JANUARY 2021

DairyBio DairyFeedbase

Dairy innovation news

First 100 Days

Feeding for production during early lactation

AGRICULTURE VICTORIA Dairy Australia GARDINER FOUNDATION

Welcome

The dairy industry is vital to regional Australia and our reputation for producing green and clean dairy products is world class. As a Dairy Australia Director, I am excited to be part of helping shape the innovative research and development programs that are driving productivity improvements in our industry that support farm profitability and help us to remain globally competitive.

Since joining the Dairy Australia board in 2017 I have made sure that the innovative research and development that the dairy services levy helps fund is focused on ensuring that our businesses are more profitable, resilient and innovative.

Dairy Australia's new strategic plan for FY20/25 has been developed to align with the key commitments of the Australian Dairy Plan and ensure we deliver on our vision of shaping a profitable and sustainable dairy industry. One of the seven priority areas of our new strategy is 'technology and data enabled farms', with accelerated genetic progress in feedbase and animal breeding a key focus. Another is 'thriving in a changing environment' where innovation and adaption is going to be so important.

As a director it is my responsibility to understand that each dairy region has its own unique challenges and opportunities and to ensure that every investment that Dairy Australia makes is able to capitalise on these. DairyFeedbase and DairyBio are major investments for Dairy Australia and these investments are vital to enable farmers to continue to successfully operate in a complex and ever-changing environment.

My husband Stephen and I have a herd of 475 Holsteins at Heywood in Victoria. There has been both good and tough times since we moved here in 2009 and a key for us is having a long-term focus. We have made innovative management practice changes and continue to use our risk management skills to ensure our business stays on track. A big part of this is making sure we know what innovation is available and what is under development.

While the research from DairyBio – as a bioscience initiative – has long lead times and is brought to farm through commercial partners like Barenbrug and DataGene I am excited about the continual transformational innovation that is being delivered for Australian dairy farmers through this pipeline. Being able to attract some of the world's best research talent and capitalising on the world class facilities at Agriculture Victoria Research's AgriBio in Melbourne and the Ellinbank and Hamilton research farms in Victoria means that DairyBio is an innovation magnet which unlocks investment and resources that would otherwise not be available to the Australian dairy industry.

DairyFeedbase – as the applied research initiative – is directly delivering new strategies and technologies for farmers: like the new First 100 Days 2020 Spring experiment results – which followed on from the 2019 experiments – offering easy to implement productivity and health enhancing tweaks to feeding during the fresh period are on **page 3**. The innovative ideas that are being researched for industry challenges like reducing emissions including adding ozone to trough water (**page 14**), being able to select for low emission cows and the improved Feed Efficiency ABV (**page 12**)

I also urge you to consider becoming involved as a partner farm in the two research initiatives that currently recruiting: Pasture Smarts which is about to deliver a game-changing pasture utilisation tool that is easy to use and become even more important with the changing climate (**page 20**); and Cool Cows which is looking to assess heat event effects in all regions and production systems and test strategies for mitigating that production loss and health issues that come with high temperatures and humidity (**page 17**).

I hope you enjoy reading about the exciting innovation being delivered through these investments and make time to join the 'Ask the Researcher' virtual forums to interact with the researchers directly.

Tania Luckin
Heywood dairy farmer and Dairy Australia Board Director

DairyBio DairyFeedbase

Ask the Researcher virtual forums

The Ask the Researcher **forums are an interactive monthly event where farmers and service providers come together with the scientists that are leading the transformational research at DairyBio and DairyFeedbase to ask questions and hear about on-farm applications and the future direction of the programs. Join us on Zoom for the hour-long sessions.**


Peter Gaffy

First 100 Days

Feeding for production during early lactation

12:30pm AEDT
17 February 2021

With WestVic Dairy's REO Peter Gaffy and Agriculture Victoria senior research scientist Dr Rodrigo Albornoz

For details on the project turn to **page 3**

Register here


Liz Mann

FFVI and FVI

The update tools for selecting pastures

12:30pm AEDT
10 March 2021

DairyTas's REO Liz Mann, Dairy Australia's Feedbase lead Ruairi McDonnell and Agriculture Victoria research fellow Professor Kevin Smith

For details on the project turn to **page 6**

Register here

First 100 Days Feeding for production during early lactation

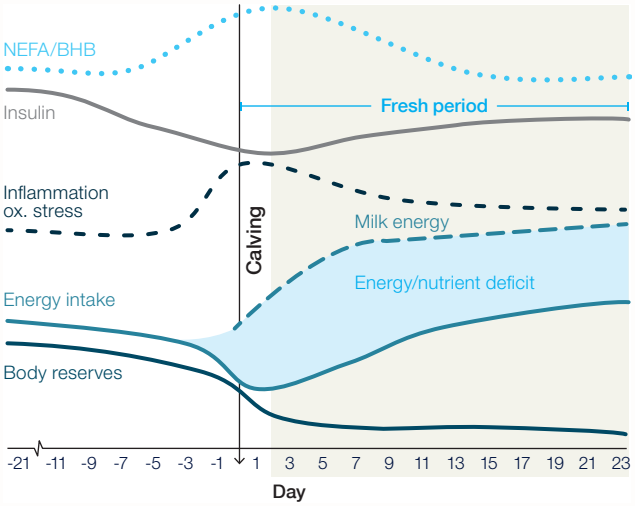
A spring 2020 experiment has reinforced the importance of the type of cereal grain fed to cows when consuming high-quality forage in early lactation. The most important factor in boosting milk production and reducing health impacts during the fresh period is to minimise the negative energy and nutrient balance that cows experience during this period. This can be achieved by promoting feed intake during the fresh period.

Agriculture Victoria research scientist Dr Rodrigo Albornoz has been studying the effects of different energy sources and forage quality on modulating feed intake in cows during early lactation for the DairyFeedbase First 100 Days project alongside project leader Agriculture Victoria senior research scientist Dr Bill Wales and Agriculture Victoria research scientist Dr Vicky Russo.

"During the transition period we know that cows experience a suppressed feed intake paired with increased insulin resistance and lipolysis, increased challenges for the immune system and increased nutrient demand (mainly glucose)," said Dr Albornoz, "poor health outcomes from a poorly managed fresh period can have short- and long-term effects like increased health treatment costs, production loss for the first 20 weeks in milk, decreased reproductive performance, and increased carryover/culling rates."

Research suggests that rapid increases in feed intake from calving to 23 days in milk (DIM) drives improved milk production that then carries over beyond the fresh period. In spring 2020 the team ran an experiment that contrasted feeding maize grain, maize grain with ruminally protected supplemental fat (with ~30% oleic acid) and wheat grain concentrate mixes for cows consuming a low-fibre legume hay with the aim of achieving 20kg dry matter intake (DMI) per cow by 23 post parturition. Preliminary results show a substantial increase in intake (+8kg dry matter [DM]) for all treatments from calving to 23 days-in-milk compared with the spring 2019 Fresh cow experiment (+2kg DM) when cows consumed a high-fibre forage (pasture silage).

This 2020 experiment at Agriculture Victoria's Ellinbank research farm fed concentrate mixes at each milking containing base cereal grains with contrasting ruminal starch fermentabilities. Separate groups received wheat grain (high ruminal fermentability) and maize grain (moderate ruminal fermentability) at a rate of 6kg DM per day from calving to 7 DIM and then 8kg DM per day from 8 to 23 DIM. A third group received the maize base mix at the same rates plus 350 g per cow per day of a fat supplement. Additionally, all cows had free access to a low fibre lucerne hay. At the start of the carryover period (24–72 DIM) all cows were transitioned to a common diet of grazed pasture and a wheat and barley grain mix.



Transition period (courtesy of Dr. Rodrigo Albornoz) NEFA/BHB: non-esterified fatty acids (NEFA) and beta-hydroxybutyric acid (BHB). Serum NEFA is a direct indication of energy balance with NEFA concentrations increasing as negative energy balance becomes more severe. Serum BHB concentrations are indicators of the metabolic response cows are making to negative energy balance.

