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Using EBVs and selection indexes to meet your Merino breeding objective

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Key Messages

- Ensure the selection index you use reflects your breeding objective.
- Combining visual assessment with EBVs and index values provides a powerful selection tool to help identify superior sheep that meet a breeder's objective.
- ASBVs and indexes enable breeders to compare sheep between studs and select the best rams for their sheep enterprise.

Introduction

A combination of visual assessment, estimated breeding values (EBVs) and selection indexes aids in the identification of superior sheep that match a breeding objective. The Trangie QPLU$ Merino project demonstrated how EBVs and a suitable selection index can accelerate flock performance and progress towards the flock's breeding objective.

Estimated Breeding Values (EBVs)

EBVs indicate a sheep's genetic merit for a specific trait. In a flock, if a sheep has an EBV of -1.5 µm for fibre diameter (FD), its genes for FD are 1.5 µm finer than the average of the group being evaluated.

EBVs are used by ram breeders and buyers to select superior sheep. EBVs can provide a more accurate picture of a sheep's breeding value than raw measurements alone. While a raw measurement accurately assesses a sheep's performance for a trait, it needs to be value-added to provide an accurate estimate of the sheep's genetic value for that trait. Value-adding uses additional information about the sheep to predict the performance of their progeny for that trait – and, as sheep breeders, isn't that what we want?

Types of Breeding Values

Not all breeding values provide the same information. There are two basic types: across-flock and within-flock EBVs.

Sheep Genetics Australia reports both across-flock and within-flock EBVs. These EBVs are only reported if the required quality assurance has been undertaken, and there is sufficient performance information to meet the prescribed accuracy standard.

Sheep Genetics Australia's across-flock EBVs, known as Australian sheep breeding values (ASBVs), are only reported when there is sufficient genetic linkage to other flocks. The linkage allows the performance of sheep within any given flock to be compared with sheep in other linked flocks. Merino and poll Merino ASBVs can be compared with each other, but cannot be compared with the ASBVs of other breeds. Only the terminal sire breeds (e.g. poll Dorset, white Suffolk) have sufficient linkage to allow the ASBVs of different breeds to be compared. The ASBVs of all other breeds can only be compared within their breed. ASBVs must be reported with their accuracy value.

Merino and poll Merino flocks without the required level of genetic linkage to other flocks have their EBVs reported as flock breeding values (FBVs), or within-flock EBVs. These EBVs are reported without an accuracy value.

Accuracy values are reported as a percentage. The higher the percentage, the closer the ASBV is to representing the true breeding value of the sheep. A true breeding value is expressed as 100%. An accuracy value indicates the amount of effective information used to calculate the EBV.

In the QPLU$ flock, EBVs were calculated using all available information, which included: multiple production measurements (yearling, hogget and adult); the pedigree of the sheep; the traits' heritability; correlations between traits; and management and environmental effects. All this information was used to maximise the accuracy of the EBV, the resulting selection, and therefore the flock's genetic progress.

Selection Indexes

A selection index combines two or more EBVs into a single value. Each EBV in the index is weighted to reflect the trait's emphasis in the breeding objective.

The higher a sheep's index value, the higher its overall performance for traits in the breeding objective.

The QPLU$ flock was established to demonstrate the use of EBVs and indexes to achieve a range of breeding objectives. One of these objectives was to place equal emphasis on increasing clean fleece weight (CFW) and reducing FD – known as an 8% micron premium (MP) selection index. The expected response to selection within the QPLU$ flock was to increase CFW by 8.3% and reduce FD by 2.2µm in 10 years.

Using EBVs and selection index figures

EBVs and selection index values are used, in combination with visual assessment for traits not in the index, to make selection and mating allocations. The EBVs and index values quickly and accurately identify the sheep with superior genetic performance for the measured traits. Accurate selection and the resulting mate allocation maximise the rate of progress and predictability of achieving a flock's breeding objective.

Table 1 shows four rams' EBVs for CFW and FD, as well as their 8% MP index value. A 'classer grade' is also reported; this is like an index for visually assessed traits – it is the combined value of the ram for these traits. In this case, the following numbers were assigned: 1 – tops; 2 – reserves; 3 – flock rams; 4 – culls. How can we use these figures to select the best ram in the flock to mate?

