



Ovine Observer

Newsletter of the Department of Agriculture and Food, Western Australia (DAFWA)

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Autumn stocktake

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Introduction

Autumn is pregnancy scanning time; a count of mouths to feed, a stock-take (literally). The Katanning Research Facility offers a benchmark to industry for many sheep performance measures, including reproduction.

There are two key research flocks at the facility; the genetic resource flock and the breech strike flock.

These two industry flocks are measured extensively for traits that are expensive and difficult to measure such as reproduction, meat quality and disease resistance.

The ewes and their progeny from both flocks have a full pedigree and have Australian Sheep Breeding Values registered with Sheep Genetics Australia.



Pregnancy scanning underway at the Katanning Research Facility

Genetic resource flock - artificially inseminated

The genetic resource flock consists of 602 Merino and 330 Dorper mixed age ewes (3-6 years old) and 139 maiden Border Leicester ewes (3 years old).

Dorper ewes have been introduced to the genetic resource flock after a request from industry last year for their inclusion into our genetic benchmarking program. The Dorpers are managed and fed separately to the Merino and Border Leicester ewes.

The Merino and Border Leicester ewes were previously the information nucleus flock (INF). The genetic resource flock (previously INF) still has a sister flock based at the University of New England Kirby farm in Armidale, New South Wales.

The ewes are mated via artificial insemination to Merino and Terminal sires annually. All progeny generated from these flocks are measured for growth, muscle, fat and meat quality traits for the estimation of breeding values. Meat quality traits and abattoir information is collected by our research partner Murdoch University.

In 2017 ewes were mated via artificial insemination in early February to 156 sires from 72 industry studs. At mating, Merino ewes, on average, weighed 64 kilograms (kg) and had a condition score of 3.1. The Border Leicester ewes were slightly heavier with an average weight of 67kg and with a condition score of 3.5. The Dorper ewes were the heaviest of all three breeds, on average weighing 75kg with a condition score of 3.8 (Figure 1).

Ewes were scanned on 4 April 2017 and classed as zero (dries), single or twin pregnancies. Fertility (percentage of ewes pregnant) was highest for Border Leicester ewes (85%), followed by Merino (76%) and Dorpers (62%).

Reproductive rates (foetuses scanned per 100 ewes mated) were similar for Border Leicester and Merino ewes (134% and 128% respectively), but lower for Dorpers (98%). Hence, Merino ewes in a good body condition at joining can have a comparable reproductive performance to a maternal breed.

The lower reproductive performance of the Dorper ewes is probably due to the short period of adaptation on the farm prior to mating (approximately four weeks).

