (grey). No more than 1/4 of the image surface can be considered as a cistern. Add 0.5 points if required.			
3	Medium cisterns (M) The presence of clearly defined cisterns (black) of different sizes are visible within the dominant image of the parenchyma (grey). Approximately 1/3 of the image is black and can be considered as gland cistern. Add 0.5 points if required.			
4	Large cisterns (L) The presence of clearly defined large cisterns (black) is visible within the dominant image of the parenchyma (grey). Approximately 1/2 of the image is black and can be considered as gland cistern without doubts. Add 0.5 points if required.			
5	Very large cisterns (VL) More than the half of the image is occupied by a single or multiple black areas clearly recognized as gland cisterns. Grey areas supposed to be cisterns are also visible and taken into account as cisterns.			

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

Group	Avg MY
LY, LP	16.5
LY, HP	16.5
HY, LP	21.6
HY, HP	22.3

- Persistency varied by group

Group	Persist
LY, LP	0.37
LY, HP	0.51
HY, LP	0.38
HY, HP	0.48

- **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.

Results

Success rate with atosiban

	n	Round 2		Round 3	
		Count	%	Count	%
OAD				19	50%
TAD	111	71	64%	56	77%

More cows on OAD overrode ATO

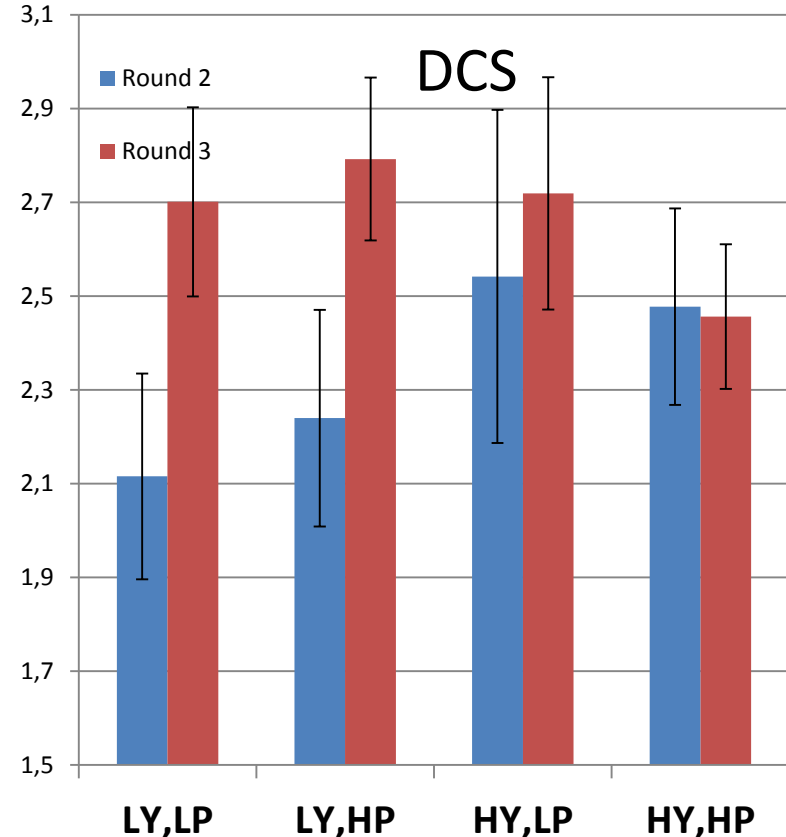
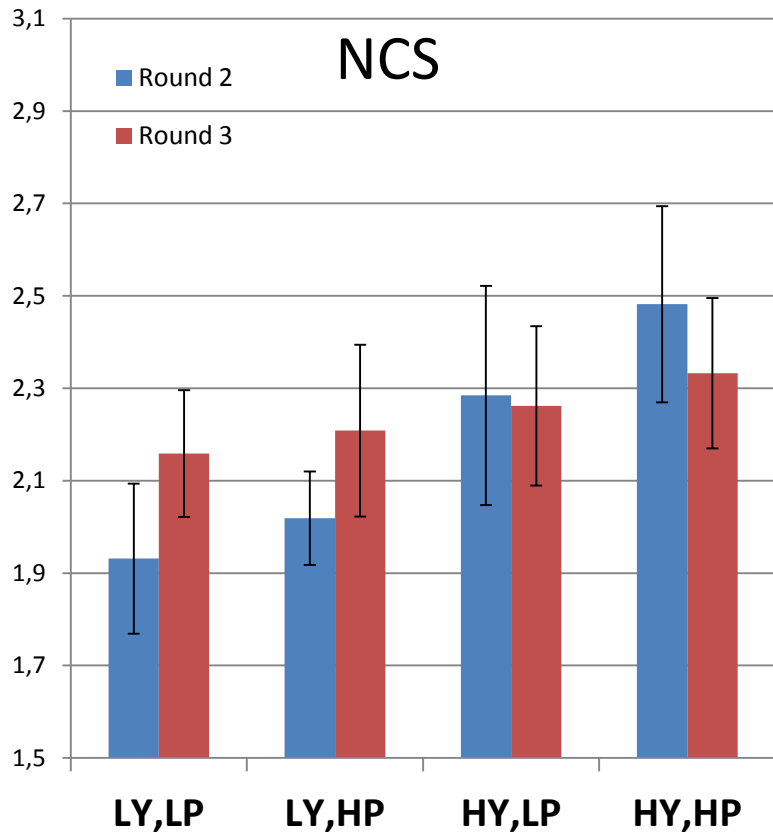
Cows in which ATO worked had 23% milk loss on change to OAD

