ESTIMATED BREEDING VALUES

A GUIDE FOR RAM BUYERS
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Author: Mark Ferguson

This booklet is intended as a guide only. Every effort has been made to ensure the information contained within is factual but this cannot be guaranteed.
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BUYING THE RIGHT RAMS

Ram buying is an important part of a sheep business. Often it is only done on one day per year, so it may seem difficult to justify investing too much time in picking your rams.

However, the impact of your ram buying decision can have a large and lasting impact on the profitability and sustainability of your sheep enterprise.

This guide is aimed at helping you to understand the complexities of breeding profitable yet functional sheep that are right for your business. It focuses on how to make genetic gain in your sheep flock by selecting rams with the right estimated breeding values (EBVs).

FIRST PRINCIPLES

EBVs are available for all of the traits that matter to your back pocket. 70% of what a sheep looks like comes from what goes down its throat... that makes it a bit hard to work out which sheep are truly superior. EBVs are a great tool to help you work out which ram has the best genes to pass on to their progeny.

The main purpose of any sheep breeding enterprise is always to improve the productivity of the sheep. But, as any sheep breeder knows, there are other things that can impact on ram performance and sheep profitability:

- Sire: type of sheep you like
- Structure: legs, feet & shoulders
- Sound: two firm testicles
- Smile: teeth hitting the pad
- Suitable: right for your farm

A ram with the best production in the world is worth little to you if it has difficulty getting lambs or is not the type of sheep that will suit your climate or enterprise. It is important to remember the fundamentals when selecting rams and to make sure you buy rams with a balance of performance and visual appeal.
RAM APPEARANCE

When buying rams, it is important to remember that each ram’s appearance has been influenced by many factors:

AGE OF DAM AND BIRTH TYPE

The table below shows the effect that the age of the dam and birth type can have on a lamb’s weaning weight.

<table>
<thead>
<tr>
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<th>BORN AS SINGLE</th>
<th>BORN AS TWIN</th>
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<tbody>
<tr>
<td>MAIDEN DAM</td>
<td>29 KG</td>
<td>25 KG</td>
</tr>
<tr>
<td>ADULT DAM</td>
<td>32 KG</td>
<td>27 KG</td>
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</table>

That is a 7kg difference between a single lamb from an adult ewe compared with a twin born lamb from a maiden ewe – that difference is all due to environmental effects that will not breed on.

EBVs provide a measure of an animal’s genetic potential, independent of environmental influences that can affect the physical appearance.
YOUR ENVIRONMENT

The environmental range that sheep occupy in New Zealand is huge. These different environments put different pressures on sheep. These pressures result in the expression of genetic variability in one environment that may be masked by another environment.

DOES YOUR RAM SUIT YOUR ENVIRONMENT?

It is important to consider whether the environment that a ram has been raised in is sufficiently similar to your farm to allow expression of all the traits that are likely to be important for you.

IS THIS KNOWN AS GxE?

No, the fact that some sheep get worms or fleece rot in some environments, but not in others, is the result of some traits being expressed only when environmental conditions are sufficiently challenging.

The true definition of GxE (or genetics by environmental interaction) is when animals are ranked differently for a production trait (for example growth to weaning) in two different environments.

CORRELATED TRAITS

When buying rams, it is important to carefully consider whether the sheep will perform in YOUR environment. In some circumstances, even though a ram has not been tested in your environment, it may have EBVs for traits that are well correlated and that can assist with selection.
WET EQUALS MORE WORMS
Wetter areas are more prone to high worm burdens. In the winter rainfall areas, these worms tend to be scour worms, resulting in a higher likelihood of scouring and dags. In summer rainfall areas, Barber’s pole worm can be a problem.

WET EQUALS MORE FLEECE ROT
Wetter areas also tend to put more pressure on wool that is prone to fleece rot. Sheep in these high rainfall areas need to be whiter and ‘water-proof’.
A GUIDE FOR RAM BUYERS

ESTIMATED BREEDING VALUES

When it comes to the genes that your rams pass on to their progeny, it is genetic performance (EBVs) that pays.

Here is a real world example — two rams were bought at auction and single-sire mated to similar ewes:

<table>
<thead>
<tr>
<th></th>
<th>RAM 8500</th>
<th>RAM 8660</th>
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<tr>
<td></td>
<td>EBVs</td>
<td>EBVs</td>
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<tr>
<td>PWT =</td>
<td>+6.8KG</td>
<td>+3.5KG</td>
</tr>
<tr>
<td>YGFW =</td>
<td>+10.8%</td>
<td>+3.8%</td>
</tr>
<tr>
<td>YFD =</td>
<td>+0.3 MICRON</td>
<td>+0.1 MICRON</td>
</tr>
<tr>
<td></td>
<td><strong>$1250</strong></td>
<td><strong>$1100</strong></td>
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There was an advantage of over $15 per lamb between two similar looking rams that cost about the same to buy. If a ram sires 300 lambs in its lifetime, that is an advantage of $4,500 (just in performance to yearling age).

