beef+lamb new zealand GENETICS

SHEEP BREEDER FORUM

23-24 JULY 2015 | NAPIER

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

29.6 million
sheep

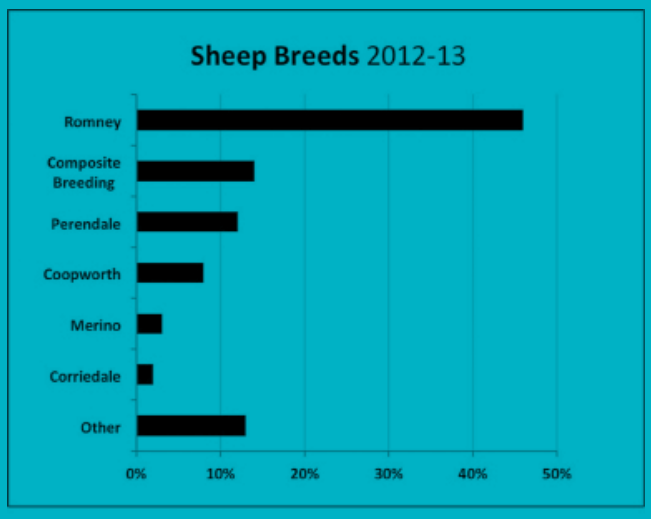
49%
North Island

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.

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

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.

CONTENTS

In collaboration with:

INTRODUCTION

Welcome to the Sheep Breeder's Forum. 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. Therefore any feedback from you in the meantime would be highly valued.

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

We trust you find this content thought-provoking and, of course, would like to hear if you have any comments on how we can make it most useful for commercial farmers – your clients.

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**

1 SOURCING INFORMATION

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.

2 APPLYING TO FARM GOALS

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

Meat yield

Facial excema phenotyping

Feed efficiency phenotyping

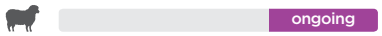
NZ beef genetics database

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

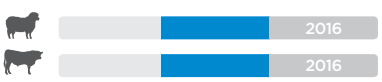
Integration of DNA into genetic evaluation systems

Connecting industry sires



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

Data capture

Best practice performance recording

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

Central Progeny Test (CPT)

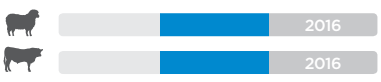
Beef Progeny Test (BPT)

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



Lower cost DNA tests

Gene discovery

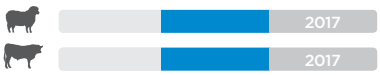
ALIGN BREEDING VALUES TO FARM MANAGEMENT AND GOALS

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

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

PLANNING	DEVELOPING	LAUNCHING

FORUM TOPIC 1

WHAT IS AUSTRALIA UP TO IN SHEEP GENETICS?

DR DAN BROWN
ARMIDALE ANIMAL AND GENETICS BREEDING UNIT

Daniel is a world-renowned scientist who runs the LAMBPLAN genetic evaluation system for the Australian sheep industry and is highly respected for his ability to communicate clearly to farmer audiences.

He is also the co-author of a large number of publications which cover supplier genetics and the application of genetics to practical animal breeding situations.

Daniel manages his own fine wool sheep enterprise as well as a 100 doe rabbit farm.

NOTES

FORUM TOPIC 2

ADULT SIZE ECONOMIC WEIGHTING

ISSUE

Some SIL breeders are concerned the penalty on adult ewe weight is too great in SIL DP indexes. A number of breeders base the overall index they use on SIL indexes but remove the adult size component (DPA or EWT BV). This makes the index used sub-optimal and will impact on likely genetic gains

ADDRESSING THE ISSUE

- Key features of the economic model used to derive SIL DP index weights will be presented for discussion
- Adverse consequences of selective deletion of the adult size component in an overall DP index will be described

DESIRED OUTCOME

- Breeders can make more informed decisions about indexes they use in their selection programmes and to present to ram buyers

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FORUM TOPIC 3

SIL DATABASE SYSTEM

PURPOSE

Future genetic evaluations will integrate DNA data seamlessly with performance and pedigree data. As well, DNA will be used to routinely identify or confirm parentage. In addition, genetic data will be access more easily by more users as part of routine processes in ram breeding operations and by buyers at time of ram sales

METHOD

- A new DNA genotype database will be integrated into the SIL data system
- Data audit systems will be enhanced and expanded
- Efficient data transfer systems will be implemented to optimise data flow for genetic evaluations