In this experiment cows consuming maize grain, with or without fat, increased intake by ~2kg DM/cow per day, reaching 24kg DMI by 23 DIM, and milk production by ~2kg/cow per day compared with the wheat grain treatment that reached 22kg DMI by 23 DIM. Differences in milk production between treatments carried over despite all cows receiving the same diet during the carryover period (pasture and grain mix). Metabolic and physical signals control feed intake in dairy cows, with metabolic signals predominant in the fresh period, and they can interact with the type of starch offered. When we feed more fermentable starch sources to fresh cows, like wheat grain, signals that inhibit DMI take place faster than when cows are fed starch sources of moderate fermentability (e.g. maize), causing a decrease in daily feed intake.

In research with total mixed ration systems (TMR), the addition of fat with ~30% oleic acid (a long chained mono unsaturated fat), has been shown to stimulate DMI, however, in this experiment DMI from cows fed maize and fat with a similar percentage of oleic acid did not differ from those fed the only the maize mix. Dr Albornoz believes that this may be due to TMR cows having a consistent fat consumption throughout the day versus a pasture-based system where the mix containing fat is only fed at each milking and therefore the digestion and absorption of nutrients may not be in synchrony with the animal's nutrient demand throughout the day.

In Dr Russo's spring 2019 experiment contrasting maize versus wheat for cows grazing early-spring low fibre pasture during the first 21 DIM there was very little milk production difference between treatments during the fresh period. However, for the following 100 days when cows continued grazing and receiving different grain treatments, cows that had received maize grain during the fresh period produced more milk and an extra 30¢ per cow per day difference compared with cows that had received wheat. The extra income from cows that received maize during the fresh period not only paid off the extra cost of feeding maize for the first 21 DIM ($6 per cow) compared with feeding wheat, but also increased profit by $24 per cow during the subsequent 100 days.

In Dr Albornoz's 2019 spring experiment when maize or wheat concentrates were fed to cows receiving a high-fibre pasture silage there was no feed intake or production differences recorded. This is believed to be the result of the higher fibre concentration of the forage. In the 2019 experiments the cows received pasture silage which had 55% neutral detergent fibre (NDF), in comparison with early spring grazing on perennial ryegrass pasture at Ellinbank with approximately 42% NDF and the 2020 experiment fed lucerne hay with 36% NDF.

"Neutral detergent fibre is a measure of hemicellulose, cellulose, and lignin in the cell wall of the forage. Hemicellulose and cellulose can be digested by the rumen bugs, but that process is slower than the digestion of sugar and starches. Lignin is not a carbohydrate and is essentially an indigestible compound. Lignin in the cell wall of plants reduces the digestibility of cellulose and hemicellulose by rumen microbes and it can limit feed intake via rumen fill (physical signal)" said Dr Albornoz, "the NDF concentration in forages is very important and can interact with the type of starch source that we are feeding. If our goal is to maximise feed intake in fresh cows in order to minimise the negative energy balance and promote positive effects on production, we should feed those cows low NDF forages and starch sources of moderate fermentability such as maize grain. If we are dealing with a high fibre forage, then the starch source does not seem to be as important given that feed intake will likely be limited by the lower digestibility of the forage rather than metabolic signals associated with the type of starch offered."

Additional information

Albornoz, R.I. and Allen, M.S. (2018) Highly fermentable starch at different diet starch concentrations decreases feed intake and milk yield of cows in the early postpartum period. Albornoz, R.I. and M.S. Allen. 2018. *Journal of Dairy Science*, Vol.101(10) pp.8902–8915, doi.org/10.3168/jds.2018-14843

Simple feed changes can generate $52,000 (May 2020) dairyfeedbase.com.au/2020/04/29/simple-feed-changes-can-generate-52000/

Ask the researcher

Join WestVic extension officer Peter Gaffy and Dr Rodrigo Albornoz to hear more and 'Ask the Researcher' about the feeding strategies for early lactation at the First 100 Days virtual forum at 12:30pm AEDT on 17 February 2021

Register here for the zoom link

Researcher profile Dr Rodrigo Albornoz

Senior research scientist, Agriculture Victoria

1. How did you end up here?

   I grew up in a big city (Buenos Aires), but my passion for ruminants sparked during my undergraduate degree in Agricultural Engineering after learning about the complex and dynamic relationship between microbes and ruminants that co-evolved over millenniums. I joined Agriculture Victoria in late 2018, after a decade of postgraduate studies and industry positions in the ruminant nutrition field across Argentina, Canada and the USA. I have always been very grateful for the work that farmers do to feed us every day and being able to contribute to their work from a research position is a great honour for me.

2. What drew you to dairy research?

   The challenge of it. The many 'moving parts' associated with the environment, management, nutrition and biology of the cow throughout the lactation creates very complex interactions with many research questions yet to be answered. And for a nerd like me, that's very exciting.

3. What makes you get up in the morning?

   The many things left to learn and experience in life, besides the smell of freshly brewed coffee.

4. PhD title: where you did it and when?

   I completed my PhD in Dairy Nutrition at Michigan State University in 2018, under the supervision of Dr Mike Allen with the support from a Fulbright Scholarship. My PhD was titled "Diet starch concentration and starch fermentability affect energy intake and production of dairy cows during the early postpartum period."

5. What projects are you working on?

   I am working with the team at Ellinbank on the First 100 Days project, which is part of Dairy Feedbase, researching nutritional interventions during early lactation that will improve the balance between nutrient supply and demand by the cow and ultimately efficiency and profitability of dairy farms.

6. What question or challenge were you setting out to address when you started this work?

   To support a sustainable, efficient and profitable dairy industry through delivering new and improved genetic and herd improvement tools.

   My focus within the team is nutrition of the cow during the fresh period, a highly stressful time for the cow, when her energy and nutrient demands are not met due to cows experiencing a suppressed feed intake, which can have negative implications on cow health and performance.

7. Why is your research important? What are the possible real-world applications?

   Our research will provide dairy farmers and nutritionists with guidelines on feeds and feeding strategies that can maximize feed intake in fresh cows and promote better health, reproductive and productive outcomes.

FFVI and FVI

Australian dairy farmers invest over $100 million per annum renovating their pastures, with ryegrass-based pastures by far the most common homegrown source of feed. With both short-term (annual and Italian) as well as perennial ryegrass species all widely used, and many different cultivars available on the market within each species, it can be a real challenge for farmers to choose the most suitable variety for their farm.

A quick and easy way to assess the yield and relative economic performance of the different cultivars within a species such as perennial ryegrass, is to use the Dairy Australia Forage Value Index (FVI). Yield data from the different cultivars is measured in independent pasture trials from around the country and analysed collectively to find differences in yield between cultivars throughout the growing season. Economic values for five different times of the year (to reflect the variation in value of homegrown feed to a dairy farm at different times of the year) are then added to the 'performance values' from the trials to create an FVI. Currently there is an FVI for perennial ryegrass, initially released in 2017, that is updated each year with additional trial data as it becomes available. There will also be a new Annual and Italian FVI released in 2021 for the first time. The FVI tables for perennial ryegrass were updated in January 2021 by DataGene using trial data from the Pasture Trial Network (PTN). The PTN are an important collaborative partner in the FVI project and provide an accurate, reliable, and independent assessment of the potential value of cultivars in different dairy regions in south-east Australia.

"Although perennial ryegrass-based systems account for the majority the milk produced in Australia, we are also looking to release new forage value indexes for annual and Italian ryegrass species respectively in 2021," said Dairy Australia's Feedbase and nutrition technical lead Ruairi McDonnell "These will initially be based on performance values only, with economic values for Annuals and Italians added for all regions of Australia later in 2021."

DataGene have recently assumed responsibility for the routine addition and updating of new trial data into the FVI on an annual basis. The tables for each cultivar are designed using a colour coding system, with the green colour representing the best performing cultivars in each region. The perennial ryegrass FVI ranks cultivars according to their colour coding and user-nominated attributes, such as seasonal production, ploidy, heading date and endophyte status. Only cultivars listed in the Pasture Seed Database and certified as a true cultivar by the Australian Seed Federation are used in the FVI.