If you add on the benefits achieved over the lifetime of the retained ewe progeny AND the genetic superiority that they will pass on to their progeny, the difference is huge.
GROWTH: WEIGHT FOR AGE (WT)

WHAT TO LOOK FOR?
Genetic differences in liveweight reflect the growth potential of an animal at the key times when animals are typically marketed. Weight is generally quoted at one of five time periods (not including birth weight (BWT)):

A. Weaning (WWT)
B. Post-weaning (PWT)
C. Yearling (YWT)
D. Hogget (HWT)
E. Adult (AWT)

HOW IS IT MEASURED?
Animals are weighed by breeders at one or more of the key time periods. Because of the relatively close correlation between weights at the different ages, EBVs for other weights can be calculated from one or two weights. For improved accuracy of the estimation of an animal’s weight across the ages, animals should be weighed at as many of the key times as possible.

WHAT DO THE NUMBERS MEAN?
Weights are measured in kilograms and EBVs are quoted in kilograms. EBVs for growth are deviations from the average animal in the database in the 1990 drop. An animal with a PWT EBV of +6kg will be 6kg heavier at post-weaning age than the average sheep in 1990.

CAN I SEE IT?
Up to a point. The bigger sheep will tend to be the high growth sheep, but birth type, age of dam and nutrition have big impacts on growth and it is easy to overlook a twin born lamb, particularly one from a maiden dam.
**WHAT’S IN IT FOR ME?**

The main reason to select for higher growth potential in your rams is to ensure that your lambs reach heavier weights at younger ages. This allows your lambs to be either marketed sooner (at the same weight) or be marketed at heavier weights (at the same age), compared with low growth lambs.

**REAL EXAMPLE (PINGELLY, WA)**

A group of rams were single-sire mated to similar ewes. The progeny from the higher PWT rams had a higher liveweight at 7 months and a higher estimated carcass value (44% dressing, $5.50/kg). Their dollar values are shown on the graph.

Alternatively, if lambs are to be marketed at the same liveweight, growth gets them out the gate quicker. Each 1kg increase in PWT EBV results in around 10 less days to reach 45kg. Ewes with higher weight breeding values also have more lambs. A 1kg increase in YWT EBV will result in around two more lambs per 100 ewes mated.

**WHAT ELSE CHANGES IF I JUST SELECT FOR GROWTH?**

**THE FREE LUNCHES**

- Marketable at earlier ages
- Higher reproductive output
- Higher fleece weight
- Higher lean meat yield

**THINGS TO WATCH OUT FOR**

- Fibre diameter goes up
- Mature weight goes up (increasing ewe maintenance requirements)
- Lambs birthweight goes up (potential dystocia problems)

**BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)**
WOOL: GREASY FLEECE WEIGHT (GFW)

WHAT TO LOOK FOR?
Greasy fleece weight is quoted at three ages:

A. Yearling (YGFW)
B. Hogget (HGFW)
C. Adult (AGFW)

HOW IS IT MEASURED?
Fleeces are weighed by breeders at an animal’s first or second shearing. For data to be eligible, wool growth must be a minimum of six months and the animal must be 10 months of age when shorn.

WHAT DO THE NUMBERS MEAN?
Fleece weight EBVs are quoted in percentages. EBVs for fleece weight are deviations from the average of the animals in the database in the 1990 drop. An EBV of +20% means the animal will cut 20% more wool than the average sheep in 1990.

WHAT’S IN IT FOR ME?
Each dot on the graph represents the YGFW and YFD breeding values of an individual sire. The average fleece value of their progeny at their first shearing is shown.

There is a $4 difference per head between high and low fleece weight rams (at the same micron).
WOOL: CLEAN FLEECE WEIGHT (CFW)

WHAT TO LOOK FOR?
Clean fleece weight is quoted at three ages:

A. Yearling (YCFW)
B. Hogget (HCFW)
C. Adult (ACFW)

SHOULD I SELECT ON GREASY OR CLEAN FLEECE WEIGHT?
Ideally you should select on clean fleece weight because that is what you get paid for. However, clean and greasy fleece weight are closely correlated, so selecting on greasy fleece weight is also suitable.

HOW IS CLEAN FLEECE WEIGHT CALCULATED?
Clean fleece weight is calculated by multiplying the greasy fleece weight by the washing yield of a sample taken from the mid-side of the animal.

WHAT ELSE CHANGES IF I JUST SELECT FOR FLEECE WEIGHT?

THE FREE LUNCHES
- Body weight and growth go up
- Staple length goes up

THINGS TO WATCH OUT FOR
- Higher fibre diameter (micron)
- Wrinkle score goes up
- Coefficient of variation of fibre diameter gets higher
- Fat goes down
- Reproduction goes down

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
WOOL: FIBRE DIAMETER (FD)

WHAT TO LOOK FOR?
Wool fibre diameter or micron is usually measured at an animal’s first or second shearing. There are three available EBVs based on the age of measurement:

A. Yearling (YFD)
B. Hogget (HFD)
C. Adult (AFD)

WHAT DO THE NUMBERS MEAN?
Fibre diameter EBVs are quoted in micron and are expressed as deviations from the average of the animals in the database in the 1990 drop.

The more negative the number, the finer the animal. An EBV of -1.6 means the animal will produce wool that is 1.6 micron finer than the average of animals in 1990.

HOW IS IT MEASURED?
Breeders collect a representative sample of wool from the mid-side of each animal and submit it to an accredited wool testing laboratory for testing.

The mid-side site is known to reflect the average fibre diameter of the fleece.
WHAT’S IN IT FOR ME?
Fibre diameter is a key driver of greasy wool price. Each dot in the graph to the right represents the YGFW and YFD breeding values of an individual sire. The average fleece value of their progeny at their first shearing is shown. There is a $7 per progeny increase in wool value from the genetically finer ram (at the same fleece weight).

