Sheep CRC Practical Wisdom Notes

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Selection for growth and lean meat yield

Key points

- Carcase weights can be significantly increased by using sires that are genetically superior for weight.
- Use of high growth sires also has an impact on mature weights, carcase composition and the performance of lambs under high and low nutrition.
- Using sires selected concurrently for muscle and growth, will increase lean meat yield, reduce fat and improve feed conversion efficiency.

Introduction

Whilst producers are not often paid for lean meat yield or meat quality traits, they are paid for weight. Therefore there are clear incentives to use, and pay for, high growth rate sires. This is illustrated in the success of the lamb industry in increasing carcase weights of lambs by over 4.5 kilograms since 1990. In the selection of sires for meat production however, there needs to be consideration of other impacts on the lamb production system, on lean meat yield and likely performance under poor nutrition.

Figure 1. Lambs grazing Lucerne

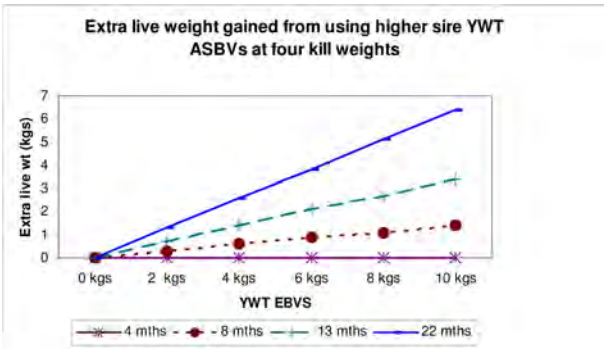

Figure 2. Extra liveweight produced from lambs bred from sires with high YWT ASBVs, when killed at 4 ages from 4 to 22 months.

What are the implications from selecting for high growth?

The lamb industry has been successful in increasing carcase weights of lambs by using sires identified as genetically superior for growth. The genetic selection tools commonly used are Australian Sheep Breeding Values (ASBVs), which are across-flock estimated breeding values, provided for weight at ages from birth through to yearling. For terminal sires this includes ASBVs for birth weight (BWT), weaning weight (WWT), post weaning weight (PWT) and yearling weight (YWT). Sires that are superior for growth may not necessarily increase birth weights and associated lambing difficulties. Although there is generally a good correlation between weights at different ages, some of the potential gain from selecting for heavier weights may not be realised until animals are older; while lambs are still on their mother, her influence, particularly her ability to feed the lamb, can mask the lamb's own potential. After weaning, the maternal effect declines.

Figure 1 shows the extra liveweight gained from using sires with higher ASBVs for yearling weight when the progeny were killed at different ages. In this experiment, the animals were killed at 4 months (sucker lambs), 8 months (carry-over lambs), 14 months (yearlings) and at 22 months. Using sires with a YWT ASBV of +10 kg produced no extra weight when lambs were slaughtered as suckers, an extra 1.4 kg liveweight when killed at 8 months, an extra 3.4 kg at 14 months and an extra 6.4 kg when killed at nearly two years of age. Similarly, when sires selected for high PWT ASBVs were used, the full growth potential was not realised until the progeny weighed 30 kg or more.

What are the effects of feed restriction?

In years of poor pasture growth or early season cut-off, lambs grow slowly if not supplemented, therefore, the implications of poor nutrition on the ability of lambs to recover and the characteristics of the carcase were examined. Figure 4 shows the increase in daily growth rate of lambs as the sire ASBV for PWT increased under high and low nutrition.

In this study, where restricted lambs were growing at 55 to 75g/head/day, the use of sires with higher ASBVs for growth provided a similar growth rate advantage to those on good nutrition. In other words, the advantage of using a sire that has an ASBV of +14 for PWT rather than +3 was 20 grams per head per day, whether fed fully or not.

However under low nutrition, progeny growth may only be 60–65% of the full potential under good nutrition. When restricted lambs were re-fed, they grew faster (compensatory growth) than the well fed lambs with a similar response to sire ASBV.

Figure 3. Lambs on restricted feed can catch up.