OUTCOME

- More accurate prediction of genetic merit
- Great degree of data auditing, particularly for parentage
- Better access to better data, where it is needed

NOTES

FORUM TOPIC 4

SIL GENETIC ENGINE

PURPOSE

To estimate genetic merit (breeding values and indexes) from a single, weekly, all-SIL genetic evaluation, removing the need for many, smaller evaluations

METHOD

- Assess available software to develop an upgraded genetic engine for SIL allowing very fast processing of larger datasets
- Flock connectedness is used to guide reporting of BVs and indexes

OUTCOME

- A single, national genetic evaluation replaces the existing variety of evaluations based on different but overlapping datasets
- Removes variation in genetic information that can confuse users
- Focus is on the breeding objective, not the reasons why estimates of genetic merit vary

NOTES

WORKSHOP 1

FACIAL ECZEMA GENOMICS

PURPOSE

Working towards genomic predictions for FE

METHOD

- Tolerance to facial eczema (FE) in sheep is highly heritable
- Genetic improvement can be achieved using traditional SIL Breeding Values (BV) for GGT21 or Genomic Predictions for FE – both complimentary
- However, in order to achieve accurate genomic prediction at least 1500 animals per breed with a RamGuard phenotype need to be genotyped

OUTCOME

This workshop will cover the requirements to develop a FE genomic prediction

NOTES

WORKSHOP 2

SIL INDEXES

PURPOSE

To introduce standards for characterizing genetic merit

METHOD

- Define a fixed set of breeding goal traits for the main sheep types
- Brand these as NZ industry standards
- Identify a small number of key marker BVs

OUTCOME

- Users know the standard index definition
- Greater buyer confidence in the index system
- Easier reporting of key information in the marketplace

NOTES

WORKSHOP 3

BREEDERS RETURN ON INVESTMENT FROM GENETIC TECHNOLOGY

To meet the future requirements of the commercial sheep producer, progressive sheep breeders need to be investing in their breeding programs, keeping up with technology and trends. The return on this investment can unfortunately be difficult to quantify but ultimately must be captured as an increase in market share of rams sold; an increase in ram price; or reductions in breeding costs. Genetic technology is just one of many areas to choose to invest in. Tools are being developed to help breeders understand their return after investing in breeding solutions and DNA technology

NOTES

WORKSHOP 4

SHEEP GENOMICS

The Sheep Genomics programme is about

1. Utilising the resource of SNP genotypes and to discover potential unique genome variations associated with commercial phenotypes.
2. Provide data that will enrich standard genetic evaluations.
3. Identify major genes of commercial importance for the development of new gene tests.
4. Continue to collect and provide resources for Industry genetic evaluations (e.g. DNA samples and genotypes from key industry sires)

NOTES

WORKSHOP 5

MATERNAL EWE

A workshop designed to get you thinking about how and when key maternal traits need to be recorded and how they are related to some important lamb traits. It will provide information around what is best practice to get the most out of your adult ewe live-weight and adult ewe body condition score breeding values in the future.

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FORUM TOPIC 5

CARCASS FAT AND IMF

MURRAY BEHRENT
GENERAL MANAGER
LIVESTOCK, ALLIANCE
GROUP LTD

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FORUM TOPIC 6

NEW & REVISED SIL TRAITS

PURPOSE

To introduce the new traits of ewe longevity and body condition to help better characterize genetic merit and to upgrade evaluations for Lamb Survival

METHOD

- Release a “longevity” BV
- Release a “body condition score” BV
- Upgrade the evaluation of Lamb Survival

OUTCOME

- More complete description of genetic merit for maternal (DP) sheep
- More accurate BVs for Lamb Survival
- Greater use of genetic information

NOTES

Maternal ewe traits

Breeders with suitable data will get eBVs for ewe body condition score (BCS) and longevity (STAY). 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)

Getting BVs for ewe longevity (STAY) and body condition score (BCS) into SIL – a longevity 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 (AgResearch); Mark Young and Sheryl-Anne Newman (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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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)