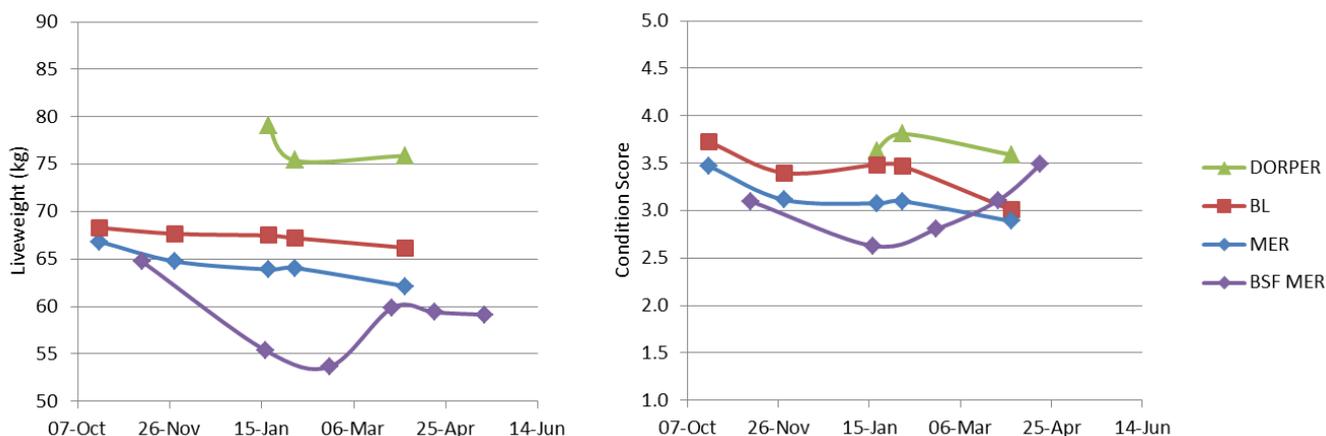


Figure 1 The liveweight (kg) and condition score profiles from weaning in 2016 until pregnancy scanning in 2017 for adult Dorper, Border Leicester (BL) and Merino (MER) ewes from the Genetic Resource Flock, and for Merino ewes from the breech strike flock (BSF MER) at the Katanning Research Facility. The Merino and Border Leicester ewes are run together as one flock, the Dorper and breech strike ewes are run as separate flocks.

**Note that all data means presented are raw (i.e. not analysed or adjusted or ewe age, previous rear type etc.)

Breech strike flock – naturally mated

The breech strike flock consists of 900 mixed age (2-9 years old) Merino ewes that were sourced from the Mt Barker and Rylington Park Research Stations. All progeny generated from the natural mating of these ewes are measured for flystrike, worms, disease resistance, wrinkle and wool quality traits.

In 2017 the breech strike flock ewes were mated naturally to single sires (n=23) on small plots for 32 days (23 February to 27 March 2017). The ewes, on average, weighed 53.7kg with a condition score of 2.8 at mating (Figure 1). Ewes were scanned for pregnancy on 14 May 2017. Fertility (88%) and reproductive rate (147%) of the breech strike Merino ewes exceeded that of the Merino and non-Merino breeds of the genetic resource flock (Table 1). This is perhaps not surprising given they were naturally mated on small plots.

The percentage of rams to ewes across the 23 plots was approximately 2.5%. Two of the 23 sires were identified as performing poorly, with 70% of ewes on their respective plots being scanned as dry. The average proportion of dry ewes was only 6% when the results of these two sires were excluded.

Table 1 The number of ewes scanned with zero (dries), single or twin pregnancies for artificially inseminated Dorper, Border Leicester (BL) and Merino (MER) ewes from the genetic resource flock and naturally mated Merino ewes from the breech strike flock (BSF MER). The Merino and Border Leicester ewes are run together as one flock, the Dorper and Breech Strike ewes are run as separate flocks. Key: artificially inseminated (AI); single sire matings (Natural).

mating type	DORPER (AI)	BL (AI)	MER (AI)	BSF MER (Natural)
ewes scanned	328	137	600	900
dries	125	20	144	107
singles	85	50	145	259
twins	118	67	311	534
fertility (%)	62	85	76	88
reproductive rate (%)	98	134	128	147

**Note that all the data means presented are raw (i.e. not analysed or adjusted for ewe age, liveweight, condition score etc.)

With pregnancy scanning drawing to a close across the state, it is now time to do your own sums and see where your flock sits. Have you met your fertility and reproductive rate targets now that you know how many foetuses are on-board?

Calculating feed requirements for single and twin bearing ewes and feeding appropriate rations is wise, especially in average (or below-average) years as 2017 may be. DAFWA feed budget tools can assist in planning appropriate rations. The 'Supplementary feed calculator for ewes on low green feed' and 'Feed cost calculator' can be accessed from the DAFWA homepage under the Tools and Support tab. Monitoring the condition score of ewes pre-lambing will also assist in maximising lamb survival, with condition score 3 being an optimum target for Merino ewes.

For more information about reproductive targets or pre-lambing management tips, contact Beth Paganoni, DAFWA South Perth, +61 (0)8 9368 3662.

Acknowledgements

These research flocks are both funded by DAFWA and Meat and Livestock Australia (MLA) also provides funding for the genetic resource flock.