Future Forage Value Index

The DairyFeedbase Future Forage Value Index (FFVI) project is aiming to develop a 'next generation' Forage Value Index (FVI) for the Australian dairy industry that delivers at least 20% more value from purchase of proven cultivars. Value will be created through provision of additional traits such as persistence and nutritive characteristics, enhanced measurement technologies based on new advances in the automated measurement of pasture DM yield and nutritive characteristics, and the deployment of genomic tools in the prediction of cultivar performance across a broader range of species and environments. Ultimately, at a practical level, the benefits of the FFVI project will be that the existing FVI will be further developed and refined much more easily and rapidly through access to a much larger pool of data, including yield, nutritive characteristics and persistence data, via the new technologies being developed. This will allow the FVI for each species to become much more accurate and relevant for farmers and accelerate the adoption of superior pasture genetics into the industry.

It is planned to use the technologies developed by Future FVI to create new indexes for non-ryegrass species that are also relevant to Australian dairy farmers.

The future forages climate modelling conducted for dairy regions indicates how our current feedbase system will need to adapt to future changes in temperature and rainfall patterns

"The future forages climate modelling conducted by Agriculture Victoria for dairy regions indicates how our current feedbase system will need to adapt to future changes in temperature and rainfall patterns," said Agriculture Victoria's senior research fellow and Melbourne University Professor Kevin Smith. "There are species available that can adapt to the predicted hotter and drier conditions though they have inherent challenges for use as a dairy pasture. Enhanced measurement and reporting of key characteristics will be important to allow Australian farmers to select the best cultivars for their region within each species."

The development of a FVI that incorporates nutritive characteristics and persistence is enabled by the economic frameworks developed by this project in 2019/20. The updated FVI framework will incorporate new plant and endophyte technologies and be suited to new breeding technologies such as F1 hybrids.

The project will continue to develop and validate sensor-based technologies for species other than perennial ryegrass as there is increasing emphasis on these species and the ability for sensor-based assessment of DM yield, nutritive characteristics and persistence with new technologies is currently unknown. During 2020/21 image-based protocols will be further enhanced to quantify the persistence of perennial ryegrass in pasture cultivar plots.

South West Victoria: Forage Value Index 2021

Cultivar	FVI SW Vic	Autumn	Winter	Early spring	Late spring	Summer	Endophyte	Ploidy	Heading date	Marketer	No. of trials
Base AR37	237	116	120	99	97	120	AR37	Tetraploid	Late	PGG Wrightson Seeds	16
Bealey NEA2	206	114	116	99	96	120	NEA2	Tetraploid	Very Late	Barenbrug Australia	13
Halo AR37	195	114	117	98	94	121	AR37	Tetraploid	Late	Agricom	16
Shogun NEA2*	188	109	113	102	96	120	NEA2	Tetraploid	Late	Barenbrug Australia	8
Impact2 NEA2	174	110	113	101	97	116	NEA2	Diploid	Late	Barenbrug Australia	16
Kidman AR1	174	111	113	101	97	116	AR1	Diploid	Early	Barenbrug Australia	8
Reward Endo5	171	113	114	96	96	118	Endo5	Tetraploid	Very late	PGG Wrightson Seeds	9
SF Hustle AR1	171	111	114	99	97	116	AR1	Diploid	Mid	Seedforce	8
Viscount NEA	162	110	112	100	97	115	NEA	Tetraploid	Late	Barenbrug Australia	4
One50 SE	160	110	113	99	96	117	SE	Diploid	Late	Agricom	4
BanquetII Endo5	159	111	113	97	96	117	Endo5	Tetraploid	Late	PGG Wrightson Seeds	9
Fitzroy SE	150	109	112	103	96	114	SE	Diploid	Early	PGG Wrightson Seeds	4
Expo AR37	146	109	113	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	9
Matrix	145	110	112	98	95	116	Standard	Diploid	Late	Cropmark	9
One50 AR1	143	109	112	98	94	117	AR1	Diploid	Late	Agricom	11
Excess AR37	142	112	113	96	95	115	AR37	Diploid	Mid	PGG Wrightson Seeds	10
Jackal AR1	141	110	111	99	97	114	AR1	Diploid	Mid	AGF seeds	8
Prospect AR37	141	109	113	99	95	115	AR37	Diploid	Late	Agricom	11
One50 AR37	140	110	113	98	94	116	AR37	Diploid	Late	Agricom	12
Ansa AR1	137	108	110	99	96	115	AR1	Diploid	Mid-Late	Pasture Genetics	9
Ansa Happe	137	109	111	98	97	115	Happe	Diploid	Mid-Late	Pasture Genetics	7
24Seven Happe	136	110	112	98	96	115	Happe	Diploid	Late	Pasture Genetics	3
Arrow AR1	135	107	109	100	98	115	AR1	Diploid	Mid	Barenbrug Australia	9
Platform AR37	135	109	111	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	4
Platinum	130	110	113	97	96	113	Low	Diploid	Late	Valley Seeds	7
AusVic	127	108	109	98	97	114	Low	Diploid	Mid	Vic Seeds	4
Revolution AR1	118	107	111	97	95	115	AR1	Diploid	Late	Seedforce	4
Jeta AR1*	117	107	106	99	98	115	AR1	Tetraploid	Mid	Pasture Genetics	8
Endure WT	98	107	108	98	96	113	SE	Tetraploid	Mid	Vic Seeds	5
Helix AR1	81	104	108	98	95	112	AR1	Diploid	Mid	Cropmark	4
Avalon AR1	78	104	107	96	99	110	AR1	Diploid	Mid	Vic Seeds	12
Victorian SE	0	100	100	100	100	100	SE	Diploid	Early	Various	15

* Hybrid cultivar containing perennial and Italian ryegrass parentage, and as such, may not persist as long as pure perennial cultivars

Gippsland: Forage Value Index 2021

Cultivar	FVI Gipps	Autumn	Winter	Early spring	Late spring	Summer	Endophyte	Ploidy	Heading date	Marketer	No. of trials
Base AR37	313	116	120	99	97	120	AR37	Tetraploid	Late	PGG Wrightson Seeds	16
Bealey NEA2	270	114	116	99	96	120	NEA2	Tetraploid	Very Late	Barenbrug Australia	13
Halo AR37	257	114	117	98	94	121	AR37	Tetraploid	Late	Agricom	16
Shogun NEA2*	250	109	113	102	96	120	NEA2	Tetraploid	Late	Barenbrug Australia	8
Kidman AR1	234	111	113	101	97	116	AR1	Diploid	Early	Barenbrug Australia	8
Impact2 NEA2	231	110	113	101	97	116	NEA2	Diploid	Late	Barenbrug Australia	16
SF Hustle AR1	226	111	114	99	97	116	AR1	Diploid	Mid	Seedforce	8
Reward Endo5	215	113	114	96	96	118	Endo5	Tetraploid	Very late	PGG Wrightson Seeds	9
Viscount NEA	214	110	112	100	97	115	NEA	Tetraploid	Late	Barenbrug Australia	4
One50 SE	211	110	113	99	96	117	SE	Diploid	Late	Agricom	4
Fitzroy SE	210	109	112	103	96	114	SE	Diploid	Early	PGG Wrightson Seeds	4
BanquetII Endo5	203	111	113	97	96	117	Endo5	Tetraploid	Late	PGG Wrightson Seeds	9
Expo AR37	192	109	113	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	9
Prospect AR37	190	109	113	99	95	115	AR37	Diploid	Late	Agricom	11
One50 AR1	189	109	112	98	94	117	AR1	Diploid	Late	Agricom	11
One50 AR37	189	110	113	98	94	116	AR37	Diploid	Late	Agricom	12
Matrix	188	110	112	98	95	116	Standard	Diploid	Late	Cropmark	9
Jackal AR1	186	110	111	99	97	114	AR1	Diploid	Mid	AGF seeds	8
Excess AR37	183	112	113	96	95	115	AR37	Diploid	Mid	PGG Wrightson Seeds	10
24Seven Happe	177	110	112	98	96	115	Happe	Diploid	Late	Pasture Genetics	3
Ansa AR1	176	108	110	99	96	115	AR1	Diploid	Mid-Late	Pasture Genetics	9
Ansa Happe	175	109	111	98	97	115	Happe	Diploid	Mid-Late	Pasture Genetics	7
Arrow AR1	175	107	109	100	98	115	AR1	Diploid	Mid	Barenbrug Australia	9
Platform AR37	173	109	111	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	4
Platinum	169	110	113	97	96	113	Low	Diploid	Late	Valley Seeds	7
AusVic	162	108	109	98	97	114	Low	Diploid	Mid	Vic Seeds	4
Revolution AR1	153	107	111	97	95	115	AR1	Diploid	Late	Seedforce	4
Jeta AR1*	145	107	106	99	98	115	AR1	Tetraploid	Mid	Pasture Genetics	8
Endure WT	125	107	108	98	96	113	SE	Tetraploid	Mid	Vic Seeds	5
Helix AR1	105	104	108	98	95	112	AR1	Diploid	Mid	Cropmark	4
Avalon AR1	91	104	107	96	99	110	AR1	Diploid	Mid	Vic Seeds	12
Victorian SE	0	100	100	100	100	100	SE	Diploid	Early	Various	15

