AMPC/Sheep CRC/MLA Case Study

Document ID:	SheepCRC_27_10
Title:	Research breeding values
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Key words:	sheep; research breeding values;

It should be cited as:

AMPC, Sheep CRC, MLA (2015) – *Research breeding values*

Fact sheet – Research breeding values

Date of issue: 27 January 2015

New Breeding Values for Yield and Eating Quality

Genetics play a significant role in productivity and profitability. Recent research has shown many carcase traits are moderately to highly heritable and provide good opportunities to improve lamb.

Australian Sheep Breeding Values (ASBV) are an estimate of an animal's true breeding value based on pedigree, genomic and performance-recorded information for a range of traits.

The following new traits have been identified by the Sheep CRC and the Sheep Genetics Technical Committee as potentially impacting on either carcase dimensions, yield or the eating quality of Australian lamb:

- Hot Carcase Weight (HCWT; kg)
- Carcase Eye Muscle Depth (CEMD; mm)
- Carcase Fat (CFAT; mm)
- Lean Meat Yield (LMY; %)
- Intramuscular Fat (IMF; %)
- Shear Force (Tenderness) (SHEARF5; kg).

These breeding valves are being released to industry, although none of these traits are currently included in any of the standard LAMBPLAN or MERINOSELECT indexes (as of January 2014).

Data from the Sheep CRC Information Nucleus flock (INF) has enabled these traits to be developed. Traits have been measured over five years, across a range of environments, on 4,500 ewes, 500 rams and greater than 10,000 progeny, to gather this information.

Carcase Weight (HCWT; kg)

Hot carcase weight of the animal, measured in kilograms.

HCWT is a function of live weight and the dressing percentage.

The Research Breeding Value (RBV) ranges around 0, with higher values indicating genetic makeup for increased carcase weight.

Carcase Eye Muscle Depth (CEMD; mm)

Eye muscle depth of the loin taken from a quartered or ultrasound scanned carcase, measured in millimeters.

It is adjusted to a constant weight—in this case carcase weight—in the same way that the ultrasonic measure of post-weaning eye muscle depth breeding value (PEMD) is adjusted to constant live weight.

CEMD has been shown to influence lean meat yield and the weight particularly of the loin muscle. It is correlated with the PEMD taken on a live animal.

The mean CEMD measurement from the INF is currently 30.0 mm, with a range of 17.0–45.0 mm. The RBVs range around 0, with higher values indicating genetic makeup for increased carcase muscling.

Carcase Fat (CFAT; mm)

Depth of fat taken at the C site in a quartered or ultrasound scanned carcase, measured in millimetres.

It is adjusted to a constant weight—in this case carcase weight. This is the same way that the PFAT breeding value is adjusted to constant live weight.

This trait has been shown to influence lean meat yield and strongly reduce the GR tissue depth. The trait is correlated with the ultrasonic measure of C fat (PFAT) in the live animal, though it is not as strong as the relationship between muscle traits.

The mean CFAT measurement from the INF is currently 4mm, with a range of 0.2–24.0 mm. The RBVs range around 0, with lower values indicating genetic makeup for reduced carcase fat cover.

Lean Meat Yield (LMY; %)

Commercial yield of lean meat as a percentage of hot carcase weight.

Lean meat yield is estimated from a combination of weight, muscle and fat dimensions and has been validated by either CT scanning or through direct commercial bone-outs.

LMY has a moderate heritability, with the normal range in lamb between 51.0% and 58.0%. The RBVs range from +1.9% to -2.0%, with higher values indicating genetic makeup for higher LMY.

Intramuscular Fat (IMF; %)

Chemical fat percentage in the loin muscle of a lamb, often referred to as marbling.

The preferred range in lamb is between 4.0% and 6.0%, with a current industry mean value of 4.3%. IMF has been shown to have a significant positive impact on the Meat Standards Australia (MSA) sensory attributes of lamb (flavour, juiciness, tenderness and overall likeability).

IMF has a moderate to high heritability and high negative correlation with shear force. That is, high IMF increases tenderness.

The measured range in INF lambs is 2.0% to 10.0%. The RBVs range from 0.7% to -0.5%, with higher values indicating genetic makeup for higher IMF%.

Shear Force (Tenderness) (SHEARF5; kg)

The force (or energy) required to cut through the loin muscle of lamb after 5 days of ageing, reported in kilograms of force.

The trait has a moderate–high heritability, and a moderate correlation with tenderness in lamb. The preferred value for lamb is 3kg or less.

The mean SHEARF5 from the INF lambs is currently 2.4kg with a range from 1.1kg to 7.7 kg. The breeding values for this trait range between -3.9 and +4.9 with more negative values indicating genetic makeup for lower shear force, or more tender meat.

Using Eating Quality Breeding Values

ASBVs allow for selection of traits that cannot be visually selected in a live animal. They can be used in a breeding program to improve the performance of future generations, or to purchase stock that are likely to be more productive and have better eating quality, lean meat yield and colour.

Lean Meat Yield (LMY) and Dressing Percent

LMY determines the financial value of a carcase. Preliminary figures suggest an $80 difference along the supply chain between a 23kg, score 2 carcase versus a 23kg, score 4 carcase.

Genetics play a significant role in LMY%, with progeny of sires with low genetic fatness (scanned trait = PF) and high genetic muscle (scanned trait = PEMD) ASBVs having a decreased whole carcase fatness and increased muscularity. Carcase weight (the other dimension of LMY) is highly heritable and directly related to weaning and post-weaning weight ASBVs.

Dressing percentage (%) is the proportion of carcase weight to liveweight. Dressing percentage is higher in progeny of sires with higher muscling ASBV (scanned trait = PEMD), producing a lamb of similar live weight, but delivering a markedly larger carcase at slaughter.

Eating quality

Shear force of the loin is under significant genetic control and contributes to tenderness, as do processing conditions and meat pH.

IMF ensures adequate flavour and juiciness for consumers and is also genetically correlated with shear force. Higher IMF produces more tender meat.

Both of these traits will play a role in the new cuts-based MSA system for lamb.

Summary

Genetics play a significant role in productivity and profitability. ASBVs or research breeding values (RBVs) allow for selection of difficult to measure traits to improve breeding programs.

The new traits identified have a significant impact on carcase dimensions, yield and eating quality of lamb.

Scanned fat and muscle traits are considered almost as good as their carcase measured equivalents as the genetic correlations are positive and strong.

Table1: Summary of INF measurements

Trait	Mean	Range	RBV base	RBV aim	Effect
CEMD(mm)	30.0	17-45	0	positive	increase muscle
CFAT (mm)	4.0	0.2-24	0	negative	decrease fat
LMY%		51-58	0	positive	increase LMY
IMF%	4.3	2-7	0	positive 4-6	increase IMF
SHEARF5 (kg)	2.0	1.1-7.7	0		

Further information

For further information refer to the Measuring Lean Meat Yield: Current and Future Technologies fact sheet.

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