MERINOSELECT indexes
A ram breeder's guide

Why use a selection index?

A selection index is an important tool to drive genetic improvement in ram breeding programs when there are a range of traits of economic or functional importance. Collectively, these traits make up the "breeding objective", which aims to improve profitability in commercial sheep enterprises.

Indexes are useful for two main reasons:

1. They balance genetic improvement appropriately across a range of traits, with the emphasis placed on each individual trait determined by its relative importance.

2. Because indexes balance improvement across traits, they can be used to overcome economically antagonistic relationships *between* traits.

> " Appropriately designed indexes are central to the goal of breeding more profitable sheep for your ram buying clients.

How Sheep Genetics develops selection indexes

When Sheep Genetics develops standard selection indexes, a breeding objective is defined for each breeding scenario. This involves a bio-economic analysis of commercial flock performance to calculate the economic value of improving traits which affect profit, based on flock structure, production and price data.

The second step is to translate the results of the bio-economic analysis into the index, by linking profit traits to ASBV traits through genetic correlations. Often the profit and ASBV traits are the same, for example fleece weight, fibre diameter and body weight are key profit drivers in commercial Merino flocks and are also easy to measure in ram breeding flocks. For profit traits which are hard to measure, however, we may rely on other correlated traits to drive improvement in the objective. An example of

this is using breech wrinkle to reduce susceptibility to fly strike. More recently, genomic information has become increasingly important for genetic improvement of these hard to measure traits.

By combining the economic values of traits with the genetic relationships between traits we can determine the appropriate relative weights which allow us to combine ASBVs into a single index value for each animal.

> " The changes in individual traits from using an index depend on the information you record in your flock. If you want to improve, or even just maintain a trait, you must record it to ensure ASBVs are sufficiently accurate for the index to do its job.

MERINOSELECT indexes

MERINOSELECT has standard indexes for four general production systems:

- Fine Wool (FW)
- Wool Production (WP)
- Sustainable Merino (SM)
- Merino Lamb (ML)

While the production systems behind the four indexes are meant to cover the broad range of breeding directions used in the Merino industry, breeding programs can vary widely in their objectives. For most breeders, the standard indexes can be a useful starting point to identifying selection candidates before making final decisions on individual trait performance.

Fine Wool (FW)

Summary of Fine Wool index

- The Fine Wool index is based on a production system where the majority of income is from wool clip, with a strong focus on reducing the micron of the clip.

- FW focuses on genetic improvement of fleece weight, fibre diameter, staple strength and reproduction.

- Emphasis on reducing wrinkle and worm egg count is also included.

Production system outline

This production system is for a self-replacing Merino flock producing 15–17 micron wool from both the breeding flock and a mixed age wether flock. The wool to meat income ratio of the production system is 71:29.

Fine Wool has a strong focus on increasing wool income by increasing fleece weight, reducing fibre diameter (both mean and CV) and maintaining staple strength. As this production system is commonly used in high rainfall zones where parasites cause significant economic losses, worm egg count and breech wrinkle have also been included.

Figure 1: Relative economic contribution of traits to the Fine Wool (FW) index

Trait contributions

Figure 1 illustrates the relative contribution and balance of the key trait groups within the indexes based on the genetic variation within the traits and their economic importance to the production system. The longer the bar, the greater relative contribution of the trait within the index, and the greater the impact on the profitability of the production system.

In FW, fleece weight and fibre diameter are the traits that contribute most to the profitability of the production system.

Selection advantage

Table 1 shows the mean ASBVs of the sires of the 2022 drop, along with the mean ASBVs for the top 10% of the sires ranked on the Fine Wool index. The sires of the 2022 drop are used as they are a relatively complete data set, with a higher level of accuracy, and are therefore a stable representation of the industry. Table 1 provides an indication of the advantage of selecting sires based on the FW index. For example, the fleece weight ASBVs for the top 10% of the 2022 drop sires was on average 23.98, +7.22 higher than the average of the group.

Selection on the FW index results in increases in fleece weight and reductions in fibre diameter, two major profit drivers. It also has emphasis on worm egg count and breech wrinkle, meaning selection using FW will reduce these two traits. This is particularly advantageous in high-rainfall areas.

