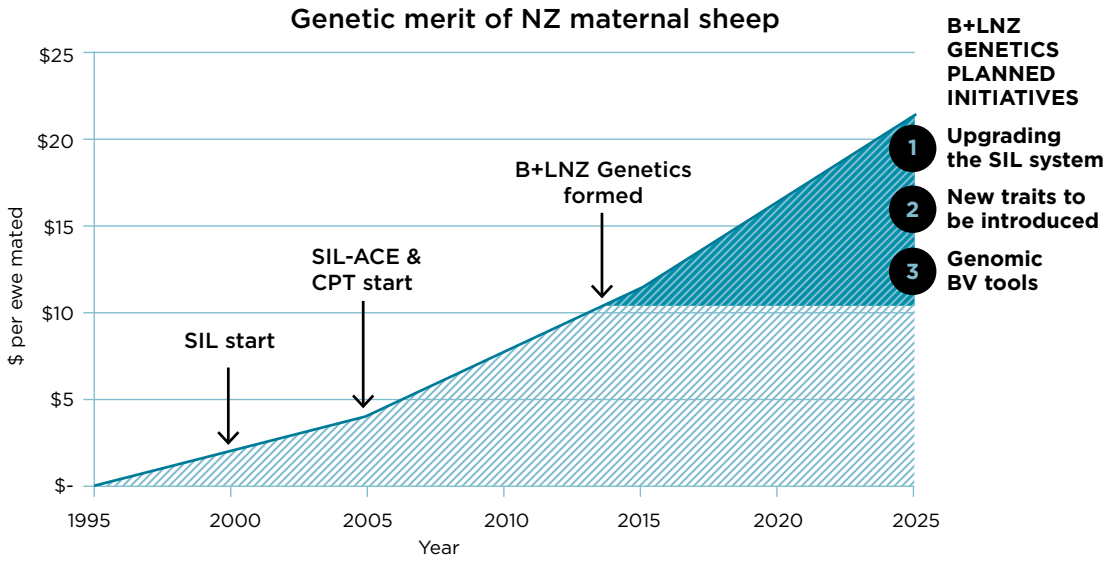
RESEARCH AND DEVELOPMENT 2015

GENETICS DELIVERS DOLLARS

If you're a farmer with a 3000-ewe flock and you've been buying SIL-recorded rams since 1995, then you have gained about $255,000 via increases in genetic merit[1].

Here's the proof



This graph starts in 1995 – five years before SIL was introduced. Note the kink in the blue line at 2005, where the black arrow points to the start of SIL's large across-flock evaluation SIL-ACE and the Central Progeny Test (CPT). These two tools clarified a ram's ability based purely on his genetics, not his environment. Breeders were quick to recognise the power of these tools.
The dollars tell the rest of story:

- **In the 10 years before SIL-ACE and CPT, genetics added $2-$4/ewe**
- **In the 10 years immediately after, genetics added $7.50/ewe**

The bottom line

These B+LNZ Genetics developments will compound on-farm gains, so that the farmer of that 3000-ewe flock stands to gain another $104,000 more value over the next 10 years.

What now?

There is another $10/ewe ahead of us over the next 10 years. How?

1. **Upgrading to the SIL system** and introducing a single, more powerful national evaluation to provide breeders with even better data, so they can reach their objectives more quickly and deliver faster progress to commercial farmers.
2. **New traits are being introduced** that are strongly correlated to commercial farmers' returns, such as stayability, body condition score and carcase value.
3. **Genomic BV tools** will provide breeders with a crystal ball into the future performance of progeny before an animal is mated, fast-tracking genetic gain by years.

1. Jude Sise, AbacusBio

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In collaboration with:

INDUSTRY SNAPSHOT: WHAT DOES NEW ZEALAND'S SHEEP FLOCK LOOK LIKE?

29.6 million
sheep

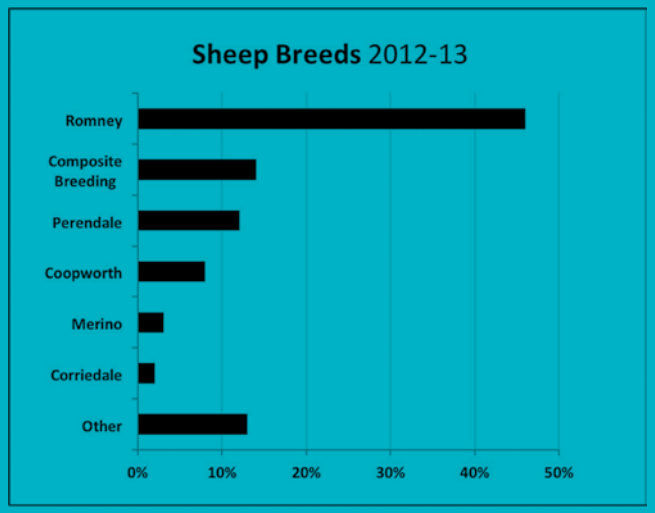
49%
North Island

51%
South Island

Total sheep numbers at 30 June 2014 were 29.6 million, a decrease of 25% compared with 2004. When comparing livestock numbers by region 49% of sheep are located in the North Island and 51% of sheep in the South Island.

19.7 million
breeding ewes

Of the 29.6 million sheep, 19.7 million were breeding ewes and 9.8 million were classified as ewe hoggets, dry ewes, wethers and rams.



The major breed in the North Island and southern districts of the South Island is the Romney. Corriedale and Halfbred sheep are mainly found in Canterbury, Malborough and parts of Otago.

WHAT MATERNAL (DP) FLOCKS MEASURE

386 active flocks

SIL Goal Trait Group	Flocks	Animals
DNA Parentage	6%	15%
Reproduction	99%	99%
Lamb Survival	92%	94%
Lamb Growth	100%	100%
Adult Size	64%	70%
Meat Yield	60%	62%
Wool production	68%	84%
Facial Eczema Tolerance	13%	18%
Worm resistance (WormFEC)	10%	13%
Worm resilience	3%	3%
Dags	7%	10%
Bareness	1%	2%

Almost all flocks measure Reproduction, Lamb Survival & Lamb Growth. The majority are measuring two or more of Adult Size, Meat Yield or Wool production. Health traits are measured by a minority of maternal ram breeders.

WHAT MEAT (TS) FLOCKS MEASURE

257 active flocks

SIL Goal Trait Group	Flocks	Animals
DNA Parentage	5%	15%
Reproduction		
Lamb Survival	95%	95%
Lamb Growth	100%	100%
Adult Size		
Meat Yield	84%	92%
Wool production		
Facial Eczema Tolerance	1%	0%
Worm resistance (WormFEC)	1%	1%
Worm resilience	0%	0%
Dags	2%	5%
Bareness	0%	2%

Most Terminal or meat flocks are measuring Lamb Growth, Lamb Survival and Meat Yield. Health traits are measured by just a few flocks.

**These figures have been sourced from Beef+Lamb New Zealand Economic Service*

INDUSTRY SNAPSHOT: WHAT DOES NEW ZEALAND'S CATTLE HERD LOOK LIKE?

As one of its first activities, B+LNZ Genetics commissioned a report on the genetic structure of New Zealand's cattle herd. A model was developed which pieced together the known cattle statistics to infer an overall picture of New Zealand's herd.

880,000
beef calves

3,560,000
dairy calves

600,000
beef x dairy calves

Across New Zealand there are approximately 880,000 beef calves, 3,560,000 dairy calves and 600,000 beef x dairy calves born every year.

10,000
new bulls every year

The beef cow herd requires approximately 10,000 new bulls every year. Most of these bulls can be provided by the top 50% of bull calves born in recorded herds*

**Approximately 36,000 heifer and bull calves are recorded per year via PBBNZ*

If each natural service bull used in the dairy industry mates 30 cows (using yearling bulls once), the dairy herd currently uses approximately 28,000 beef bulls and 47,000 dairy bulls. The significant majority of these bulls are un-recorded for beef traits.

Of the 600,000 beef x dairy calves born, approximately 415,000 are finished, with a further 20,000 kept as beef breeding cow replacements.

An additional 630,000 beef steers and heifers (from the beef cow herd) are finished each year, along with 400,000 beef and dairy bulls.

Just under 1 million cull cows are killed each year, with approximately 15% of these being beef cows and 85% dairy cows.

An approximate estimate of farm-gate value for different stock classes (and excluding bobby calves) gives a picture of:

- 35% finished beef x beef cattle
- 22% finished beef x dairy cattle
- 22% dairy bull beef
- 5% cull beef cows
- 15% cull dairy cows

INTRODUCTION

In our first year in operation, Beef + Lamb New Zealand Genetics has been strongly focused on identifying the genetic tools that are most valuable for New Zealand farmers.

This reflects that:

We exist to help farmers make the most profitable breeding choices for their operation

We want to make breeding decision-making among the most valuable decisions on-farm

We commit to developing easy-to-use selection tools to achieve this

In doing so we've been very aware that when it comes to knowledge of genetics, most commercial farmers are less informed than breeders. If we are to help accelerate genetic gain across-the-board, we need farmers to be as well informed as possible. We want farmers to have the best possible conversations with breeders as they integrate their genetics with evolving management programmes.

