

# Economic Analysis of MLP data Project ON-00775

Final Report

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## 7.1. Woolgrower Summary

The Merino Lifetime Productivity (MLP) project, funded by Australian Wool Innovation (AWI) and Site partners, represents the most extensive genetic evaluation of Australian Merino sires undertaken to date. Involving 134 semen sires selected to encompass a broad spectrum of breeding philosophies and a cross section of the national gene pool, the genetic evaluation was conducted across five trial sites over five to six years. All progeny were retained, except for a small percentage of “welfare” culls. Comprehensive measurements of progeny lifetime traits—including wool production (clean fleece weight, fibre diameter, staple strength, and length), reproduction (weaning and conception rates), growth (liveweight and fat depth), and survival—have informed a detailed economic analysis. This economic evaluation quantifies the financial impacts on commercial woolgrowing enterprises using current profit drivers, providing insights for producers seeking to optimise breeding decisions for enhanced profitability.

### Financial Impact of Genetic Selection

Several analysis techniques were compared and all showed substantial differences in profitability between sire teams, however, it was concluded that the techniques that included extra detail (profit per hectare analysis) were more accurate than a simple value of production analysis and gross margins analysis. The difference between the highest and lowest performing sires represents approximately 28% of average farm profitability, which translates to significant financial outcomes in a commercial breeding program. For a property with sheep grazing country, running 2,000 breeding ewes selecting superior genetics versus lesser genetics could alter farm profit by \$40,000 per annum. An alternative representation of that result is that if the average price paid for sires was \$2500/head, profit would be the same if the price paid for the lowest and highest profitability sires were \$500 and \$3600 respectively. Meaning the top sire would deliver an extra \$2100 of value during his productive lifetime in a commercial flock.

### Key Traits Influencing Profitability

The economic analysis identified the traits contributing most significantly to variation in farm profitability:

#### *Major contributors:*

1. Fleece value – Higher clean fleece weight and finer wool
2. Reproduction - Improved weaning rates through better conception, litter size, and ewe rearing ability

#### *Secondary contributors:*

1. Adult liveweight and carcase specifications affect sale animal values
2. Fleece quality traits (staple strength and staple length) influence wool prices
3. Survival from yearling to adult age

While major production traits (fleece weight, fibre diameter, reproduction) drive the majority of profitability differences, the analysis demonstrated that minor traits such as staple strength, survival, and carcase characteristics also contribute meaningfully to overall financial performance. Sires achieving balance across multiple traits consistently ranked among the most profitable. Sires with extreme focus on individual traits at the expense of overall balance typically showed reduced profitability compared to more balanced genetics.

## **Breeding Philosophy Comparison**

The analysis examined eight different breeding philosophies, including fine wool specialists, breeders with a visual assessment focus, breeders utilising objective measurements for breeding decisions, more growth and meat-focused objectives, and index-focused selection.

The key finding was that high-performing sires were identified across nearly all breeding philosophy groups. The variation in profitability within each breeding approach was comparable to the variation between approaches. This indicates that the effectiveness of implementation and individual sire selection is more important than the specific breeding philosophy employed.

Implication for ram buyers: Focus should be placed first on their own breeding objective, and for potential purchases evidence of performance in traits important to that objective, rather than on the breeding philosophy of the stud.

## **Industry Indexes and Profitability**

The correlation between the indices and the financial performance varied and were higher for the Fine Wool and Wool Production indexes than for the Sustainable Merino and Merino Lamb indexes. It is likely that the lower correlation with the Sustainable Merino and Merino Lamb indexes was because they include traits, such as worm egg count, lean meat yield and intramuscular fat that are looking to address future market scenarios or reduce future risk rather than being profit drivers today. It is a recommended research outcome to develop an index that reflects current profit drivers so woolgrowers can be fully informed about breeding decisions linked to current and future profit drivers.

## **Analysis Limitations**

This economic evaluation did not include valuation of some traits that may be important to specific production systems or management approaches. Traits not included in the profitability analysis were wool style and character, worm egg count, intramuscular fat, meat-eating quality, lean meat yield, footrot resistance, flystrike resistance, and non-mulesing traits (bare area, breech wrinkle, and dag score). These traits contribute to wool value, animal welfare, ease of management, and may influence profitability through pathways not captured in this analysis. Examples of the above include not representing the value of some wool traits that are very important in superfine and ultra fine production systems, and not representing the cost of parasites in low chemical production systems. Wool producers should consider these traits alongside the economic analysis when making selection decisions aligned with their specific management systems, breeding objectives and future risk management options.

## **Recommendations for Woolgrowers**

1. Review your breeding objective, what are the important traits for your sheep business, country, skills and preferences
2. Review ram and ewe assessment methods and selection criteria to ensure emphasis is placed on traits demonstrated to drive profitability in your commercial production system.
3. Selection of stud and sire, and the price paid for the rams is more important than selecting a particular breeding philosophy.
4. Consider the long-term value when selecting genetics, considering both current market conditions and long-term price expectations

5. Assess the genetic progress that is being made. This can be done by comparing the average ASBV of purchases each year or by the Flock Profile or Genomic only Breeding Value (GBVs) assessment tools
6. When considering economic analyses of genetic comparisons, preference results generated using the more sophisticated profitability assessments because they include more realistic representation of animal feed requirements and also include the likely management changes you would implement to maximise the gain from an alternative genotype.

The findings from this comprehensive genetic evaluation confirm that ram selection decisions have substantial effects on farm profitability. Utilising available sound genetic information that you have confidence in and selecting sires with demonstrated superiority across economically important traits reduces the risks in the selection process and provide significant financial returns to commercial Merino enterprises.

## 7.2. Executive Summary

### 7.2.1. Project Overview

The Merino Lifetime Productivity (MLP) project, funded by Australian Wool Innovation (AWI) and Site partners, represents the largest genetic evaluation of Australian Merino genotypes, assessing 134 sires across five sites over 5–6 years. Sires were selected to reflect diverse breeding philosophies and the national gene pool, providing an unparalleled dataset for quantifying lifetime productivity and economic outcomes.

This final report (Project ON-00775) presents economic analyses comparing three distinct methodologies used to evaluate the 134 sires. The results quantify the financial implications of genetic variation across sires, individual traits and breeding philosophies, and examine the correlation between the financial analysis and the standard industry indexes.

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### 7.2.2. Methods

Three analytical approaches were employed to evaluate the financial performance of the 134 sire teams, each utilising different data sources and methods for representing the feed budget and on-farm management.

#### 7.2.2.1. Analysis methodology

The three methodologies compared were:

##### Value of Production (VOP)

Calculated income per ewe equivalent using adjusted sire means from the trial, representing actual measured production per head at each site. This approach accounted for differences in feed requirements between mated ewes and dry stock but did not differentiate requirements based on animal liveweight, reproduction rate, or weaning rate. Management practices reflected those implemented at each trial site, with the equivalent number of ewes plus followers per hectare for each team. Income was calculated from annual wool clips, cast-for-age ewe sales, and surplus young ewe and wether sales, net of selling costs.

##### Gross Margin (GM) per DSE

The GM utilised within-site, across-year flock breeding values (FBVs) to estimate production, with the feed budget represented through DSE ratings scaled by metabolic weight and reproductive status. This approach incorporated variable costs including husbandry, supplementary feeding, infrastructure, and labour. The analysis represented a self-replacing flock at equilibrium with standard management timing for lambing and shearing varying across site. The DSE system assumed a single feed-limiting period determined stocking capacity and the same number of DSE were carried for each sire team.

## Profit per hectare

The profit analysis employed within-project, across-site FBVs with detailed whole-farm modelling using the Australian Farm Optimisation (AFO) model. This deterministic steady-state equilibrium model included comprehensive feed budgets calculated across 10 periods per year, allowing optimisation of stocking rate, nutrition profile, age structure (wether and CFA ewe sale ages), and supplementary feeding strategy for each genotype. Three regional models were utilised representing different growing season lengths: South-west Victoria (9-month growing season, 686mm rainfall, no cropping), Great Southern Western Australia (6-month growing season, 500-550mm rainfall, 50% cropping), and Cereal Sheep Zone Western Australia (4-month growing season, 300mm rainfall, 80% cropping). The model incorporated Australian Feeding Standards assumptions for energy requirements and production responses.

All three analyses employed consistent price scenarios based on 5-year, 10-year, and 20-year median prices for wool and meat. Wool prices were calculated from fibre diameter, staple strength, and staple length specifications. Sale animal values were determined from a base price adjusted using a grid for dressed weight and fat score. Mortality estimates excluded deaths from misadventure or management failure.

The gross margin analysis includes the flock costs and represents the feed requirements of the flock in greater detail than the value of production analysis and is therefore considered to be a better analysis. Similarly, the profit per hectare analysis represents in greater detail than the gross margin more of the factors that vary when genotype is altered on-farm, including the feed budget, nutritional management and sale age decisions. Therefore, the profit analysis is considered to be the best analysis technique.

### 7.2.2.2. *Application of Results for Comparative Analysis*

The financial estimates generated from the three methodologies were used to conduct comparative analyses examining individual trait contributions, breeding philosophy effectiveness, and industry index validity.

*Individual trait economic values* were estimated using multiple regression with profit per hectare (averaged across the three regional models) as the dependent variable and within-project FBVs for each trait as independent variables. The regression slopes were multiplied by the standard deviation of each trait across the 134 sire teams to quantify the economic impact of one standard deviation change in each trait.

*Breeding philosophy comparisons* utilised the Classer Advisory Group's classification of sires into eight groups based on breeding approach, with profitability, trait levels, and index values compared both between and within groups using descriptive statistics including means, 25th and 75th percentiles, and ranges. Visualisation of trait balance across breeding philosophy groups employed pie charts weighted by economic values, with slice size representing trait importance and fill proportion indicating production level relative to the overall mean of all 134 sires. (Using 60K DNA tests AGBU also reviewed and confirmed the genomic groups that the CAG had created, pers comms Geoff Lindon).

*Industry index evaluation* employed ordinary least squares regression between index values (calculated by AGBU from within-project FBVs) and the financial performance metrics from each analysis method, with coefficient of determination ( $r^2$ ) calculated to assess how well each index predicted profitability under different analytical approaches and price scenarios.

### 7.2.3. Key Findings

#### 7.2.3.1. Magnitude of Genetic Impact on Profitability

The range in estimated profitability between the highest and lowest performing sires was substantial and consistent across all three analysis methodologies:

- Range of financial performance between the extreme sires represented approximately 28% of mean performance across all methods
- For typical medium to high rainfall zone producers (with 2000 breeding ewes), the difference between highest and lowest performing sires translated to \$40,000 in annual farm profit variation
- Breakeven ram purchase price for the bottom 25 percentile and top 25 percentile for the 10-year median prices were \$2180 and \$2885/hd with a range of \$705/hd. which demonstrates the substantial economic value embedded in genetic selection decisions.
- There was more range with 5-year median prices and less with 20-year prices, the range was \$1340 and \$555/head respectively.

The importance of genetics was proportionally lower in the cereal-sheep zone where livestock enterprises contribute less to whole-farm profit, though absolute dollar differences per DSE remained comparable to higher rainfall zones.

#### 7.2.3.2. Analysis Methodology

A novel and significant finding of this research was that different economic analysis techniques produced only low to moderate correlations in sire rankings ( $r^2 = 0.31$  to  $0.33$  between Value of Production, Gross Margin and Farm Profit). This demonstrates that analytical approach substantially influences valuation outcomes and sire rankings.

Implications

The choice of analysis methodology is important when evaluating genetic comparisons. More sophisticated modelling approaches that represent feed budgets in detail and optimise management for individual genotypes provide fundamentally different valuations compared to simpler per-head or DSE-based approaches. This has implications for future genetic evaluation and calculation of economic values for breeding objectives.

#### 7.2.3.3. Contribution of Individual Traits to Financial Performance

Major contributors to profit variation (\$/standard deviation):

- Clean fleece weight: Adult CFW contributed \$2.51, yearling CFW \$1.55
- Fibre diameter: Adult FD contributed \$2.29, yearling FD \$0.91
- Reproduction: Combined components (conception \$1.40, litter size \$1.32, ewe rearing ability \$1.31) aggregated to approximately \$2.49 for weaning rate

Minor but meaningful contributors (\$/standard deviation):

- Adult weight: \$0.28
- Staple strength: \$0.50
- Survival (yearling to adult): \$0.22
- Yearling fat depth: \$0.20
- Staple length: \$0.05

#### Key insights

When composite traits are considered, fleece value and weaning rate emerge as the dominant drivers of profitability variation.

The value of a 1% improvement in survival (\$0.57) exceeds the value of 1% additional fleece weight (\$0.26), though low heritability results in minimal standard deviation between teams. However, the results still suggest that survival warrants inclusion as an ASBV, with priority similar to quality traits like staple strength and carcass fat.

The economic value of traits will be calculated in the GEPEP project using a different approach than used here. After that is carried out it will be useful to compare and discuss the 2 sets of economic values with those calculated using SheepObject.

#### 7.2.3.4. *Breeding Philosophy Comparisons*

Eight breeding philosophy groups defined by the Classer Advisory Group were analysed for financial performance and trait profiles:

- Group DA (Higher rainfall, across-flock assessments) and Group F (Index-focused) achieved highest average profitability.
- Group B (Free skin) and Group E (Growth/fertility emphasis) showed below-average profitability under all price scenarios
- Group A (Ultrafine specialists) exhibited highest variability, performing best under favourable fine wool price scenarios but showing significant trade-offs in fleece weight and frame size

#### Key insights

Variation within breeding philosophy groups was comparable to variation between groups. No single breeding philosophy demonstrated clear superiority across scenarios. High-performing sires existed within nearly all breeding philosophy groups, suggesting that breeding efficacy and careful trait selection matter more than adherence to a particular philosophical approach.

The most profitable genotypes generally achieved balance across traits rather than extreme specialisation. However, distinguishing whether observed differences reflect breeding objectives or breeding methodology efficacy remains challenging.

#### 7.2.3.5. *Correlation Between Industry Indexes and MLP Financial Evaluation*

Industry indexes (Fine Wool, Wool Production, Sustainable Merino, Merino Lamb) were evaluated against MLP profitability estimates:

- FW and WP indexes showed moderate to high correlation with profit analysis ( $r^2 = 0.40-0.73$  for WP,  $0.58-0.65$  for FW depending on region and price)
- SM index showed low to moderate correlation ( $r^2 = 0.10-0.40$ )
- ML index showed low to very low correlation ( $r^2 = 0.01-0.22$ )

#### Key insight

Correlation of profit with the FW and WP indexes was moderate to high, and was higher for the profit analysis than the VOP & GM analyses. The lower correlation with SM and ML indexes is likely due to the emphasis applied in those indexes to traits that are thought to future proof the enterprise but are not currently profit drivers. However, this deserves further examination and it is a recommended research outcome to develop an index that reflects

current profit drivers so woolgrowers can be fully informed about breeding decisions linked to current and future profit drivers.

#### 7.2.3.6. *Change in Fleece Value with Age*

The change in fleece value with age across the sire teams showed a big range of between an increase of \$2.02 to a reduction of \$4.51 per year across the 5 or 6 full wool shearings. Selection to improve fleece value change appears to require direct assessment of the adult age traits because the correlation between FVC and the other production traits is low. Although, the economic value of the fleece value change trait was low, giving a mixed message about the importance of further research, it seems justified to address industry concerns with further research addressing the profitability of flocks that only measure early in life production versus flocks that also measured adult production.

#### 7.2.4. Limitations and Future Directions

Several important traits were not valued in this analysis due to quantification challenges:

- Worm egg count
- Intramuscular fat and meat-eating quality
- Lean meat yield
- Footrot and flystrike resistance
- Non-mulesing traits (bare area, breech wrinkle, dag)
- Optimal body weights, impact of very high weights on shearing costs

Additionally, the analysis valued carcass fat solely through its contribution to sale value, not accounting for emerging evidence from the Genetic Evaluation of Productivity, Efficiency and Profitability (GEPEP) project regarding fat's role in resilience and energy metabolism. Inclusion of GEPEP findings may substantially increase the economic value attributed to genetic fatness and potentially re-rank sire teams.

#### 7.2.5. Recommendations

##### 7.2.5.1. *For Research Administrators and Funding Bodies:*

1. Prioritise collaboration between geneticists, economists, ram breeders and buyers working and interested in the area of index development. The demonstrated importance of methodology choice and the poor correlation between some indexes and detailed profitability analysis highlight the need for closer collaboration. This industry collaboration with an economic focus could inform Industry Strategic Plans rather than the Strategic Plans directing breeding directions.
2. Discuss with ram breeders and ram buyers the demand for an index that reflects current profit drivers with a price horizon of 2 to 5 years. The index would allow producers to compare genetic merit on shorter and longer timeframes of their choice.
3. Re-evaluate SM and ML indexes to identify sources of divergence from detailed profitability analysis and improve alignment with commercial production systems. Use of independent culling levels although not technically preferred, is a practical and understandable way of preparing for future markets and risks.
4. Support development of simplified modelling tools that can represent detailed feed budgets and optimise management for different genotypes without requiring extensive manual calibration. Both AFO and GrassGro require significant adaptation to streamline genotype calibration for routine genetic evaluations.
5. Support some further examination of the change in fleece value with age and whether measuring later in life traits improves the financial outcome.

6. Develop survival ASBVs as a priority comparable to fleece and carcass quality traits, given its meaningful economic value and high observability by producers.
7. Invest in quantification methods for currently hard-to-value traits (disease resistance, meat quality, welfare traits) to enable complete breeding objective representation.
8. Commission qualitative research to better understand how commercial producers adjust management (stocking rate, nutrition, age structure) when changing genotypes, improving model assumptions about management of genotypes.

#### 7.2.5.2. *For Future Financial Analysis of Genetic Evaluations:*

1. Adopt modelling approaches (AFO, GrassGro, or similar), rather than value of production or gross margins analysis, for economic evaluation of genetic comparisons, given their superior representation of feed budgets and management optimisation, despite increased complexity.
2. Separate effects of data level (adjusted sire means vs. within-site FBVs vs. across-site FBVs) from management representation effects in future comparisons to better understand contribution of each factor.
3. Incorporate GEPEP findings once peer-reviewed to provide updated valuations accounting for genetic fat's role in resilience and energy metabolism.

#### 7.2.6. Conclusions

This comprehensive economic analysis of MLP data confirms genetic selection as a critical driver of farm profitability, with differences between highest and lowest profit sires equivalent to \$2,100-5,800 per ram purchased. The analysis methodology employed substantially affects both absolute values and relative rankings of sires, with detailed whole-farm modelling providing insights not captured by simpler per-head or per-DSE approaches.

Fleece value and reproduction emerge as dominant drivers of profitability variation, though balanced selection across all economically relevant traits produced the highest performing genotypes. No single breeding philosophy demonstrated clear superiority, suggesting multiple pathways can achieve genetic progress when well implemented.

The moderate correlation between detailed profitability analysis and some widely used industry indexes, particularly SM and ML, indicates need for enhanced collaboration between genetic and economic analysts and industry to ensure industry breeding objectives align with on-farm profit drivers. Future work should focus on developing accessible modelling tools, quantifying currently unmeasured traits, and validating economic assumptions against commercial producer behaviour.

The MLP project has provided an unprecedented resource for understanding genetic influences on Merino productivity and profitability, with findings that will inform future breeding decisions and research priorities.

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### 7.3. Introduction

The Merino Lifetime Productivity project is AWI's flagship R&D program designed to quantify the lifetime productivity of a range of Merino genotypes that have been selected to be representative of the Australian gene pool. 134 semen sires were evaluated across 5 sites and the production of the progeny was measured for 5 or 6 years. The sires were selected from a broad cross section of the Australian Merino industry including a spectrum of breeding philosophies. As such, this is the biggest genetic comparison carried out and it has contributed substantial knowledge on many genetic traits and the genetic analysis is ongoing. This project also provides an unparalleled database for economic comparison across individual traits, sire types and breeding philosophies.

Economic evaluation of the profitability of these different genotypes has been carried out using the data from the extensive measurement of the ewe and wether progeny in the project. The estimated profitability of the different genotypes included both the value of production per head and the number of sheep carried, which are both generally recognised as important to profitability. Quantifying how genotype affects the number of sheep that will be carried is challenging because it requires estimating how producers will adjust condition score targets and stocking density for genotypes that vary in energy requirements, appetite and production potential. Historically different analysis techniques have been used in the financial evaluation of genetic comparisons, and 3 different representations of the feed budget and on-farm flock management were tested and compared in this project:

1. Ignore the feed budget except for differences in energy requirements for reproducing ewes and non-reproducing sheep.
2. Represent the feed budget using variation in DSE/hd, which assumes a single feed limiting period of the year determines the number of stock that can be carried.
3. Use a farm modelling approach that includes a detailed feed budget that maximises profit through optimal selection of stock numbers, supplementary feeding, age structure, nutritional management and, turn off age and weight.

The alternative representations of on-farm management and the alternative estimates of team productivity, described above, were combined in 3 different analysis methodologies. The results of the 3 methodologies are compared for consistency across the 134 teams by examining the correlation between the financial estimates. The 3 methodologies used were:

- value of production (VOP) using the adjusted sire means from the trial and management as carried out at each trial site, ignoring the feed budget and carrying the same number of ewes plus followers per hectare for each team. This represents actual production per head as measured at the sites.
- gross margin (GM) per DSE using site FBVs and standard management as carried out at each trial site. The feed budget is represented using DSE/hd for the ewes and followers.
- profit per hectare using across site FBVs, with management optimised to maximise profitability for each team. Analysis carried out using the Australian Farm Optimisation model (AFO)

The analyses carried out was extensive; however, there were some traits that weren't valued in the analysis. These include worm egg count, intramuscular fat, meat-eating quality, lean meat yield, Footrot, Flystrike and non-mulesing traits (bare area, breech wrinkle and dag). These traits are an important component of some breeding objectives however, their impact on farm profit is difficult to quantify and was not included in the analyses carried out. Furthermore, the analysis only included the contribution of fat to carcass value and didn't

include the effect of fat on resilience and energy metabolism that is being examined in the GEPEP project. So, although the economic analysis carried out was very extensive and covered more detail than previous economic evaluations of genetic comparisons there are still areas that could be improved.

This report presents the economic analyses carried out for all the teams evaluated in the MLP project and discusses the results in the following sections:

- The contribution of genetic variation to farm financial performance
- Comparison of different economic evaluation methodologies
- Contribution of each measured trait to the variation in financial performance including the contribution of survival as a potential trait.
- Comparison of the financial performance of different breeding philosophies using the groups defined by the Classer Advisory Group (Drew Chapman, Matthew Coddington, Chris Bowman, Graham Wells, Jock McLaren, Geoff Lindon).
- Comparison of industry indexes with the measures of financial performance

## 7.4. Methods – Description of the Analyses

### 7.4.1. Prices in the analysis

The same price scenarios were used in each analysis and were chosen to be consistent with the prices used in SheepObject (Swan and Walkom *pers comm.*). A brief description is below, and more detail is provided in the Appendix.

The calculations used to estimate the value of wool and value of sales sheep were consistent for the 3 analysis methodologies tested, a summary is provided here, and more detail is included in the Appendix.

The standard prices for wool and meat used in the analysis were based on the 50<sup>th</sup> percentile nominal prices received over the last 10 years. Two other scenarios were examined being the median price over a 5-year period and the median over a 20-year period. The sensitivity analysis varied wool price and sale sheep price concurrently, i.e. there were 3 price scenarios (short, medium and longer term). The 10-year scenario was medium prices for wool, meat and grain, and a medium premium for finer wool. The 5-year scenario had higher prices for all commodities and a high premium for finer wool while the 20-year scenario had lower prices however, the FD premium for 19 $\mu$  down to 15 $\mu$  was higher than the 10-year scenario. Below 15 $\mu$  the premium for the 20-year scenario was very low.

The wool specifications used to estimate the wool price received were fibre diameter, staple strength and staple length. The premiums and discounts are explained in more detail in the Appendix. The price of fleece wool for the fibre diameter range between 13.5 and 19 $\mu$  was a combination of data provided by Andrew Woods (*pers comm.*) and information from Mecardo (2022).

Sale animals were calculated from the dressed weight (DW) of the animal and a value per kilogram. The net value of the sale sheep is calculated accounting for the selling costs. The value per kilogram was estimated from the price per kg for animals with premium specifications (Ag Commodity Prices 2024) and was then scaled from this 'premium specs' quote using a grid based on the specification of dressed weight and fat score for the sale animals for each sire team. The grids are shown in the appendix.

#### 7.4.2. Analysis Methods

A detailed description of each analysis method is included in the Appendix; a brief summary is provided here.

Sheep enterprise income was a combination of the number and age structure of the stock carried, fleece value per head and sale value per head. The traits used to value these are summarised in Table 1.

*Table 1: The traits and age stages measured in the trial that were used to estimate sheep enterprise profitability.*

Group	Trait	VOP	GM	Profit
Numbers and age structure	Repro	Actual	A	A
	Mortality	Actual	Y to A5	Y to A5
	Weight	-	P, H & A	Y & A
Sale value	Weight	Actual	P, H & A	Y* & A
	Carcase fat	Actual	Y & H	Y
Fleece value	CFW	Actual	P, Y, A	P, Y & A
	FD	Actual	"	"
	SS	Actual	"	A
	SL	Actual	"	"

\* Weight for post weaning and hoggets sales were estimated from YWT BV.

##### 7.4.2.1. Value of Production

The VOP was calculated for each age group of ewes and wethers for each management period in which they were measured. The management periods span from one shearing to the next and are generally one year but can vary based on the shearing interval and often the management period from weaning to the first shearing was less than 12 months.

This analysis calculated:

- the value of wool produced per animal shorn
- the sale value of the animal if it were sold at the end of the management period
- the value of wool and sale animals for a flock calculated per ewe equivalent grazing pressure.

All are net of selling costs and the wool and sale values were calculated per head for each age group of the ewes and wethers separately, as well as a combined whole of flock VOP per ewe equivalent.

The whole flock VOP includes income from:

- The annual wool clip
- the sale of cast-for-age ewes at the end of the trial period
- the sale of surplus young ewes and the wether progeny based on the sale age strategy.

The estimation of value of production per head has been carried out for all age groups of ewes and wethers that were measured, whereas the Flock VOP was calculated for a flock with the specified sale age strategy as discussed in the Appendix.

The Value of Production (VOP) for the entire flock is calculated "per ewe equivalent grazing pressure during the feed limiting period of the year". This metric factors in the influence of weaning rates, annual mortality, and the production value per individual for both ewes and wethers. While this metric was chosen as the primary indicator of production value, it is important to note that it is not directly related to the overall profitability of the entire flock. To

address this limitation, subsequent analyses, such as the calculation of gross margin per hectare and profit per hectare, will be undertaken.

Grazing pressure was expressed per 'ewe equivalent' rather than DSE because using DSE would imply that adjustments were made to reflect energy requirements (LW differences between teams, LW gain for different animal classes and demands for pregnancy and lactation) which has not been done. The follower classes of animals were assumed to be 0.67 ewe equivalents and breeding age ewes were 1 ewe equivalent regardless of the number of lambs raised.

Mortality and weaning rate were included in the Flock VOP to represent a self-replacing flock selling surplus young ewes after the hogget shearing at approximately 18 months and selling all wethers after the post-weaning shearing at approximately 10 months. The estimates of mortality excluded the deaths that occurred from 'misadventure' or were deemed to be due to 'management failure'.

