

DIRECTORS' UPDATE

Welcome to our third and last edition for 2013! I am truly delighted to confirm the purchase and installation of a new Robotic Rotary DeLaval AMR® at the University dairy farm 'Corstorphine', on Camden campus.



The University of Sydney has approved this investment allowing our Dairy Science Group to install the most up-to-date robotic milking equipment ensuring the continuation of our leadership in pasture-based robotic milking systems.

The development is a commercial decision by the University that will ensure the viability of our dairy operation into the future. The farm will milk up to 450 cows in this new 24-bail robotic rotary, enabling high quality teaching, research and training at undergraduate and postgraduate levels.

This investment will complement the development and installation of another robotic rotary AMR in a commercial farm in southern Australia, where FutureDairy's team will conduct whole-farm system research and development in the near future. We can hardly wait to bring robotic milking back to Camden early next year! **Yani Garcia**

FROM THE PRESIDENT



This year's DRF Symposium, held in beautiful Kiama, was one of the most enjoyable yet. We had a great range of speakers but I particularly enjoyed the farm visits. The first visit was to John and Andrea Henrys at Pyree who have installed two box robots to milk their 130 cows and built an excellent shed to house the cows.

The second visit was to Michael, Lynne and Nick Strong's farm at Jamberoo where we discussed among a number of issues, their trials for different pasture mixes.

What I admired most of these two farming families was their willingness to challenge themselves to find new ways forward for their dairy businesses and then their generosity to share what they had learnt with us. **Bill Inglis**

CAMDEN FARMS

GREAT NEWS AND VERY EXCITING TIMES AHEAD FOR THE DAIRY OPERATION AT CAMDEN!

The University of Sydney has recently approved a business case developed by Dairy Science team to install a brand new 24-bail robotic rotary DeLaval AMR® at Camden dairy farm 'Corstorphine'.

The rationale for the investment was driven by a strong commercial value proposition to enhance farm profitability and economic long-term viability of the operation. It is expected that the new robotic equipment will allow a significant increase in number of cows milked per farm staff compared to industry average. In addition, the new robotic rotary will reduce the need of costly after hour tasks. Labour cost is the second largest cost of producing milk in Australia.

At the same time, the new robotic rotary will allow the Dairy Science Group to cement and expand the University's existing global reputation of excellence in dairy research and to consolidate the leadership in research, teaching and training in all aspects of automation in pasture-based dairy farms.

We are delighted to confirm that a contract between DeLaval and the University was signed on the last week of November!



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ROBOTIC MILKING UPDATE

Dr Kendra Kerrisk

Current status of robotic milking across Australia

The trends for robotic milking adoption (both nationally and internationally) are still rising. In Australia we now have 22 commercial robotic milking farms with robots supplied by three manufacturers. The current breakdown by state is as follows:

- New South Wales 3
- Queensland 4
- South Australia 4
- Tasmania 4
- Victoria 6
- Western Australia 1

Interestingly more than a third of the commercial farms have increased the number of robots on farm since they commissioned their operations. In addition to the farms that are already up and running there are at least another 3 farms signed up for installation at the time of writing.

NSW Department of Primary Industry Advertising Development Officer – Robotic Milking Systems

The need for industry support for the farming system around the robotic milking technology has been recognized and we are very excited about the prospects of the imminent recruitment of a Development Officer - Robotic Milking Systems.

*For further information regarding AMR
please contact Kendra Kerrisk at
Kendra.kerrisk@sydney.edu.au*

ROBOTIC MILKING UPDATE (cont.)

The position has recently been advertised by NSW Department of Primary Industries and interviews conducted, with an appointment being eminent. With a national focus, this position will provide leadership, drive innovation and build collaborative networks and knowledge for the NSW and Australian dairy industry around robotic milking systems.

Expressions of Interest for Robotic Rotary collaboration

With clear indications of funding approval for FutureDairy beyond the current financial year we have been on the hunt for a commercial farmer to collaborate with us with respect to on-farm application of a high throughput robotic rotary installation.

We put out a call for expressions of interest in July and had an overwhelming response – it seems that the industry is watching and waiting for the robotic milking technology that has been developed for moderate to large scale operations.

We are in the final stages of discussion with candidates that went through to the final round and look forward to announcing our new collaborative partner in the near future.

Presentations and publications

Recently our group has been very active with a large number of presentations at both the International Grasslands Conference and the Spatially Enabled Livestock Management Symposium.

Dr Nicolas Lyons was awarded his PhD and has recently received news that his fourth manuscript has been accepted for publication.

This is a great achievement and an indication of the commitment and motivation he has demonstrated through his tenure.

He has two manuscripts published in Journal of Dairy Science, one accepted for publication in Livestock Science and two accepted in Animal Production Science.



Saranika Talukder and Tori Scott (both PhD students) have also recently received news that their first manuscripts have now been accepted for publication in Animal Production Science and the Journal of Dairy Science, respectively.