As a result we've developed the *Genetic Cornerstones*. *Genetic Cornerstones* covers the broad principles behind applying genetics to a farming operation, and our progress in developing the necessary tools for this. The sort of questions we want farmers to ask themselves as they assess *Genetic Cornerstones* are:

1. Do I want more from my animals' performance, and in what areas in particular?
2. When did I last make a significant decision that changed my animals' breeding values and characteristics?
3. Did that decision reflect or complement changes to my broader farm management strategy?
4. Are other, external, developments affecting what I need to achieve from my animals?
5. In light of the above, have I developed a genetics strategy with my current ram or bull breeder?

The *Genetic Cornerstones* are still under refinement – we plan to distribute them to all farmers within a couple of months. We trust you find this content thought-provoking and, of course, would like to hear if you have any feedback.

Any comments can be made to me directly or by email on graham.alder@blnzgenetics.com.

All the best

Graham Alder
General Manager
B+LNZ Genetics

The Genetic Cornerstones

If we're honest, few farmers can ask themselves these questions and say; "sorted!". Apart from anything else, there's seldom a finite end-point in the game of genetic gain. Below are what we believe to be the four foundation 'genetic cornerstones', including pointers for farmers and snapshots of B+LNZ Genetics progress in each area, from *conceiving* (initial planning) through to *refining* (fine-tuning existing services).

SOURCING INFORMATION

1 **DISTINGUISHING HERITABLE PERFORMANCE THAT IS PASSED ON**

2 **ONGOING, RELIABLE ASSESSMENT OF GENETIC MERIT**

APPLYING TO FARM GOALS

3 **ALIGN BREEDING VALUES TO FARM MANAGEMENT AND GOALS**

4 **ACHIEVE ONGOING GENETIC GAIN**

DISTINGUISHING HERITABLE PERFORMANCE THAT IS PASSED ON

Non-genetic factors have a bad habit of skewing decision-making away from the most important factor in ram or bull selection – **the potential of offspring**. A highly rated ram for genetic potential for lambing percentage, for example, might have been born a single. Or an animal highly rated for growth might have had a slow start as a triplet. Or, a bull could have great genes yet its productivity is permanently compromised by adverse events early in life. Favourable rearing and feeding can also inflate an animal's own performance but won't affect its progeny's potential. These are all non-genetic biases and we need to be very wary of them!

Non-genetic effects also vary between farms, between years and between animals within a flock within a year. When estimating genetic potential we need to see past non-genetic effects as much as possible – **hence the importance of estimated breeding values**.

POINTERS

- Buy rams or bulls based on the best estimates of the potential of their offspring using estimated breeding values (eBVs). You may have to assess some traits yourself where there isn't an EBV, e.g. structural soundness.
- The biggest animal on offer may not carry the best genes for growth. He may be the offspring of a mature mother with plenty of milk, born early in the season and experienced less disease challenge than that of other animals.
- Check that the genetic evaluations behind the eBVs are based on all relevant available information (across flock evaluation carries more power than simple within flock evaluation, for example).

ONGOING, RELIABLE ASSESSMENT OF GENETIC MERIT

Genetic engines used by SIL and Breedplan remove considerable bias in estimating genetic merit. They take into account such things as the age of a mother and the fact one animal was born earlier than another, and (in the case of sheep) as a single or as a multiple. It also helps by favouring an average animal from a very good family over the best animal from an average family. Although it's almost impossible to get 100% accurate parentage on all lambs and calves born using field recording, new DNA tools are helping ensure near 100% accuracy for parentage. Bias in genetic information can also be reduced if there are good genetic connections between flocks or herds, built by usage of common or link sires. This sort of good connection is imperative for breeders to benchmark their own progress and for sourcing outside genetics to maintain progress in their own breeding programmes.

POINTERS

- Seek out ram or bull breeders who record performance in the traits you want to improve, and who can provide estimates of genetic potential derived from measured performance data, or from DNA tests for key traits. Generally those using full DNA parentage testing can supply more accurate genetic information.
- Clearly identify those traits you know you can get BVs for and those that you can't such as structural soundness (your ram or bull breeder will be able to assist with both).
- Well-connected flocks or herds (built on usage of common sires with other flocks or herds) rather than breeders solely breeding from within their own herd or flock can provide the best genetic information.

ALIGN BREEDING VALUES TO FARM MANAGEMENT & GOALS

Our aim is to help you match your farm goals with directly comparable breeding values (such as carcase weight by a certain date; lambing percentage; lamb survival). Keep in mind that change isn't *always* good – it's only good if you're not where you already want to be. For example there may be no benefit in pushing lambing beyond 180% if that compromises other traits or makes management more difficult. So the genetic goal for some traits may be "no change". Consider, too, that good farm management obviously depends on integration of changes to genetics with other systems e.g. pasture management, subdivision, crops, and health regimes. Genetics is not a silver bullet providing the sole route to performance improvement.

Remember, heritability varies from trait to trait. The number of lambs born, for example, has low heritability, while carcase attributes have relatively high heritability.

POINTERS

- Identify the traits you are seeking to improve and the degree of improvement you want from these traits.
- Consider other non-genetic based initiatives on farm (new pastures, subdivision etc.) to ensure they complement your genetic goals.
- Ensure your ram or bull breeder's improvement programme is aligned with yours. Your feedback is important to the success of their business so give your breeder a clear understanding of your needs.
- Assess your breeder's genetic gain trend line for traits important to you
- Identify the traits that may be important to you and which cannot be measured genetically (e.g. structural soundness) and work directly with your breeder on these.

ACHIEVE ONGOING GENETIC GAIN

It's often said you can't manage what you can't measure – and for good reason! You know the BVs of the animals you are buying and where they sit in industry percentile band tables. It's now a matter of; (i) ensuring future ram or bull purchases continue to advance the gain you want and that; (ii) you're measuring the benefits on farm with minimal bias. To minimise bias from measures of your animals' performance on farm it's important to look at longer-term average changes because even over three years climatic factors can have a distorting effect. It also means matching genetic change with changes in management - better subdivision, better grazing management or more strategic use of fertiliser to exploit improved genetic potential.

POINTERS

- Look at the performance of your own flock or herd against appropriate industry benchmarks i.e. for similar farm types.
- Assess your rate of genetic change against industry averages and monitor change in relation to the targets you've set.
- Work closely with your ram or bull breeder to understand that your respective strategies for genetic gain are taking you both in the same direction. Ask for genetic trend graphs to assess this.

B+LNZ GENETICS INITIATIVES

DISTINGUISHING HERITABLE PERFORMANCE THAT IS PASSED ON

Breeding values (BVs) for important traits
Providing information on the traits ram and bull breeders are performance recording to guide farmers to breeders who are focused on improving the traits that are most important to their farm management and goals.

Maternal traits

Facial excema phenotyping

Meat yield

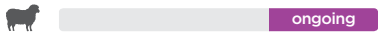
NZ beef genetics database

Feed efficiency phenotyping

One source of genetic information
Improving the accuracy of SIL BVs by conducting all-SIL flock evaluations weekly, that remove non-genetic effects as far as is possible.

SIL evaluation upgrade

Connecting industry sires



Integration of DNA into genetic evaluation systems

New traits related to farm profit
Introducing new traits to more completely define genetic merit as it affects farm profitability, including maternal longevity, maternal body condition score, and refining the breeding goals for carcase merit.

Body condition score

Longevity

Carcase merit parameters

ONGOING, RELIABLE ASSESSMENT OF GENETIC MERIT

Increasing accuracy of genetic information
Promoting best practice in the management of breeding flocks and in the collection of performance data.

Breed effects

Best practice performance recording

Data capture

Strengthening genetic comparisons across populations
Building genetic connectedness through support of industry progeny tests and co-operative sire referencing schemes.

Central Progeny Test (CPT)

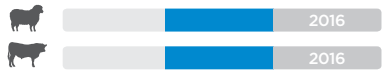
Beef Progeny Test (BPT)

Accounting for the effect of the environment in genetic evaluation
Removing biases in genetic evaluation caused by environmental effects.

Environmental effects

DNA to increase accuracy of genetic information
Increasing the accuracy of pedigree in breeding flocks and herds without having to DNA test every animal. At the same time, increasing the accuracy of breeding values earlier in the life of animals.

Genomics



Gene discovery

Lower cost DNA tests

ALIGN BREEDING VALUES TO FARM MANAGEMENT AND GOALS

Linking genetics to farm goals
Developing tools that align farm goals with available estimates of genetic merit such as FlockFinder, a tool for a farm's genetic plan and benchmarking of flocks/herds.

Farm Genetic Plan

Promoting use of total profit breeding objectives
Encouraging the assessment of performance in all key traits for a given animal type, which means buying from breeders who are measuring all key traits.

Economic evaluation

Indexes relevant to farm management goals
Developing tools to help those who want to improve some traits while holding others at an optimum for their situation e.g. fatness (body condition), maternal size or litter size in sheep. This means new indices that ensure farmers don't 'overshoot' the optimum level for any particular trait.

