Leading Breeder 2019
Breeding for a future environment

Wednesday 20 – Thursday 21 March 2019
Dubbo Regional Theatre and Convention Centre, NSW
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Text it number
After every presenter there will be an opportunity to ask questions. Please text all questions to the 0418 155 556.
LEADING BREEDER 2019 CHAIRMAN

Richard Apps
Manager – Co-innovation & Objective Measurement, Meat and Livestock Australia

Biography

Richard Apps comes from a family farming business in northern NSW running beef breeding, backgrounding and finishing enterprises. He holds a Bachelor of Rural Science degree from the University of New England.

Richard commenced his career in the beef industry where he spent some 10 years as an Executive Officer for a range of beef cattle seedstock societies. Following this he moved to central Queensland working on development of genetic evaluation and technical breeding program advice for the northern Australian beef seedstock industry.

Richard commenced work with Meat & Livestock Australia in 2002 joining the LAMBPLAN team, from where he has progressed through roles managing the Sheep Genetics program, sheep and southern beef extension activities, the on-farm sheep R&D portfolio, the beef and sheep genetics R&D program; and currently focuses on objective measurement and industry co-innovation programs.
## Program

### Wednesday 20 March

#### Session 1

2:00 – 3:30pm  
**What does the future hold for the sheep industry and breeding programs?**

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<td>The MLA genetics landscape (30 min)</td>
<td>Dr Daniel Brown, Sheep Genetics Manager, MLA</td>
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<td>The challenges and the opportunities with sheep breeding (30 min)</td>
<td>Jamie Heinrich, Ella Matta White Suffolk and Poll Merino Stud</td>
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<td>The genetic project scene (30 min)</td>
<td>James Taylor and Emma McCrabb – Sheep Genetics Development Officers</td>
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<td>Short presentation followed by Q&amp;A panel with presenters:</td>
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<td>• Dr Troy Fischer, Superwhites Producer Innovation Fast Track Project</td>
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<td>• Peter Blackwood, Corriedale Eating Quality Genomics</td>
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<td>• Mark Mortimer, Merinolink DNA Stimulation Project</td>
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<td>• Professor Julius van der Werf, MLA Resource Flock</td>
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#### Session 2

3:55 – 5:15pm  
**Breeding within an integrated supply chain**

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<td>Connecting the customer to farmer (30 min)</td>
<td>Natalie Isaac, Global Manager – Industry Insights and Strategy, MLA</td>
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<td>Data capture and feedback – The Almtech Project (30 min)</td>
<td>Sarita Guy, Postdoctoral Research Fellow, AGBU</td>
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<td>Breeding for consumer outcomes (20 min)</td>
<td>Phil Clothier, Woolumbool Sheep Studs</td>
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**Dinner: 6:00pm – 9:30pm**  
A celebration of 30 years of genetic evaluation – A walk through time

### Thursday 21 March

#### Session 3

8:30 – 10:30am  
**Breeding for welfare and reproduction**

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<td>Reproduction and welfare in industry (20 min)</td>
<td>Peta Bradley, Sheep Genetics – Senior Development Officer, MLA</td>
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<td>Enabling genetic improvement of reproduction in tropical beef cattle (Repronomics project) (30 min)</td>
<td>David Johnston, Principal Scientist, AGBU</td>
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<td>Introducing Sheep Genetics’ new reproduction RBVs (30 min)</td>
<td>Kim Bunter, Principal Scientist, AGBU</td>
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<td>Breeding for reproduction – A breeder perspective (20 min)</td>
<td>Lynton Arney, Inverbrackie Border Leicester Stud</td>
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<td>Maternal efficiency in future breeding programs (25 min)</td>
<td>Sarah Blumer, Research Officer, Murdoch University</td>
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<td>Selecting sheep for the future (25 min)</td>
<td>Andrew Swan, Principal Scientist, AGBU</td>
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<td>A Resource Flock of the future (25 min)</td>
<td>Hamish Chandler, Program Manager – Genetics, MLA</td>
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<tr>
<td>A breeder’s role in the National Adoption Plan (25 min)</td>
<td>Clara Bradford, National Adoption Manager – Genetics, MLA</td>
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SESSION 1

What does the future hold for the sheep industry and breeding programs?
THE MLA SHEEP GENETICS LANDSCAPE

Dr Daniel Brown Sheep Genetics Manager, MLA

Biography
Along with being the Sheep Genetics Manager Daniel is a Principal Scientist at the Animal Genetics and Breeding Unit at Armidale and is responsible for the routine estimation of Australian Sheep Breeding Values (ASBVs) for Sheep Genetics to deliver to ram breeders as well as the ongoing research and development of the genetic evaluation system.

Further to this he is the program leader in the ALMTECH project’s - Program 4: Industry Databases which is aiming to facilitate the optimal use of objective measurements of lean meat yield and eating quality data from commercial supply chains by commercial growers and the national genetic evaluation systems for sheep and beef.

Summary of presentation
Genetic evaluation of sheep in Australia has evolved massively over the last 30 years and it will be great to celebrate some of these achievements over this year’s Leading Breeder conference. LAMBPLAN started from simple beginnings in the 1970s with basic within group phenotypic comparisons and without the power of modern computers. Today we approach three million animals in each of the major analyses with nearly nine million records from 80 traits and close to 30,000 genotypes. The following figure captures some of the achievements over the last 30 years.

The MLA genetics team is now the largest in MLA’s history, which is great for Sheep Genetics. Caris Jones has now moved into a new Project Managers role to help manage the increasing number of genetics projects. Furthermore, the recent establishment of a dedicated role for genetics adoption and extension is very exciting, especially since Clara Bradford (nee Collison) has taken on this role. The Sheep Genetics team has a new Senior Development Officer role, and Peta Bradley is doing a terrific job in this position. These changes have allowed us to welcome two new Development Officers, Emma McCrabb (MERINOSELECT) and James Taylor (LAMBPLAN) to the team. We are lucky enough to have the whole MLA genetics team in Dubbo for Leading Breeder 2019 so please take the opportunity to introduce yourself and put a face to the name on the other end of emails and phone call when you can.

As part of our ongoing process of continual improvement, the Research & Development team have been working hard behind the scenes to release new enhancements to the routine analyses in April this year. These changes will include:

- New research breeding values (RBVs) for component traits of female reproduction, condition score and maternal behaviour score for maternal
- Genomic information will be utilised for more breeds
Index refinements including the revision of Carcase Plus, new Maternal Wool Production Index and improved index documentation

• Reporting of inconsistencies between pedigree and genomic information, to improve pedigree quality

There is also a number of new and exciting projects, which will foster more innovation and development for sheep genetic evaluations into the future. These include:

• Re-development of the Sheep Genetics database. This will increase our operational efficiency and build the capacity to deal with future “big data” pipelines.

• A Sheep Genetics website development project, which will improve the presentation of ASBVs to users

• National Livestock Genetics Consortium (NLGC) investment in research and development projects including ongoing resource flock funding, more sensory testing for eating quality, and genomic prediction studies

• The federally funded ALMTech project is working on a range of new technologies aiming at delivering more accurate measurements from supply chains back to producers and potentially Sheep Genetics

• AWI’s Merino Lifetime Project will also deliver exciting outcomes and data for Merino breeders including for the major production area of reproduction.

The conclusion of the Sheep CRC this year will see the end of a long history of collaborative RD&E in the sheep industry that has led to significant advancements for Sheep Genetics, including:

• Delivery of genomically enhanced ASBVs and indexes to drive simultaneous genetic progress for lean meat yield and eating quality

• The evolution of genomic testing for parentage and ASBV prediction, including the Flock Profile test in Merinos

• MLA, the Sheep CRC, UNE and other parties are all working together to ensure a smooth transition post-CRC so that all the current activities can continue as needed without interruption to industry.