Australian consumers are more responsive to intramuscular fat than American or Chinese consumers

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This project was undertaken with collaborators at Texas Tech University, Lubbock United States of America (USA) and China Agricultural University, Beijing China.

Introduction

The USA and China are Australia's most valuable export markets for chilled and frozen sheepmeat products, yet international consumer perceptions of Australian sheepmeat are poorly understood.

Previous work in beef has demonstrated that perceptions of eating quality differ between Australian and Korean consumers. This may stem from greater sensitivity to intramuscular fat (IMF) among Australian consumers, whose palatability scores for tenderness, juiciness, liking of flavour and overall liking have been shown to be particularly responsive to changes in IMF. Additionally, Japanese consumers respond negatively to branched chain fatty acids, which would off-set the positive relationship between IMF and eating quality traits.

Extrapolating these Asian results to Chinese consumers, we hypothesise that their eating quality scores would be less responsive to changes in IMF than the eating quality scores of Australian consumers or the similarly Westernised palates of American consumers.

Materials and methods

Lambs and yearlings (n=328) were from the Kirby Meat and Livestock Australia genetic resource flock and consisted of maternal, terminal and merino sire types.

Animals were slaughtered in two kill groups, and the *longissimus lumborum* (loin) muscle was collected and aged for 10 days prior to frozen transport to the USA, China and within Australia.



Loin samples for consumer scoring

Untrained consumers tasted and scored six grilled samples for eating quality traits of tenderness, juiciness, liking of flavour, and overall liking on a scale of 1 to 100. A total of 720 consumers were surveyed in each country.

Each animal was represented by a loin cut in two different countries at the same time. Each cut was sampled ten times. IMF and Warner Bratzler shear force (WBSF), both good indicators of eating quality for Australian consumers, were measured on loin samples.



Consumer tasting session in China

Eating quality data was analysed using linear mixed effects models in SAS with fixed effects of country, muscle type, sire-type within age class, sex within age class, and kill group. Random terms included sire, tasting session within country, and animal identification.

Results and discussion

The level of IMF in the loin had a significant positive association with all sensory traits, across all countries ($P < 0.001$). As IMF increased from 2.5% to 9%, consumer sensory scores increased for tenderness (by 7.9 eating quality scores), juiciness (5.8), liking of flavour (7.2) and overall liking (6.7).

The increase in consumer sensory scores with increasing IMF levels highlights IMF as a strong driver of eating quality. In agreement with our hypothesis, Australian consumers demonstrated a stronger response to changes in IMF% compared to Chinese consumers, yet contrary to our hypothesis the American consumers were similar to the Chinese.

For overall liking, the Australian consumer scores increased by 1.8 scores per 1% increase in IMF (Figure 2). The increase was 0.8 scores or less for Americans and Chinese consumers ($P < 0.05$).