Updated Indexes

Easy-to-use industry standard indexes
Promoting use of standard indexes together with a small set of key, marker BV traits, keeping genetic information simple, relevant and easy to use.

NZ standard indexes

ALIGN BREEDING VALUES TO FARM MANAGEMENT AND GOALS (CONTINUED)

Online tools to aid ram and bull purchases
Developing decision support tools to aid ram or bull purchases. This enables benchmarking of actual flock or herd performance against its genetic potential and considers defined performance targets.

Apps & API (SIL tools)

ACHIEVE ONGOING GENETIC GAIN

Breeders' genetic progress
Seeking information that shows the genetic progress a ram or bull breeder is making. This will demonstrate they are delivering on a breeding programme that can give ongoing value.

Breeder metrics

Investing in New Zealand's genetic capability
Increasing academic resources to encourage and train future genetic specialists through supporting academic teaching and graduate students.

DEVELOPMENT PHASES - KEY

QUICK FACTS

Whangara Farms is based 30 kilometres north of Gisborne and is managed by Richard Scholefield.

It totals 7100 hectares and supports 70,000 stock units.

Its sheep and beef operation includes 32,500 ewes and 6000 cattle. The two beef breeds on the farm include Angus and Simmental.

Whangara Farms operates as a partnership between two Maori incorporations; Whangara B5 and Pakarae. The two neighbouring farms joined in 2006.

Whangara Farms, Gisborne

The beef progeny test involves artificially inseminating 400 cows from Whangara Farm's A-herd. At the core of the project is looking into bull Estimated Breeding Values (EBVs) and whether utilising them results in more animals in specification through the Beef^{EQ} grading system, run by Silver Fern Farms, as well as better female productivity. They are also looking at whether artificial insemination (AI) is more effective than traditional methods at producing progeny of high specification. Alongside the test cows, Whangara Farms continues to run a traditional breeding system. "That is where some real comparisons can be made right before our eyes – they are in the same environment with the same feed and same conditions," says Richard.

beef+lamb new zealand GENETICS | BEEF PROGENY TEST

"I operate in a very traditional East Coast area, where EBVs are frowned upon. For me, I'd like to show farmers that you can increase your beef cattle performance by selecting higher EBVs for certain characteristics."

RICHARD SCHOLEFIELD, WHANGARA FARMS MANAGER

Maternal ewe traits

Breeders with suitable data will get eBVs for ewe body condition score (BCS) and stayability (STAY). Stayability is how long ewes stay in the flock. It can be thought of as '*productive longevity*'. SIL developments include genetic evaluation modules for both traits. For BCS the trait is defined at the time of mating, but can be recorded at other times in the year. Stayability uses existing records to estimate an exit time of a ewe, but can be improved by recording exit codes for animals.

Contributors: Michael Lee, Neil Cullen & Sheryl-Anne Newman (AgResearch); Peter Amer, Tim Byrne & Bruno Santos (AbacusBio), Sharon McIntyre (SIL)

Getting BVs for ewe stayability (STAY) and body condition score (BCS) into SIL – a stayability module is now on SIL and a BCS module in progress for 2015.

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Economic indexes

This project involves modelling farm systems to estimate the economic value of new traits that will be added to sheep and beef breeding objectives (e.g. condition score and stayability). Outcomes look to provide faster and greater economic gain through:

- More focus on maternal performance including robustness
- More relevant and NZ-centric selection indexes for flocks and herds.

Contributors: Tim Byrne and Peter Amer (AbacusBio)

Develop breeding objectives and selection indexes to better describe farm profit in hard country.

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SIL meat module

The project aims to provide clear direction for the genetic improvement of carcass merit and allow breeders to integrate data on carcass merit (from processing plants) into their breeding programme. It involves working with meat processors to develop a SIL module that can use data from multiple sources to deliver robust meat EBVs. A year of data has been collected across 25 sires and 240 progeny using live CT, ultrasonic, VIAscan, carcass CT and some dissection

Contributors: Alliance Group Limited, Neville Jopson, Nadia McLean (AbacusBio); Wendy Bain, Chris Cowie, Sheryl Newman (AgResearch); Mark Young (SIL)

Developing next generation breeding goals for carcass merit, including a new SIL meat module that can use meat measurements from any source and deliver consistent EBVs.

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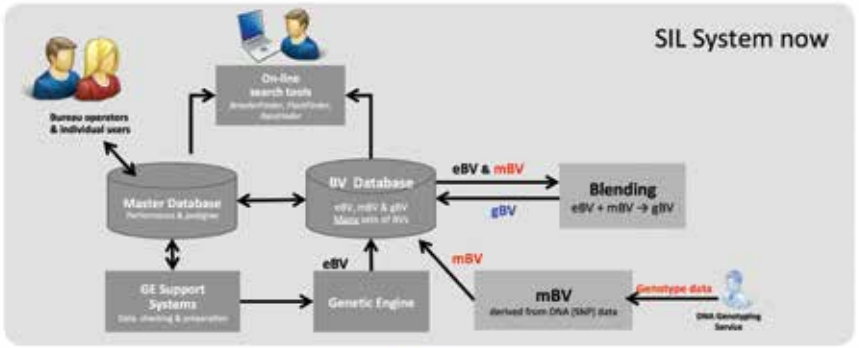
Supercharging SIL genetic evaluation

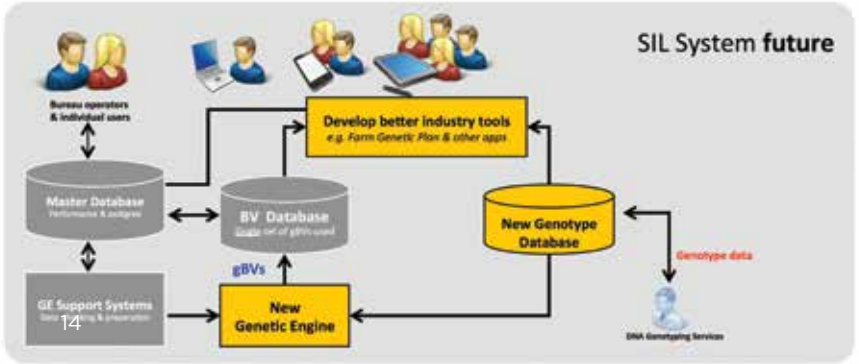
This involves an updating genetic evaluation software and optimising analysis. Pedigree, performance and DNA data will be combined into one evaluation, more processes will be automated and improvements made to the system dataflow.

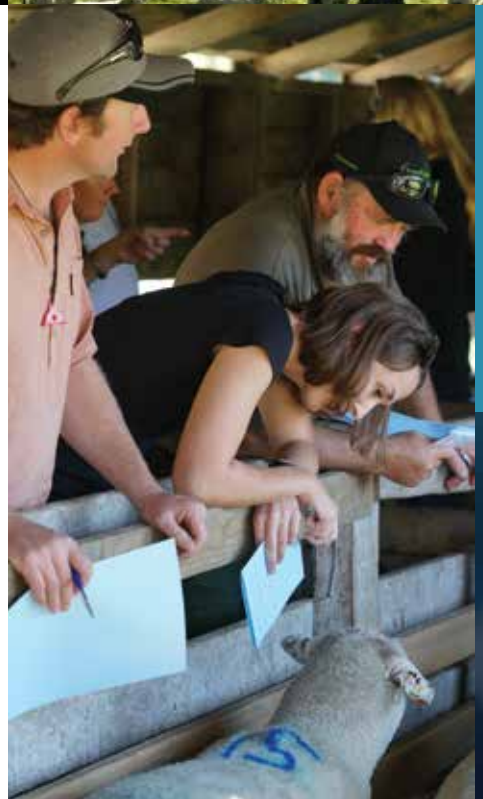
A single national genetic evaluation will give:

- More accurate & robust BVs
- More focus on use of genetic information
- Faster genetic progress!

Contributors: Sheryl-Anne Newman and Benoit Auvray (AgResearch), John Davys (Rezeare Systems), Mark Young (B+LNZ Genetics)







To eliminate variation in BVs from many different evaluations and increase power and speed to run one, all-SIL evaluation, weekly.

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SIL Genetic Engine

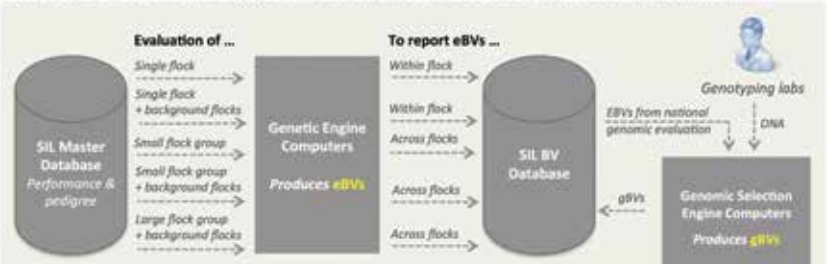
This project involves the development of a new state-of-the-art genetic engine for SIL allowing fast and efficient use of DNA information to generate genomic breeding values in a single analysis step. The new genetic engine will be linked to the SIL master pedigree and performance database and the future SIL DNA database. It will replace the multiple current SIL evaluations with a single weekly national genetic evaluation using the new genetic engine.