* Hybrid cultivar containing perennial and Italian ryegrass parentage, and as such, may not persist as long as pure perennial cultivars

Northern Victoria: Forage Value Index 2021

Cultivar	FVI Nth Vic	Autumn	Winter	Early spring	Late spring	Summer	Endophyte	Ploidy	Heading date	Marketer	No. of trials
Base AR37	220	116	120	99	97	120	AR37	Tetraploid	Late	PGG Wrightson Seeds	16
Bealey NEA2	183	114	116	99	96	120	NEA2	Tetraploid	Very Late	Barenbrug Australia	13
Shogun NEA2*	172	109	113	102	96	120	NEA2	Tetraploid	Late	Barenbrug Australia	8
Kidman AR1	162	111	113	101	97	116	AR1	Diploid	Early	Barenbrug Australia	8
Impact2 NEA2	162	110	113	101	97	116	NEA2	Diploid	Late	Barenbrug Australia	16
Halo AR37	160	114	117	98	94	121	AR37	Tetraploid	Late	Agricom	16
SF Hustle AR1	154	111	114	99	97	116	AR1	Diploid	Mid	Seedforce	8
Viscount NEA	148	110	112	100	97	115	NEA	Tetraploid	Late	Barenbrug Australia	4
Fitzroy SE	144	109	112	103	96	114	SE	Diploid	Early	PGG Wrightson Seeds	4
Reward Endo5	138	113	114	96	96	118	Endo5	Tetraploid	Very late	PGG Wrightson Seeds	9
One50 SE	136	110	113	99	96	117	SE	Diploid	Late	Agricom	4
BanquetII Endo5	129	111	113	97	96	117	Endo5	Tetraploid	Late	PGG Wrightson Seeds	9
Expo AR37	124	109	113	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	9
Jackal AR1	123	110	111	99	97	114	AR1	Diploid	Mid	AGF seeds	8
Arrow AR1	120	107	109	100	98	115	AR1	Diploid	Mid	Barenbrug Australia	9
Prospect AR37	118	109	113	99	95	115	AR37	Diploid	Late	Agricom	11
Matrix	116	110	112	98	95	116	Standard	Diploid	Late	Cropmark	9
Ansa AR1	114	108	110	99	96	115	AR1	Diploid	Mid-Late	Pasture Genetics	9
Ansa Happe	113	109	111	98	97	115	Happe	Diploid	Mid-Late	Pasture Genetics	7
One50 AR1	113	109	112	98	94	117	AR1	Diploid	Late	Agricom	11
24Seven Happe	110	110	112	98	96	115	Happe	Diploid	Late	Pasture Genetics	3
Platform AR37	110	109	111	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	4
One50 AR37	109	110	113	98	94	116	AR37	Diploid	Late	Agricom	12
Excess AR37	109	112	113	96	95	115	AR37	Diploid	Mid	PGG Wrightson Seeds	10
AusVic	103	108	109	98	97	114	Low	Diploid	Mid	Vic Seeds	4
Platinum	103	110	113	97	96	113	Low	Diploid	Late	Valley Seeds	7
Jeta AR1*	96	107	106	99	98	115	AR1	Tetraploid	Mid	Pasture Genetics	8
Revolution AR1	88	107	111	97	95	115	AR1	Diploid	Late	Seedforce	4
Endure WT	70	107	108	98	96	113	SE	Tetraploid	Mid	Vic Seeds	5
Avalon AR1	55	104	107	96	99	110	AR1	Diploid	Mid	Vic Seeds	12
Helix AR1	52	104	108	98	95	112	AR1	Diploid	Mid	Cropmark	4
Victorian SE	0	100	100	100	100	100	SE	Diploid	Early	Various	15

* Hybrid cultivar containing perennial and Italian ryegrass parentage, and as such, may not persist as long as pure perennial cultivars

Tasmania: Forage Value Index 2021

Cultivar	FVI Tas	Autumn	Winter	Early spring	Late spring	Summer	Endophyte	Ploidy	Heading date	Marketer	No. of trials
Base AR37	186	116	120	99	97	120	AR37	Tetraploid	Late	PGG Wrightson Seeds	16
Bealey NEA2	159	114	116	99	96	120	NEA2	Tetraploid	Very Late	Barenbrug Australia	13
Halo AR37	152	114	117	98	94	121	AR37	Tetraploid	Late	Agricom	16
Shogun NEA2*	143	109	113	102	96	120	NEA2	Tetraploid	Late	Barenbrug Australia	8
Kidman AR1	141	111	113	101	97	116	AR1	Diploid	Early	Barenbrug Australia	8
Impact2 NEA2	135	110	113	101	97	116	NEA2	Diploid	Late	Barenbrug Australia	16
SF Hustle AR1	133	111	114	99	97	116	AR1	Diploid	Mid	Seedforce	8
Fitzroy SE	130	109	112	103	96	114	SE	Diploid	Early	PGG Wrightson Seeds	4
Viscount NEA	125	110	112	100	97	115	NEA	Tetraploid	Late	Barenbrug Australia	4
One50 SE	123	110	113	99	96	117	SE	Diploid	Late	Agricom	4
Reward Endo5	122	113	114	96	96	118	Endo5	Tetraploid	Very late	PGG Wrightson Seeds	9
BanquetII Endo5	115	111	113	97	96	117	Endo5	Tetraploid	Late	PGG Wrightson Seeds	9
One50 AR37	113	110	113	98	94	116	AR37	Diploid	Late	Agricom	12
Prospect AR37	113	109	113	99	95	115	AR37	Diploid	Late	Agricom	11
Expo AR37	111	109	113	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	9
Jackal AR1	110	110	111	99	97	114	AR1	Diploid	Mid	AGF seeds	8
One50 AR1	109	109	112	98	94	117	AR1	Diploid	Late	Agricom	11
Matrix	108	110	112	98	95	116	Standard	Diploid	Late	Cropmark	9
Excess AR37	107	112	113	96	95	115	AR37	Diploid	Mid	PGG Wrightson Seeds	10
24Seven Happe	103	110	112	98	96	115	Happe	Diploid	Late	Pasture Genetics	3
Ansa AR1	100	108	110	99	96	115	AR1	Diploid	Mid-Late	Pasture Genetics	9
Ansa Happe	99	109	111	98	97	115	Happe	Diploid	Mid-Late	Pasture Genetics	7
Platform AR37	99	109	111	98	96	115	AR37	Diploid	Late	PGG Wrightson Seeds	4
Arrow AR1	98	107	109	100	98	115	AR1	Diploid	Mid	Barenbrug Australia	9
Platinum	98	110	113	97	96	113	Low	Diploid	Late	Valley Seeds	7
AusVic	92	108	109	98	97	114	Low	Diploid	Mid	Vic Seeds	4
Revolution AR1	86	107	111	97	95	115	AR1	Diploid	Late	Seedforce	4
Jeta AR1*	78	107	106	99	98	115	AR1	Tetraploid	Mid	Pasture Genetics	8
Endure WT	71	107	108	98	96	113	SE	Tetraploid	Mid	Vic Seeds	5
Helix AR1	57	104	108	98	95	112	AR1	Diploid	Mid	Cropmark	4
Avalon AR1	44	104	107	96	99	110	AR1	Diploid	Mid	Vic Seeds	12
Victorian SE	0	100	100	100	100	100	SE	Diploid	Early	Various	15