Notes on interpreting the VOP results:

- Value of production is based on measured production (with corrections only for ewe source, dam age and birth type rear type) and is not adjusted for heritability and genetic correlations between traits. As such, it is not a 'best' estimate of the profitability if a sire was used over another flock of ewes.
- The estimate of value of production reflects the management as implemented in the trial for time of lambing and time of shearing and reflect differences between teams in mortality, wool value, reproduction and sale value of progeny and old ewes.
- The results include VOP for each age group of ewes, however, this is not a good picture of the change in VOP by age because the trial design doesn't allow separation of the age effects and variation due to seasonal conditions between years at the site because there were only 2 age groups and limited between year link sires.
- The differences in management and nutrition across sites and year drop mean the results are not comparable for sire teams across years within a site or across sites and this explains why the link sires have a separate VOP for each site and year drop in which they are represented.
- VOP only focuses on income and does not take into account the cost of production (husbandry, supplementary feeding, contract and labour) to obtain that income.
- Value of production is expressed per head and does not account for the feed requirement of the animals. For example, ewes that wean more lambs require more energy and are therefore likely to be run at a reduced number per hectare which will trade-off with the higher value of production per ewe received from the extra sale animals.
- The VOP as calculated represents the productivity of the sire team in the project environment with the grazing intensity as carried out at the site and selling surplus young ewes as hoggets and wethers after the post weaning shearing. This may not be the nutritional and management conditions that best suit all the teams.

#### 7.4.2.2. *Gross margin*

The GM was calculated for a flock with a specified age structure accounting for the differences in production between teams based on within site, across year flock breeding values (FBVs). Differences in carrying capacity for each team was based on estimating the DSE/hd for the teams from metabolic weight and reproductive outcomes. The flock GM includes income from:

- The annual wool clip
- the sale of cast-for-age ewes at the end of the trial period
- the sale of surplus young ewes and the wether progeny based on the sale age strategy.

And variable costs associated with:

- Husbandry and contract costs
- Supplement fed
- Infrastructure costs
- Labour

The flock represented was a self-replacing flock with the numbers of each age group at equilibrium. The number of sheep sold was balanced by the number of animals born and the mortality of animals in each age group.

Notes on interpreting the GM results:

- A GM is the income earned from a flock minus the variable costs. It is a valid method to compare profitability across flocks if the fixed costs do not change between teams. A challenge in ensuring this when comparing teams is to correctly calculate stocking rate and therefore correctly equating the fixed costs of the pasture resource. The assumptions about DSE/head are therefore very important.
- The GM estimate is reflecting the management as implemented in the trial for time of lambing and time of shearing. The management has not been adjusted to suit each individual team.

#### 7.4.2.3. Profit analysis

The analysis was carried out with the deterministic steady-state equilibrium mode of the Australian Farm Optimisation model (AFO) (Young *et al.* 2023, 2024). AFO is a major upgrade on the MIDAS model which has previously been used to calculate the profitability of teams in sire evaluations and wether trials (Windsor and Young 1999, Clarke *et al.* 2019). The model calculates the profitability of the whole flock based on the productivity of each class of stock (including clean fleece weight, fibre diameter, staple strength, staple length, liveweight, weaning rate and mortality), commodity prices and the farm carrying capacity calculated in the detailed feed budget. The model is briefly described below, and a more detailed description is included in the appendix.

As an optimising model it calculates for each genotype the optimal management for stocking rate, nutrition profile, pasture grazing intensity and rate of grain feeding that will maximise profitability and optimise productivity of the animals in the flock. The model accounts for changes in age structure linked to weaning rate and mortality, and the change in ewe energy requirements that result from increasing lamb survival or altering the number of ewes pregnant or lactating with singles or twins. Furthermore, the model optimises sale age strategy and time of sale within year, accounting for feed requirements, growth potential and carcase specifications. Therefore, it is possible to evaluate each genotype when optimally managed for that genotype, rather than as managed in the genetic evaluation. However, in order to predict production levels with different management the calibration of each genotype is more complex.

Three existing regional versions of the AFO model were used, each representing a typical farm in regions with different length growing seasons. On each farm the flock was a self-replacing Merino flock, mating Merino ewes to Merino rams. Management was on an annual

cycle of lambing and shearing and the timing varied with region but was fixed for the genotypes in that region. The regions were selected to represent diversity in the feed supply through the year. There was variation in the length of the growing season and the proportion of the farm allocated to cropping, which affects the availability of stubbles during the summer/autumn period. The models have been calibrated using local knowledge to represent current farm-management technology, including pasture species, machinery complements and inputs used. Tasks contracted and crop and livestock options considered are all consistent with those used by farmers in the modelled region. The husbandry program was based on regional best practice management and there was minimal production penalty associated with disease.

*The south-western region of Victoria (SWV).* This model represents a ‘typical’ farm in the Hamilton region in south-west Victoria (Young *et al.* 2010). The total area of the farm was 1000 ha and comprised of three land management units. There was no crop on the farm and the standard pasture grown on all land management units was a highly productive perennial ryegrass pasture with high fertiliser rates and best grazing management practices. The average annual rainfall was 686mm, the average break of season occurred in the first week of April and the growing season length was 9 months. The flock lambed in August, and the annual shearing was in January.

*The Great Southern region of Western Australia (GSW).* The Great Southern region in Western Australia is characterised by winter-dominant rainfall that supports a mix of cropping and livestock enterprises. The location modelled was 500–550 mm rainfall with a 6-month growing season. The model represented a typical 2130 ha farm that includes three LMUs with varying productivity and optimal land use (Young *et al.* 2024). There was 50% of the farm in crop and 50% was pasture. The flock lambed in July, and the annual shearing was in January.

*The cereal sheep zone of Western Australia (CSZ).* The region selected for the cereal sheep zone was the eastern wheatbelt of WA. The eastern wheatbelt is a winter rainfall region with an annual rainfall of approximately 300mm with the majority occurring from May to October. The farm system was cropping dominant farming system with 80% of the farm in crop and 20% as pasture, therefore there was an abundance of crop stubbles available for grazing in summer and autumn. The model represented a 6093ha farm that included seven LMUs with varying productivity and optimal land use (Young 2024). The flock lambed in May, and the annual shearing was in November.

*Flock management.* Ewes entered the breeding flock at mating at 19 months of age and remained in the flock for 4 or 5 breeding opportunities, whichever was most profitable for the genotype. Young ewes that were surplus to requirements for replacing the flock were sold after the hogget shearing prior to entering the breeding flock. Wethers were sold between weaning and up to 3.5 years of age at any of 6 time points per year, the selection was based on maximising profit for the genotype. The average and range of the optimal sale times for the teams is in Table 2. They were shorn annually at the main shearing and shorn again prior to sale if fleece weight was sufficient.

*Table 2: The average and range of the sale age of wethers and CFA ewes, and the proportion of sheep enterprise income from wool, for the optimised management of each sire team.*

	Average	Range
Proportion of CFA ewes sold at 5.5yo (%)	99	90 to 100
Sale age of wethers (months)	8.1	5.5 to 11.5
Percentage of income from wool (%)	42	34 to 50

*Feed budget.* For this analysis the assumptions of the Australian Feeding Standards (Freer *et al.* 2012) were used in the AFO livestock generator to generate the energy requirement and production parameters for the mathematical programming model. The important assumptions include:

- intake is a function of SRW, the age of the animal relative to maturity and the fatness of the animal.
- the energy requirement for maintenance is related to metabolic liveweight ( $LW^{0.75}$ ) and age, and as such the variation between the teams in maintenance requirement is only due to liveweight and there is no variation in the efficiency of tissue gain per MJ of energy stored.
- Partitioning and body composition is calculated from the current LW relative to mature LW and varies very little with level of intake and partitioning of energy retained is controlled by the relative size of the animal, hence there is very little variation between the teams. The effect of partitioning on energy requirements and the financial implications is examined in the GEPEP MLP add-on project.

#### 7.4.3. Calculations

Wool income per head was estimated from average clean fleece weight and the value per kg estimated from the team average fibre diameter, staple strength and staple length.

Sale animal value for each team was calculated as the average of the individual animal sale values calculated from the dressed weight of the animal and a value per kilogram. The value per kilogram was estimated from the price per kg for animals with premium specifications and was then scaled using a grid of dressed weight and fat score. CFA Ewes and older wethers were valued on the basis of being sold into the mutton market. Young ewes that are surplus to the number required to replace the flock are valued as being sold into the young ewe breeding market. The value of animals younger than 15 months of age was based on being sold as prime lamb if heavier than 18kg dressed weight, air-freight lamb if between 16 and 18kg or store lamb if lighter than 16kg at the time of sale.

### 7.5. Contribution of genetic differences to financial performance

#### 7.5.1. Background and Methods

A major outcome of the economic analysis is the estimate of the financial outcome from varying genotype as represented by the broad cross section of sires included in the MLP project. It is likely that the sire selection was biased toward better sires because although some sires were selected to represent ranges in traits of interest rather than be good overall sires, most of the sires were self-nominated by the studs. Nearly all sires with data had had semen collected by the breeder prior to being used in the project. The Classer Advisory Group selected some sires performing well in the show ring or were currently being widely used by industry. Although the selection may be biased, the range in financial performance of these sires is indicative of the ram selection choice faced by commercial producers and the associated differences in financial performance. There is no other known dataset that is a better comparison of sires from different breeding philosophies and breeding objectives.

There was a wide range in the estimated financial performance of the sires tested for each of the analysis methodologies, either when examined as the range between the top and bottom sires or the interquartile range between the 75<sup>th</sup> and 25<sup>th</sup> percentiles.

### 7.5.2. Variation in financial performance

The range in financial performance, when the interquartile range is expressed as a proportion of mean financial performance, was similar for each of the financial methodologies and averaged 7.5% (Table 3). The range in the extreme sires averaged 28% of annual profit. The range within the sire teams did not vary systematically with price scenario. However, region had an effect with the range being lower for the cereal-sheep zone with a higher proportion of farm in crop and lower stocking rates. Although when the range was expressed in \$/DSE the values for the cereal-sheep zone were similar to the other regions examined. So, the importance to the stock enterprise is similar, just the livestock enterprise is less important to whole farm profit and therefore there may be less motivation to optimise genetic decisions in the cereal-sheep zone.

The wide range in financial outcome for the livestock enterprise associated with varying flock genetics demonstrates the potential importance of genetic selection decisions for commercial producers. For a typical producer in the medium and high rainfall zones with 2000 ewes the difference between the 75<sup>th</sup> and 25<sup>th</sup> percentile sire would alter farm profit by \$10 000 annually and this increases to \$40 000 annually when comparing the highest and lowest performing sires.

Table 3: Average and the range of the financial outcomes from the VOP analysis (\$/ewe equivalent), the gross margins analysis (\$/DSE) and the profit analysis (\$/pasture hectare).

	Price Scenario	Mean	Percentile		Interquartile range (% of mean)
			75 <sup>th</sup>	25 <sup>th</sup>	
<b>Value of Production (\$/EE)</b>					
Ave. across sites and drops	5 yr	169	176	163	7.8%
	10 yr	138	143	133	7.4%
	20 yr	107	111	104	6.7%
<b>Gross margin (\$/DSE)</b>					
Ave. across MLP sites	5 yr	70	73	67	8.8%
	10 yr	51	52	49	7.3%
	20 yr	32	34	31	9.7%
<b>Profit (\$/Pasture ha)</b>					
Great Southern WA	5 yr	679	708	651	8.4%
	10 yr	432	451	418	7.7%
	20 yr	162	177	150	16.3%
South-west Victoria	5 yr	682	714	648	9.8%
	10 yr	427	441	414	6.4%
	20 yr	230	239	222	7.2%
Cereal sheep zone WA	5 yr	233	238	229	3.6%
	10 yr	198	200	196	1.9%
	20 yr	172	174	171	1.5%

### 7.5.3. Breakeven Value of Rams

The wide range in financial outcome across the sires indicates that ram selection is an important contributor to farm financial outcome. To put the financial outcome in the context of the ram purchase decision, the difference calculated in the profit analyses were converted to differences in profit per ram purchased. The difference in profit per ram is equivalent to the extra amount that could be paid for the higher profit sire. This price adjustment for each sire relative to the average has been added to the average auction price of \$2500/ram to calculate the breakeven purchase price for each sire, assuming that the average MLP has similar productivity to the average ram at auction. The average and range are tabulated in

Table 4 and the distribution is shown in Figure 1. In summary, the breakeven value of each sire is the price that could be paid by a commercial producer to achieve the same farm profit.

The range between sires in the breakeven ram price varies by price scenario. For the 10-year price scenario the range between the top and bottom 25 percentile (interquartile range) was \$705 per ram ranging from \$2180 up to \$2885. The range between the extreme sires with the 10-year price scenario was \$3,100 which increased to \$5,800 for the 5-year scenario (Figure 1). The interquartile range was \$1340/ram with the scenario of 5-yr median prices and \$555/ram for the 20yr-median prices.

This range in breakeven price puts the difference in progeny productivity into context of a commercial producer’s willingness to pay and shows that the genetic variation measured in MLP was associated with a wide range of ram prices and high production rams are much more valuable than low production rams.

Table 4: Breakeven ram price and the 75<sup>th</sup> and 25<sup>th</sup> percentiles.

Scenario	75 <sup>th</sup> percentile	Average	25 <sup>th</sup> percentile	Interquartile Range
5-year prices	\$3135	\$2500	\$1795	\$1340
10-year prices	\$2885	\$2500	\$2180	\$705
20-year prices	\$2805	\$2500	\$2250	\$555

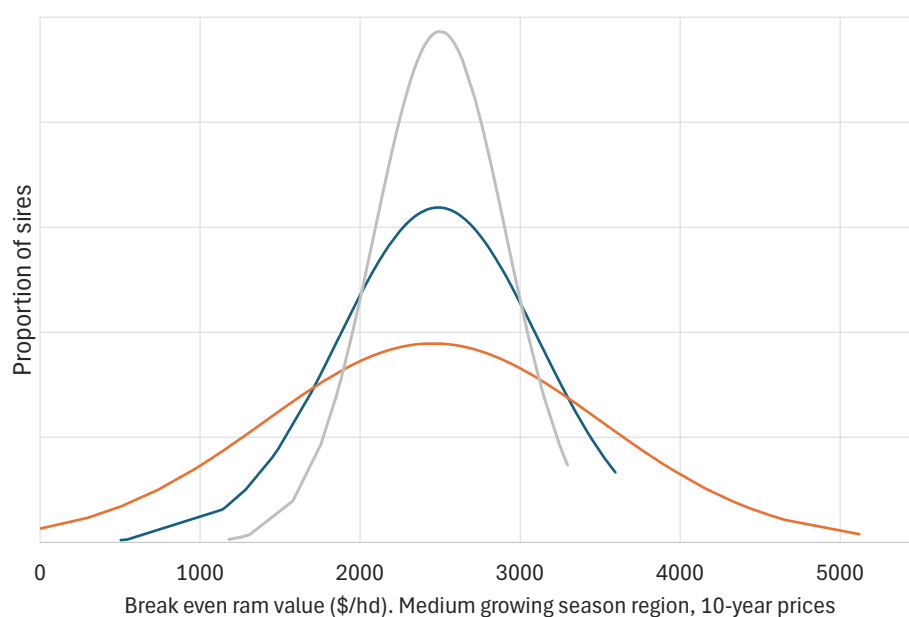


Figure 1: The distribution of break-even ram price across the 134 sires for the 3 price scenarios, 10-year median (blue), 5-year median (orange) and 20-year median (grey). Normal distribution fitted using mean and standard deviation and graphed using actual range of BE values.

#### 7.5.4. Conclusions

Ram choice is an important financial decision and for a property with sheep grazing country running 2,000 breeding ewes, selecting the highest profit sire versus the lowest profit sire would increase annual farm profit by \$40,000. This range in profit corresponds to a range in the breakeven price of the extreme sires of \$3,100/head or \$700/head between the 75<sup>th</sup> and 25<sup>th</sup> percentile sires.

Although genetic selection is an important financial decision, our analysis of profitability is still incomplete due to challenges in valuing some traits and particularly traits that affect

producers' choice about stocking density. The effect of analysis methodology is examined in the next section and shows that different techniques vary in their valuation of different rams.

## 7.6. Comparison of analysis methodology

### 7.6.1. Background

The results presented in the previous section using three different analysis methods showed that the profitability of flocks varied widely across genotypes. This is consistent with other economic analysis of genetic comparisons (Windsor and Young 1999, Clarke *et al.* 2019, Wallace *et al.* 2021), however, what is not understood is whether all economic analysis techniques rank sires similarly. Despite the importance of genetic selection, a comparison of economic analysis techniques has not previously been carried out. This section reports on the correlation between the 3 analysis techniques and shows that value of production, gross margin and profit analysis using a whole farm model have only low to moderate correlation.

The methods used for each analysis have been described in a previous section and more detail is included in the Appendix. Following is a discussion of the points of differences between the 3 analyses. Differences in the level of data used (adjusted sire means, within site flock breeding values and within project flock breeding values) is confounded with analysis technique (VOP, GM and profit), because as described earlier, data and representation of the feed budget and on-farm management were changed concurrently.

### 7.6.2. Results

#### 7.6.2.1. Value of Production analysis versus Gross Margin analysis

The factors contributing to the divergence between VOP and GM include:

- The feed budget in the VOP analysis was calculated per ewe equivalent, this approach accounted for differences in the feed requirement of mated ewes and dry stock, however, there was no differentiation associated with animal liveweight, reproduction rate or weaning rate. In contrast, the GM analysis represented the feed budget using DSE/hd for each class of stock. The base DSE/hd varied with the reproduction rate of the ewes with dry ewes having a DSE of 1.0, single bearing ewes 1.4 and twin bearing ewes 1.8 DSE/ewe. Dry stock on the farm during the feed limiting period were assigned a base DSE of 1 DSE/hd. Therefore, flocks with higher reproduction had a higher DSE/ewe than lower reproduction flocks. The base DSE/hd were then scaled by the mature weight of the genotype raised to the power 0.75 (metabolic weight). Therefore, the teams with heavier sheep had a higher DSE/hd than lighter teams.
- The extra information accounted for in the flock breeding value compared with the adjusted sire means includes
  - Allowance for heritability of traits
  - Utilising information on other traits and the correlations with those traits
  - Accounting for genetic grouping
- The VOP analysis, using adjusted sire means, represented the variation in wool production with age of adult ewes. This was not differentiated in the gross margin which used a single breeding value for adult CFW and adult FD that was calculated from all age groups of ewes measured in the flocks. The younger age groups (P and W) were differentiated in both analyses.
- The costs of production were included in the gross margin

- The age structure of the flock (as determined by weaning rate and survival) and the turn-off weights and ages were the same for both VOP and GM.

The correlations between the financial performance estimated by value of production and by gross margin analysis were low to moderate with an average  $r^2$  of 0.31 (Figure 2 to Figure 6), this indicates that only 31% of the variation in GM is explained by variation in value of production. Therefore, the improvement in the representation of the feed budget and the change from adjusted sire means to flock breeding values leads to significant reranking of sires. Suggesting that analysis outcome varies with technique used and therefore selection of analysis technique is important.

There was not an obvious pattern of higher or lower correlation across sites. At the New England site both years had a moderate correlation, at Pingelly, MerinoLink and Macquarie both years had a low correlation, whereas at Balmoral one year was low and the other moderate.

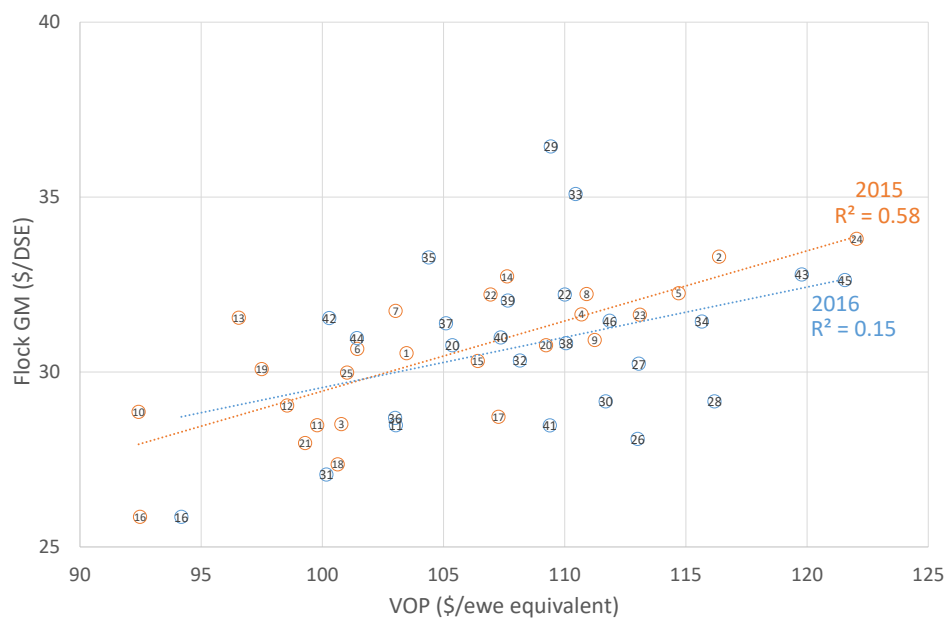


Figure 2: The correlation between the Flock VOP (\$ / ewe equivalent) and the Flock GM (\$/DSE) for each drop at Balmoral.

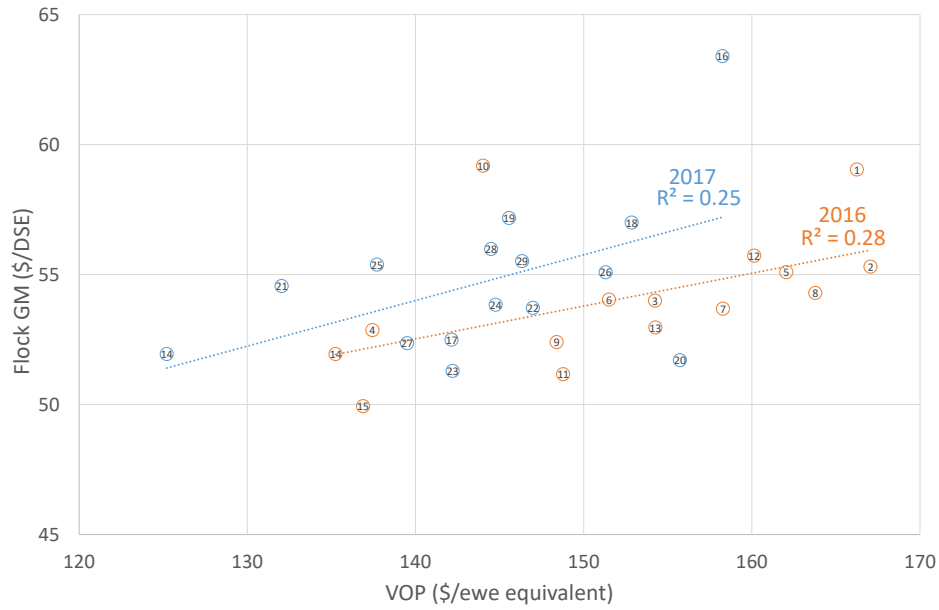


Figure 3: The correlation between the Flock VOP (\$ / ewe equivalent) and the Flock GM (\$/DSE) for each drop at Pingelly.

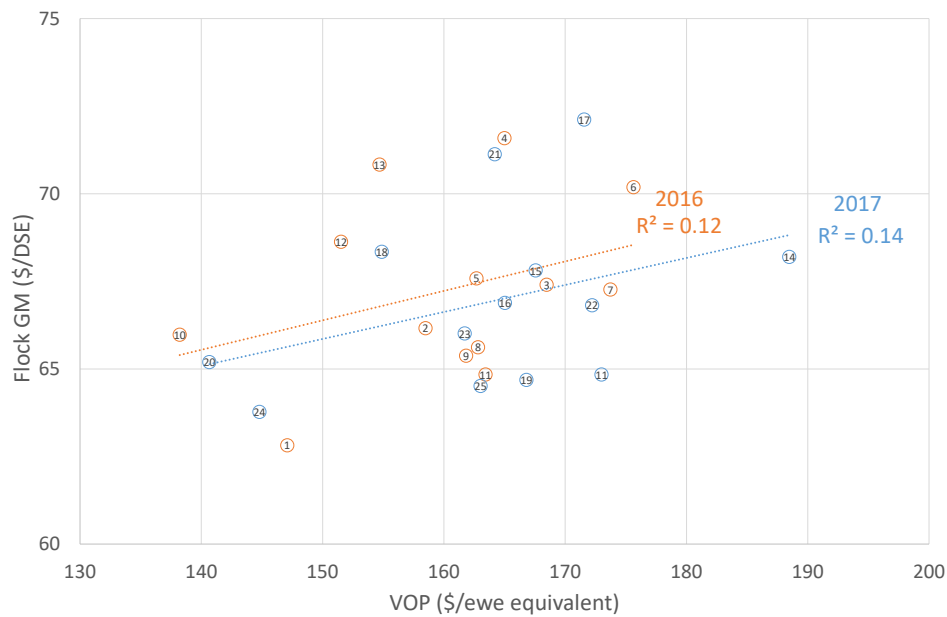


Figure 4: The correlation between the Flock VOP (\$ / ewe equivalent) and the Flock GM (\$/DSE) for each drop at MerinoLink.

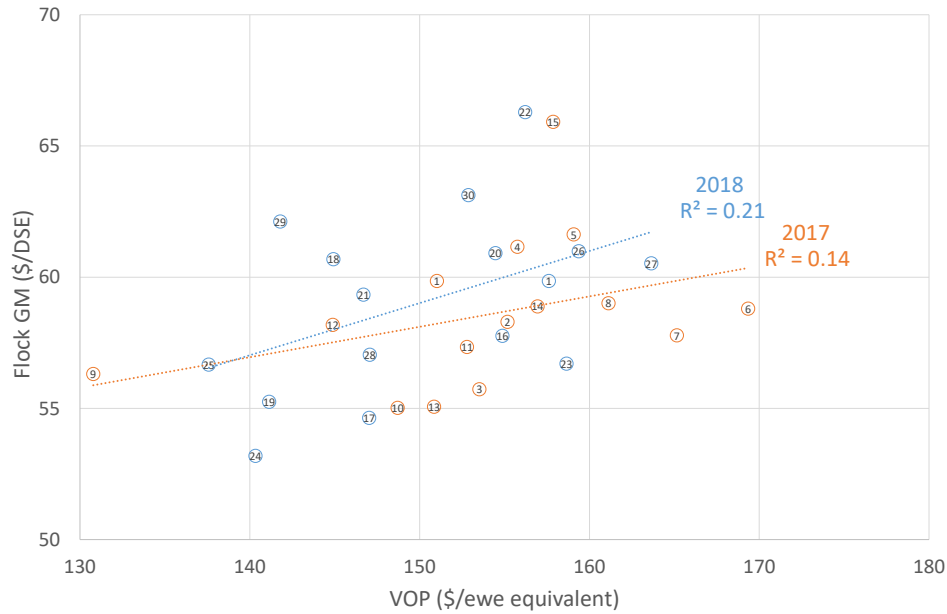


Figure 5: The correlation between the Flock VOP (\$ / ewe equivalent) and the Flock GM (\$/DSE) for each drop at Macquarie.