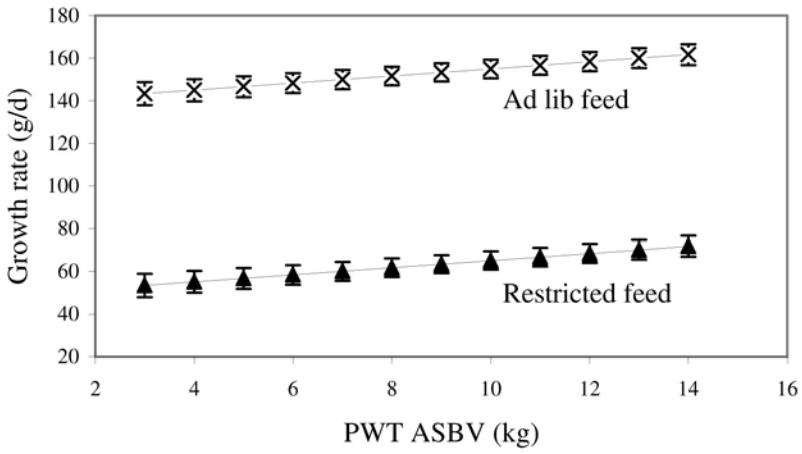

Figure 4. Extra liveweight produced from lambs bred from sires with high PWT ASBVs on either ad lib or restricted feed.

How is carcase composition affected by sire selection?

Increasing growth rates through breeding will produce lambs that reach target weights more quickly, but when there is no selection emphasis on fat or muscle, will produce lambs that have more fat and not necessarily higher lean meat yield.

Lambs that have been weaned early or had restricted feed post-weaning can be fed to catch up, so producing carcases with minor differences in composition compared to lambs fully fed. Whilst total carcase fat may not differ between lambs that have compensated and those on good feed, fat deposition over the carcase may differ, with more fat deposited over the GR site in the lambs that were restricted. As this is the site used to assess lambs for fat, this may lead to lambs that have had restricted feeding being assessed as fatter. In the project reported above, this effect was small, with only an extra 0.8 mm fat over the GR site for a 21 kg carcase.

Lean meat yield can be increased by selecting for increased growth and reduced fat. For example, two carcases from a trial that had similar carcase weight (23.6 and 23 kg), but different fat scores (2 and 4 respectively), had considerable differences in GR fat and saleable meat yield. The score 2 lamb had 10 mm fat at the GR site and 56% saleable meat, whereas the fat score 4 animal had 20 mm fat and 48% saleable meat; the leaner animal produced 2 kg more lean meat than the fat animal.

How is muscle affected by selection?

There can still be large variation in the amount of meat produced within a fat score, primarily due to muscling. Selection for increased muscling, as eye muscle depth (EMD) will increase meat yield by reducing bone and fat content. The graph below shows results for levels of fat in carcases from sires with no trait selection (Control), compared with high growth ASBVs (Growth) and high muscle ASBVs (Muscle) and under both low and high nutritional conditions. The interesting result is that under high nutrition, it is usual for animals to grow more but also to lay down more fat — except when selected for muscling.

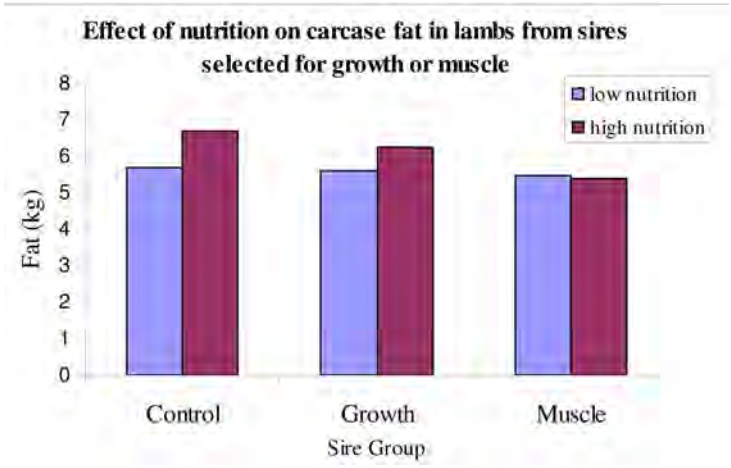

Figure 5. Comparison of carcase fat levels in lambs from sires selected for growth or muscling compared with unselected (control) sires under different levels of nutrition.

