Calf ALIVE

Thursday 25 Nov – Friday 26 Nov 2021

Hughenden, Queensland

Proceedings: *Notes from presentations and discussion*

Editors: *Luis Prada e Silva, Karen Eyre*

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Objectives

Create awareness within the beef producer and RD&E communities of recent advances in Australian and international calf loss research that offers practical advice on ameliorating loss

Initiate Calf Alive, a major new north Australian research project, with the project team of producers and scientists

WITH THANKS TO OUR SPONSORS:

Program

Day 1	***Project team***
Michael McGowan	Potential interventions and how and why they would work -understanding the biology
Luis Silva	How to accurately test intervention on a commercial business
Mark Trotter	Remote monitoring of individual cows and calves within the NB2 Calf Alive Project
Tim Schatz	Calf Watch – Developing a system to remotely monitor calving and study calf loss in northern Australia
Luis Silva	Calf Alive - Creating a 5-years research plan and a detailed 1-year plan
Day 2	***Public forum***
Geoffry Fordyce	Keeping calf loss at achievable levels
Jarud Muller	Milk delivery to newborn calves in the tropics
Latino Coimbra	Monitoring milk delivery in tropically beef cows
Ala Tabor	Current progress in Vibrio and Trich research – how you can help
Kieren McCosker	Reducing calf loss from exposure: The effect of shade on Calf loss in the Barkly Tableland, NT
Karen Eyre	Tail hair testing: a practical tool to select for performance in harsh environments
Greg Mifsud	NB2: Lifting calf survival and breeder herd health through integrated wild dog management
John Gaughan	Rumen temperature and cow activity

Main Messages

- Calf wastage, averaging about 10% across north Australia and costed at >$500 per calf lost, could be halved with large potential benefits to beef business.
- A majority of calf loss occurs at or soon after calving; therefore, solutions must target pregnant cows and position them for successful calving and calf rearing.
- Successful solutions for calf wastage require on-going detailed analysis of prevailing causes, complemented by multi-faceted situation-specific strategies to ensure cows have a suitable feed base, that lactation, health, and stress are well managed, and breeding is appropriate.
- Poor nutrition and environmental stress (e.g., heat) have been identified as major contributing causes to calf wastage. These issues reduce foetal blood supply, retard normal development of the calf and or lactation, and therefore cause insufficient delivery of colostrum and milk to neonates, which can lead to their death.
- Poor milk delivery can be measured by monitoring calf weight as weight change is governed by milk intake.
- About a third of cows may experience a 3-day delay to full lactation, putting calf survival at high risk. A higher-quality diet for a short period pre-calving appears to substantially reduce the risk.
- Preliminary research suggests that the provision of artificial shade near watering points does not have a large impact on calf loss, but may influence grazing behaviour
- Analysis of two types (isotopes) of nitrogen in tail hair may be able to differentiate cows that are more or less nitrogen efficient, which may affect both conceptions and calf survival.

- Accurate diagnostic tests for vibrio and trich (reproductive diseases) have been developed, mainly for bulls.
- Calf Alive will research interventions, especially late-pregnancy nutrition boosts, to consistently achieve higher calf survival rates and higher herd production. This will be linked to predator research. Remote sensing will be used to understand and improve the efficacy of how interventions work. In addition, losses in cows calving at 2 years of age and the reasons and potential solutions for losses will be investigated.
- Conducting the planned research in Calf Alive requires collaborators to comprehend and manage methods, such as understanding the research question and how to collect data, all designed to unequivocally answer the research question without risk of even small errors that could jeopardize their investment.
- Smart tags, GPS collars, rumen boluses and accelerometers can potentially help identify where, when and how cow or calf mortality occurs in remote situations. Initial research is required to consistently collect the data and correctly interpret data.
- Intra-vaginal birthing sensors expelled at calving, coupled with multiple paddock antennae, have successfully enabled fixing time and place of calving of least 50% of cows. Currently, GPS collars are able to achieve higher success rates and generate more data for behaviour analyses.

Background

Calf loss in beef breeding herds is a global problem causing reduced live weight production and lower profitability from cattle ownership and is also associated with diminished welfare of both people and animals. In the northern forest of Australia, median loss averages 15-20% over vast areas. Large studies in recent times have shown the major risk factors to be very different to that which cause calf loss in intensive or temperate-region cattle systems, and are primarily nutritional and environmental, with infectious diseases being an irregular primary cause. Interventions that improve milk delivery to neonatal calves and prevent primary infectious diseases are expected to reduce rates of loss. This symposium reviews the opportunities available to manage cows for lower reproductive wastage, thus higher productivity, the consequences of which will be better returns for time and money invested. Unfortunately, the specific benefit of many potential methods to reduce calf wastage remain indefinite, which is the reason for a major new research project, Calf Alive.

The first half of Calf Alive 21 (Day 1) involved only the new project team where the background for the research and the research processes to be used were discussed. The second half (Day 2) was a public forum at which the latest research applicable to beef systems was presented.

Contents

Potential interventions and how and why they would work – understanding the biology

Prof Michael McGowan
m.mgowan@uq.edu.au

Michael is Professor of Livestock Medicine, University of Queensland. He created and led the Cash Cow project and leads on-going calf wastage research in northern Australia.

What are we aiming for?

High proportion of heifers to become pregnant within 2 months of introduction of bulls
According to country type achievable level of cows becoming pregnant within 4 months of calving and pregnant cows weaning a calf
Calves must be born alive, have normal birthweight and be functionally normal
Calves must have suckled normally within 1 hr of birth and be able to continue unhindered to suckle to receive 10% of bodyweight as colostrum and thereafter as milk

Major factors contributing to high calf wastage-cow mortality

Calf wastage	Effect
Disease factors	
Recent BVDV transmission	9%
High prevalence of vibrio	7%
Cow and calf factors	
Failed to lactate last year	3.5%
Low birthweight	8%
Bottle teats	20%
Large udder	6%
Tallest third of cows	3.5%
Env, nut & management factors	
High THI around calving	4-7%
Low dry season protein	4%
Vit A deficiency	≤25%
Low P in northern forest	10%
Low P and low cow BCS	3.5%
Muster around calving	2-9%
Wild dog predation	5%
Dehorning	2%
Low mustering efficiency	9%

Cow mortality	Effect
Cow factors	
Dystocia in 2yo calvers	5-10%
Aged cows	6%
Northern forest	7%
Low available dry season pasture	5.5%
Late follow-up to break	4%
Low cow BCS mid-dry	3-8%
No cow segregation	10%
No P supplementation	1%

Poor nutrition and environmental stress during the last half of gestation through to early lactation have been identified as major contributing factor/causes of calf wastage. Why?

- Intrauterine growth retardation can result in still births, premature births, calves born alive with low birthweight, calf born alive with smaller than normal organs especially thyroid and thymus. Thyroid hormones play an important role in foetal growth and neurocognitive development. After birth, the thymus has immune, regulatory and humoral functions. Also, brown adipose tissue around thymus critical for neonatal survival.
- Calf born alive but complete or partial failure to suckle sufficient colostrum. Calf or cow only problem or both.
- Calf born alive but complete or partial failure to suckle sufficient milk in first 2 weeks. Calf or cow only problem or both.

After confirmed pregnancy most calf wastage occurs around birth – what are major causes?

Key finding from Beef CRC - 41% calves had low birthweights

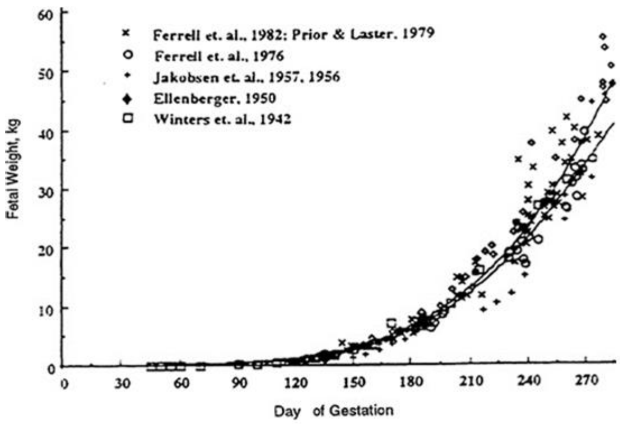
Odds of mortality approx. 2 X greater in lower birthweight calves

TComp av. birthweight – 35 kg
Bra av. birthweight – 33kg

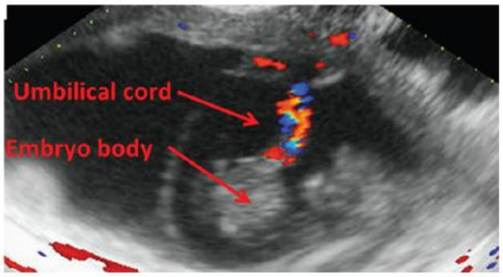
Birthweight	Cow age group					
	≤4 years old		5–7 years old		7+ years old	
	N	OM	*N*	OM	*N*	OM
<29 kg	833	19.5	782	9.7	216	13.0
29–32 kg	642	12.6	863	8.1	224	8.5
32–35 kg	604	8.9	980	5.8	283	2.8
35–39	373	5.9	816	4.3	267	6.0
>39 kg	295	7.8	1192	5.7	401	4.7

Survival of newborn lambs is inversely related to birth weight, until weights that result in dystocia are reached (Alexander 1974).

Intrauterine growth retardation results from inadequate nutrient supply to the foetus due to placental insufficiency and/or low maternal circulating metabolite concentrations during late gestation if nutrient intake and body reserves are limited.



Uterine blood flow increased about 4.5-fold during the interval from 137 to 250 days, whereas umbilical blood flow increased 21-fold during this interval.



Generally, a nutritional insult later in gestation will influence birthweight (placental capacity to supply nutrients), whereas a nutritional insult earlier in gestation (or prior to conception) may alter programming of specific tissues. So less affected in terms of size but potentially affected in terms of function later in life.

What is the effect of high heat load in 3rd trimester?

Table 5—Uptakes of metabolites by the gravid uterus, fetus, and uteroplacenta of control and heat stressed cows[a]

Metabolite	Treatment	Gravid uterus	Fetus	Uteroplacenta
Oxygen	Control	4.37	1.82	4.22
	Heated	3.59	1.42	2.16
Glucose	Control	1.20	0.17	1.52
	Heated	0.66	0.06	0.58
AAN[b]	Control	1.68	1.50	1.97
	Heated	-.22	0.61	-.54

[a] Mmol/min.
[b] AAN = alpha-amino nitrogen.

Ferrell, (1993)

Heated – cows maintained at THI of 86 for 12 hrs, then 75 for 12 hrs from day 100 -174 (control THI 58). Foetal weight 18% lower.

Uterine and umbilical blood flows were reduced 34% and 23%, respectively. Also note that blood flow to mammary gland is reduced and if this occurs in last few months prior to calving then daily milk yield is reduced.

Heat stress decreased gestation length, first colostrum yield, and Holstein calf birth weight.

Calf vigour

1974 US study found incidence of weak calf syndrome was 10% in cattle consuming forages with CP <10%. Incidence of reduced calf vigour higher in 1st lactation cows

Vigour Indicators	Minutes post calving
Lift its head	3
Attain sternal recumbency *	5
Attempt to stand	20
Stand spontaneously	60-90

Indication of normal calf vigour

Overall strategy is to ensure adequate nutrient supply for normal development and function of foetus, mammary gland and calf

Planned literature review to support interventions

'Strategies to manage prenatal nutritional and environmental factors which adversely affect survival and development of beef calves'

Are we on the right track?