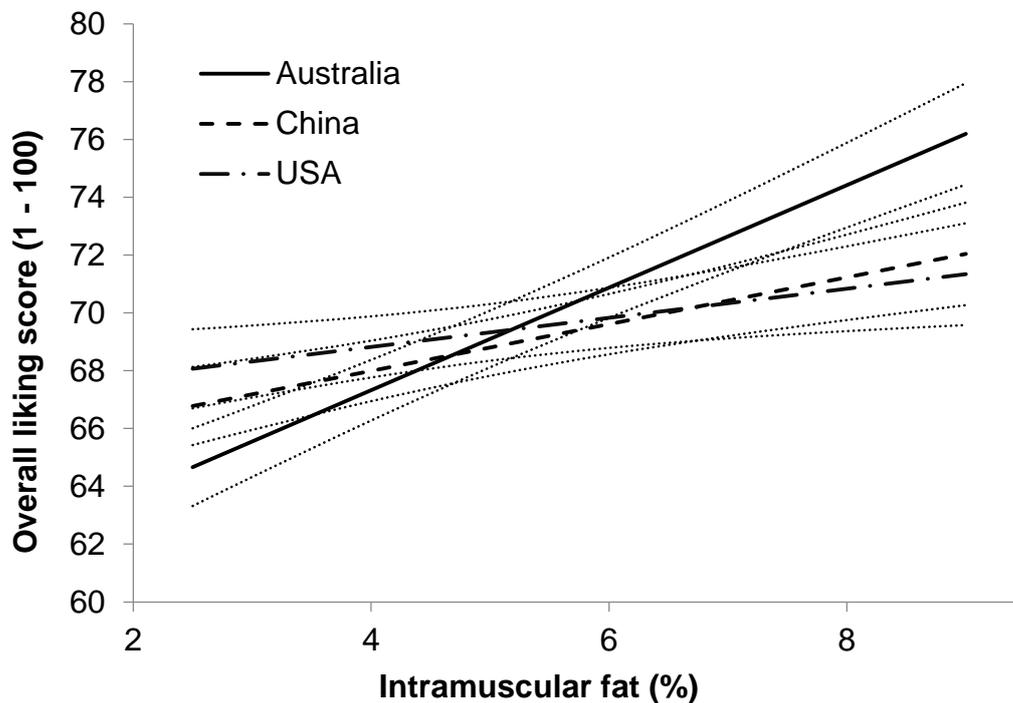


Figure 2 The association between consumer overall liking scores and intramuscular fat % for Australian, Chinese, and American consumers. Lines represent predicted means (\pm s.e.)



Consumer tasting session samples



Consumer tasting session in Australia

Shear force (N) is a measure of the force required to chew a meat sample. Higher shear force levels of the loin had a negative association with the sensory traits, across all countries ($P < 0.001$). As shear force increased from 15 to 95 N, consumer sensory scores reduced for tenderness (by 17.6 eating quality scores), juiciness (8.6), liking of flavour (5.5) and overall liking (8.9).

In contrast to the results for IMF, the size of this effect was consistent across all countries (Figure 3). Given that there was no variation in the response to WBSF between countries, the variation observed for IMF between countries may be a reflection of the inherent correlation between consumer scores with liking of flavour most strongly linked to IMF changes. This would support the assertion that Asian consumers are more sensitive to branched chain fatty acids.