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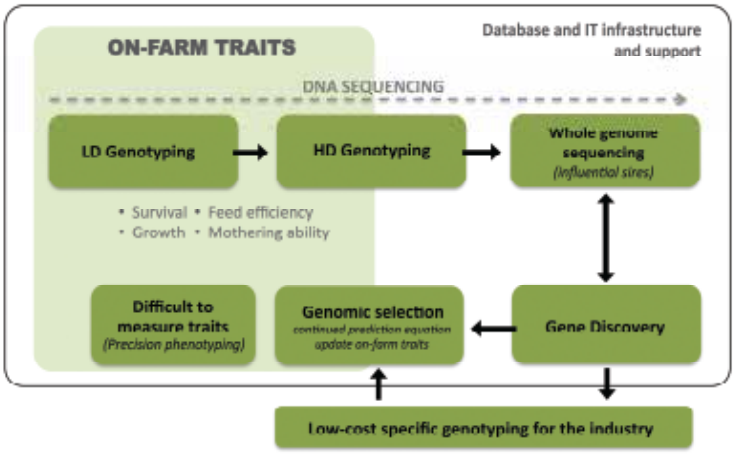
Sheep Genomics

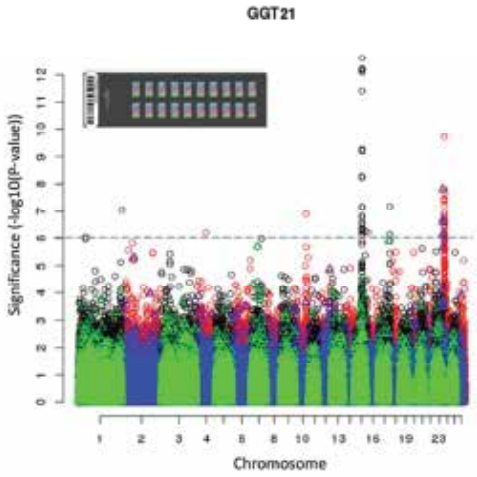
Research aims to deliver greater genomic discovery (causative mutations, genes and genetic pathways) for all traits of economic importance, a better understanding of the biology of the trait, more accurate gBVs and better persistence of accuracy across generations. A systematic pipeline will be developed 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.

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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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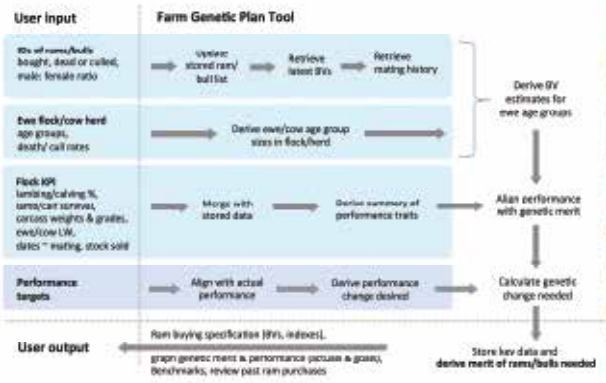
Matching Genetics to user needs

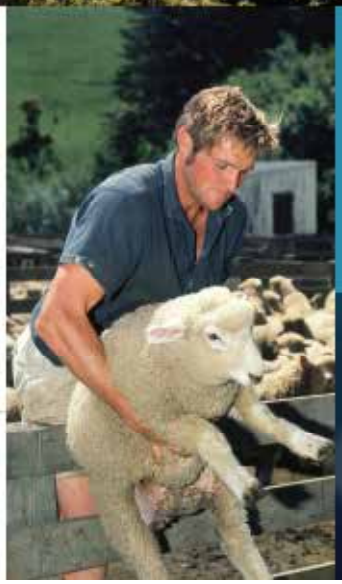
This project aims to inform future ram and bull buying decisions for farmers, by matching genetic merit of the ewe flock or beef cow herd to performance metrics and business objectives. This is achieved through;

- 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

Farm Genetic Plan





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

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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

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

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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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.