Key benefits of the upgrade are:

- One evaluation, so no variation between different sets of BVs
- Most accurate BVs estimated
- Leading to faster genetic gain.

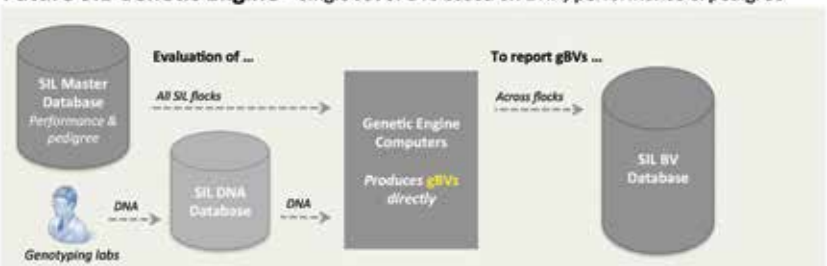
Contributors: Benoit Auvray, Sheryl-Anne Newman, Michael Lee, Ken Dodds and Fiona Hely

Current SIL Genetic Engine – Various different sets of BVs exist for the same animal



SIL-ACE = SIL largest across flock eBV evaluation – 350 flocks, ~ 70% of SIL data – Run 2 monthly
SHEEPSK = gBV evaluation for animals with DNA information – 100 flocks – Run monthly

Future SIL Genetic Engine – Single set of BVs based on DNA, performance & pedigree



New SIL-ACE = national gBV evaluation, 100% of SIL data, including DNA information – Run weekly

The upgrade will see pedigree, performance and DNA information combined in a single, weekly national genetic evaluation – removing the need for many smaller evaluations.

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QUICK FACTS

Rangitaiki Station is a Landcorp Farming property, situated on the Napier-Taupo Road, and managed by Sam Bunny.

The station's 8350 effective hectares are nearly all flat and carry 83,000 stock units.

The cow herd is made up of 1400 head of Angus mixed-age cows and 380 rising-one-year-old heifers.

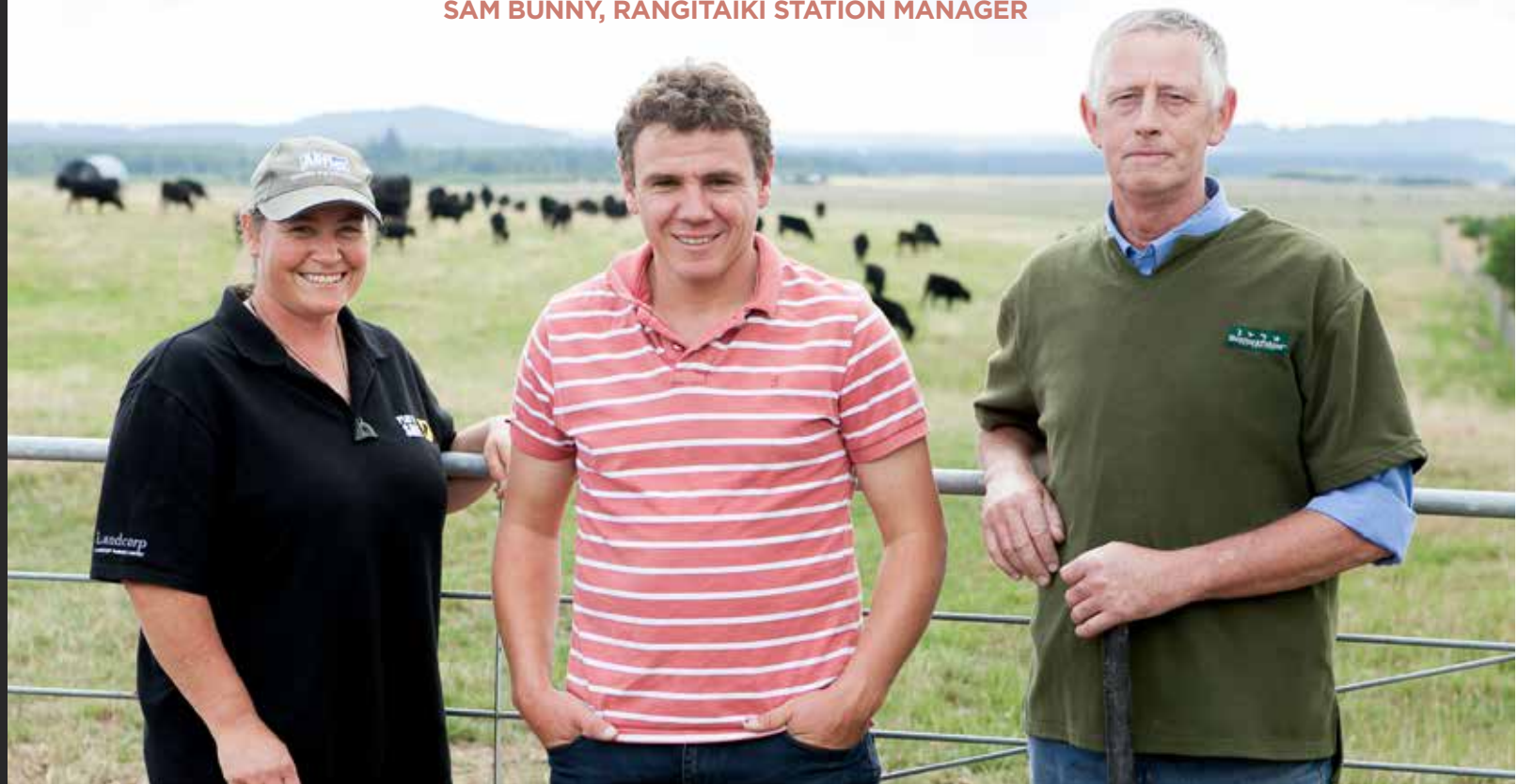
At 700 metres above sea level, cold hard winters dictate much of the farm's policy.

Rangitaiki Station, Taupo

The beef progeny test at Rangitaiki involves 400 of the cows and all 380 heifers. A range of Angus bulls are being used, in line with the station's breeding cow policy. In addition – with the large number of cows and heifers available – some were mated to Hereford and Stabiliser bulls, as alternative maternal breeds, and some cows were mated to Simmental bulls, as a terminal sire option. Rangitaiki Station manager Sam Bunny is overseeing the B+LNZ Genetics Beef Progeny Test on the property, the day-to-day logistics are handled by sheep and beef manager Kevin Stewart and finishing cattle stock manager Tracy Gage-Brown.

"I want to know whether more money spent on decent genetics pays off. Also – long term – observing whether the heifer replacements coming through make a difference."

SAM BUNNY, RANGITAIKI STATION MANAGER



beef+lamb new zealand GENETICS | BEEF PROGENY TEST

Central Progeny Test

B+LNZ Genetics Central Progeny Test (CPT) helps identify best genetics across sheep breeds. For farmers, this is valuable for informing ram selection. Established in 2002, the CPT evaluates progeny of industry leading, dual purpose and terminal rams across three lowland sites and two hill country sites. Growth and meat production is assessed for all sires, while maternal performance and disease resistance is assessed for dual purpose sires.

Contributor: Alliance Group Limited, Neville Jopson (AbacusBio)

Central Progeny Test sites

1. Poukawa, Hawke's Bay (L)
2. Koromiko station, Wairarapa (H)
3. Ashley Dene, Canterbury (L)
4. Onslow View, Otago (H)
5. Woodlands, Southland (L)

Providing vital genetic connections that broaden the world's largest across-flock, across-breed genetic evaluation service – SIL-ACE.

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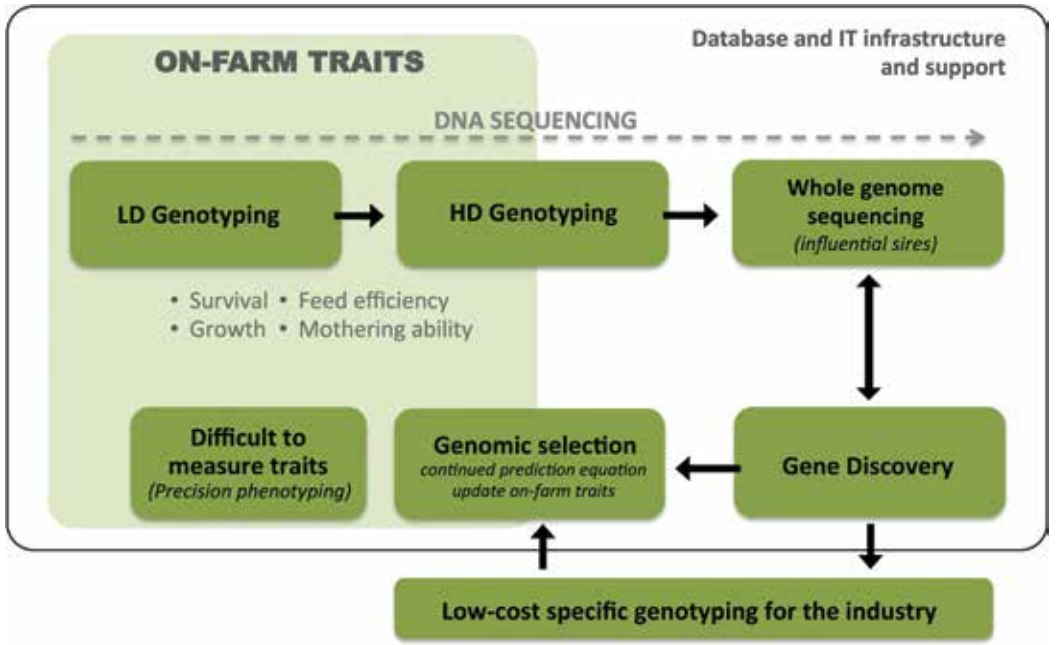
Sheep Genomics