Rams A and B have the highest index value, indicating that of the four rams, they have the best genetic performance for CFW and FD to achieve an 8% MP breeding objective. Both rams have a high performance and the appropriate balance for CFW and FD. The EBVs show that ram A will breed progeny that are a little heavier cutting and finer than ram B.

Ram A has a lower classer grade than ram B, and only a very marginal difference in index value. If performance for measured traits has a similar emphasis to visual traits in the flock breeding objective, this would result in ram B being selected.

Rams C and D have lower index values, indicating that if these rams were mated, the flock's genetic progress towards the breeding objective would be slower. Ram C also has a low classer grade, making it unsuitable as a stud sire.

Table 1. Classer grade, hogget (H) breeding values (EBVs) for CFW and FD and 8% MP index value.

Ram	Classer Grade	HCFW %	HFD µm	8% MP Index
A	2	26.5	-1.5	161.7
B	1	22.4	-1.4	161.0
C	3	24.8	-0.9	154.0
D	1	11.2	-1.7	147.6

Appropriate selection indexes

Breeding objectives commonly include more measured traits than just FD and CFW. There are a large number of measured traits that can be included in an index – these include wool, meat, reproduction and disease traits. Visually assessed traits can also be included in an index.

As the number of traits in a breeding objective increases, it becomes increasingly difficult to value a ram on raw measurements or EBVs alone. This is where a selection index becomes an invaluable tool. The index value enables a sheep's performance for several traits to be quickly and accurately ranked for a breeder's objective.

Ram sale catalogues

It is critical that ram buyers know that the selection index they use accurately reflects their flock's breeding objectives. A range of indexes are commonly supplied with sale rams, to cater to various client needs; however, if the relevant index is not provided, the ram buyer should ask the breeder to provide an index that suits their needs.

It is also important that a ram buyer knows the stud's breeding objective and the stud flock's progress towards this objective, as any change in the stud's performance will affect the commercial flock performance.

Ram buyers can use the appropriate index values, combined with visual assessment, to quickly and accurately identify those rams best suited to their own commercial breeding objective.

Table 2 provides an example of a Merino ram sale catalogue that includes hogget EBVs, 10% MP index values and raw measurements. The index reflects a breeding objective of increasing CFW and body weight (WT), reducing FD and improving wool quality. The two rams that will maximise flock performance towards meeting this breeding objective are rams A and B.

Table 2. Hogget breeding values (EBVs), 10% MP index value and measured performance expressed in deviations from the drop average.

TRAIT	Ram	CFW %	FD µm	CV %	WT %	10% MP Index
EBVs	A	18.0	-0.1	-0.2	1.5	132.9
Measured	A	130	0.7	-1.0	109	
EBVs	B	4.0	-1.8	-0.2	0.1	132.9
Measured	B	98	-0.9	-1.9	96	
EBVs	C	7.8	-0.5	-0.6	5.4	120.6
Measured	C	113	0.5	-1.8	108	
EBVs	D	2.8	0.1	1.1	4.7	110.0
Measured	D	113	0.5	3.3	108	

Even though the two top rams have the same index values, their EBVs are different. The EBVs show that ram A progeny will have higher CFW and WT, whilst ram B progeny will have a lower FD.

In contrast, rams C and D have very similar values for raw measurements, but very different index values and EBVs. These rams highlight the value of EBVs compared with measured performance alone, as EBVs provide a better picture of the ram's breeding value.

Ram C was a twin bred by a high performing sire, so his measurements do not show his true breeding potential. Ram C's EBVs indicate that his progeny will have substantially higher CFW and WT, and lower FD and CV (coefficient of variation of FD), than ram D – but this is not obvious from using the rams' measured performance alone.

When selecting rams, it is important to use visual assessment in combination with EBVs and an index that reflects the flock's breeding objective. The ram that best matches the flock's breeding objective may not necessarily have the highest index or be the most expensive.

ASBVs and index values allow the breeding value of rams from different studs to be compared, so that the most appropriate rams for a particular breeding objective can be selected, regardless of flock of origin.

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Further Reading

Primefact Nos. 578, 579 and 581

A Few Selected Lines Issues 1-7

Proceedings Trangie QPLU$ Open Day 2006

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