* Hybrid cultivar containing perennial and Italian ryegrass parentage, and as such, may not persist as long as pure perennial cultivars

Researcher profile Ruairi McDonnell

Technical lead – Feedbase and nutrition, Dairy Australia

1. How did you end up here?

   I often ask myself that! I came out to this side of the world from Ireland nearly 10 years ago, for a "few months". Worked on a dairy farm in New Zealand initially and then landed a job with the Department of Agriculture and Food in Western Australia as a dairy research scientist in 2013. From there I have had a couple of different roles, with Dairy Australia as an extension officer with GippsDairy, progressing to my current role as the technical lead for DA in Feedbase and nutrition.

2. What drew you to dairy research?

   It's such a diverse and challenging job being a successful dairy farmer. You have to master many different skills. I love the more applied type of dairy research (which I worked on in WA) that can be directly adopted by dairy farmers. The Forage Value Index is a good example of this actually.

3. What makes you get up in the morning?

   Repeat alarms on my phone!! From a work perspective, I love working on projects and tasks that make a difference directly to farmers profitability and sustainability. Having worked in research and in extension, its so important that good research finds it way to farmers and fully adopted.

4. PhD title (if applicable): where you did it and when?

   I have a master's degree in ruminant nutrition from University College Dublin, completed in 2008 and it was titled "The effect of divergent phenotypic selection for Residual feed intake on methane emissions from beef heifers."

5. What projects are you working on?

   I am involved in several interesting projects, for Dairy Australia.

   Forage Value Index – continuing the development of the FVI by expanding it to new traits such as persistence and quality, as well as new species such as Annual and Italian Ryegrass.

   C4 Milk – based in Queensland and aims to assist dairy farms in subtropical regions to increase their margin over feed costs (MOFC) through developing and implementing forage and nutrition management strategies using high-forage diets within their feeding systems.

   DairyHigh – a DA co-investment in Tasmania Institute of Agriculture where we are using a farmlet research approach to try and achieve 20 t DM/ha from irrigated pastures using 200kg N/ha and various pasture sward mixes ranging from a perennial ryegrass monoculture to a mixed species sward.

6. What question or challenge were you setting out to address when you started this work?

   The FVI allows farmers to pick the most profitable pasture genetics and the project actually quantifies the scale of the economic advantage of farmers using superior pasture genetics. Prior to the FVI, there was no real objective measure of how much more advantageous it was to use better pasture cultivars.

7. Why is your research important? What are the possible real-world applications?

   Farmers spend a lot of money on pasture renovations in Australia each year and the costs per hectare can quickly become very substantial. Choosing the most profitable cultivars with the best quality and persistence (traits we are working on adding to the FVI in the coming years) will ensure farmers are making the best decisions for their farm business in this area.

Ask the researcher

Join DairyTas extension officer Liz Mann, technical lead Ruairi McDonnell and Professor Kevin Smith to hear more and 'Ask the Researcher' about the future directions of the FVI and FFVI at the FVI and FFVI virtual forum at 12:30pm AEDT on 10 March 2021

Register here for the zoom link

Increasing the reliability of feed-saved ABV

The first national feed efficiency breeding value in the dairy world was the Feed Saved Australian breeding value (ABV) researched by DairyFutures CRC and released by DataGene into the Balanced Performance Index (BPI) in 2015.

When it was introduced it was the first practical use of genomics to assess a trait that is not observable on-farm and allowed farmers to breed cows in a new way: by reducing their maintenance requirements for the same amount of milk produced. This major innovation was achieved through using real feed intake data – which is expensive and difficult to measure and consequently generally only available from research projects.

In November 2020 DataGene implemented DairyBio research to update the Feed Saved ABV, this update has increased the reliability of the ABV from 33 to 43%. The increase in reliability was made possible through access to a larger dataset from DairyBio's participation in the Efficient Dairy Genome Project (EDGP). EDGP is an international database collaboration which contains information from eight research herds in Australia, Canada, Denmark, Switzerland, United Kingdom and United States.

What is reliability? An ABV is an estimate of an animal's true breeding value. Reliability is a measure of confidence in the ABVs. The higher the reliability, the closer an animal is to its true breeding value. The reliability figure determined for each ABV provides an indication of the amount of information that has been used in the ABV calculation. The higher the reliability, the more likely the ABV is to predict the animal's true breeding value.

"The updated breeding value for lifetime residual feed intake was calculated using 3,711 animals with a multivariate model. We used a multivariate model because we treat heifers, Australian cows and overseas cows as three different, but correlated traits" said Agriculture Victoria senior research scientist Dr Bolormaa Sunduimijid "This doubled the number of cows from the 2015 release which has enabled us to increase the reliability of the residual feed intake component from 11 to 20%. Residual feed intake is the difference between animal's actual and predicted feed intake (for maintenance and production requirements) and is a key component of the feed saved ABV."

Dr Sunduimijid led the research using the doubled the Holstein reference population and over 10,000 more SNPs (41,276) than 2015 as the table below displays.

Comparison of number of cows, origin and SNPs for 2015 and 2020

	2015	2020
Number of SNPs	28,621	41,276
Total cows	2,036	3,711
Cow origin		
Australian cows	235	584
Australian heifers	843	824
Overseas cows	958	2,440

"A SNP is a single nucleotide polymorphism, which is a variation at a single position in the genome. For example: the genomic data we use is made up of millions of letters and we are looking for differences in letter combinations, or SNPs, at the same position on the genome. We recode the genotype data as 0, 1 or 2 copies of the alleles (A, C, G or T) present at each SNP position for every animal. So, say we are counting Ts at a given position, then an animal with 2 Ts is coded 2 and if another has no Ts we code as 0 and repeat. Luckily this process is automated," said DairyBio animal program leader and Agriculture Victoria principal research scientist Professor Jennie Pryce. "The genomic prediction equation takes into account the size of the effect at each position on the genome and the coded SNP (0, 1 or 2) summed across the genome. Most SNPs have a small individual effect, which is why we use information across the whole genome."

The DairyBio researchers provided the final genomic prediction equation in mid-October and the updated version was programmed in by DataGene and ready to use by the November run.