CAN I SEE OR FEEL IT?
Yes, feeling the softness of the wool can be used to compare animals with some success, but measurement is much more accurate. Traditionally, finer crimping wool was generally finer, but bold crimping, yet fine sheep are now relatively common.

IS MICRON ALL ABOUT HOW YOU FEED THEM?
Like all traits, nutrition has a large impact on fibre diameter. Importantly, EBVs can separate the genetic part from the nutritional part.

WHAT ELSE CHANGES IF I JUST SELECT FOR FIBRE DIAMETER?

**THE FREE LUNCHES**
- Comfort factor improves

**THINGS TO WATCH OUT FOR**
- Lower fleece weight
- Lower bodyweight and growth
- Staple length goes down
- CV goes up
- Staple strength goes down

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
WOOL: STAPLE STRENGTH (SS)

WHAT TO LOOK FOR?
Staple strength is quoted at three ages:

A. Yearling (YSS)
B. Hogget (HSS)
C. Adult (ASS)

WHAT DO THE NUMBERS MEAN?
Staple strength EBVs are quoted in newtons per kilotex (N/ktex) and are expressed as deviations from the average of the animals in the database in the 1990 drop.

An EBV of +5 means the animal will produce wool that has a staple strength 5 N/ktex higher than the average of animals in 1990.

HOW IS IT MEASURED?
Staple strength is measured by a machine that holds the staple at the base and tip and measures the maximum force required to break the staple, measured in Newtons (N).

Staple thickness is determined from the weight and length of the staple. This thickness is measured in kilotex (ktex). The force required to break the staple divided by the thickness of the staple provides the staple strength value (N/ktex).

CAN I TELL VISUALLY IF A RAM IS LIKELY TO HAVE LOW STAPLE STRENGTH?
It is close to impossible to visually differentiate rams on their genetics for staple strength.
ISN’T STAPLE STRENGTH ALL ABOUT WHEN I SHEAR AND HOW I FEED THEM?

Like all traits, nutrition has a large impact on staple strength because of the impact that fibre diameter profile has on staple strength.

Shearing time also has a major impact and shearing close to the point of lowest fibre diameter improves staple strength.

However, within sheep all managed the same way and shorn at the same time, there is large genetic variation in staple strength. Importantly, EBVs can separate the genetic part from the management part.

WHAT’S IN IT FOR ME?

Staple strength is an important component of greasy wool price. It accounts for around 20% of the price received. Having sheep that are genetically superior for staple strength will improve wool price.

FACTORS THAT INFLUENCE GREASY WOOL PRICE:

WHAT ELSE CHANGES IF I JUST SELECT FOR STAPLE STRENGTH?

THE FREE LUNCHES

- Muscling improves
- Resistance to worms improves
- Fatness improves
- Lower CV of fibre diameter
- Higher fleece weight

THINGS TO WATCH OUT FOR

- Higher fibre diameter

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
WOOL: CV OF FIBRE DIAMETER (CV)

WHAT TO LOOK FOR?
The coefficient of variation of fibre diameter (CV) is generally quoted at one of three ages:

A. Yearling (YDCV)
B. Hogget (HDCV)
C. Adult (ADCV)

HOW IS IT MEASURED?
Coefficient of variation of fibre diameter is a measure of the amount of variation there is between individual wool fibres within a fleece. It is measured on the same mid-side sample and at the same time as fibre diameter is measured.

WHAT DO THE NUMBERS MEAN?
EBVs for CV are quoted in percentages and are expressed as deviations from the average of the animals in the database in the 1990 drop.

The larger the variation in fibres in the fleece, the higher the CV will be and the higher the EBV for CV will be. An EBV of -2% means the animal will produce wool with a CV that is 2% lower than the average of animals in 1990.

CAN I SEE OR FEEL IT?
Low CV wools tend to feel softer, so you may be able to subjectively tell the difference between extreme wools. However, the subtle differences that exist between animals within a flock will generally not be picked up subjectively.
WHAT’S IN IT FOR ME?
Processors tend to favour wools of low CV because of improvements in processing and improved wearability of garments made.

But the benefits on-farm of sheep with low CV is more likely to come through reducing the likelihood of fleece rot and therefore body strike.

Research in the 1980s showed that sheep with low CV are less likely to get fleece rot and fly strike.

There is also emerging evidence that sheep with a lower CV are genetically better able to cope with restricted nutrition over summer and therefore lose less liveweight.

WHAT ELSE CHANGES IF I JUST SELECT FOR CV?

THE FREE LUNCHES
- Muscling improves
- Resistance to worms improves
- Higher fatness
- Higher staple strength
- Higher growth
- Less fleece rot/body strike

THINGS TO WATCH OUT FOR
- Lower fleece weight

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
WHAT TO LOOK FOR?
Staple length is generally quoted at one of three ages:

A. Yearling (YSL)
B. Hogget (HSL)
C. Adult (ASL)

HOW IS IT MEASURED?
Staple length tends to be measured at the same time and on the same staples that staple strength is measured on. It is measured on a minimum of 10 staples selected from a mid-side sample.

Staple length can either be measured manually or by an automated machine. In both cases the process is carried out in an accredited laboratory and the staples are measured in a relaxed state after being held straight and in a standard environment for 24 hours.

WHAT DO THE NUMBERS MEAN?
EBVs for staple length are quoted in millimetres (mm) and are expressed as deviations from the average of the animals in the database in the 1990 drop.