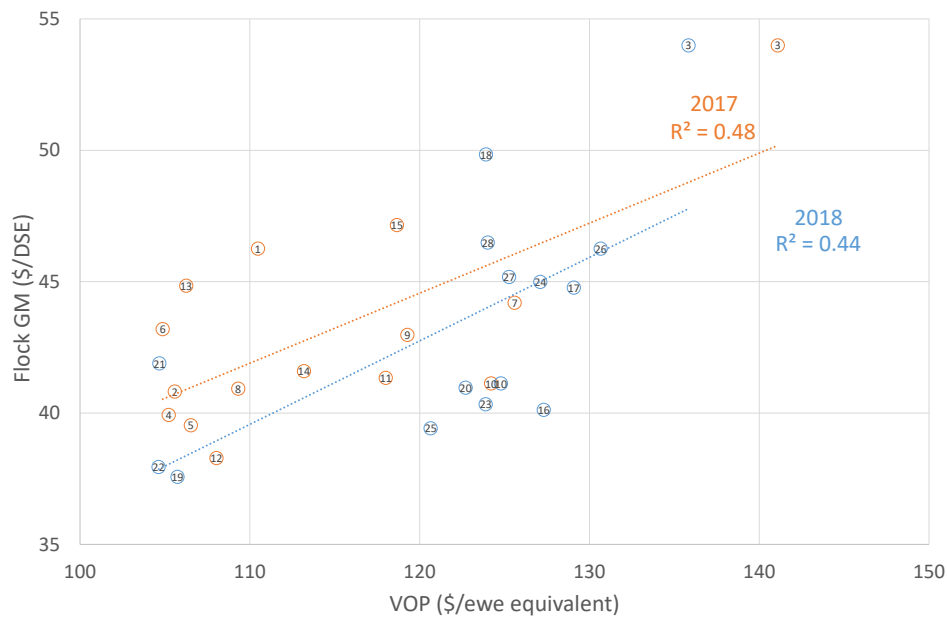


Figure 6: The correlation between the Flock VOP (\$ / ewe equivalent) and the Flock GM (\$/DSE) for each drop at New England.

### 7.6.2.2. Gross margin versus profit analysis

The financial performance of each team assessed using the GM analysis and the profit analysis can only be compared site by site (Figure 7). The profit analysis evaluated all 134 sires in a single analysis and the profit result is independent of the site the sire was evaluated. The between site ink sires allow comparisons and the mean and spread of profit (Figure 7 y axis) is similar for each site, indicating that the range of sires selected for each site was consistent across site. The GM analysis however, was calculated with site specific information and the mean GM at each site differs and reflects differences in average productivity across sites. Productivity was highest at MerinoLink and lowest at Balmoral.

It is worth noting that the between site differences were not rigorously represented because the comparison of the sires is only within site.

There are several differences between the gross margins analysis and the profit analysis.

- The most important difference between the approaches is in the representation of the feed budget and the estimation of the number of animals of each genotype that will be carried. The gross margin estimates the number of animals that can be carried based on estimated energy requirement (DSE/hd) during the feed limiting period of the year. The energy requirement of the flock is assumed to be proportional to the metabolic weight of the mature animals. The basis of this assumption is that maintenance requirement is proportional to metabolic weight.

The modelling feed budget differs in some key areas

- The feed budget is calculated for 10 periods of the year rather than a single period. The feed budget is calculated using MJ of ME and includes calculating the energy required for maintenance, it also includes the energy required for growth, pregnancy and lactation, and the reduction in energy requirements of animals that are losing weight. The modelling can therefore represent the differences between teams that have different patterns of energy requirement during the year and the implications of this on the number of stock that can be carried or the amount of supplementary feeding required.
  - The modelling analysis includes the capacity to adjust nutrition during the year to either reduce energy requirement during the feed deficit or increase intake during feed surplus. These changes in nutrition are linked to changes in animal growth rates and production. This allows the modelling analysis to identify differences in the optimal nutritional management between the teams.
  - In the gross margin analysis, the supply of feed (DSE/ha) during the feed limiting period is fixed and cannot be adjusted for each team. However, in the modelling analysis, although the production potential of the feedbase is fixed, the grazing management can be varied for each team to optimise the grazing strategy for each team. This can include adjusting the timing and severity of grazing pasture and adjusting the amount and timing of supplementary feed. As such, the modelling analysis is more detailed and the calibration of the variation due to genetic differences is more detailed because it requires calculating the effect of altering nutrition on productivity and the differences due to genotype.
- Differences in production between genotypes are linked differently to differences in energy requirements.
    - In the gross margins analysis, the energy requirement for pregnancy and lactation are represented by increasing the DSE/hd for single and twin bearing ewes. Whereas in the modelling analysis the change in energy requirement is based on calculations from the Australian Feeding Standards and varies with ewe size, growth potential and intake.
    - In the gross margins analysis, there is no account taken of the energy required to produce wool, whereas in the modelling the energy requirement is based on the Australian Feeding Standards. Increasing wool production potential increases profitability, however, the magnitude of the increase is reduced if the energy requirement of wool production is included.
  - The gross margin and the profit analysis, use different breeding values. The gross margins analysis was carried out at the site level and used within site breeding values, and this is one reason that the GM values cannot be compared across sites.

The profit analysis used within project-across sites breeding values and therefore the profit outcomes can be compared for all the sires evaluated in MLP.

- For both the GM and profit analysis the fleece production of single bearing ewes was calibrated using the respective fleece FBVs. However, there were differences in the calculation of the penalty in wool production of single-, twin- and triplet-bearing ewes. The gross margin analysis assumed a fixed reduction which was constant for all teams, whereas in the profit analysis it is estimated based on competition for energy with fetal growth and lactation. Therefore, in the profit analysis the penalty in wool production due to reproduction varies with lamb birth weight and weaning weight (which are estimated from standard reference weight) as the drivers of ewe energy requirements for fetal growth and milk production.
- The number of traits included in the analysis. It is more onerous to calibrate the variation in production between genotypes for the modelling than for the gross margin. Therefore, fewer traits were evaluated in the modelling analysis. In the comparison carried out in this report there were more age stages included in the weight traits in the GM analysis than in the modelling analysis. The gross margin analysis included changing the sale value of wethers at the post weaning age stage based on the PWT BV. Whereas in the modelling analysis the weight of the young animals is only affected by the AWT BV and the effect that this has on the lifetime growth curve. The shortcoming in the GM analysis of including the PWT BV is that the variation in the energy required by young animals that grow faster or slower is not included, which will overvalue the contribution of the trait.
- The modelling analysis calculates profitability which includes the fixed costs of the farm. These fixed costs include the cost of family labour and permanent employees, the cost of infrastructure, interest on core debt and an interest cost for all assets. In the context of a genetic analysis these would be important if the genotype affects the amount of labour required or is altering the requirement for infrastructure. Both may occur if genotype change is linked to altering the number of animals carried. These fixed costs effects are not included in the gross margin analysis even though stock numbers can change because DSE/hd changes.

The correlation between the profit per hectare and the gross margins was low to moderate and varied between sites (Figure 7). The lowest correlation was an  $r^2$  of 0.15 at the Pingelly site up to 0.57 at the New England site, with the average  $r^2$  being 0.33. The low to moderate correlations confirm the conclusion in the previous section comparing VOP and GM, that when evaluating genotypes the selection of analysis techniques is important. This is a novel finding and is the first study to compare different analysis techniques. Further examination of the drivers of the change linked to the factors represented in the modelling analysis is below.

A further important implication of this finding about the effect of the analysis technique is associated with the calculation of economic values for breeding objectives. Choice of method to represent the on-farm management changes, the feed budget and the energy requirements for different traits will be important for some of the traits.

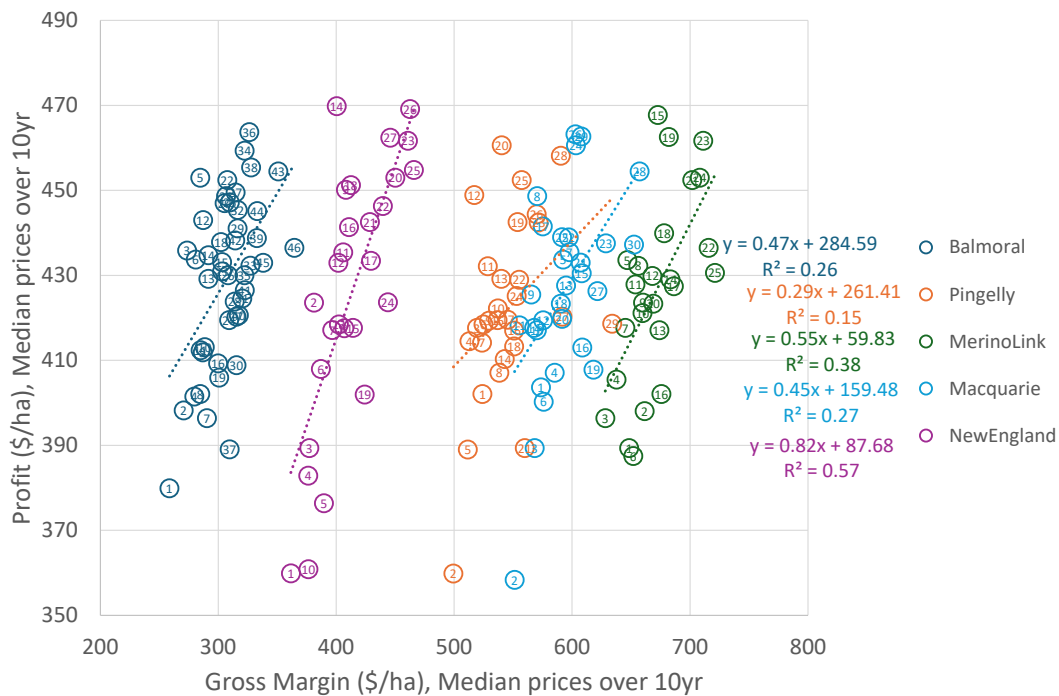


Figure 7: Comparison of the gross margin estimated for each team (\$/ha) and the profit (\$/ha) with 10-year median prices. Note: The GM analysis was calculated using within site breeding values and different base production, therefore the comparisons must be done within site (Balmoral, Pingelly, MerinoLink, Macquarie and New England)

### 7.6.2.3. Age structure

One of the differences between the profit and gross margin analyses was in the representation of the age structure of the flock. In the gross margins analysis, the same age structure was tested for all the teams at a site. Whereas in the profit per hectare analysis the age structure, as controlled by sale age of the wethers and the sale age of the cast-for-age ewes, was adjusted for each team to maximise the profit of the team.

The importance of adjusting age structure for each team was tested by constraining the whole farm profit model to a single sale age for the wethers and selling the CFA ewes at 5.5 years old, and compared that to selecting the best of 6 sale options per year (up to 3.5yo) for the wethers and selling at either 5.5yo or 6.5yo for the ewes.

Customising the sale age strategy for each team increased profit for all the teams and the increase varied from \$4 up to \$40/ha (Figure 8). The correlation between the 2 estimates had an  $r^2$  of 0.84, indicating that it is not the main controlling factor for the low to moderate correlation between the gross margin assessment and the profit assessment. Although, even with a very high correlation there were teams that varied in ranking of up to 50 places. For example, team 80 improved from 53<sup>rd</sup> to 7<sup>th</sup>, team 35 improved from 80<sup>th</sup> to 25<sup>th</sup>, team 117 dropped from 19<sup>th</sup> to 69<sup>th</sup> and team 132 dropped from 10<sup>th</sup> to 59<sup>th</sup>.

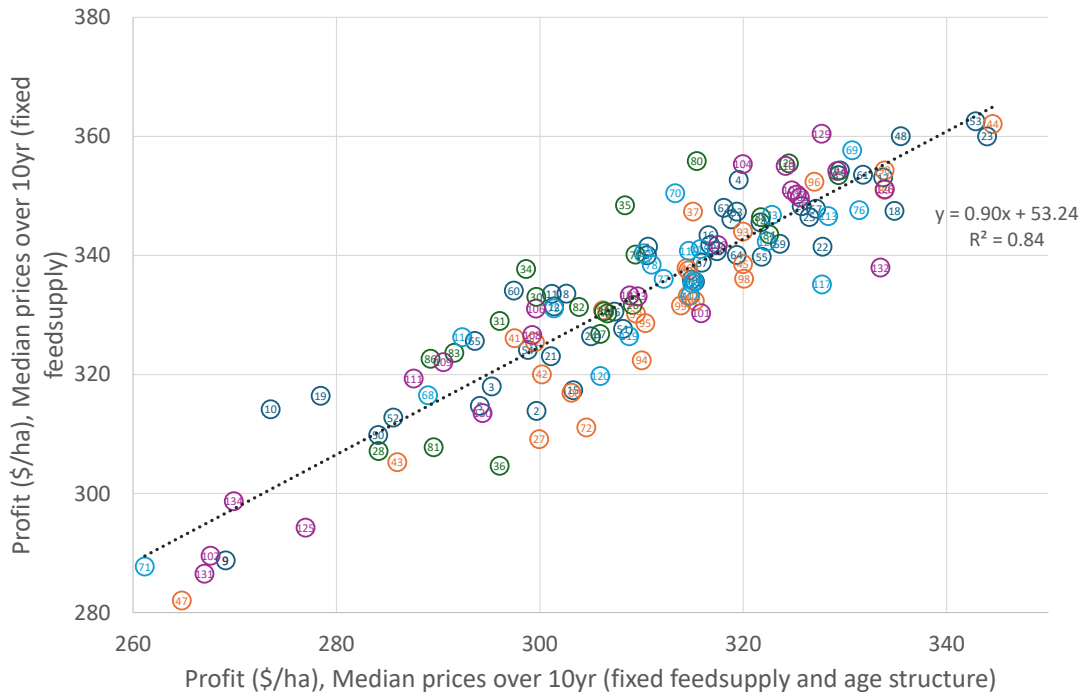


Figure 8: Impact of optimising the age structure of the flock on the profitability of teams evaluated with a fixed time of sale versus sale age optimised for the team

#### 7.6.2.4. The feed budget

The other major difference between the approaches was the representation of the feed budget. The modelling approach allows the feed level for each team to be adjusted to improve the allocation of feed during the year to match the production potential of the team. This was represented in the modelling by individually optimising the stocking rate and the feed profile during the year for each team to achieve turn-off specifications, rather than only evaluating the feed profile as offered in the trial.

Optimising the nutrition for each team increased the profit by between \$56 and \$118/ha for the teams (Figure 9). The correlation between the 2 estimates had an  $r^2$  of 0.83, which is also very high. However, there was still reranking of the teams associated with the difference in profit improvement of up to \$60/ha. For example, team 51 improved from rank 93<sup>rd</sup> up to 37<sup>th</sup>, team 87 improved from 102<sup>nd</sup> to 53<sup>rd</sup> and Team 127 improved from 29<sup>th</sup> to 2<sup>nd</sup>. Team 18 dropped from 23<sup>rd</sup> to 61<sup>st</sup>.

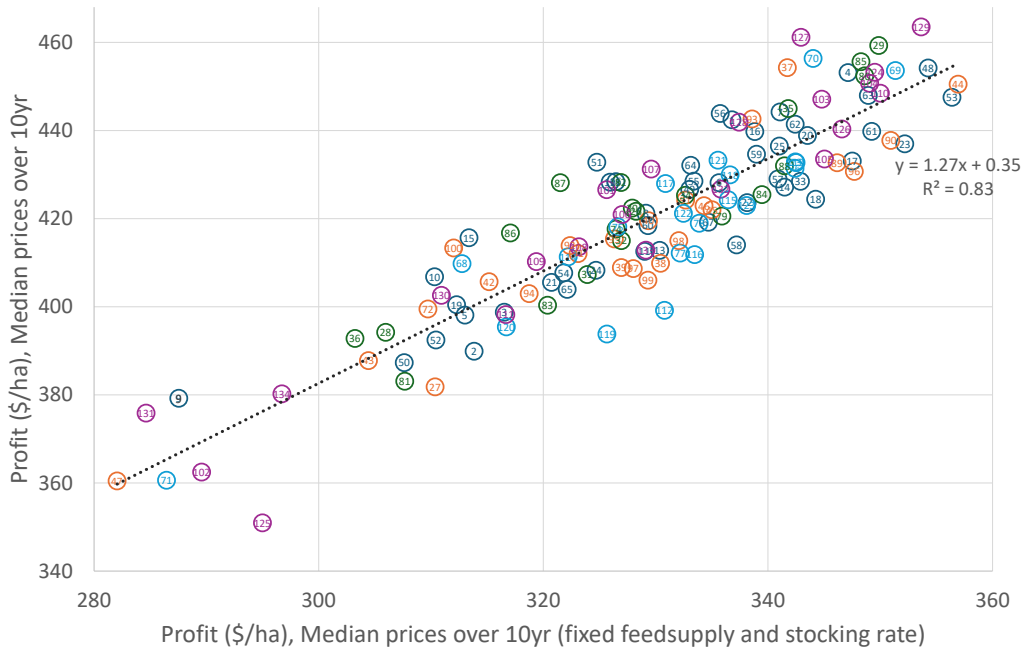


Figure 9: The effect of improving the feed budget on the estimates of the profitability of the teams.

#### 7.6.2.5. Combined age structure and feed budget

Each change individually shows a very high correlation with and without the extra detail included. However, the combined effect of the customised age structure and improved feed budget reduced the  $r^2$  of the simpler and more detailed representation to 0.64 (Figure 10). The increase in profit assessed between the 2 methods was between \$75 and \$147/ha and the variation between teams led to reranking. In the extreme, teams varied in rank by up to 60 places, for example team 70 improved rank from 65<sup>th</sup> to 4<sup>th</sup> and team 35 increased from 81<sup>st</sup> to 18<sup>th</sup>. Other teams dropped and the extreme was team 18 that dropped from 6<sup>th</sup> to 61<sup>st</sup>.

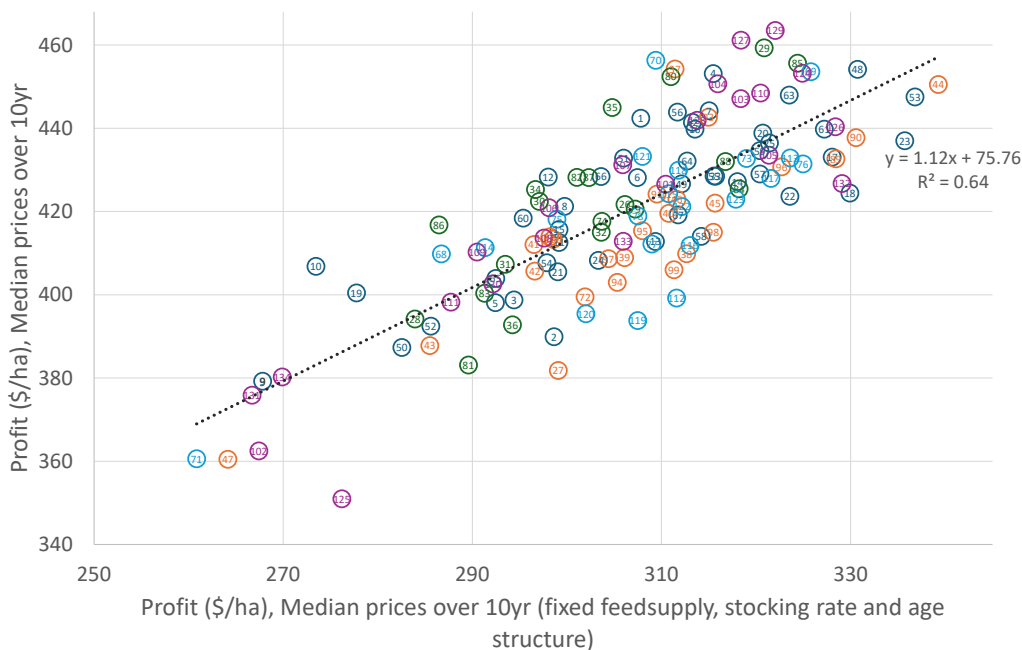


Figure 10: Comparison of the profit per hectare analysis including and excluding both the age structure and feed budget changes.

### 7.6.3. Sensitivity analysis

#### 7.6.3.1. Variation in feed supply profile (region)

Changing the region alters the feed supply for which the genotypes are assessed. South-west Victoria is a high rainfall zone with a long growing season and the cereal sheep zone was a low rainfall, short growing season environment with abundant stubble. The correlation between profit for the teams when assessed under different feed profiles was very high with an  $r^2$  of 0.87 and 0.86. The re-ranking of teams was less when assessed across seasons rather than when age structure or the feed budget were compared.

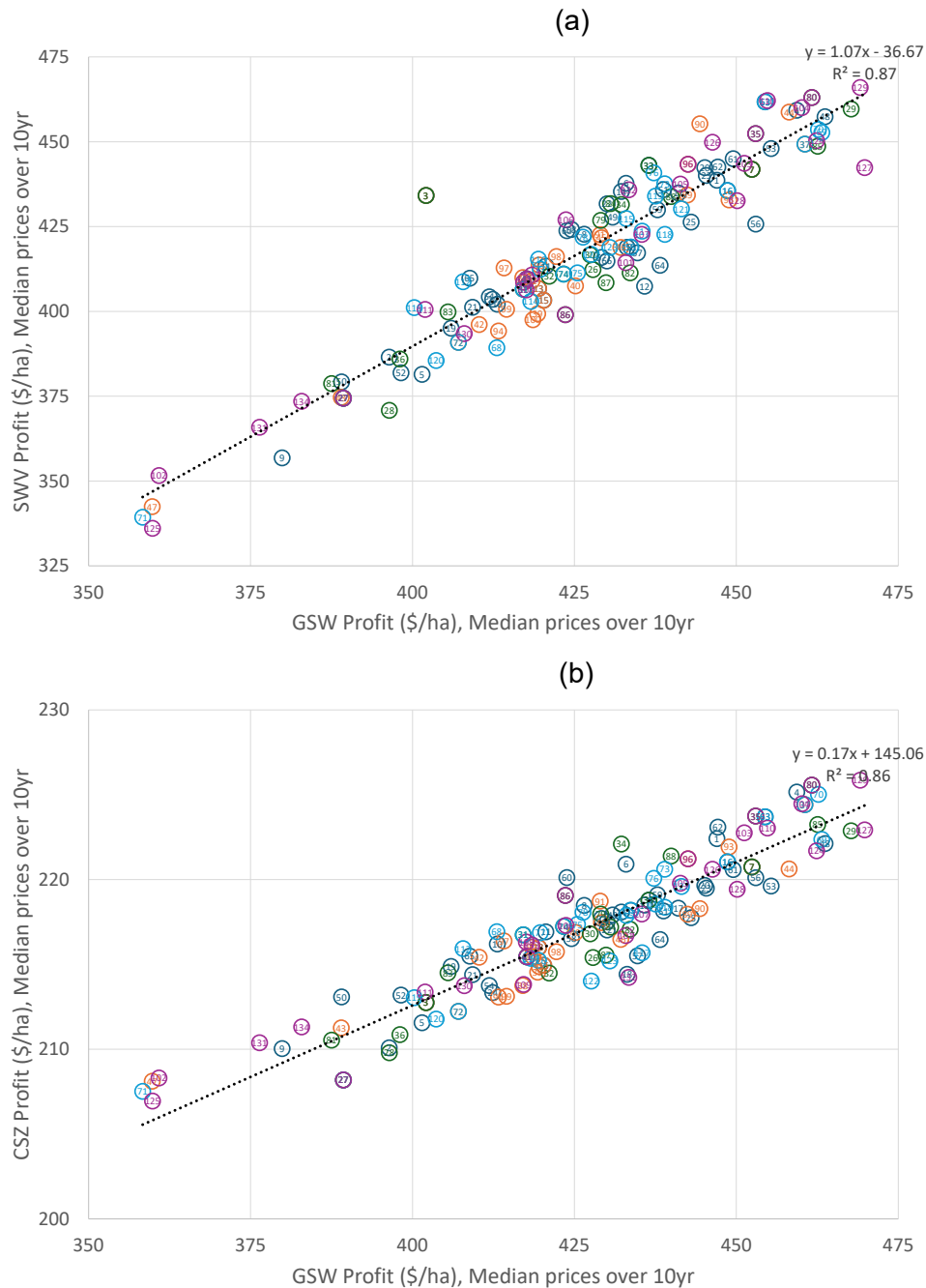


Figure 11: Effect of feed supply on the estimate of profitability. (a) comparing the profitability estimated in the GS region of WA with south-western Victoria, and (b) GS of WA compared with the cereal sheep zone of WA with 10-year median prices.

### 7.6.3.2. Impact of prices

Three price scenarios were compared based on the historical timeframe of the prices. The correlation between profit assessed using 10-year median prices and using 5-year and 20-year prices was 0.72 and 0.89.

The higher variation between teams using the 5yr prices was associated with the premium for fine wool. The finer teams performed relatively better in the 5-year scenario. Higher liveweight and higher fat teams also tended to perform better, but the effect was less than for fibre diameter.

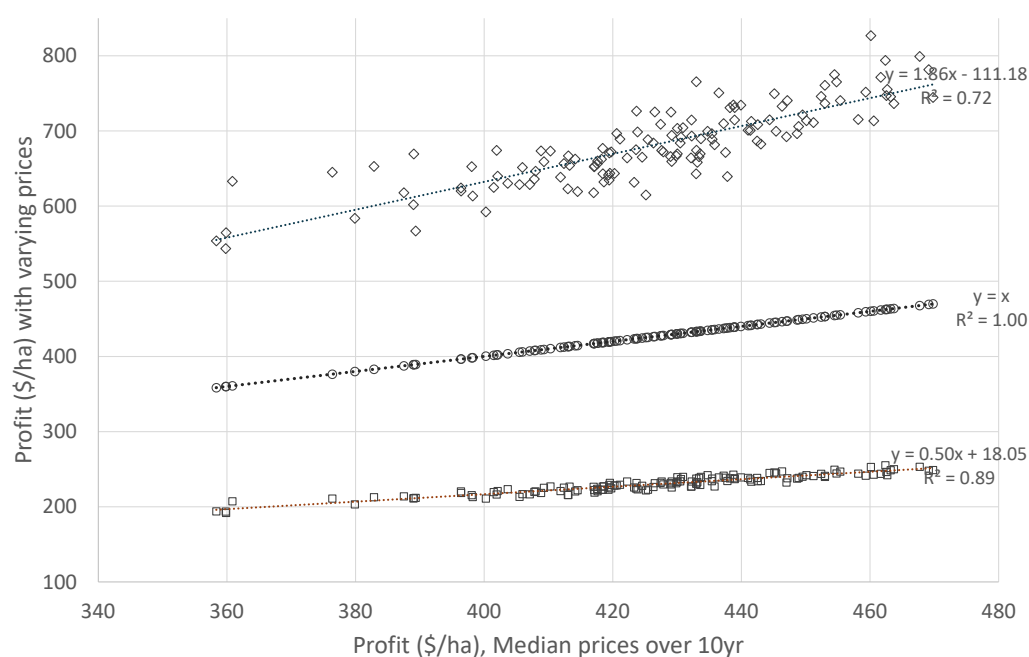


Figure 12: Correlation between profit per hectare calculated with 10-year median prices (○) with calculations using the 5-year median prices (◇) and 20-year median prices (□).

### 7.6.4. Conclusions

This analysis was carried out using 3 different levels of data and 3 different ways of representing the feed budget and on-farm management of the flock: The 3 levels of data were: (i) Adjusted sire means; (ii) Flock breeding values calculated within site-across years and (iii) Flock Breeding Values calculated within project-across site. The 3 representations of the feed budget and on-farm management were: (i) Value of Production using ewe equivalents, Gross margin using dry sheep equivalents and (iii) Farm profit using a detailed modelling approach with detailed feed budget and optimisation of age structure and nutrition. In this analysis the data used and the method of handling the feed budget were changed together, however, these 2 factors could be separated to improve the understanding of the importance of each.

The results from the detailed modelling showed that optimising age structure, turn-off age and the detailed representation of the feed budget all contributed to the variation observed. Therefore, it is concluded that using more detailed analysis techniques and the extra effort required is justified when evaluating genetic comparisons. However, the correlation of profit of the sires assessed in different regions and with different prices was high to very high indicating that detailed regional analysis is not a high priority.