Although genetic evaluations have been available to the Australian sheep industry for the last 30 years, the future will continue to see more evolution of sheep genetic evaluation in Australia. Some key aspects on the horizon might include Flock Profiles for maternal and terminal breeds, multiple new providers of genomic tests, footrot RBVs and no doubt much more. With the current landscape, as well as what is on the horizon, we can be confident that the industry has the ability and will breed sheep for a future environment.

Notes
THE CHALLENGES AND OPPORTUNITIES WITH SHEEP BREEDING

Jamie Heinrich Ella Matta White Suffolk and Poll Merino Stud

Biography
Jamie grew up on his family's 880 hectare sheep farm, Ella Matta, on Kangaroo Island. He completed a university degree in International Business at the University of South Australia, followed by three years working at one of Australia's biggest meat processors Thomas Foods International, in the meat export and livestock departments. Since then, for the past 5 years, he has been a joint owner and manager on the family farm. They operate Australia's first registered White Suffolk stud, along with a Poll Merino and Maternal Composite seed stock operation, as well as a commercial 18 micron Poll Merino flock. Their core breeding philosophy is about maximising genetic gain through the use of performance recording and ASBVs, while keeping a balanced focus on ease of care and visual structural selection.

In late 2014 he was the Youth Ambassador for the Sheep Meat Council of Australia, and has attended the past 5 American Sheep Industry conferences. He sits on the boards of Sheep Producers Australia and Livestock SA and is the Vice Chair of Agriculture Kangaroo Island. He was a 2017 Nuffield Scholar, studying 'attracting and retaining young people in the sheep industry' which took him to 17 countries over 20 weeks.

Summary of presentation

Consumer trends
• Rapidly increasing animal welfare concerns
• The rise of fake meat
• ‘Sustainability’ used in marketing
  • i.e. pasture raised, free-range, natural, organic, cruelty free, antibiotic free, hormone free.
• Health conscious
• Less people cooking
• Growing middle class, particularly Asia
• A limited and inelastic supply with an increasing world demand

What is happening with on-farm production?
• Easier data collection and analysis opportunities
• Fast improving technology
  • i.e. sheep handling equipment, EID, remote sensing, virtual fencing, farm management software, soil mapping.
• Improving production VS ease of care / welfare (genetics and management)
• Carcase grading potential and feedback
• DNA and ASBVs

Where do sheep fit?
• Has become a premium product (meat and wool)
• Is a renewable resource
• Great but possibly declining eating quality
• Impressive natural qualities of wool
• Growing negative image in the media: Live export, drought, lamb survival and mulesing

How do we match them all up?
• Always keep customer in mind with breeding decisions and management practices
• Pushing production is great, but need to not sacrifice quality, sustainability or welfare
• Use genetics and management to phase out of mulesing and improve lamb survival
• Data collection (ASBVs and otherwise), you only get out what you put in
• Breed for a base-line in eating quality. Most lamb is good, but now that it has become a premium product, and people are paying a premium price, we cannot afford any poor eating experiences
• Not getting paid yet, but future grading will be able to objectively measure and eventually pay for eating quality and yield. Could also provide important data to help with genetic breeding decisions
• Traceability will be key
• Carbon neutral potential, a great line when telling our story and combatting negativity
• We have a positive story, we all need to tell it!

Notes
THE GENETICS PROJECT SCENE

Co-Chairs: James Taylor and Emma McCrabb LAMBPLAN and MERINOSELECT Development Officers

Biographies

Dr Troy Fischer

Troy along with his wife Nette, run a seedstock and grain business at Wasleys in the mid north of South Australia. They sell over 300 terminal rams annually across SA, VIC and NSW. Their stud, Ashmore White Suffolks, has been involved in LAMBPLAN for almost 30 years with a strong focus on the use of technology and performance recording to identify the best animals.

Prior to returning to farming, Troy has worked in the red meat, wool and wine industries in a range of research, management and commercial roles. Troy has a PhD in sheep genetics and a Bachelor of Rural Science (Hons) both obtained at the University of New England. Troy is a graduate of Course 16 of the Australian Rural Leadership Program and is a graduate of the Australian Institute of Company Directors.

Peter Blackwood

Peter is the stud principal of Blackwood Corriedales which he runs with his wife Claire located near, Evandale, Tasmania. Blackwood Corriedales has been performance recording since its inception in 2006. Alongside the stud Peter also runs a commercial operation targeted at producing prime lambs for the trade market.

He has over 30 years farming experience in Tasmania and has also held roles in contract stock husbandry, Cooper’s Animal Health Sales Manager and Store Manager of TP Jones and Co. Peter has had significant involvement in the Corriedale breed and is the immediate past Chairman of the Performance Corriedale Group, a position he held from 2015-18. He was a founding member of this group that formed in 2007.

Currently Peter is managing the Corriedale Meat Eating Trial at Cressy, Tasmania. This is in conjunction with the Davies research Centre, The University of Adelaide and MLA.

Mark Mortimer

Mark is a third generation farmer from Tullamore in Central NSW. Mark works in the family partnership with his father Robert and brother Doug. Mark has a degree in Farm Business Management from Sydney University that he utilises in his day to day duties and future planning for the family enterprise.

Mark currently sits on the Sheep Genetics Techincal and advisory Committee, the National Livestock Genetics Consortium (NLGC), the MerinoLink and Macquarie Merino Lifetime Productivity trial steering committee.

Mark manages the Centre Plus Central Nucleus. His key roles include data capture with electronic tags and the storage, management and analysis of the data from Centre Plus.

This work has developed a strong interest in genetics and the technologies that go hand in hand with sheep breeding programs and often translates to other industries looking to increase breeding outcomes.

Professor Julius van der Werf

Julius has a MSc and PhD from Wageningen University in the Netherlands. Prior to moving to Australia he was the Assistant Professor in Wageningen from 1985 to 1993 and a Senior Researcher in dairy cattle breeding at the National Institute for Animal Science and Health between 1993 and 1997.

In 1997, he moved to Armidale, first as Senior Lecturer and now as Professor in Animal Breeding and Genetics at the University of New England (UNE). His research specialises in research into genetic evaluation, breeding program design, breeding objectives and genomic selection. Julius has supervised ~50 PhD students at UNE. In addition to this he has been manager of the Sheep CRC genetics program since 2003. He is also member of the Sheep Genetics Technical Committee, the MLA NLGC TASK force and the ARC panel of experts. He is chief editor of the journal Genetics, Selection and Evolution and Associate editor of the Journal of Animal Breeding and Genetics.

Dr Troy Fishcer: Superwhites Producer Innovation Fast Track Project: Ramping up genetic gain in eating quality and lean meat yield in Australian Lamb

Background to Superwhites

Superwhites is a breeding group of 19 White Suffolk breeders across Australia who collectively market 3500 rams per annum. The focus of the group is on progeny testing the top 10 young sires each year, strengthening genetic linkages and improving genetic gains. For more information see, www.whitesuffolk.com.au/superwhites
What was the project set up to do?
Improve rate of progress in breeding for eating quality and lean meat yield traits through improved accuracy of ASBVs and hence make better selection decisions.

Why?
Eating quality of lamb has been steadily eroding on the back of decades of selection for increase in production.

How did we go about it?
• DNA test top 30% of young males to improve accuracy for selection decisions
• Collect DNA, carcase and meat quality phenotypes on cull stud females, creating a progeny test for a cross section of sires used within the group.

The presentation will focus on the results from this project.