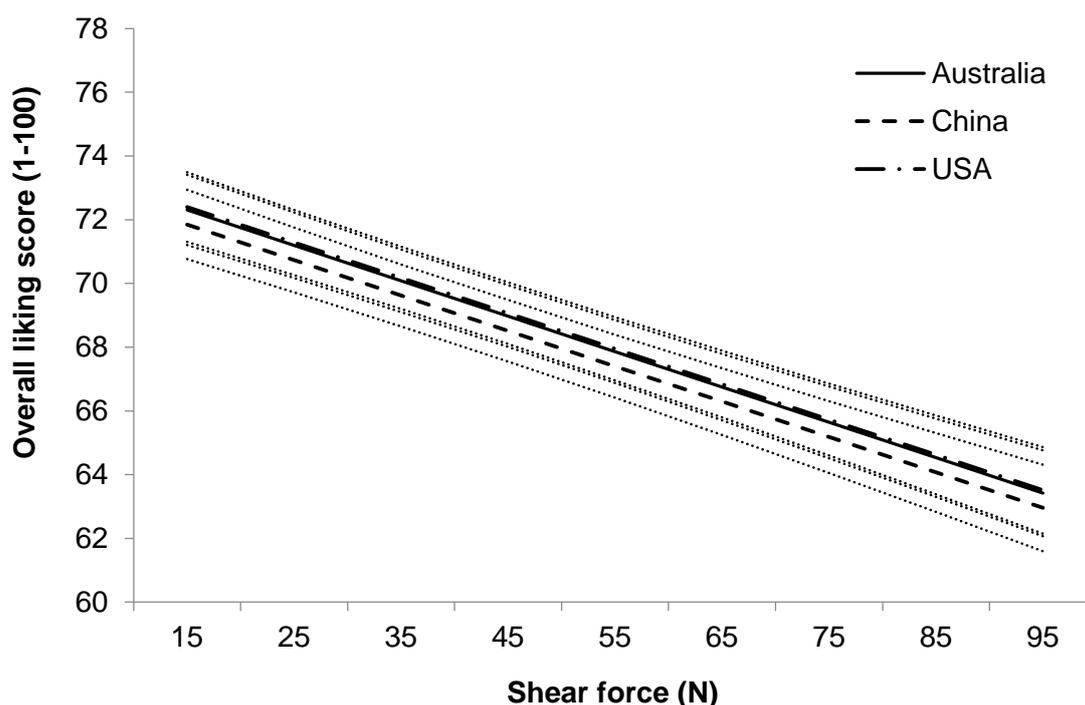


Figure 3 The association between consumer overall liking scores and Warner Bratzler shear force for Australian, Chinese, and American consumers. Lines represent predicted means (\pm s.e.)

Conclusion

Increasing IMF showed a positive impact on all eating quality traits regardless of cultural background; however, Australian consumers demonstrated the greatest sensitivity towards IMF changes. Results indicate sheepmeat producers supplying the Australian domestic market would yield the greatest improvements in eating quality by breeding for higher IMF, where other factors along with IMF likely contribute to perceived eating quality for American and Chinese consumers.

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Opportunities for sheep enterprise expansion

Greg Kirk and Paul Omodei, Planfarm

Introduction

Expanding the sheep enterprise is looking more financially attractive, with current margins for sheep matching or exceeding crop margins in some regions of Western Australia (WA). The expansion of sheep numbers on an individual farm can be achieved either by a change in sheep productivity and profitability without a change in cropping area, or a change in land use away from cropping back to sheep production.

In this study, historical financial and production data, and interviews with top sheep producers were used to identify opportunities for producers to expand their sheep enterprise.

Financial analysis of sheep and cropping enterprises in the wool belt and cereal-sheep zone

The past financial performance and relative productivity of 350 farm businesses, focusing on those located in the wool belt (H4) and the cereal-sheep zone (L4 and M4), were analysed across the 2011-2015 period. This was considered a time period that broadly reflects the seasonal and market conditions regularly encountered in WA. The analysis of each region aimed to discover what was the overall average farm financial performance (Table 2) and what was the relative contribution of the sheep and cropping enterprises.

Table 2 Key characteristics and financial results in H4, M4 and L4 regions for 2011-2015. Note acronyms: dry sheep equivalent (DSE), kilogram (kg), winter grazed hectares (wgha), hectares (ha).

	L4 (cereal zone)	M4 (cereal zone)	H4 (wool belt)
% area available to graze	28	34	45
Stocking rate (DSE/wgha)	2.5	4.7	8.3
Wool (kg/wgha)	10.3	19.6	31.2
Lambs per wgha	0.90	1.75	2.40
Overall operating profit (\$/ha)	118	67	311

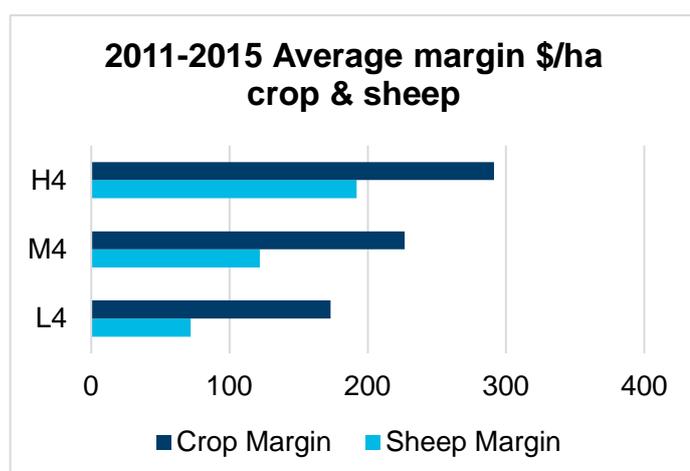


Figure 4 Average crop and sheep margins per hectare for the L4, M4 and H4 regions for 2011-2015

During the 2011-2015 period, crop margins were substantially higher than sheep margins on average. However, relatively small changes in crop and sheep income could switch margins in favour of sheep in the H4 and M4 regions. Crop margins are a lot more volatile than sheep margins across all the regions, being far more responsive to seasonal conditions.

