THE VALUE OF SALEABLE MEAT YIELD TO LAMB PROCESSORS

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Abstract – The value of saleable meat yield (SMY) to lamb processors was investigated using two Australian processing plants as case studies. A new computer model – the Lamb Value Calculator (LVC) - was used to model the effect of hot carcase weight and level of fabrication on yield. The value of SMY to the lamb processor was dependant on carcase weight, level of fabrication and the discounts applied to individual cuts. A 1% change in SMY had a greater effect on net return of heavy carcases (27kg) compared to lighter carcases (21kg). However, discounts applied to some heavy carcase cuts decreased the effect on the value of yield. In this instance, there was no difference in the value of yield to the processor between 24kg and 27kg carcases. Increasing the level of fabrication increased the value of yield to lamb processors. The value of SMY to lamb processors is plant specific and can be used by processors to assist in sorting decisions and to support value based trading.

Key Words – Carcass weight, Fat, Sheep.

I. INTRODUCTION

Lean meat yield [1] and saleable meat yield [2] are important along the lamb supply chain (reviewed by [1]) and both have an influence on the market value of the carcase. In the Australian lamb industry, the majority of lamb is purchased from lamb producers on the basis of carcase weight, with price penalties for very fat (fat score 5 - GR tissue depth >20mm) or very lean carcases (fat score 1 - GR tissue depth <5mm). Although the use of pricing Australian lamb on the basis of lean meat yield has been discussed for over 20 years [2], little sustained progress has been made. Currently there are no strong price signals to lamb producers to increase lean meat yield and decrease the amount of fat in their lambs. This is partly due to the limited availability of objective measurement technologies in the Australian lamb industry [1]. Nevertheless, processors are willing to use improved measures of lean meat yield if they are cost effective and easy to use [3]. Demonstrating the value of yield to the processor may encourage the rapid uptake new LMY measurement technologies when they become available.

This paper describes the use of a new computer model – the Lamb Value Calculator – to demonstrate the effect of carcass weight, carcass fabrication and cut discounts on the value of SMY to Australian lamb processors.

II. MATERIALS AND METHODS

Carcase data was recorded for 24 lambs with GR tissue depth (measured 12cm from the midline over the 12th rib) ranging from 2-20mm and hot carcase weight (HCWT) ranging from 17-26kg. Measurements included HCWT, GR tissue depth and fat thickness (CFat) and cross sectional area of the *M. longissimus thoracis et lumborum* (EMA) at the 12th rib. Lean meat yield was then estimated using the Lamb Value Calculator (LVC) model (v4.32; Chris Smith). This model estimates the weights of a set of specified commercial cuts using HCWT and GR tissue depth as predictors. These weights can be multiplied by cut values to arrive at total carcase value. They can also be directly added and divided by carcase weight to provide an

[1] Lean Meat Yield (LMY): the amount of lean meat boned out from a carcase as a percentage of carcase weight)

[2] Saleable Meat Yield (SMY): yield of bone-in or boneless cuts trimmed to a desired fat coverage as percentage of carcase weight)

estimate of saleable product yield. Furthermore the weights of these commercial cuts can be estimated at different levels of fabrication based upon the cuts and levels of fat trim specified by the user.

For verification purposes, the lean meat yield estimated for the 24 carcases from the Lamb Value Calculator was compared with the estimates from a direct prediction equation which estimates LMY from computer tomography (CT^LMY) according to the equation:

$$CT\hat{}LMY = 61.48 - 0.09HCWT - 0.375GR - 0.223CFat + 0.292EMA \ [4]$$

The Lamb Value Calculator was then used to quantify the impact that carcase weight has on the value of yield processed to two levels of fabrication – "Standard" and "Value added". As these measurements are not true lean meat yields (i.e. they include bone and salvage fat), but instead represent saleable product yield, they were designated as Standard saleable yield and Value added saleable yield. Standard saleable yield was based on carcases processed into square cut shoulder (6mm fat), fore shank tipped, breast, neck, short loin trimmed, rack trimmed, flap and bone in leg with aitch bone removed (Table 1). Value added saleable yield was estimated from carcases that were processed into eye of shoulder, boneless shoulder, fore shank tipped, breast, neck, eye of short loin, tenderloin butt off, trimmed rack, flap, boneless leg with chump on and shank off and hind shank with bone in (Table 1).

Table 1. Cut specification for standard and value added carcase fabrication.

Standard	Value Added
Square cut shoulder (6mm fat)	Eye of shoulder Boneless shoulder
Fore shank tipped	Fore shank tipped
Breast	Breast
Neck	Neck
Short loin trimmed (25mm tail, 6mm fat)	Eye of short loin Tenderloin butt off
Trimmed rack (6mm)	Trimmed rack (6mm)
Flap	Flap
Bone in leg, aitch bone removed.	Boneless leg, chump on, shank off Hind shank, bone in.