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**Peter Blackwood: Corriedale Eating Quality Genomics**

**Background**
Performance Corriedale Group meets twice yearly, to discuss, plan and achieve benefits to Performance Corriedale’s for their commercial sheep breeders. Using ASBV’s, a young sire program and group involvement, the aims of the group have been/are being met. We had discussed the Eating Quality of Corriedales, which anecdotally was believed to be good, we did not want to lose this by increasing performance in the breed, but this had to be measured.

**Aims of the project**
Measure 900 lambs over three years representing 45 Corriedale sires from Southern Australia. Traits to be measured Shear-force, Intra-muscular fat and, lean meat yield. We have also tried to measure as many traits for growth, wool, fat and muscle, before slaughter to maximise benefit of the trial. All measurements to be supplied to Sheep Genetics.

**Where we are at?**
• 2017 – 212 lambs representing 14 sires, Slaughtered April 2018 av 19.4 kg, 28 traits recorded growth, wool, scanning muscle fat, structure traits, Meat traits- Carcase weight, intramuscular fat, shearforce and lean meat yield.
• 2018 – 235 lambs representing 14 sires, predicted slaughter date April 2019 expected carcase weight 21.5 kg.
• 2019 - >400 lambs from 12/14 sires.

**Corriedale lambs**
• Do have low Shear-force and high intramuscular fat.
• Data collected will add to Corriedale predicted performance from DNA collected from each lamb and sire represented. This will strengthen the accuracy of Genomics into the future for Corriedales.

Notes
Mark Mortimer: Merinolink DNA Stimulation Project

This project is not about testing whether genetic tools work, but about building a system of how they can be used in industry. Not just about the implementation of single tools in set situations, but taking the best tools & knowledge from our world leading researchers and delivering it through service providers & breeders to commercial producers. The project will focus on capacity building and working collaboratively at all levels within and across the industry to double the rate of Genetic Gain.

Project scale

Collectively the ram breeders involved with the project sell 9,500 Rams, 17,000 doses of semen & have 1750 ram buying clients annually. There are also 70 commercial breeders representing 250,000 sheep all having done a Flock Profile test & utilising the RamSelect Ram Team Manager.

Producer participant in the project will contribute $1.35 million over the 5 years of the project. This money will be match by the MLA donor company and backed by the University of New England. In 2018 there were 60,000 DNA parentage tests & 10,000 15k DNA tests conducted.

Project objectives

1. To increase the number of Merino ram breeders submitting full pedigree data to Sheep Genetics by 100% (greater than 95% full pedigree). The impact will be to increase the accuracy of ASBV’s and genetic gain.

2. To increase the use of genomic testing by Merino ram breeders to select stud sires. The impact will improve ASBV accuracy and increase selection response.

3. To increase the number of Merino ram breeders that use MateSel to maximise genetic gain.

4. To increase the number of commercial Merino breeders using Flock Profile tests to benchmark their genetic progress and target ram selection by incorporating the information in RamSelect.

5. To explore the use of the Flock Profile test by ram breeders and their clients to better tailor ram selection to client needs and measure changes in genetic merit and changes in breeding programs over time.

6. To facilitate data collection and genomic testing to enhance the existing genomic reference population.

7. To test the concept for ram breeders to carry out genomic testing only, without phenotypic measurement, whilst being supported by an industry run reference flock that they are strategically linked to.

8. To provide an extension process to guide, facilitate and explore optimal use of DNA testing for both parentage and genomic selection, as well as mate selection and explore future opportunities with the project participants.

9. To train and mentor service providers in the application of DNA testing and genomic selection in Merino breeding programs.

Notes

Professor Julius van der Werf: MLA Resource Flock

The Sheep CRC initiated the Information Nucleus Flock (INF) and it is clear now a large well-designed data set with many animals measured for many traits allows much more accurate estimation of heritability and genetic correlations. The INF has certainly delivered much more clarity into the heritability of novel traits, but probably the most important outcome has been the realisation that more growth leads to lower eating quality. Eating quality is a trait that is not easy to select for so genomic selection was a possible solution to fix this problem.

Genomic selection

Implementation of genomic selection in sheep breeding provides a number of challenges, compared to dairy cattle. In dairy, traits that would be the main target for genomic selection have already been measured in the progeny of bulls that were used in the past. In sheep there was almost no data for slaughter and eating quality traits whereas reproduction data is scarce as well. The INF data was a good start for genomic selection. However, also unlike dairy, in sheep there are many...
breeds and there is a lot of genetic diversity within the breeds (e.g. Merino). Genomic selection tends to work only with data from within the breeds (or from crossbreds if the breed is art of that) so reference populations need to be developed for each breed. Therefore, the accuracy of genomic selection in sheep can only increase over time as reference population data sets are being build up.

Project design

The MLA resource flock was initiated as a successor of the INF in 2012. It has been fully funded by MLA. On an annual basis about 2000 lambs are produced at 2 research flocks (Kirby in Armidale, NSW and Katanning, WA) and one satellite flock (Temora) from 150 sires, and all lambs are measured for slaughter traits. The breed composition is similar to the INF with 40% Merino, 40% terminal and 20% maternal sires and 80% Merinos and 20% first cross. The 4 major breeds that were used in the INF, Merino, White Suffolk, Poll Dorset and Border Leicester are still dominant, but there is now more space for testing Dorpers, Dohnes, some smaller terminal breeds and maternal composites. Traits related to reproduction and wool are not measured but the new MLA RF plan accommodates for genotyping of ewes with reproduction data (about 2500 per year). The resource flock database, combined with INF, has now about 20,000 animals with genotypes and phenotypic measurements of the key slaughter traits as well as growth and parasite resistance and this resource can be used for genomic prediction. The RF resource is also used for various other experiments, mostly related to meat science. The total data set is large but the data per breed is only growing slowly. Over time the reference population will increase gradually and contribute to increasingly accurate genomic predictions. A key strategy is to look for more data suitable for prediction, e.g. through co-investment with breeders that collect these ‘hard to measure’ traits.

Notes
SESSION 2

Breeding within an integrated supply chain
CONNECTING THE CUSTOMER TO FARMER

Natalie Isaac Global Manager – Industry Insights and Strategy, MLA

Biography
Natalie Isaac is MLA's Global Manager- Industry Insights and Strategy. Natalie leads the team responsible for collecting and reporting data and insights along the supply chain, from slaughter and sale data through to consumer market research; and developing Global Market Strategy. The supply or production data is well known as MLAs Market Information or National Livestock Reporting service (or NLRS). The combination of production and demand insights are used to develop MLAs global market strategy in consultation with industry. The consumer research is used widely by industry to target the most attractive opportunities for the Red Meat industry and informs MLAs in-market activity.

Natalie has a Master of Applied Science (Food Science and Nutrition) and Master of Management. She has a real passion for using data and insights to help with business decisions and informing strategy. She has extensive experience in commercial organisations across strategy, sales, marketing and research and development.

Summary of presentation
We operate in a dynamic global market place, where there are many high level variables that can have an impact on our consumers. Changes in population, income and urbanisation are all factors that are expected to contribute to growth in the global demand for sheepmeat. At the same time, changing consumer attitudes, rising prices and competing foods can have a negative impact on demand. Most institutions are currently forecasting a slight increase in global demand of sheepmeat.

These are just a few of the high-level trends; there are many more trends that we monitor. Not all demand is equal, there is a very wide range in quality being demanded. With Australian production forecasts declining in the short term and global demand expecting a slight increase, it is important that we understand the target consumer and know what is important to them.