Table 1: ASBV trait means for sires of 2022 drop progeny, and mean ASBVs for top 10% of sire ranked on the FW index (May 2024 MERINOSELECT analysis)

Trait group	Mean of the 2022 drop sires	Mean of top 10% of 2022 drop sires
Fleece weight	15.72	23.98
Fibre diameter	-0.73	-1.68
CV diameter	-0.63	-0.53
Staple strength	0.74	1.17
Growth	6.16	5.22
Lean meat yield	1.11	1.04
Mature weight	5.65	4.20
Condition score	0.11	0.06
Conception	0.03	0.03
Litter size	0.07	0.08
Rearing ability	0.03	0.03
Wrinkle	-0.26	0.00
Worm egg count	-5.72	-11.97

When selecting on the FW index, long-term responses in individual traits will vary depending on features of the breeding program, including traits measured, level of pedigree recording, use of genomic testing, flock structure and selection emphasis on the index. The selection advantages shown in Table 1 gives an indication of the likely direction and relativity of response for the FW index.
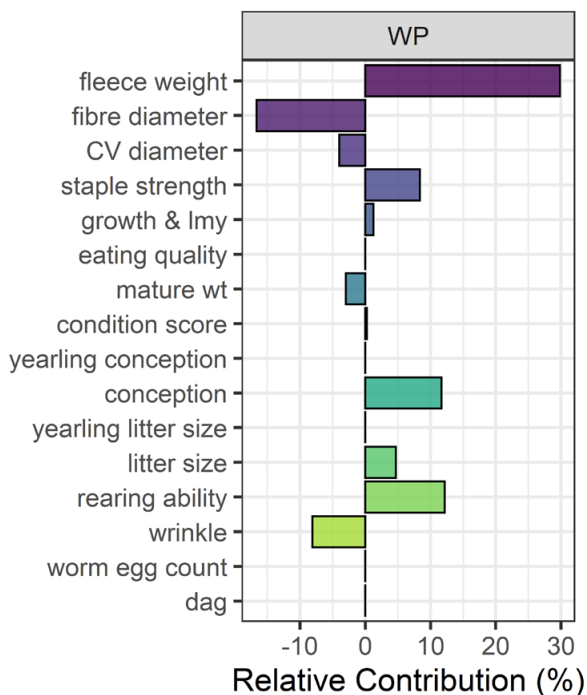
Wool Production (WP)

Summary of Wool Production index

- The Wool Production index is based on a production system where the majority of income is from wool clip, with a strong focus on increasing wool production.

- The index focuses on genetic improvement of fleece weight, fibre diameter, staple strength and reproduction.

- Emphasis on lower wrinkle is also included.

Production system outline

The Wool Production index is based on a self-replacing production system producing 16–18 micron wool from both the breeding flock and a mixed age wether flock. The wool to meat income ratio of the modelled production system is 71:29.

Wool Production has a strong focus on increasing fleece weight, staple strength and reproduction, whilst decreasing fibre diameter. Relative to the FW index, WP is suited to breeding programs looking to increase income through higher wool cuts, but without compromising on wool quality.

Figure 2: Relative economic contribution of traits to the Wool Production (WP) index

Trait contributions

Figure 2 illustrates the relative contribution and balance of the key trait groups within the indexes based on the genetic variation within the traits and their economic importance to the production system. The longer the bar, the greater relative contribution of the trait within the index, and the greater the impact on the profitability of the production system.

In WP, clean fleece weight and fibre diameter are the traits that contribute most to the profitability of the production system.

Selection advantage

Table 2 shows the mean ASBVs of the sires of the 2022 drop, along with the mean ASBV for the top 10% of the sires ranked on the Wool Production index. The sires of the 2022 drop are used as they are a complete data set, with a higher level of accuracy, and therefore a stable representation of industry. Table 2 provides an indication of the selection advantage of selecting sires based on the WP index. For example, the fleece weight ASBVs for the top 10% of the 2022 drop sires was on average 26.45, +10.73 higher than the average of the group.

Selection on the WP index results in increases in fleece weight and reductions in fibre diameter, two major profit drivers. It also places emphasis on reproduction and breech wrinkle, meaning selection using WP will increase your flock's reproductive performance and reduce breech wrinkle. This is particularly advantageous in flocks looking to produce more lambs and more kilograms of fleece per animal.