Sheep and wool production tend to be more stable, with the most profitable years being determined less by seasonal conditions and more by high sheep and wool prices.

At present prices, the margin differentials between crop and sheep are favouring expansion in the wool belt and western parts of the cereal-sheep zone. Sheep margins can equal cropping margins if the

average grain prices fall by only 13%, 18% and 21% in the H4, M4 and L4 regions respectively. APW at \$245/t FIS is 17% below the 2011-2015 average price of \$295/t FIS.

Cereal zone (L4 and M4)

In the cereal zone the major management decisions revolve around cropping, which can have negative impacts on the sheep enterprise. However, the sheep enterprise can be used to increase overall profitability by utilising land which would otherwise be unproductive; by utilising stubbles and low quality feed grain.

Wool belt (H4)

In the wool belt the dominant land use is cropping. However, 95% of farms in the region run sheep and average flock sizes are larger than in the cereal zone regions. Producers in this region have the greatest opportunity to expand their sheep enterprise as small percentage changes in productivity via management, breeding or technology can produce significant changes in sheep numbers.

Comparison of the cereal zone (L4 and M4) and the wool belt (H4)

The comparison of relative productivity of sheep and cropping across the three regions revealed a sheep 'production gap' in the lower rainfall cereal regions compared to H4 (Figure 5). Producers in L4 and M4 were more efficient at converting rainfall into grain than rainfall into sheep products. This may represent opportunities to expand their sheep enterprises.

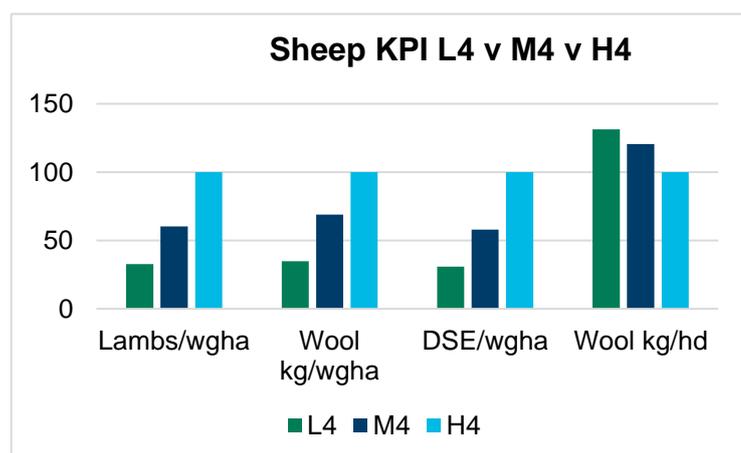


Figure 5 Sheep production key performance indicators (KPIs) in the L4 and M4 regions, as a percentage of the H4 region

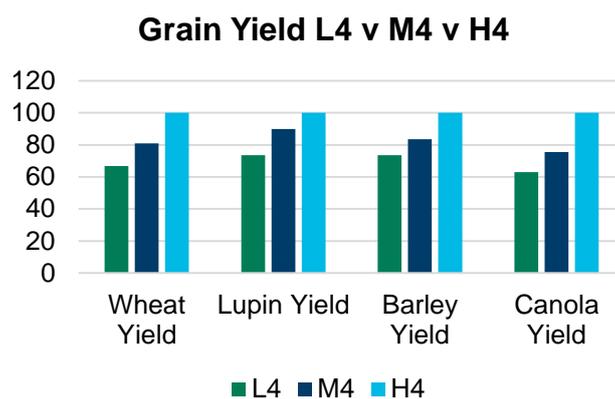


Figure 6 Grain yield for various crops in the L4 and M4 regions, as a percentage of the H4 region

Increasing sheep numbers by reducing cropping

It is feasible to increase sheep numbers by reducing cropping percentages when the lowest yielding crop paddocks are moved back to pasture. This improves the average quality of the cropping and pasture paddocks, and provides an opportunity to increase stocking rates.