Data from two lamb processing plants were used in the Lamb Value Calculator model. Input and output costs were based on September 2014 (Plant 1) and October 2013 (Plant 2) prices, including cost of lamb ($/kg HCWT), boning costs and fixed costs.

Outputs were expressed as net return compared to net return of a basic carcase. A basic carcase was classified as having 21kg HCWT and 12mm GR depth. The basic carcase had a Standard yield of 90.1% at Plant 1 and 89.6% at Plant 2. Value Added yield of the basic carcase at Plant 1 was 69.6%.

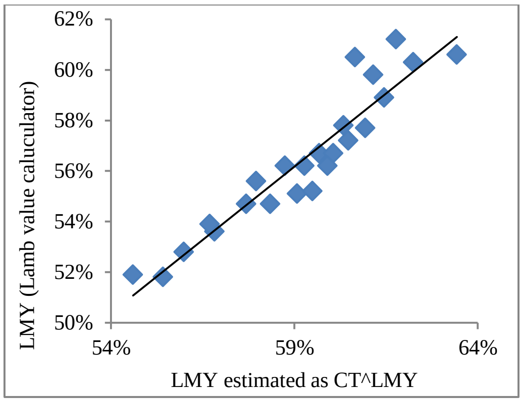
The effect of yield on net return was investigated at three HCWT, representative of Australian markets; domestic (light = 21kg), mid-range (24kg) and export (heavy = 27kg). The impact of discounts in cuts from light carcases (21kg) and heavy carcases (27kg) that do not meet cut specifications on the effect of yield on net return was modelled using data from Plant 2. Discounts were applied to square cut shoulder and leg of the heavy carcases and to the rack in light carcases. No discounts were applied to any cuts from a 24kg carcase.

III. RESULTS AND DISCUSSION

There was a significant relationship between CT^LMY and fully boned out yields calculated using the Lamb Value Calculator (R^2=0.89; $P<0.001$; Figure 1). Therefore the calculator is a valid tool to predict the comparative value of individual carcases. Furthermore, the two prediction methods provide equivalent relative predictions of yield, although they do not necessarily predict absolute yield. To convert the predictions to absolute yield it would be necessary to apply a plant conversion to each of the methods.

The value of saleable meat yield to the lamb processor was dependant on carcase weight, level of fabrication and discounts applied to individual cuts (Table 2). SMY had a greater effect on the value of heavier carcases compared to lighter carcases. A 1% increase in yield of a 21kg carcase, processed to a standard fabrication, increased net return by an average of $1.29/carcase and there was an additional average $0.48 net return per carcase for a 1% increase in yield from a 27kg carcase. There was a curvilinear effect of yield on net return when carcases were boned out to standard cuts (Figure 2). The effect of yield on net return decreased at higher levels of SMY and was greatest at lower levels of SMY.

Figure 1. The relationship between individual lamb LMY estimates (CT^LMY) and Lamb Value Calculator estimates of fully boned out yields (LMY).



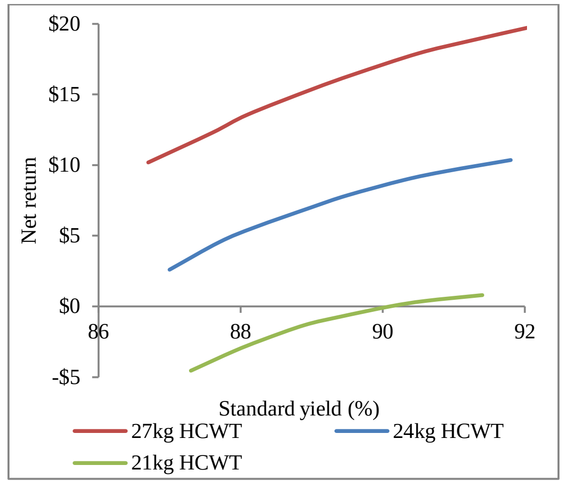
Net return increased as carcase weight increased at a constant yield (Figure 2 & 3). A heavy carcase had a net return of $18/carcase greater than the basic carcase (21kg HCWT, 12mm GR) with a standard processing yield and $27 more per carcase with Value Added Yield. This is not unexpected since heavier carcases produce more meat and the fixed costs and costs per carcase are less per kg in heavier carcases.

Table 2 Average net return (±S.E.) per 1% increase in saleable yield with standard and value added fabrication and standard fabrication with discounts (+Disc) at three carcase weights (HCWT).