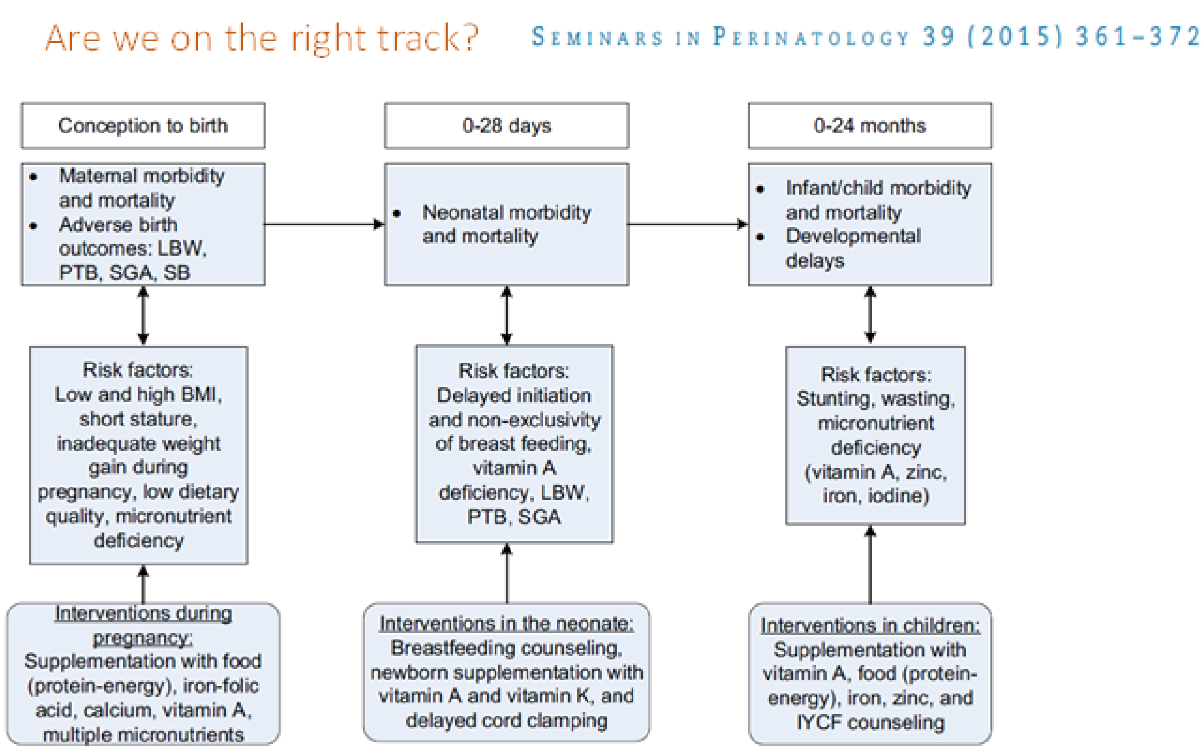


Fig. – Nutrition risk factors and interventions for maternal, neonatal, and child health and development.

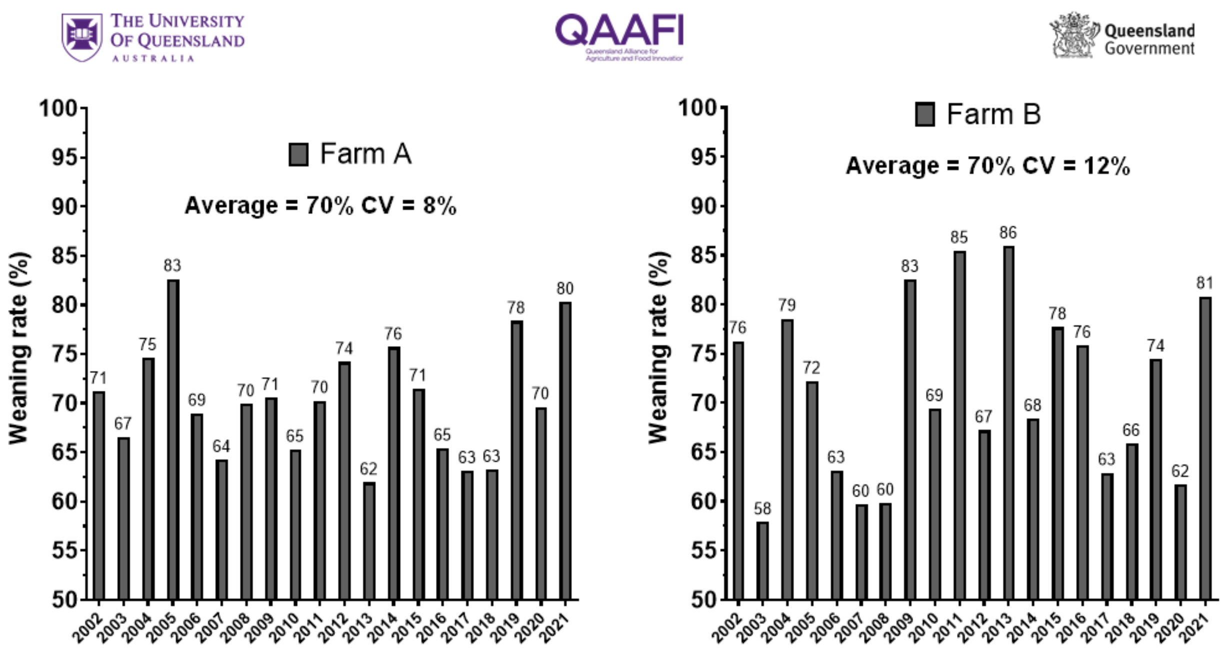
How to accurately test intervention on a commercial business

Associate Prof Luis Silva
l.pradaesilva@uq.edu.au

Luis is an Associate Professor of Ruminant Nutrition at QAAFI, University of Queensland. He leads on-going calf wastage research in northern Australia.

Illusions of Patterns and Patterns of Illusions

Human intuition is not suited to situations involving uncertainty



People can neither make up a sequence of random numbers nor recognize whether a given string is randomly generated
That’s why such great effort was required to confirm global warming, why drugs are sometimes declared safe and then pulled from the market, why coaches are fired when the team fails, why CEOs are thought to have superpowers to make or break a company.

Spain hosts an enormously popular Christmas lottery. In the mid-1970s, a man sought a ticket that ended in 48. He found a ticket, bought it, and won the lottery.
When asked why he was so intent on finding that number, he replied:
I dreamed of the number seven for seven consecutive nights. And seven times seven is 48

Examples of decisions based on Anecdotal evidence
Buying a boot because someone famous endorses it.
This wine has a fancy label, it must be good.
That bull looks good, therefore the offspring will also be good
This supplement has lots of things on it, it must be worth the extra cost

The Two Friends Who Changed How We Think About How We Think
Daniel Kahneman and Amos Tversky
2002 Nobel Prize in Economics

- by showing that people frequently fail to fully analyze situations where they must make complex judgments
- Departures from perfect rationality can be anticipated and specified. In other words, errors are not only common but also predictable.
- Aversion to loss

Measurement and the Law of Errors
How do I evaluate if a management decision improved (or reduced) my weaning rate?
There is less than 5% of random chance of achieving 80% or above weaning rate.
Same for 60% or less

Common mistakes that can ruin data collection

1. ***Not understanding the research question and why specific data is needed***

Aim of data collection: To answer the research questions asked by the project team – producers and scientists
The data needed is determined by the research questions. Nothing is collected 'for fun'.
Every bit of missing or inaccurate data reduces the ability to answer the questions.
In the field many decisions are made as situations do not always unfold exactly as anticipated. If the research question and why data is being collected are not understood, the results is too often the wrong, or incomplete, data is collected.
Example: Subcontracting the work to a consultant who might be a good person, but not fully cognizant of requirements. They skip important data because they don't understand and make poor decisions on what data is collected and how it should be collected.

2. ***Having the right person as data-collector***

Data collectors:

- They need to be personally confident, but not too much so
- They need to not piss off everyone, but also need to be able to say 'woo up – I have to stop to catch up or deal with this issue'.
- They need to look at the crush where all the action is happening, and they need to focus on the job at hand, not what they're doing in the back yard.
- They need to understand that what is recorded is what happened on the day. If there is no data, nothing happened.

3. ***Trying to collect too much data within a specific time***

Data collection increases the usual time in the field. If you plan too much in the day, it simply won't get done and critical data may go missing.

Example: Usual practice is to limit cow management groups sizes for detailed data collection to <500. Even this can be a challenge when the business has poor (even shockingly dangerous) facilities.

4. *Not calling data in a consistent manner*

When recording data either manually or into an electronic data capture device, always call data in the same sequence using the same expressions that have been agreed before you start. Always call numbers digitally. Always call 0 as zero and the letter O as Oh – Oh sounds like 8 in a noisy yard. Example: Number 64 is called as sixty-four and recorded as 624. Naughty.

5. *Not checking instruments are correctly calibrated regularly*

Electronic instruments are notorious for drift and need to be checked regularly.
Example: Load cells can be highly inaccurate if the unit moves, there is build-up of rubbish under the cells, or there is simply drift in the zero. Zero needs to be checked all the time.

6. *Not being tidy*

It is a disaster when you contract another person to enter data manually and find you cannot differentiate some of what is written on data sheets. Always ensure those responsible for data collection are neat and have legible writing.
Example: 7s and 1s need to be clearly differentiated.

7. *Not having regular on-the-spot, end-of-the day and between-days assessments of data to ensure all is OK with the data*

Trends in data are valuable guides to whether the correct data is being collected and its precision.
Example: A growth rate check on weight data might reveal problems with curfew protocols or problems with a weighing platform

8. *Not maintaining a diary of exactly what happened on the day of collection*

It is always good practice to maintain a diary of events when collecting data. This provides valuable context when apparently strange results emerge.
Example: Weighing protocol can have a huge impact on weights and any variation on the usual needs to be clearly recorded.

9. *Animals without tags*

Always make sure animals leave the yard with 2 tags – NLIS and visual identification tag
Use 6 digits number: 100001 not 1

Risk assessment

Remote monitoring of individuals cows and calves within the NB2 Calf Alive Project

Assoc Prof Mark Trotter
m.trotter@cqu.edu.au

Luis is an Associate Professor of Precision Livestock Management at the University of Central Queensland in Rockhampton. His research interests include remote monitoring of spatio-temporal variability in agricultural systems.

Mud-map
Introduction
What do we want to know?
What sensor systems deliver this information?
What technologies are actually available to monitor this?