Further information

DataGene's Feed Saved ABV technote: read it here or tinyurl.com/FSATNOTE

DataGene's Feed Saved ABV factsheet: read it here or tinyurl.com/FSAFSHEET

Pryce JE, Wales B, Haas Y, Veerkamp R & Hayes B, 2013, Genomic selection for feed efficiency in dairy cattle, *Animal: An international journal of animal bioscience*, Vol 8, pp.1–10 doi.org/10.1017/S1751731113001687

Berry DP, Coffey MP, Pryce JE, de Haas Y, Løvendahl P, Krattenmacher N, Crowley JJ, Wang Z, Spurlock D, Weigel K, Macdonald K and Veerkamp RF, 2014, International genetic evaluations for feed intake in dairy cattle through the collation of data from multiple sources, *Journal of Dairy Science*, Vol 97, Iss 6, doi.org/10.3168/jds.2013-7548

Gonzalez-Recio O, Pryce JE, Haile-Mariam M & Hayes BJ, 2014, Incorporating heifer feed efficiency in the Australian selection index using genomic selection, *Journal of Dairy Science*, Vol 97, pp.1–11, dx.doi.org/10.3168/jds.2013-7515

Pryce JE, Johnston J, Hayes BJ, Sahana G, Weigel KA, McParland S, Spurlock D, Krattenmacher N, Spelman RJ, Wall E & Calus MPL, 2014 Imputation of genotypes from low density (50,000 markers) to high density (700,000 markers) of cows from research herds in Europe, North America, and Australasia using 2 reference populations, *Journal of Dairy Science*, Vol 97, pp.1799–1811, dx.doi.org/10.3168/jds.2013-7368

Pryce JE, Gonzalez-Recio O, Nieuwhof G, Wales WJ, Coffey MP, Hayes BJ & Goddard ME, 2015, Definition and implementation of a breeding value for feed efficiency in dairy cows, *Journal of Dairy Science*, Vol 98, pp.7340–50 dx.doi.org/10.3168/jds.2015-9621

Pryce JE, Gonzalez-Recio O, Thornhill JB, Marett LC, Wales WJ, Coffey MP, de Haas Y, Veerkamp RF & Hayes BJ, 2014, Validation of genomic breeding value predictions for feed intake and feed efficiency traits, *Journal of Dairy Science*, Vol 97, pp.537-542, dx.doi.org/10.3168/jds.2013-7376

Researcher profile Dr Bolormaa Sunduimijid

Senior research scientist, Agriculture Victoria

1. How did you end up here? What drew you to dairy research?

   In high school I loved subjects that involved lots of numbers, equations and formulae (specialist maths, maths methods, and chemistry) and I used to spend my many school holidays in countryside close to farm animals (cows, horses, sheep, and goats) which I loved. After I finished high school, I went to Brno in Czech Republic to study molecular biology and genetics. My Master's program was heavily focused at molecular and population genetics areas. After I finished my undergraduate and master's degree at Masaryk University, I worked on a goat project at the Animal Institute of Mongolia as a junior researcher. In 2003, I had an opportunity to do my PhD at the University of New England in NSW. This was a turning point in my life. My PhD project was one of the Rural Industries Research and Development Corporation (RIRDC) projects for breeding fibre goats for resistance to worm infections and more focused on quantitative genetics (many equations and statistical analyses). By conducting this research work, we developed a DNA marker set for conducting parentage test, obtained genetic estimates for traits associated worm infection and resistance and fibre production traits, evaluated the use of irradiated larval vaccines for control of worm infection, and provided an evaluation of potential markers for worm infection or resistance and faecal egg counts in Australian Cashmere and Angora goats, which were not studied by the time. At this point, I realised that I have chosen the right career path.

2. What makes you get up in the morning?

   My daughter, family, work, and sunny days.

3. PhD title: where you did it and when?

   Comparative genetics studies of Cashmere and Angora goats, University of New England, NSW between 2003–2007.

4. How long have you been working in research?

   Since 1997. Goat projects (Mongolia, 1997–2003 and RIRDC PhD), 2003–2007), beef cattle projects (Beef CRC 3, 2007–2013), dairy cattle pilot project (2009–2010), sheep projects (Sheep CRC 2 & 3, 2012–2019), and dairy cattle projects (DairyFutures CRC, 2019–2020).

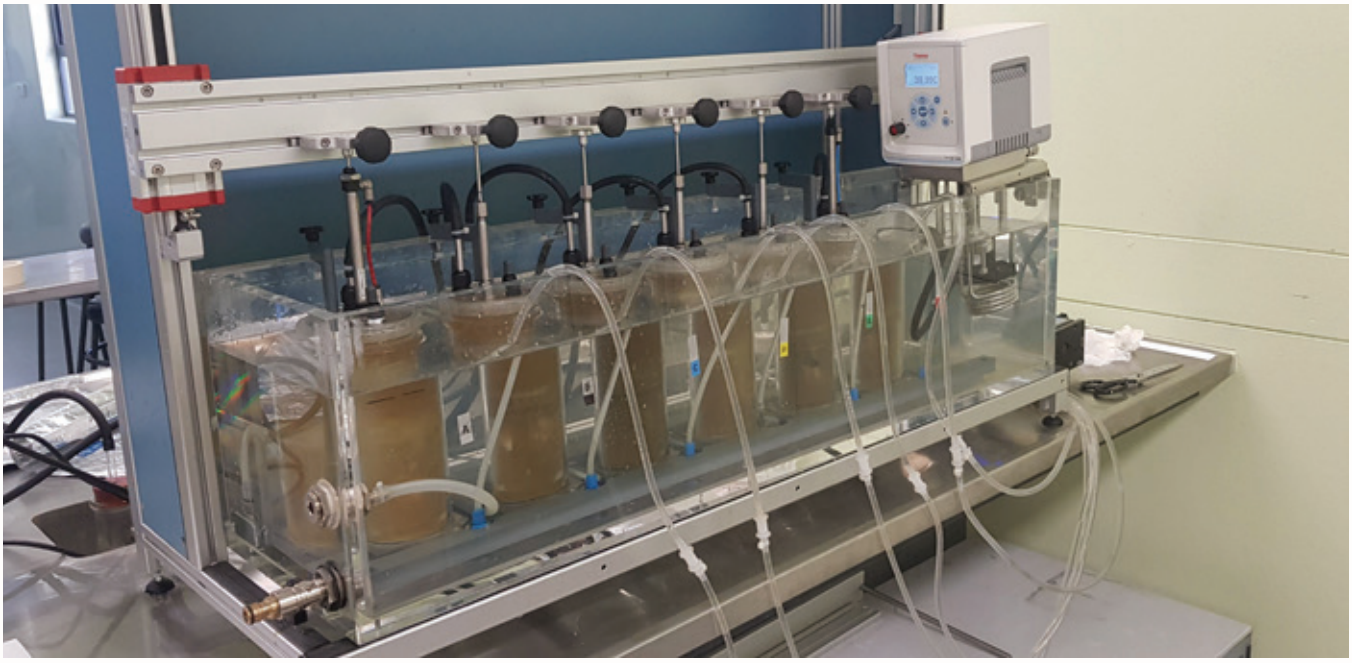
5. What projects are you working on?

   I have been working on the feed efficiency project. Feed costs make up a large proportion of the variable and total costs on a dairy farm. Therefore, selection for feed efficiency in dairy cattle is desirable. Feed Saved genomic breeding values (ABV), which includes the genetic component of lifetime residual feed intake combined with the maintenance requirements calculated from liveweight ABV, have been introduced for the first time by our group. The improving feed efficiency may result in decrease of emission of methane, which is a key precursor gas of the harmful air pollutants. I am now working on obtaining the methane emission ABVs for the industry.

6. What question or challenge were you setting out to address when you started this work?

   The Feed Saved ABV had been part of the BPI for five years and my research focused to update lifetime residual feed intake ABV and its reliability using 3,711 Australian and overseas Holsteins with multivariate model. The first challenge was to prepare and collate all phenotypes and genotypes in the different formats from different sources and the other challenge was to find the best fit model to obtain the accurate GEBVs for real life implementation by given number of animals with phenotypes and genotypes.

Adding ozone to decrease emissions



Rusitec system at University of Sydney

Between 2 to 12% of the energy consumed by cows is converted to methane (CH_4) in the rumen, and this represents a substantial potential loss in milk production. Alongside this the dairy industry is under increasing pressure to reduce enteric CH_4 from cows for a low carbon future.

The Australian dairy industry has substantially reduced CH4 emissions per litre of milk from 33.6g methane (CH_4)/kg milk in 1980 to 19.9g CH_4/kg milk in 2010 (Moate et al 2015). This 40% decline in emissions has been credited to increased milk production and feed efficiency per cow through breeding (like DairyBio's Feed Efficiency ABV) and improved feeding strategies. To achieve further CH_4 emission reductions Dr Peter Moate, a senior research scientist at Agriculture Victoria, said "We know there is no silver bullet to eliminate enteric CH_4, and there are going to have to be multiple avenues to achieve a cumulative reduction effect."