The variation in the optimum management that was identified in the detailed modelling aligns with management decisions that would be made on farm. For example, lean genotypes would be held on-farm for longer to reach sale specs whereas better condition genotypes would be sold earlier. Whereas in the GM analysis the animals are sold at a fixed age, ready or not. The practical implications for producers who are reviewing genotype decisions is that they need to consider management adjustments to optimise different genotype in their environment to maximise the economic advantage of genotypes. Without these adjustments the financial analysis may not accurately reflect the financial outcome of different genotypes.

GrassGro as a modelling approach (Wallace *et al.* 2021) is missing from the techniques evaluated in this project. However, it is expected that GrassGro would also differ from the simpler VOP and GM approaches. It is also expected that the calibration of the genotypes in GrassGro would be similarly difficult as for AFO. Furthermore, the GrassGro user interface is not tailored to allow adjusting the genetic parameters to represent the different sire teams. However, the representation of feed requirements is similar between GrassGro and AFO, although the optimisation of the management of different genotypes would be more time consuming using GrassGro.

## **7.7. Contribution of measured traits to financial performance**

### **7.7.1. Background and Methods**

Teams varied in estimated profitability, and this was associated with variation in a broad range of production traits (Section 7.5). However, those results did not directly quantify the link between trait and profit. Economic values of traits for use in an index are usually estimated by altering productivity one trait at a time and examining the change in profitability. A similar outcome can be achieved from the results of this project with a multiple regression approach between profit and the production levels for each trait for the 134 sires. This approach approximates the value of each trait, and it is presented as the economic value for a change of 1 standard deviation in each trait. An across trait comparison provides a picture of the importance of variation in each trait in the variation in profitability between the sire teams.

The multiple regression was fitted with profit per hectare from each of the 3 regions as the dependent variable with the independent variables being the FBVs. The economic value of each trait was calculated as the slope of the regression for the trait averaged across the 3 regions multiplied by the standard deviation of the trait FBVs across the 134 sire teams (Table 5).

A pie chart of the trait production levels has been constructed that presents the balance of traits for groups of teams. The slice size on the pie chart is weighted by the economic value of one standard deviation of the trait and the proportion of fill is the production level of the group relative to the overall average of all the sire teams. The overall average is the solid line mid-way in the circle, and higher and lower production have a larger or smaller pie. The range presented on the graph is +/- 1.25 standard deviations from the overall average, sufficient to cover the range of the groups of animals considered in this report. A larger pie means a higher BV except of FD for which the direction is reversed so that finer wool results in a larger pie.

Pie charts were calculated for the average of the top 25% and bottom 25% of the 134 MLP sire teams determined by profit per hectare averaged across the 3 regions using 10-year, 5-year and 20-year median prices. This allows comparison of the trait levels and the balance between traits of the higher and lower profitability sires. The size of the trait slices varies with

price scenario because the relative importance of traits varies with the price, for example the premium for finer wool increases from 25% of the weighting with 10-year prices (Figure 14) to 39% of weighting with 5-year prices (Figure 15).

### 7.7.2. Results and Discussion

The traits that contributed most to the variation in profit between the sire teams were clean fleece weight, fibre diameter and the reproduction traits (Figure 13 and Table 5). For each of the major traits the variation in profit associated with the variation in production across the 134 sires was a similar magnitude. Liveweight, carcass fat depth, fleece quality and survival were minor contributors.

These economic value results confirm the widely held belief on the importance of fleece weight and fibre diameter for the profitability of Merino wool enterprises, and when combined to form a 'Fleece Value' composite trait it has the highest value. However, the results also demonstrate the important contribution of improving reproduction to improving profitability. The approximate ratio of the economic value of 1 standard deviation in fleece value relative to weaning rate was 64:36. The higher value for the fleece traits is reflecting their higher heritability compared to the reproduction traits. In Figure 13 the length of the tail is an indication of the variation between teams for each trait, and it shows that within the sires selected for the trial there was most variation in CFW and FD, although there was also wide variation in conception and weaning rate.

The ratio of the economic value of YCFW to ACFW is 37:63. The weight on YCFW reflects the number of yearling ewes relative to the number of adults for flocks that are achieving high weaning rates and are retaining most young ewes till selecting replacements after the yearling or hogget shearing. In a flock achieving 100% lambs weaned there are 50 ewe weaners for every 100 ewes, which, ignoring mortality and differences in FD and value per kg, would generate a ratio of 33:67 for yearlings to adults.

Currently there isn't an ASBV for Survival, however, the MLP trial has contributed significant data to facilitate the creation. The relatively low economic value of survival (Table 5) indicates that survival is of lower importance than the production traits but similar to the quality traits such as carcass fat depth, staple strength and staple length. The low economic value is mostly associated with the low standard deviation for survival between the teams. The value of a 1% improvement in survival (\$0.57) is greater than a 1% increase in CFW (\$0.26), but the standard deviation is an order of magnitude lower (due to low heritability). The conclusion is that an ASBV for survival is a similar priority to fleece and carcass quality traits, however, it is an easier trait for breeders and farmers to observe so the adoption may be quicker than for traits such as IMF and shear force.

The value of YFAT in Table 5 solely reflects the contribution of carcass fat depth to the value of sale animals and this is a relatively low value. The value is significantly higher for the VOP and GM analyses which calculate sale value assuming the nutrition profile as managed in the trial. At most sites the wethers at post-weaning age were below spec for carcass fat and hence the higher fat team received higher sale prices. Whereas, in the profit analysis the nutrition and sale age of each team was optimised to suit the team. In that analysis fat depth had a low value. However, the value doesn't include the contribution of carcass fat depth as a reflection of wholebody energy and the link with increased profitability that is being examined in the Genetic Evaluation of Productivity, Efficiency and Profitability project (AWI ON 521). The preliminary results from GEPEP indicate that the economic value of fat depth will have substantial upward revision when the findings have been peer reviewed and included in mainstream analyses.

Table 5: Multiple regression estimates of economic value per trait unit of each trait calculated using VOP, GM and profit averaged across sites or regions for the 10-year price scenario. VOP and GM results were scaled to the same total value for CFW for ease of comparison. The results for the profit analysis are also presented for the economic value of a 1 standard deviation change in each trait.

Trait	VOP	GM	Profit analysis	
	\$/unit	\$/unit	\$/unit	\$/Std dev
Adult weight (kg)	0.55	-0.05	0.08	0.28
Yearling fat depth (mm)	2.46	1.97	-0.13	-0.20
Adult CFW (%)			<b>0.26</b>	2.51
<b>Yearling CFW (%)</b>	<b>0.41</b>	<b>0.41</b>	<b>0.15</b>	1.55
Adult FD (µm)			-1.93	-2.29
Yearling FD (µm)	-3.96	-2.35	-0.81	-0.91
Adult SS (N/kTex)	-0.05	0.03	0.13	0.50
Adult SL (mm)	0.11	-0.08	-0.01	-0.05
Conception (%)		0.11	0.26	1.40
Litter size (%)		0.08	0.11	1.32
Ewe rearing ability (%)		0.11	0.25	1.31
(Weaning Rate %)*	0.30	0.08	0.19	2.49
Survival Y-A5 (%)	-0.60	0.46	0.57	0.22

\* Weaning rate FBV was fitted as an independent variable with CON, LS and ERA excluded. Fleece value could not be calculated accurately because there is not a breeding value.

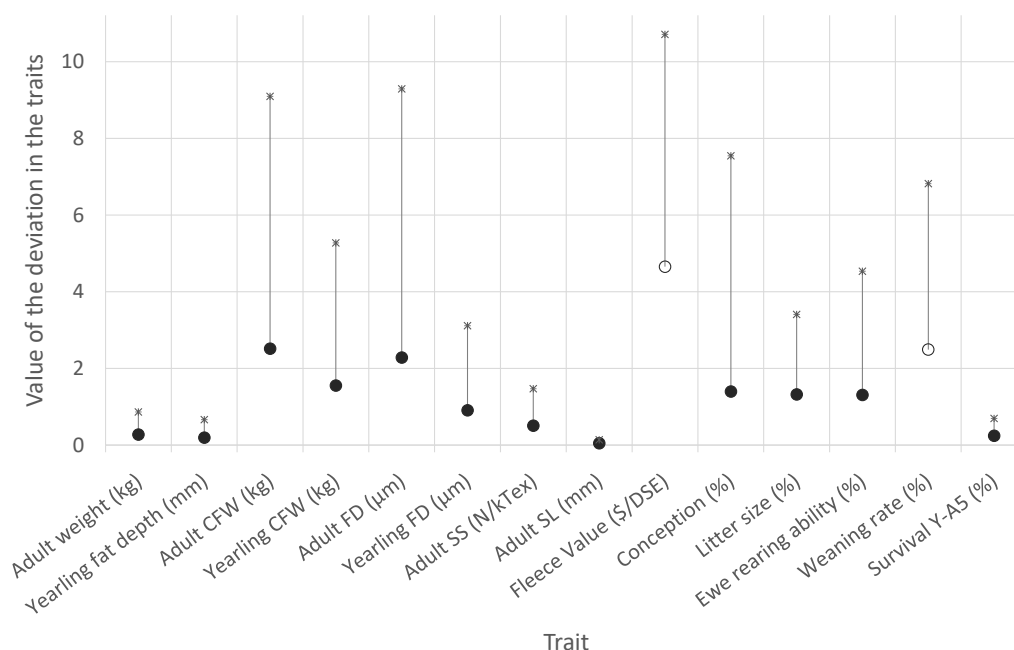


Figure 13: Economic value of a 1 standard deviation change in each trait (●) plus the range to the extreme of the trait (\*) across all teams. Note: Fleece Value and Weaning rate (○) are both composite traits that summarise the component traits that were used in the profit analysis. Note: Fleece value is only included as an approximation of the range because there is no breeding value.

The contribution of traits to profit are compared for the high and low profit sires for the 3 price scenarios in Figure 14, Figure 15 and Figure 16. The high profit sires generally have higher productivity (a larger circle) than the low profit sires, which is to be expected because the size of the circle is proportional to profitability.

The high profitability sires have relatively less production for survival, adult weight, yearling fat depth and adult staple strength for each of the price scenarios. This contrast with the low profit sires that have higher survival and higher fat depth across the price scenarios. This gives an indication that the high profit/high production sire teams may be trading off survival and fatness to increase production and profit. It is worth noting that the profit analysis carried out did not include the latest findings from the GEPEP project that was focused on improving understanding of the link between genetic production traits and profit per hectare. An analysis using the GEPEP findings may increase the size of the survival and YFAT segments and alter the sire teams in the low and high profit groups. Therefore, the above conclusion may change regarding the profitability of trading off reduced survival and fatness to increase fleece production.

There is a change in importance of fibre diameter between the price scenarios, with a higher premium for fine wool with the 5-year price scenario. In that scenario low or high FD is the biggest difference in economic value between the low and high sire groups. This indicates the importance of future market conditions when making genetic selection decisions, however, this is a decision that must be made with imperfect knowledge. In a situation of imperfect knowledge, the prudent assumption is a reversion to mean prices and using longer term historical prices, although this could be changed if there is strong evidence of an underlying shift in the structure of the market, linked to either on-farm production technology or post farm gate processing technology and consumer demand trends.

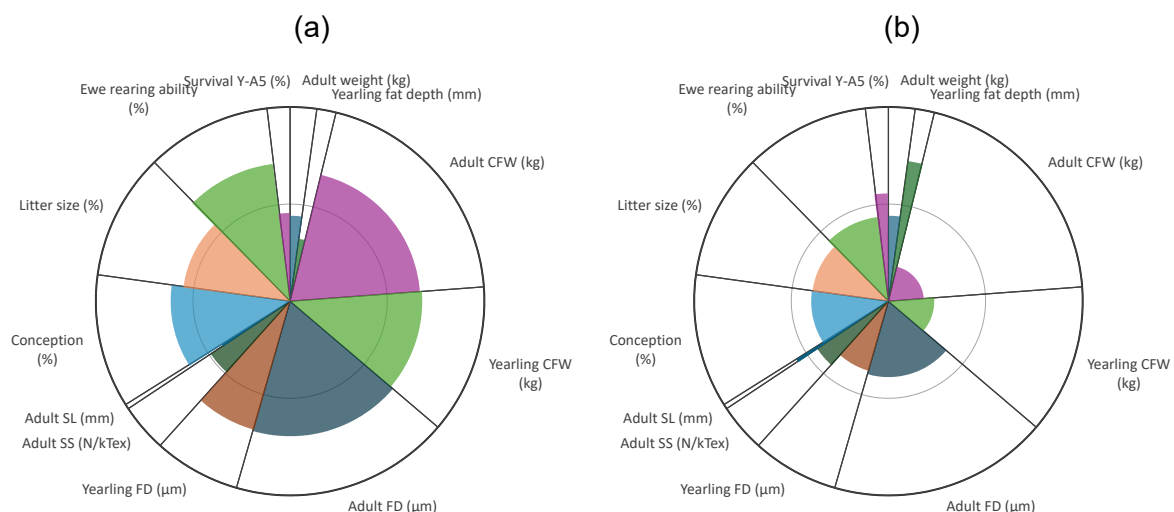


Figure 14: The balance of the production traits for (a) the top 25% and (b) the bottom 25% of sires determined from average profitability across the 3 regions using 10-year median prices.

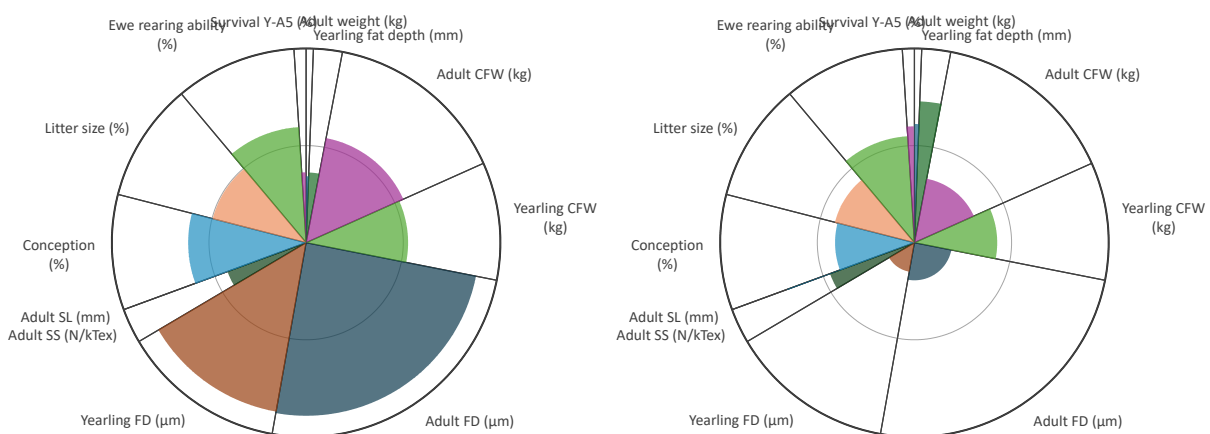


Figure 15: The balance of the production traits for (a) the top 25% and (b) the bottom 25% of sires determined from average profitability across the 3 regions using 5-year median prices.

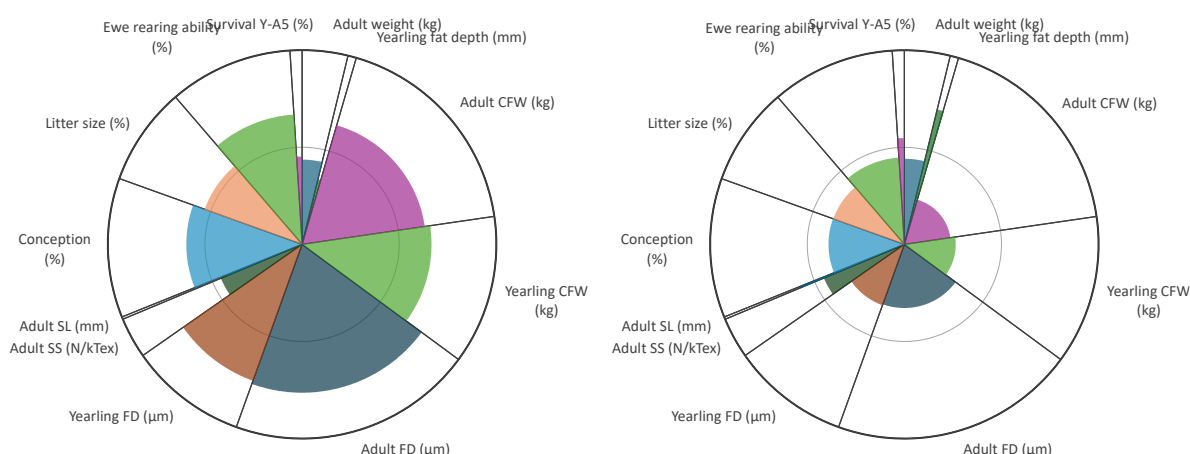


Figure 16: The balance of the production traits for (a) the top 25% and (b) the bottom 25% of sires determined from average profitability across the 3 regions using 20-year median prices.

The above results on the balance of trait outcomes for the top 25% and bottom 25% align with the correlation of profit with each trait individually. This single trait regressions is a picture of how each trait varies between high and low profit sires, but with the added advantage of the capacity to examine any trait with a FBV (Table 6).

Table 6: Correlation between each trait individually with profit averaged across the 3 regions for the 10-year price scenario.

Trait	Correlation
Adult weight	-0.02
Yearling fat depth	-0.39
Yearling ewe muscle depth	-0.39
Intramuscular fat	-0.11
CFW (Yearling + Adult)	0.51
FD (Yearling + Adult)	-0.27
Staple Strength	0.06
Staple Length	-0.15
CV of Fibre Diameter	0.27
Conception	0.24
Litter size	0.16
Ewe rearing ability	0.23
Weaning rate	0.35
Survival	-0.09
Dag	0.11
Fleece rot	0.07
Worm egg count	0.12

The single trait correlations confirm that profit is correlated with improvements in CFW, FD, reproduction and staple strength. However, increased profit with current profit drivers is also correlated with lower survival, higher CV of fibre diameter, more wrinkle, more dag, more fleece rot, less fat, less eye muscle depth and reduced resistance to worms. Indicating that these traits have been traded off in the pursuit of higher profit. In most cases, except fat and eye muscle depth, the correlation is low or very low, so the adverse industry trend is slow.

### 7.7.3. Conclusion

The multiple regression method used in this project to estimate EV of traits is only an approximation of actual EVs and will be affected by the productivity of the sires included in the trial. However, the large sample size and broad cross-section of sires should ensure that the results are a reasonable reflection of actual EVs. The results show that fleece value and reproduction are the main drivers of the economic variation between the sires.

These estimates of the economic value of traits are representative of current profit drivers and do not include any allowance for traits that may be valuable in the future. An index calculated from these values would provide ram breeders and ram buyers an estimate of genetic merit for the current profit drivers that could be compared with the future facing indexes. The industry demand for such an index could be assessed.

The GEPEP project will estimate EVs for a broader range of traits including fat depth. This estimation will use a more rigorous process than this project although with the same modelling framework. When the GEPEP project is complete it will be a useful exercise to compare these EVs with those generated here and using Sheep Object.

## 7.8. Breeding Philosophies

### 7.8.1. Background and Methods

This section draws out differences between the sire teams, particularly by examining the sire groupings identified by the Classer Advisory Group (CAG) team. These sire groups are based on the CAG's view of the breeding philosophy of the source stud. Variation in profit per hectare, the breakeven value of rams and the variation in traits and indexes have been examined for these groups.

The future profitability of a breeding programme will depend on the ability to identify superior animals for the traits that are financially important in future market and production systems. There may be some difference between breeding philosophies in breeding efficacy that may help when looking to design a breeding program and objectives for the future. To examine this question about breeding philosophy the Classer Advisory Group (CAG) allocated the sire teams to groups based on breeding philosophy and methodology. In this section the current profitability and productivity of the sire teams in each group have been compared to examine whether some breeding philosophies have achieved greater gains in some traits and overall profitability than other breeding philosophies.

Differences might be expected when comparing breeding philosophies that vary in emphasis on visual identification versus measured performance when evaluating traits that are challenging to observe (e.g. FEC, SS, IMF, LMY, EMD, ewe rearing ability) or are more influenced by the environment rather than genes (e.g. low heritable traits of Reproduction, Survival). To further complicate drawing conclusions, it is not possible to identify if the differences between breeding philosophy is due to differences in the breeding objective or differences in the capacity of the breeding philosophy or individual breeder to identify superior genotypes. All progeny receive the same husbandry operations so the low WEC progeny don't pick up the possibility of reduced drench costs, nor are there differences in flystrike prevention and treatment costs between low and high wrinkle progeny (or the differences in phenotyping and genotyping costs for ram breeders. The AWI - NSW Stud Breeder Trust project is looking at the ram breeding enterprise cost differences between breeding philosophies.) While there are limitations to the comparison the MLP project offers the best data set to explore such comparisons.

A pie chart of the trait production levels has been constructed that presents the balance of traits for groups of teams. The slice size on the pie chart is weighted by the economic value of one standard deviation of the trait and the proportion of fill is the production level of the group relative to the overall average of all the sire teams. The overall average is the solid line mid-way in the circle, and higher and lower production have a larger or small pie. The range presented on the graph is +/- 1.25 standard deviations from the overall average. A larger pie means a higher breeding value except for FD for which the direction is reversed so that finer wool results in a larger pie.

Five different results are presented:

1. Estimated profit per hectare (Figure 17).
2. Breakeven value of rams (Figure 18).
3. Balance of the production traits relative to the average of all the sire teams (Figure 19 to Figure 26).
4. The trait levels for teams in each CAG group including average, 25<sup>th</sup> and 75<sup>th</sup> percentiles, and the extreme highs and lows (Figure 27 to Figure 41).
5. The index level for teams in each CAG group including average, 25<sup>th</sup> and 75<sup>th</sup> percentiles, and the extreme highs and lows (Figure 42 to Figure 45).

## 7.8.2. Results and Discussion

### 7.8.2.1. Financial performance

The average profit and range in profit of the teams in each group was similar (Table 7-Table 9, Figure 17), except that group B was significantly lower ( $p < 0.05$ ) than all groups other than group E. However, the general conclusion is that the different breeding philosophies, if well implemented, have bred high profit sires and a financial advantage of one approach over another is not obvious, as there was as much variation within each CAG group as between CAG groups.

*Table 7: Average profit and range of profit for each CAG group from the profit analysis averaged across the 3 sites for the 10-year price scenario.*

CAG Group	Average	75 <sup>th</sup> percentile	25 <sup>th</sup> percentile
A	351	372	339
B	326	334	308
CA	354	365	344
CB	354	363	346
DA	359	368	352
DB	354	358	349
E	342	353	333
F	358	366	348

*Table 8: Average profit and range of profit for each CAG group from the profit analysis averaged across the 3 sites for the 5-year price scenario.*

CAG Group	Average	75 <sup>th</sup> percentile	25 <sup>th</sup> percentile
A	549	591	514
B	486	509	456
CA	537	555	518
CB	523	545	505
DA	548	569	531
DB	528	540	511
E	508	526	492
F	540	563	513

Table 9: Average profit and range of profit for each CAG group from the profit analysis averaged across the 3 sites for the 20-year price scenario.

CAG Group	Average	75 <sup>th</sup> percentile	25 <sup>th</sup> percentile
A	189	203	178
B	171	179	159
CA	188	196	181
CB	188	196	183
DA	193	199	187
DB	189	190	186
E	183	191	176
F	192	196	188

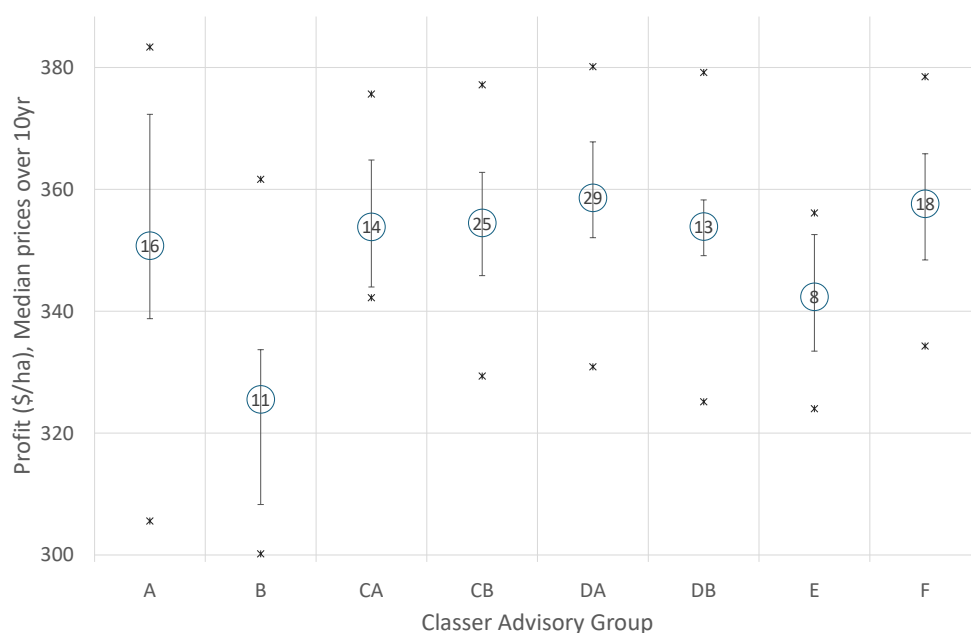


Figure 17: Average profit and the range (\$/ha) for each CAG group using average profit across the 3 sites with 10-year median prices. The circle represents the average profit of the teams in the CA group, number in the circle is number of teams in that group, the length of the whiskers is the 25<sup>th</sup> and 75<sup>th</sup> percentiles and the \* is the highest and lowest team.

The range of breakeven ram prices between the CAG groups follows the same pattern as the variation in profit between groups and the variation is from +\$210/head for the DA group to -\$980/hd for the B group, with the extremes for individual sires from +\$1000 to -\$2000/head (Figure 18).

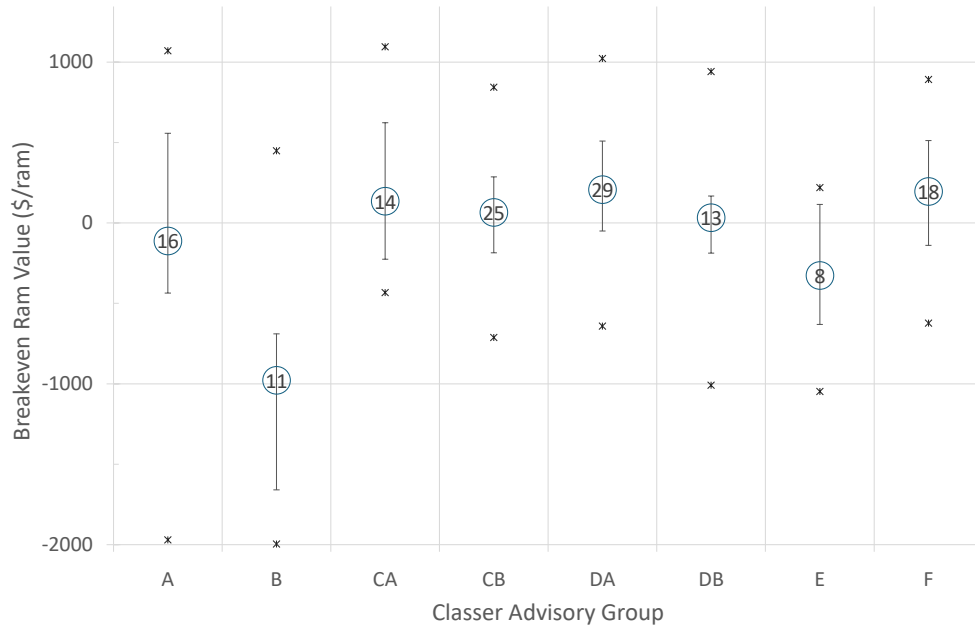


Figure 18: Breakeven price adjustments for sires presented for each CAG group calculated from the medium growing season analysis using 10-year median prices.