Keep an eye out for these publications relating to management of automatic milking systems.

CCTV MONITORS COWS 24/7

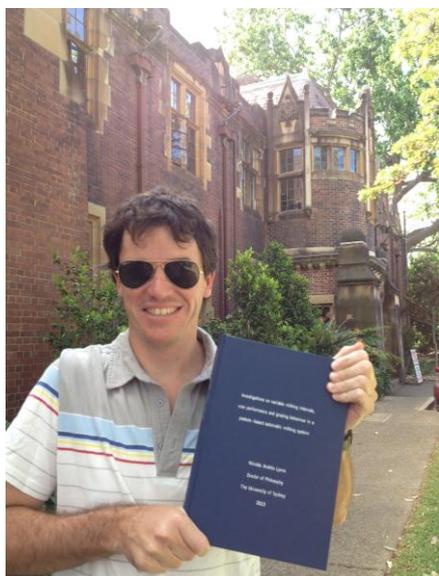


The Dairy Science Group at Camden has a new collaboration with SCR engineering which aims at focusing on the changes in activity and rumination that occurs around the time of calving.

We are using CCTV cameras to monitor these cows calving 24 hours a day to match up what we see on video with the sensor data.

Look to the next edition for further details' on what is being achieved.

CCTV camera being used in trials at Camden



CONGRATULATIONS NICO!

Congratulations to Dr Nicolas Lyons on being awarded his PhD in July!

Nico has been part of the Dairy Science Group and FutureDairy project for 3 years and it is brilliant to see the results of his research and thesis writing rewarded with such fantastic reports.

Good luck with your continuing career plans!

ROBOT AMONGST THE HERD: A PILOT INVESTIGATION REGARDING THE BEHAVIOURAL RESPONSE OF DAIRY COWS

By Cameron Clark

It is widely recognised that technology has a vast role to play in helping Australia's farmers reduce the time spent on repetitive tasks, increasing the attraction and retention of employed labour in the industry and to provide and act on data to increase farm productivity to sustainable levels.

The continuous monitoring and movement of livestock between areas defined for grazing or from these areas to procedural locations (i.e. yards, dairy facility) is a repetitive task that is ideally suited to automation.

A pilot study conducted at the University of Sydney's dairy research farm in Camden determined the behavioral response of dairy cows to an unmanned ground vehicle (UGV) across time.

Following the morning milking, the first 20 cows to be milked were separated from the main herd at 0830 h and offered 0.5 ha of an ad-libitum kikuyu pasture allocation (50 kg DM/cow to ground level). A pre-defined figure eight route was determined for the UGV within this 0.5 ha.



*Robot at work amongst
the cows*

ROBOT AMONGST THE HERD (cont.)

After allowing time for the cows to settle, the robot entered the pasture allocation at 0900 h and traversed the figure eight route at a speed of 2.5 km/h (average traverse time was 7 min).

Between traverses the robot was parked outside the allocation until the process was repeated a further four times at 15 min intervals.

The 0.5 ha was virtually split into four sectors for observation purposes, with four observers covering one sector each.

To determine the interaction between the UGV and cows, the number of cows exiting or entering each sector when the UGV was in or out of the given sector was recorded. Data were analysed by GLMM within REML.

The model was as follows:

*Cows out = Fixed (Robot (presence/absence) * Traverse number) + Random (Cow)*

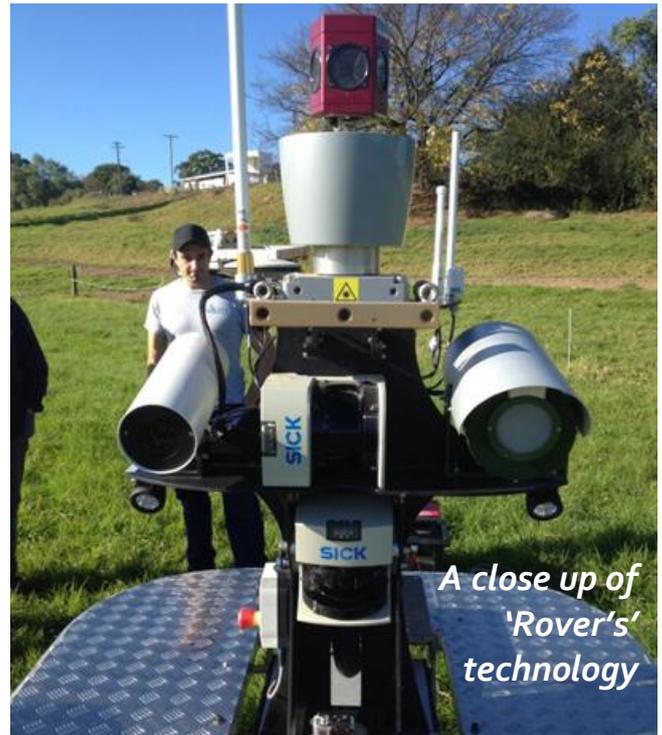
There was a significant effect of Robot ($P = 0.02$) and Traverse ($P < 0.01$) on the number of cows exiting a sector, however, there was no interaction between these fixed effects. Twice as many cows exited a sector when the robot was present (8%) as compared with absent (4%). More cows exited a sector in traverse 1 (14%) as compared with all other traverses (mean = 4%)

The greater number of cows exiting a sector in the first traverse was likely associated with an initial period of increased cow movement as cows foraged.