CQUniversity's role in Calf alive
Evaluate on-animal sensor systems for delivering key information
Evaluate environmental monitoring systems (e.g. weather and feed-base) for delivery of key information

Cow behaviours
Calving (when and where?)
Maternal investment
Landscape utilisation

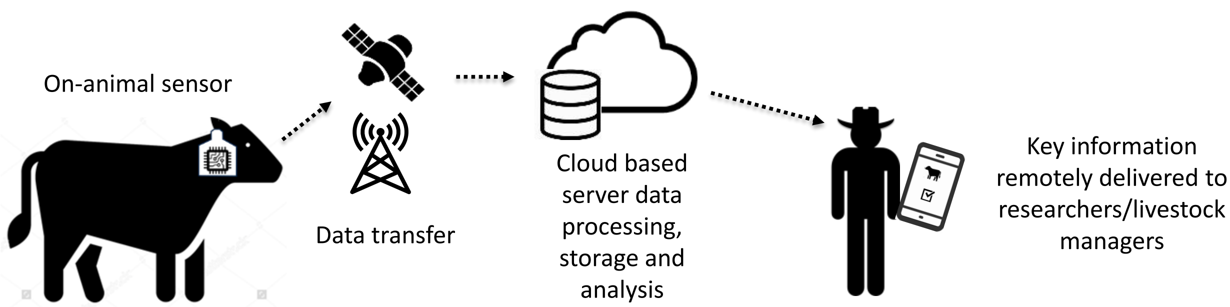
Relationships with environmental variables
Feed-base
Thermal stress
Landscape and resource (water) characteristics

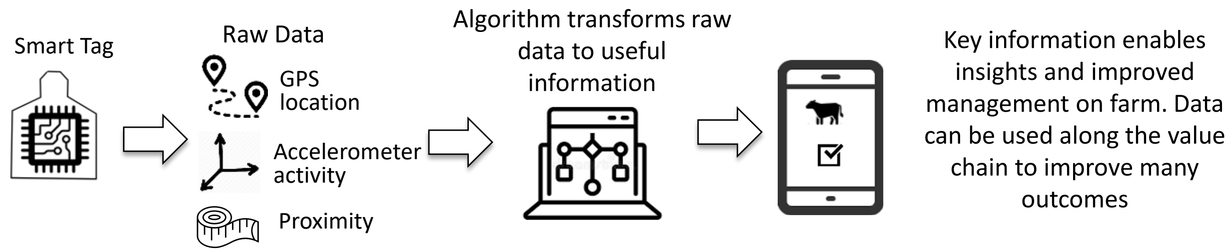
CQUniversity skills and experience
Co-development and evaluation of sensor technologies (hardware) for extensive livestock systems
Development of algorithms to turn data into information
Focus on tools for producers to use in day-to-day management

What do we want to know?
Cow and calf mortality events
When and where does a cow die?
When and where does a calf die?

Cow and calf morbidity events
Disease state detection
Dystocia

What sensor systems can deliver this information?





On-animal sensors (OAS) aka “smart tags”

Location information (GPS & Proximity)
Where has an animal been in the landscape?
What resources has it used?
What is it doing?
Where is it now (to enable post mortem)

Accelerometer
Fine scale behavioural data
Grazing
Standing/lying
Rumination
Heat stress?

Data integration

Form factor (how is it attached to the animal)
Everyone wants an ear tag!
Collars have proven reliable in many research/semi-commercial deployments
For some specific behaviours other form factors might be required (e.g. leg tags for bull mounting)
Hybrid systems may be valuable (e.g. CSIRO/Ceres research system)

What technologies are available? (focus on OAS)
If you read the glossy web sites you'd think this is all solved!
A viable smart tag for extensive environments remains a challenge
There are several candidates out there
Long term testing continues to evaluate the reliability of these systems

What's out there?
Smart Paddock
Ceres Tag
Moovement
Agtech360
Herddog
Chipsafer

Research grade v commercially viable systems
At CQU we continue to deploy high resolution systems along side commercial devices
Enables testing of data accuracy and fidelity
Enables capture of high resolution data (not possible with most commercial systems)
The downside:
Its store-on-board technology (no live data transmission)
For GPS this is a collar
New research grade systems may fill this gap
E.g. CSIRO/Ceres Tag collar systems

Challenges for the technology
Welfare – healing of wound post application remains a genuine concern
Accuracy of data collected (e.g. GPS accuracy)
Communication of data from cow to cloud (LoRA v Satellite v Bluetooth)
Long term retention of ear tag
Long term device reliability (does it work after a few months/years)

Recommendations
- Cows

Real-time ear tag (Ceres)
SOB research grade back-up collars (GPS)
Rumen bolus
- Calves

Tags/collars???
Rumen bolus???
- Environmental sensors

TBA!

Calf Watch – Developing a system to remotely monitor calving and study calf loss in northern Australia

Tim Schatz
tim.schatz@nt.gov.au

Tim leads the beef cattle research team within the Department of Industry, Tourism and Trade in the Northern Territory. His research interests include beef breeding production.

Investigating calf loss in northern Australia has been difficult as calving females and dead calves are hard to find in large paddocks, and close observation during calving alters behaviour. Being able to remotely monitor calving would allow collection of data that previously was not possible.
CalfWatch aim: to develop a method to remotely monitor calving and then to use it to investigate the causes of reduce calf loss.

Researchers at the University of Florida developed a system of using birth sensors to remotely monitor calving. Calf Watch adapted this system for use in northern Australia.
Birth sensors are inserted into the birth canal of pregnant cows up to 4 months before calving. When sensors are expelled at birth, the rapid change in temperature causes them to start emitting a UHF signal that is received by antennas mounted on towers in a low-power wireless-area network (LPWAN).

Signals are transferred by a gateway, via the internet to servers owned by the sensor manufacturer (JMB North America). A calving alert is then sent and is also immediately viewable on a website.

Towers – were built to mount the antennas and house the electronic equipment. Each tower has a read range radius of about 1.8 -2.0 km in 360 degrees.
Towers are equipped with:

- Power supply = 3 x 100W 12 V solar panels, 2 x 100 amp hour gel filled batteries, and a solar regulator
- An ethernet gateway attached to a UHF antenna to receive signals from expelled sensors.
- An industrial quality rugged modem and a yagi directional antenna to send signals to JMB servers via the internet (due to poor/no mobile phone signal strength).
- Birthing sensors (re-useable) cost ~ $250 each and a fully equipped tower cost about $9,500.

4 towers gave satisfactory coverage of the 2,215 ha trial paddock (un-cleared native pasture).

The cows were fitted with Smart Paddock GPS tracking collars to enable them to be found at calving and later for follow up observations.

- Collars are “pinged” at least every 15 minutes
- Batteries last at least 4 months
- Provide GPS location of cows in real time (so that we can find out where they are when we get an alert). ie don’t store data on board or communicate it hours later when animals walk past an antenna.

- Total cost of a collar and support to monitor it (monitoring equipment, website, site visit etc.) was $300.

Fitted about 200 cows with birth sensors and GPS collars and evaluated the system and investigated causes of calf loss over 2 calving seasons (2019 and 2020).
Method: get an alert when a cow calves ..... find her location from the GPS collars .... find her in the paddock and record observations. Use Avenza Maps smart phone app to navigate to destinations.

The system worked very well .... when all the technology worked.

However if any of the technology failed (either the birth sensors or the GPS tracking collars) then it was usually not possible to find calving cows to do calving observations.........
unless we saw them by chance near the water trough shortly after calving.

The birth sensors gave calving alerts from 85% of cows in 2019 and 51% of cows in 2020. (Many sensors were being re-used or were old in 2020 – possible explanation for worse performance).
GPS tracking collars were working when needed on 46% of cows in 2019 and 74% of cows in 2020. It was the 1st deployment of Smart Paddock collars in northern Australia on a large scale and lessons were learned about construction for tropical conditions (high temperature, moisture etc.), and cows being rough on collars.
Found that electronic components are variable in their reliability and performance......... not all work as expected.
The system has potential for use in research and possibly where the time of birth of high value animals needs to be identified, but is not suitable for commercial situations due to cost and complexity.

Calf loss rates were 17% in both 2019 and 2020 which is at the high end of the normal range for mature cows in northern Australia (CashCow - Northern Forest zone 25th - 75th percentiles = 9.4% - 19.2%).
The loss rates were 6 percentage units higher than the average at this site in the previous 4 years (ie. 10.7%).
This suggests that even though efforts were made to disturb cows as little as possible during calving, the extra activity of people taking observations may have contributed to higher calf loss (...poor mothers?)

Causes of calf loss

Cause of calf loss	2019	2020
Early abortion - unknown cause		1.0%
Dystocia	1.0%	0.5%
Unknown Peri-natal loss	4.0%	
Unknown Post-natal loss	4.0%	2.6%
Unknown - No information		7.3%
Post-natal loss - bottle teats	6.0%	4.7%
Post-natal loss – Neonatal septicaemia via umbilical cord	0.6%	
Post-natal loss – infection of the umbilical cord	0.6%	
Possible dog predation		0.5%
Deformity		0.5%
Total loss	17.0%	17.1%

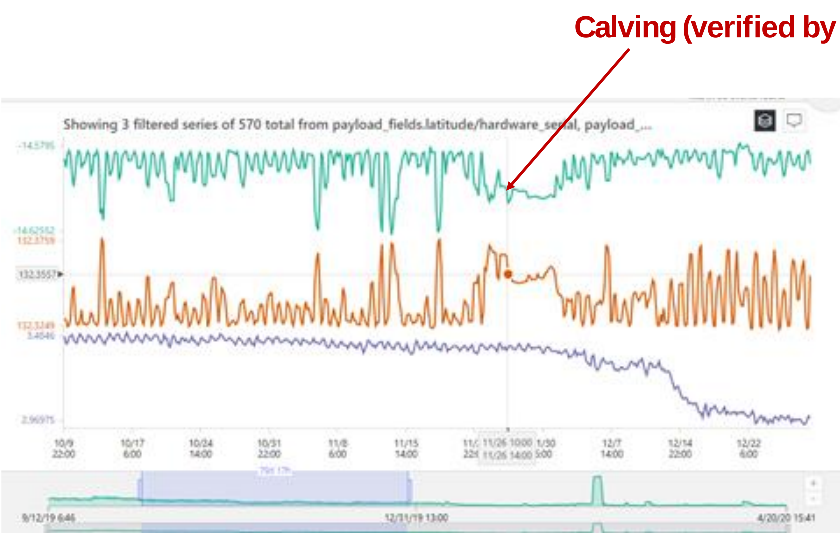
Still quite a bit of “unknown” loss (8% and 10%).

There were numerous minor causes (1% or less) of calf loss including abortion, dystocia, neonatal septicaemia via umbilical cord, pneumonia, deformity and wild dog attack however "unknown causes" were the biggest cause of loss in both years (2019 = 8%, 2020 = 10%) due to variable performance of the birth sensors and GPS tracking collars.
Some of the losses due to unknown causes are likely due to poor mothering (cows abandoning calves). The frequent observation required to confirm this was not conducted in case it impacted cow behaviour (tried not to disturb cows that appeared agitated in case it exacerbated the problem). Also some cows were not observed at all after calving due to equipment failure.

Some calves just disappeared without a trace.

The other major cause of loss was bottle teats (2019 = 6%, 2020 = 5%).
A number of cows that lost calves were observed to have bottle teats shortly after calving, but several weeks later their udders looked normal and so they would not be identified as having bottle teats at a muster months later. If this herd is typical of northern herds then it is likely that bottle teats is a bigger problem than previously thought and that cows with bottle teats are remaining in herds and losing multiple calves.