Following is a discussion of each CAG group

Group A – Specialist wool; ultrafine breeders selected for the traditional Italian-type wool market. Breeding objective is focussed on micron, style and wool quality.

This group ranked 5<sup>th</sup> out of 8 on average profitability with 10-year median prices (Table 7-Table 9, Figure 17), however, it had a very wide range with the highest profit team included in this group but also the second lowest profit team. The group had the highest profitability with 5-year median prices, linked to the higher premium for fine wool in that scenario. This profit picture is consistent with the index values. The average FW index for this group was high (Table 10) and had a big range (Figure 42), with individual teams in this group having both the highest and lowest score for the FW index. The group also had the lowest ranked team on all the other indexes (WP, SM and ML - Figure 43, Figure 44 and Figure 45).

As expected, the majority of the economic value of this group is from lower fibre diameter (Figure 19, see also Figure 29 and Figure 30), however, there is some trade-off in profit due to lower fleece weight. Also, as expected this group has smaller frame adults and there is a penalty on value of sale sheep. Reproduction in this group is characterised by below average litter size achieved with average conception and above average ewe rearing ability. Survival and yearling fat are close to average.

The differences observed for this group are likely explained by the breeding objective of these breeders who are targeting a specific wool market segment.

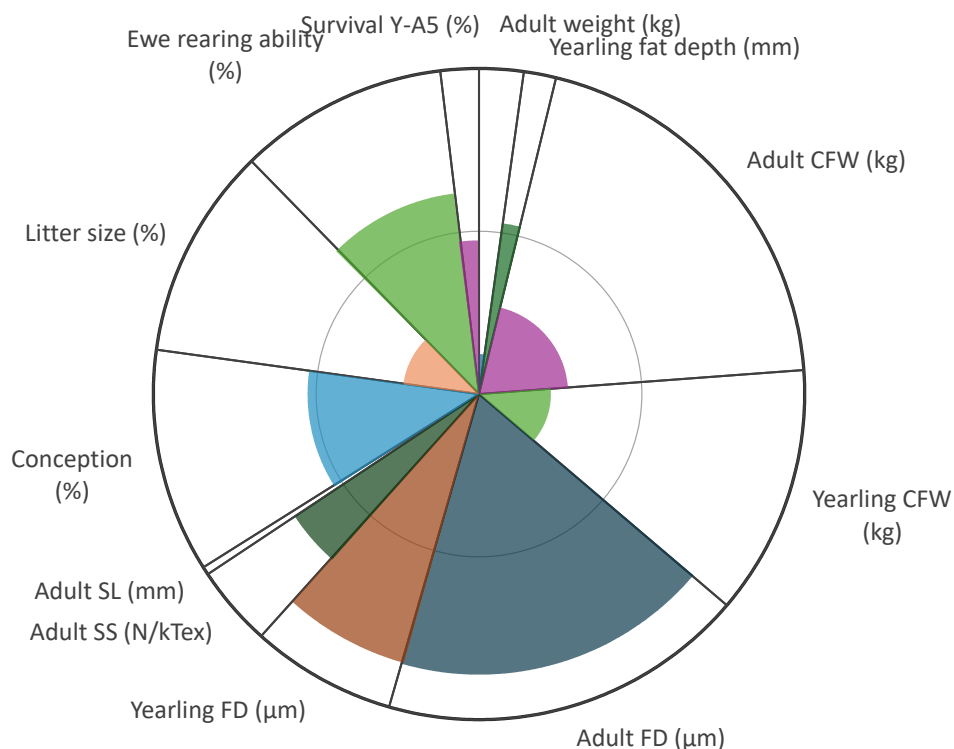


Figure 19: The balance of the production traits averaged for the sire teams in CAG group A.

Group B – Free skin; breeders striving to create a free skinned animal (some non-mules) with extra staple length and wool quality for multi-shearings (may or may not be using Breeding Values)

Note: the farming system in which the genotypes were evaluated, with one annual shearing, may not suit the sire teams in this group that have been bred for extra staple length. However, the error in profitability is likely to be small because the estimated economic value of staple length is small, indicating the penalty incurred by these teams from producing over length wool was not large.

This group had the lowest profit (Table 7-Table 9, Figure 17), and the difference was statistically significant to the other groups other than group E that had the second lowest profitability. The group had below average CFW and staple strength, with above average fibre diameter and the longest staple length. Survival and adult weight were close to average, reproduction was slightly below average and yearling fat depth was well above average (Figure 20). This production profile results in the group having the lowest average index values for the FW and WP indexes (Table 10 & Figure 42 and Figure 43). While the group performed best on the ML index, being above average (but lower than group E) and having the highest index team.

The production profile of this group raises the question whether the selection criteria used in this breeding philosophy is able to identify high fleece value animals. There is not an obvious trade-off of higher reproduction or animal liveweight associated with the low fleece traits, such as for group E, although YFAT is high.

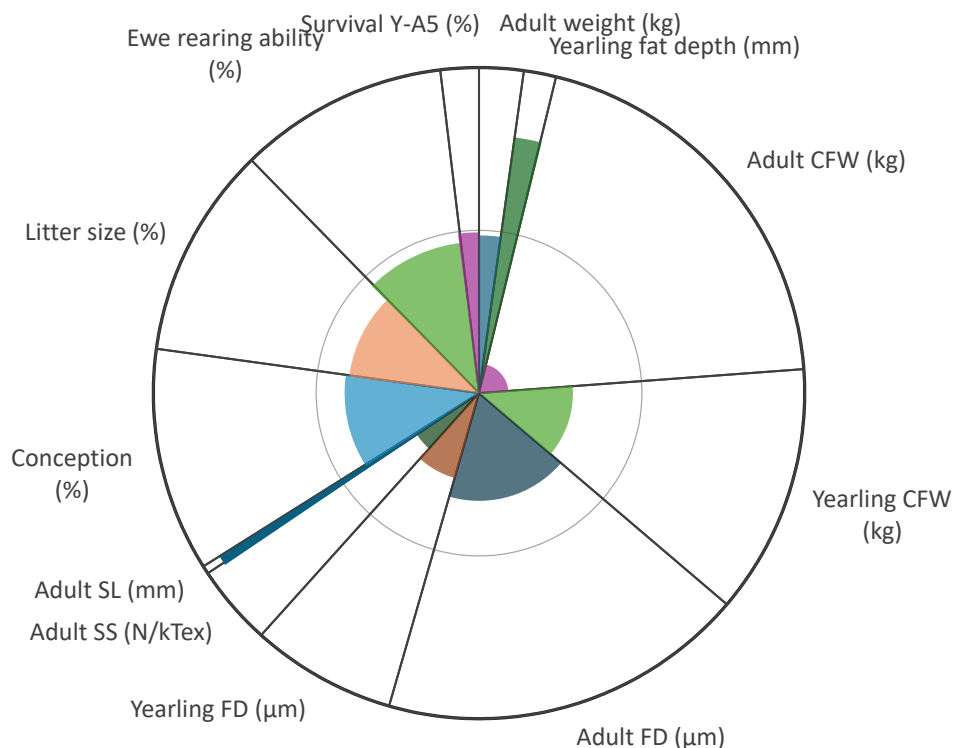


Figure 20: The balance of the production traits averaged for the sire teams in CAG group B.

Group CA – Higher rainfall, with focus on within flock assessments, equal weight on wool type, production, structural correctness and growth.

This group is close to average for most traits (Figure 21) and there was relatively low variation between the teams in the group for all traits and index values (Figure 27 to Figure 41). ACFW was above average and staple length was shorter than average (higher economic value), whereas reproduction was slightly below average and yearling fat depth and yearling faecal egg count were poorest of the groups (Figure 38 and Figure 40). Profitability was close to average, however, the index values were all low (Table 10), with SM and ML having the lowest average of the 8 groups.

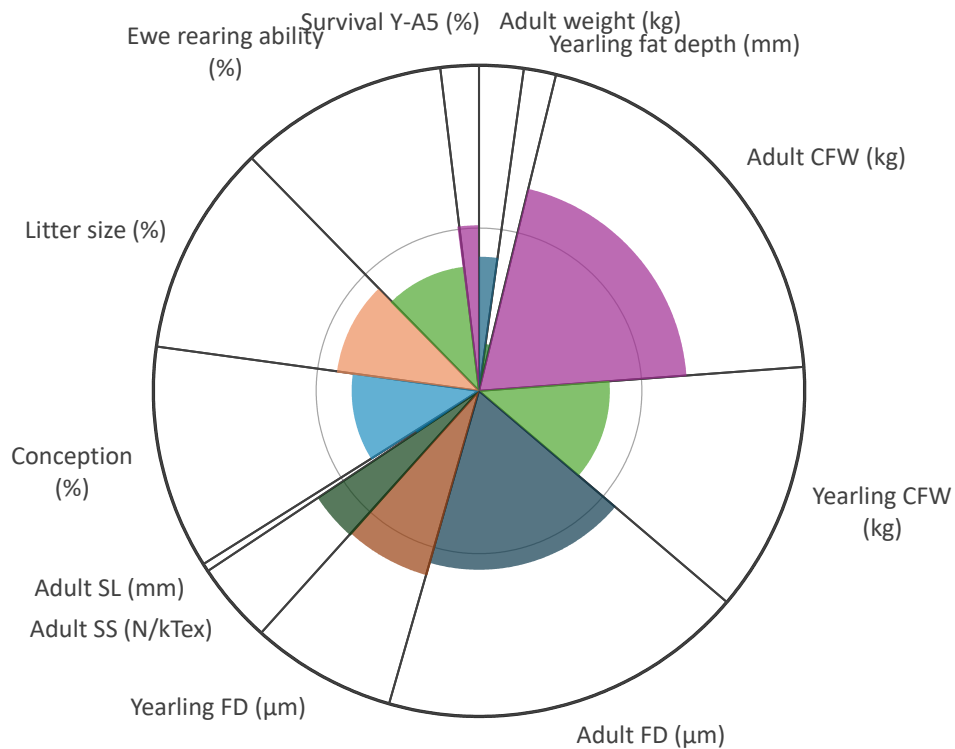


Figure 21: The balance of the production traits averaged for the sire teams in CAG group CA.

Group CB – Lower rainfall, with focus on within flock assessments, equal weight on wool type, production, structural correctness and growth.

This group had average profit (Table 7-Table 9, Figure 17) and average index values (Table 10 & Figure 42, Figure 43, Figure 44 and Figure 45) which was achieved with high fleece weights and broad wool (Figure 22). The group had the highest average fleece weights and highest average fibre diameter and the heaviest and broadest individual teams. Conception was below average with the group having the lowest average and the lowest individual team (Figure 33). Yearling fat depth was slightly below average, although the group included the lowest and highest individual teams (Figure 38). All other traits were close to average.

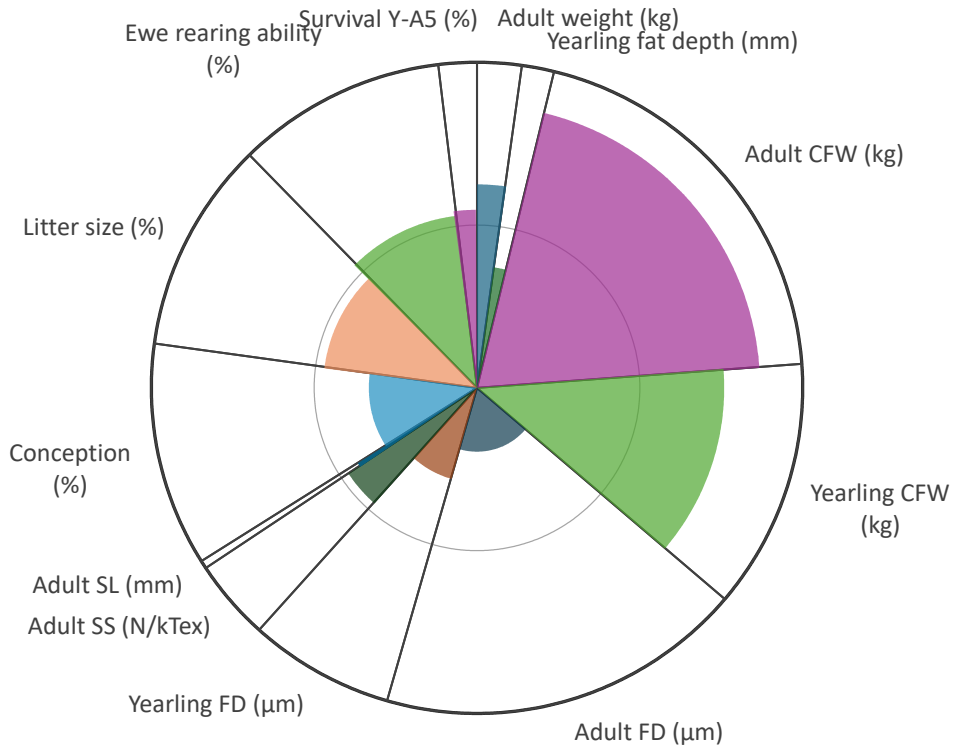


Figure 22: The balance of the production traits averaged for the sire teams in CAG group CB.

Group DA – Higher rainfall, with focus on across flock assessments, equal weight on wool type, production, structural correctness and growth.

This group had an even balance for all traits (Figure 23) and it was the most even balance across the traits for all groups. All traits were close to average except for fibre diameter that was finer than average. This package of traits resulted in the highest average profit with 10-year (Table 7-Table 9, Figure 17) and 20-year median prices, and the second highest with 5-year prices. The group was above average for the FW and WP indexes, average for SM and slightly below average for ML (Table 10).

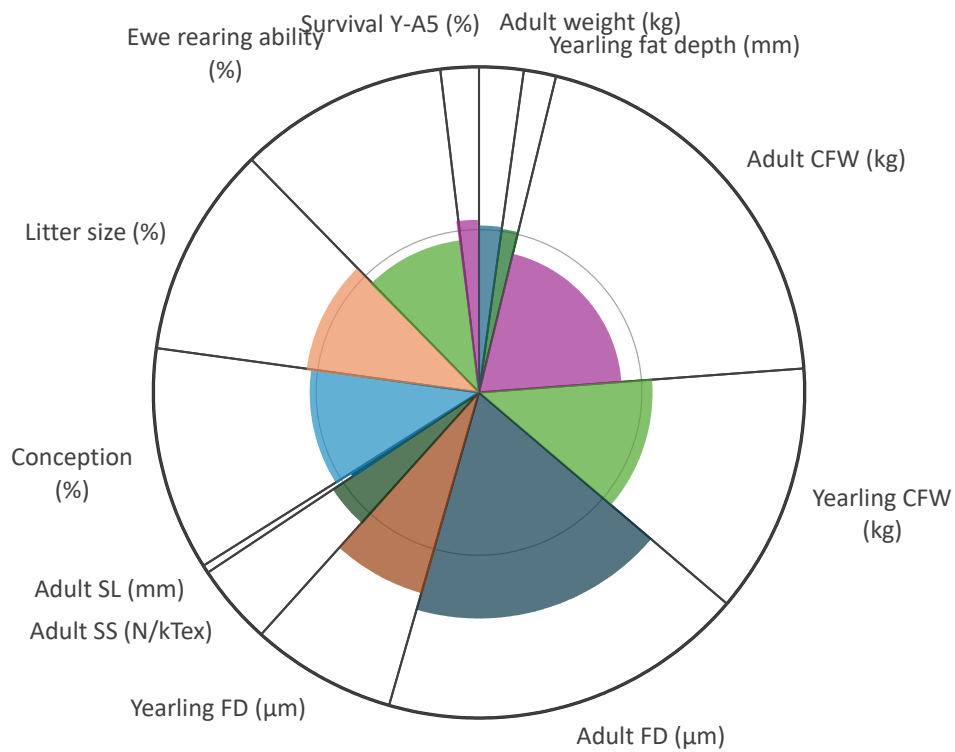


Figure 23: The balance of the production traits averaged for the sire teams in CAG group DA.

Group DB – Lower rainfall, with focus on across flock assessments, equal weight on wool type, production, structural correctness and growth.

This group had average profitability for all price scenarios (Table 7-Table 9, Figure 17) which was achieved with above CFW, slightly broader wool and below average ewe rearing ability (Figure 24). This higher CFW and broader wool is consistent with the low rainfall CB group. The group had lower survival and yearling fat depth, and longer staple length (lower economic value). Although profitability was average for all price scenarios the group was above average for the FW, WP and SM indexes and had the highest average WP index (Table 10), and the highest team on the SM index (Figure 42, Figure 43 and Figure 44). The group was average for the ML index.

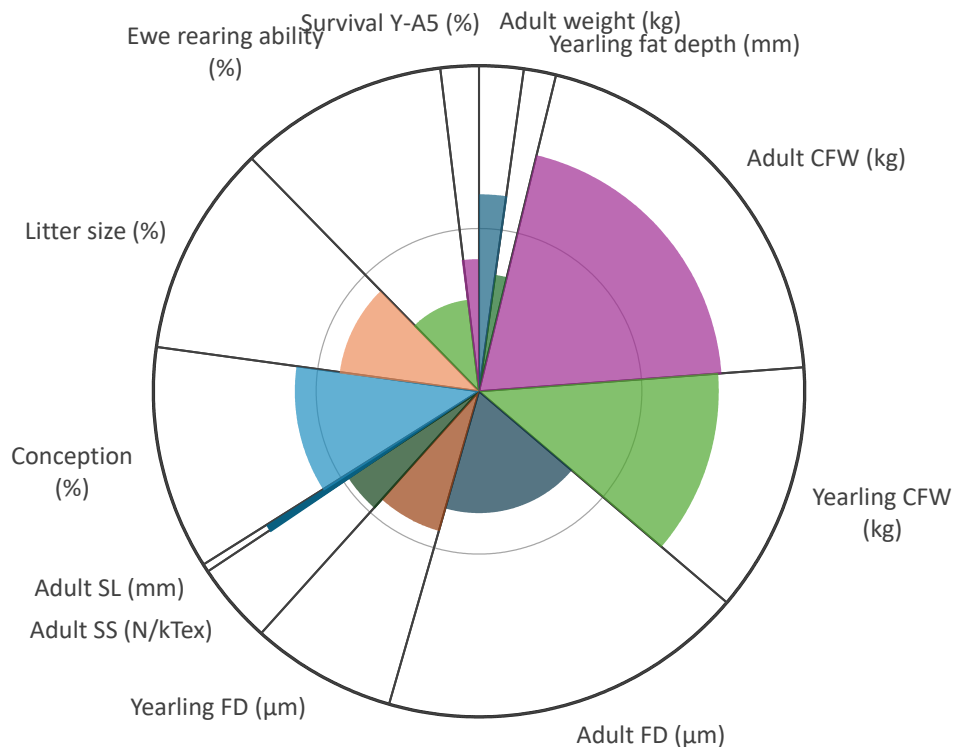


Figure 24: The balance of the production traits averaged for the sire teams in CAG group DB.

Group E – Growth, carcass and fertility emphasis; a stronger emphasis on high early growth rate, carcass traits with high fertility and maternal traits.

This group has below average profitability for all 3 price scenarios (Table 7-Table 9, Figure 17), indicating that for historical market conditions the heavy focus on traits linked to meat production has not translated to increased profit. However, this is the group that may change the most if the findings of the GEPEP project were included in the profit analysis. This group has the highest group average for conception, litter size, eye rearing ability, survival, weight and yearling fat (Figure 25), it also includes the highest individual team for many of these traits. This focus in the breeding objective on meat production traits has traded-off with the wool production traits and the group had the lowest average fleece weight, the broadest wool, below average staple strength and above average staple length.

The average index value for ML was highest of all the groups (Table 10 & Figure 45) and SM was also above average, however FW and WP were below average (Figure 42 and Figure 43).

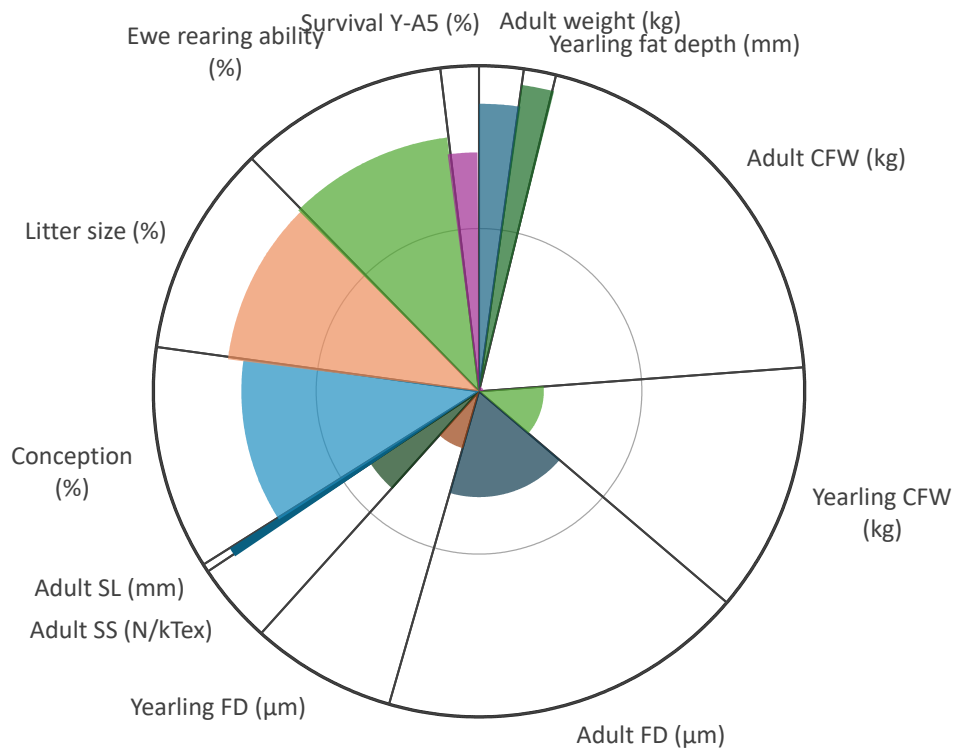


Figure 25: The balance of the production traits averaged for the sire teams in CAG group E.

Group F – Index focus; breeding using sires principally derived from across flock breeding values (ASBVs), with the main ram and ewe selection emphasis applied using breeding values and indexes.

This group is balanced across most traits but has slightly more emphasis on yearling fat depth, conception and especially litter size. The emphasis on litter size is likely a result of selection using the old NLW ASBV that increased LS more than conception and ewe rearing ability. All MLP sires were born prior to the availability of the component reproduction ASBVs that were introduced in 2022. The index focused breeders of this group may now adjust selection pressure across the component reproduction traits if they are concerned about high litter size. Survival was the single trait that was more than 0.25 SD below average.

The group had the second highest profit for the 10-year (Table 7-Table 9, Figure 17) and 20-year price scenarios and was third highest for the 5-year price scenario, although the gap to the highest team was greater with the 5-year median prices due to the higher FD premium.

The group had the highest FW and SM index and was above average for the WP and ML indexes (Table 10). This outcome of better than average outcome for all indexes is consistent with the breeders in this group being more focused on index outcomes.

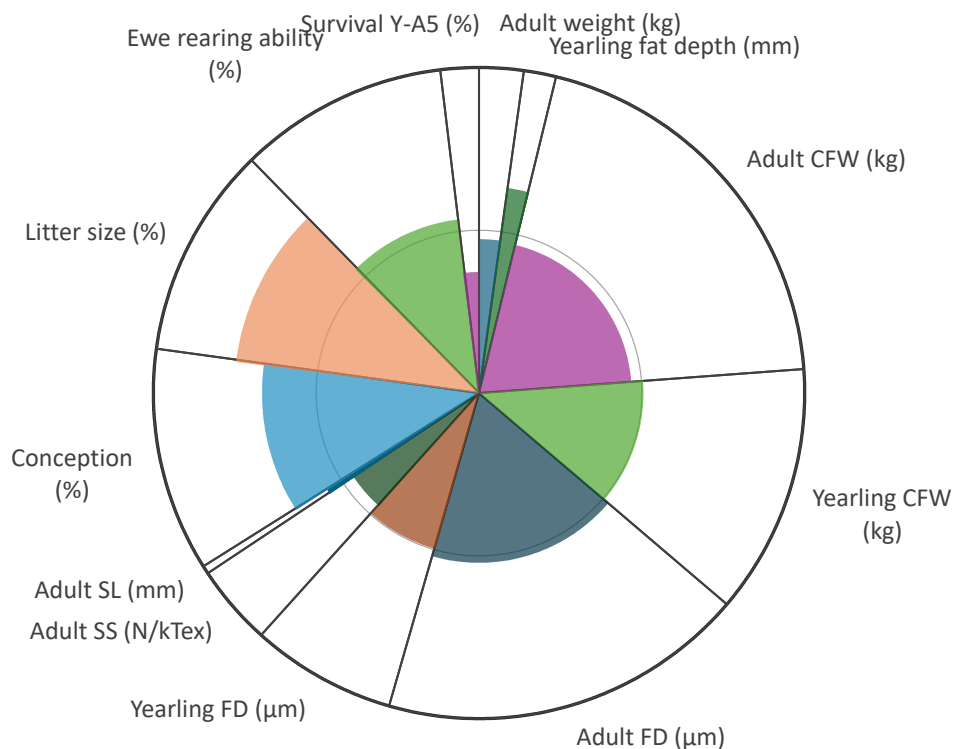


Figure 26: The balance of the production traits averaged for the sire teams in CAG group F.