These results also indicate that dairy cows habituate to the moving UGV quickly.

Future work will aim to fully automate the process of herding and integrate this process with other data requirements such as ground cover and soil moisture levels.

For further information please contact cameron.clark@sydney.edu.au



DRF 2013 SYMPOSIUM - OVERVIEW

After many consecutive years on Campus at Camden, we welcomed the opportunity to take to the road in 2013 in order to reach into other dairying regions.

As a consequence our presenters, sponsors and delegates gathered at one of the most picturesque dairying regions of the state – Kiama.

The 2013 Symposium adopted the theme 'Taking Control' which was extremely topical and well received by business operators who were seeking to grown margins in tight times.

The opening sessions were designed to challenge the delegates as we drew on experiences from the oil and gas sector and the UK.

The two opening speakers; Steve Jones (former chairman of Plexal Group) and Joe Delves (UK Nuffield Scholar and Dairy Farmer) were rated by Day 1 respondents to the feedback survey as being in the top three presenters.

Also in the top three was Greg Mills who took us through the process of 'building a business brain'.

Heading to Kiama had the added advantage that it allowed us to include two commercial farm tours to the program.

At the property of John and Andrea Henry's (*pictured above right*) farm at Pyree delegates heard about the Henry's two Lely box robots and their 120-head mixed breed herd with a composted bedding barn.

John and Andrea were rated as one of the favorite speakers on day 2 along with the Tate Brothers (Phil and Craig, *pictured right*) who presented with John House to share their '**secrets to success**' with reproductive performance.



2014 DIARY DATE

The 2014 DRF Symposium is to be held on Thursday 20th and Friday 21st June.

More details will be available in the first edition of the 2014 Newsletter and the online FutureDairy newsletter.

DRF 2013 SYMPOSIUM (cont.)

The second farm tour was at Lemongrove – a 62 ha lease farm that borders the Jamberoo town site. Lynne Strong provided the introduction to the property and informed delegates of the range of fascinating pasture initiatives that were being conducted on the property.

The annual DRF Symposium acts as a 'shop window' exercise for the DRF to extend quality dairy science and an opportunity for scientists to interact with farmers; an exercise that was highly praised by the attending delegates.

Another traditional and extremely well received element of the program is the emerging scientists' competition.

Attendees were challenged and extremely impressed by the amazing line-up of young scientists. Their involvement in the program creates a strong sense of trust that the future of research in the dairy industry will be in very capable hands.

Delegates overall praised the program content, the food and the logistics and clearly enjoyed the farm visits, despite the difficult (windy) conditions that prevailed.

Chair of the Organising Committee

Dr Kendra Kerrisk



Kendra Kerrisk and Esther Price



The recipient of the **Milk Marketing NSW Dairy Science Award** for 2013 was Ray Johnston from NSW DPI. Congratulations Ray!

(Pictured (R) receiving the Dairy Science Award from George Davey (L))



2013 SYMPOSIUM PHOTOS

POST GRADUATE UPDATES

DR. NICOLAS LYONS *PhD*

Following the successful examination of my thesis entitled "Investigations on variable milking intervals, cow performance and grazing behaviour in a pasture-based automatic milking system" by 3 external reviewers; I have been awarded the degree of Doctor of Philosophy.

Graduation will occur mid-December, which will definitely represent a great milestone.

It is great and challenging to have achieved this degree in such a novel and interesting field of growing interest worldwide.

Two papers have already been published in Journal of Dairy Science, 2 have been accepted for publication in Livestock Science and another accepted with Animal Production Science.

Another manuscript has been submitted to Animal journal. Hopefully all 6 of them should be available soon to the wider scientific audience!



I am now back in Australia, working in the Dairy Science Group at the University of Sydney.

I will be working for some months updating the management guidelines for AMS farms, with special focus on latest research, large herds and the robotic rotary.

The last couple of months have included several presentations and seminars in different places. It has been very interesting to meet and catch up with different colleagues working in related fields.

In late June I accompanied Dr Cameron Clark at the Precision Dairy 2013 Conference in Minnesota, US and a workshop at Michigan State University.

NICOLAS LYONS (cont.)

During September I also attended the 22nd International Grassland Conference in Sydney where I presented 2 posters, which was followed by a very interesting workshop with researchers from Teagasc Moorepark (Ireland) and the Outeniqua Research Farm from the Western Cape Government (South Africa).



