Using objective technologies to inform Australian Sheep Breeding Values for carcass traits

Sam F Walkom[2, 1], Panoraia Alexandri[2, 1], Daniel J Brown[2, 1]

1. AGBU, a joint venture of NSW Department of Primary Industries and University of New England, Armidale, NSW, Australia

2. Advanced Livestock Measurement Technologies project, Meat & Livestock Australia, North Sydney, NSW, Australia

Corresponding author: Sam Walkom. Email: swalkom@une.edu.au

Historically, consumer preferences in domestic and international markets have driven the industry to produce meat cuts that are larger and leaner. Selection for leaner carcasses is antagonistically associated with eating quality and consumer appreciation via corresponding reductions in intra-muscular fat (IMF) and tenderness. In recent times industry breeding objectives have focussed on breaking these antagonistic relationships to produce lean carcasses with high eating quality. However, the availability of carcass records in seedstock flocks has been limited, with most carcass data provided via research reference populations. Consequently, most of the genetic gain, in carcass attributes, achieved in the lamb industry has been due to correlated responses via index selection.

Since the development in 2017, of the Advanced Livestock Measurement Technologies (ALMTech) project (Gardner *et al.* 2021), Australia's meat supply-chains have been investing in objective measurement technologies to improve productivity across the whole value-chain. This co-ordinated and collaborative effort to transform industry competitiveness has created feedback and decision support systems that are providing producers with more accurate descriptors of carcass quality. The development of these objective technologies has the potential to improve carcass recording in seedstock flocks, due to reduced costs and greater access, with both the greater volume and speed of phenotype arrival likely leading to increased genetic gains. Dual-energy X-ray absorptiometry (DEXA) technology, and the algorithms which interpret the images to measure lean, bone and fat are rapidly gaining acceptance as an accurate means to describe carcass composition in sheep. Genetic evaluation of lean meat yield (LMY) measured by DEXA and the historical 'gold standard' computed tomography (CT) suggest that the DEXA LMY is likely to be the same genetic trait as the CT measured LMY (Walkom *et al.* 2023). These promising results opened the way for the inclusion of DEXA estimates of LMY in the Sheep Genetics national evaluation in the autumn of 2024. While current on-farm live animal measures (ultrasound scanning of fat and muscle depth) are allowing breeders to achieve significant genetic gain in LMY (Walkom *et al.* 2017), these can be improved through the use of DEXA technology to measure LMY on selection candidate's half-sibs to improve EBV accuracy and the accuracy of selection. Unlike LMY in sheep, there is no viable objective measure of IMF on the live animal, with all measurements for the trait based on a post-slaughter chemical analysis of intramuscular fat. ALMTech research has shown that the MEQ probe and SOMA NIR can generate accurate IMF results in the processing environment. Genetic analysis for IMF measured with these new technologies has shown similar capacity to chemical IMF in identifying animals that have genetically superior eating quality (Alexandri *et al.* 2023). Consequently, IMF records from both these technologies have been helping to inform Sheep Genetics breeding values since their inclusion in the genetic evaluation in the autumn of 2024. Eating quality data collected from the reference flock has also clearly demonstrated that measurement of tenderness, as mechanical shear force, is as important to eating quality as IMF, and that the genetic relationships between these traits is low. This highlights the need to continue to collect information on shear force and work to develop new technologies to accurately measure the trait in the supply chain.

Utilising objective technologies to increase recording of hard to measure carcass traits provides the opportunity to build the genomic reference quicker and more cost effectively, leading to improved accuracy of selection within seedstock flocks and paves the way for the development of accurate genomic only selection tools for the commercial prime lamb industry. The application of these technologies across the industry is also likely to provide value-based marketing and feedback signals which will likely impact ram purchasing choices of commercial producers. This should lead to more balanced selection for LMY and EQ across the lamb industry. While the amount and type of data collected within processing facilities is rapidly increasing with the development of new technologies, the volume and ease of data flow varies significantly across the industry. To make use of these new sources of data, it will be crucial to ensure that records are correctly linked to the corresponding animal. This can be challenging in the processing environment where routine processing practices (eg. retain for trimming) can affect carcass sequences and identification (Guy *et al.* 2018). Until hook tracking is reliability implemented across the industry, producer attitudes towards feedback from the processing sector and the inclusion of objective measurements from that source in the genetic evaluation, will remain cautious.

Conclusions**.** The incorporation of technologies such as DEXA, MEQ and SOMA into processing plants will decrease the cost and increase the efficiency of objective carcass data collection on genetically described animals. This provides seedstock breeders opportunities to collect carcass data through progeny testing, or testing of surplus (cull) breeding animals. This will help breeders to overcome the unfavourable genetic correlations between yield and eating quality due to higher EBV accuracies and improved ability to select breeding animals which are favourable for both.

Acknowledgements This work was part of the Advanced Measurement Technologies for globally competitive Australian meat project, funded by the Australian Government Department of Agriculture and Water Resources and many industry partners.

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