### 7.8.2.2. Traits

Clean fleece weight

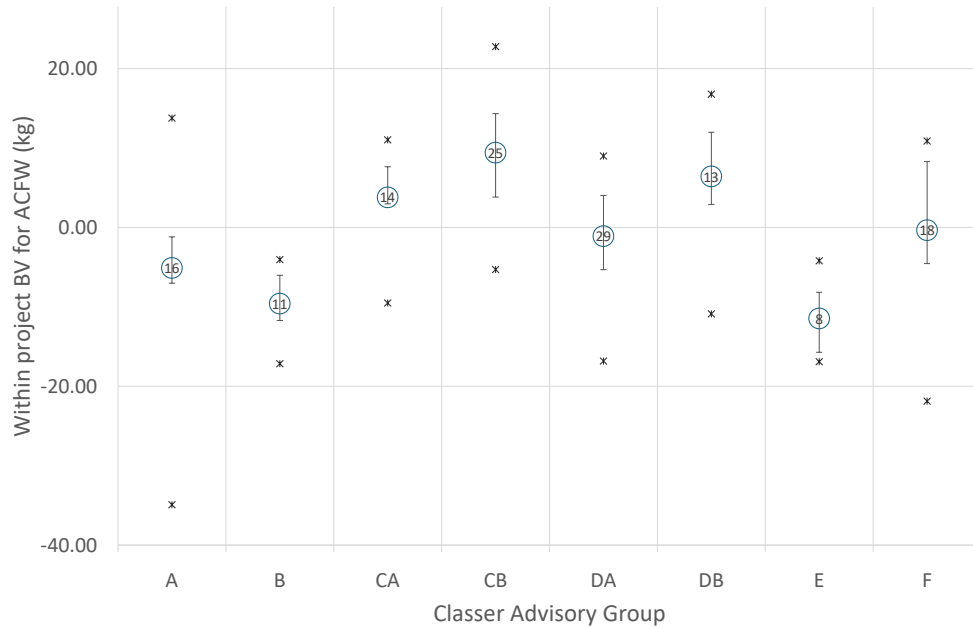


Figure 27: The within project breeding value for Adult Clean Fleece Weight (kg) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

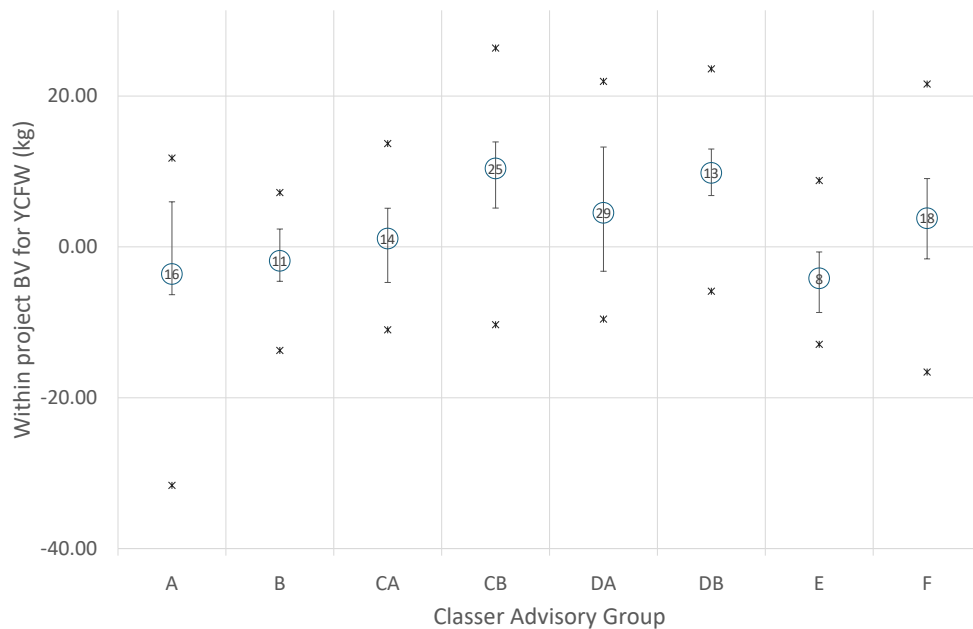


Figure 28: The within project breeding value for Yearling Clean Fleece Weight (kg) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Fibre diameter

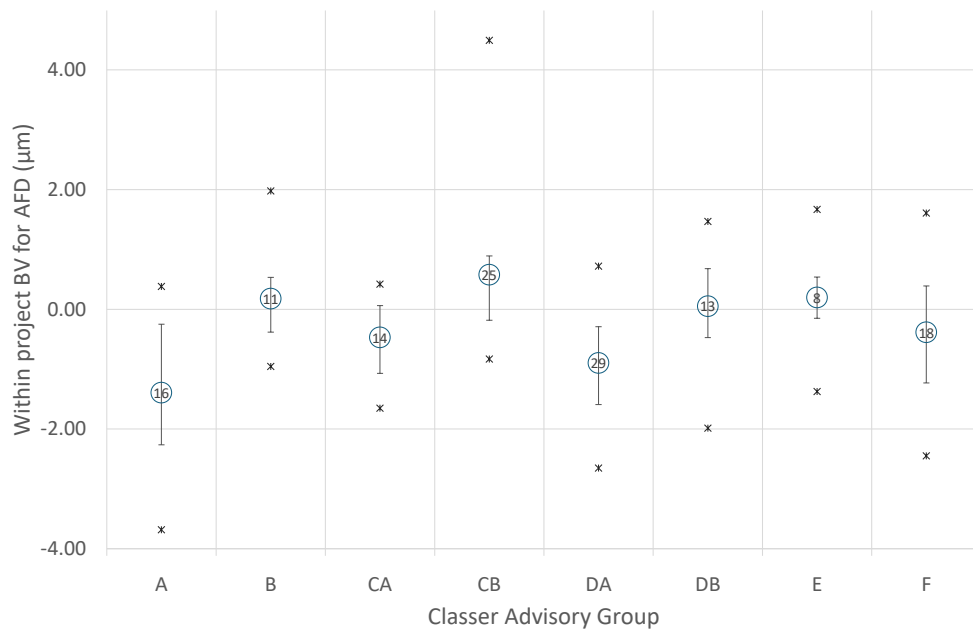


Figure 29: The within project breeding value for Adult Fibre Diameter ( $\mu\text{m}$ ) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

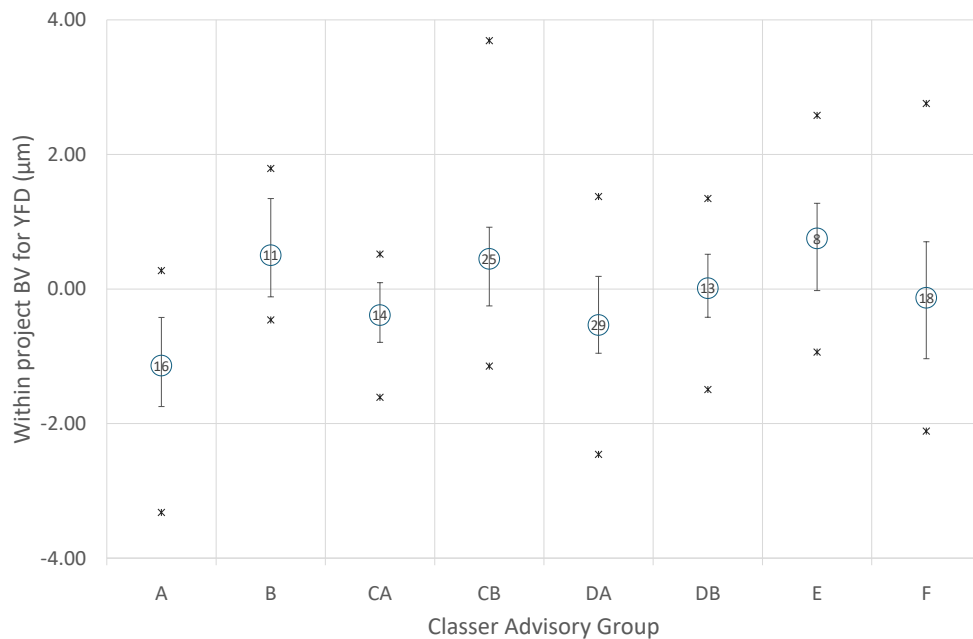


Figure 30: The within project breeding value for Yearling Fibre Diameter ( $\mu\text{m}$ ) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### Adult staple strength

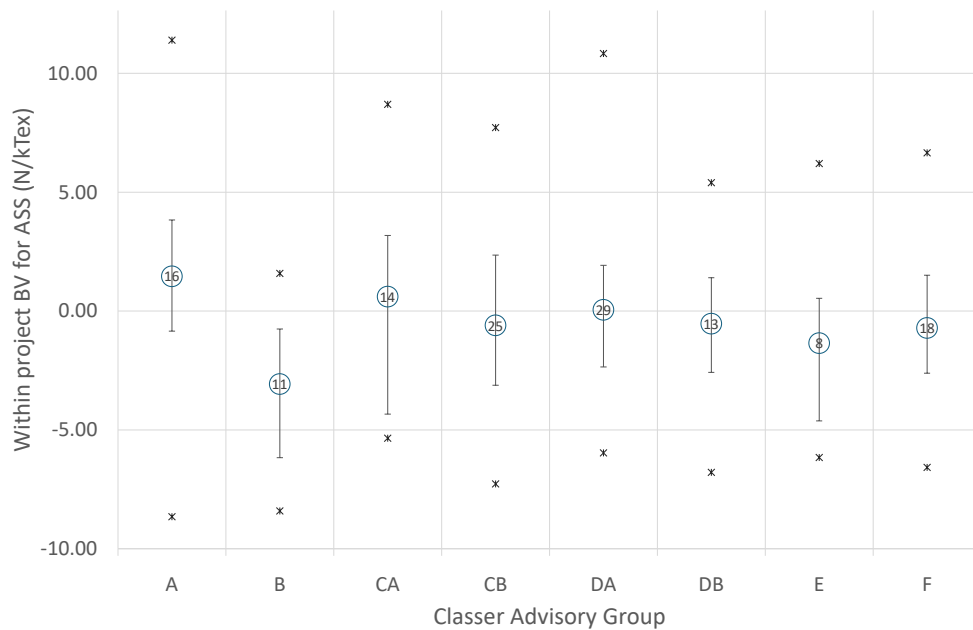


Figure 31: The within project breeding value for Adult Staple Strength (N/kTex) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### Adult staple length

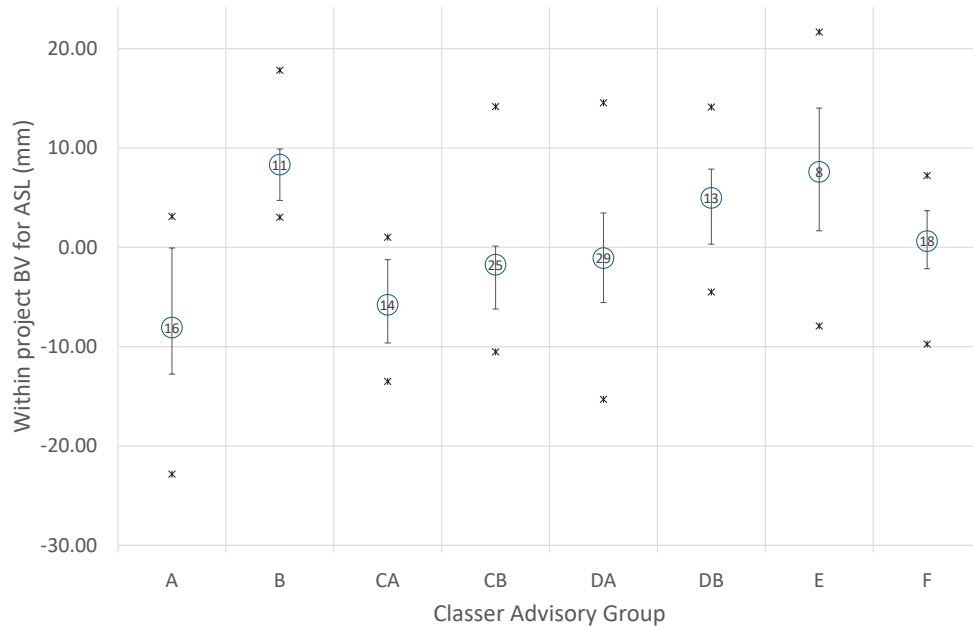


Figure 32: The within project breeding value for Adult Staple Length (mm) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Conception

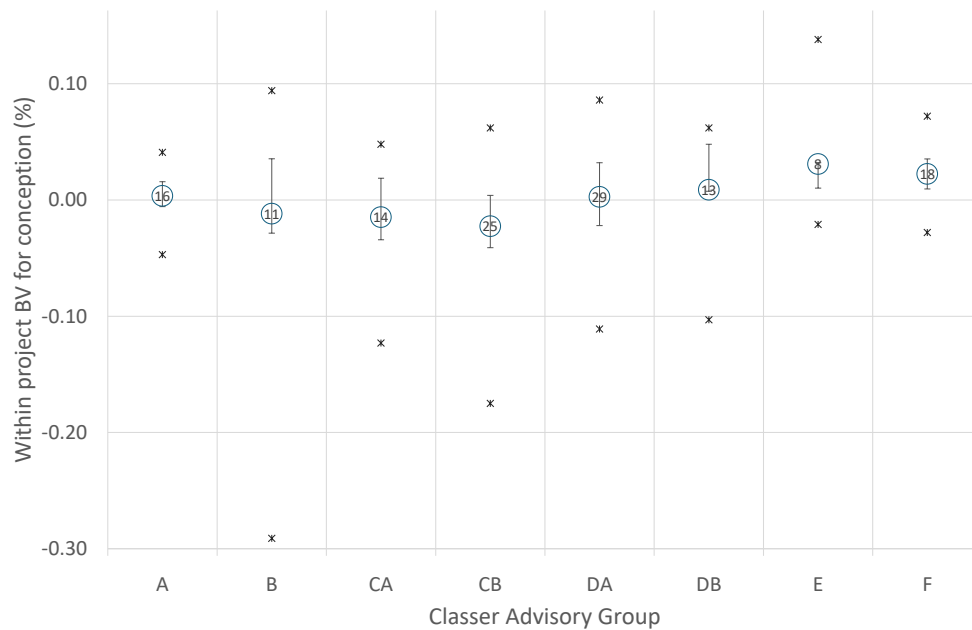


Figure 33: The within project breeding value for Conception (%) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Litter Size

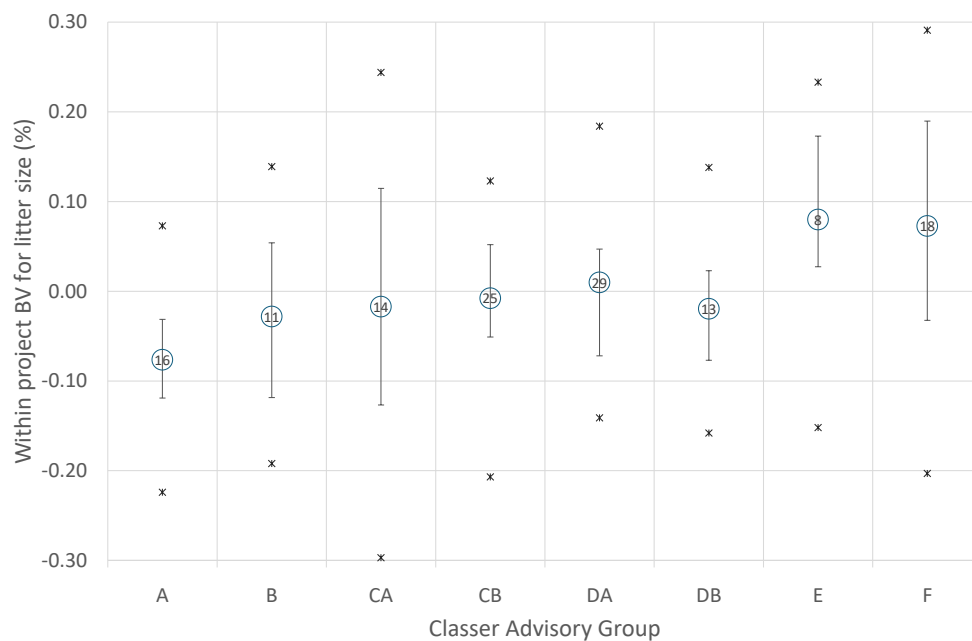


Figure 34: The within project breeding value for Litter Size (%) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Ewe Rearing Ability

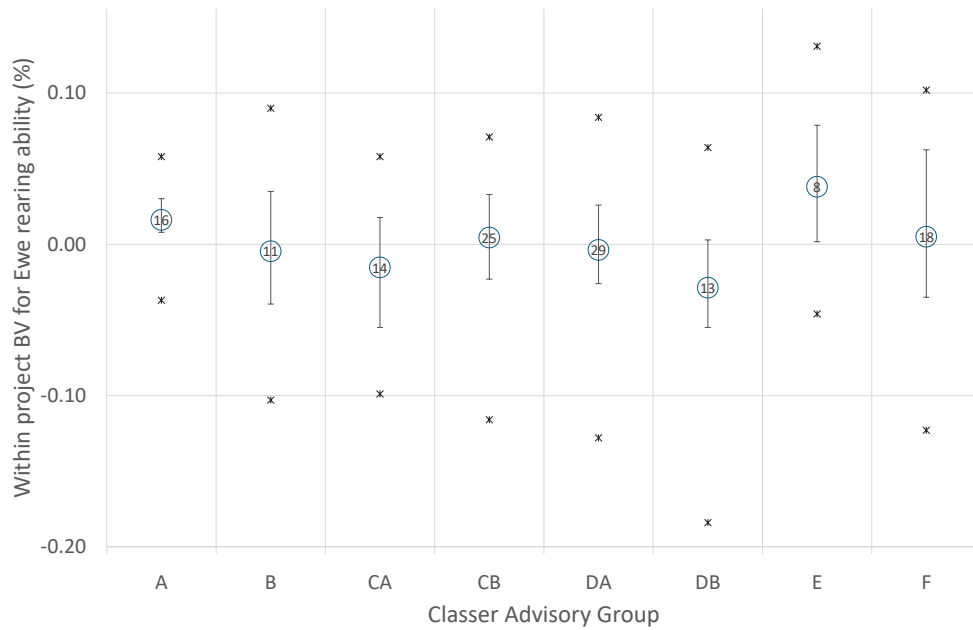


Figure 35: The within project breeding value for Ewe Rearing Ability (%) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Weight

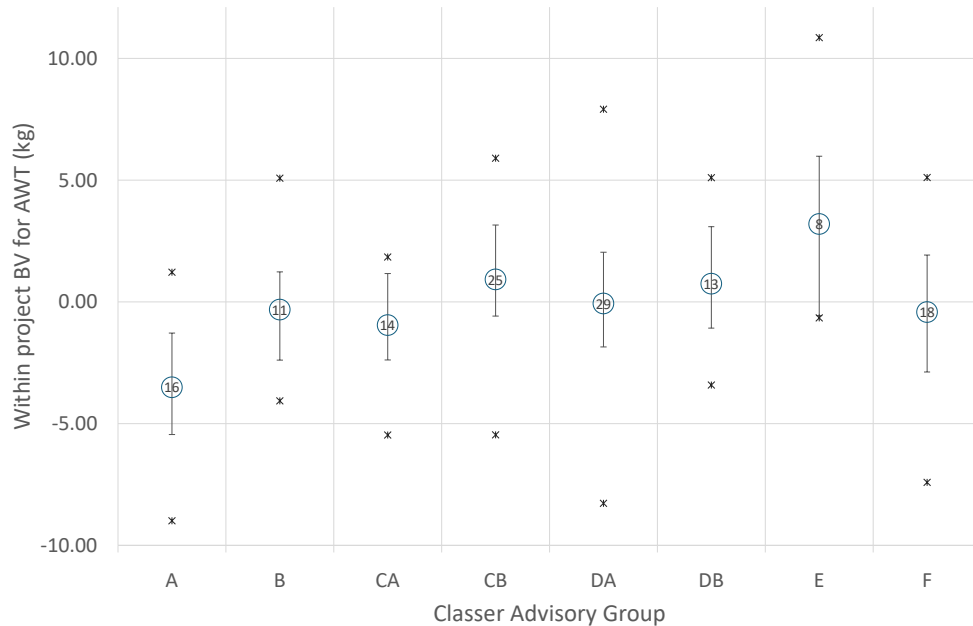


Figure 36: The within project breeding value for Adult Weight (kg) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

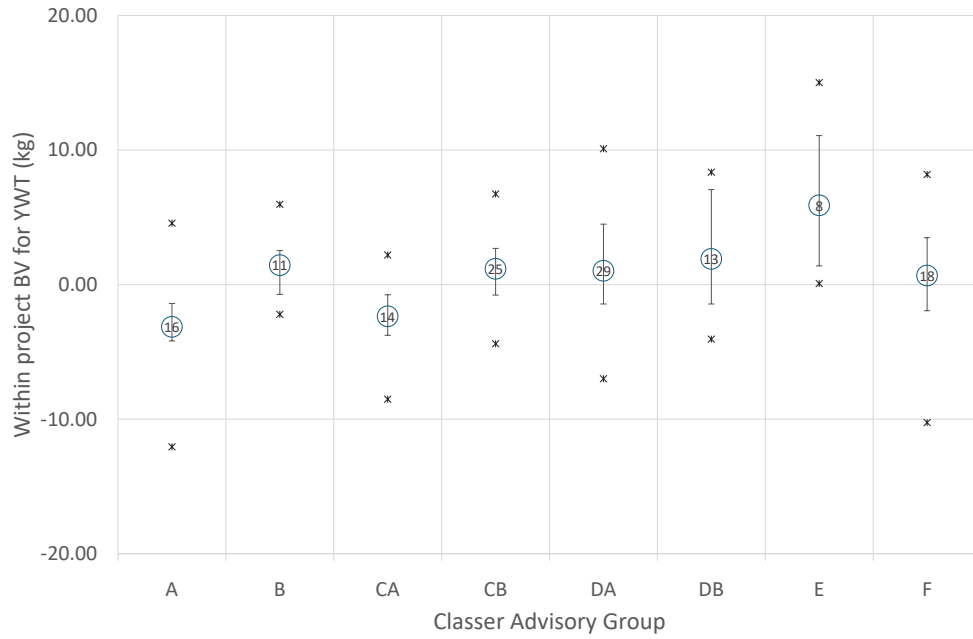


Figure 37: The within project breeding value for Yearling Weight (kg) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

#### Yearling Fat

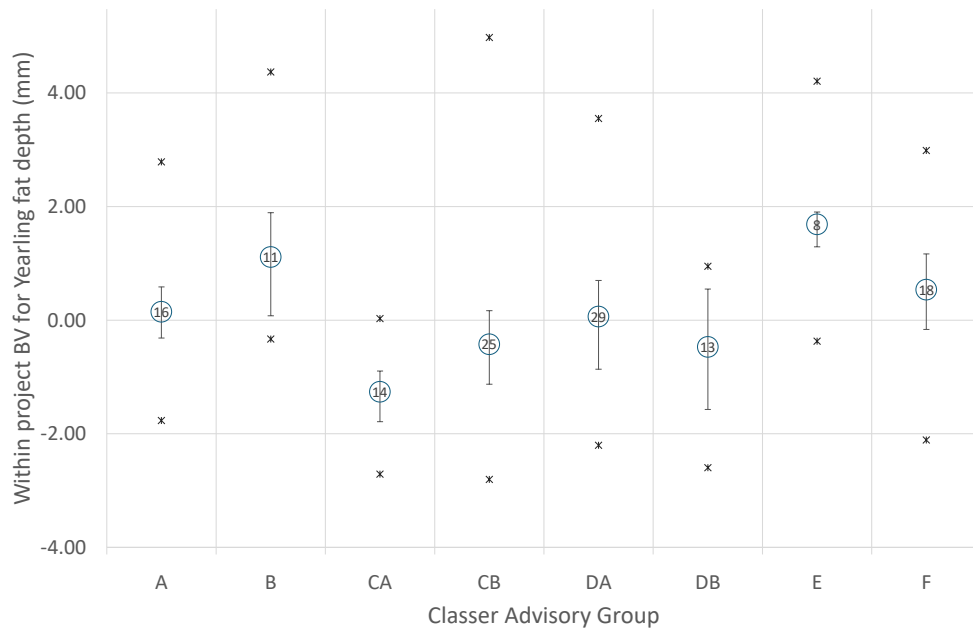


Figure 38: The within project breeding value for Yearling Fat Depth (mm) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### Yearling eye muscle depth

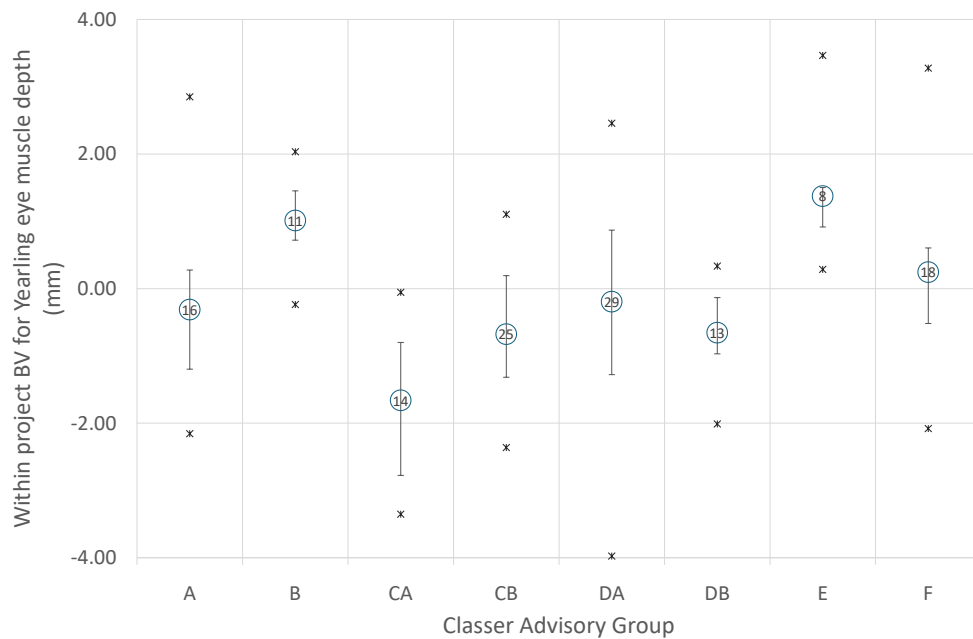


Figure 39: The within project breeding value for Yearling Eye Muscle Depth (mm) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### Yearling faecal egg count

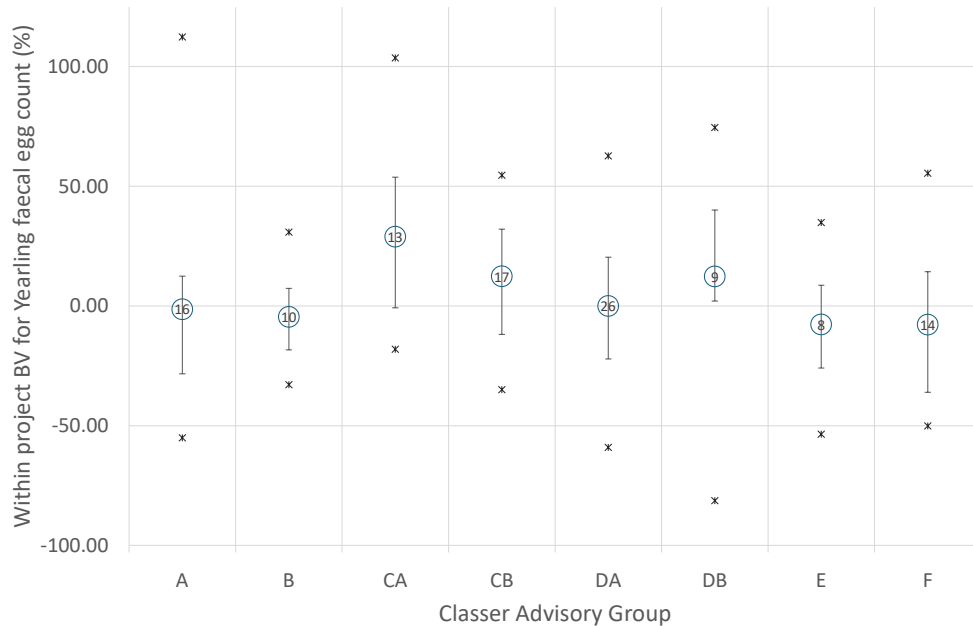


Figure 40: The within project breeding value for Yearling Faecal Egg Count (%) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Survival

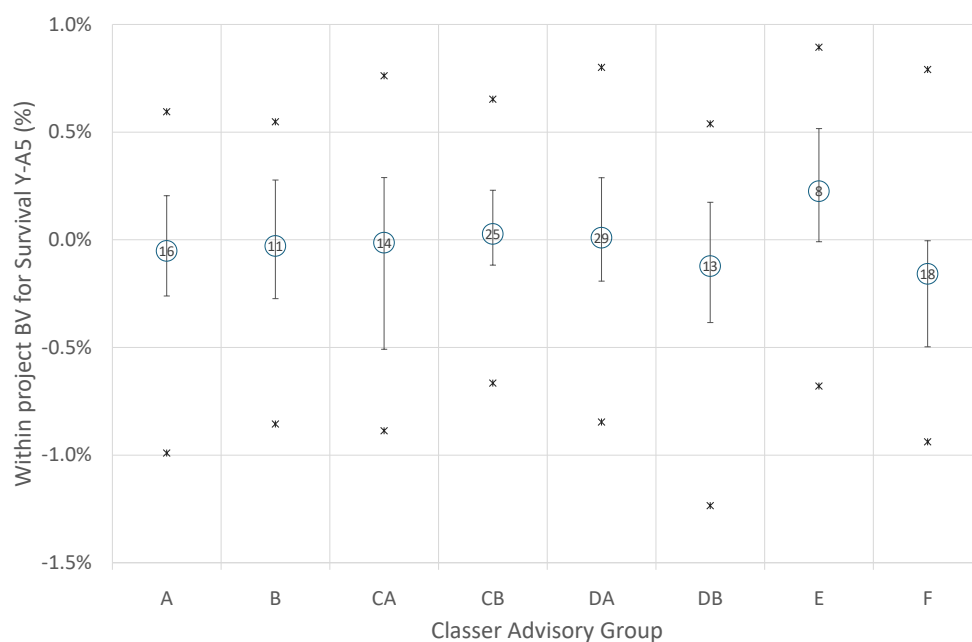


Figure 41: The within project breeding value for Survival (Yearling to A5) (%) and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### 7.8.2.3. Indexes (calculated 28 May 2025)

Table 10: Average index values for each CAG group for the 4 industry indexes calculated from within project ASBVs.