I also attended the 4th Spatially Enabled Livestock Management Symposium held in Camden where I delivered 2 oral presentations, after which we had a small seminar with Bernadette O'Brien also from Teagasc Moorepark (Ireland), who now leads the Autograssmilk Project in Europe (and has been one of my thesis reviewers!).

Hopefully in the next edition of the newsletter I can share with you some exciting news of how my professional career continues!

HELEN GOLDER *PhD Student*

I am currently completing the final chapters of my thesis which is focused on increasing the understandings of ruminal acidosis.

Three chapters of my thesis were accepted for publication in peer reviewed journals in the last couple of months (detailed on the next page).



In July, I gave 3 presentations on the recent results from my PhD at the Joint Annual Meeting of the American Dairy Science Association in Indianapolis, Indiana.

My first presentation was on examining the changes in rumen bacteria community composition in cattle over the first 3.6 hours after they had consumed a single morning feed of: (1) control (no grain), (2) grain, (3) grain and sugar, (4) grain and histidine, or (5) grain, sugar, and histidine diets.

I observed a large variation in bacterial community composition between cattle, regardless of diet, suggesting the rumen microbial ecosystem is host specific.

HELEN GOLDER (cont.)

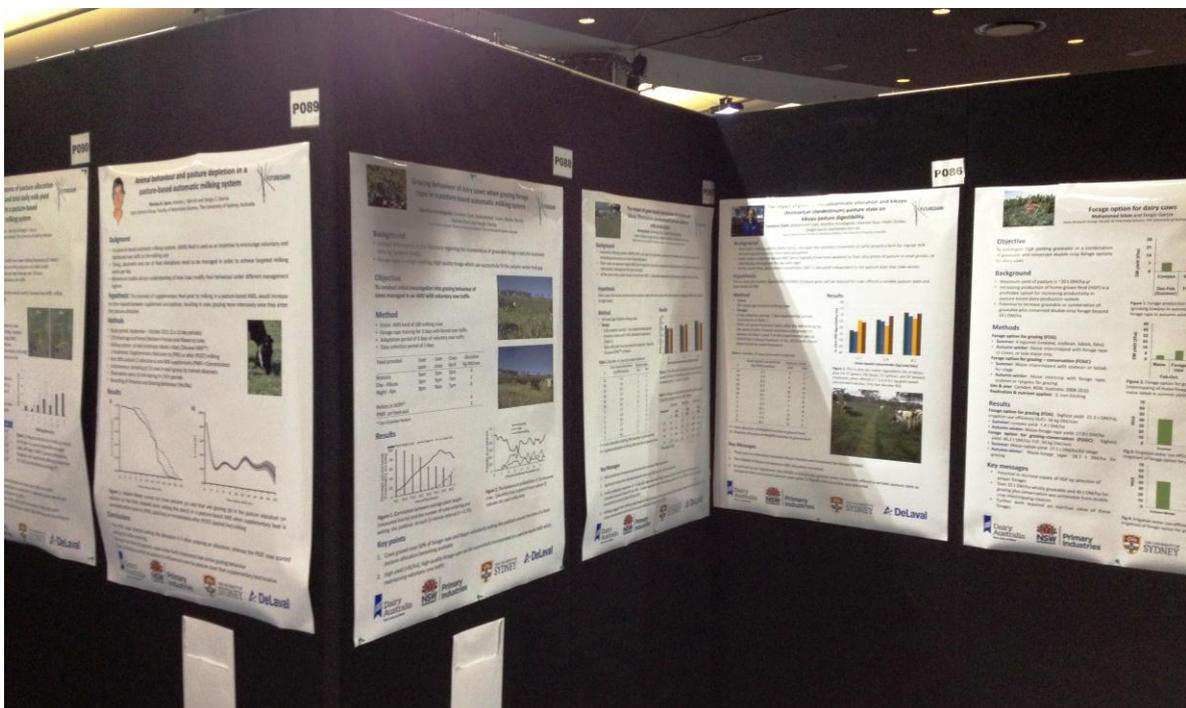
Despite this variation within cattle from the same dietary groups, I observed that bacteria from certain phyla or families were dominant in the majority of cattle but distinct rumen bacterial community composition occurred among cattle fed the different diets.



The largest changes in bacterial community composition and bacterial diversity occurred for cattle with sugar included in their diet and were associated with increased rumen lactic acid and butyrate concentrations.

A number of bacterial species associated with acidosis in the literature were not detected in this study or were only present in low relative abundances.

This suggests these bacteria may not be involved in the initial onset of acidosis when cattle that have not previously been exposed to rapidly fermentable carbohydrates are fed abrupt single feeds of rapidly fermentable carbohydrates.



The Dairy Science Group had 6 posters presented at the IGC 2013 held in September in Sydney

MICHAEL CAMPBELL

PhD Student

While everyone knows I should be finished my PhD by now I am still going and hope to have it all written up by early next year.