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**

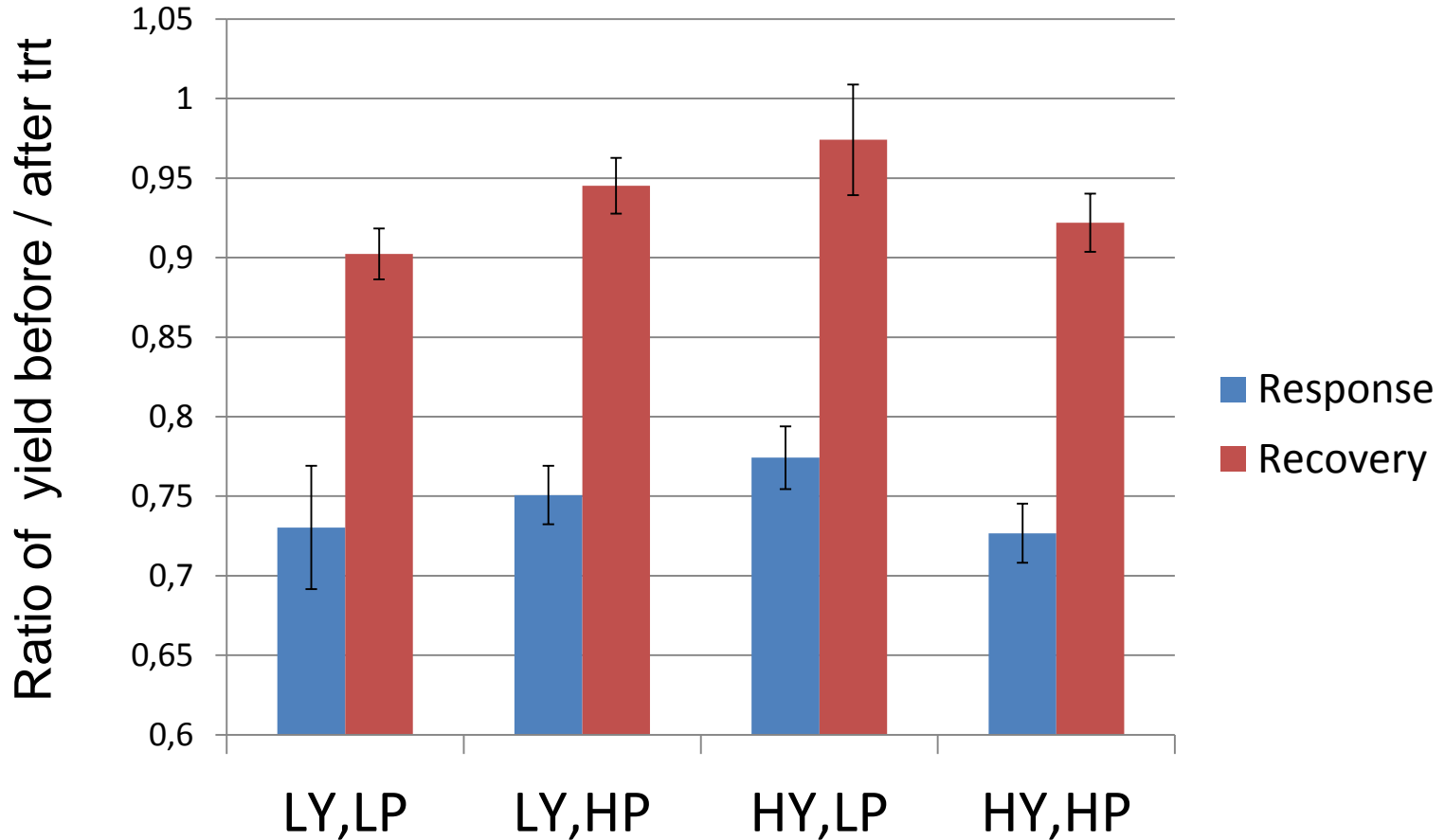
Using 2013 grouping, cisternal/alveolar ratio <42% (not milked out)



