Sheep CRC Practical Wisdom Notes

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Sheep CRC Practical Wisdom
Know it. Do it.

Sheep CRC genomic test for Merinos —what are the benefits?

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Key points

- A Genomic Test is a DNA test that gives information about 15,000 genetic markers and it can be used to predict genetic merit. In contrast, the Parentage or Poll Test is only based on a few hundred markers, and can only be used to verify parentage or predict polled status.
- Genomic tests increase ASBV accuracy and, therefore, rate of genetic gain.
- The accuracy increase is highest when there are limited measurements available, for example in young animals, and for traits that cannot be easily measured early on.
- Most of the extra gain can be achieved for the adult wool traits. Currently, genomic tests can increase overall genetic gain in Merinos by approximately 10–15%.
- A cost effective strategy is to test the best 20% of the young ram drop, as this will achieve most of the additional potential genetic gain.

Figure 1. Collecting blood samples onto a 'blood card' for genomics testing.

Introduction

Genetic gain in sheep breeding programs can be made by identifying and selecting the best animals. Greater genetic gain is achieved when those animals can be more accurately selected and mated at younger ages.

Australian Sheep Breeding Values (ASBVs) are based on performance and pedigree information, but can now also include DNA marker information from the Sheep Genomic Test. This genomic test increases the accuracy of selection of young animals, especially for traits that are generally measured later in life or not measured at all.

What increase in genetic gain can genomic tests offer?

For all three Merino selection indexes reported by Sheep Genetics, genomic testing adds accuracy to ASBVs and the indexes. This is associated with a predicted increase in rate of genetic gain by approximately 10% where rams are first mated at 18 months and 15% if the best rams are first mated at 6 months.

Table 1. Predicted rates of gain ($/ewe/year) for various indexes with and without the use of genomic testing on rams prior to selection.

MERINOSELECT Index	Ram first use at 6 months		Ram first use at 18 months	
	Without Genomics	With Genomics	Without Genomics	With Genomics
Merino Production	$2.05	$2.34	$1.87	$2.05
Fibre Production	$2.06	$2.36	$1.91	$2.10
Dual Purpose	$1.91	$2.20	$1.74	$1.91

Which animals should be tested and when?

Test the most promising young ram candidates

Since genomic testing is still relatively expensive, it is wise to invest only in those animals where you can make a difference. Ram selection is more important than ewe selection, and only the most promising rams are likely to be used in the stud. Also, the information from the Genomic Test is most useful when there is limited information available. Therefore, it is best to test the most promising young rams.

For many ram breeders who are already recording considerable performance and pedigree information, much of the potential gain from genomic tests can be obtained from testing a relatively small percentage of the ram drop. Rams that have poor ASBV and index values when identifying candidates for genomic testing are unlikely to be selected in the sire team.

Testing the top 20% of the ram drop is expected to give approximately 80%–90% of the potential additional genetic gain from genomics compared with testing the entire ram drop. Testing more rams (top 20%) than are required as replacement sires in the stud (usually around 3%) allows ram breeders to refine selection once genomic test results have been incorporated into ASBVs. There is limited value in only testing rams that are going to be selected anyway. The idea of the Genomic Test is that you can make better selections from a larger group of promising rams.

Table 2. Percentage of possible additional genetic gain achieved compared with testing 100% of the ram drop for first use of rams at 6 or 18 months old.

Proportion of ram drop tested	Proportion of possible extra genetic gain	
	First use at 6 months	First use at 18 months
5%	27%	29%
10%	61%	72%
15%	79%	88%
20%	87%	94%
30%	94%	98%

Sampling animals from a number of progeny bloodlines or family groups will widen the pool of future sires allowing genetic diversity to be maintained and assist in avoiding future inbreeding.

How are ASBV accuracies increased with the Genomic Test?

The value of the genomic information depends on the increase in ASBV accuracy compared with conventional performance recording at the time of selection.

The increase in ASBV accuracy is highest for traits that are measured later in life, for example in adult wool production traits or for traits that are not directly measured, such as staple strength. Increases tend to be smaller for traits where animals have had performance recorded prior to genomic testing, such as post weaning weight. Genomic selection will provide greater accuracy increases in traits that have little performance recording prior to first selection. Table 3 shows the increase in ASBV accuracy for several important traits when first use of rams is at either 6 or 18 months.

Table 3. Accuracy of some ASBV and indexes for rams at 6 and 18 months of age.

Trait	6 months		18 months	
	Without genomics	With genomics	Without genomics	With genomics
Post weaning WEC	28	36	47	50
Yearling clean fleece weight	43	63	67	75
Yearling mean fibre diameter	54	71	80	84
Yearling CV fibre diameter	44	57	70	74
Yearling staple strength	29	48	46	56
Merino Production Index	28	40	38	45

The value proposition

Selecting better rams will have an immediate impact on their direct progeny. But selecting better rams for the stud will have more important future benefits as the next generation of stud rams and ewes multiply that improvement over more offspring and pass that on to future generations. It is estimated that the additional genetic gain achieved from every genomic test will return $500–$1,000 additional value to Australia's sheep industry over the next 20 years. Importantly, for each of the selection indexes much of the genetic gain is expected to be achieved in on-farm traits. This is important as it demonstrates much of the economic gain that will be realised in commercial production systems, for example in parasite resistance and adult wool production. We expect that within the next year we will also be able to predict genetic merit for reproduction based on the genomic test.

The value proposition for a ram breeder is dependent on their clients' preparedness to pay more for rams of higher genetic merit. It may be of use to outline to commercial clients that much of the benefit of the genetic gain is expected to be realised in commercial production systems.

Other important factors that determine the cost effectiveness of genomic testing for a ram breeder are the percentage of males tested and the percentage of males born that are sold as rams. Selling a higher proportion of males born as rams and prudent use of genomic tests, e.g. testing 10–20% of the ram drop will give a higher return per genomic test compared with testing all rams.

Take home messages

- The Sheep CRC Sheep Genomic Test increases ASBV accuracy, especially for young rams and for traits that are measured later in life.
- More accurate selection will increase genetic gain.
- Young rams can be used with more confidence, and using more young rams in the stud reduces generation interval.
- General testing recommendations for the ram breeder:
    - Test animals prior to selection.
    - Test more animals than you need, about 20% of the most promising young ram candidates.
    - Consult with an advisor to optimise your testing strategy.

Further information

Sheep CRC website: www.sheepcrc.org.au, then choose Genotyping tests.