Sheep CRC Practical Wisdom Notes

Document ID:	SheepCRC_25_45
Title:	Fat and eye muscle depth in Merinos breeding programs Sept 2015
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Key words:	sheep; fat and eye muscle depth; merino breeding

It should be cited as:

Sheep CRC and Sheep Genetics (2015) – *Fat and eye muscle depth in Merinos breeding programs Sept 2015*

SHEEP CRC
Sheep CRC Practical Wisdom
Know it. Do it.

Fat and eye muscle depth in Merino breeding programs

Key points

- If reproduction and ewe condition are important traits for individual breeders then they should directly measure them and not rely on indirect correlations with other traits. Selecting on fat or eye muscle depth is not a substitute for selection directly on reproduction.
- Due to the number of complex interactions and correlations between traits, it is important for ram breeders to directly measure all important traits that contribute to farm profitability and use multiple trait selection indexes that consider the value of all these traits, rather than focusing on just one or two traits.
- To achieve the highest gains in reproductive efficiency within the context of overall on-farm profitability, ram breeders should record reproduction in their ram breeding flocks. Additional information from correlated traits including body weight, fat, eye muscle depth, scrotal circumference, wrinkle, and fleece weight will help improve the accuracy of number of lambs weaned ASBVs, but direct measurements by far makes the biggest contribution.

Introduction

For many years, Australian Merino breeders have based their selection primarily on wool characteristics. With the increasing value of lamb and mutton in the Australian sheep industry and increasing cost of labour and other inputs, the modern Merino ewe is now being bred for reproductive efficiency, meat attributes and lower input costs, as well as profitable wool production.

The importance of body reserves and condition score to provide a buffer against periods of poor nutrition and for maintaining ewe condition score during pregnancy is widely recognised. As fatness and muscling have implications at various points throughout the production cycle, there is significant debate throughout the sheep industry about the amount of emphasis that breeding programs should place on fat and eye muscle depth. This is also an issue for debate within southern beef breeding herds. This Practical Wisdom Note has been developed to provide more detailed information about the genetic relationships between fat, eye muscle depth, and other traits of economic importance in Merino breeding programs, the consequences of including fat and muscle as selection traits in current Merino indexes, and the relationship between fat and muscle ASBVs and on-farm reproductive performance.

What fat are we talking about? Subcutaneous C site fat depth at the 12/13th rib can be measured post weaning (6-8 months) or around 12 months of age, and is used to determine post weaning (Pfat) or yearling (Yfat) Australian Sheep Breeding Values (ASBVs). Eye muscle depth (Pemd and Yemd), are normally measured at the same time, and are moderately correlated (r=0.61) with fat, such that animals with increased fat depth will frequently also have increased muscle depth. Together eye muscle and fat depth determine both carcase attributes and condition score in sheep.

The genetic relationships observed in data collected by MERINOSELECT breeders and the Sheep CRC Information Nucleus flock indicate that animals with genetically higher fat and muscle tend to have more favourable breeding values for body weight, fibre diameter CV, worm egg count, wrinkle, reproduction rate, intramuscular fat, and ewe condition score, but less favourable breeding values for fleece weight, fibre diameter, and lean meat yield. The strength of these relationships is shown in Table 1 of genetic correlations below. It is important to note the high genetic correlation of 0.7 between Yfat and Yemd with adult ewe condition score, which means that means that changes in Yfat and Yemd are likely to impact on the ability of adult ewes to put on body condition.

Table 1: Summary of correlations between fat and eye muscle depth recorded on young animals with a range of production traits (averaged across fat and eye muscle as they are similar).