CAG group	Index			
	Fine wool	Wool production	Sustainable Merino	Merino lamb
A	108	101	97	97
B	83	84	100	108
CA	96	98	93	96
CB	99	105	104	104
DA	110	107	105	104
DB	110	112	108	108
E	91	94	110	117
F	112	111	110	109
Overall average	103	103	103	105

## Fine Wool

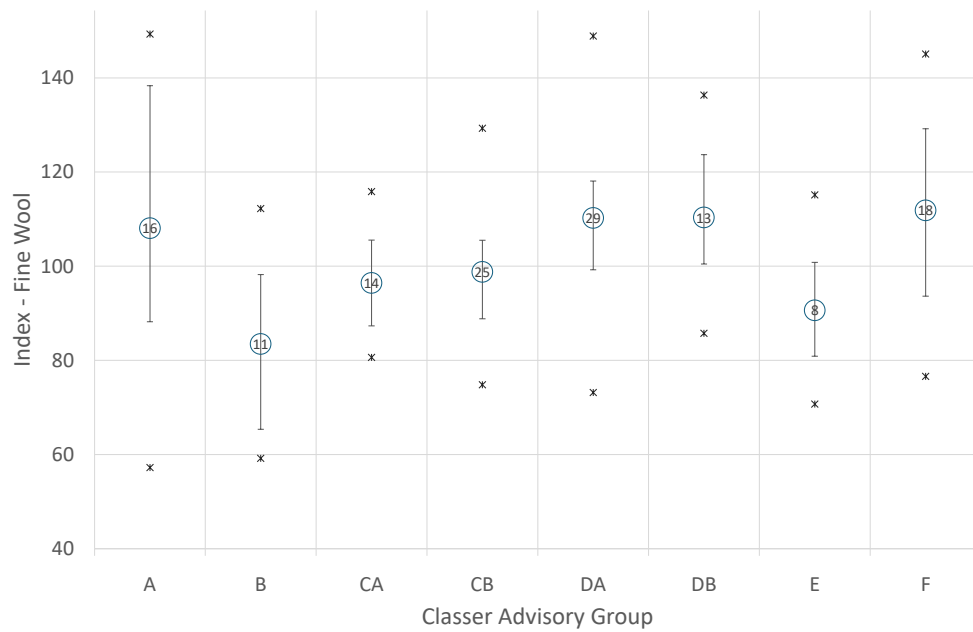


Figure 42: The Fine Wool index calculated from within project breeding value and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Wool Production

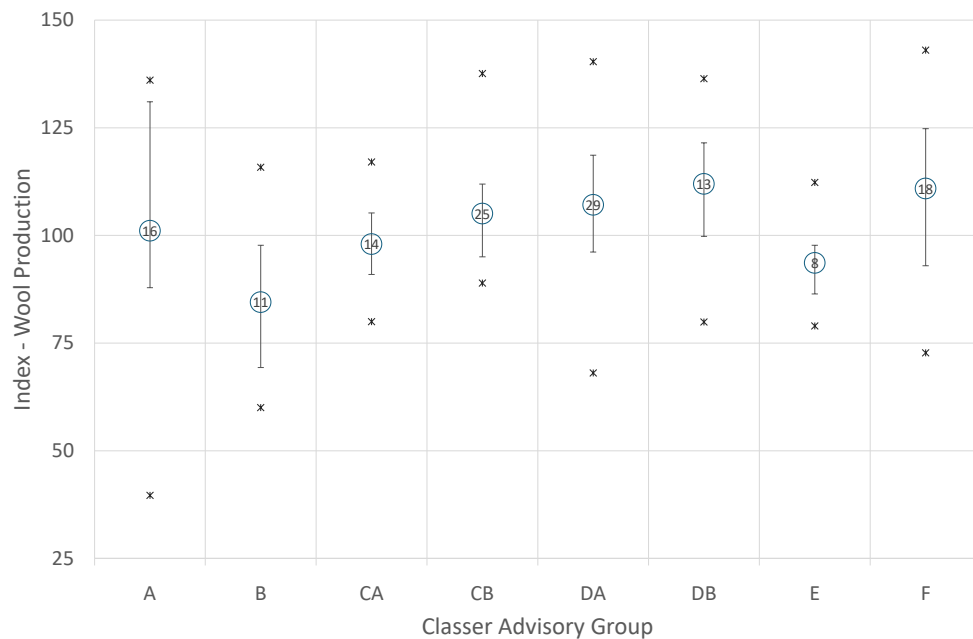


Figure 43: The Wool Production index calculated from within project breeding value and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Sustainable Merino

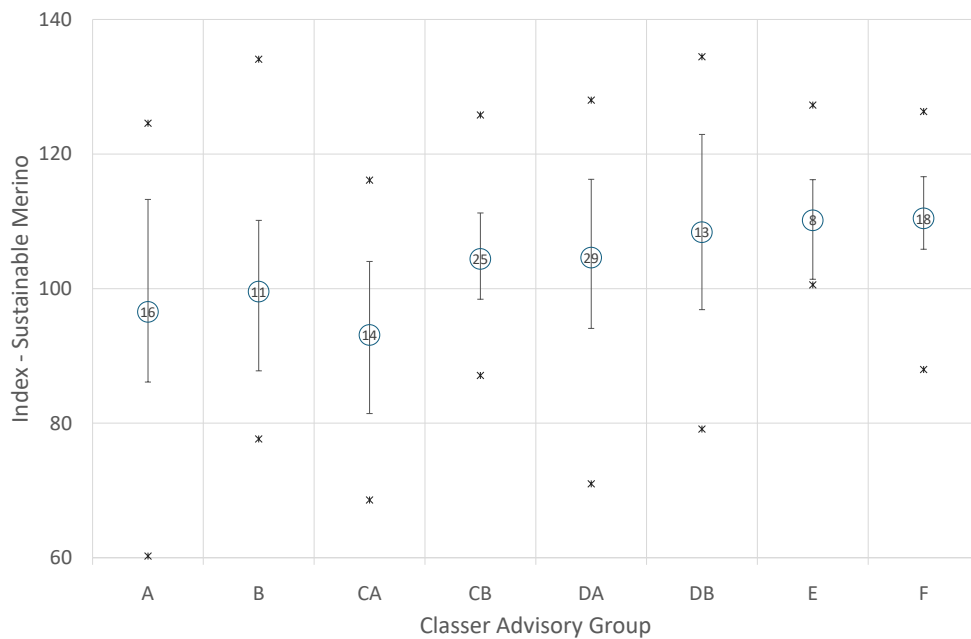


Figure 44: The Sustainable Merino index calculated from within project breeding value and the range (\$/yr) across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

## Merino Lamb

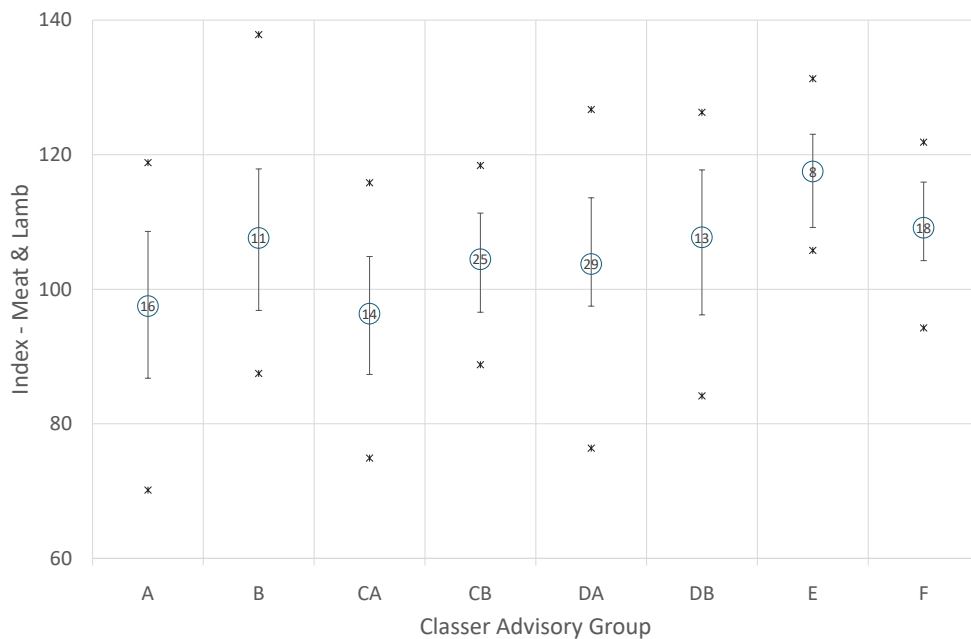


Figure 45: The Merino Lamb index calculated from within project breeding value and the range across the CAG groups for the 134 sire teams. The circle represents the average for the CAG group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

### 7.8.3. Conclusions

There is often heated debate within industry about the advantages and disadvantages of the different breeding philosophies used in the Merino seed stock industry, and the results of this analysis indicate that there are large differences in the financial performance of different sires within the industry. However, despite the large range within the sires it is not possible to draw strong conclusions about the superiority or not of different breeding philosophies because the variation between CAG groups was similar to the variation within the groups. Even conclusions about the poorer financial performance of CAG groups B (Free skin) and E (Growth focus) is tempered by the lower number of sires representing these groups in the trial. Most of the MLP sires were born between 2011 and 2016, so relatively soon, in breeding terms, after the creation of across flock breeding values in 2006. As such, the MLP project has limitations as a data source to draw specific conclusions about different breeding philosophies, other than to say that no breeding philosophy appears to have a clear financial advantage in the mid 2010's given the large variation that exists within each group.

Ram buyers finding a profitable ram sources for their breeding objective is more important than choosing a breeding philosophy. ASBVs along with the new genomic assessment tools can provide the evidence needed to best find the profitable ram sources. The future profitability of sires within each breeding philosophy will depend on the ability to identify superior animals for the traits that are financially important in the future.

## 7.9. Correlation between indexes and financial evaluation

### 7.9.1. Background

Indexes are another form of economic analysis carried out to quantify differences between teams in the economic merit of sires and dams, and there are 4 widely used industry indexes in use in Australia (Sheep Genetics 2024):

- (i) FW – Fine wool targets producers aiming for finer wool. The production system modelled is based on producing 15–17 micron wool from the breeding flock and a mixed age wether flock. The wool to meat income ratio of the production system is 75:25 weighted towards wool;
- (ii) WP – Wool production focuses on increasing total wool cut and staple strength. The production system modelled is a self-replacing system producing 16–18 micron wool from the breeding flock and a mixed age wether flock. With a wool to meat income ratio of 71:29 for this production model;
- (iii) SM – Sustainable Merino is a balanced index for self-replacing flocks, including sustainability and carcass traits. Based on a self-replacing Merino flock the production system produces 17–19 micron wool with lambs sold off-shears at a post weaning age. The production model is 46:54 wool to meat income ratio;
- (iv) ML – Merino Lamb is designed for Merino flocks producing prime lambs. Based on a self-replacing Merino flock joining ewes as ewe lambs with the older aged ewes joined to a terminal sire to produce crossbred lambs, the ewes produce 18–21 micron wool. The strong focus on producing lambs from the Merino ewe means that the production system is 31:69 wool to meat income ratio.

These indexes are important in determining industry breeding directions and the MLP economic analysis provides an opportunity to compare the indexes against the profitability estimates of the 134 sire teams. This section evaluates the correlation between the indexes and profitability.

### 7.9.2. Method

The within project index values for the sires used in the comparison were calculated by AGBU on 28 May 25.

Ordinary least squares regression was performed to evaluate the relationship between the selection indexes and the different measures of farm financial performance. The coefficient of determination ( $r^2$  - Table 11) was calculated from the Pearson correlation coefficient ( $r$ ). The result presented for the VOP was the correlation averaged over each drop for the 5 sites, for the GM the correlation was averaged over the 5 sites. For the profit analysis the individual results are presented for the 3 regional analyses. All correlations were calculated and are presented for each of the 3 price scenarios.

### 7.9.3. Results and Discussion

The correlation between the indices and the financial performance varied from very low to high (Table 11). The correlations were generally higher for the FW and WP indexes than for the SM and ML indexes across the 3 analysis methods, the only exceptions were the 10-year and 20-year price scenarios for the VOP analysis. For each price scenario the correlation for the FW and WP indexes were highest for the profit analysis and lowest for the VOP analysis, with GM intermediate. The high correlation between FW and WP indexes and most of the profit analysis scenarios confirm that there are similarities between the profit analysis approach used in this project and the approach used to develop the industry indexes using Sheep Object. The correlation of the SM & ML indices with profitability are much lower even though the production systems that underpin these 2 indices are more closely aligned to the production system evaluated in the profit analysis (17-19 $\mu$  wool with progeny sold off-shears at a post weaning age and wool:meat income ratio of 42:58). It is likely that the poorer correlation with profitability for SM & ML than FW & WP is associated with the weighting put on the traits aimed to future proof the enterprise but are not current profit drivers (breach wrinkle, dag, lean meat yield, intramuscular fat and worm egg count – van der Werf 2024).

Table 11: The correlation ( $r^2$ ) between the estimate of value of production (\$/EE), flock gross margin (\$/DSE) and profit per hectare (\$/ha) and the suite of MerinoSelect industry indexes (based on MLP within project BVs). The 3 price scenarios are presented for each analysis method. VOP is the average across sites and drops, GM is the average across sites and Profit is presented for each regional analysis. Colour coding: Very Low, Low, Moderate, High, Very High

Price scenario	Analysis method	Scenario	Industry index				Best index
			FW	WP	SM	ML	
10 yr	VOP	Site.Drop average	0.21	0.27	0.33	0.33	SM
	GM	Site average	0.34	0.27	0.07	0.04	FW
	Profit	Long growing	0.65	0.73	0.40	0.22	WP
		Med growing	0.58	0.67	0.40	0.22	WP
		Short growing	0.59	0.63	0.21	0.05	WP
5 yr	VOP	Site.Drop average	0.29	0.26	0.25	0.22	FW/WP
	GM	Site average	0.38	0.21	0.03	0.00	FW
	Profit	Long growing	0.61	0.40	0.15	0.05	FW
		Med growing	0.58	0.40	0.15	0.04	FW
		Short growing	0.61	0.42	0.10	0.01	FW
20 yr	VOP	Site.Drop average	0.19	0.26	0.35	0.34	SM
	GM	Site average	0.37	0.29	0.08	0.04	FW
	Profit	Long growing	0.62	0.64	0.37	0.21	FW/WP
		Med growing	0.62	0.61	0.37	0.22	FW/WP
		Short growing	0.62	0.59	0.21	0.05	FW/WP

#### 7.9.4. Conclusions

The correlation between the standard industry indices and the profit assessment was moderate to high for the FW and WP indices; low to moderate for the SM index; and the correlation with the ML index was low to very low. The lower correlation with the SM and ML deserves further investigation and may be associated the emphasis placed in the indexes on traits that future proof the enterprise. An index that is focused on the current profit drivers could be useful to compare with these indexes to provide understanding of the trade-off between profitability and the 'future' traits.

### 7.10. Change in Fleece Value with age

#### 7.10.1. Background and Method

Anecdotal evidence suggests that between studs there is a wide range in the change in fleece production as animals age. It is thought that this could be an important omission if selection is based purely on early in life wool production because early life performance may not be a good indicator of whole of life.

The importance of lifetime fleece value change (FVC) on flock profitability was quantified by estimating FVC for each sire team and regressing against estimated flock profitability in a model that included YCFW & YFD but excluded ACFW & AFD. The fitted model reflects the fleece weight and fibre diameter information available when selecting on early in life fleece production and tests the importance of being able to estimate FVC at that time. Extra detail on the method is presented below.

FVC for each team was estimated using the annual fleece value for the ewes estimated in the value of production (VOP) analysis carried out previously (for details see milestones 540, 560 & 570). The fleece value was estimated using 10-year median prices from adjusted sire means for CFW, FD, SS & SL averaged across the F1 ewe progeny at each shearing. An across site analysis was carried out that included Sire, Site.Year, Age (linear and quadratic effects) and Sire x Age. Site.Year was included as a factor with levels for each year at each site. This factor represents seasonal differences in feed availability and differences in the duration between shearings. The shearing duration at some sites and years was different to 12 months but changes in shearing date were consistent across the drops so were represented by the Site.Year term. The model was fitted as least squares regression and had an  $r^2$  of 0.91 and all coefficients in the model were significant ( $p < 0.05$ ). The coefficients for Sire x Age are the annual change in fleece value for each sire team (See the appendix Table 21 for fleece value change for each sire).

The correlation between FVC and the production traits was estimated for all the production traits used in the estimation of profit. This correlation provides a picture about correlated traits that could be used to select for improved FVC.

A multiple regression was fitted to determine the contribution of each trait to explaining the variation in profit per team as described in section 7.7.1. However, for this analysis ACFW & AFD were excluded from the analysis and FVC for each team was included. Although profit was estimated including the FBVs for ACFW & AFD, the multiple regression captured the variation in these traits using FVC. As such, the economic value of Yearling (or Hogget) CFW and FD plus FVC represents the lifetime fleece value.

### 7.10.2. Results

The range of FVC across the sire teams was between an increase of \$2.02 to a reduction of \$4.51 per year across the 5 or 6 full wool shearings (Table 21), indicating a big range in the increase or decrease in adult fleece value. However, there was little difference across the CA groups except for an indication that Group A may have a slightly greater reduction in fleece value with age (Figure 46).

The correlation between FVC and the other production traits is low, indicating that it is difficult to identify teams that differ in FVC from current early in life measurements and therefore the later in life traits need to be directly measured. The highest correlation was with AWT, YWT and AFD being 0.21, 0.15 and 0.11. For each of these 3 traits, increases in the trait resulted in positive change in fleece value with age. Of these traits, YWT with a correlation of 0.15 is the only trait available early in life.

The estimated economic value of FVC was \$0.27 per standard deviation (Table 12) so the incentive to measure adult CFW & FD appears to be low. However, the cost of practices or measurement that would improve FVC appears to be poorly understood as does the correlation between FVC and other traits. Given the \$6.50/hd/yr range in FVC this could represent an avenue for further research using the MLP database. This could include an analysis that compared the expected genetic gain and the profitability of flocks that only measured early in life production versus a flock that also assessed adult production. This analysis is not possible from the production measurements used for the current economic analysis because it requires quantifying the effect of the increased selection pressure on adult traits with the trade-off in the reduction in gain from the traits that are adversely affected.

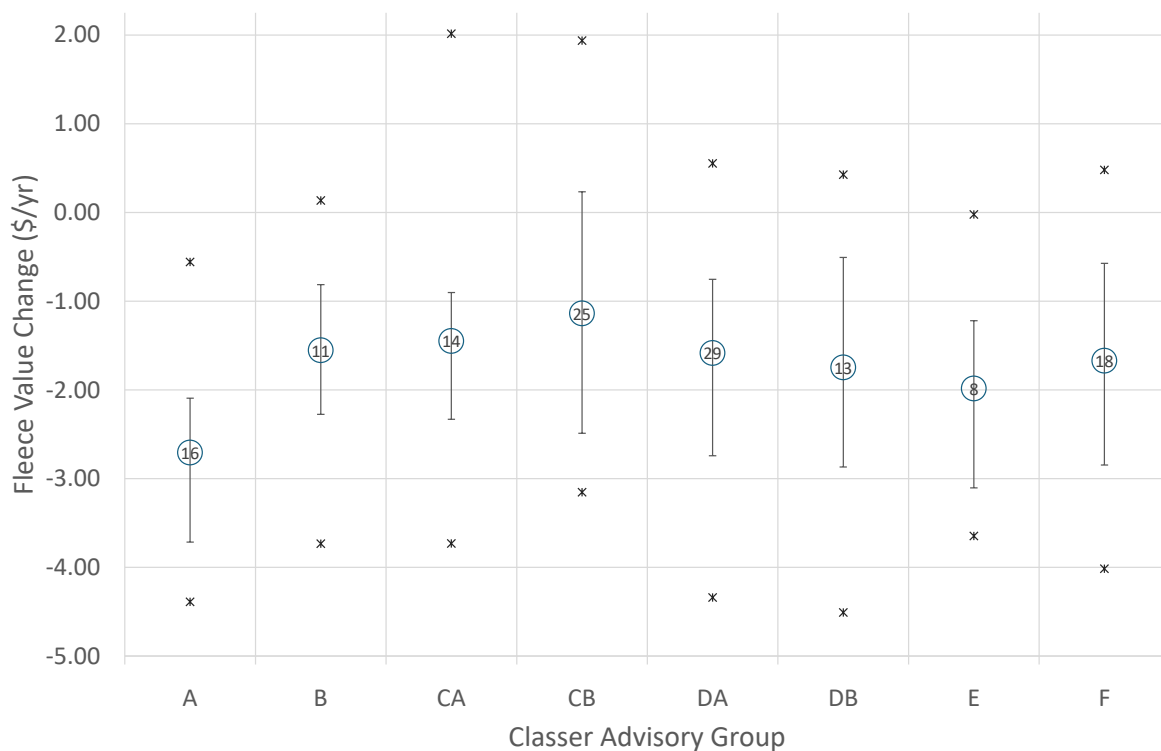


Figure 46: Fleece Value Change and the range (\$/yr) across the CA groups for the 134 sire teams. The value is calculated from annual ewe fleece at each shearing as estimated in the value of production analysis. The circle

represents the average for the CA group, number in the circle is the number of teams in the group, the length of the whiskers is the 25 and 75 percentiles and the \* is the highest and lowest team in the group.

Table 12: Estimated economic value of a 1 standard deviation variation of each trait, comparing the coefficients when the regression model includes adult CFW and FD with the coefficients when those traits are replaced with annual change in fleece value.

Trait	Including ACFW & AFD	Including Change in Fleece Value
Adult weight (kg)	0.28	0.12
Yearling fat depth (mm)	0.20	0.60
Adult CFW (kg)	2.51	
Yearling CFW (kg)	1.55	3.19
Adult FD ( $\mu\text{m}$ )	2.29	
Yearling FD ( $\mu\text{m}$ )	0.91	2.64
Adult SS (N/kTex)	0.50	0.49
Adult SL (mm)	0.05	0.58
Change in Fleece Value		0.02
Conception (%)	1.40	1.25
Litter size (%)	1.32	1.12
Ewe rearing ability (%)	1.31	1.43
Survival Y-A5 (%)	0.24	0.11

### 7.11. Ewe and wether correlations

The correlation ( $r^2$ ) between the value of wool produced by wethers at different ages and the value of wool from adult ewes was compared using the VOP results that are based on adjusted sire means. Similarly, the estimated sale value of the wethers at different ages was compared with the sale value of CFA ewes. These results give an indication of the accuracy with which variation between teams in fleece value and sale value from wether trials predicts variation in fleece value and sale value of adult ewes. The variation will in part be described by variation in (i) nutrition for ewes and wethers in the trial; (ii) differences in ages; and (iii) ewe fleece value being affected by reproduction. For fleece value the correlation improves for later measurements of wether fleece value, with the correlation increasing from 0.39 at post weaning age up to 0.68 at 2 years of age. When both ewes and wethers are compared at yearling age the correlation averaged 0.7, with a range from 0.54 to 0.86. The correlation for sale value was lower and at all the ages the correlation was less than 0.20.

These results indicate that wether trials can reflect adult ewe fleece value if retained out to 2 years of age, however, at some sites the correlation was still as low as 0.56. Assessment of wether sale value at any age was a poor estimator of adult ewe sale value.

Table 13: Correlation ( $r^2$ ) and (range) between the value of wool production from wethers at post weaning, yearling and 2 yo shearing (\$/hd) with the total value of wool produced by adult ewes (\$/hd, 2+3+4+5yo) and the correlation of sale value of wethers (\$/hd) estimated at post-weaning, yearling and A2 age with sale value of CFA ewes (\$/hd).

	PW wethers	Yearling wethers	2yo wethers
Wool	0.39 (0.18 – 0.72)	0.55 (0.35 – 0.81)	0.68 (0.56 – 0.90)
Meat	0.1 (0 – 0.24)	0.18 (0.01 – 0.54)	0.14 (0.02 – 0.21)

## 7.12. Project Conclusions

The MLP project provides a valuable resource for genetic and economic analysis and the analyses in this project have reinforced the finding that genetic variation is an important driver of on-farm profitability (Clarke *et al.* 2019; Wallace *et al.* 2021). Each analysis technique showed a range in financial outcome linked to sire variation of 5 to 10% between the 75<sup>th</sup> and 25<sup>th</sup> percentile and a range of 20 to 40% between the highest and lowest ranked sires. This variation in financial outcome is equivalent to variation in the breakeven ram price from \$2180 to \$2885/head for the 75<sup>th</sup> and 25<sup>th</sup> percentile sires or \$500 to \$3600/head for the extreme sires. Indicating there is significant financial reward for commercial producers to quantify their breeding objective and price rams based on this objective.

The analyses carried out in this project have used production systems that are relevant to a broad cross section of the Australian Merino industry. In the VOP and GM analyses the production system was based on the flock management at each site and selling wethers at the post weaning LW assessment. In the profit analysis the production system was optimised for each sire team, and the team average for wether sale age was 8.9 months old and the proportion of income from wool was 42%. Although the findings are relevant to a broad cross section of production systems and a diversity of traits where valued (reproduction, mortality, weight, carcass fat, fleece weight, fibre diameter, staple strength and staple length), the results will not reflect variation in profitability in all production systems and all environments. Important exceptions are super fine and ultra fine wool producers. The analysis did represent historic prices for wool down to 13.5µ and did represent the increasing premiums as FD reduced, however, it didn't represent factors such as style, character and skirting ratios that are an important profit driver in these segments. The analysis also did not attempt to value the traits associated with worm and fly control. The analysis assumed effective animal husbandry practices with minimal worm burdens and flystrike, which reflects the practice at the trial sites where animal husbandry inputs were aimed at ensuring the least resistant animals did not have animal welfare problems. Therefore, teams with greater resistance to worms and flies did not have an opportunity to express their resistance and it was not valued in the financial analyses. This is a realistic representation of current commercial farm practice where effective worm and fly control is available at relatively low cost. However, the results will not reflect future (or current) scenarios where worm and fly control are more challenging and more expensive.

Although the range in financial performance was similar for each analysis technique the correlation between the techniques was only low to moderate, demonstrating that choice of technique is important. It is concluded that the representation of the feed budget and the management of the flock are important factors to consider in economic evaluations of genetic comparisons. The variation between the outcomes of the 3 methodologies indicates that the link between analysis outcome and on-farm implementation needs strengthening to increase confidence in the on-farm outcomes. However, it is expected that the modelling approaches (such as AFO and GrassGro), that represent the feed budget in greater detail and can represent changes in management of sale animals, provide a better picture of profitability for producers managing animals as a single genotype. The modelling approaches represent the on-farm management adjustments made to match sale age with the weight and fat score of the animals rather than managing as a diverse group of genotypes and selling/valuing all animals at the same age as done in genetic comparisons.

