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The importance of Lean Meat Yield

The value it creates in the supply chain and the importance of better feedback to farmers

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Lean meat yield – a definition: Lean meat yield percentage (LMY%) refers to the proportion of a carcase that is composed of lean tissue (muscle).

Why is lean meat yield important?

Lean meat yield is a key efficiency and profit driver throughout the supply chain. Lamb is sold in lower yielding formats at a retail level (ie more bone and fat) compared to beef, pork and chicken and is typically more expensive, especially when compared on a $/kg lean at retail (Pethick, Ball et al. 2010). High yielding carcases deliver cuts that have a better shape and ensure retailers do not have to present products of overly fat animals for display and sale. For processors a high yielding animal represents increased efficiency in the boning room. These carcases require less labour to trim fat and there is less carcase wastage. For producers, higher yielding animals can be finished to heavier weights without becoming overly fat and accruing penalties. Additionally, fast growing, high yielding animals can be finished either faster or to heavier weights, in a shorter period of time, offering the producer savings on feed costs.

The challenge is to produce a fast growing lamb that can be turned off quickly, that are of favourable conformation, and also gives a satisfactory return to the producer. It is increasingly important that price signals reflect not just more carcase as it may represent increasing amounts of fat. With continued evolution of the payment scheme of lamb there is the potential to improve profitability through the use of genetic selection for increased yield.

Can lean meat yield be measured in the abattoir?

Ideally we need reliable measures of lean meat yield in order to provide feedback and price signals along the supply chain. Ultimately farmers need to be able to assess how their animals are performing and adjust their genetic selection and management practices accordingly. Unfortunately lean meat yield is not a parameter that can be easily measured in a commercial environment.

In abattoirs the main indicator used to describe LMY% determined by palpating the GR site with fat score values measuring from 1 to 5, representing 5mm intervals of GR tissue depth. Data collected within the Australian Coopertive Research Centre for Sheep Industry Innovation (Sheep CRC) Information Nucleus Flock (INF) has demonstrated this to be a poor indicator of LMY%, so other measures need to be developed.

There are a number of technologies already available or being developed that offer good alternatives. Viascan enables processors to determine lean meat yield and distribution with sufficient accuracy to allow reliable feedback to producers. X-ray has been incorporated into

some plants to improve carcase cutting and boning and if coupled with image analysis, could be used to determine LMY%. Ultrasound and other tissue depth probes similar to the AUSMEAT sheep probe are also being investigated. Computed tomography (CT) scanning offers the most accurate way of determining the proportions of fat, muscle and bone within a carcase and very recent research in pork by the Danish Meat Research Institute suggests line speed CT scanning will be a commercial reality in 2014.

How can producers improve LMY%?

Sheep Genetics Australia produces Australian Sheep Breeding Values (ASBVs) which are used to predict the performance of a sire for many economically significant wool and carcase traits. ASBV's use performance information of an individual sheep, its relatives (pedigree) and its progeny to predict the breeding value of a sire. An ASBV can be directly compared across age groups and flocks which is not possible if using raw measurements alone.

The 3 main ASBVs that we use to indirectly select for lean meat yield are post weaning weight (PWWT), C-site fat depth (PFAT) and eye muscle depth (PEMD). Combinations of these ASBVs are used to create selection indices for ranking sires eg. Carcase Plus Index. The original index was based on PWWT, PFAT and PEMD in ratios of 60:20:20.

The Lamb 2020 Index is constructed as a dollar index rather than as a desired gains index like Carcase Plus. Lamb 2020 is made up of: BTW (kg) 8%; WWT (kg) 24%; PWWT (kg) 25%; PFAT (mm) 9%; PEMD (mm) 22%; PWEC (%) 12%.

How can we tell that Australian Sheep Breeding Values are working?

The Sheep CRC has generated an Information Nucleus Flock (INF) currently with 8 sites across Australia. The INF represents a unique opportunity to assess the impact of genetic selection for increasing lean meat yield. Each year approximately 100 sires which are divergent for a range of traits, including the carcase ASBVs are used to produce lambs at each of these sites. Animals are slaughtered at an average carcase weight of 21.5 kg. Hot standard carcase weight (HSCW) and GR tissue depth (measured 110mm from the midline to the lateral surface of the 12th rib) were recorded along with a number of other carcase and meat quality traits. A subset of these carcases underwent CT scanning following their division into 3 primals (forequarter, saddle region and hindquarter). This allows an accurate determination of the quantities and distribution of fat, muscle and bone within the carcase. The results of the analysis show that there are sound financial reasons to continue to select for lean meat yield.