The project played a role in the development of affordable GPS tracking collars that can be used to locate cows in extensive areas.
The collars contain accelerometers and efforts are underway to further develop the collars to identify calving from accelerometer data in real time and send calving alerts. If this can be done it would enable birth date to be recorded remotely in extensive areas without the need for birth sensors.



Calf Alive – Creating a 5–year research plan and a detailed 1–year plan

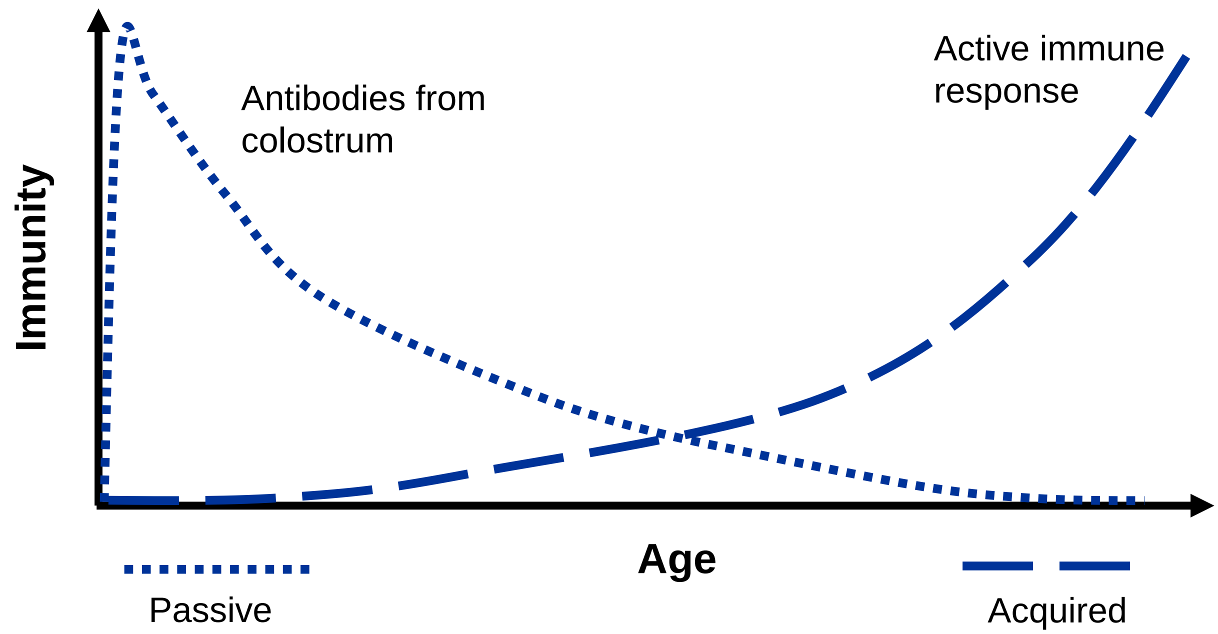
Assoc Prof Luis Silva
l.pradaesilva@uq.edu.au

Luis is an Associate Professor of Ruminant Nutrition at QAAFI, University of Queensland. He leads on-going calf wastage research in northern Australia.

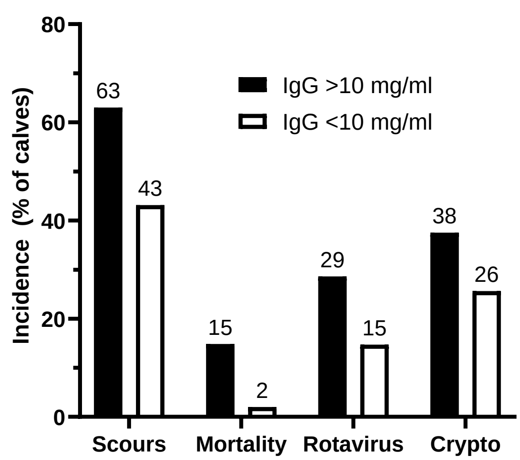
Better nutrition during late pregnancy will improve colostrum yield, calf health and survival

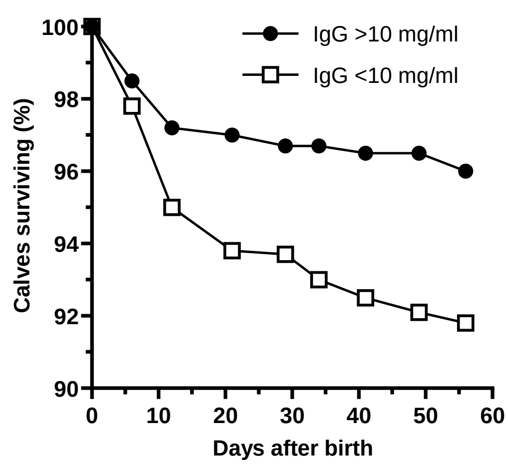
Most calf loses are in the first week...... due to Poor nutrition and environmental stress

Immunity in newborn calves. *Calves need to receive colostrum in the first 12h after birth*

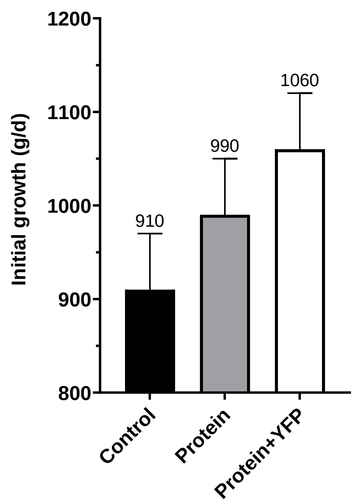


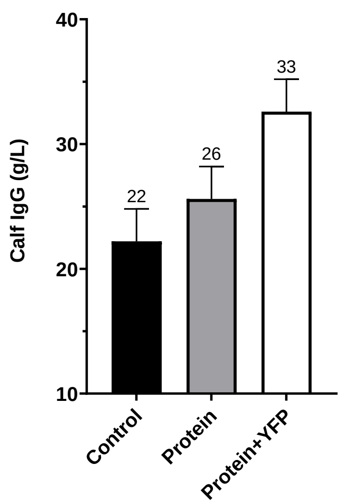
Lower passive immunity increase sickness and death





Supplementing cows during late pregnancy (average 14 days prepartum) increased milk delivery





Innovation on farm to determine…

- the impact of nutrition and environmental stress on calf wastage
- if more resilient breeders can be identified
- the incidence of mortality in calving 2-year-olds heifers
- applicability of sensors on collection of useful data in extensive grazing conditions
- the impact of interventions on whole-of-business productivity, profitability and sustainability

On farm application

- Monitor environmental stress in paddock and on animal
- Pregnant breeders across ten collaborative properties to assess nutritional options
- Measure individual animal productivity linking cow with calf
- Remote monitoring of movement and mortality in 2,000 heifers and cows
- Tail hair from heifers predict reproductive performance as cows

Calf Alive – Criteria to participate

Animal measurements

Measure	Start of cattle year	Branding	Weaning 1	Weaning 2
Live weight	x		x	x
Cow hip height	x			x
Body condition	x		x	x
Lactation status	x	x	x	x
Stage of pregnancy	x			x

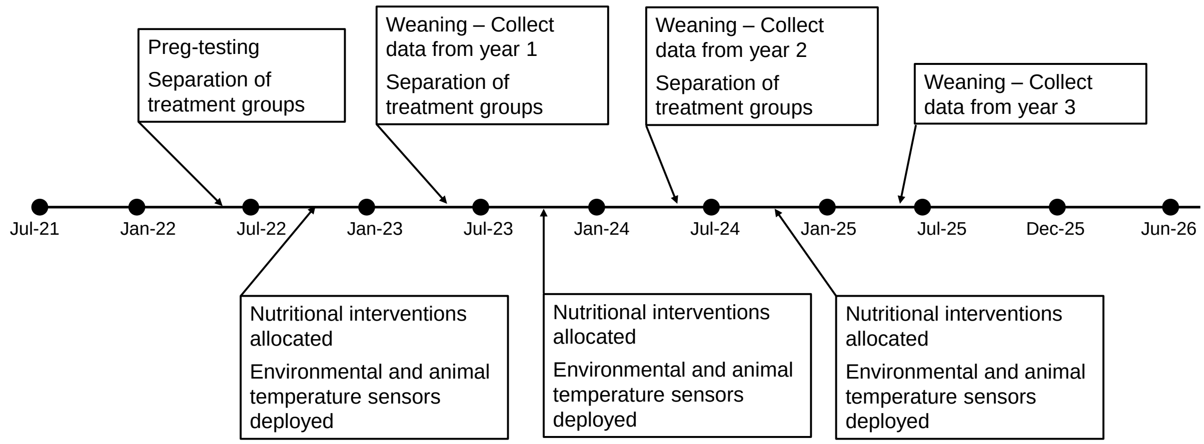
Objectives

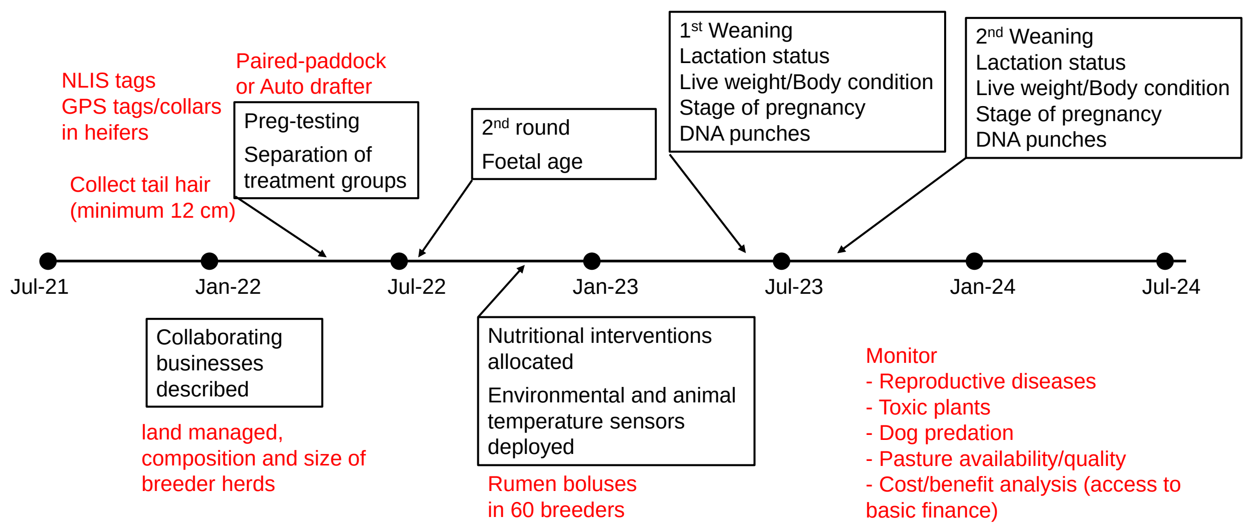
The main objective is to test cost-effective gestational nutritional management strategies to increase calf survival, reduce herd mortality, and improve calf growth

We will achieve this objective with these actions:

- Determining the incidence of mortality in calving 2-year-olds heifers in northern
- Determining the impact of nutrition and environmental stress on reproductive efficiency and herd mortality in northern Australia
- Determining if more resilient breeders can be identified in advance with the use of tail hair analysis indicating the loss of nitrogen in the urine
- Modelling the impact of management intervention on whole-of-business productivity, profitability and sustainability