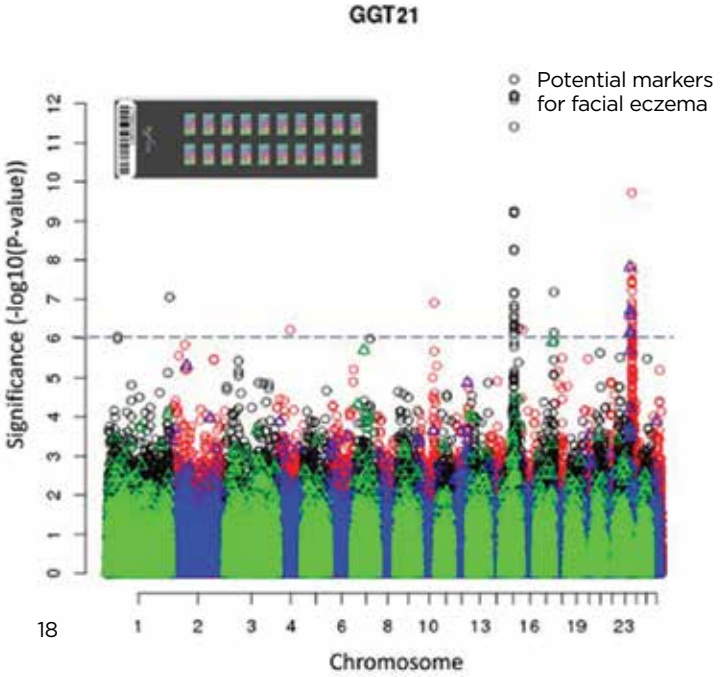
Research aims to deliver greater genomic discovery (causative mutations, genes and genetic pathways) for all traits of economic importance, a better understanding of the biology of the trait, more accurate gBVs and better persistence of accuracy across generations. A systematic pipeline will be developed for inclusion of all genotype data for efficient gene discovery and implementation into the industry. Trait information is collected via CPT and SIL databases, with a focus on maternal and on-farm traits.

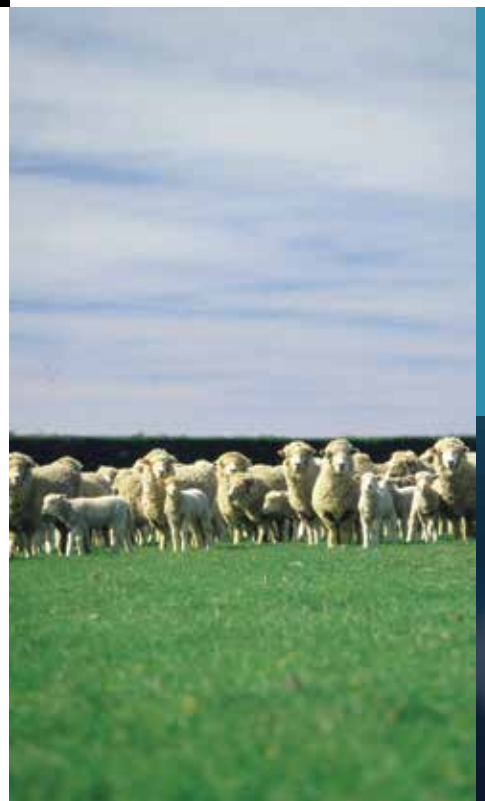
Contributors: Shannon Clarke and Suzanne Rowe (AgResearch)

GENOMIC TECHNOLOGY FOR MATERNAL AND ON-FARM TRAITS



GENE DISCOVERY FOR FACIAL ECZEMA





Generating data that feeds genomic selection and gene dicovery studies, whilst developing cost effective genotyping technologies that lead to more accurate marker-assisted selection.

beef+lamb new zealand GENETICS

Genotype by Environment interaction (GxE)

Research evaluates CPT sires over hill and low country sites and compares rankings to estimate GxE. Maternal traits from relevant commercial flocks are recorded to evaluate the use of commercial data to predict eBVs for breeding and to understand how to improve breeding for BCS and stayability. The performance of rams on commercial farms is evaluated in relation to the performance of ewes. EBVs from different farms, stud and environments will be compared and information used to improve ram breeding.

Contributor: Michael Lee (University of Otago), Anne Ridler (Massey University), David Robertson (The Veterinary Centre), Neville Jopson (AbacusBio)

Developing an infrastructure to evaluate animals in commercial environments. Providing more relevant EBVs, including EBVs for stayability and body condition score on commercial farms.

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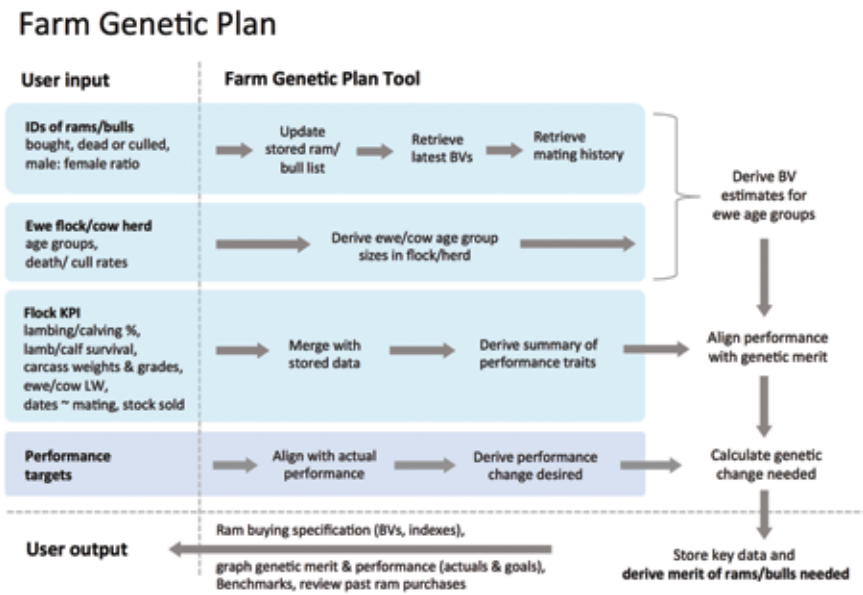
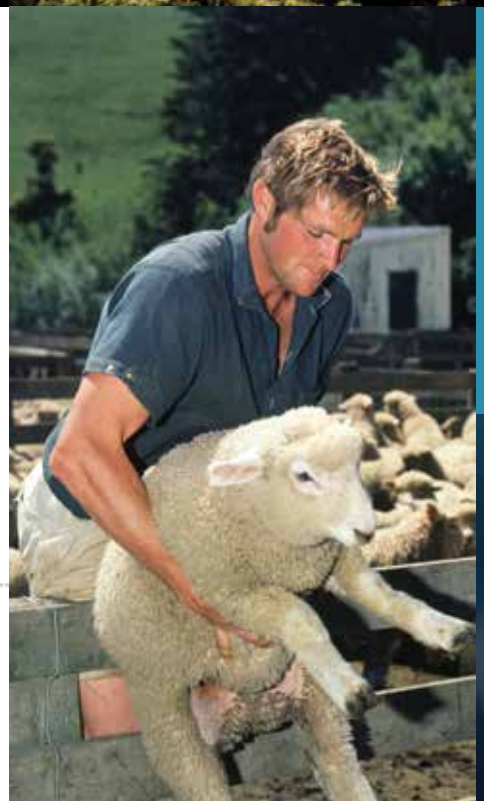
Matching Genetics to user needs

This project aims to inform future ram and bull buying decisions for farmers, by matching genetic merit of the ewe flock or beef cow herd to performance metrics and business objectives. This is achieved through;

- Aligning scales of genetic merit with farm KPIs and comparing to business objectives to identify the 'genetic gap'
- Developing tools that enable IDs to be entered for rams/bulls purchased, to estimate genetic merit of the flock/herd
- Produce specification for future ram/bull purchases

Contributors: Mark Young, B+LNZ Genetics





Helping sheep and beef farmers make more informed buying decisions and providing better feedback to breeders on industry needs.

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QUICK FACTS

Ngāti Kahungunu owned Tuatane Station sits on the North Island's East Coast near Pongaroa.