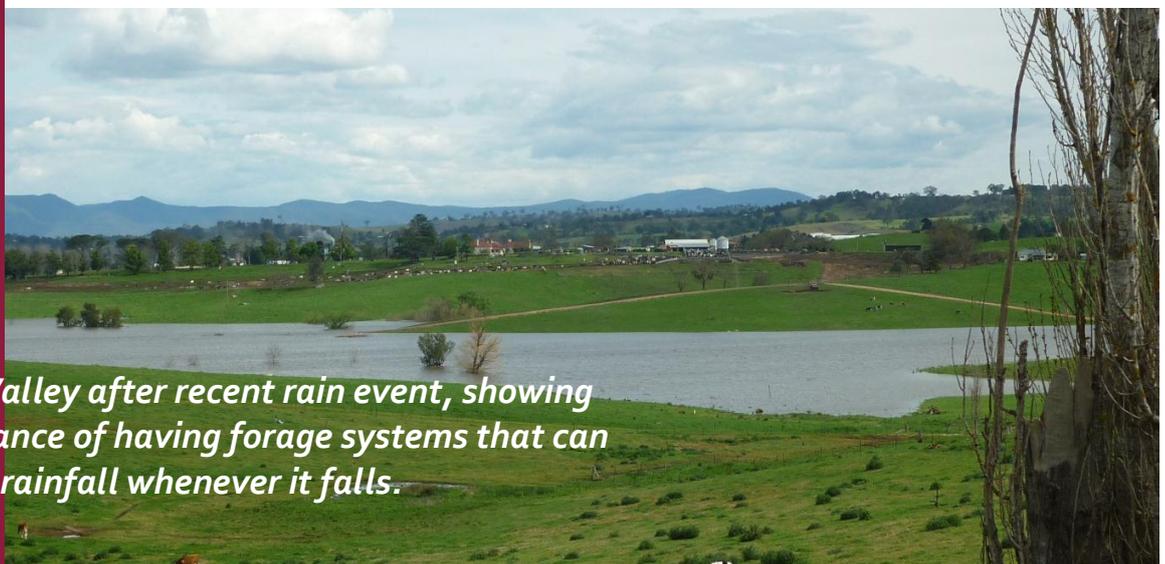
I have been spending my time looking at ways to analyse the risk associated with adopting a complementary forage system in different farming systems.

While I have been working on my PhD project I have also been fortunate to be able to work with dairy farmers from a few of the key regions and it has further emphasised to me the importance of 'relatively cheap' home-grown feed and its role in profitable dairy farming in Australia.

Being able to produce high quality feed at home, as is the case with a complementary forage system, can be a way to produce the bulk of feed needed by the milking herd and reduce the impact of price fluctuations of purchased feed and the transport costs associated with such feeds on the dairy business.

Once the risk analysis work is complete the final part of my PhD is to design a simple to use risk tool for use in making decisions about growing forage crops on a seasonal basis.

I really hope this can be of use to all dairy farmers.

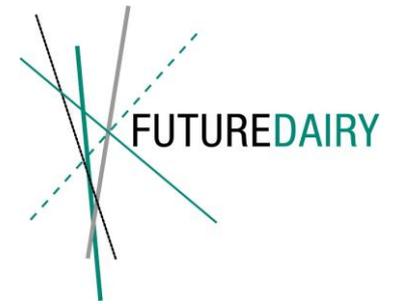


The Bega Valley after recent rain event, showing the importance of having forage systems that can respond to rainfall whenever it falls.



RACHAEL RODNEY

PhD student



In August I participated in the Global Youth Agriculture Summit in Calgary, Canada.

Over 150 youth delegates and mentors from 20 countries came together to discuss food insecurity and the role that youth may have addressing this challenge into the future.

It was very interesting to work with people from around the world and I found that while our production systems are often very different we have common challenges and there is a need for shared solutions.

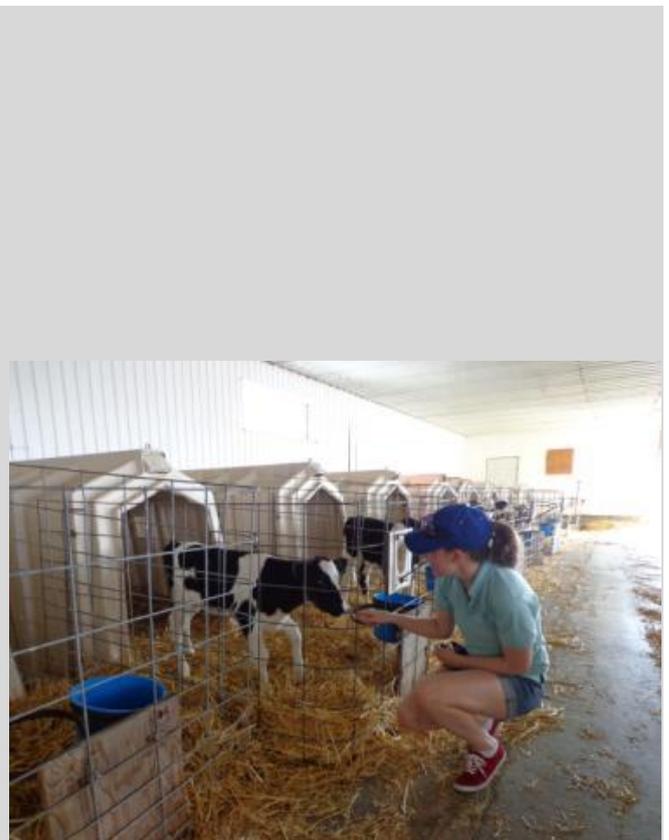
The importance of agriculture will continue to increase as we work to feed an expected world population of 9 billion by 2050.