Table 2: ASBV trait means for sires of 2022 drop progeny, and mean ASBVs for top 10% of sire ranked on the WP index (May 2024 MERINOSELECT analysis)

Trait group	Mean of the 2022 drop sires	Mean of top 10% of sires
Fleece weight	15.72	26.45
Fibre diameter	-0.73	-1.20
CV diameter	-0.63	-0.48
Staple strength	0.74	1.36
Growth	6.16	6.45
Lean meat yield	1.11	1.35
Mature weight	5.65	5.34
Condition score	0.11	0.07
Conception	0.03	0.04
Litter size	0.07	0.09
Rearing ability	0.03	0.04
Wrinkle	-0.26	-0.10

When selecting on the WP index, long-term responses in individual traits will vary depending on features of the breeding program including traits measured, level of pedigree recording, use of genomic testing, flock structure and selection emphasis on the index. The selection advantages shown in Table 2 gives an indication of the likely direction and relativity of responses for the WP index.
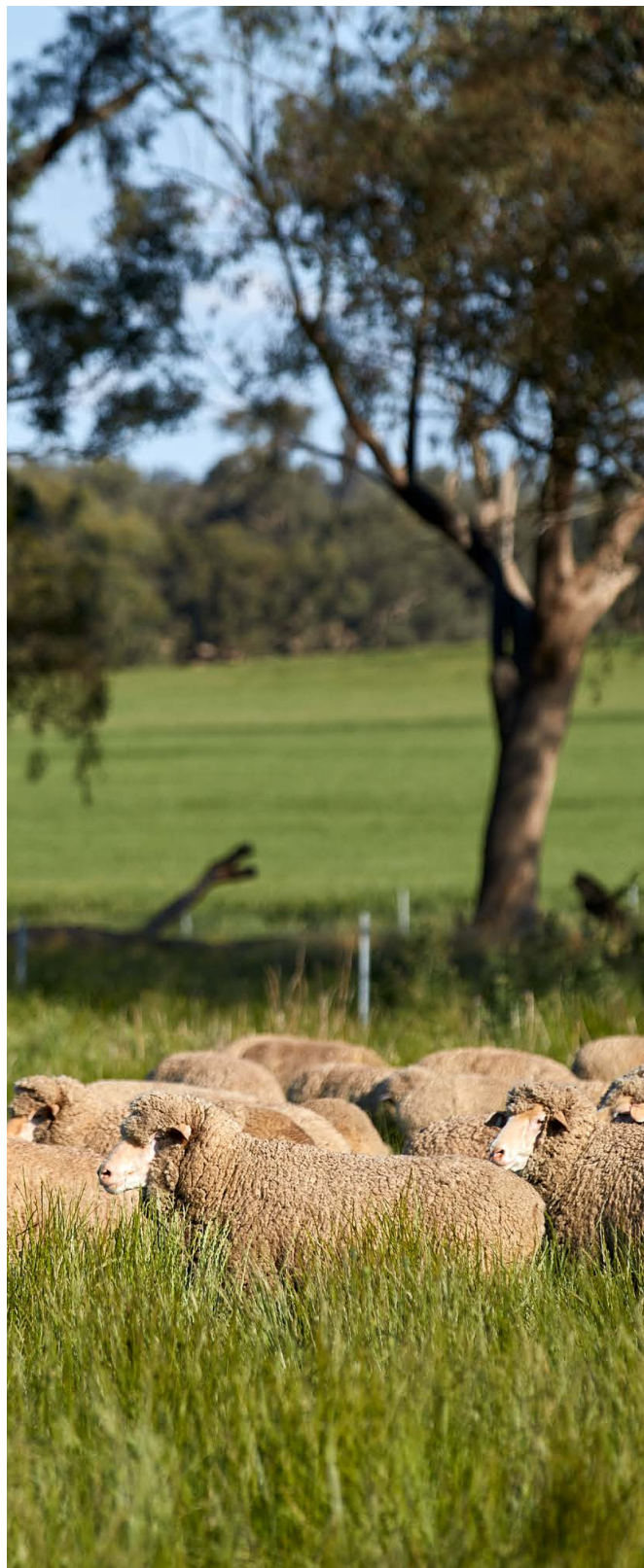
Sustainable Merino (SM)

Summary of Sustainable Merino index

- The Sustainable Merino index is based on a production system where the income is from sheepmeat production and the wool clip are reasonably balanced.