The longer the staple the higher the EBV for SL will be. An EBV of +10 means the animal will produce wool staples that are 10mm longer than the average of animals in 1990.

CAN I SEE IT?
In sheep in the same mob, that have been on the same nutrition, you can visually pick those with much higher staple length. However, picking subtle differences between most of the animals is quite difficult to detect visually and much better done by machine.
WHAT’S IN IT FOR ME?
There tends to be an optimum staple length at which wool price is maximised. Both wool shorter than the optimum and longer than the optimum will be discounted. This is generally because processing equipment is set up to handle wool around 80 to 90mm long.

![Graph showing wool price discount vs staple length]

SO WHY SHOULD I WORRY ABOUT STAPLE LENGTH?
Increasing staple length is one of the key ways that fleece weights can be maintained or increased while the amount of wrinkle is reduced. Staple length can also increase fleece value at a lamb shearing, particularly if it results in the wool being combing length. It will therefore remain a priority for some producers.

In addition, research in the last decade has shown that there are processing efficiencies to be gained by processing longer staple wools. It is probable that eventually growers will receive a price premium for longer staple wools.

In the meantime, with careful management and flexible shearing times, producers are able to capitalise on the benefits of long-stapled sheep without suffering over-length discounts.

WHAT ELSE CHANGES IF I JUST SELECT FOR STAPLE LENGTH?

THE FREE LUNCHES
- Fleece weight improves
- Washing yield goes up
- Lower CV
- Higher growth
- Less fleece rot

THINGS TO WATCH OUT FOR
- Reproduction goes down
- Fibre diameter goes up

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
CARCASS: CARCASS MUSCLING (EMD)

WHAT TO LOOK FOR?
Carcass muscling is reflected by eye muscle depth (EMD). It is generally quoted at one of three ages:

A. Weaning (WEMD)
B. Post-weaning (PEMD)
C. Yearling (YEMD)
D. Hogget (HEMD)

HOW IS IT MEASURED?
The depth of the eye muscle or backstrap is measured between the 12th and 13th long ribs. The measurement is done by ultrasound by accredited scanners and is completed in live animals at one of the above ages.

WHAT DO THE NUMBERS MEAN?
Muscling EBVs are measured and quoted in millimetres and are expressed as deviations from the average of the animals in the database in the 1990 drop.

An animal with a PEMD of +1.2 will genetically have an eye muscle 1.2mm deeper than the average of animals in 1990.

CAN I SEE IT?
You can see and feel differences in the musculature between animals, but the changes associated with the EMD EBV are subtle and very difficult to detect. Importantly, both management and nutrition change EMD, but an EMD EBV tells you the genetic propensity of an animal for muscling.

WHAT’S IN IT FOR ME?
The main reason to select for improved muscling is to improve the value of the carcass through increasing the amount of lean meat it contains. But there are other benefits in both terminal and maternal breeding.
HIGHER VALUE CARCASS IN LAMBS

More lean meat across the entire carcass.

More weight in the high value loin area.

Less weight in the low value forequarter.

HIGHER REPRODUCTIVE RATE IN ADULT EWES

An extra 6 lambs per 100 ewes mated for every 1mm increase in YEMD.

Ewes with higher muscling have more twins and also lighter lambs at birth. Importantly there is no reduction in lamb survival of these lambs. It enables selection for high growth without running into the problems associated with high lamb weights at birth.

WHAT ELSE CHANGES IF I JUST SELECT FOR CARCASS MUSCLING?

THE FREE LUNCHES

• Lean meat yield increases
• Shifts lean meat from the forequarter to the loin
• Increases dressing percentage
• Higher reproductive rate in ewes
• Higher worm resistance
• Low birthweight without low lamb survival

THINGS TO WATCH OUT FOR

• Can result in lower growth
• When extreme and combined with low fat can reduce eating quality

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
CARCASS: CARCASS FATNESS (FAT)

WHAT TO LOOK FOR?
Carcass fatness is reflected by the depth of fat between the eye muscle and the skin, it is generally quoted at one of three ages:

A. Post-weaning (PFAT)
B. Yearling (YFAT)
C. Hogget (HFAT)

HOW IS IT MEASURED?
Depth of fat is measured at the same time eye muscle is measured and at the same point - between the 12th and 13th long ribs. The measurement is done by ultrasound by accredited scanners and is completed in live animals at one of the above ages.

WHAT DO THE NUMBERS MEAN?
Fatness EBVs are measured and quoted in millimetres and are expressed as deviations from the average of the animals in the database in the 1990 drop.

An animal with a PFAT of +0.6 will genetically have 0.6mm more subcutaneous fat than the average of animals in 1990.

CAN I SEE OR FEEL IT?
You can feel differences in the fatness between animals, but the changes associated with the FAT EBVs are subtle and very difficult to detect. Importantly, management and nutrition changes FAT considerably – EBVs tell you the genetic propensity of an animal for fatness.
WHAT’S IN IT FOR ME?

For prime lambs
Fatness is one of the traits that has an intermediate optimum. It is possible for carcasses to be both too lean and too fat for efficient processing, and different markets have different requirements.

For breeding ewes
Having enough genetic fat in breeding ewes can be important for maintaining or increasing the number of lambs weaned, particularly when nutrition is restricted. There is a lamb birth weight advantage (resulting in improved survival) and a ewe reproduction advantage from having sufficient genetic fat.