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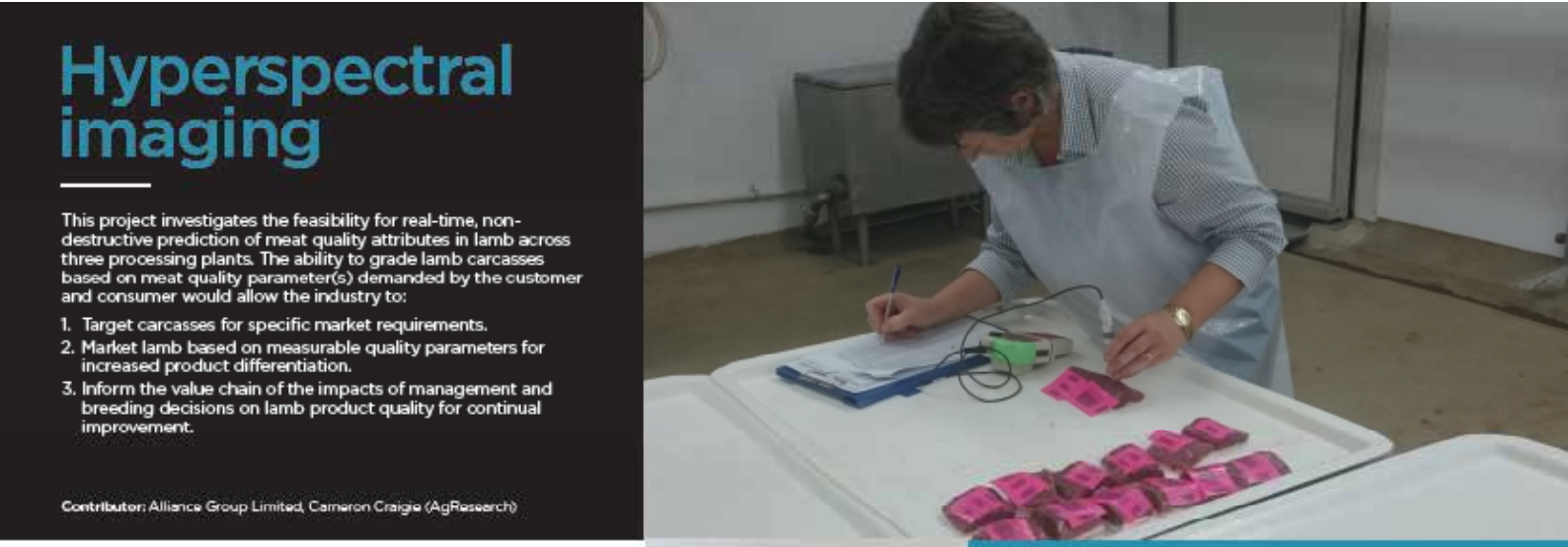
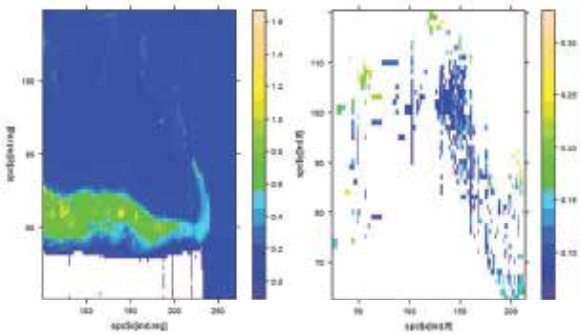
Hyperspectral imaging

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)





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

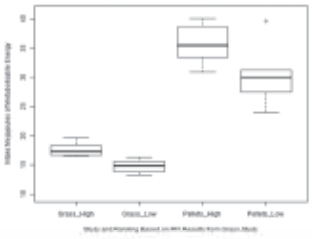
Feed Intake facility est. July 2015

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

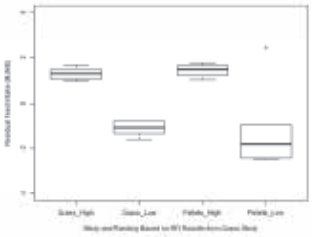
Pilot studies successfully provided comparable data to that generated from cattle. There is great potential to determine if genetic differences between maternal sheep genetics do exist.

Contributors: Tricia Johnson (AgResearch)