- The index focuses on genetic improvement of fleece weight, growth and lean meat yield and reproduction.

- Emphasis on reduced wrinkle, dag and worm egg count is also included.

Production system outline

The Sustainable Merino index is based on a self-replacing production system producing 17–19 micron wool, and selling lambs at post-weaning, off-shears. The wool to meat income ratio of the modelled production system is 46:54.

Sustainable Merino has a strong focus on increasing fleece weight, growth and lean meat yield, and reproduction, whilst maintaining staple strength and fibre diameter. It also focuses on reducing worm egg count, dag and wrinkle. This index is suited to producers with a strong focus on sustainability, particularly those operating in a high rainfall area. In comparison to FW and WP, this index is more balanced between wool and meat production.
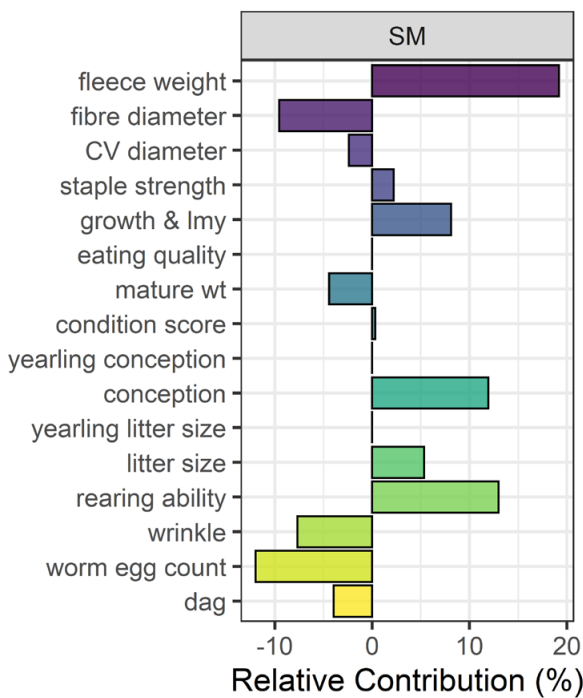
Trait contributions

Figure 3 illustrates the relative contribution and balance of the key trait groups within the indexes based on the genetic variation within the traits and their economic importance to the production system. The longer the bar, the greater relative contribution of the trait within the index, and the greater the impact on the profitability of the production system.

In SM, fleece weight, reproduction, and sustainability traits contribute most to the profitability of the production system.

Figure 3: Relative economic contribution of traits to the Sustainable Merino (SM) index

Selection advantage

Table 3 shows the mean ASBVs of the sires of the 2022 drop, along with the mean ASBV for the top 10% of the sires ranked on the Sustainable Merino index. The sires of the 2022 drop are used as they are a complete data set, with a higher level of accuracy, and therefore a stable representation of industry. Table 3 provides an indication of the selection advantage of selecting sires based on the SM index. For example, the fleece weight ASBVs for the top 10% of the 2022 drop sires was on average 22.42, +6.70 higher than the average of the group.

Selection on the SM index results in increases in fleece weight, growth and lean meat yield, and reproduction, three major profit drivers. It also has emphasis on worm egg count, wrinkle and dag, meaning selection using SM will decrease your flock's worm egg count, wrinkle and dag. This is particularly advantageous in flocks operating in a high rainfall zone, or with a strong focus on improving welfare traits, whilst producing large volumes of lamb and wool.

Table 3: ASBV trait means for sires of 2022 drop progeny, and mean ASBVs for top 10% of sire ranked on the SM index (May 2024 MERINOSELECT analysis)

Trait group	Mean of the 2022 drop sires	Mean of top 10% of sires
Fleece weight	15.72	22.42
Fibre diameter	-0.73	-0.70
CV diameter	-0.63	-0.73
Staple strength	0.74	1.42
Growth	6.16	8.51
Lean meat yield	1.11	1.66
Mature weight	5.65	7.29
Condition score	0.11	0.17
Conception	0.03	0.05
Litter size	0.07	0.13
Rearing ability	0.03	0.05
Wrinkle	-0.26	-0.49
Worm egg count	-5.72	-22.16
Dag	-0.03	-0.08

When selecting on the SM index, long-term responses in individual traits will vary depending on features of the breeding program including traits measured, level of pedigree recording, use of genomic testing, flock structure and selection emphasis on the index. The selection advantages shown in Table 3 gives an indication of the likely direction and relativity of responses for the SM index.