WHAT ELSE CHANGES IF I JUST SELECT FOR CARCASS FATNESS?

THE FREE LUNCHES
- Higher birth weight under low nutrition
- More lambs born under low nutrition
- CV of fibre diameter goes down
- Intramuscular fat (marbling) improves
- Eating quality improves

THINGS TO WATCH OUT FOR
- Carcass fatness goes up
- Fleece weight goes down

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
REPRODUCTION: NUMBER OF LAMBS BORN (NLB) AND NUMBER OF LAMBS WEANED (NLW)

The reproductive rate of breeding ewes is recorded across a ewe’s lifetime with each lambing opportunity adding further information to the EBVs for reproductive rate. The two EBVs used are not age specific.

A. Number of lambs born (NLB)
B. Number of lambs weaned (NLW)

HOW IS IT MEASURED?
Each time a ewe is put to the ram, it is classed as a lambing opportunity. Breeders record whether each ewe became pregnant and, if so, how many lambs were conceived. The number of lambs the ewe gave birth to and weaned is also recorded.

The number of lambs born (NLB) is the number of lambs a ewe gives birth to and the number of lambs weaned is the number of alive lambs at weaning. EBVs on rams are calculated from records of their female relatives.

WHAT DO THE NUMBERS MEAN?
Reproduction EBVs are quoted in percentages. An EBV of +20% means that a ram will have daughters that wean 10% (because a ram only contributes half of the genetics) more lambs than the average of animals in 1990.

WHAT TO LOOK FOR?
Look for the highest positive values. Currently, the range in Merinos is about +31% to -17%. There is a similar range in all breeds. The higher the NLW breeding value of a ram, the better the reproduction you can expect from its daughters on average.

SHOULD I SELECT ON NLB OR NLW?
Generally, select for number of lambs weaned. This EBV emphasises higher lamb survival as well as the total number of lambs.
WHAT’S IN IT FOR ME?
Reproductive performance can have a big impact on the profitability of a ewe flock, particularly when meat prices are high. A maternal central progeny test undertaken in Australia demonstrated the large variation in the profitability of sires based on reproductive performance. The graph below demonstrates the range in margin in daughters from sires from just two of the breeds. Around 80% of the difference in profitability between sire groups was the effect of reproduction.

![Graph showing annual gross margin ($ per ewe) for Border Leicester and East Friesian sires.](image)

Adapted from Fogarty et al. 2005 AAABG 16: 60-63.

WHAT ELSE CHANGES IF I JUST SELECT FOR THE NUMBER OF LAMBS?

**THE FREE LUNCHES**
- Body weight goes up
- Growth goes up
- Wrinkle score goes down

**THINGS TO WATCH OUT FOR**
- Lower fleece weight
- Lower staple length

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
HEALTH: RESISTANCE TO WORMS (WEC)

WHAT TO LOOK FOR?
Resistance to internal parasites is defined by genetic differences in faecal worm egg count (WEC). It is quoted at one of four ages:

A. Weaning (WWEC)
B. Post-weaning (PWEC)
C. Yearling (YWEC)
D. Hogget (HWEC)

HOW IS IT MEASURED?
Adult female worms inside the sheep produce eggs which pass out in the faeces. A faecal worm egg count (WEC) is a measure of the number of worm eggs in one gram of faeces.

In order to get useable data for WEC, it is necessary to test individuals when the mob average WEC is high enough to be able to measure differences between individuals (>300 eggs per gram for scour worms; >1500 eggs per gram where Barber’s Pole is present). Once the mob average is high enough, breeders collect individual faecal samples from all sheep in the mob. These samples are then submitted to an accredited laboratory for individual testing.

WHAT DO THE NUMBERS MEAN?
EBVs for WEC are quoted in percentages and they are expressed as deviations from the average animals in the database in the 1990 drop.

An animal with a WEC EBV of -25% will have a 25% lower worm egg count than the average animal in 1990. The more negative the WEC EBV, the more resistant to worms the animal will be.

IS THERE ANY OTHER WAY OF PICKING THE WORMY ONES?
No, it is impossible to predict which animals are genetically more resistant to internal parasites. The only way to do it is using EBVs.

WHAT’S IN IT FOR ME?
There is resistance to all but the newest families of drenches on New Zealand sheep farms and at some point worm resistance to these new families will also develop. It is therefore imperative to develop more permanent options to deal with worm outbreaks, particularly in areas that have significant worm problems.

In higher rainfall areas where treating for worms and losses in production are major costs to the sheep enterprise, having animals that are genetically less likely to get a high worm burden can be invaluable.
THERE ARE A WIDE RANGE OF BENEFITS INCLUDING:
- Less drenching
  - less labour
  - less chemical usage
  - lower chance of drench resistance
- Lower losses in production from worm outbreaks
- Lower contamination of paddocks with worm eggs
  - lower challenge for young stock
  - less worms in the following season

WHAT ELSE CHANGES IF I JUST SELECT FOR RESISTANCE TO WORMS? THE FREE LUNCHES

- Higher muscling
- Higher staple strength

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
HEALTH: BREECH WRINKLE (EBWR)

WHAT TO LOOK FOR?
Breech wrinkle is relatively consistent across ages and the only EBV available is the early breech wrinkle trait (EBWR).