We found that ozone reduced the relative abundance of CH_4

Dietary additives and feed manipulation have proven to be effective short term strategies – the key for the dairy industry is to ensure that any strategy has no negative effect on milk production through reduced dry matter intake or digestibility and can provide a persistent reduction in enteric CH_4. Dr Moate, who specialises in dairy nutrition at Agriculture Victoria Ellinbank, had the original idea to study the effect on enteric CH_4 emissions by adding ozone to a cows diet.

Professor Alex Chaves led the research at the University of Sydney. This initial research was conducted with ruminal fluid incubated in vitro using a Rusitec system. The research found that ozone added to the in vitro incubation decreased CH_4 production by about 20% and CH_4 gas concentration by almost 6% without impacting dry matter digestion of maize silage or grain concentrates.

"We found that ozone reduced the relative abundance of CH_4, producing organisms without significant effects on production of volatile fatty acids or the pH of the incubation," said Professor Chaves.

While the study was conducted in vitro (in the lab), Dr Moate and Professor Chaves believe that the results from this initial study warrant further in vivo (within a living cow) research.

"Adding ozone to a water trough could be undertaken in a simple and inexpensive manner. It would just require a solar panel, an ozone generator and a pump. Besides reducing CH_4 emissions, ozonation of drinking water may have other benefits. Algae in drinking water can produce toxins and adding ozone can inactivate the toxins. It is also possible that ozone might inhibit the growth of algae *per se* in drinking water and this might reduce the need for labour to frequently clean algae out of water troughs", said Dr Moate "Ozonation has long been used to remove pathogens from drinking water and make it potable and it has been reported that substantial increases in productivity can result from providing stock with good quality drinking water."

Researcher profile Dr Peter Moate

Senior research scientist, Agriculture Victoria

1. How did you end up here?

   In the mid-1970s I was inspired by the research of Dr Norman Borlaug whose research with dwarf varieties of rice lead to the Green Revolution and saved millions of people from hunger. Inspired by Norman's achievements, I have always wanted to do something that will make a difference.

   I started work with (the then) Victorian Department of Agriculture in 1980. After just a few years with Agriculture Victoria Research, I became the first person in the world to wrap large round bales of hay in plastic using a machine wrapper – now wrapped silage is common across the globe. This marked the first of many world-leading achievements for me, I worked closely with medical researchers at the University of Pennsylvania to develop a now widely-used software to monitor glucose levels in diabetics; developed a model to analyse MRI images on breast tumours; and did statistical analysis of research data that led to the development of the commonly used pain relief drug, Targin. I returned to Agriculture Victoria Research in 2009.

2. What drew you to dairy research?

   I was drawn to dairy research because it provided me with the chance to work on a diverse range of interesting topics. In the 1980's I helped develop the anti-bloat capsule for dairy cows. In 1996, aware of the emerging problem of global warming, I was the first person in Australia to measure methane emissions from dairy cows. In 2016, our research formed the basis of the Australian Government's Greenhouse Gas accounting for the livestock industries. There are right to farm issues in the dairy industry and my career has been motivated by wanting to make lives easier for dairy farmers and to make the world a better place.

3. What makes you get up in the morning?

   I get up in the morning excited by the possibility that today may be the day that I gain a new insight or make a novel scientific discovery.

4. PhD title: where you did it and when?

   I completed a PhD in veterinary science at the University of Sydney in 2008. My PhD research thesis was: "Towards a model to predict the fatty acid composition of milk." My thesis involved a model to predict the absorption of individual long chain fatty acids in dairy cows. This model has been incorporated in all the major programs used to formulate optimal rations for dairy cows.

5. What projects are you working on?

   I am currently researching the impact of different feeds on the production of dairy cow methane emissions such as wheat, canola meal and grape marc and develops new ways to measure methane emissions emitted from dairy cows. I am also looking at how diet changes can make cows more resistant to heat stress which is part of the DairyFeedbase Cool Cows project.

6. What question or challenge were you setting out to address when you started this work?

   The common thread throughout my career has been working towards making a difference to people's lives through research. Methane emissions and climate change are wicked problems that need complex interlocking solutions.

7. Why is your research important? What are the possible real-world applications?

   My research benefits Australian and international dairy farmers who are facing market pressures to reduce their greenhouse gas emissions. However, as greenhouse gas emissions contribute to global warming, ultimately my research benefits our children and their children I am especially proud of my research because my grandchildren will be able to say that their grandfather tried to do something to reduce global warming.

   The nature of this research compliments my role as Licence Holder for animal ethics across the Agriculture Victoria Research Division, and in which my responsibility is to ensure all animal research is conducted in line with the Victorian Prevention of Cruelty to Animals Act 2019.
   In my spare time I enjoy reading, swimming and gardening.

Researcher profile Professor Alex Chaves

Animal nutrition, University of Sydney

1. How did you end up here?

   My interests in farming started when I was kid growing up in the third biggest city in Brazil. My father was a lawyer and my mum a University lecturer. I loved going to my uncle's farm every second weekend to milk cows, ride horses, pick fruit and fish – it was great to get away from the city.

   In 1989, I went the best agriculture university in Brazil, where I completed a 5-year degree in agronomy. After that I undertook further studies in farm management (1994) and silage (1995–1997) at Federal University of Viçosa (Viçosa-MG, Brazil).

   My academic curiosity then took me to New Zealand, where I did a PhD in animal science at Massey University, followed up by a post-doc in dairy nutrition at INRA in France.

   Then I went halfway around the world again – this time, to Canada, where I was a visiting scientist at the Agriculture and Agri-Food Canada in Alberta, working on ruminant nutrition. In 2008, I landed down under, and began lecturing in animal nutrition at the University of Sydney.

2. What drew you to dairy research?

   My passion for dairy was seeded when I was a kid during my uncle's farm visits during the weekends: I love dairy cows and their motherhood instinct.

   This passion grew during my undergraduate degree, where I gave dairy farmers advice on dairy cow nutrition strategies, grazing management, and decision making. After this, I supervised students who were assisting dairy farmers in Minas Gerais State, Brazil.

3. What makes you get up in the morning?

   I am a morning person and have always loved watching the sunrise – the start of a new day. I don't take life for granted, and I enjoy every single part of it: work, family and 'free' time between all of my other commitments.

4. PhD title: where you did it and when?

   "Digestion characteristics of forages, including perennial ryegrass at different stages of maturity, and supplementary feeding for dairy grazing pasture" Massey University (Palmerston North, New Zealand). Thesis submitted in September 2003 and PhD degree awarded in May 2004.

5. How long have you been working in dairy research?

   I have been working in dairy research for the last 25 years. It pretty much started in my masters degree in sorghum silages, in collaboration with Embrapa Dairy Research (CNPGL, Juiz de Fora, MG – Brazil).

6. What projects are you working on?

   My current research focuses on understanding how the diet of ruminants impacts their performance and health, sustainability of farm systems, and the emission of greenhouse gases.

   I am working on mitigation strategies for ruminal methane emissions, having pioneered in vitro and in vivo techniques.

   This is a long-term interest of mine: from 2013–16, I worked with EMBRAPA (Brazil's equivalent of the CSIRO) and the São João del-Rei to assess Brazil's compliance with the Kyoto Protocol.

   I have also collaborated with Prof Breves, director at the University of Veterinary Medicine in Hanover, Germany, on research in this area, as part of a Humboldt Fellowship for Experienced Researchers.

7. What question or challenge were you setting out to address when you started this work?

   How to support a sustainable livestock industry with insufficient funding.

8. Why is your research important? What are the possible real-world applications?

   Agriculture contributes 14% of total greenhouse gases (GHG) in Australia. 50% of these emissions (7% of the total emissions) are from livestock production. It is therefore essential that the agricultural sector mitigate its negative impact on the environment by lowering its GHG emissions.