Determine the impact of nutrition and environmental stress on reproductive efficiency and herd mortality





Benefits to calf-alive participants

- Be an active member in an exciting program addressing an industry priority
- Clear understanding of performance, productivity and profitability
- Improve productivity using objective data to inform decisions

- Gain invaluable information, at an individual animal level, for improving reproductive performance
- Inputs used as test interventions or to monitor cattle such a supplements or minor infrastructure

Requirements to calf-alive participants

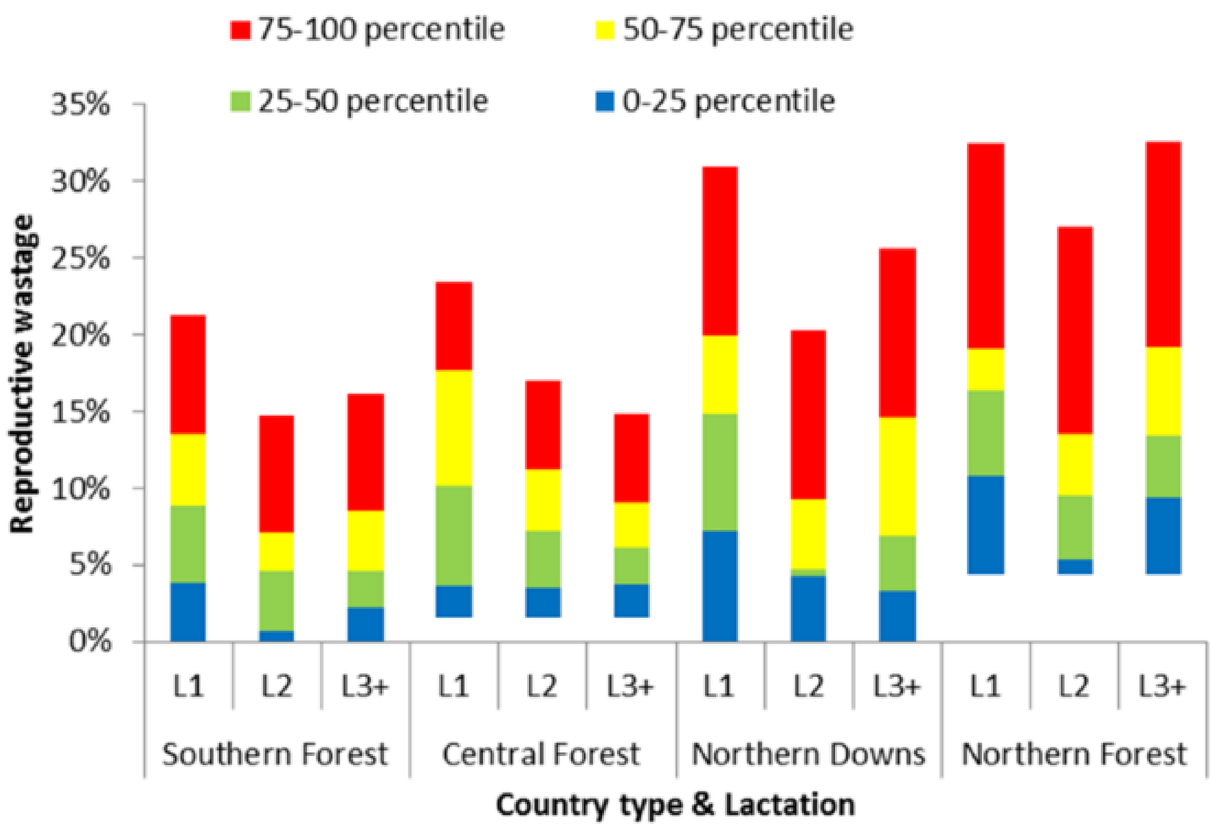
- Able to provide access to two groups of breeding cattle (selected as pregnant heifers or cows) annually kept as separate groups that are managed similarly (or one group with capacity to auto-draft) over a one-year period, ie, from weaning/PD to weaning/PD.
- Able to achieve clean musters, and able to keep and provide project team access to a diary of group management.
- Maintain secure individual identification of all study cattle using NLIS tags coupled with visual flag tags.
- Has the facilities to safely weigh cattle and conduct reproductive assessments at selected musters.
- Ensure bulls are used at a rate nominated by the project team, and those selected are free of vibrio (vaccinated), are not pestivirus carriers and have met ACV BBSE standards for scrotum, physical, semen and morphology.
- Ensure all study cattle have had a sample for DNA collected at the start of the cattle year for post-weaning-age cattle, or at branding for calves.
- Provides access to the study group by the research group to enable assessment of infectious disease incidence (strategic sampling, eg, blood, of selected animals) and of environmental risk factors including land and pasture measures, wildlife (eg, pigs, wild dogs, marsupials) activity.
- Able and willing to define all business costs, excluding finance and taxation aspects, associated with the study group and share with the project.
- Be willing to consider for groups they manage, more intensive individual animal measures that enable monitoring of reproductive performance and behaviour and of risk factors such as heat stress.
- Agree to place one to two weather stations on site and consider the use of rumen boluses and GPS monitors (ear tags, collars) in selected cattle to monitor body temperature and behaviour.

Keeping calf loss at achievable levels

Geoffry Fordyce
geoffry.fordyce@gmail.com

Geoffry is a director of GALF Cattle Pty Ltd, Charters Towers, and formerly with QAAFI at UQ. His research and business interests focus on beef breeding production systems.

Calf wastage in surviving cows: Cash Cow



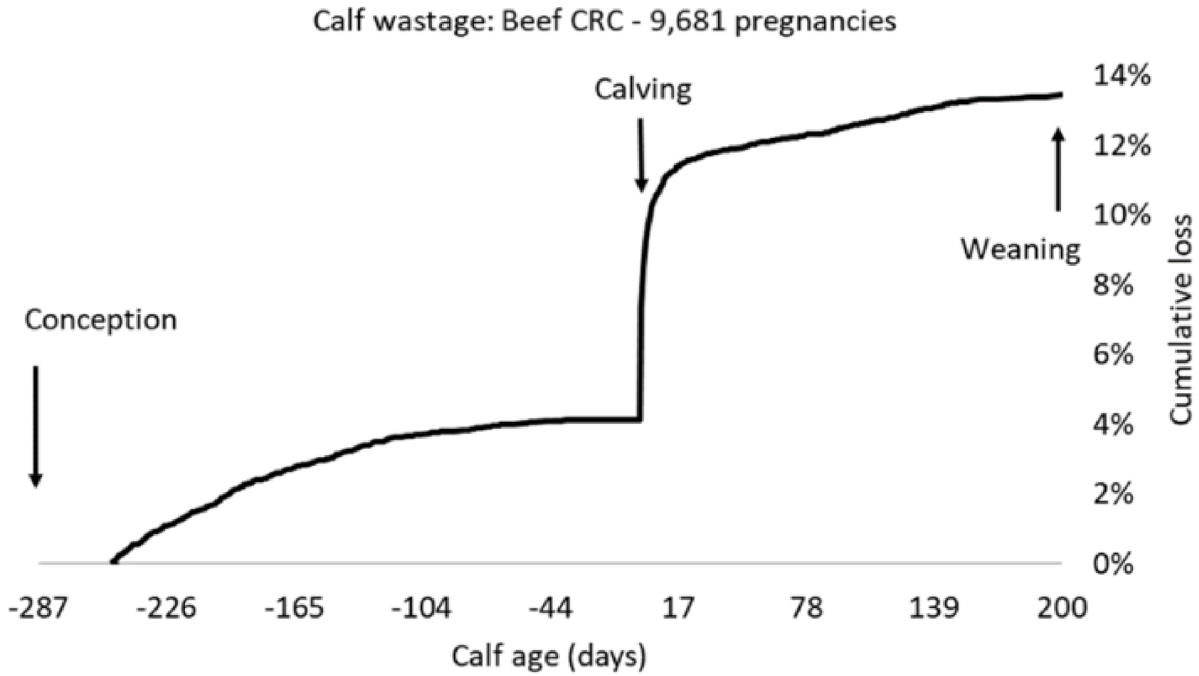
What's happening in your herd?
Loss occurs in all herds, but is yours at an achievable level?
What is causing calf wastage in your herd?
If you identify one cause, you can be CERTAIN it will only be one of SEVERAL causes
It is always a complex problem, but solutions are available

Calf loss: north Australian beef herd
Too many calves lost annually
$400M problem that could be halved + Welfare issue

Calf loss: Average beef herds with 5,000 cattle
If calf loss is a problem and could be consistently reduced by 5%, about 100 calves extra weaned & cow production up by ~120 kg/calf saved. That's ~$50K extra production.
If spend $30K annually to achieve this outcome, secondary impacts on cow survival, growth and pregnancies, and on calf growth to weaning will yield further benefit.

Pathways to calf wastage are complex
If amelioration is approached in a systematic manner, there are solutions available
There is no clear answer for excess calf wastage in some situations, and research to explore solutions will be as complex as the problems themselves

Timing of calf wastage



Whatever causes this, it can't be fixed after calving
Interventions must be for pregnant cows

Relative impacts of risk factors on calf wastage
The most important disease is Vit F deficiency (Food)

How does poor nutrition & poor management and environmental stress cause newborn calf loss?

- Most likely that milk delivery is disrupted in the first 3 days of life because:
- Cow does not milk properly - common problem 30% of cows (& in women)
- Calf unable to suckle properly – low vigour
- Calf does not get enough fluid (neonatal death) and/or colostrum (death when older)
- Recent research shows improving feed ***QUALITY*** in last weeks of pregnancy can significantly reduce delayed lactation
- Direct role of high temps v water access v shade?
- Water quality and access may be more effective than to use shade or change calving times

Solutions for nutrition & environment problems

- Ensure easy access to water (<3 km) & pasture for cows at all times, especially in late pregnancy
- Enable newborn calves to access clean water
- Manage weaning for cow condition

- Where P deficiency occurs, supplement pregnant cows
- Provide urea-based licks or access to fresh or green feed in late pregnancy where pasture protein is low
- More attention to diet quality in first pregnancy, even if heifers in good condition
- Timber belts and ridges for extreme weather
- Avoid calving in fat condition at 2 years old

One of the above by itself may have no impact; Use a multifaceted systems approach

Infectious reproductive diseases

- Vaccinate all bulls annually with Vibrovax
- Test for presence of trich – if so, cattle vet advice to control
- Develop a pestivirus management strategy for your situation with your vet
- When a good wet expected after a run of dry years, consider 3-day vaccine for young females
- No method to prevent Akabane virus infection
- Lepto vaccination may not reduce calf loss, but effective in transmission to humans

Whatever you do, make it part of a systems approach

Predators

- Killing predators may not reduce calf loss, if it is not the root cause
- A healthy environment provides alternate & preferred predator tucker than calves
- Effective predator control requires a sound understanding of fauna ecology – consult a fauna specialist
- 10% calving mature cows with first-calvers may help?
- Predator issues are managed as one part of a systems approach