HOW IS IT MEASURED?
Breech wrinkle is scored by breeders either in the marking cradle on non-mulesed lambs or off shears after a weaner or yearling shearing, using body wrinkle (if mulesed). Breech wrinkle is scored on a scale of 1 to 5, with 1 being an animal with no wrinkle and a 5 being an animal with excessive wrinkle.

WHAT ABOUT BODY WRINKLE?
There is a very strong correlation (90%) between breech wrinkle and body wrinkle. An animal with a low EBWR will be genetically less wrinkly over the body as well as the breech area.

WHAT DO THE NUMBERS MEAN?
Wrinkle EBVs are quoted in scores and are expressed as deviations from the average of the animals in the database in the 2000 drop.

An animal with an EBWR of -1.0 will be genetically one wrinkle score less wrinkly than the average animal in 2000.

CAN I SEE OR FEEL IT?
Wrinkles are obviously easy to see in animals off shears, but rams are generally sold in 4 to 8 months of wool, making it difficult to pick the less wrinkly ones.

Further complicating the issue is the fact that skin wrinkle is on average 0.3 to 0.5 of a score higher in single born lambs than twin born lambs, is 0.2 to 0.3 of a score higher in lambs from adult ewes than maidens, and is 0.5 to 1.0 scores higher in lambs from ewes that were fed well during pregnancy than those fed less well.
WHAT’S IN IT FOR ME?
There are a few key reasons why selecting sheep with less wrinkle is a good idea. Sheep with less breech wrinkle have a lower susceptibility to fly strike. As a result, sheep with lower wrinkle scores are much easier to manage in systems where mulesing has ceased.

Wrinkly sheep also have lower lifetime reproductive output than less wrinkly sheep.

WHAT ABOUT WOOL CUT?
In general, wrinkly sheep cut more wool. But with balanced selection, it is possible to select heavy cutting yet low wrinkle sheep.

WHAT ELSE CHANGES IF I JUST SELECT FOR LOWER WRINKLE?

THE FREE LUNCHES
• Higher reproduction
• Less fly strike
• Higher staple strength

THINGS TO WATCH OUT FOR
• Lower fleece weight

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
HEALTH: SCOURING AND DAGS (DAG)

WHAT TO LOOK FOR?
Sheep accumulate dags when seasonal and parasite conditions are present that are conducive to scouring. This can occur at any age. The EBV that is available is the late dag trait (LDAG).

HOW IS IT MEASURED?
Dags are scored by breeders on a scale of 1 to 5, with 1 being no dags and 5 being an animal with excessive dags.

WHAT DO THE NUMBERS MEAN?
DAG EBVs are quoted in scores. So an animal with an LDAG EBV of -1.0 will be genetically one dag score less daggy than the average animal in 2000.

WHAT’S IN IT FOR ME?
In winter rainfall areas, the accumulation of dags can be costly. Not only is the contaminated wool of little or no value, paying contractors to remove it also costs money.

When dags are combined with the environmental conditions for flies to be active, they are the major cause of breech strike, resulting in a large production loss, as well, requiring considerable labour inputs to identify and treat sheep.

WHAT ELSE CHANGES IF I JUST SELECT FOR LESS DAGS?

THE FREE LUNCHES
- Less fly strike
- More fleece wool
- Less crutching

THINGS TO WATCH OUT FOR
- Resistance to worms?

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
HEALTH: BREECH COVER (BCOV)

WHAT TO LOOK FOR?
Some animals naturally produce less wool around the breech area (are bare-breeched). Breech cover can be assessed at any age: The EBV for breech cover is BCOV.

HOW IS IT MEASURED?
Breech cover is scored by breeders on a scale of 1 to 5, with 1 being a large bare area around the anus and 5 being an animal with complete wool coverage around the anus.

WHAT DO THE NUMBERS MEAN?
BCOV EBVs are quoted in scores. An animal with a BCOV EBV of -1.0 will be genetically one breech cover score less covered around the anus than the average animal in 2000.

WHAT’S IN IT FOR ME?
Breech cover is one of the indicator traits for susceptibility to flystrike. It is another string in your bow in the fight against flystrike. Combining low wrinkle and low breech cover EBVs can significantly reduce flystrike and reduce the reliance on surgical mulesing. Sheep with less breech cover also have a higher reproductive output (see graph below).

WHAT ELSE CHANGES IF I JUST SELECT FOR LOWER BREECH COVER?

THE FREE LUNCHES
- Higher reproduction
- Less fly strike

THINGS TO WATCH OUT FOR
- Fleece weight

BUT REMEMBER YOU CAN MANAGE THESE CORRELATIONS BY SELECTING ANIMALS BASED ON INDEXES (SEE INDEX SECTION)
YOUR STRATEGY

WHICH ARE THE KEY TRAITS I SHOULD FOCUS ON?
Unfortunately the answer is – that depends! It depends on your type of sheep, your production system and your target markets. Think about which traits have the potential to MAKE you money and also those that will SAVE you money.

- If your production system is focussed on turning off finished lambs, you will need emphasis on growth and carcass traits. Reproduction is also likely to be a profit driver.
- If your production system is focussed on turning off store lambs, reproduction and early growth are likely to be key traits of focus.
- If your system is focussed on producing wool and some surplus sheep, wool quality and quantity should receive some emphasis.

Whatever your production target, breeding sheep that require less labour and remain healthier is important. Which traits will save you time and money at your place?
SETTING YOUR TARGETS

1. PICK YOUR TRAITS
Focus on the traits that are most likely to MAKE you money or SAVE you money. REMEMBER you are breeding a sheep for future markets, not those that prevail today. So be mindful of likely price trends and production scenarios in the future.