Key opportunities

- The improved margins for sheep enterprises may encourage producers to increase sheep numbers, particularly when combined with the benefits of a mixed farming operation such as weed control.
- Producers in the wool belt have the greatest opportunity to increase sheep numbers due to current flock sizes. They are also more likely to be at the forefront of driving efficiencies and profitability through investment in new management technologies.

- There is a production gap between wool belt and low rainfall sheep producers highlighting an opportunity for low rainfall producers to expand their sheep enterprises.
- Reducing cropping percentages to increase sheep numbers is a feasible strategy.

Sheep producer survey results

Twenty five key producers were interviewed about their management practices and intentions for the future. Participants were from the top 50% of sheep producers, as measured against the Planfarm Bankwest benchmarks, and were spread across the cereal and wool zones. While sheep production was secondary to cropping, all of the producers acknowledged that the enterprises are complimentary.

The key reasons producers gave for running sheep:

- increased productivity – sheep gave producers an opportunity to utilise non-arable land, maximise labour utilisation and utilise low quality feed grain
- improved pastures and cropping (weed control and nitrogen for crops)
- risk mitigation (spreading financial risk in the business, increased cash flow, exit strategies)

Average operation

The average operation was 3593 effective hectares with 37% grazed and 59% cropped. Merino ewes were joined by all but two producers, with almost half also joining older ewes to a terminal sire. Lambing percentage was on average 97% with a joining period of six weeks and weaning at 14 weeks. Producers are aiming at increasing sheep numbers by 5-10% by increasing lambing percentage and keeping more young ewes.

The producers had similar management strategies for sheep including long and short term breeding objectives, culling of dry ewes, early supplementary feeding, monitoring ewe condition and using updated infrastructure.



All producers surveyed assessed their sheep enterprise performance every year with financial benchmarking or productivity performance (lambs per hectare).

All producers considered the keys to making money in sheep to be producing pasture to drive stocking rate and lambs per hectare, with a non-negotiable focus on animal health. Pasture improvement is a key focus of the business and producers proactively managed stocking rates to seasonal conditions.

The future

When asked what they would change about the sheep industry, nearly 50% of producers wanted more market transparency and product competition with 24% believing that greater government research, development and extension would increase brand recognition and prices.

Key producer survey findings

- cropping is currently more of a priority to producers in the cereal zone
- there is scope to improve on-farm management with a focus on ewe management, pasture production, increasing lamb survival and lambs weaned per hectare grazed in all regions. Improving management will have the greatest impact in the wool belt where flocks are larger
- producers recognise the potential for improved profitability and productivity through improved management.

Low growth Merino lambs mobilise more fat during feed deprivation

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Introduction

Under current Australian industry pre-slaughter guidelines, lambs may be off feed for up to 48 hours prior to slaughter.

During this feed deprivation period, there is significant adipose tissue turnover in prime lambs, however the role of fasting per se and genotype in younger animals has not been studied.

Animals with high metabolic requirements (such as pregnancy and growth) have increased adipose tissue mobilisation and plasma non-esterified fatty acid concentrations (NEFA) during periods of feed restriction.

Therefore it is hypothesised that selection for increasing growth using the Australian Sheep Breeding Value for post-weaning weight (PWT) will increase NEFA response to feed deprivation.

Materials and methods

Lambs (n=89) from Merino dams at the Katanning Research Facility were artificially inseminated using terminal and Merino sires. The sires had a broad range in PWT breeding values.