PILOT STUDY RESULTS

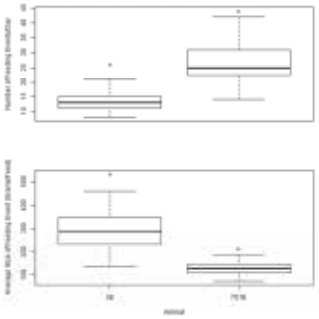


37 Animals fresh-cut ryegrass vs lucerne pellets: Some re-ranking, but most extreme animals consistent



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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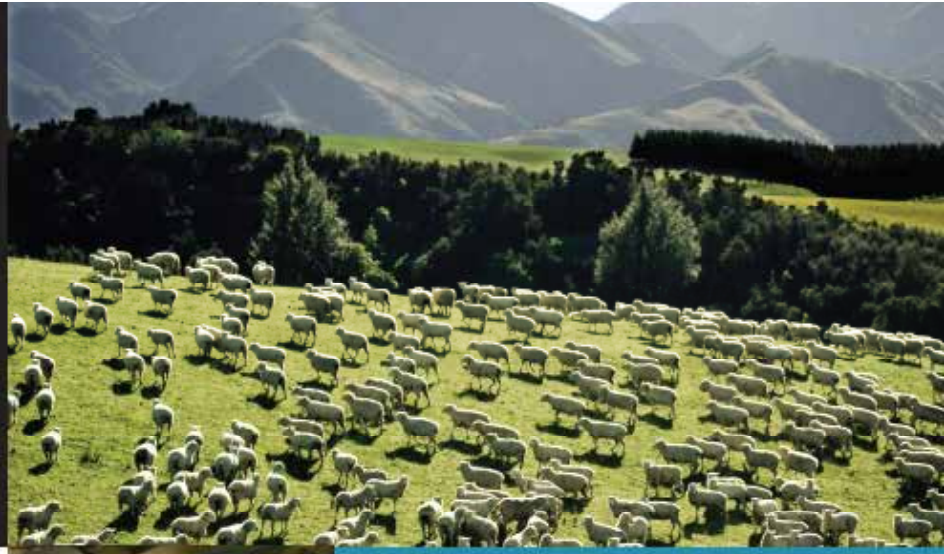
Supercharging SIL genetic evaluation

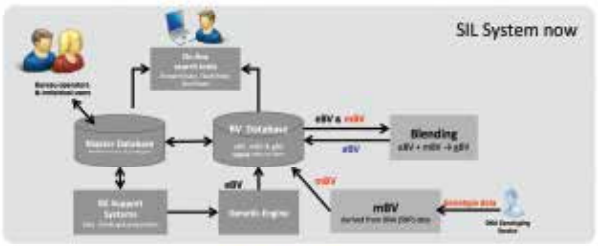
This involves an updating genetic evaluation software and optimising analysis. Pedigree, performance and DNA data will be combined into one evaluation, more processes will be automated and improvements made to the system dataflow.

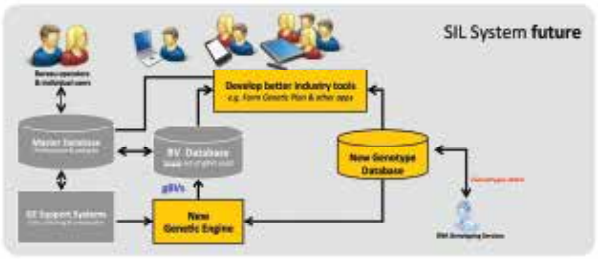
A single national genetic evaluation will give:

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

Contributors: Sheryl-Anne Newman and Benoit Auvray (AgResearch), John Davys (Rezaare 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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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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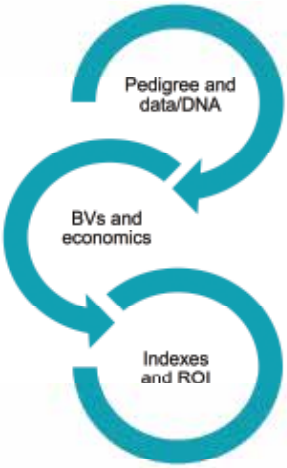
Farm records to economic indexes

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
- EBVs are a way of identifying genetically superior animals for a range of traits
- Selection indexes convert EBVs into economic terms and represent the profit potential of a ram
- Some simple calculation can be done to calculate 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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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.