Effective area totals 3375 hectares; about 100 hectares in flats, two thirds in easy hill and the balance in steep, coastal hill country. Its eastern boundary is 12km of coastline.

Cattle support the sheep operation, which consists of 17,500 mixed-age Romney ewes and 5500 ewe hoggets.

Tautane is leased by Taratahi Agricultural Training Centre and is a training ground for young agricultural students.

Tautane Station, Hawke's Bay

The beef progeny test Involves artificially inseminating 383 of Tuatane Station's mixed-age cows in 2014/15 and again in the 2015/16 season. Bull genetics were selected to represent a broad range of types, from quite moderate bulls, through to bulls which have strong emphasis on carcass attributes. Tautane Station manager Matt Smith says accommodating the B+LNZ Genetics Beef Progeny Test on Tautane also serves an educational role, by exposing the young agricultural trainees to a large-scale genetics trial.

beef+lamb GENETICS | BEEF PROGENY TEST

"A lot of people are in one camp or the other – EBVs or type – when it comes to bull selection. I see room for both approaches and that's why Taratahi was keen to get involved in the Beef Progeny Test."

MATT SMITH, TAUTANE STATION MANAGER

Standard definitions of genetic merit

To develop new standards for the marketplace, with a focus on the concept of 'breeding worth'. Definitions developed will focus on the two main sheep types – maternal (dual purpose) and terminal (meat). Each rating of breeding worth will have a fixed set of standard traits with a small subset of key 'marker' BVs. (e.g. Lamb survival, Lamb Growth).

Contributor: Mark Young (B+LNZ Genetics)

NZ Maternal Worth	
SIL GOAL TRAITS	MARKER BV
Reproduction	**NLB**
Lamb survival	**SUR**
Lamb growth	**WWT**
Adult size	**EWT**
Meat yield	**LEANY**
Wool production	**FW12**

NZ Terminal Sire Worth	
SIL GOAL TRAITS	MARKER BV
Lamb survival	**SUR**
Lamb growth	**WWT**
Meat Yield	**LEANY** **FATY**

Developing standard definitions to simplify and focus genetic information in the marketplace.

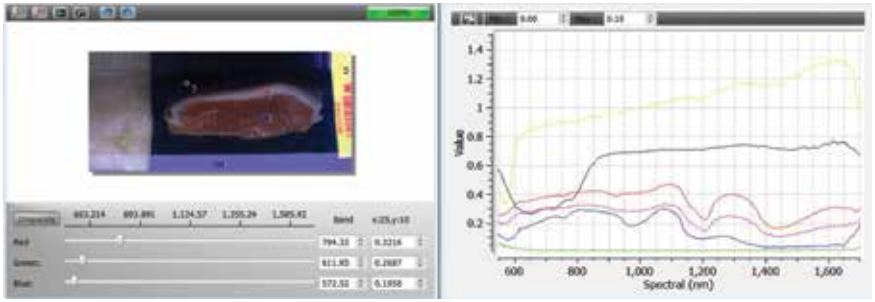
beef+lamb new zealand GENETICS

Hyperspectral imaging

This project investigates the feasibility for real-time, non-destructive prediction of meat quality attributes in lamb across three processing plants. The ability to grade lamb carcasses based on meat quality parameter(s) demanded by the customer and consumer would allow the industry to:

1. Target carcasses for specific market requirements.
2. Market lamb based on measurable quality parameters for increased product differentiation.
3. Inform the value chain of the impacts of management and breeding decisions on lamb product quality for continual improvement.

Contributor: Alliance Group Limited, Cameron Craigie (AgResearch)



Using hyperspectral imaging to identify different tissue types (e.g IMF, marbling)

Developing a suitable tool to assist the value chain capture value from superior quality lamb, and improve product consistency.

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Feed efficiency in sheep

Residual feed intake (RFI)

- RFI = Actual - Predicted Feed Intake (based on requirement for maintenance & production)
- Cattle heritability estimates 0.07 - 0.62

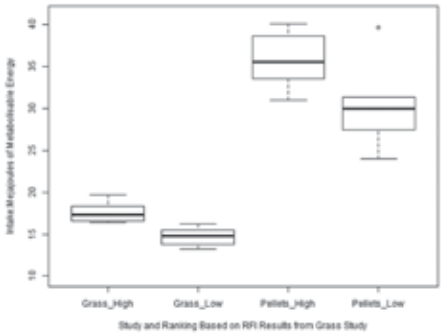
Feed intake facility est. July 2015

- Feed: Lucerne Pellets (ME 10.4)
- Test ~200 hoggets/ year
- Estimate heritability, repeatability and corr. with production traits

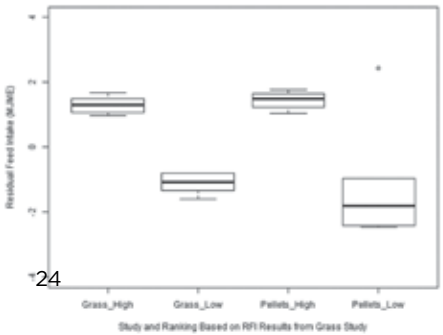
Pilot studies successfully provided comparable data to that generated from cattle. There is great potential to determine if genetic differences between maternal sheep genetics do exist.

Contributors: Tricia Johnson (AgResearch)

PILOT STUDY RESULTS

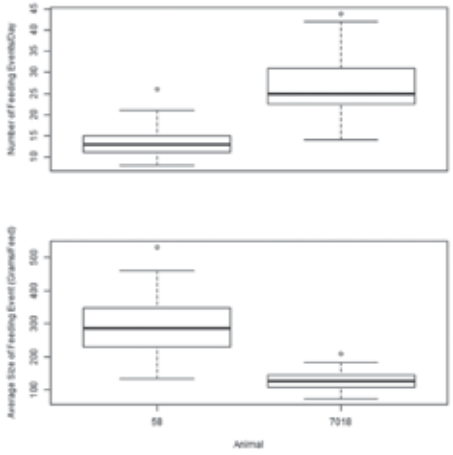


37 Animals fresh-cut ryegrass vs lucerne pellets:
Some re-ranking, but most extreme animals consistent



Difference in intake between extremes based on grass results consistently ~20%

AUTOMATED FEEDERS



Information on frequency and size of feeding events, e.g. two pilot study animals:

- Same total intake/day
- One eating small amounts often
- One eating larger amounts less often

Can we breed sheep for commercial farmers that require less feed to achieve productive outputs?

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Trait prioritisation

To provide a better understanding of the commercial drivers for genetic improvement in sheep and to focus research priorities, there has been a review of changes in the NZ sheep industry since the original study in 2011. The review considered the impact changes should have on the priority for investment. This involved;

- Identifying the impact of changing trends in sheep numbers and locations (easy vs. hill country)
- Identifying market forces requiring changes in meat quality, yield and carcase weights
- Assessing economic and production impacts of changes within each trait, using an industry panel to rank investment preferences.

Contributors: Peter Amer, Tim Byrne, Jude Sise and Bruce McCorkindale (AbacusBio)

TOP 10 TRAITS: 2014

1. Meat yield
2. Adult live weight
3. Weaning weight (maternal)
4. Carcass weight (terminal)
5. Weaning live weight (direct)
6. Number of lambs born (NLB)
7. Parasites
8. Feed efficiency
9. Twinning
10. Lamb survival (direct)

Meat yield, adult live weight and maternal weaning weight continue to dominate as the top three traits for targeted research.

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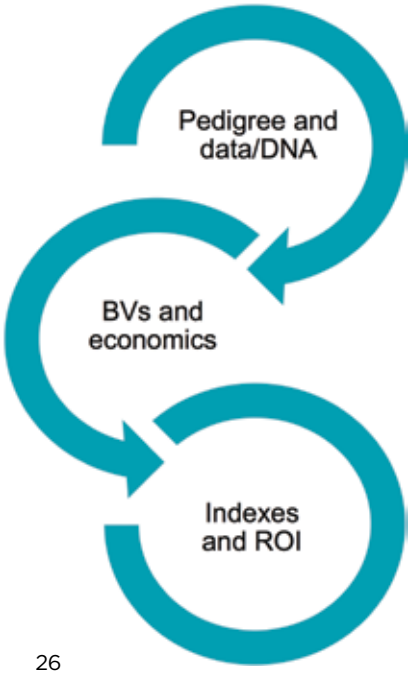
Farm records to economic indexes

Breeding values are calculated from pedigree, performance data, and DNA information, using mathematical models and statistical genetics parameters (e.g. heritability). To weight BVs based on their relative economic importance we need economic weights. These are calculated for each trait. Relevant traits are included in sub-indexes, and an overall index. Index values combine eBVs with economic weights and are a measure of the profit from the ram per ewe mated

Contributor: Tim Byrne (AbacusBio)



- Ram breeders record a range of data which is required for GE. This data goes into SIL
- BVs are a way of identifying genetically superior animals for a range of traits
- Selection indexes convert BVs into economic terms and represent the profit potential of a ram
- Some simple caluclationcan be done to caluculate ROI

Pedigree is based on parentage recording (farm records) and DNA information (e.g. parentage plus) Performance information is collected and can be informed by DNA information.