Animals selected for muscling grow more muscle, as expected, but sometimes at the expense of other traits like fat, bone and wool. Under low nutrition, they are programmed to grow muscle at the expense of wool and bone, and under high nutrition at the expense of fat.

Selection for muscle can therefore be a powerful tool in reducing levels of fat. In this research the use of sires with low fat ASBVs reduced fat by 4% whatever the level of nutrition. Using sires with high muscle ASBVs, reduced fat by 3% under low nutrition and by 10% under high nutrition. However, to ensure that meat is not tough, this research shows that very high muscle breeding values can be selected as long as growth ASBVs are greater than +5 kg.

How are lean meat yield and feed conversion efficiency affected by selection?

Lean meat yield is the proportion of meat produced from a carcase, excluding fat and bone. Higher lean meat yield means more valuable product, as consumers prefer meat not bone and fat.

Increased selection for muscling will reduce bone, increase muscle (with a localized effect on the loin) and also reduce fat, as described previously. The reward for increasing muscle is not captured under a normal grid price scheme based on carcase weight and GR. The reward for reduced fat from muscle selection will also not be rewarded under this system, as the GR measure is not sensitive enough to detect these differences in fat levels (See Quality Sheepmeat – Carcase characteristics of the major sheep breeds in Australia).

However, while lean meat yield is not commonly measured or paid for, there are good reasons to select for increased lean meat yields:

- Use of high growth and muscle animals has the potential to reduce feed costs, as these animals will reach targets more quickly and eat less feed to get there. For a pasture-based system, this can mean as much as four weeks less grazing and for feedlots, up to two units of feed conversion. This is based on the increased efficiency of laying down muscle instead of fat.
- Improvements in lean meat yield will become increasingly important as processors and retailers are able to easily measure it. As lamb supply increases, there will more discrimination for fat and a value put on higher value cuts.

What are the implications of selection for growth and muscle?

When sires with high YWT ASBVs are used in a self replacing flock, the ewe progeny retained for breeding may have bigger mature weights than expected, which will impact negatively on feed requirements and stocking rates.

The effect of a sire's genetics on carcase composition is greater than nutrition and can help offset some nutritional limitations. However, good growth rates close to slaughter are still required to achieve good meat quality (see Quality Sheepmeat – A brilliant finish). This means that for lamb finishers, knowledge of the genetic background of lambs is far more important than knowledge of their nutritional background. Selection only for growth will produce animals that reach weights faster, but will have more fat and larger mature weights, this includes bigger retained ewes, but not necessarily heavier birth weights when they are lambs.

Progeny of sires with higher growth exhibit faster growth under both good and poor nutrition. However, only 60–65% of potential growth is achieved under very low nutrition. But lambs that have been restricted and re-fed, end up having only minor differences in carcase composition.

New research (published in 2014) has confirmed that selection for increased muscle and growth has the potential to unfavourably affect meat eating quality.

Intramuscular fat (IMF) is an essential component of the tenderness, juiciness, flavor and overall liking of lamb, but lowering PFAT will also reduce intramuscular fat. Fortunately, increasing PEMD and PWT has little effect on intramuscular fat, but they can decrease tenderness.

Eating quality can be maintained or improved while increasing lean meat yield; continue to select for higher PEMD and PWT but change how fat is selected. The best result will be achieved by using the new intramuscular fat (IMF) breeding value available through the Sheep CRC 12K genomics test. Directly select for a higher IMF to offset the loss of eating quality from higher lean meat yield. If genomics is not used, PFAT should be kept at moderate levels to avoid lowering intramuscular fat content.

Take home messages

- When choosing sires, select for a combination of high growth and muscling (rather than just one or the other being high) and also select for lower fat.
- When choosing sires, select for a combination of high growth (PWT) and muscling (PEMD) (rather than just one or the other being high) and higher IMF (from a genomics test) or moderate PFAT if genomics is not used.
- Regardless of the genetics, ensure all lambs are achieving high growth rates prior to slaughter to ensure good meat quality.
- It is more important for lamb finishers to source lambs with superior genetics for growth than lambs that have been on good feed.

Further information

For further information visit: http://www.sheepcrc.org.au

Acknowledgements

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