Merino Lamb (ML)

Summary of Merino Lamb index

- The Merino Lamb index is based on a production system where the majority of income is from sheepmeat production, particularly lambs, with some income from adult ewe wool clips.

- The index focuses on genetic improvement of fleece weight, growth, lean meat yield, eating quality and reproduction.

- Emphasis on reduced wrinkle is also included.

Production system outline

The Merino Lamb index is based on a self-replacing production system with yearling joining of ewe lambs, and older ewes mated to terminal sires. As a consequence, the wool to meat income ratio of the modelled production system is 31:69.

Merino Lamb has a strong focus on increasing fleece weight, growth, lean meat yield, eating quality and reproduction, while also reducing wrinkle. This index is suited to producers with a strong focus on increasing lamb production and quality whilst maintaining fleece production in adult ewes (18–20.5 micron).
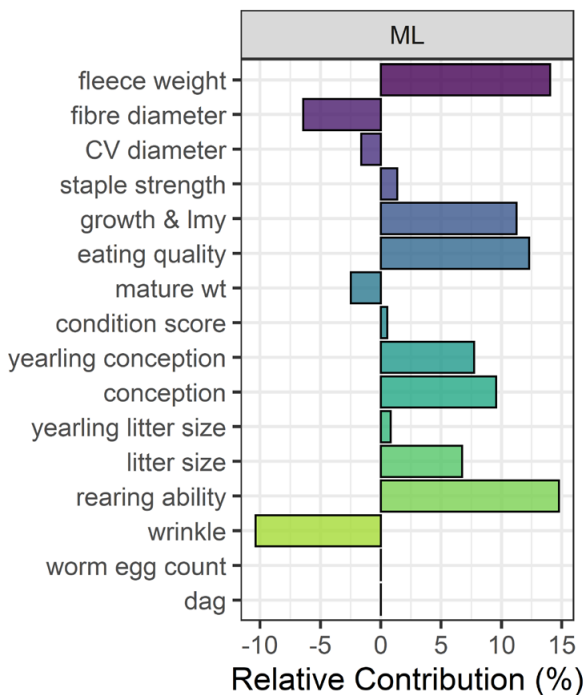

Figure 4: Relative economic contribution of traits to the Merino Lamb (ML) index

Trait contributions

Figure 4 illustrates the relative contribution and balance of the key trait groups within the indexes based on the genetic variation within the traits and their economic importance to the production system. The longer the bar, the greater relative contribution of the trait within the index, and the greater the impact on the profitability of the production system.

In ML, clean fleece weight, eating quality and reproduction are the traits that contribute most to the profitability of the production system, with relative high focus on growth and lean meat yield as well.

Selection advantage

Table 4 shows the mean ASBVs of the sires of the 2022 drop, along with the mean ASBV for the top 10% of the sires ranked on the Merino Lamb index. The sires of the 2022 drop are used as they are a complete data set, with a higher level of accuracy, and therefore a stable representation of industry. Table 4 provides an indication of the selection advantage of selecting sires based on the ML index. For example, the fleece weight ASBVs for the top 10% of the 2022 drop sires was on average 18.32, +2.71 higher than the average of the group.

Selection on the ML index results in increases in fleece weight, growth, lean meat yield, eating quality and reproduction at both yearling and adult. It also places emphasis on reducing wrinkle. This index is suited to flocks joining an apportion of ewes to terminal sires for high quality lamb production, whilst maintaining a valuable fleece.