We know that what the consumer wants, is delivered through the farmer. Consumers around the world want their protein to be safe, animals that are well cared for, and food with a consistent quality that tastes delicious. The farmer and how the farmer breeds and manages livestock can deliver all of these attributes. As global sheepmeat retail prices grow and continue to be at a premium to other proteins, delivering what the consumer needs and expects is increasingly important.

Notes
DATA CAPTURE AND FEEDBACK – THE ALMTECH PROJECT

Dr Sarita Guy Postdoctoral Research Fellow, Animal Genetics and Breeding Unit (AGBU)

Biography

Sarita first developed an interest in agriculture after a farm stay on a merino stud in Parkes. Being dragged behind a quad bike on an overturned car bonnet and the smell of sheep hooked her to the country lifestyle.

Sarita went on to complete a Bachelor of Animal and Veterinary Bioscience then a PhD in quantitative genetics at the University of Sydney. She developed a broad research interest in data-driven decision-making to improve productivity and welfare in livestock production. Sarita joined AGBU at the end of 2017. As a postdoctoral research fellow for the Advanced Livestock and Measurement Technologies project (ALMTech), she is researching the use of objective measurement data for the genetic improvement of lean meat yield and eating quality. A large component of her work is to facilitate the flow of data on carcase attributes from processors to producers, then also to genetic evaluation systems for genetically informed animals.

Summary of presentation

The Advanced Livestock Measurement Technologies (ALMTech) project for globally competitive Australian meat has the following objectives:

- **Accurate measurement** (objective and predictive) systems of live animals, carcases and cuts in major beef, lamb and pork supply chains.
- **Valued producer feedback** to effect decision making on compliance and profitability.
- **Value chain information systems** to extract maximum value of products.

These objectives will be achieved with many collaborating partners along multiple supply chains. These collaborations are essential to maximise effective decision making, reduce risk and optimise profitability for all partners in the meat value chain. The ALMTech activities and examples of the technologies currently being investigated for the enhanced data capture of lean meat yield, fat depth, eating quality and health status are outlined in Figure 1 below.

Figure 1. A snapshot of Advanced Livestock Measurement Technologies (ALMTech) activities and technologies being investigated for accurate data capture and information slow along the value chain.

What this could mean for animal breeding?

The current carcase data used for our genetic evaluation systems rely on reference populations (progeny test kills). Reference populations are essential for estimating ASBVs for genetically linked breeding stock in industry. However, collecting carcase phenotypes is an expensive, labour intensive exercise that involves the manual collection of samples and data, and is counterproductive to the fast-paced processing environment. ALMTech aim to develop technologies that can be...
appropriately incorporated in the processing chain to decrease the cost and increase the efficiency of objective carcase data collection. Combined with enhanced processor systems that allow tracking of individual carcases, as well as on-farm information flow systems, the hope is to move towards better collection and flow of accurate phenotypes to genetic evaluation systems.

With the potential to minimise the logistical difficulties and costs involved with the collection of carcase data, this also presents ram breeders the opportunity to record more carcase measures. This will lead to higher ASBV accuracies and therefore greater genetic gains in yield and eating quality.

* ALMTech is funded by the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program. Collaborators include R&D Corporations, Commercial Companies, State Funding Departments and Universities.

Notes
BREEDING FOR CONSUMER OUTCOMES

Phil Clothier  Woolumbool Sheep Studs

Biography

Phil is 65 year old farmer, farming at Lucindale in the South East region of South Australia. He is married to Sharon and has 3 adult sons all of whom are married and between them we have 10 grandchildren. He was educated at Crystal Brook Primary, Lucindale Area and Urrbrae Agricultural High. He was awarded the Urrbrae Certificate in Agriculture on completion of study at Urrbrae.

Phil’s family has lived and farmed at Lucindale for the past 57 years. His parents purchased the Lucindale property in a partially developed state and developed the original 325 hectares over time into a 1700 hectare farm running approximately 13 000 DSE. The average annual rainfall is 520mm and is very reliable. The original properties were managed by a family partnership consisting of the parents and 3 brothers and their wives.

In 2008 he began farming with Sharon on 700 hectares of the original properties where they employ one son as a full time employee. The property is approximately divided on a DSE basis into 50% Seedstock and 50% commercial (Wool and Prime Lamb) production.

Seedstock flocks are all Sheep Genetics recorded and consist of
• Poll Dorset
• White Suffolk
• Multimeat Composite
• Poll Merino.

Summary of presentation

The consumer is King? But just who is our consumer?

Is it the Prime lamb producer we supply rams to or is it the Processor who slaughters and distributes the product from those lambs or is it the person who ultimately eats the lamb or wears the wool?

I believe we have to satisfy all 3.

It is most important that we produce sires capable of enhancing the lamb producer’s profitability because without a viable and profitable Prime lamb producer we have nothing.

It is also important that we satisfy the processor by providing sires with the genetics that enhance their business.

And finally it is of utmost importance that the consumer of a lamb meal or the woollen clothing is satisfied with the product they purchased.

At Woolumbool we have always attempted to produce sires which have a balance in the desirable traits we believe are necessary to satisfy all three of our consumers.

Concentrating on Lamb production only, until recently it has been relatively simple to achieve this by targeting just a few important traits by intensive phenotypic measurements of the traits and having SG produce ASBV’s for them.

• Birth Wt
• Growth
• Fat
• Muscle
• WEC

Recent research is indicating we may have a future problem with the final consumer.

It has been shown that as we have increased growth and muscle which enhances the outcomes for our first two consumers that the eating experience is very slowly declining.

To address this is not easy as the traits for EQ are difficult and expensive to measure.

The breeding groups Meat Elite Australia and Superwhites our stud have been involved with over many years have helped us to keep pace with genetic improvement. They have also recently embarked on projects to address the EQ traits in lamb.
To enhance our studs capacity to integrate all of this into our program and yet still try to keep the operation as commercial as possible we have undertaken the following.

- Up to date and very functional sheep yards.
- New shearing shed and sale centre.
- EID in all pedigreed animals.
- Using genomics to aid in selection of sires.
- Use of Matesel program to maximise genetic gain over entire flock.
- Benchmarking both financially and genetically.

Notes
SESSION 3

Breeding for welfare and reproduction
REPRODUCTION AND WELFARE IN INDUSTRY

Peta Bradley Sheep Genetics – Senior Development Officer, MLA

Biography

Peta is the Senior Development Officer with Sheep Genetics based in Armidale. Peta has been in this position for 6 months prior to this she was the MERINOSELECT Development Officer. She completed a Bachelor of Rural Science at the University of New England in 2017, which included an honours project in the genetic parameter estimation of reproduction traits in Border Leicester sheep, which she completed under the supervision on the Professor Julius van der Werf.

In her current role as Senior Development Officer she is responsible for client interaction, service delivery and extension activities that increase the adoption and awareness of the Sheep Genetics analysis. Further to this Peta assists in the development of tools that optimise breeding program design which include the use of genomics and integration of new traits to drive genetic gain in the sheep industry.

Peta grew up on a property near the village of Armature in Central West New South Wales were her family run a commercial and stud sheep operation alongside a cropping enterprise and has had extensive experience in the sheep and wool industry throughout her education and career.

Summary of presentation

Key points

1. Seedstock breeders need to have foresight to make recording and selection decisions in advance to place the industry in good stead to face heath, welfare an reproduction challenges of the future.

2. Breeders are able to successfully balance and select for management traits in combination with production traits. However, the recording of many these traits is still at low levels across all analyses.

3. ASBVs are a vital tool for the genetic selection of these reproduction and health traits and as breeders you need to start thinking about these traits and using the tools available now! As breeders, you need be thinking about the future in their recording and selection programs so that they can start now!