	Genetic Correlations	Phenotypic Correlations
Body Weight	0.26	0.17
Greasy Fleece Weight	-0.26	-0.05
Fibre Diameter	0.17	0.07
Fibre Diameter CV	-0.17	-0.04
Fibre Curvature	0.13	0.04
Staple Length	0.05	0.06
Staple Strength	0.06	-0.02
Worm Egg Count	-0.21	-0.04
Breech Wrinkle	-0.37	-0.09
Reproduction (NLW)	0.15	0.02
Intra muscular fat	0.55	0.13
Lean Meat Yield – with Yfat	-0.80	-0.30
Lean Meat Yield – with Yemd	-0.25	-0.08
Adult ewe condition score	0.70	0.13

This mix of favourable and unfavourable correlations means that a selection strategy focused solely on improving Yfat will have varied consequences for different traits. Identifying the right animals to breed from becomes much more complex when trying to balance selection for all traits which determine on-farm profitability. One of the tools to address this is to use a selection index, which defines the appropriate emphasis to place on each economically important trait in the breeding objective. The overall selection response will depend on which traits have been measured, how they interact with each other, and their relative emphasis in the index.

It is also important to note that the phenotypic relationships are on average generally small and therefore breeders will often not clearly observe these relationships on farm.

MERINOSELECT currently has standard indexes for three breeding objectives: Dual Purpose (DP), Merino Production (MP), and Fibre Production (FP). Of these, DP includes a weighting on eye muscle, but none include fat directly. However, when ram breeders measure the two traits they have an indirect impact on the index through the genetic correlations discussed above, because these are used in the calculation of ASBVs. Predictions of genetic gain show that when Yfat and Yemd are measured, there will be positive genetic responses for both traits in all indexes, accompanied by a small increase in reproduction, but reduced responses in body weight, fleece weight and fibre diameter. Importantly, gains for reproduction are increased dramatically when reproduction is measured directly, irrespective of whether YFAT and YEMD are also measured.

The relationship between Yfat or Yemd ASBV and on-farm reproduction rate is also of interest within the context of overall profitability. In MERINOSELECT data, an increase of 1mm in Yfat or Yemd ASBV on average increases number of lambs weaned by 5% across a range of flocks. Importantly, there was considerable variation around this increase, ranging from -20% to +20% in different flocks, and seasons within each flock. In many cases, no significant relationship was observed at all. This variability emphasises the fact that Yfat or Yemd explain only a small proportion of the observed variation in reproduction, as was shown by the very low estimate of the phenotypic correlation in Table 1, and indicates that there are a number of other genetic, management and environmental factors at play.

Take home messages

- If a breeder is of the view that reproduction and ewe condition are important traits then they should directly measure them and not rely on indirect correlations with other traits. Selecting on fat or eye muscle depth is not a substitute for selection directly on reproduction.
- Due to the number of complex interactions and correlations between traits, it is important for ram breeders to directly measure all important traits that contribute to farm profitability and use multiple trait selection indexes that consider the value of all these traits, rather than focusing on just one or two traits.
- To achieve the highest gains in reproductive efficiency within the context of overall on-farm profitability, ram breeders should record reproduction in their ram breeding flocks. Additional information from correlated traits including body weight, fat, eye muscle depth, scrotal circumference, wrinkle, and fleece weight will help improve the accuracy of number of lambs weaned ASBVs, but direct measurements make the biggest contribution.

Further work required

The current MERINOSELECT and LAMBPLAN indexes do not consider the value of traits such as ewe condition score, meat eating quality or lean meat yield. As these traits are genetically related to Yfat and Yemd ASBVs, it will be important to re-evaluate the role of Yfat and Yemd once the economic values are better defined. There are also other traits which are correlated which have not been considered in the current indexes such as wrinkle, dressing percentage and meat tenderness.

It is also likely that the value of fatness varies with environmental conditions. This issue is currently being examined in more detail using the Sheep CRC INF database. The outcome of this study will assist to understand the genetic importance of fatness and reproduction rate of ewes. This ongoing R&D conducted by Sheep Genetics for both MERINOSELECT and LAMBPLAN is important to keep updating and improving trait ASBVs and Indexes as new information is received.

Acknowledgements

This research made possible by contributions from the Sheep CRC researchers and their organisations throughout Australia, the ram breeders participating in Sheep Genetics and through funding provided by MLA, AWI and the Commonwealth and state Governments.

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