	Net return		
HCWT	Standard [1]	Value added [1]	Standard +Disc[2]
21kg	$1.29±0.129	$3.44±0.067	$1.15±0.116
24kg	$1.59±0.122	$3.92±0.040	$1.39±0.112
27kg	$1.77±0.100	$4.39±0.034	$1.34±0.107

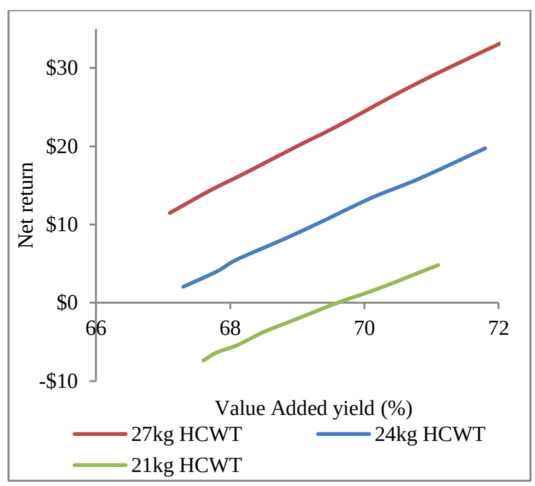
[1] Plant 1; [2] Plant 2

Figure 2. The effect of Standard saleable meat yield at three carcase weights on net return.



GR depth had greater effect on net return of heavier carcases than lighter carcases. In heavier carcases, an increase of 5mm GR (1 fat score) decreased carcase value by 11%, whereas in lighter carcases, an increase of 5mm GR depth decreased carcase value by approximately 7%. The effect of fatness on carcase value increased as fatness increased such that fat score 5 carcases need to be 2-3kg heavier than fat score 2 and 3 carcases to achieve the same net return.

Figure 3. The effect of Value Added yield at three carcase weights on net return.



When discounts were applied to cuts that were above or below weight specifications, the value of yield to the processor remained dependant on carcase weight, although to a lesser extent. A 1%

increase in SMY of a 21kg carcase increased net return to the processor by an average of \$1.15/carcase and there was greater increase in net return from heavier carcases (Table 2). However, there was little difference in the effect of SMY on net return between 24 and 27kg carcases (\$0.05).

The model demonstrated that there are plant and time effects on the value of yield to the processor. A comparison of the net return per 1% increase in saleable yield (Table 2) shows a \$0.20 difference in the value of a 1% change in yield from a 24 kg carcase with a standard fabrication between plant 1 and plant 2, using prices at different time points. The 24kg carcases did not have any discounts, therefore this difference is due to different cut specifications, different input costs and returns and different processing yields. This demonstrates that it is important for processors to undertake plant specific assessment of the value of yield to the processor. The Lamb Value Calculator is one tool that can be used to do this assessment.

Care must be taken if this information is used to develop value based trading. If price signals to the lamb producer favour increased LMY, there is the risk that eating quality of the product will be reduced [4, 5]. Therefore, there must be mechanisms incorporated into value based trading that ensure the eating quality of the product is not negatively affected. The curvilinear response of net return on SMY may assist in putting a limit on the upper levels as the value of SMY to the processor decreases.

IV. CONCLUSION

SMY has a significant impact on net returns for lamb processors. The value of SMY to the processor is dependent on HCWT, GR depth, level of fabrication and discounts applied to cuts that do not meet market specifications. Knowledge of the value of SMY can be used to develop value based trading mechanisms that will encourage supply of carcases that better meet market needs. In addition, the knowledge of the value of SMY to the processor can be used to optimize sorting decisions based on maximizing net returns. However there is still a need to develop objective, accurate lamb carcase measurements before this can be implemented. In addition, eating quality needs to be managed to ensure that there is not a decline in consumer acceptability as yield is increased.

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REFERENCES

1. Pethick, D.W., Ball, A.J., Banks, R.G. & Hocquette, J.F. (2011). Current and future issues facing red meat quality in a competitive market and how to manage continuous improvement. Animal Production Science. 51: 13-18.
2. Hopkins, D.L. (1994). Predicting the weight of saleable meat in lamb carcases and the suitability of this characteristic as a basis for valuing carcases. Meat Science. 38: 235-241.
3. Goers, H. & Craig, P. (2008). Sheep feedback systems, in Final Report V.MSL.0001: Meat & Livestock Australia, North Sydney, NSW.
4. Pannier, L., Gardner, G.E., Pearce, K.L., McDonagh, M., Ball, A.J., Jacob, R.H. & Pethick, D.W. (2014). Associations of sire estimated breeding values and objective meat quality measurements with sensory scores in Australian lamb. Meat Science. 96: 1076-1087.
5. Gardner, G.E., Williams, A., Siddell, J., Ball, A.J., Mortimer, S.I., Jacob, R.H., Pearce, K.L., Hocking Edwards, J.E., Rowe, J.B. & Pethick, D.W. (2010). Using Australian Sheep Breeding Values to increase saleable meat yield percentage. Animal Production Science. 50: 1098-1106.