



Sheep CRC Practical Wisdom Notes

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Author:	David Pethick
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Intramuscular fat: The key to maintaining eating quality while improving lean meat yield

Key points

- Moderate levels of intramuscular fat (IMF) contribute strongly to lamb's reputation for tenderness, juiciness, flavour and overall liking.
- Genetic selection heavily in favour of lean meat yield risks an unfavourable decline in IMF and therefore eating quality.
- Genetic selection can be tailored to maintain or improve both IMF and lean meat yield.

Introduction

While increased lean meat yield significantly improves processing returns and helps to meet consumer demand for lower fat sheep meat, the current genetic selection for components of yield potentially may have unfavourable effects on eating quality.

To achieve greater lean meat yield, rams have been selected with higher post weaning weight (PWT) and eye muscle depth (PEMD) Australian Sheep Breeding Values (ASBVs) and lower post weaning fat ASBV (PFAT). This has significantly increased lean meat yield over the last decade, particularly in the terminal sire breeds.

However, decreasing fat at the C site (the measurement site for post weaning fat) also lowers intramuscular fat (IMF), which in turn lowers the eating quality attributes. Intramuscular fat plays a major role in consumer perceptions of tenderness, juiciness, flavour and overall likeability of lamb, generally with a minimum of 4% intramuscular fat required to maintain positive consumer responses.

While the market signals for live weight or carcass weight are clear, those for lean meat yield, fat and eating quality characteristics are not, but this may change in the future as new technology to measure yield and eating quality becomes available.

Nevertheless, the interests of the lamb industry—that is to maintain the reputation of lamb as both a nutritious and flavoursome meat—will be best served by continuing to produce lean carcasses while concurrently maintaining or improving eating quality, in particular the tenderness, flavour and juiciness of lamb.

The Sheep CRC Information Nucleus Flock produced lambs from terminal, maternal and Merino sires out of first cross and Merino ewes across eight sites for five years. Phenotypic and slaughter data on these lambs were collected allowing research into meat traits and analysis of these in relation to management, selection methods and eating quality.

While the results supported some of the findings of previous studies, new outcomes were also generated. The information and recommendations that follow are based on this research.



Figure 1. Meat showing a high degree of marbling or intramuscular fat.

What affects intramuscular fat?

PFAT and total carcass fatness

Post weaning fat (PFAT) and intramuscular fat (IMF) are genetically correlated. Selection for lower PFAT decreased IMF in progeny of terminal sires, and at a lesser rate in Merino and maternal sires in the Information Nucleus Flock. It is likely that these breed differences may be due to the lower selection pressure traditionally applied to PFAT in maternals and Merinos.

In terms of measurements on the carcass, in particular, as shortloin fat decreased (and shortloin muscle increased) for carcasses of similar weight, IMF decreased. However, while shortloin muscle and fat are good indicators of whole carcass muscle and fatness, this offered only a partial explanation for the decline in IMF.

Furthermore, the impact of PFAT on the eating quality, in particular tenderness, varies depending on the cut and partly its inherent level of IMF.

The loin had a greater decline in tenderness scores compared to the topside in progeny of sires with lower PFAT and this was partly explained by the different IMF levels. The decline in tenderness also varies depending on the cut and its inherent level of IMF, for instance, the loin has a greater decline in IMF compared to topside in progeny of sires with lower PFAT.

PEMD

Contrary to prior research, there is a low genetic correlation between post weaning eye muscle depth (PEMD) and IMF.

While the Information Nucleus Flock had a small number of extreme sires that did show high PEMD and reduced IMF, the remainder of the 279 sires showed no such relationship. Therefore, selection for both increased PEMD and IMF will be relatively straight forward.

However, independent of IMF, an increase in PEMD was associated with higher shear force and a decrease in the tenderness, overall liking and flavour scores in meat subject to consumer testing. However, given that IMF has a strong genetic correlation with reducing shear force (more tender), simultaneous selection for PEMD and IMF will be beneficial for consumers.

PWT

There is no genetic association between post weaning weight (PWT) and intramuscular fat.

Selection for higher PWT will increase growth rate and mature size and animals will reach slaughter weight earlier, but IMF is not affected .

As carcass weight increases (corrected for slaughter age), so does IMF, which shows the importance of growth rate driving IMF. This is likely to be a phenotypic relationship reflecting environmental effects on growth rate rather than a genetic effect related to mature size.

While extra nutrition to achieve heavier weights at slaughter could provide higher IMF levels, the effects are low compared to sire effects.

Other factors

Other management and production factors are likely to affect IMF. The study results were not conclusive for nutrition, dam genetics, slaughter age and the breed type of sires, but they may affect IMF. However, hot carcass weight was clearly shown to have the largest of the non-genetics effects on IMF, with higher weights having higher IMF. Increased fatness at the GR site was also associated with increased IMF, but the effect was minimal above fat score 3 (15mm).

Do Australian lambs have sufficient IMF?

The Information Nucleus Flock study is representative of the range of Australian production regions. While the average IMF% was just greater than the 4% minimum level for acceptability, a significant proportion of lambs fell below this level. Hence, this highlights the need to carefully monitor continued selection for lean meat yield to avoid lower IMF levels.

Can selection for lean meat yield continue while maintaining eating quality?

The development of the Sheep CRC genomics test has seen a number of new breeding values calculated for meat traits; these include lean meat yield and intramuscular fat ASBV, both of which have moderate to high heritabilities.

With no or little genetic correlation with either growth or muscle and IMF, sires can be identified with high PWT and PEMD that also have high IMF. There is a stronger negative correlation between PFAT and IMF, which means selecting for carcass leanness and high IMF is more difficult, but still entirely possible.

For breeders not using genomics, continued selection for higher PWT and PEMD will produce more lean meat yield with little effect on IMF. Rather than choose a low PFAT (which would also increase LMY), breeders should select moderate values to avoid further lowering IMF.

Progress increasing lean meat yield and maintaining IMF will be a little slower than using the IMF ASBV instead of the PFAT ASBV because PFAT is not a direct measure for IMF and higher PFAT is associated with lower lean meat yield.

Take home messages

- Increasing lean meat yield and maintaining IMF are both essential to the profitability and consumer appeal of lamb.
- Current selection to increase lean meat yield by decreasing PFAT reduces IMF.
- Improved selection can be achieved by using the IMF ASBV (from a genomics test) as a direct measure of IMF to replace the use of PFAT.
- Breeders not using the IMF ASBV should apply only moderate selection pressure using PFAT.
- Breeders can continue to use PWT and PEMD to improve lean meat yield with minimal impact on IMF.

Further information

www.sheepgenetics.org.au

Acknowledgements

This Practical Wisdom note is based on the Sheep CRC's Information Nucleus Flock research and the resulting articles:

Pannier L., Pethick D.W., Geesink G.H., Ball A.J., Jacob R.H. and Gardner, G.E. (2014) Intramuscular fat in the longissimus muscle is reduced in lambs from sires selected for leanness. Meat Science, Volume 96, Issue 2, Part B, February 2014, Pages 1068-1075

Pannier, L., Gardner, G.E., Pearce, K.L., McDonagh, M., Ball, A.J., Jacob, R.H. and Pethick, D.W. (2014) Associations of sire estimated breeding values and objective meat quality measurements with sensory scores in Australian lamb. Meat Science, Volume 96, Issue 2, Part B, February 2014, Pages 1076-1087