What are these ASBV's delivering?

Post weaning eye muscle depth (PEMD): The progeny of high PEMD terminal sires have increased weight of the loin and eye muscle area (Gardner, Williams et al. 2010) which is similar to that found by Hegarty *et al* (2006) where the progeny of high PEMD sires had increased loin weight. Recent analysis of the CT data has also shown more muscle in the saddle but has also demonstrated that this offset by a decrease in the amount of forequarter

lean tissue. Due to the value of the loin cuts this will have a positive impact on the value of the carcase. About 100gms Of short loin per 7 units of PEMD .

Post weaning weight (PWWT) impacts on carcase weight: Increasing PWWT had its major economic influence by delivering heavier carcases earlier. Lambs with high PWWT values are faster growing and reach heavier slaughter weights or target weights sooner. Thus terminal sire lamb offspring had an increased pre-slaughter live weight and HCW of 3.00kg and 2.22kg respectively over 10 PWWT ASBV range (Gardner, Williams et al. 2010). This was less in the maternal sired lambs. The impact of the PWWT ASBV is largely related to maturity at slaughter, with animals moving toward a larger mature size and therefore are at an earlier stage of maturity at slaughter. Even so, evidence in the INF suggests that this is having only a small impact on LMY% and only in females.

Decreasing PFAT gives a leaner more muscular animal

A decreasing PFAT value decreases whole carcase fatness. It has previously been thought that this would be a site specific effect, impacting at the site of measurement (C-site). Across a 4 unit range in PFAT there was shown to be on average a 13% decrease in carcase fat. This was offset by an increase in carcase lean and bone. Decreasing PFAT had no effect on the distribution of tissues within the carcase.

Carcase plus Index

As would be expected, the Carcase Plus Index largely reflects the combined effects of the three ASBVs as they were represented at the time. The greatest effect of Carcase plus on whole body composition was to reduce carcase fat. An increase in carcase lean was seen, but similar to the effect of PWWT only in the female progeny. Carcase plus caused redistribution of all three tissue types to the saddle region.

Economic impacts

The results from the CT scanning project are being used to develop a prediction model to estimate the lean meat yield of a carcase. We will then be able to more precisely determine the economic impact of the manipulation of LMY% using the ASBVs PWWT, PEMD and PFAT. The redistribution effects need to be considered to determine the net increase in carcase value. A payment scheme that rewards farmers who meet desired carcase specifications would therefore be of benefit.

Are there concerns associated with heavy selection for lean meat yield?

As we continue to select for increasing lean meat yield it is important not to loose sight of meat quality and human health traits. Of particular importance for eating quality is intramuscular fat (IMF) which is a key driver of consumer perceptions of tenderness, juiciness and flavour. Selection for leanness and muscularity has been shown to reduce IMF (McPhee, Hopkins et al. 2008) which will adversely affect eating quality. The PFAT ASBV is a very important driver of LMY% and it is negatively related to IMF. The genetic correlation is moderate/high and so it is crucial to have dual selection for both yield and eating quality. A factor that will help in balancing the impact on eating quality is the

alteration of the Carcase Plus Index in 2011 to have less emphasis on decreasing fat and more emphasis on eye muscle depth. Now there will be a 65% emphasis on growth, 30% muscling and 5% negative fat. Finding sires that are in both the moderate to high ASBV range for IMF and negative PFAT will deliver higher LMY%, while maintaining eating quality.

Conclusion

Lean meat yield % can be measured but this is currently difficult to do accurately at high speed in the abattoir. There are financial benefits of improving LMY% along the supply chain. LMY% can be manipulated using the Australian Sheep Breeding Values for growth, fat and muscling, with PWWT increasing size, PEMD increasing muscling and PFAT decreasing fat. It is important to monitor the impact of increasing LMY% on eating quality to maintain long term consumer satisfaction and confidence in the lamb industry.

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