Overview

Agriculture is a continually evolving industry that has been adaptive to a changing environment. It cannot be denied that the space sheep breeders are now operating in is not just influenced by what happens behind the farm gate. The modern sheep producer has to be on the forefront of addressing the needs of external influences. Genetics plays a vital role in allowing producers to manage reproduction, health and management traits with production traits. Seed stock breeders have an integral role in breeding the sheep for the future environment by recording and selecting for these traits now.

Current adoption and recording of reproduction and health traits

• Some breeders are already managing key health traits in their breeding objective whilst continually making progress in production traits. There are examples of flocks in the analysis that have:
  - Successfully increased Number of Lambs Weaned but maintained Adult Weight
  - Have a WEC average in the top 5% of animals and a YCFW in the top 15%
  - Have a CFW in the top 10% of the analysis whilst continuing to decrease their breech wrinkle and have an average in the top 25% of the analysis

• There is significant improvements to be made in the recording of health and reproduction traits across all 3 analyses

Genetic tools to breed for improved and welfare and reproduction

• There is currently a range of health traits with ASBVs available to assist breeders in breeding sheep for a future environment and there are new enhancements in the reproduction evaluation to better identify the key components of reproductive performance.

• Current ease of management traits include the below – which ones are important to you and are you recording them?

<table>
<thead>
<tr>
<th>Breech Cover</th>
<th>Breech Wrinkle</th>
<th>DAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll Horn</td>
<td>Adult weight</td>
<td>WEC</td>
</tr>
</tbody>
</table>

• From the evidence based on selection within flocks it takes, time to make significant genetic progress in these traits whilst balancing other production traits. So what will be next? Some traits where work has begun include:

<table>
<thead>
<tr>
<th>Lamb survival</th>
<th>Tail length</th>
<th>Methane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed efficiency</td>
<td>Ewe stability</td>
<td>Heat tolerance</td>
</tr>
</tbody>
</table>
Some of these traits are easily recorded on farm whilst others are much more difficult to measure, highlighting the need for a reference population and genomic prediction as enablers for future selection.

What are you doing now to prepare for this future environment?

Notes
ENABLING GENETIC IMPROVEMENT OF REPRODUCTION IN TROPICAL BEEF CATTLE (REPRONOMICS PROJECT)

Dr David Johnston Principle Scientist, Animal Genetics and Breeding Unit (AGBU)

Biography
David is a beef cattle geneticist at the Animal Genetics and Breeding Unit (AGBU) at the University of New England, Armidale, where he has been for 26 years. During that time David has been responsible for the design and management of several large beef cattle breeding projects, and the implementation of the research into the international beef genetic evaluation scheme called BREEDPLAN.

David’s expertise is mainly in the area of mixed model estimation and prediction, and a major focus of his work has been the development of genetic evaluation procedures for new traits. These have included important developments in male and female reproduction traits, mature cow weight, abattoir carcase and meat quality traits, net feed intake, and more recently, research into the incorporation of DNA-based data into estimated breeding values.

Currently, David is project leader of a large MLA-funded breeding project in Queensland and the Northern Territory that is developing enhanced genetic evaluation of female reproduction traits through the implementation of new genomic selection techniques in tropically-adapted beef breeds. David spends considerable time interacting with the beef industry and has been an invited speaker at scientific forums, both nationally and internationally.

Summary of presentation
Introduction
Reproduction is the main profit driver in northern Australia and genetic improvement is an important tool for increasing commercial weaning rates. To enable tropical beef breeds to develop the capacity to drive genetic change in reproduction a research project was established to build genomic reference populations in several key tropically-adapted beef breeds. This large collaborative breeding project, known as the Repronomics™ project, has recently been completed and collected large numbers of phenotypes and genotypes on females generated in the project. Reproduction traits recorded included: heifer age at puberty, lactation anoestrous interval, calving and weaning rates, along with many other traits. The phenotypes have been combined with genotypes on all project and industry animals in the recently implemented genomic selection capacity of BREEDPLAN. This enables the genetic improvement of female reproduction rate and many other economically important traits in the northern Australian beef industry.

Experimental design
The project used the largest breeds in northern Australia (viz; Brahman, Droughtmaster, Santa Gertrudis). Progeny of key sires in each breed were generated at research facilities in Queensland (Brian Pastures & Spyglass) and the NT (Douglas Daly). The Douglas Daly herd is part of a long term Brahman selection line experiment utilising yearling mating. All herds are fully BREEDPLAN recorded, and at each location, breeds were run together. Genetic linkages were established to other research projects and to industry herds. The project generated more than 5,000 calves and all male progeny were steered and have been recorded in a satellite MDC project for postweaning growth, carcase and meat quality traits.

Real-time ultrasound scanning was used to perform regular ovarian assessments on all females to accurately determine follicle development and the presence of a corpus luteum. Results from these serial scans were used to define heifer age at puberty (N=2,400), and the interval to return to cycling in lactating first-calf cows (N=1,600).

Maiden heifers and 1st calf-cows were naturally mated to determine mating outcomes, and all older cows were eligible for a fixed-time AI program that was used to generate the progeny on high importance industry sires or emerging new sires. The selection of sires in each breed was designed to maximize the genomic relationship of future selection candidates (i.e. young bulls) to the animals intensively recorded in the reference populations.

All project females were genotyped with a 25K or 35K SNP chip, and all project sires with a high density 80K Bos Indicus chip. Several hundred industry sires were also genotyped from leading performance seedstock herds in each breed. These included several cooperating industry herds, as well as in Brahman and Santa Gertrudis sires with high accuracy days to calving EBVs.

Genomic evaluations and industry application
The project has achieved its targeted number of females and intensively recorded them for reproduction despite some very challenging droughts in early years. All phenotypic and genotypic data is now included in the recently developed genomic single-step BREEDPLAN evaluations. The project data serves as the genomic reference population for each of the three breeds, especially for female reproduction traits, and has significantly increased EBV accuracies.
The project has been re-funded and will continue to build the size of the reference populations, using the very latest genetics in three breeds, and will further increase EBV accuracies. The data will also allow the development of combined breed evaluations across the full range of EBVs and $indexes.

Notes
INTRODUCING SHEEP GENETICS’ NEW REPRODUCTION RBVs (FOR MATERNAL BREEDS)

Dr Kim Bunter  Principle Scientist, Animal Genetics and Breeding Unit (AGBU)

Biography
Kim Bunter is a geneticist at the Animal Genetics and Breeding Unit (Armidale, NSW) and has worked for the Australian livestock industries over the past 30 years. During that time she has conducted collaborative research for several species (beef, sheep, pigs, ostriches, oysters) in the areas of reproduction, feed efficiency, meat quality, health, welfare, survival and longevity, including investigation of novel physiological traits like progesterone, IGF-I, in-vitro heat stress and immune competence phenotypes.

Kim started working with the research team for Sheep Genetics in 2009 and has a particular interest in the ongoing development of genetic evaluation (GE) systems for reproduction and survival traits in livestock species. Her most recent projects for the sheep industry have included investigating the potential use of progesterone, pregnancy scanning and foetal aging data for GE, as well as the development of better models to predict breeding values for fertility, litter size and lamb survival using industry data.

Kim enjoys interacting with breeders and has a goal to implement strategies which will be robust in Industry settings. She has been invited to speak at both scientific and industry events, and is the current president of the national genetics body for professionals, educators and industry: the Association for the Advancement of Animal Breeding and Genetics (see https://aaabg2019.org/ for the upcoming conference – including breeder days).