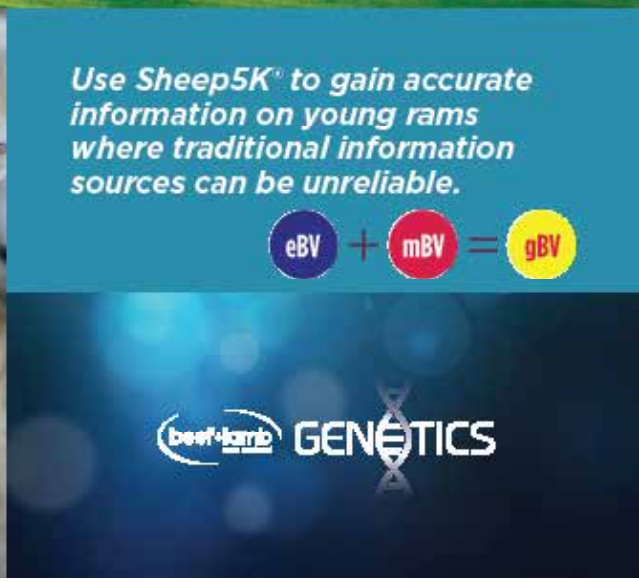
Contributors: Zoetis and B+LNZ Genetics

Breeds and Traits Delivered

TRAIT	UNITS		BOARMIX	COOPWORTH	PERENDALE	COMPOSITE
PRODUCTION	CWT	kg				
	WWT	kg				
	WWTM	kg				
	DWI	kg				
	LWT2	kg				
	EMAC	cm				
MEAT YIELD	LEAN	kg				
	FAT	kg				
HEALTH	FEC1	%				
	FEC2	%				
	AFEC	%				
	LDAG					
	ADAG					

Table 2

TRAIT	WWT	WWTM	CWT	LMB	EMAC	LEANY	FAT2	FEC2	ADAG	SHT21
PROGENY EQUIVALENTS	8	5	4	4	2	3	2	5	11	4	2



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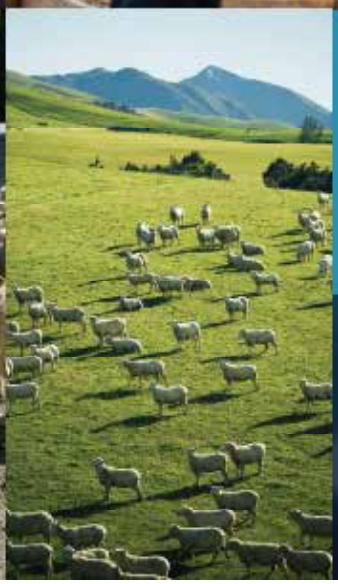
Genetics of disease resistance

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.

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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

↓

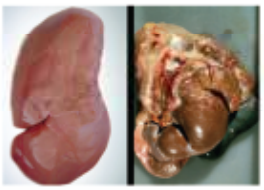
BVs updated and best rams selected

↓

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.

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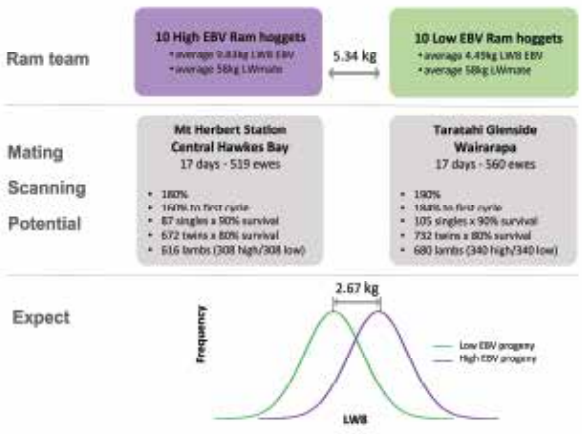
Data drives dollars

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 Tarataki Agricultural Training Centre (Glenside)



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

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FocusGenetics PROVEN IN THE PADDOCK

MASSEY UNIVERSITY UNIVERSITY OF NEW ZEALAND

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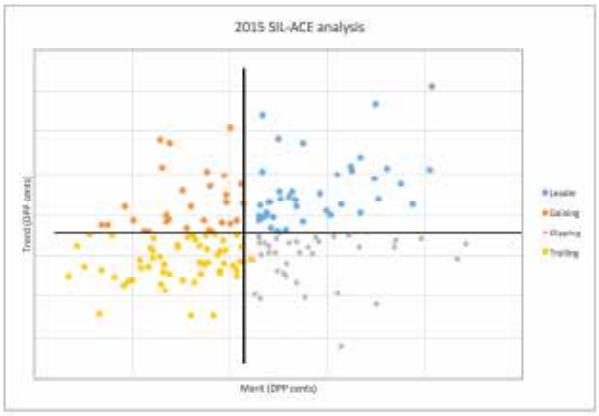
Ram Buyer's accountant

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), Sheri Liebergreen (Zoetis)



Quantifying the potential value of using high merit rams.

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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.

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Techion Group Ltd
TECHNOLOGY IN ACTION

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