I spent some time on a Canadian dairy farm and spoke with Canadian dairy farmers and cattle nutritionists to get an understanding of the Canadian dairy industry.

I also visited the Agriculture and Agri-food Canada Research Centre in Lethbridge, Alberta.



Rachael with the Australian delegation at the Global Youth Agriculture Summit (above) and on a Canadian dairy farm (right).



TORI SCOTT *PhD Student*

I have been spending my time working away analysing data and writing up papers, preparing to submit my thesis next year.

I have also had the pleasure of presenting some of my research at the 2013 Precision Agriculture Symposium (Spatially Enabled Livestock Management Symposium) held in Camden at the end of September, and meeting some of the other researchers and representatives working in this field.



Recently, I have been looking at some behavioural data I collected in a study investigating the impact of feeding at the dairy, either before or after milking, on cow traffic as cows enter the dairy.

We know that cows in a voluntary AMS, being given an opportunity to volunteer for milking at any time (as compared to being herded into the milking parlour for batch milking in a conventional system), can spend long periods of time in the pre-milking yard prior to milking.

We aim to operate any robotic milking system efficiently (having cows present at the milking equipment regularly and without delay), and would like our cows to be out of the dairy and on pasture/at feed for as much of the day as possible.



It is important we understand how cows spend their time in the dairy, and then use this information to develop management strategies that can increase cow traffic through the dairy and minimise time spent loitering in the pre-milking waiting yard in voluntary milking systems.

Studying their behaviour in intensive trials will help us to generate this necessary level of understanding.

I look forward to sharing these results with you soon.

Tori at the 2013 Symposium where she presented as part of the Emerging Scientist Program

SARANIKA TALUKDER *PhD Student*

POTENTIAL OF INFRARED CAMERA FOR PREDICTION OF TIME OF OVULATION

A study was conducted to assess the potential of digital infrared thermography as a predictor of time of ovulation in dairy cows.

Twenty cows were synchronized using controlled internal drug release (CIDR) and prostaglandin $F_{2\alpha}$.

Vulval and muzzle temperatures were measured every 12 h (hour) from CIDR insertion to 32 h post PGF $_{2\alpha}$ injection and then every 4 h until ovulation occurred.

Thermal images obtained with a FLIR T620 series infrared camera were analysed using ThermoCAM Researcher Professional 2.9 software.

Of the 20 cows enrolled in this study, 12 ovulated, 7 did not ovulate and 1 cow developed cystic ovarian disease.

The interval between PGF $_{2\alpha}$ injection and the onset of standing oestrus was 66 ± 17 h whilst the interval between PGF $_{2\alpha}$ injection and ovulation was 89 ± 21 h.

The mean interval between onset of standing oestrus and ovulation was 24 ± 15 h.

Average and maximum temperature of both muzzle and vulval differed significantly ($P < 0.05$) in relation to time to ovulation (Figure 1).

Whilst the highest vulval and vaginal temperatures were observed 24 h before ovulation, only the vulval temperature was significantly higher than other recorded temperatures.

On the other hand, the lowest vulval and vaginal temperatures were observed 48 h and 72 h before ovulation respectively.

The maximum and minimum muzzle temperatures were noted during 72 h and 48 h before ovulation. The muzzle, vulval and vaginal temperatures recorded 48 h prior to ovulation were significantly ($P < 0.05$) lower than those temperatures recorded at ovulation.

SARANIKA TALUKDER (cont.)

Vulval and vaginal temperature increased 24 h before ovulation at the time of ovulation ($P < 0.05$). Muzzle temperature was relative last 24 h before ovulation (Figure 1).