Summary of presentation
The new reproduction RBVs represent major reworking of the reproduction analysis currently used by Sheep Genetics, which produce ASBVs for NLB and NLW. In summary, the key features of the new analyses are:

1. Replacement of NLB and NLW with their component traits:
   a. Conception (CON), which will be expressed as a % of ewes joined
   b. Litter size (FSIZE), reflecting the actual number of lambs born
   c. Ewe rearing ability (ERA), reflecting the % of lambs born which were successfully reared until weaning
2. Separate traits for yearling and adult ewes
3. Increased data use across more flocks because of individualised component trait error detection and filters, while using joining and lambing details, and pregnancy scan data, to maximise flexibility
4. Use of genomic data for multiple breeds in single step analyses – the most powerful tool currently available to combine pedigree with genomic information
5. Better models fitted explicitly – no pre-adjustments for any trait. This means flock specific differences in effects will be captured better
6. Introduction of RBVs for new traits: maternal behaviour score (MBS) and pre-joining condition score (CS)
7. Including additional traits (post-weaning and yearling scrotal circumference, as well as post-weaning fat and eye muscle depth) in analyses to provide correlated information for reproductive or CS traits
8. Reportable traits are confined to CON, FSIZE, ERA, MBS and CS, since ASBVs for all other traits are already reported

To make the most of the opportunities provided, breeders should accurately record joining details (rams, management groups and dates) and outcomes (dry or lambs born) for pedigreed ewes from mothering up at lambing (preferred) or via pregnancy scanning. This information is supplied to Sheep Genetics via a “mating module” which can be built by all supported software packages. Conception will be evaluated only if dry ewes are reported, through including dummy “DRY” tags as previously, or via the mating module. Rearing ability will only be evaluated if details on individual lambs are provided, and their survival to weaning is validated by future (weight or wool) records. Therefore, timely entry of data (eg weaning weights) will also ensure that ERA is analysed.

Recording reproductive outcomes directly is the most important strategy for improving accuracy of breeding values for the components of reproduction, given modest genetic correlations amongst traits in maternal breeds. The provision of breeding values for individual component traits will enable breeders to make more precise decisions about selection amongst component traits (eg. litter size versus lambs surviving). Validation testing supports robust predictive capacity for reportable traits from the new analyses.
BREEDING FOR REPRODUCTION – A BREEDER PERSPECTIVE

Lynton Arney Inverbrackie Border Leicester Stud

Biography

Lynton is stud principal of Inverbrackie Border Leicester Stud which he runs with his wife Claire located near Strathalbyn, South Australia. He purchased the stud from his parents in 1989 and began performance recording with his first drop of lambs in 1990. He is a strong believer that measurement and accurate recording enables better breeding decisions and is very committed to using ASBVs in their breeding program.

He has had a lot of industry involvement holding the position of Chair of Australian Border Leicester Association, member of Lambplan Advisory Committee, Maternal Central Progeny Test Advisory Group, Information Nucleus Advisory Group at Struan, South Australian Sheep Industry Development Board and was a founding member of $uperBorder$. He was awarded a Nuffield scholarship in 2001 studying Seedstock production systems.

The Inverbrackie flock averages around the top 10% of Border Leicesters in the Lambplan database. Lynton and Claire are now marketing their rams across eastern Australia using the IQ Border brand and providing the IQ Xbred brand to their clients to build industry recognition for the 1st cross progeny from their high ranking rams.

Summary of presentation

Within our Border Leicester stud we have taken the approach that without a high Number of Lambs Weaned (NLW) there is no reason for the Border Leicester. The role of the Border Leicester is to produce 1st cross ewes that are used to produce 2nd cross prime lambs in a structured cross breeding program which relies on a high lambing % and high growth rates for profitability.

We accept that good genetics is only a part of the strategy used by prime lamb producers to achieve a high lambing % and that their management is extremely important. We are in the business of supplying top genetics to the prime lamb industry and we are unable to pass on gains to industry through feed or management that does not reflect commercial reality. We take the approach that it is the ewe’s job to rear what she produces and it is our job to record what she has done.

As our average rainfall is 390mm with our pasture production averaging around 6 months. This affects our ability to finish late lambs and to achieve a high % of ewe lambs pregnant each year however making the sheep fit our production system has been a very good selection tool.

We embrace the differences between the animals in their management groups. Good recording is the only way that good outcomes can be made in a lowly heritable trait. Using ASBVs and TGRM/ Matesel over several years we have been able to achieve good progress in NLW.

NLW should not be treated as a single trait. There are several stages that need to be considered when collecting reproduction records to be able to make good genetic decisions. There are differences between animals for:

- Conception
- Fecundity
- Foetal survival
- Lambing difficulties
- Ewe rearing ability
- Lamb survival

As breeders we need to collect information that will indicate the genetic or environmental factors that influenced getting a lamb through to weaning and focus on the genetic aspect. Recording the information that will enable these stages of lamb production to be broken down into components is our biggest challenge. The new Research Breeding Values will enable us to consider conception, ewe rearing ability and lamb survival in our breeding program. Having these traits available will enable better decisions for targeted progress to be made into the future.
SESSION 4

Creating opportunities through genetics
MATERNAL EFFICIENCY IN FUTURE BREEDING PROGRAMS

Sarah Blumer Research Officer, Murdoch University

Biography
Sarah Blumer works as a research officer at Murdoch University based in Perth, Western Australia. Her PhD work examined the mitigation of liveweight loss in adult ewes during summer and autumn in Mediterranean farming climates. Current research work includes: Managing Mums with Multiples, Lifetime Maternals, and the Merino Lifetime Productivity Genetic Evaluation: Systems Efficiency & Profit.

Sarah’s main areas of interest are composition, feed efficiency in the adult ewe flock, and translating experimental results to value in the field.

Summary of presentation

Key points
1. Income and costs per hectare are the drivers of livestock profitability.
2. Selecting on ‘value per head’ traits such as live weight or fleece weight may compromise per hectare profit due to negative effects on efficiency and resilience traits.

Overview
Current work shows that there are considerable differences between breeds and genotypes in conversion of food energy to body reserves (as measured by whole body energy). As such, there may be scope to select for traits and genotypes within the Australian flock that better fit producer and locality needs. Maternal breeders should be considering system efficiency (the amount of product or profit generated by a flock over a production cycle when grazing a specified feed resource) as well as feed efficiency (amount of product produced by an animal grazing a given feed) and maternal efficiency (amount of product per ewe).

System efficiency is composed of many traits and, number and weight of lambs weaned are two of them. However, the energy inputs into the adult ewe flock are a major component of on farm costs and a systems efficiency index that considers improved intake and liveweight efficiency will increase farm profitability.

Whole body energy stores and efficiency
• Adult ewes with a higher proportion of whole body fat, when fed a poor quality diet:
  - Require less feed (0.8MJ/hd/d of ME per ½ condition score).
  - Lose less weight (30g/hd/d per ½ condition score).
• There are differences between breeds and bloodlines in partitioning of surplus energy intake into fat and lean tissue:
  - Storing and then mobilising fat tissue is 3 or 4 times as efficient as storing and then mobilising lean tissue.

Variable costs
Improved adult efficiency and resilience traits reduce variable costs and management inputs. This can complement breeding values for traits such as wrinkle, dags and faecal egg count which all contribute to reducing costs and making managing sheep easier. Development of efficiency traits will allow farmers to breed ewes that require lower inputs and are better able to cope with a variable climate, reducing supplementary feeding and labour costs. However the true value of systems efficiency and resilience traits is in the opportunity to increase stocking rate and maximise profit per hectare.

Table 1. Sire differences for stocking rate when estimated by liveweight (kg) or standard reference weight (kg). Note: SRW includes an effect of condition score.