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QUICK FACTS

Mendip Hills is a 6130 hectare property, 20 minutes north of Cheviot.

The rolling to high country property is supported by two irrigated blocks and the total operation winters nearly 40,000 sheep, deer and beef stock units.

The cattle operation includes 1150 breeding cows and 180 rising-one-year-old heifers. The herd is a mix of Hereford, Angus and crossbreds.

Mendip Hills station is owned by the Black family and managed by Simon Lee.

Mendip Hills, North Canterbury

Semen from a total of 11 Hereford bulls was used this year, and further bulls will be added next year. These were selected with input from the Hereford Society, property manager Simon Lee, Mendip Hills's stock agent Graham Sidey and Hereford breeder Gray Pannett. Hereford bulls were selected to give a range of types, but making sure they fitted with Mendip Hills' commercial goals. It also included bulls with high percent IMF EBVs, and both horned and polled Herefords.

beef+lamb new zealand GENETICS | BEEF PROGENY TEST

"There is no compromise for good breeding. It's good value for money. You need good females, because they're the backbone of your business. I believe there's value in good genetics. But is there? We'll find out."

SIMON LEE, MENDIP HILLS MANAGER

Genetics of disease resistance

It is well established that there are genetic differences between sheep in their ability to resist disease. Resistance to internal parasites is estimated by measuring faecal egg counts (FEC) or antibody levels. This trait is moderately heritable, which allows for genetic selection. These heritable differences lead to opportunities to breed animals with enhanced resistance, which can:

- minimise the use of drenches, and delay the onset of drench resistance in some circumstances
- reduce parasite egg numbers on pasture
- reduce the potential problem of consumer concerns about drug residues in food
- improve flock growth rates

Contributors: Shannon Clarke (AgResearch)

Breeders will make the most profitable gains by using a selection index that incorporates both production and FEC traits.

beef+lamb new zealand GENETICS

Facial Eczema

This project looks to address the issue of Facial eczema which is highly heritable (~40%) making it well suited to genomics. Progress to date has been through Ramguard. Update on project:

- >3600 animals genotyped, >80% Rom → only Rom predictions (acc.~0.44)
- Need to get numbers for all breeds
- Genomicsis best when genotyped animals are closely related to training set, so need diversity of breeders (even within Rom.)

Contributors: Tricia Johnson and Neville Amyes (AgResearch)

ULTIMATELY TWO STAGE SELECTION

Genomics not a one hit solution for FE.
Once genomic accuracy acceptable (based on breed and relatedness)

Use genomics to select candidate ram lambs

↓

Selected lambs Ramguard tested at higher dose than otherwise possible

↓

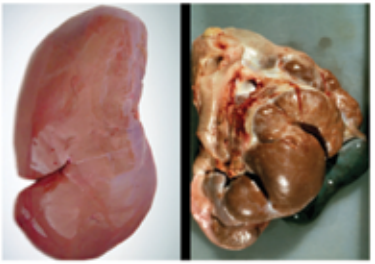
BVs updated and best rams selected

↓

DNA from Ramguard rams genotyped → pipeline → updating genomic prediction

ramGUARD™

Animals artificially dosed with toxin sporidesmin (0.20mg/kg - 0.60mg/kg) → subclinical liver damage estimated by Gamma Glutamyl Transferase (GGT) levels. If low GGT levels & dosed at 0.2mg/kg → animals are tolerant to a low dose of sporidesmin, can't extrapolate to higher dose levels, but does not exclude higher level of tolerance



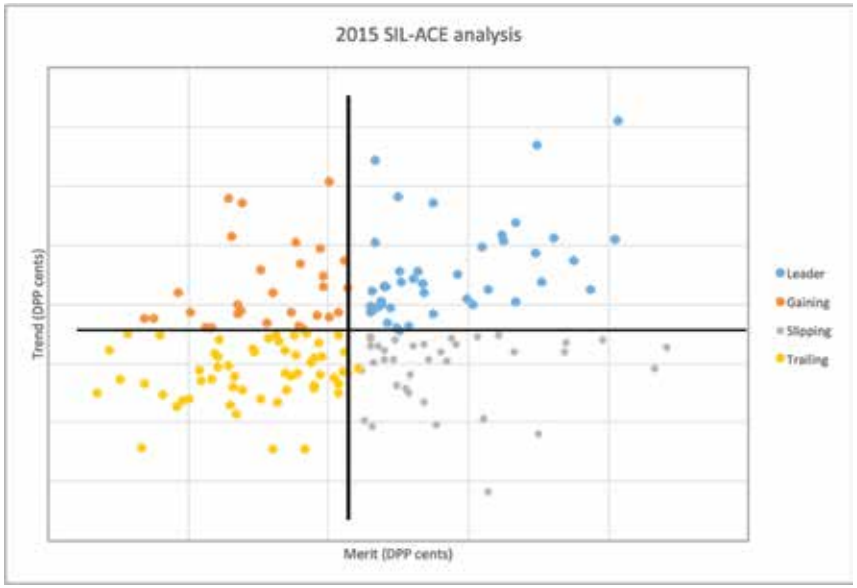
To genotype Ramguard tested animals to improve genomic accuracies across multiple breeds.

beef+lamb new zealand GENETICS

Ram Buyer's accountant

The 2015 SIL-ACE data set was used to estimate average genetic merit and average index trend achieved from 2011-2015. The biggest benefits were achieved through commercial farmers routinely buying high merits rams from breeders achieving high rates of genetic gain.

Contributors: Jude Sise (AbacusBio), Sharl Liebergreen (Zoetis)



Quantifying the potential value of using high merit rams.

beef+lamb new zealand GENETICS

Beef genetics plan

The beef genetics plan focuses on work that is specific to New Zealand beef and New Zealand environments.

It involves;

- Evaluating maternal performance and survival for different cow types
- Evaluating the relationship between maternal performance, finishing performance and carcass quality/market attributes
- Potential new EBVs for cow performance (eg condition score/fat depth and stayability)
- Genomic tools relevant to New Zealand cattle and farm systems
- Confidence in Trans-Tasman ranking (Grass vs. Grain)
- Improved linkage (within NZ and Trans-Tasman)
- Quantifying the economic value of genetics for commercial farmers

Contributors: Stephen Miller (AgResearch), Jason Archer and Tim Byrne, (AbacusBio)

Delivering genetic tools for New Zealand beef farmers that will improve maternal performance on hill country, while also producing carcases that meet market specifications.

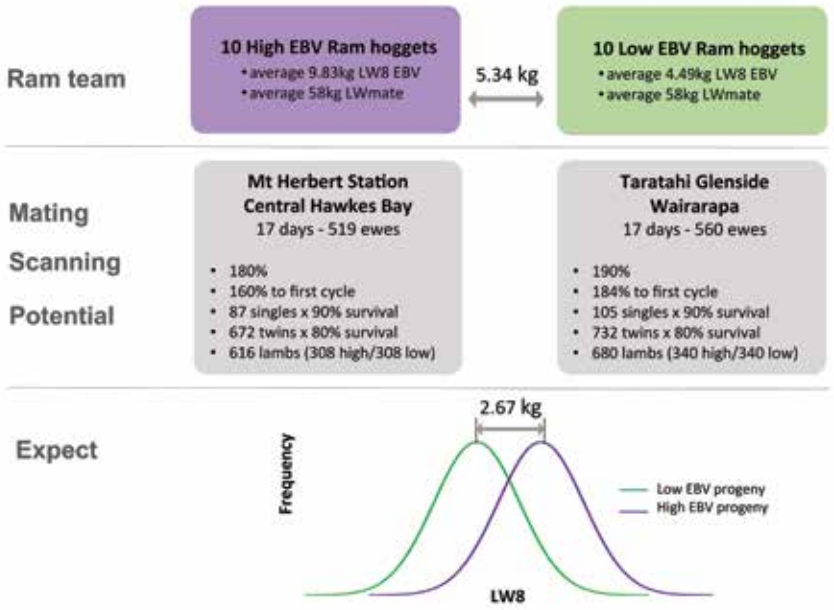
beef+lamb new zealand GENETICS

Data drives dollars

How well do ram EBVs translate to differences in the lambs born on your farm?

A new project run by Massey University and Focus Genetics aims to demonstrate the advantage in performance that results from using rams of high genetic merit. The experiment involves using two teams of rams of high or low genetic merit over 500 mixed-aged ewes on commercial farms in Waipukurau and Gladstone. A Farmer Learning Community has been set up at each farm to foster interaction between farmers, technologists and scientists, with the intention of understanding how farmers want to learn about new and existing technologies.

Contributors: Focus Genetics, Sheep Research Centre Massey University, Mt Herbert Station and Taratahi Agricultural Training Centre (Glenside)



Highlighting the commercial opportunities of picking ram teams based on genetic merit rather than phenotypical observation.

beef+lamb new zealand GENETICS

Why do I need to use Sheep5K?

For Accuracy

Use Sheep5K® to gain accurate information on young rams where traditional information sources can be unreliable. Genomic tools such as Sheep5K® add significant accuracy to breeding values of young rams, comparable to having many direct progeny already on the ground, as shown in Table 2 (below).