Other strategies

- Cull cows with bad udders or teats
- Dis-bud at 2-3 months rather than dehorn
- Use open surgical castration rather than rings
- Use Trisolfen & meloxicam products when branding
- Use methods to avoid mustering of newborns, eg, segregation on expected calving period
- Reduce dystocia in 2-year-old calvers by: low birth wt EBVs, avoid wt loss (esp in early-mid pregnancy) and calving by green date
- Ensure bulls not carriers of genetic diseases
- Tick and fly control in pregnant cows

Include any of these in a systems approach

Risk assessment template

Solutions for your business

- Work out level of loss = situation analysis – monitor pregnant cows
- Diagnose the specific causes & opportunity to reduce – use risk assessment template
- **Use a full-system approach that cost-effectively reduces loss**
- & also improves cow survival, cow growth,

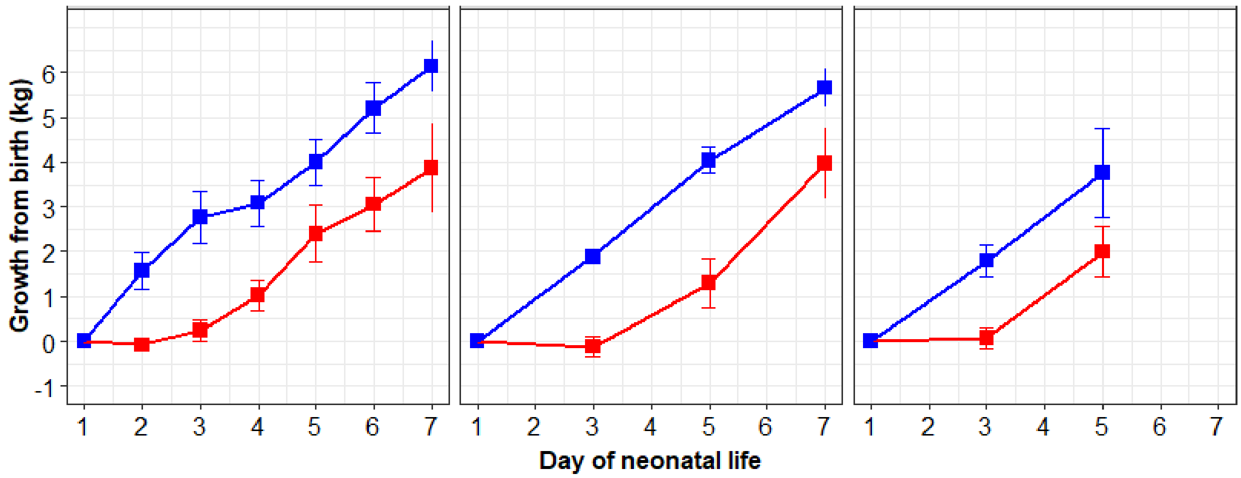
- pregnancies and calf growth to weaning
- (most of the problems created in pregnant
- cows & can't fix after calving)
- Don't expect magic; success can be tricky but rewarding, and relies on constant attention to root causes

Milk delivery to newborn calves in the tropics

Jarud Muller
jarud.muller@daf.qld.gov.au

Jarud is a scientist with the Department of Agriculture and Fisheries in Charters Towers. His research interests focus on beef cow fertility

Timing of milk delivery



Take home messages
3-day problem
1/3 calves at risk
Interventions and research should take milk delivery into account

Monitoring milk delivery in tropically beef cows

Latino Coimbra
ldossant@myune.edu.au

Latino is a PhD student based at UNE in Armidale. He is studying nutritional influences on milk delivery to neonatal beef calves.

Why we are doing this experiment?

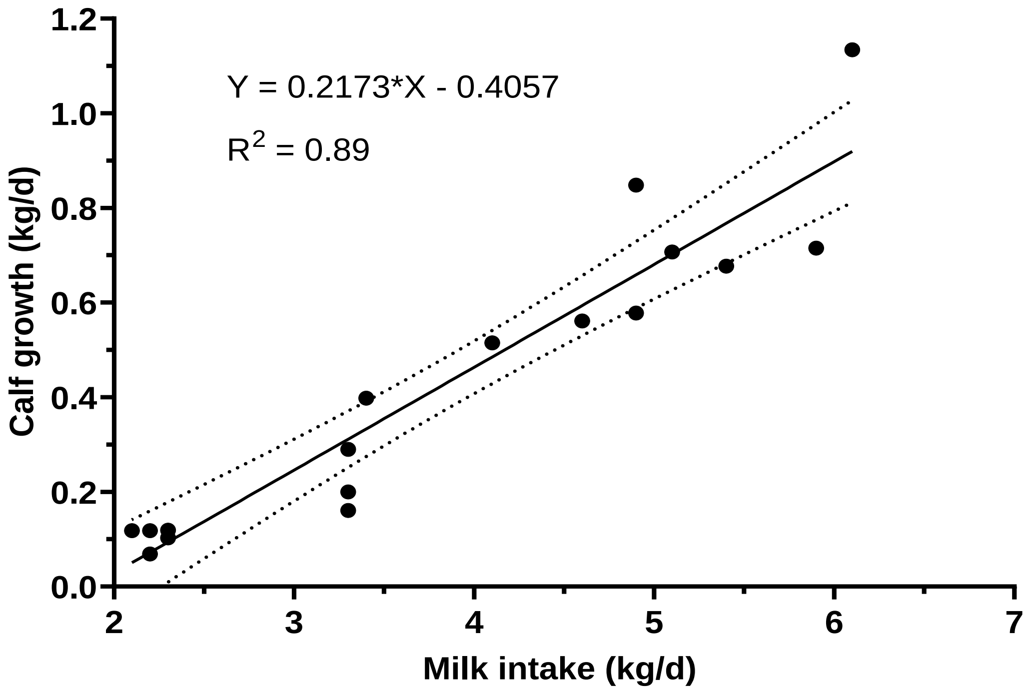
- High calf loss in Northern Australia.
- Most of them occurs during first week of life.
- Associated with poor milk delivery, caused mainly by nutritional and environmental stress.
- Measuring milk yields of tropical beef cows (Brahman cows) is difficult.
- Developing a practical way of measuring milk in the field is important.

Research question: Can daily body weight gain of the calves during the first two weeks of life be used to accurately predict milk yields in tropically-adapted beef cows?

Brief description of the experiment:

- 24 neonatal Brahman cross calves.
- First 3 days a calf stay with the dam.
- Treatments: 4 volumes of milk (2.3 L/d, 3.5 L/day, 5.5 L/day, and 7.5 L/day).
- Based on the calculation of ME and gain for young dairy calves with 35 kg of BW.
- The expected average daily body weight gain: 50 g/day, 400 g/day, 800 g/day, and 1200 g/day.
- After 2 weeks: 4 L of milk and calf starter.
- Measurements: Calf growth and IgG1 concentration in the blood.

Results:



Conclusion

- There is a strong correlation between calf live weight gain and milk production ($R^2 = 0.89$).
- For each extra litre of milk, there is a 217 g/d increase in ADG of the calf.
- A calf needs 1.9 kg of milk just to stay alive.
- As calves are growing >700 g/d in the field, the cows are producing > 5 kg milk since day 1, represents high energy and protein demands.
- As prepartum supplementation increases calves ADG from 0.9 to 1 kg/d, milk yield was increased by about 0.5 kg/d (experiment 1).
- Daily body weight gain of the calves during the first two weeks of life can be used to predict milk yields in tropically-adapted Brahman cross cows.

Implication for the industry:

- Daily body weight gain of the calves during the first weeks of life can be used as a robust and simple tool to monitor changes in milk yield in the field.
- Supplementation during prepartum period and 14 days after calving could increase milk yield and calves growth.

Current progress in Vibrio and Trich research – how you can help

Professor Ala Tabor
a.tabor@uq.edu.au

Ala is a molecular biologist at QAAFI, UQ. Her research interests include genetic solutions to animal health problems, especially in beef cattle.

Vibrio

- A sexually-transmitted disease in cattle
- Spread by bulls; vibrio bacteria live in the sheath
- Has been extremely difficult to diagnose
- We have developed a DNA test: few false negatives or false positives
- Huge improvement on previous tests
- When we infected cycling heifers, they cleared it within one cycle
- Therefore, the test is best used in bulls if necessary, supported by vaginal mucus antibody testing

Reproductive tract bacteria

- Huge numbers of diverse bacteria live in the vagina and bull prepuce normally
- These populations change during the oestrus cycle
- Recently found the most common is botulism bacteria, just waiting for a chance......
- Tests for the some of the unexpected bacteria may give clues to clinical infections

Trich

- Very similar to Vibrio, but caused by protozoa (one-cell animal), not bacteria
- Successful DNA test available since 2006
- Found in about 25% of herds, mainly larger herds with less control
- No treatment or vaccine available
- Can only clear by having low numbers of young bulls, seasonal mating, and culling positives
- Currently developing a commercial vaccine that was pioneered 50 years ago

How can you help?

- Provide samples from bulls in herds with records showing sub-optimal cow performance!
- We would supply kits to your local veterinarian to assist in sampling and sending to us. Please contact me
- Question for Vets - We have the ability to develop yard side diagnostic tests through veterinarians in the future – results in 20-30mins as opposed to ~2 weeks – what would be on your wish list?

  Trich?
  Vibrio?
  Any others ???

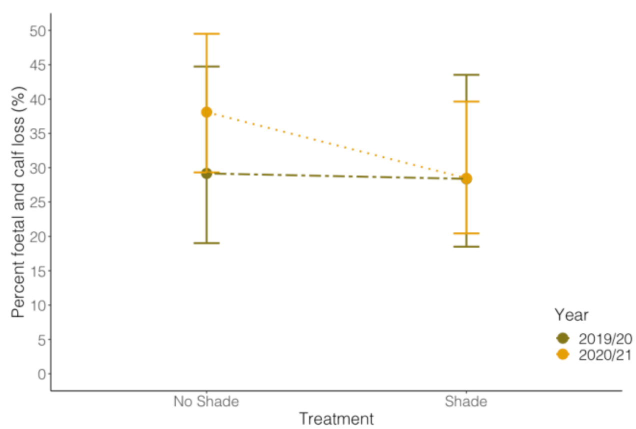
Reducing calf loss from exposure: The effect of shade on Calf Loss in the Barkly Tableland

Dr Kieren McCosker
k.mccosker@uq.edu.au

Formerly based in Katherine (NT) as a Beef Production Scientist, Kieren did a PhD in the Cash Cow project. Kieren is now with QAAFI , UQ. He has research interests across all aspects of beef production systems.

Association with heat load in the Cash Cow study. A Heat stress resulted in 4-7% higher loss, except in NT.

Foetal and calf loss
Preliminary results suggest limited to no association with treatment



Year	No Shade	Shade	Diff	P-value
2019/20	29.2 (19.0, 44.7)	28.4 (18.5, 43.5)	-0.7 (-18.2, 16.6)	0.92
2020/21	38.1 (29.3, 49.5)	28.5 (20.4, 39.6)	-9.6 (-23.4, 4.1)	0.17
Overall	34.9 (27.9, 43.7)	28.4 (21.9, 36.9)	-6.5 (-17.3, 4.3)	0.24

Average distance walked per day

- Cattle were typically walking between 6-8 km prior to calving
- Cattle with access to shade tended to walk further in the lead up to calving
- There appeared to be two distinct drops in walking
    - At the time of calving
    - At the time of cycling (6 weeks)

Proportion of positions within 200m of water (and shade)

- Cattle were typically walking between 6-8 km prior to calving
- There appeared to be two distinct drops in walking
    - At the time of calving
    - At the time of cycling (6 weeks)

Heat map of cow positions at the time of expected calving (within 2 weeks)

- A heat map is essentially a graphical representation of frequency an animal was observed in similar position. This analyses took into account individual animal (id).
- As a mob, more positions around watering points than other areas.
- As an individual, animals were likely just to isolate themselves from the rest of their group around the time of calving.