<table>
<thead>
<tr>
<th>Sire</th>
<th>Wool &amp; Meat income per head to 22 months</th>
<th>Current LW 1-Feb-19</th>
<th>Estimated SR based on LW</th>
<th>Income per hectare 1-Feb-19</th>
<th>Condition score 1-Feb-19</th>
<th>Estimated SRW*</th>
<th>Estimated SR based on SRW</th>
<th>Income per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$/hd relative</td>
<td>kg</td>
<td>metabolic</td>
<td>%</td>
<td>LW</td>
<td>kg</td>
<td>metabolic</td>
<td>%</td>
</tr>
<tr>
<td>A</td>
<td>230</td>
<td>100%</td>
<td>59.2</td>
<td>21.3</td>
<td>0%</td>
<td>100%</td>
<td>2.3</td>
<td>66.1</td>
</tr>
<tr>
<td>B</td>
<td>266</td>
<td>116%</td>
<td>60.2</td>
<td>21.6</td>
<td>-1%</td>
<td>114%</td>
<td>3.0</td>
<td>60.2</td>
</tr>
<tr>
<td>C</td>
<td>271</td>
<td>118%</td>
<td>62.4</td>
<td>22.2</td>
<td>-4%</td>
<td>113%</td>
<td>2.4</td>
<td>68.6</td>
</tr>
<tr>
<td>D</td>
<td>245</td>
<td>107%</td>
<td>62.5</td>
<td>22.2</td>
<td>-4%</td>
<td>102%</td>
<td>3.3</td>
<td>59.8</td>
</tr>
</tbody>
</table>

* assuming 15% of SRW/CS
SELECTING SHEEP FOR THE FUTURE

Dr Andrew Swan Principle Scientist, Animal Genetics and Breeding Unit (AGBU)

Biography
Andrew Swan’s career spans almost 30 years dedicated to developing genetic improvement programs for the Australian sheep industry. While at CSIRO during the 1990s and early 2000s he was part of a team focused on breeding for wool quality in fine and superfine wool Merinos, culminating in the award winning T13 project which delivered advanced research outcomes to industry. Andrew also participated in the R&D program to develop the Sheep Genetics evaluation system launched in 2005, a landmark achievement for the Australian sheep industry.

After joining the Animal Genetics and Breeding Unit in 2006 he has played a central role in advancing the MERINOSELECT and LAMBPLAN evaluation systems, contributing to the introduction of genomic evaluations from 2013, and the development of indexes to improve the profitability of commercial Merino, dual purpose, and meat focussed sheep enterprises. Andrew especially enjoys working with ram breeders and sheep producers, and has had a long-term involvement in Merino sire evaluation, both as a technical advisor to the Australian Merino Sire Evaluation Association and as a committee member of the New England Merino Sire Evaluation Association.

Summary of presentation
Successful breeding programs underpinned by the LAMBPLAN and MERINOSELECT evaluation systems have led to substantial genetic change in the sheep industry over the past 30 years. These changes have allowed sheep producers to improve productivity, product quality and profitability in the face of declining terms of trade.

The advent of genomic testing for sheep has the potential to increase the rates of genetic gain above those that have been achieved in the past, which means that it is vital to ensure that breeding objectives remain appropriate – poor choices in objectives can lead to detrimental impacts occurring at a more rapid rate for example.

We contend that breeding objectives of the future need to be based on “triple bottom line” business principles, considering social, environmental, and financial aspects of commercial sheep enterprises.

The important social factors are increasing community awareness of animal welfare standards and demand for ethically produced food and fibre. Key issues for genetic improvement programs which can be addressed with ASBVs currently or soon to be available are: reducing neonatal mortalities, with the new reproduction analysis splitting net reproduction rate into its components thereby allowing a better balance in improvement between prolificacy and lamb survival to weaning; breeding mules-free Merinos without compromising wool production and quality; and improving genomic predictions for diseases including internal parasites and footrot in addition to immune competence. Other health and welfare problems which can be investigated further through projects such as AWI’s Merino Lifetime Productivity project include weaner and breeding ewe survival and efficiency.

The major environmental issue for sheep breeders will be how to respond to the challenges of climate change, with ongoing selection for productivity a key adaptation strategy. While selection for production in the current environment will remain fundamental, additional focus on traits such as heat tolerance, response to increased environmental variation, and potentially new pests and pathogens will also require investigation. Improving the financial performance of sheep enterprises has been a primary focus of breeding objectives used over the past 30 years, and must remain so in the future.

The traditional goals of increasing output per unit of input while improving product quality are a given, and the recent adoption of lamb eating quality breeding objectives for terminal sires supported by genomic predictions for meat traits is an example of what can be achieved in this regard. Recently developed indexes for maternal sheep breeds also address cost of production, aiming to limit the genetic trends observed in mature ewe size while minimising the impact on lamb growth rate. This change addresses rising feed costs in the breeding ewe flock and not insignificantly sheep handling issues (which are also welfare related).

In summary, future genetic improvement will be enhanced by improved breeding objectives and selection indexes which address the triple bottom line for sheep enterprises, supported by genomic reference populations to deliver accurate ASBVs for hard to measure traits. The key to success for ram breeders will be to focus appropriate recording strategies and selection on an index targeting the breeding objective as accurately as possible. This will mean measuring as many of the index traits as possible, in combination with genomic testing.

Clearly there is a wide range of opportunities to collect data that could be used as part of a reference population, but the value of this data varies to a large degree. MLA is currently supporting a number of projects across the beef and sheep industries to continue growing reference populations, but also to evaluate the use of data from these different sources. It is likely that the long term solution will be a combination of all of the categories outlined. The balance between them will depend on their relative value.
From a breeder’s perspective, the size of the reference populations continues to grow. This means that the accuracy of genomic predictions continues to improve as does the contribution that genomics can make to your breeding program. However, it is important to keep in mind that the phenotypes that you record in your flock will form part of the reference population that is used in the analysis.

The value that these phenotypes contribute to the analysis depends on the quality of the information. It has always been the case that the quality of your data impacts not just on the accuracy of ASBVs for your own animals, but also the accuracy of ASBVs for animals with pedigree links to your animals. In addition to that your data quality now has an impact on all animals where there has been a genomic relationship identified.

Data quality is more important than ever.

**Notes**
A RESOURCE FLOCK OF THE FUTURE

Hamish Chandler Program Manager – Genetics, MLA

Biography
Hamish Chandler completed a Rural Science degree at the University of New England, Armidale, New South Wales, Australia in 1995. After completing his degree, Hamish worked briefly in the poultry industry and then the Artificial Breeding industry working with cattle and sheep. He then worked as part of the BREEDPLAN team which conducts Australia's national genetic evaluation for beef cattle for 5 years.

Hamish and his wife Leanne have owned and operated a farming business in the New England region of New South Wales since 1998. Today the business focuses on sheep breeding and cattle trading enterprises across 620 Ha.

Hamish started with Meat and Livestock Australia as the LAMBPLAN Project Officer in 2009 and went on to become the Sheep Genetics Manager in 2013 managing Australia’s national genetic evaluation for sheep. In 2016 he took on the role of Program Manager – Livestock Genetics within MLA. This role sees Hamish managing MLAs investment in genetics R&D and evaluation programs across beef and sheep.

Summary of presentation
By now we are all aware of the need for a reference population to underpin genomic prediction. The number of records in the reference population, the quality of those records and the genomic relationship between our animals and those in the reference determines the accuracy of our genomic predictions.