2. DETERMINE WHERE YOU ARE
What is the current performance of your sheep? Against all the traits that you think are important, estimate your CURRENT level of performance. If you find yourself scratching your head, invest some time in working it out. It is pretty hard to know if things are improving if you don’t know what the base line is.

3. WHERE DO YOU WANT TO BE?
For each of your important traits, determine where you would ideally like your sheep to be in 10 years. It is important that these goals are specific and measurable. You will be tempted to write things down like “fast growing” or “heavy cutting”, but if you don’t put a number on it you have no way of measuring success. In geneticist speak, this is called a breeding objective. Call it whatever you like, but just make sure you do the thinking. It helps to clarify your ram buying decisions.

AN EXAMPLE

4. MAKE A PLAN
Once you are clear on where you want to take the flock, you need to come up with a clear plan for how you are going to get there. Where are the rams coming from and what genetics do they need to be carrying in order to achieve my goal? See the breeding objective tool at the back of this booklet, which is designed to help with this process.
UNDERSTANDING INDEXES

WHAT IS A SELECTION INDEX?
A selection index is the combination of two or more EBVs into a single value. Each EBV is weighted to reflect the trait emphasis in the breeding objective. Selection indexes are available for Merino production systems, maternal production systems and terminal production systems, and some examples are outlined below.

WHICH INDEX IS RIGHT FOR YOU?
When using an index, it is important to ensure that the traits that make up the index are the desired traits for your breeding objective and that the effects on those traits are moving in the desired direction (upward or downward pressure). It is important to look at the traits in an index and the likely genetic response to the index to determine if it is well matched to your breeding direction.

WHAT ARE THE BENEFITS OF AN INDEX OVER INDIVIDUAL TRAITS?
The right index can be very useful in making ram buying decisions because it reduces the amount of information you need to process. It basically provides one value for the overall breeding value of the ram. Importantly, an index also takes into account the correlations between traits and enables you to make progress on a range of traits, even though there may be an unfavourable correlation between some of them.
A MATERNAL EXAMPLE: THE MATERNAL $ INDEX
(used in Border Leicester and Coopworth)

Likely genetic response: Moderate increase in post weaning and weaning weight. Small increase in reproduction and birth weight.

A MERINO EXAMPLE: THE 7% INDEX

This index results in a large increase in CFW with a moderate reduction in fibre diameter and small increases in staple strength, weight and number of lambs weaned.
UNDERSTANDING PERCENTILE TABLES

WHAT IS A GOOD EBV?
When buying rams based on EBVs, one of the key questions is where should the minimum cut-off for a particular trait be? That is, should I only buy rams that are in the top 10% for YCFW? The right cut-offs for EBVs will depend on an individual enterprise, and how much emphasis you wish to place on each trait (high/medium/low). To work out where the individuals in your sale catalogue sit within the industry, you can use percentile band tables.

PERCENTILE BAND TABLES
Percentile band tables are regularly published by SHEEP GENETICS and can be downloaded from their website. They provide a snap shot of the genetic variability within the current drop for all of the key production traits. They enable you to see the EBVs of the best and worst performing animals for any given trait and allow you to make a judgement about the genetic merit of the animals in your sale catalogue.

It is important to note that a percentile band table only allows for comparison of sheep among their breed or breed groups. Age appropriate abbreviations are placed in front of the traits allowing for specific breeding objectives. The tables are particularly useful if your emphasis on particular traits does not match up with an index and thus you can use each individual trait when selecting rams.

An example of a percentile band table is given below for Merino production systems. The highlighted YCFW value at 16.9% shows that the top 20% of animals in the data base are above 16.9% for YCFW.

<table>
<thead>
<tr>
<th></th>
<th>YCFW</th>
<th>YFD</th>
<th>YSS</th>
<th>7% DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 10%</td>
<td>20.3</td>
<td>-2.1</td>
<td>3.1</td>
<td>156</td>
</tr>
<tr>
<td>Top 20%</td>
<td>16.9</td>
<td>-1.7</td>
<td>2</td>
<td>147</td>
</tr>
<tr>
<td>Top 30%</td>
<td>14.4</td>
<td>-1.4</td>
<td>1.2</td>
<td>141</td>
</tr>
<tr>
<td>Top 40%</td>
<td>12.1</td>
<td>-1.2</td>
<td>0.6</td>
<td>137</td>
</tr>
<tr>
<td>Average</td>
<td>10</td>
<td>-1</td>
<td>-0.1</td>
<td>132</td>
</tr>
<tr>
<td>Bottom 10%</td>
<td>-4</td>
<td>0.1</td>
<td>-3.5</td>
<td>109</td>
</tr>
</tbody>
</table>
UNDERSTANDING ACCURACY

WHAT IS ACCURACY?
All EBVs are quoted with an accuracy that reflects the amount of information that is available to calculate the EBV. The accuracy of an EBV is a measure of how sure you can be that the EBV reflects the true breeding value of the animal. The more information available on an animal and its relatives, the closer the EBV will reflect the true breeding value and hence the higher the accuracy will be.

WHAT DO THE NUMBERS MEAN?
Accuracy is quoted as a percentage. An accuracy of 100% would mean that the EBV is the same as the true breeding value of an animal. The lower the accuracy quoted, the wider the range around the EBV that the true breeding value may sit.