Preliminary results

These preliminary results suggest that the provision of shade near watering points does not have a large impact on calf loss, but there is some evidence of influencing grazing behaviour

Next time…

In 2021, the paddocks were equipped with remote technology to detect calving events.

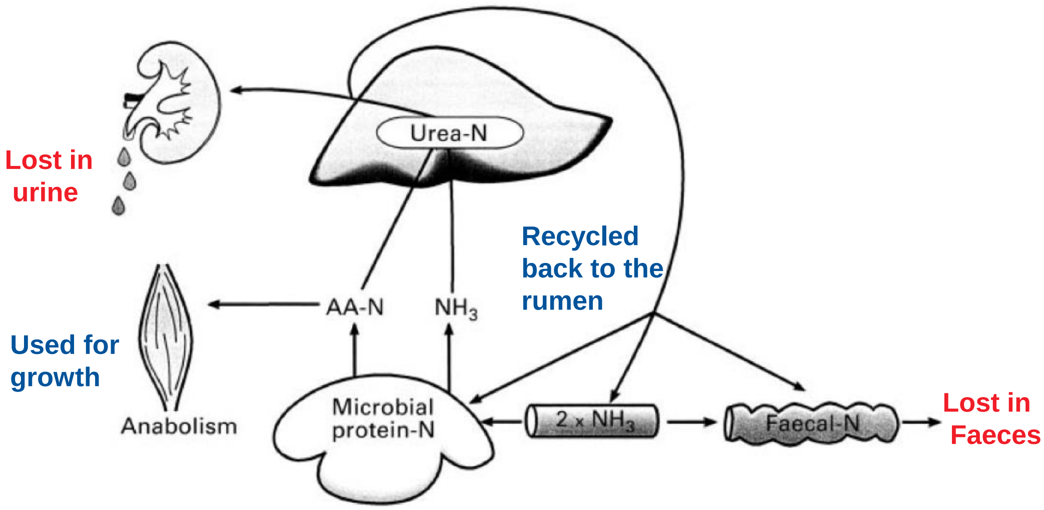
- This will support an assessment of:
    - Time and location of calving
    - environmental conditions at the time of calving
    - Proximity of water

Tail hair testing: a practical tool to select for performance in harsh environments

Dr Karen Eyre
kturnbull1@uq.edu.au

Karen is a post-doctorate at QAAFI, UQ. Her PhD in Ruminant nutrition positions her well for a major role in the new Calf Alive project.

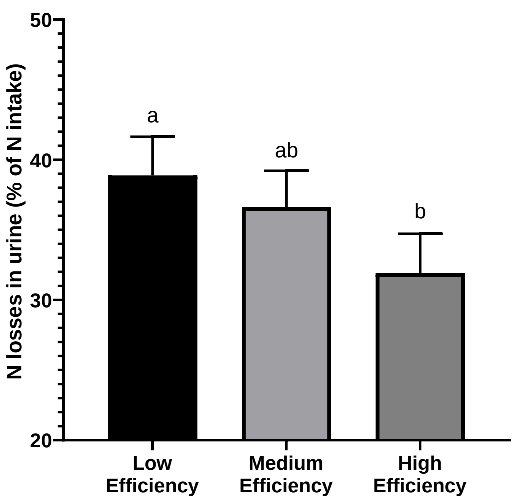
How do animals adapt to harsh environments?
Animals can reduce nitrogen losses in low-protein diets

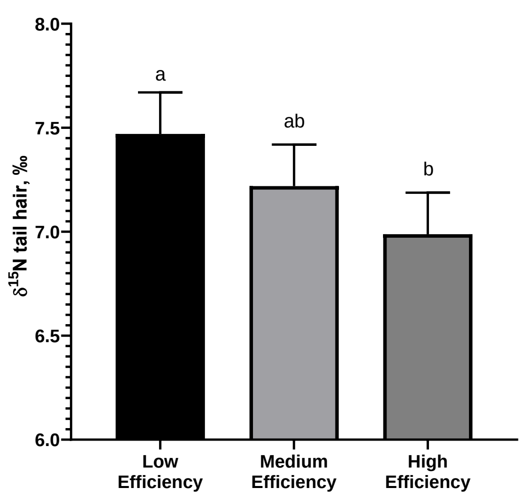


Nitrogen recycling mechanism in ruminants

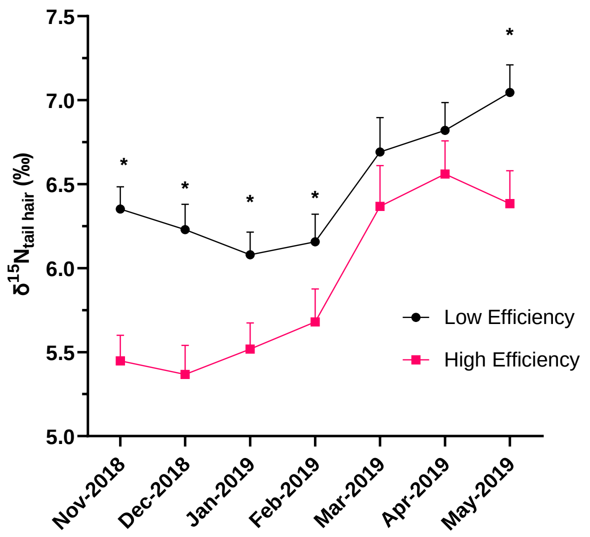
How to measure nitrogen losses?
Stable isotopes

More efficient animals <u>have</u> proportionally less N15 on the tail hair





Can we apply this technique to evaluate efficiency in breeders?



YES!

High-fertility cows had lower 15N in the tail hair grown during the dry season

What does this mean for cows?

Small changes in BCS have dramatic impact on fertility

A 4% increase in efficiency is the difference between a cow maintaining BCS or going backwards

Take Home Points

Problem

- Identification of animals that are more efficient on low quality, N deficient diets

What have we learned?

- There is huge variability in nitrogen use efficiency in the Brahman herd
- Feed efficiency of steers and reproduction efficiency of breeders are both correlated with N losses in urine
- Is this heritable?

NB2: Lifting calf survival and breeder herd health through integrated wild dog management

Greg Mifsud
greg.mifsud@invasives.com.au

Greg is the National Wild Dog Management Coordinator for the Centre for Invasive Species Solutions.

Impacts from wild dogs on calf survival and growth

Primary Impacts:

- Primarily attacks on live calves and weaners;
- Spreading disease and parasites that impact production and cow/heifer health;

But could also include a range of lesser known secondary impacts including:

- Increased risk of mis-mothering from stress resulting from high predator numbers and activity at calving;
- Increased stress and spikes in body temp from being harassed by dogs;
- Reduced weight at birth and weight gain in calves due to increased activity and stress from presence of wild dogs in the paddocks;
- Predators can affect pasture utilization by stock and may limit their access to water.

What if the presence of dogs and their negative interactions with cattle were contributing to poor calves at birth

Objective 1: Find out what the dogs are doing! So we can control them more effectively

Objective 2: Investigate what level and type of interactions are occurring between Cattle and wild dogs

Objective 3: Try and determine the cost of wild dogs impacts on the individual and across industry.

Hydatid disease may be costing Qld beef industry $100m each year - Jon Condon Beef Central, 29/06/2021

“We see the effects of hydatids in carcasses on a daily basis,” Teys Australia’s Dr John Langbridge .

Impacts of wild dogs on Queensland Grazing Industry

Agforce Qld estimate these costs to be in excess of $100 million per annum Based on current market values

Major Economic Costs Associated with Wild Dogs in the Queensland Grazing Industry		
Cost Category		**Costs 08/09**
Cattle Producers	Calf livestock losses	$22,840,000
	Product loss due to dog-bitten cattle (saleyards)	$1,036,914
	Product loss due to dog-bitten cattle (processors)	$1,031,441
	Neospora caninum	$3,143,536
	Hydatids	$2,057,685
	Wild dog management costs	$11,460,498
Sheep/Goat Producers	Sheep/goat livestock losses and attacks	$16,950,000
	Wild dog management costs	$2,248,642
Local Government	Includes bounties and management program	$2,623,543
Wild Dog Barrier Fence	Contributed from Local and State governments	$1,870,316
Queensland State Government	Department of Employment, Economic Development and Innovation Queensland Parks and Wildlife	$1,754,000
TOTAL COST		$67,016,575

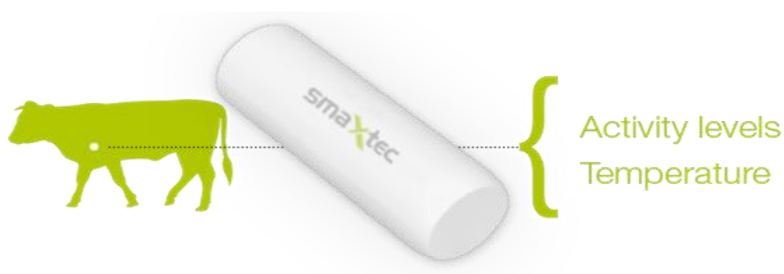
Rumen temperature and cow activity

Prof. John Gaughan
j.gaughan@uq.edu.au

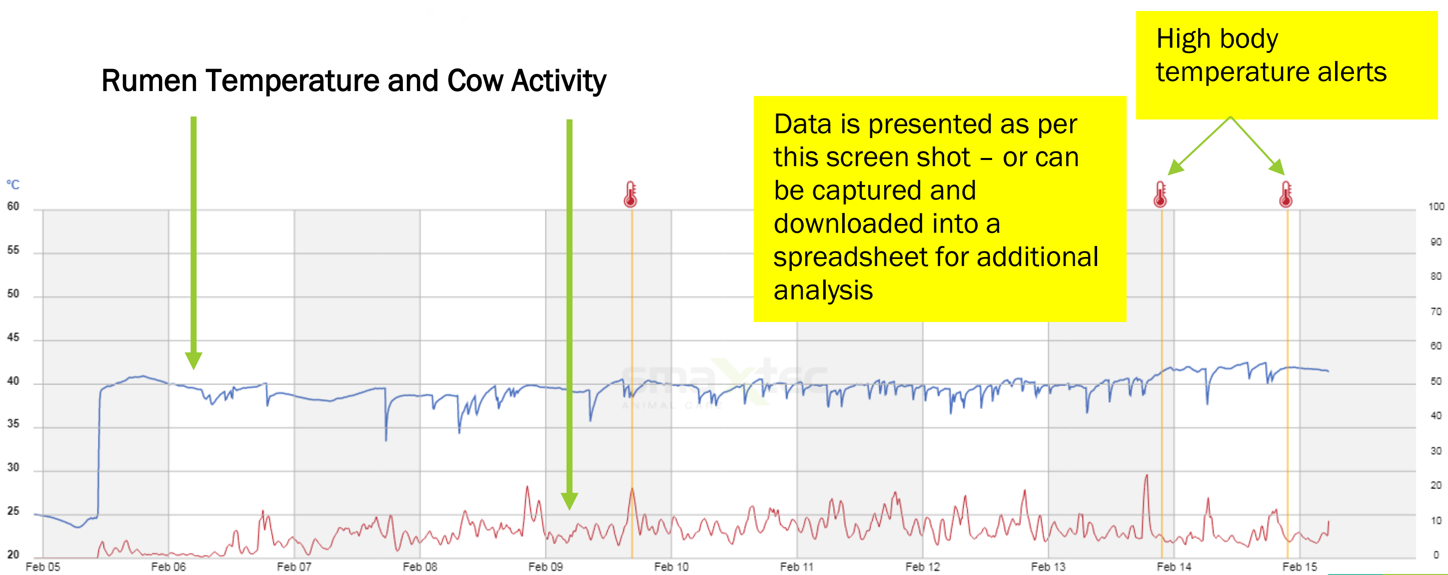
John is a professor at the University of Queensland School of Agriculture and Food Sciences, Faculty of Science. He is also an Affiliated Associate Professor for the Centre of Animal Science, Queensland Alliance of Agriculture and Food Innovation