9. What do you like to do when you aren't working on research?

   I love teaching my students animal nutrition and how to formulate animal diets. Outside of work, I love spending time with my daughters outdoors. I also enjoy cycling, swimming and international cuisines. French cheeses and German beers are always welcome, too.

Partner up to make your cows cool

The Feeding Cool Cows project is actively recruiting partner farmers from all over Australia to help assess the impact of hot weather on a range of production systems and environments.

The aim is to improve resilience of farms during hot weather through understanding the interaction between nutrition and genetics and developing nutritional strategies to reduce the negative impacts of hot weather on milk production.

There are three levels of collaboration available to partner farmers.

Level 1

This level of participation is open to any Australian dairy farm that has Holstein-Friesian cows, that meet selection criteria and can provide data such as individual cow daily milk yield. The research focus is: What are the daily milk yield responses to hot weather in cows of varied heat tolerance, fed a range of diets, and managed under different conditions?

Level 2

This level of participation is open to any Australian dairy farm that has Holstein-Friesian cows, meet the Level 1 criteria and have activity meters on their cows. The research focus is: What is the impact of hot weather on the behaviour and productivity of cows?

Level 3

This level of participation is only open to farms in northern Victoria that have Holstein-Friesian cows, meet the Level 1 and 2 criteria and are willing to allow the team access to their cows to measure body temperature during summer, plus keep a feed diary for the duration of the project. The research focus is: What are the daily milk yield responses to hot weather in cows of varied heat tolerance, fed a range of diets, and managed under different conditions? What are the nutrition by genetic or nutrition by infrastructure (shade, sprinklers, fans etc.) interactions during hot weather? What are the relative effects of nutrition, genotype (HT_gBV), and hot weather on body temperature?

If you are keen to be involved or have questions, contact Agriculture Victoria research scientist Dr Josie Garner via josie.garner@agriculture.vic.gov.au or 0448 308 930 or download the expression of interest form at dairyfeedbase.com.au

Researcher profile Dr Josie Garner

Research scientist, Agriculture Victoria

1. How did you end up here? What drew you to dairy research?

   I grew up on the far south coast of NSW in an area famous for its dairy industry. I had been exposed to the dairy industry from a young age and took a keen interest in dairy cattle. I worked on dairy farms throughout high school and reared my own dairy calves at home in the back yard, so I was pretty certain that when I finished school I wanted to work in the dairy industry somehow. It was not until university during my final honour's year of my Bachelor of Animal Science, that I realised I enjoyed research and that maybe I wanted to pursue a career as a scientist. Before I graduated, I successfully gained a position as a dairy research scientist with Agriculture Victoria Research, Ellinbank in 2012.

2. What makes you get up in the morning?

   I live on a dairy farm so sleep ins are somewhat of a luxury but I genuinely enjoy my job so that makes it easier to get out of bed.

3. PhD title: where you did it and when?

   In 2014 I began a PhD project with The University of Melbourne, titled "The gene expression and physiology of the heat stress response in dairy cattle" which I completed in 2017. During my PhD I lead an experiment which successfully validated the world first genomic breeding value for heat tolerance in dairy cattle which resulted in the trait being released to the dairy industry for farmers to improve the heat tolerance of their herds.

4. How long have you been working in dairy research?

   I have worked in dairy research at Ellinbank for 8 years. During this time, I have worked on a diverse range of research projects that have allowed me to learn many new skills and develop as a scientist.

5. What projects are you working on?

   I am currently a part of the Dairy Feedbase Feeding Cool Cows project. This project aims to develop summer feeding strategies to reduce the negative impacts of hot weather on milk production and animal welfare of dairy cows. The project so far has investigated a range of concentrates, additives and forages and measured the production and physiological responses to heat stress of dairy cows fed a range of diets.

6. What question or challenge were you setting out to address when you started this work?

   Heat stress causes considerable declines in milk production and is an animal welfare concern to the industry. What cows eat can affect how they respond to their environment so we set out to determine what would be an optimal diet for dairy cows during summer to improve their milk production and improve welfare outcomes by reducing core body temperature.

7. Why is your research important? What are the possible real-world applications?

   We aim to develop evidence-based guidelines for summer feeding that are cost effective and result in improved overall herd production during hot weather.

8. What do you like to do when you aren't working on research?

   When I am not at work, I love to spend time with my family and work on our dairy farm.

Researcher profile Anna Thomson

Research scientist, Agriculture Victoria

1. How did you end up here?

   When I was at school my favourite subjects were computing, biology and chemistry so I think I was always destined to be in science! It wasn't a straightforward road though, initially I thought I might become a vet but it wasn't for me. I went on to do my university degree in Agriculture after enjoying farm work. That was what eventually led me to agricultural research!

2. What drew you to dairy research?

   I worked on a lot of different farms as a teenager and during my university degree but dairy farming was the one that stuck. I love the dairy lifestyle even though you have to be ready to work all hours. During my degree I had to do a placement so I naturally chose a dairy research farm to work on and my science career carried on from there.

3. What makes you get up in the morning?

   Trying to discover something new. The best thing about working as a researcher is that you get to try and find out something no one knows the answer to yet. That's why I enjoy the statistics and data side of the job just as much as the practical work.

4. PhD title: where you did it and when?

   It's a long one! "Incorporating grass-clover and lucerne silages into UK dairy systems: forage agronomy, silage analysis accuracy and lucerne feeding strategy," University of Reading, UK (2017).

5. How long have you been working in dairy research?

   My first dairy research job was a technician role which I did around my university studies starting in 2012. So, 8 years. Since then my role has evolved from PhD student to Post-doctoral research assistant and finally to research scientist including a move from the UK to Australia.

6. What projects are you working on?

   I work at Agriculture Victoria Research (Ellinbank, Vic) in the Pasture Smarts project. Our objective is to evaluate non-destructive technologies for use in pasture monitoring. Enabling farmers to have access to accurate and near real-time data on how their pastures are growing all year round is our ultimate goal!

7. What question or challenge were you setting out to address when you started this work?

   Previous research told us that there is an unexploited gap between pasture utilisation and theoretical pasture potential on dairy farms. To maximise the return from pastures, farmers need to be equipped with better tools to aid in their management decision making when it comes to their milking platform. These tools need to be easy to use and less labour intensive than existing options e.g. rising plate meters.

8. Why is your research important? What are the possible real-world applications?

   Giving farmers the ability to know more about their pastures will have both production and environmental benefits. Forage is a cheap source of feed so making more from the same land area isn't just good business sense, it means potential savings in terms of fertilisers, agri-chemicals, and purchased feed as well by adopting a more 'precision' farming approach.

9. What do you like to do when you aren't working on research?

   I use sport to wind down after a day on the farm. My favourite is playing competitive badminton which I train for up to four days a week!

Pasture Smarts partner farm opportunity

Pasture Smarts project leader Dr Liz Morse-McNabb and team members Amy Copland and Dani Stayches

The Pasture Smarts project team is looking for Victorian dairy farmers to test their game changing pasture measurement technology and help design a pasture management system that works for you.

In return you will get your farm mapped and have access to a prototype mobile app and dashboard. The app and dashboard will show you daily pasture yield data per paddock and will provide you the option to enter other pasture activity information that happens on your farm.

The team, led by DairyFeedbase Pasture Smarts project leader and Agriculture Victoria senior research scientist Dr Liz Morse-McNabb, currently has seven partner farms who have been invaluable to ensure that the tools delivered provide the information that will be useful to them. The team are seeking to expand to 20 partner farms in coming months.

We not only want to get your opinions on how the app works but we need to make sure all the background models that support the app are accurate for your farm and location. This means that we will need to visit your farm at least once to collect pasture samples and use our sensors to measure pasture parameters. If you have a good record of grazing for the last few months that will also help us check that our models work well and can pick up grazing events.

If you want more information contact Liz at elizabeth.morse-mcnabb@agriculture.vic.gov.au or download the expression of interest form at dairyfeedbase.com.au

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