Timing

Sheep5K and Sheep50K are closely linked to specific SIL analyses which are now being run fortnightly. The National Genomic Evaluation (NGE) is the only SIL analysis that incorporates genomic information from Sheep5K and Sheep50K. It is essential that all pedigree, performance and genomic information is added to SIL before the NGE commences.

Contributors: Zoetis and B+LNZ Genetics

Breeds and Traits Delivered

TRAIT		UNITS		ROMNEY	COOPWORTH	PERENDALE	COMPOSITE
PRODUCTION	CWT	Kg	Carcass weight	■	■	■	■
	WWT	Kg	Lamb weaning weight - direct effect	■	■	■	■
	WWTM	Kg	Lamb weaning weight- maternal effect	■	■	■	■
	LWB	Kg	Live weight at 8 months	■	■	■	■
	LW12	Kg	Live weight at 12 months	■	■	■	■
	EWT	Kg	Adult ewe live weight	■	■		■
	EMAC	Cm	Ultrasonic Eye Muscle Area, weight adjusted	■	■	■	■
	NLB	#	Number of alive lambs at birth	■	■	■	■
WOOL	LFW	Kg	Lamb fleece weight (Greasy)	■	■	■	
	FW12	Kg	Fleece weight at 12 months (Greasy)	■	■	■	■
	EFW	Kg	Ewe fleece weight (Greasy)	■	■	■	■
MEAT YIELD	SHLY	Kg	Shoulder Lean Yield, weight adjusted	■	■	■	■
	LNLY	Kg	Loin Lean Yield, weight adjusted	■	■	■	■
	HQLY	Kg	Hind Quarter Lean Yield, weight adjusted	■	■	■	■
	FATY	Kg	Fat Yield, weight adjusted	■	■	■	■
	LEANY	Kg	Lean Yield, weight adjusted	■	■	■	■
HEALTH	FEC1	%	Faecal egg count (end of first challenge)	■	■	■	■
	FEC2	%	Faecal egg count(end of second challenge)	■	■	■	■
	AFEC	%	Adult ewe faecal egg count	■	■	■	■
	LDAG		Lamb dag score	■	■		■
	ADAG		Adult dag score	■	■		■
	GGT21		Facial Eczema	■			

Table 2

TRAIT	NLB	WWT	WWTM	CWT	LWB	EWT	EMAC	LEANY	FW12	FEC2	ADAG	GGT21
PROGENY EQUIVALENTS	18	8	5	4	4	2	3	2	5	11	4	2

Use Sheep5K® to gain accurate information on young rams where traditional information sources can be unreliable.

eBV + mBV = gBV

beef+lamb new zealand GENETICS

Accuracy in performance recording

Use technology to drive efficiency and accuracy in your stud operation

Sorting for breeding is a complex task. Accuracy is critical. With paper recording, room for error is high and you need well-trained staff. Electronic recording is more accurate than paper so you can base breeding decisions on your data with confidence.

With electronic recording you can monitor reproductive performance, record and breed for preferred traits, and view and draft by a larger range of breeding values from SIL.

Breeders are using weigh scales to select rams or ewe replacements, then feeding in different information. Multi-criteria draft features allow you to draft off sire, dam, rank, faults, then draft your animals for your breeding flock.

beef+lamb new zealand GENETICS

Breeding for Parasite Resistance

New generation technology set to fast-track genetic gains

B+LNZ Genetics, AgResearch and Techion Group have united to re-launch WormFEC with a new, innovative diagnostic platform – FECPAK^{G2}. Samples are processed and digitally imaged at a microscopic level and uploaded to the Internet. Egg counts are performed by a web-based lab technician and results stored online. EID tags can be used to eliminate error when data is processed and loaded into SIL. These advances mean breeders submit only ONE sample to gain WormFEC certification, lowering the costs and making it easier for breeders to screen sires.

Contributors: Greg Mirams (Techion Group), John McEwan (AgResearch) and B+LNZ Genetics

Farmers need more tools to manage parasites than a drench gun – breeding is a key part of the sustainable solution.

beef+lamb new zealand GENETICS

QUICK FACTS

Caberfeidh is one of eight properties operated by Lone Star Farms.

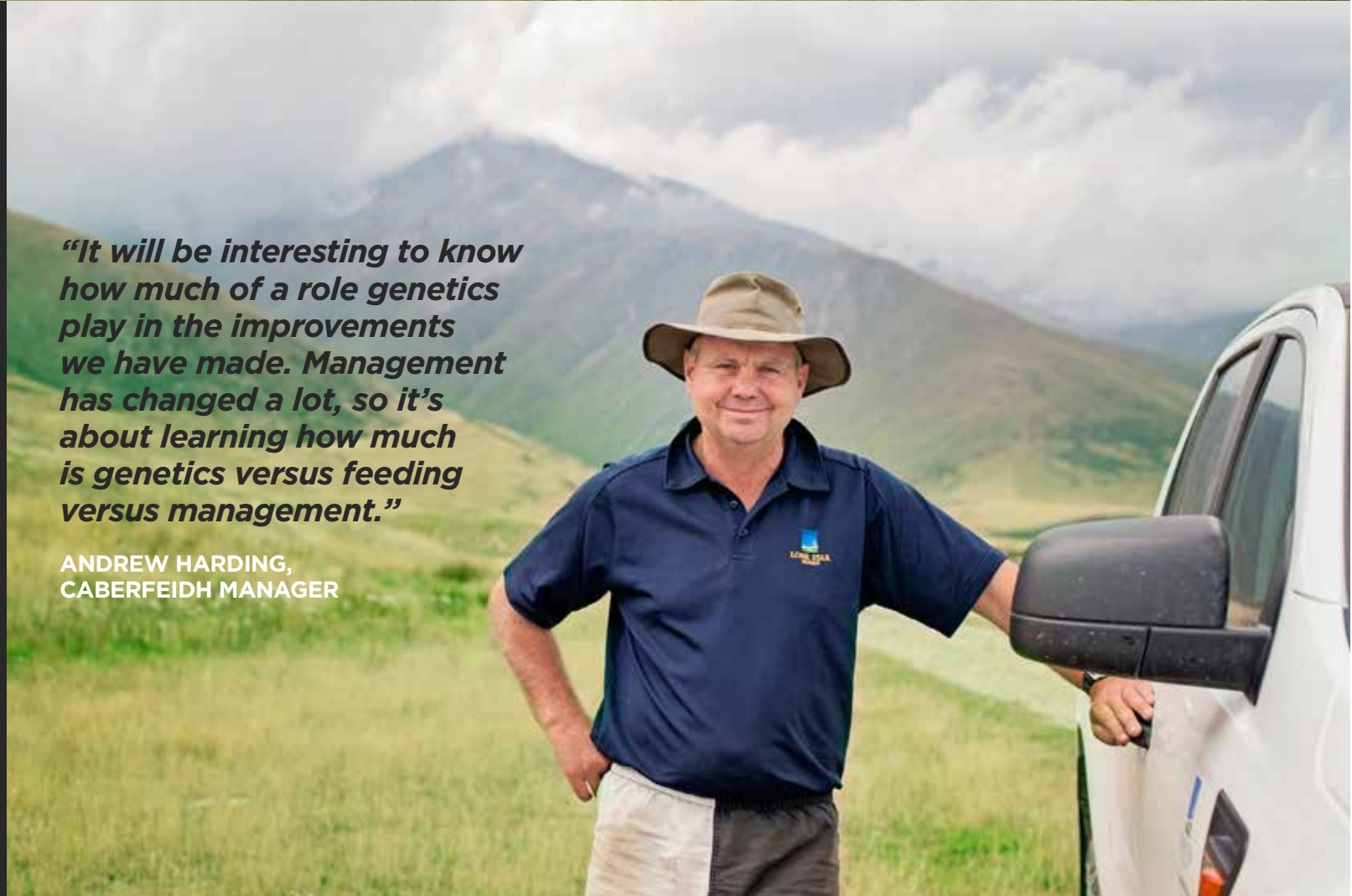
It covers 6000 hectares in the Hakataramea Valley of South Canterbury and is mostly flat to rolling, with 1350 hectares oversown hill country.

The cow herd is made up of 360 mixed-age Angus breeding cows and 102 in-calf rising-one-year-old heifers.

The property is managed by Andrew Harding and includes about 2000 hectares of lucerne and lucerne/fescue mix.

Caberfeidh Station, South Canterbury

The beef progeny test involves only Caberfeidh's heifers. Bulls were firstly selected, based on being safe options for mating to heifers. They were then selected against Caberfeidh's goals, which included good growth rates (600 day weight EBVs) and moderate cow size. Caberfeidh manager Andrew Harding is looking forward to the B+LNZ Genetics Beef Progeny Test clarifying the role genetics plays in the property's overall performance improvements.



"It will be interesting to know how much of a role genetics play in the improvements we have made. Management has changed a lot, so it's about learning how much is genetics versus feeding versus management."

ANDREW HARDING, CABERFEIDH MANAGER

beef+lamb new zealand GENETICS | BEEF PROGENY TEST

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