Rumen Temperature – Bull

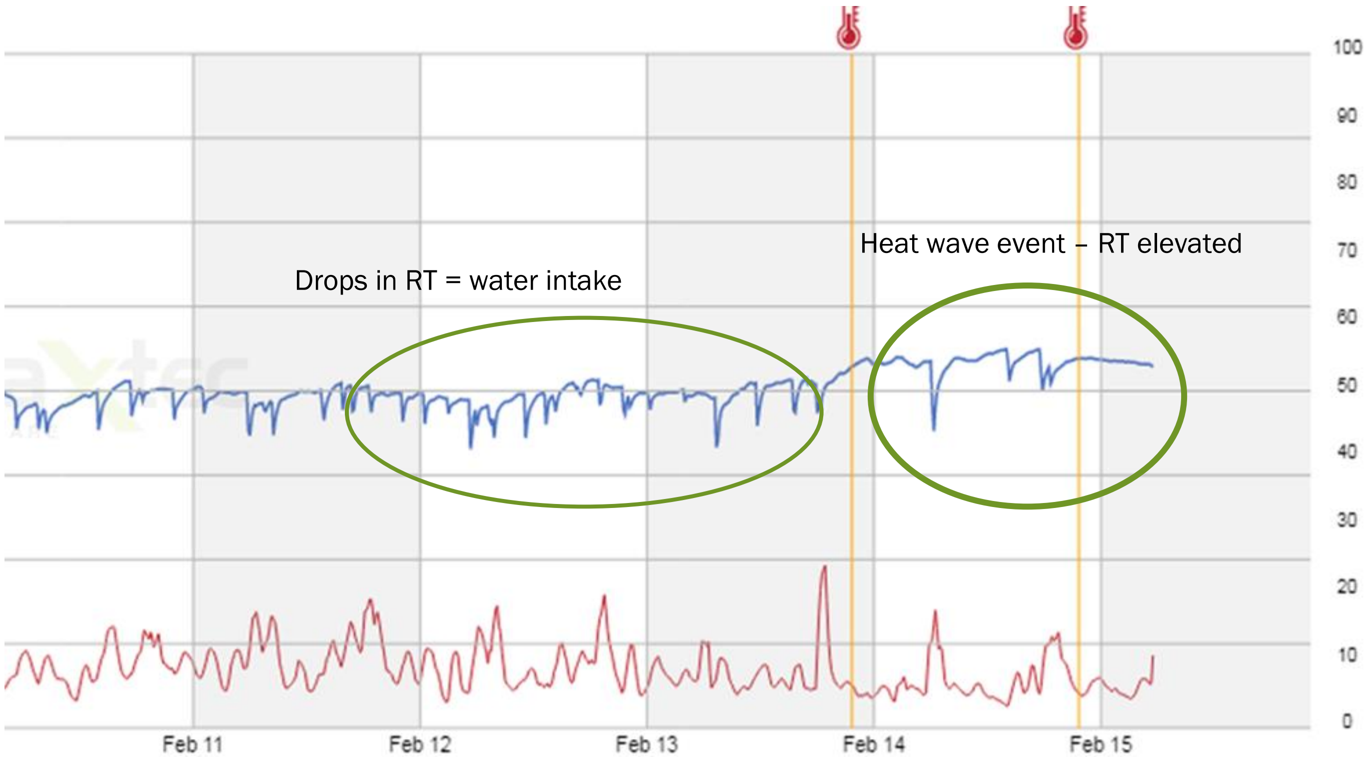
- Rumen boluses – temperature.
- Real time monitoring
- Rumen temperature is a good proxy for rectal or vaginal temperature
- Need continuous measures – not a point in time.



Rumen Temperature and Cow Activity

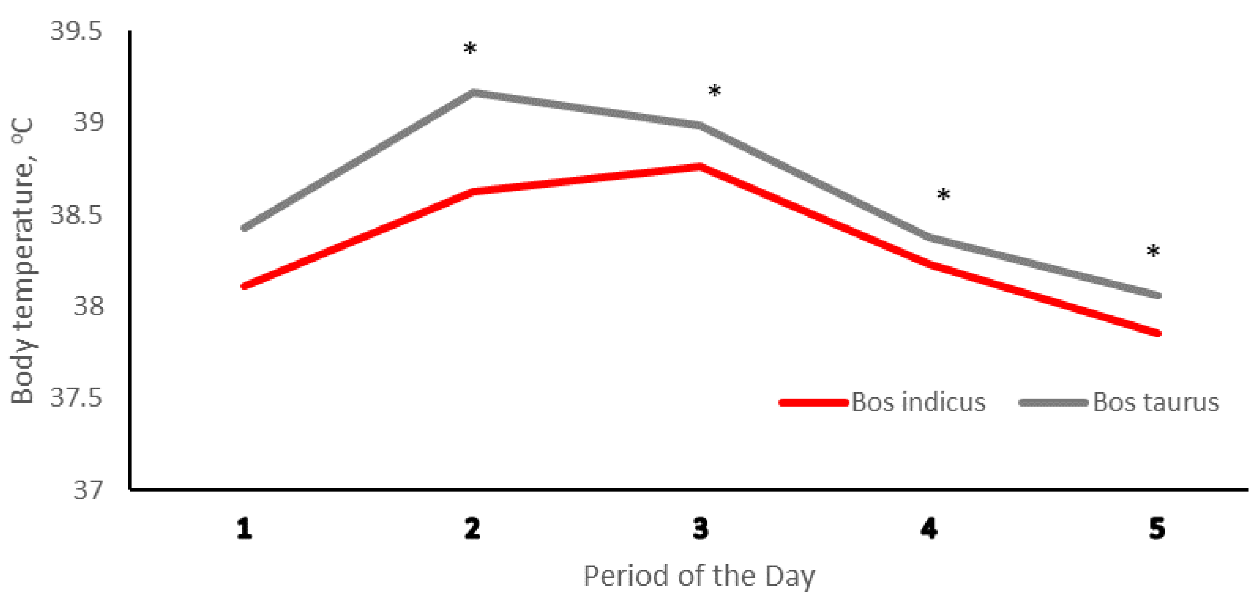


Rumen Temperature (Drinking & Heat Wave)

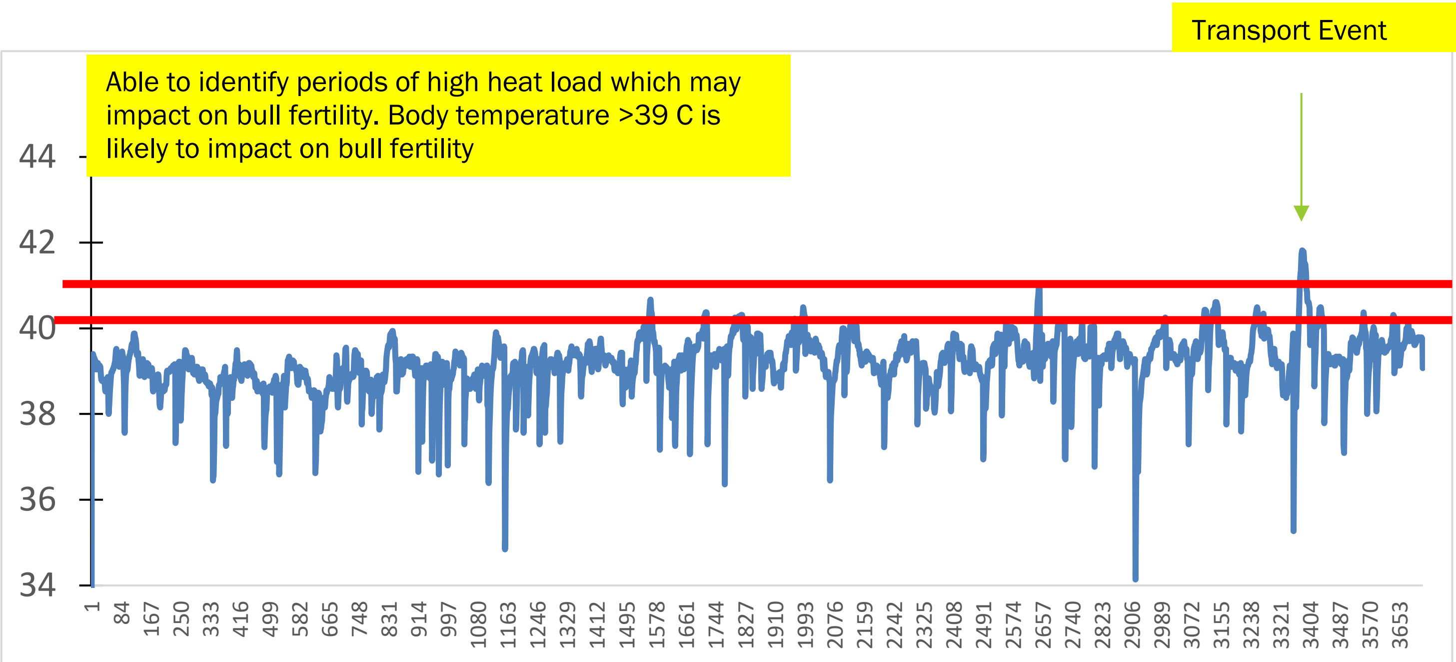


Breed Type

The mean body temperature (BT; °C) for un-shaded *Bos indicus* and *Bos taurus* steers over 5 periods (period 1 = 0600 to 1000 h; period 2 = 1100 to 1500 h; period 3 = 1600 to 2000 h; period 4 = 2100 to 0100 h and period 5 = 0200 h to 0500 h). BT was collected over 40 days.
Allows us to determine breed x environment effects



Rumen Temperature – Bull



Rumen Temperature Measurement

- Collect rumen temperature at regular intervals, e.g., every 10 min
- Can use the temperature data to determine drinking events
- Rumen temperature data can be obtained 24 h d, 7 days/wk for at least 2 years
- These data will be incorporated with climate data, feed data, cow fertility and calf performance
- This will allow us to develop management and nutritional strategies to improve cow fertility and calf survival
- In the future data can also be obtained from bulls which may also help to improve herd fertility