We know that a reasonable accuracy of prediction requires a reference population of at least 2000 to 5000 animals, depending on the heritability of the trait of interest. We also know that, as genes in the population change over time by recombining to produce new sequences, we need to continually add to our reference population in order to maintain the required accuracy of prediction. It has been estimated for moderate heritability traits that we need to add between 400 and 500 animals with records to our reference population per year to maintain our existing prediction accuracy for that population.

Therefore the question that we need to ask is not should we maintain a reference population, but how do we maintain a reference population into the future?

There are a number of options for collecting reference population data and the introduction of a single-step analysis for Sheep Genetics evaluations over recent years makes it easier to incorporate data from these different sources. The challenge is that for each of these different options there are different factors affecting data quality and therefore accuracy of the resulting genomic predictions. This in turn has a significant impact on how cost effective each option is.

The broad categories for these options are:

• Structured projects – Populations established specifically for the purpose for capturing reference population data, such as the Resource Flock or the BINS used in the beef industry. These projects typically supply good quality data for a wide range of traits through to the hard to collect and novel end of the scale. However, they are limited in the number of records that they can capture and are relatively expensive to support on a per animal basis.

• Breeders’ flocks – In a single-step genetic evaluation any animal that has both a genotype and phenotype forms part of the reference population. The phenotypes for these animals are often being collected independently of the need for a reference population and as such should be cost effective. However, the traits recorded are usually limited to the relatively easy to measure. Data quality has the potential to be good, but is dependent on the attention to detail in recording fixed effects and management groups.

• Commercial industry – There is a large volume of data that could be utilised from commercial breeders’ flock, processors and potentially other parts of the supply chain. This data is likely to be much cheaper on a per unit basis than other options. However, the value that we can get from this data will commonly be limited by data quality. In many cases fixed effects such as age, age of dam or birth type cannot be accounted for and management grouping over the life of the animal is unknown. The lower quality of this data means that many more records are needed to deliver the same accuracy of genomic predictions. Figure 1 shows how many additional records are needed to provide the same accuracy of prediction for a lower heritability trait. If lower data quality leads to the derived heritability being lower, in this example 15% instead of 30%, the number of records needed in the reference to maintain the same accuracy doubles.
A BREEDER’S ROLE IN THE NATIONAL ADOPTION PLAN

Clara Bradford National Adoption Manager – Genetics, MLA

Biography

Clara completed a Bachelor of Animal Science at the University of New England including an honours project investigating treatment alternatives for nitrite poisoning in sheep. During university she gained experience in many industries, working on orchards, feedlots, sheep, cattle and cropping properties. Clara was also selected as a member of the 2014 Australian National Meat judging team, travelling to the USA to compete and experience a unique industry tour.

Clara grew up on a small property in the country town of Scone NSW. Growing up she was highly involved in the horse industry working and competing in many disciplines over the years. She attended St Josephs High School where she developed a passion for agriculture. After school she sought the ultimate outback adventure travelling to a remote cattle station in the Northern territory to work as a jillaroo.

In Clara’s spare time she enjoys riding horses, fishing, touch football, travelling and spending time with friends and family. Clara started with MLA in 2016 as the LAMBPLAN Development Officer before moving into her current role as Genetics Adoption Manager last year.

Summary of presentation

Key points

- Adoption is a priority for industry and MLA; without adoption of genetic tools and technologies, rate of genetic gain and ultimately productivity will be limited in the Australian sheep industry.
- The MLA Genetics Adoption Strategy provides the initial pathway for industry to overcome the barriers to adoption.
- Industry leaders (including yourself) have a responsibility to support key tactics from the adoption plan and drive adoption where they can.

The National Livestock Genetics Consortium, initiated in 2016, set the goal of doubling the annual rate of genetic gain in the commercial livestock value chain by 2022. In order to achieve this goal, adoption of genetic technologies and tools is a key priority.

Advancements in genetic technologies and tools has led to an increase in genetic merit and more importantly an increase in the annual rate of genetic gain in both beef and sheep over the past decade. Across all three sheep analyses since 2000, the average rate of gain has increased from one to three index points per year. The leading flocks and herds have driven genetic gain in industry so far, however there is opportunity to increase the rate of genetic gain across the broader industry and ultimately improve on farm productivity by increasing the adoption of genetic technologies and tools. The adoption of these technologies and tools in the remaining majority of the industry has been mixed, and even declined in some sectors. In an ABRI report (2015), only 24% of northern studs were committed to BREEDPLAN and over half have never recorded or ceased recording. Similarly, whilst the number of MERINOSELECT rams as a total proportion of all rams sold has grown over the past 11 years (from 24% in 2005 to 34% in 2016), the majority of the Merino industry are either not providing or requesting rams with Australian Sheep Breeding Values (Sheep Genetics, 2017). Hence, a key ingredient to lifting the rate of genetic gain across the industry is increasing the utilisation of genetic tools in industry. Or simply put, Adoption.

The influence of sheep breeders

Historically, majority of the adoption efforts have focused on encouraging stud breeders to record and be a part of genetic evaluations. Whilst this has been important, a significant proportion of the commercial sector have not adopted the technologies and tools available. This is for a variety of reasons including the lack of value proposition or adopting the complex language. A shift in focus to the commercial sector aims to drive demand or ‘Pull’ for animals with breeding values rather than a ‘Push’ approach. This will ultimately create greater demand for good genetics and improve the genetic gain of the entire industry.

It is vital for industry to have Genetics Champions, and those Champions are here at Leading Breeder 2019. Many commercial producers value the knowledge of their fellow producers, especially seedstock producers that are so passionate about breeding the best performing animals in industry. As leading breeders and consultants, you have the unique opportunity to connect and engage with commercial producers, educate, share knowledge and point them to the resources developed as part of this strategy (detailed in the presentation). Your ability to demonstrate the value of genetics, introduce the notion of objective selection and deliver superior genetics are valuable assets to the genetics adoption strategy.
The Genetics Adoption Strategy, based on all available research, recommendations and surveys focuses on employing tactics to overcome key adoption barriers. The strategy has four main pillars:

- **Demonstrate value and grow demand**
- **Pathway to learning**
- **Simplify the language and tools**
- **Align adoption and R&D**

Aligning with these four pillars, MLA is currently developing:

- A genetics marketing campaign due to be released in April 2019. This includes advertisements, articles and case studies
- New Resources including ‘how to’ videos, new website and ‘tips and tools’ sheets
- Developing new pathways to learning including the coordination of the genetics network
- Research & Development (R&D) into novel ways to display breeding values
- Involvement in the implementation of adoption strategies in R&D projects (including MerinoLink DNA Stimulation Project)

All of the new marketing campaign materials will be housed on a central website genetics.mla.com.au, which aims to direct commercial producers to be enlightened of the commercial benefits of genetics, and learn how to take the first steps. The first series of information is to provide producers with the value proposition of breeding values, followed by a second series of information to take the first steps to implementing breeding values in their production system. Make sure in April you check it out!

The genetics network is the most important and an ongoing tactic in the strategy. So far, MLA has targeted service provider networks in beef and sheep, providing up to date information about genetic evaluations, what R&D is on the horizon and a platform for networking and knowledge sharing. As the genetics network develops, leading breeders will be a central conduit for advice to the commercial sector.

Bringing R&D and adoption together will underpin the success of many new technologies. As leading breeders, you can demonstrate and collaborate with your commercial clients when adopting these new technologies. This includes developing projects and strategies where seedstock and commercial sector are both involved.

MLA is committed to doubling the rate of genetic gain across the commercial livestock value chain and that the Genetics Adoption Strategy will help guide industry to achieve this goal. However, this is not possible without contribution from leading breeders like yourself. Please reach out to anyone within the MLA Genetics team if you have any feedback, ideas to address the four pillars of the strategy or have a project in mind.

**Notes**