On day zero, lambs were assigned to individual pens and fed the same ration – metabolisable energy (ME) 11 megajoules per kilogram of dry matter (MJ/kg DM), crude protein 14.5% DM. On day six, lambs were taken off feed and resting blood samples were collected at zero, 24, 36 and 48 hours via jugular cannulas. Plasma NEFA concentration was measured for each lamb at each time point.

NEFA concentration was analysed using linear mixed effect models with fixed effects for sire type, sex and time off-feed. PWT and body composition indicators obtained from the carcasses post slaughter were included as covariates.

Results and discussion

NEFA concentration increased with time off feed ($P < 0.05$). In Merino sired lambs, NEFA concentrations were 13% and 22% higher ($p < 0.05$, Figure 7) at 36 and 48 hours of feed deprivation compared to Terminal sired lambs

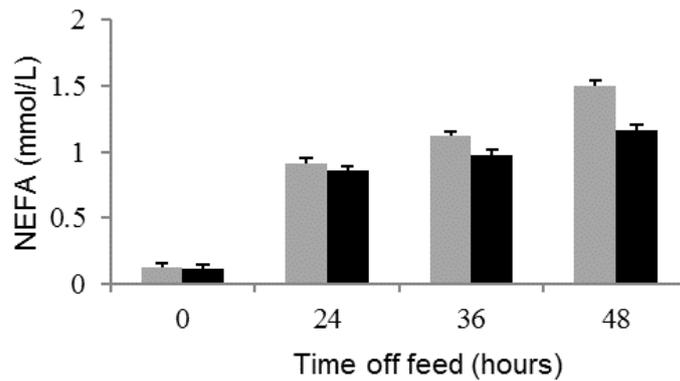


Figure 7 Effect of time off-feed (hours) on NEFA concentration measured in millimoles per litre (mmol/L) in Merino (grey bars) and Terminal (black bars) sired lambs

** denotes $p < 0.01$

Contrary to our hypothesis, there was a negative association between NEFA concentration and increasing PWT during feed deprivation. Lambs from sires with a high PWT breeding value had lower NEFA concentrations than lambs from sires with a low PWT breeding value.

NEFA concentration decreased by 23% ($p < 0.05$, Figure 2) as PWT increased from -1kg to 12kg. This effect was only present in Merino sired lambs after 48 hours of feed deprivation.

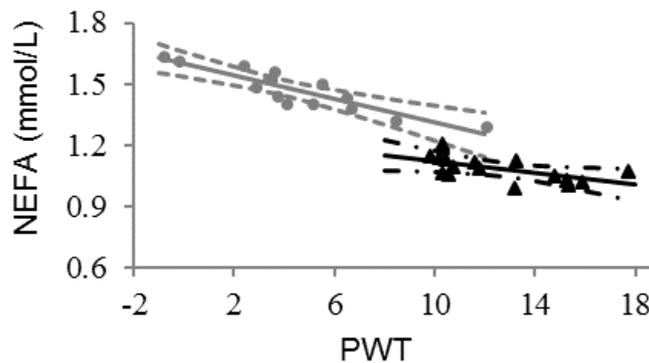


Figure 8 Association between NEFA (mmol/L) and PWT at 48 hours off-feed. Lines represent predicted means \pm s.e. Dots (●) denote Merino and triangles (▲) Terminal sire residuals (difference between predicted and expected NEFA values)

There was a difference in the NEFA concentration between Terminal and Merino sire types at 36 and 48 hours of feed deprivation, however this was due to the differences in sire PWT breeding values. This difference in growth impetus between sire types may also explain the reduced NEFA response in high growth Terminal sired lambs compared to Merino lambs at 48 hours of feed deprivation.

The mechanism driving this relationship is unclear; however higher rates of protein turn-over are observed in high growth animals. During starvation this may result in an elevated supply of gluconeogenic amino acids, which allow the lambs to synthesise glucose for energy.

This may reduce the reliance of these lambs on fat mobilisation. Further studies are needed to understand the metabolic effects of fasting under commercial pre-slaughter conditions.

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