The potential difference (either higher or lower) that the true breeding value may be from the EBV across a range of accuracies and traits:

<table>
<thead>
<tr>
<th>Accuracy Level</th>
<th>PWT (kg)</th>
<th>YWT (kg)</th>
<th>YFAT (mm)</th>
<th>YEMD (mm)</th>
<th>NLW (per 100 ewes)</th>
<th>YgFW (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>2.6</td>
<td>2.9</td>
<td>1.2</td>
<td>1.0</td>
<td>13</td>
<td>0.35</td>
</tr>
<tr>
<td>50%</td>
<td>2.5</td>
<td>2.8</td>
<td>1.1</td>
<td>0.9</td>
<td>12</td>
<td>0.33</td>
</tr>
<tr>
<td>60%</td>
<td>2.3</td>
<td>2.6</td>
<td>1.0</td>
<td>0.8</td>
<td>11</td>
<td>0.30</td>
</tr>
<tr>
<td>70%</td>
<td>2.0</td>
<td>2.3</td>
<td>0.9</td>
<td>0.7</td>
<td>10</td>
<td>0.27</td>
</tr>
<tr>
<td>80%</td>
<td>1.7</td>
<td>1.9</td>
<td>0.8</td>
<td>0.6</td>
<td>9</td>
<td>0.23</td>
</tr>
<tr>
<td>90%</td>
<td>1.2</td>
<td>1.4</td>
<td>0.6</td>
<td>0.5</td>
<td>6</td>
<td>0.16</td>
</tr>
</tbody>
</table>

For example: for an animal with a YWT EBV of 6kg and an accuracy of 70%, the true breeding value of the animal would be somewhere between 3.7kg and 8.3kg (i.e. between 6kg-2.3kg and 6kg+2.3kg).
WHAT IS ACCURACY INFLUENCED BY?
The more information available on an animal, the higher the accuracy will be. Some of the key factors that influence accuracy are:

- Amount of performance information available on the animal
- Number of progeny and other relatives that have performance information
- Accuracy of the parents’ EBVs
- Correlations between the trait reported and other measurements
- Heritability of the trait

An animal with a lot of pedigree information, and a good history of measurement, will have EBVs with higher accuracy than an animal with sire-only pedigree. Once animals have progeny on the ground, accuracy is much improved.

DOES ACCURACY MATTER?
Finding rams with high accuracy needs to be balanced with finding rams with higher genetic merit. It is generally advisable to use young sires with lower accuracy but higher genetic merit to ensure genetic gain.

The higher the number of sires in a team, the higher the likelihood they will breed to their average EBV (because each ram is equally likely to move up or down) and accuracy will be less important.
GENOMICS AND SNP CHIPS

A TASTE OF SNP CHIPS
The genomic era is well and truly upon us, and with it the ability to predict a sheep’s performance from DNA extracted from a couple of drops of blood and then tested on a SNP chip. The sheep SNP chip is a glass slide containing 54,241 DNA markers called single nucleotide polymorphisms (SNPs). You may hear it referred to as the 50K SNP Chip. Knowing how an animal tests at these 54,241 markers allows the prediction of performance traits.

HOW WILL SNP CHIPS HELP?
Because SNP chips are based on DNA and not on performance, animals can be tested at a young age, which allows:

• More accurate selection (particularly on hard to measure traits or those that occur only later in life).
• A shorter generation length (because animals can be selected accurately and used at a young age).

They also increase the accuracy of EBVs and indexes for measured traits.

WHAT DO RAM BREEDERS HAVE TO DO?
To do a genomic test on an individual or group of sheep, all the ram breeder needs to do is to take a drop of blood from each animal and place it on a blood card. This card is then sent to SHEEP GENETICS who forward it for testing on the 50K SNP Chip. The results from this test are then forwarded back to SHEEP GENETICS for calculation of genomic breeding values.

HOW WILL I USE THEM?
For ram buyers, the process of identifying the right rams remains unchanged. The genomic information provided from the SNP chip test will be sitting in behind the EBVs for an individual animal. The information is essentially an enhancement of normal EBVs and will not be visible to ram buyers.
CONCLUSION

Breeding sheep should not be too complicated, but consistently breeding profitable ones in a changing market isn’t that easy!

Successful commercial sheep breeders have a simple strategy and stick to it. Buying rams with known genetic superiority in the traits that are important to their enterprise is part of this strategy.

In New Zealand, we are very fortunate to have at our disposal the world-leading genetic evaluation system for fine-wool sheep in MERINOSELECT. This system is very useful in determining which rams are most likely to have a positive impact on the future profitability of your sheep flock.

However, it is important to keep in mind that, while EBVs are a tool in breeding sheep, they do not provide all of the answers. There is still very much a need for good sheep – people who can remove sheep that will not be functional in a commercial production system, regardless of how good the EBVs say the sheep is.

Breeding functional but profitable sheep is all about common sense. It is about using a good balance of:

A. Sheep type
B. Visual performance
C. Performance figures

Missing out on any one of these three criteria will no doubt result in a less desirable outcome for commercial sheep producers.
WHERE TO LEARN MORE

WWW.PERFECTSHEEP.CO.NZ

MARK FERGUSON
mark.ferguson@nzmerino.co.nz
021 496 656

WILL GIBSON
will.gibson@nzmerino.co.nz
021 993 782