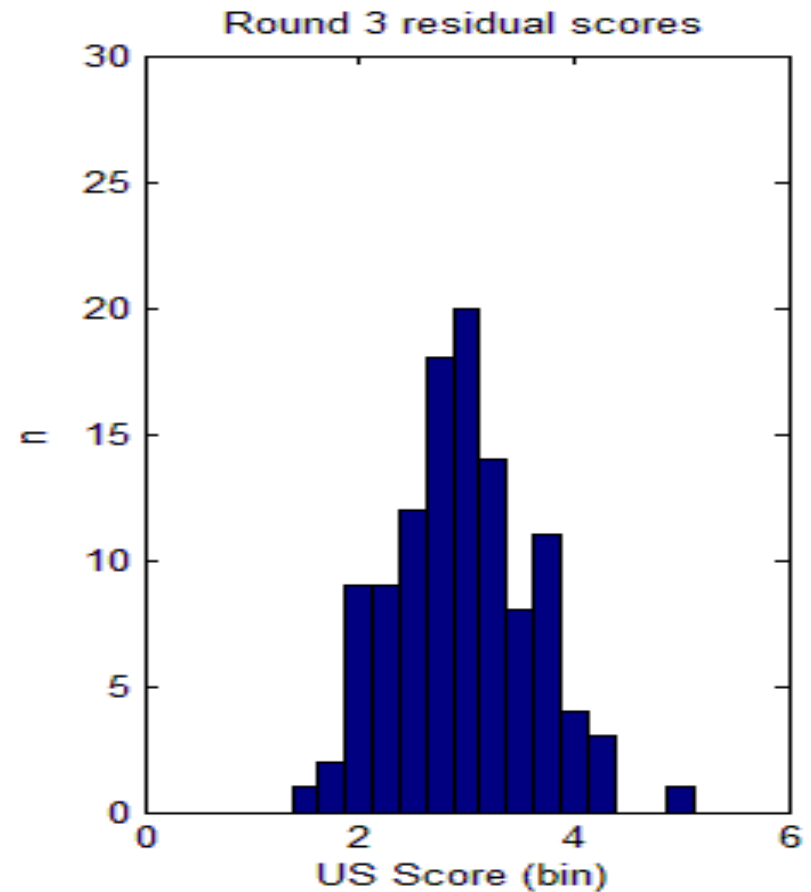
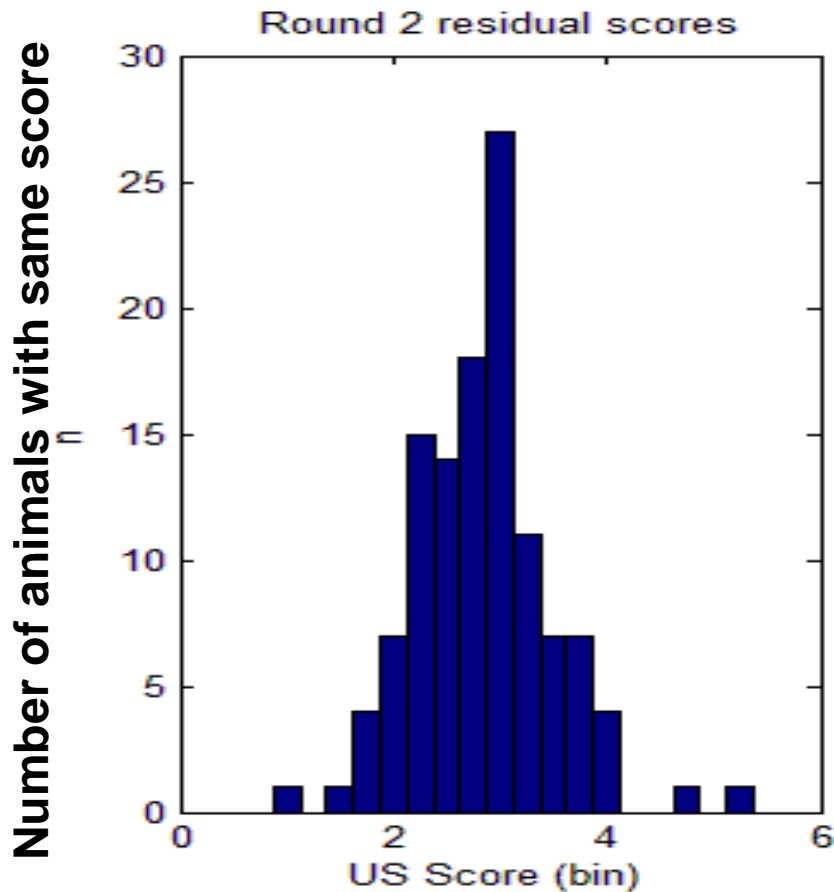
Cistern size increased from S2 to S3 10

Results

No significant differences in resistance to, or recovery from OAD by group



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 to 15% of “total milked out volume” still in the udder after milking – inhibition- teats**





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BE-DGR 2011

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