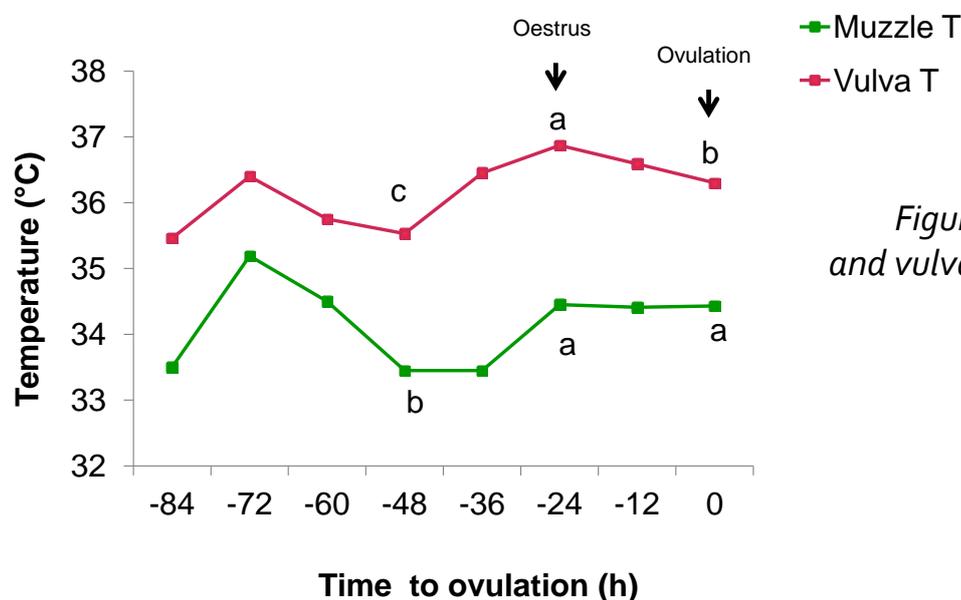


Figure 1. Maximum IRT muzzle and vulval temperatures in relation to time to ovulation.

OVERSEAS AND BACK

DRF's Director A/Prof Yani Garcia spent a week in Uruguay in November. He presented two invited papers at the 1st International Congress of Veterinary Science in Montevideo and participated in several other activities organised by Universidad de la República's Professors Cecilia Cajarville and José Luis Repetto.

Paddock discussion at the recent ICVS in Uruguay



The busy schedule included a workshop with postgraduate students, visits to commercial farms and to the research station of INIA LaEstanzuela.

A highlight was the visit to the discussion group "Agua y Leche" (water and milk), a group of farms that aim to produce more milk from home grown pasture, a key competitive advantage of Uruguay.

Collaborative projects between the faculties of Vet Science of the Universidad de la República and University of Sydney are well underway.

DRF director A/Prof Yani Garcia in Colonia, Uruguay

The International Grasslands Congress was recently held in Sydney (Sept 15-19).

As part of the experience international visitors are given the opportunity to join a post conference tour.

Corstorphine had the pleasure of hosting a group consisting of about 45 people who came to look over the University's dairy research set up.

The crowd were presented with highlights of the work currently being done by our research team and given a brief tour of our teaching resources at Camden.

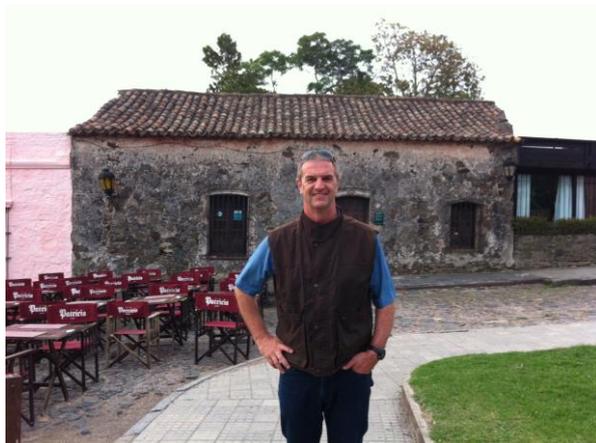
Right and above, Yani Garcia talks to the post IGC tour group

Another group of mainly farmers and consultants recently visited from Argentina as part of a tour visiting research institutes, companies and farms in Australia and New Zealand.

Yani Garcia and Nico Lyons presented to the group, highlighting the outcomes and future visions of FutureDairy and the Dairy Science Group. This was followed by a farm walk of Corstorphine.

The group included dairy, beef and agricultural farmers. This was a great opportunity for the team here at Camden to showcase the dairy research being conducted to other industries.

Right, Yani Garcia, Nico Lyons and the Argentinean group after their visit in September





UBA
Universidad de Buenos Aires



LUIS MILLAPAN

My name is Luis Millapan and I arrived from Argentina three months ago to participate in a research project within the Dairy Science Group in Camden.

I have an Agronomy degree after which I did a post graduate specialisation in milk production.

My actual position is as an Assistant Lecturer in the Dairy Department at the University of Buenos Aires (UBA), Argentina.

My work is basically related to teaching, research and extension on commercial dairy farms.

This year I was awarded the Thalmann's external scholarship program from UBA, to undergo an Occupational Training Program with Assoc. Prof. Yani Garcia and the FutureDairy team.