Table 4: ASBV trait means for sires of 2022 drop progeny, and mean ASBVs for top 10% of sire ranked on the ML index (May 2024 MERINOSELECT analysis)

Trait group	Mean of the 2022 drop sires	Mean of top 10% of sires
Fleece weight	15.61	18.32
Fibre diameter	-0.75	-0.49
CV diameter	-0.49	-0.74
Staple strength	0.61	1.06
Growth	5.44	8.46
Lean meat yield	1.01	1.35
Eating quality	-0.25	-0.03
Mature weight	5.03	7.30
Condition score	0.08	0.20
Yearling conception	0.03	0.16
Conception	0.02	0.05
Yearling litter size	0.01	0.04
Litter size	0.06	0.13
Rearing ability	0.02	0.05
Wrinkle	-0.18	-0.62

When selecting on the ML index, long-term responses in individual traits will vary depending on features of the breeding program including traits measured, level of pedigree recording, use of genomic testing, flock structure and selection emphasis on the index. The selection advantages shown in Table 4 gives an indication of the likely direction and relativity of responses for the ML index.
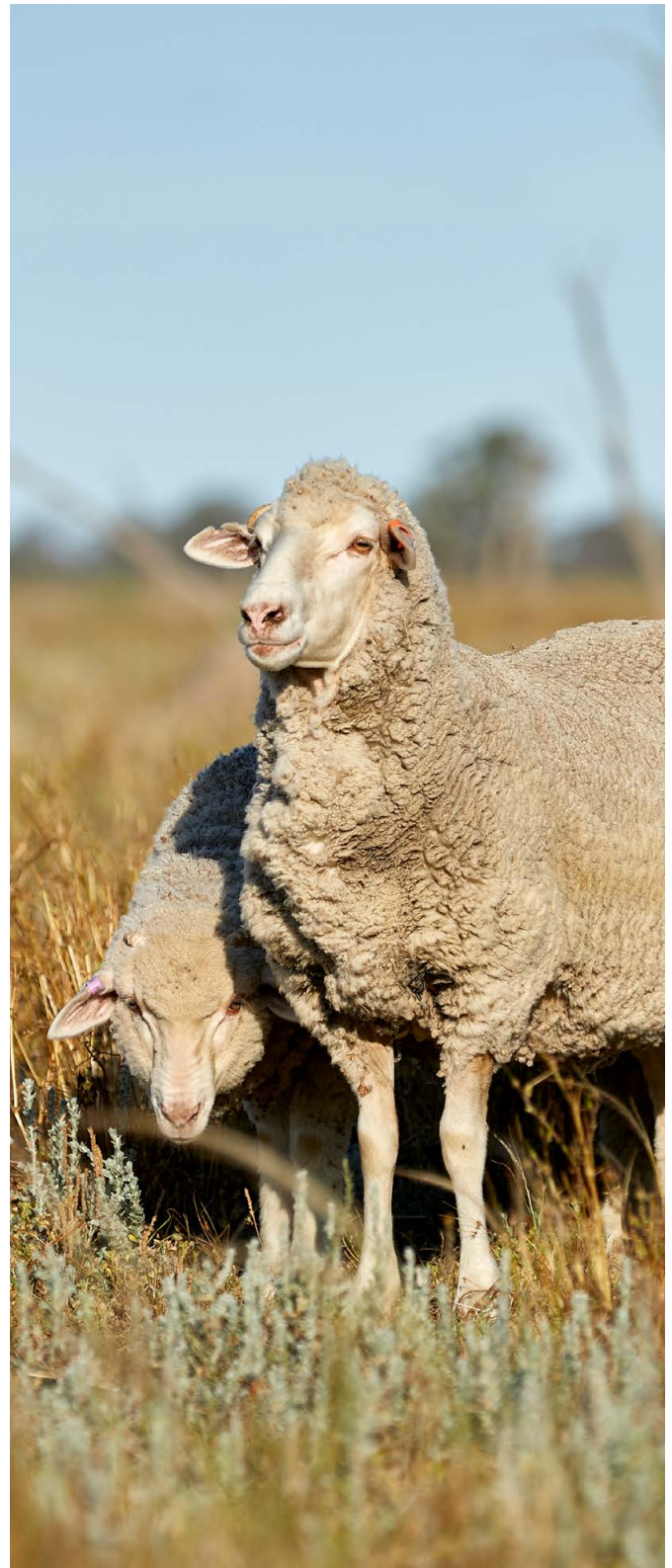
Factsheet current as at May 2024

More information	📞 02 8055 1818	✉ info@sheepgenetics.org.au	🔗 sheepgenetics.org.au