The objective of this training is to increase skills in research and teaching areas in ruminant nutrition, forage utilization and dairy production systems.

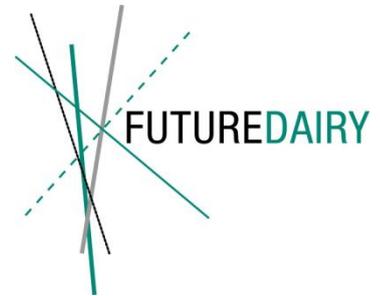
During my stay, I've been participating in the unit of study Dairy Production & Technology for ABVS students at the Faculty of Veterinary Science.

Additionally, I've participated in a spring trial conducted by Dr Ravneet Jhajj. The objective of the trial was to determine ways to improve feed conversion efficiency within pasture-based AMS systems.

Last summer a similar experiment was conducted with kikuyu as pasture type in Corstorphine dairy farm, and now we are running the trial with ryegrass as pasture type.

We expect that the impact of pasture difference on milk production and grazing behaviour will differ between both species.

I took the opportunity to be in contact with others researchers such as Dr Cameron Clark, who is investigating novel technologies for dairy farmers.



LUIS MILLAPAN (Cont.)

My main involvement was a small study on monitoring animal behaviour during calving with CCTV cameras and activity and rumination collars.

On Camden Campus, I had the opportunity to play soccer with the student community every week. It's been a great experience sharing time with students from around the world!

And last but not least, I spent time wandering Sydney and the Blue Mountains.

I have really enjoyed my stay in Australia with the Dairy Science Group and at the same time I was learning something new every day!



Luis has just left us to travel home for the impending birth of he and his wife's first baby. We wish them both a very happy journey into parenthood!



**Universidad Nacional
de Entre Ríos**

JONATHAN OJEDA

My name is Jonathan Ojeda. I am an Agricultural Engineer and completed my Bachelor of Agronomy Sciences degree at the University Of Entre Ríos Argentina.

Presently, I am doing research leading to a PhD in Agronomy at the University of Mar del Plata (Argentina, CONICET Research Scholarship).

Last year I was invited to complete a 2 month research training experience in Australia.

I am currently working with the Dairy Science Group within the Faculty of Veterinary Science at the University of Sydney and the Dairy Centre of Tasmanian Institute of Agriculture, University of Tasmania. I will also do training with Agricultural Production Systems Simulator Modelling (APSIM).



JONATHAN OJEDA (Cont.)

This training will help to develop my skills in the use and application of the simulation model APSIM to calibrate and validate forage crop production and utilisation in Argentinian conditions.

My activities are part of a research program designed to model production and utilization of forage crops in Argentina led by Dr Monica Agnusdei (INTA Balcarce).

For me this research training in Australia is the first tangible step of a collaborative program between CONICET, INTA Balcarce and the University of Sydney.

The 2 month program includes training on the use and simulation of forage crops with researchers from the University of Sydney (A/Prof Yani Garcia and Dr Rafiq Islam) and the University of Tasmania, Dr Keith Pembleton and Dr Richard Rawnsley).



In addition to this APSIM training, I am hoping to gain as much experience as I can from all areas of field and lab work currently being undertaken within the Research Groups.

Left, Jonathan records observations during a recent trial at Corstorphine

TEACHING AT CAMDEN

The past few months have seen the 2013 AVBS 4002 students complete their Dairy Production and Technology Course.

This included a trip to farms on the South Coast and the Kangaroo Valley (below) as well as visits to a few of our local dairy businesses.

The students did extremely well with a large number gaining High Distinctions in their final course mark. Congratulations to them all!



A huge THANK YOU to all the farmers who open up their properties to make our student visits possible!

**MOST RECENT SCIENTIFIC PAPERS
ACCEPTED AND IN PRESS**

Lyons, N. A., Kerrisk, K. L., Dhand N. K. and Garcia, S. C. (2013) Factors associated with extended milking intervals in a pasture-based automatic milking system. *Livestock Science (In press)*.

Lyons, N. A., Kerrisk, K. L. and Garcia, S. C. (2013) Milking permission and milking intervals in a pasture-based automatic milking system. *Animal Production Science (In press)*.

Lyons, N. A., Kerrisk, K. L. and Garcia, S. C. (2013). Milking frequency management in pasture-based automatic milking systems: A review. *Livestock Science (In press)*.

Talukder, S., Celi, P., Kerrisk, K., Garcia, S. & Dhand, N. (2013) Factors affecting reproductive performance of dairy cows in a pasture-based, automatic milking system research farm: a retrospective single cohort study. *Animal Production Science. (In press)*

Scott, V., Thomson, P.C., Kerrisk, K.L., Garcia, S.C. (2013) Influence of provision of concentrate at milking on voluntary cow traffic in a pasture-17 based Automatic Milking System. *Journal of Dairy Science (in press)*



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