The economic values of the traits included in the profit analysis were estimated using a multiple regression approach. These estimated economic values are useful approximations to highlight the contribution of each trait to profitability. Fleece value and weaning rate were the main contributors to variation in profitability of the individual teams. However, the minor

traits also contribute to financial outcome and need to be incorporated in a balanced way that reflects future expectations for prices and production systems.

Comparison of the groups of teams identified by the classer advisory group showed that each breeding philosophy (except for group B and perhaps E) had bred high profit sires and a significant financial advantage of one approach over another is not apparent. However, it is difficult to draw firm conclusions about the different breeding philosophies because there is appreciable difference between teams within each CAG group and the variation between CAG groups is similar to the variation within the groups. Sire teams in each CAG group had achieved gains in profitability through variation in different traits, however, it is not possible to determine if this is due to difference in the breeding objective or difference in the efficacy of the different breeding philosophies or breeders to identify animals that excel in different traits. The future profitability of studs and sires with each breeding philosophy will depend on the ability to identify superior animals for the traits that are financially important in the future.

Although economists and geneticists have historically worked independently when valuing traits and estimating the value of genetic gain, this separation may be limiting the progress being achieved by industry. The importance of achieving the correct balance of traits to maximise on-farm profitability has been demonstrated in this analysis by the 20-40% range in estimated profitability between the most and least profitable teams evaluated. The breeding objective is the driver of the resulting balance of traits from a breeding programme and in quantitative genetics this is quantified through the economic values of traits and the variation with age stage. Identifying and valuing the traits is central to useful economic values. Variation in outcomes from the three analysis methodologies, alongside very low to moderate correlations between farm profitability and the SM/ML indexes, emphasise the importance of improving collaboration between geneticists and economists to optimise integration of their skill sets. It is therefore recommended that collaboration between the 2 groups is facilitated as an industry priority.

An index that is focused on current profit drivers could be useful for producers to understand the priority placed on immediate profitability versus future profitability. This may be especially so if the reason for the low correlation between profit and the SM/ML indexes is associated with the indexes focussing on improving traits that are expected to be valuable in the future.

The contribution of survival to the variation in profitability was shown to be similar to the contribution from carcase fat depth, staple strength and staple length. The low economic value is associated with the low variation in survival between the teams. The value of a 1% improvement in survival (\$0.57) is greater than a 1% increase in CFW (\$0.26), but the standard deviation is an order of magnitude lower. The conclusion is that an ASBV for survival is a similar priority to fleece and carcase quality traits, however, it is an easier trait for breeders and farmers to observe so the adoption may be quicker than for traits such as IMF and shear force.

A preliminary analysis of the change in fleece value as animals age, showed there was a large range of \$6.50/hd/yr between the highest and lowest teams and there was a low correlation between FVC and other production traits, indicating that the later in life traits need to be directly measured. Furthermore, the economic value of the trait was low, giving a mixed message about the importance of further research. The discussion within industry suggests that there are unanswered questions and these may be addressable using the MLP database, possibly an analysis that compares the expected genetic gain and the profitability of flocks that only measure early in life production versus flocks that also measured adult production. This would require quantifying the effect of the increased selection pressure on adult traits with the trade-off in the reduction in gain in other traits.

This work has highlighted avenues to improve future economic analysis of genetic comparisons:

1. It is recommended that future economic evaluations of genetic comparisons use a modelling approach to improve the representation of the feed budget and the on-farm management changes linked with making genetic change. This recommendation is subject to the limitation described below.
2. The constraint to widespread use of models to evaluate genetic comparisons is the complexity in calibrating the genotypes to represent the different genotypes in the models. The models, AFO and GrassGro, need to be adapted to simplify the process of calibrating the genotypes and then comparing profitability. Furthermore, the calibration of reproduction in GrassGro would need to be improved so that changes in ewe rearing ability can be represented rather than weaning rate only being controlled by altering conception, as carried out by Wallace *et al.* (2021).
3. The findings of this economic evaluation could be enhanced once the GEPEP project has been finalised. In this evaluation the value of fatness is solely reflecting the contribution of carcass fat depth to the value of sale animals and is a relatively low value. However, the findings in the GEPEP project is that genetic fatness is substantially undervalued, so the upward revision may re-rank the team.
4. Different levels of analysis are useful for different audiences because of the differences in belief about quantitative genetics. It is recommended that a future analysis examine the outcome of using the different data separate to altering the representation of the on-farm management as done in this analysis, so that analysis method and data are not confounded.
5. Development of economic approaches to quantify the hard to estimate traits is required to properly represent and balance the complete breeding picture. This includes traits such as WEC, IMF, MEQ, LMY, Footrot, Flystrike and non-mulesing traits (wrinkle, stain, dag). This would improve the analysis in this report that included the contribution of CFW, FD, SS, SL, Body weight, conception, litter size, ewe rearing ability and survival.
6. Qualitative research to identify the management decisions of commercial farmers when assessing changes linked to changing genotype, including the on-farm feed budget, flock age structure and nutrition management.

### 7.13. References

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## 7.14. Appendix

### 7.14.1. Prices and Income calculations

The prices used in the analyses were chosen to be consistent with the prices used in SheepObject (Swan and Walkom *pers. comm.*). The standard prices for wool, meat and grain used in the analysis were based on the 50<sup>th</sup> percentile nominal prices received over the last 10 years (Source: Andrew Wood, Mecardo and Ag Commodity Prices). Two other scenarios were examined being the median price over a 5-year period and the median over a 20-year period. The sensitivity analysis varied wool price, sale sheep price and supplement price concurrently, i.e. there are 3 price scenarios (short, medium and longer term).

#### 7.14.1.1. Wool prices

The wool specifications used to estimate the wool price received were fibre diameter, staple strength and staple length. These are explained in more detail below.

Prices were calculated to represent the value of the measured fleece weight accounting for the different components of the clip, i.e. "sweep the floor" (STB). The expected proportion of each component of the fleece, the variation in average fibre diameter between the components and the prices for each component were based on relative prices reported by Mecardo (2021a - Table 14). The proportion of the wool allocated to fleece, pieces, bellies and locks was fixed across teams, because, although fine wool flocks prepare clips with a higher proportion of pieces, there was no data collected to back this industry wide generalisation between teams.

Table 14: Parameters required to calculate the sweep the board scalar. Source Mecardo 2021a (8 Feb 2021).

	Fleece	Pieces	Bellies	Locks	Crutchings
Proportion of clip (%)	78.0	13.0	4.1	2.1	3.4
FD relative to Fleece ( $\mu$ )	0	-0.9	-0.3	-0.6	0.2
Price relative to MPG (%)	95.9				
Price relative to fleece (%)		86.5	84.5	62.6	66.7

The price per kg is net of the cost of selling, wool tax and freight to store (see Table 15 for the selling costs).

Table 15: Wool selling costs. Note: Some costs are incurred per kilogram and other costs are incurred as a proportion. The 'per kg' and the 'percentage' costs are summed to generate a total cost.

	\$/bale	Bale wt	\$/kg greasy	%
Freight	18	186	0.10	
Broker costs (\$/kg greasy)			0.25	0.5%
Testing costs (\$/kg greasy)			0.10	
Levies				1.5%
Total (\$/kg greasy)			\$0.45	
Average yield			64.2%	
Total (/kg clean)			\$0.70	2.0%

Fibre diameter

The price of fleece wool for the fibre diameter range between 13.5 and 19 $\mu$  was a combination of data provided by Andrew Woods (*pers comm.*) and information from Mecardo (2022). Andrew Woods provided information on the wool price in 0.5 micron increments down to 13  $\mu$  and this information included price data that could be used to calculate median prices for a 5 and 10 year horizon. Mecardo (2022) document prices down to 14 $\mu$ , this was

extrapolated to 13.5 using the information from Andrew Woods. Prices from 20 to 30 $\mu$  was sourced from Ag Commodity Prices (2024) which included 5-, 10- and 20-year median prices. This range of prices by FD is sufficient for the teams being assessed across all the sites (Figure 47).

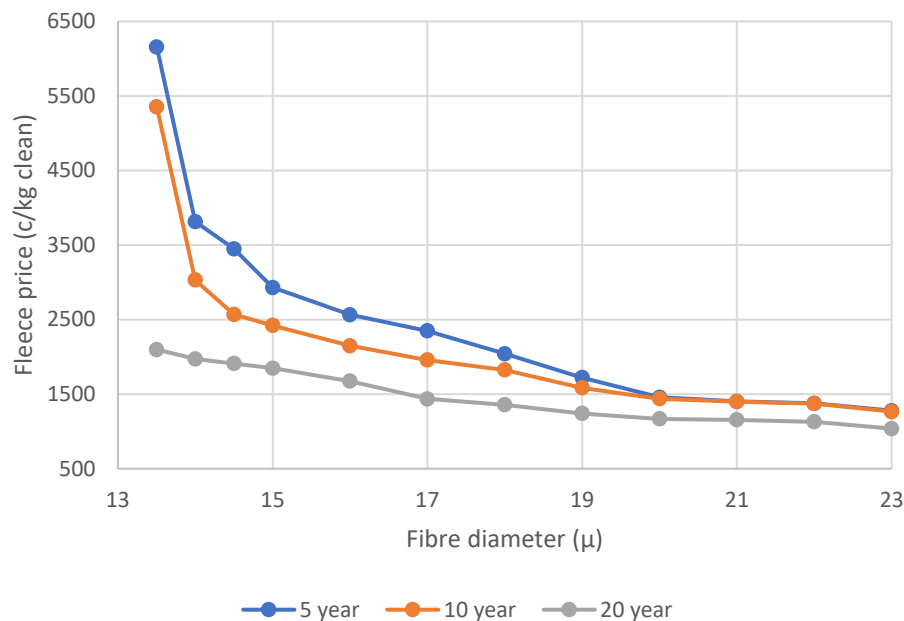


Figure 47: Micron price guide for wool of different fibre diameter for the 3 price scenarios tested - Standard prices- median over 10 year horizon (●), average prices over 5 year horizon (●), average prices over 20 year horizon (●).

#### Staple strength

The SS premium and discounts (P&Ds) were adjusted with the sensitivity on the time horizon for the commodity prices. The P&Ds were based on the 5 and 10 year staple strength P&Ds reported from Mecardo (2024). Data was presented for 15, 17, 19 and 21 $\mu$  (Figure 48) and these values have been extrapolated to the range of FD required by the teams by assuming that the P&Ds as a proportion of the fleece price is constant for the range below 15 $\mu$ . Above 21 $\mu$  it is assumed the down trend in the P&Ds with increasing FD continues to zero value, which occurs at about 24 $\mu$ . Due to lack of data, in the range <18N/kTex and >55N/kTex it has been assumed that the discount or premium is constant.

The P&Ds for staple strength have been much lower in the last 10 years than the 10 years prior (Mecardo Sep 2021b). The P&Ds for the 20 year timeframe have been based on the scaling the 10 year time frame by a factor of 1.8 times which was derived from graphs produced by Mecardo (2021b).

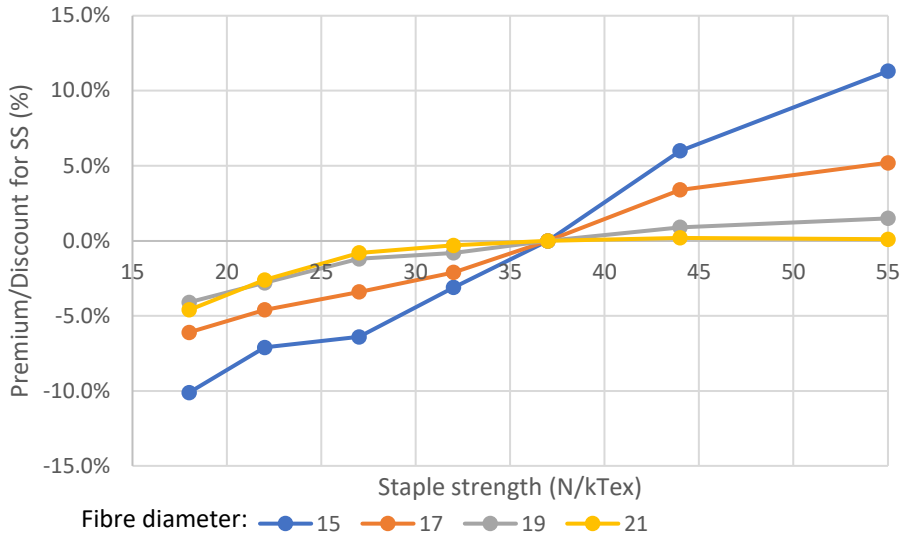


Figure 48: The median premium or discount (%) for staple strength over a 10 year period and the variation due to fibre diameter. Note: FD lower than 15µ use the 15µ value. Above 21µ the value is interpolated from a linear trend of discount and FD. Within the range 15µ to 21µ, the value is interpolated between the values shown.

#### Staple length

The SL P&D used in this analysis were based on more limited data than was available for staple strength. The magnitude of the discount for shorter and longer SL across the range of FD was scaled by the same factors as those derived for SS on the basis that SL and SS both have a similar effect on processing performance as shown by the Team3 equation for predicted hauteur (Team3 2004). The discount for varying SL for 17µ wool was based on reporting from Mecardo (2021c).

The 5 year average P&Ds showed that the discount for low staple length had a discontinuity at 50mm at which point there was a 15% reduction in the value of the wool (Figure 49). Below and above this point a change in SL was associated with the same change in price per mm. The maximum price was achieved over a range of SL, and above the optimum range the price dropped linearly with increasing staple length. The optimum SL range and the rate of price reduction was assumed to vary by FD, 15µ and below it was assumed the maximum price was achieved between 68 and 85mm and the price reduction was 0.56%/mm below 68mm and 0.28%/mm above 85mm. For 17µ the optimum range was 73 to 90mm with a price drop of 0.4%/mm on the low end and 0.2%/mm on the high end. For 19µ and above, 83 to 100mm with 0.2%/mm and 0.1%/mm (Figure 49).

The SL P&Ds were not adjusted with the sensitivity on the time horizon used for the commodity prices due to a lack of data.

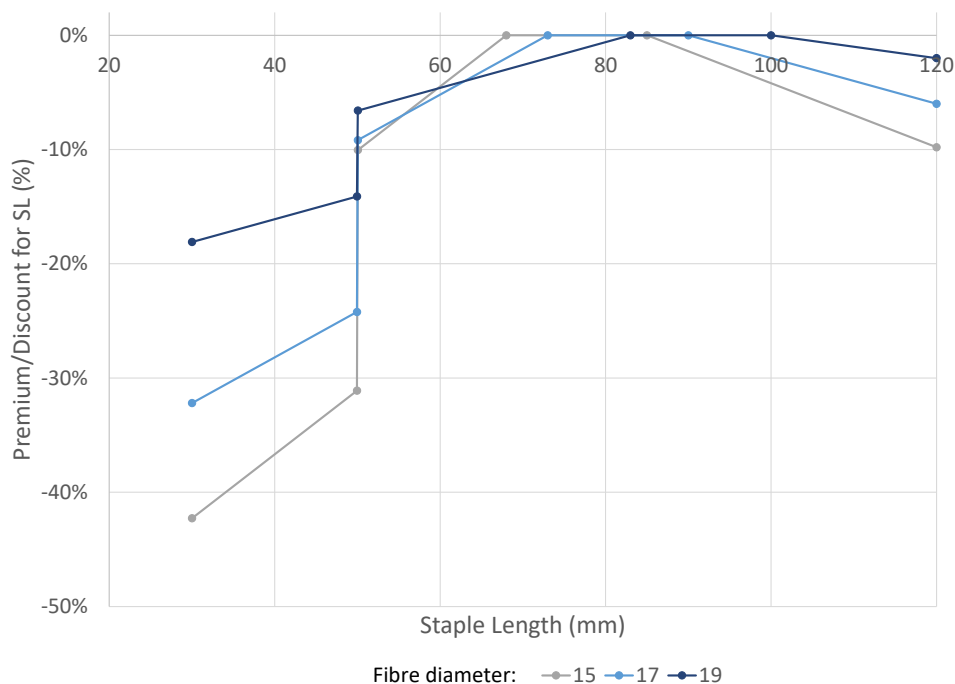


Figure 49: The discount (%) for staple length and the variation due to fibre diameter. Note: FD outside the range 15 to 19μ use either the 15 or 19μ value. Within the range, the value is interpolated between the values shown.

#### 7.14.1.2. Sale sheep prices

Sale animals were calculated from the dressed weight (DW) of the animal and value/kg. The net value of the sale sheep is calculated accounting for the selling costs, some of which are a percentage of the gross proceeds and some are on a cost per head (Table 16).

Table 16: Livestock selling costs. Note: Some costs are incurred per kilogram and other costs are incurred as a proportion of the price received. The 'per kg' and the 'percentage' costs are summed to generate a total cost.

	\$/hd	%
Freight	3.00	
Commission (%)		5.0
Fees (\$/hd)	0.17	
Insurance (%)		0.45
Levies - Lamb	1.50	
Mutton	0.20	
Total Lamb	\$4.67	5.45%
Mutton	\$3.37	5.45%

The value per kilogram was estimated from the price per kg for animals with premium specifications and was then scaled using a prime lamb grid or mutton grid using DW and fat score. The standard for the 'premium' price for each grid was the 10-yr median nominal price, with sensitivity carried out for the 5yr and 20yr median prices (Table 17).

Table 17: Mutton and lamb prices (c/kg dressed weight) for animals meeting the premium specifications (Mutton: 18-26kg DW fat score 2 to 3, Prime lamb: 22-28kg DW fat score 2 to 3) and the range of percentiles from the last 20 years (Source: Mecardo 2023; Ag Commodity Prices 2024).

	5 yr median c/kg DW (% of median)	10 yr Median c/kg DW	20 yr median c/kg DW (% of median)
Mutton	538 (+35%)	399	304 (-24%)
Restocker ewes	700 (+35%)	519	395 (-24%)
Prime lamb	745 (+19%)	626	501 (-20%)

As described in more detail below, the price received for the sale animals in each team were scaled from this ‘premium specs’ quote using a grid based on the specification of dressed weight and fat score for the sale animals for each sire team (see Table 19 and Table 20).

The method used to estimate fat score depended on the information available at the time of sale. If condition score was available, then fat depth was estimated using Equation 1 from van Burgel *et al.* (2011). The relationship used when making the estimation from CS was based on the average of the 2 experiments published. In the 2 trials the slope was consistent (0.06) but the estimates of the intercept varied from 2.5 to 3.2. The relationship using the average value of 2.85 leads to a CS of 3.15 equating to 5mm of GR tissue depth (fat score 2) and CS 3.75 equating to 15mm of GR tissue depth (fat score 4). If condition score was not available then fat depth at the GR site was estimated from ultra sound fat depth at the c site using [Equation 2 -fat depth \(GR\) =  \$\frac{\text{fat depth \(c site\)}-1.2}{0.22}\$](#)  [Source: van Burgel et al. \(2011\) Fig 5b](#). A fat depth of 2.3mm equates to 5mm GR tissue depth (fat score 2) and 4.5mm equates to 15mm of GR tissue depth (fat score 4). If neither CS nor a fat depth assessment were available then fat score defaults to 2.

$$\text{Equation 1 -fat depth (GR)} = \frac{\text{condition score}-2.85}{0.06} \text{ Source: van Burgel et al. (2011) Fig 3}$$

$$\text{Equation 2 -fat depth (GR)} = \frac{\text{fat depth (c site)}-1.2}{0.22} \text{ Source: van Burgel et al. (2011) Fig 5b}$$

The dressing percentage for the animals was estimated from a reference value of 45% for a weaned second cross lamb with a fat score of 3, fleece length 50mm and 3 hours off feed. Adjustments were made for (Source: MLA Sheep Assessment Manual 1/2017):

- Breed. Merinos are 2.5% lower
- Fat score: Each unit of fat score below or above 3 reduces or increases dressing percentage by 2%. E.g. the dressing percentage of an animal with a fat score of 1 was reduced by 4% and fat score 4 was increased by 2%.
- Age. The dressing percentage was reduced by 1% for animals between 1 and 2 years old and by 2% for older animals.
- Sex. The dressing percentage of ewes was reduced by 1% compared to wethers

There are differences in price during the year which affects sale price for flocks that shear and sell at different times of the year, and for flocks that sell empty ewes at scanning. The variation in price during the year is based on historical monthly price movements for lamb and mutton, for each month relative to the annual low in Oct (Table 18).

Table 18: Price variation of mutton and lamb for each month of the year. Source: MLA and NLIS price reports collated by Michael Young (pers comm.).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mutton	6%	2%	10%	14%	9%	14%	17%	15%	6%	0%	7%	6%
Lamb	11%	4%	13%	11%	9%	16%	15%	12%	-2%	0%	8%	5%

Ewes and older wethers

Cast-for-age (CFA) Ewes and older wethers were valued on the basis of being sold into the mutton market. The price received for animals meeting premium mutton specifications was based on the national percentiles for mutton (Table 17) and the values for animals with poorer specs were scaled by using the grid of weight and fat score (Table 19).

Dressed weight was estimated from LW as outlined above including the adjustment for fat score, age and sex (described below).

Table 19: Weight and fat score grid and the price scalar for mutton prices. The scalar is of the reported 'premium' mutton price for the percentiles tested. The actual price per kg received for mutton is calculated by multiplying the percentile (\$/kg) by the scalar in this table.

Dressed weight (kg)	Fat score				
	1	2	3	4	5
10.1	58%	58%	58%	58%	38%
14.1	85%	85%	85%	85%	38%
18.1	96%	100%	100%	100%	77%
35.1	87%	94%	94%	94%	77%
40.1	85%	88%	88%	88%	77%
45.1	77%	77%	77%	77%	77%

Surplus young ewes sold as restockers

Young ewes are valued as being sold into the restocker breeding market. They receive a 30% premium above the mutton price provided they are a minimum of CS 2.5 and are shorn and sold prior to 2 years of age. Below CS 2.5 or after 2 years of age they are valued as mutton. This method for valuation results in larger frame young ewes selling for a higher price than smaller frame ewes.

Lambs

The value of animals younger than 13 months of age was based on being sold as prime lamb if heavier than 18kg, air-freight lamb if between 16 and 18kg, store lamb if lighter than 16kg at the time of sale and 'no commercial value' (ncv) if less than 10kg. The sale grid scalars (dressed weight by fat score) reflect these 3 options - prime lamb, air freight and store lamb (Table 20).

Dressed weight was estimated from LW assuming a dressing percentage of 42.5% with an adjustment for fat score (described above).

Table 20: Weight and fat score grid of the price scalar for lamb prices. The scalar is of the prime lamb price for the percentiles tested.

	Dressed weight (kg)	Fat score				
		1	2	3	4	5
	Less than 10kg	ncv	ncv	ncv	ncv	ncv
Store	10 – 16	75%	71%	71%	71%	85%
Air freight	16.1 – 18	69%	90%	90%	90%	65%
Prime lamb	18.1 – 28	66%	100%	100%	100%	60%
"	28.1 – 31	71%	88%	88%	88%	68%
"	31.1 –	76%	75%	75%	75%	81%

### 7.14.1.3. References for Prices

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#### 7.14.2. Value of Production per head

##### 7.14.2.1. *Data – Adjusted sire means*

Measured fleece production traits and individual animal meat production traits (at the first assessment post shearing) have been used to calculate value of wool production and value of sale animals. Weaning rate and annual mortality were combined with the above traits to calculate the Flock VOP. See the site reports for all the production values. The timing of lambing and shearing varied between sites and this affects which weight assessments were utilised to calculate sale values.

##### 7.14.2.2. *Detailed Methodology*

The VOP was calculated for each age group of ewes and wethers for each management period in which they were measured. The management periods span from one shearing to the next and are generally one year but can vary based on the shearing interval and often the management period from weaning to the first shearing was less than 12 months.

The analyses calculated:

- the value of wool produced per animal shorn
- the sale value of the animal if it were sold at the end of the management period
- the value of wool and sale animals for a flock, calculated per ewe equivalent grazing pressure.

All are net of selling costs and the wool and sale values were calculated per head for each age group of the ewes and wethers separately, as well as a combined whole of flock VOP per ewe equivalent.

The whole flock VOP includes income from:

- The annual wool clip
- the sale of cast-for-age ewes at the end of the trial period
- the sale of surplus young ewes and the wether progeny based on the sale age strategy.

The estimation of value of production per head has been carried out for all age groups of ewes and wethers that were measured, whereas the Flock VOP was calculated for a flock with the specified sale age strategy as discussed in the 'Numbers' section below.

Notes on interpreting the VOP results:

- Value of production is based on measured production (with corrections only for ewe source, dam age and birth type rear type) and is not adjusted for heritability and genetic correlations between traits. As such, it is not a 'best' estimate of the profitability if a sire was used over another flock of ewes.
- The estimates of value of production reflects the management as implemented in the trial for grazing intensity, time of lambing and time of shearing, and include differences between teams in mortality, wool value, reproduction and sale value of progeny and old ewes.
- The results include VOP for each age group of ewe, however, this is not a good picture of the change in VOP by age because the trial design doesn't allow separation of the age effects and variation due to seasonal conditions between years at the site.
- The differences in management and nutrition across sites and year drop mean the results are not comparable for sire teams across years within a site or across sites and this explains why the link sires have a separate VOP for each site and year drop in which they are represented.
- VOP only focuses on income and does not take into account the cost of production (husbandry, supplementary feeding, contract and labour) to obtain that income.
- Value of production is expressed per head and does not account for the feed requirement of the animals. For example, it has not been taken into account that ewes that wean more lambs require more energy and are therefore likely to be run at a reduced number per hectare.
- The VOP as calculated represents the productivity of the sire team in the project environment with the grazing intensity as carried out at the site and selling surplus young ewes as hoggets and wethers after the post-weaning shearing. This may not be the nutritional and management conditions that best suit all the teams.

Numbers (Reproduction and mortality)

The weaning rate was sourced from the raw data tables in the Final Site Reports and has not been corrected for factors associated with the dam of the F1 ewes. The number of ewes at each stage was sourced from the raw data tables in the Final Site Report, which are based on the number of ewes at classing prior to shearing. This data has been cleaned and there were no unusual numbers for any of the teams when compared between years.

The numbers of wethers at each stage were not published in the site report and this data was sourced from the number of animals present when body weights were taken. This data does include anomalies with some animals missing at some of the assessment times but present again later. In these circumstances the data was cleaned by increasing the number of animals in the team to align with the higher number at subsequent assessments.

The cleaned 'annual' numbers data was then adjusted for animals that went missing due to 'misadventure'. The number of animals lost to 'misadventure' varied across sites and year, and the correction was made by reducing the potential number of animals from which cumulative survival was calculated.

The calculations carried out included

1. Cumulative survival between the annual assessment of animal numbers.  
*cumulative survival = current numbers / potential number of animals*

Where:

$$\text{potential numbers} = \text{number weaned} - \text{losses to date due to misadventure}$$

2. Annual survival which is the proportion of animals surviving at the end of the year relative to numbers at the start of the year.

$$\text{annual survival} = \text{cumulative survival (end)} / \text{cumulative survival (start)}$$

The impact of including mortality will be greater for this value of production evaluation, that is based on phenotypic evaluation of mortality, than for the gross margins and profit assessments. In the gross margin and profit analyses the effects of mortality will be based on estimated breeding values for mortality which have much less variation than phenotypic observation of mortality.

#### Wool value calculation

The wool production data was corrected for the F1 progeny's birth-type-rear-type (BTRT), progeny's date of birth, dam source, dam age and birth group (AI or backup). Using corrected values improves the comparison of the value of the progeny at a common reproductive rate because it removes the penalty from progeny groups that included more twin born lambs or late born lambs in the original AI mating that produced the F1 animals that were measured in the trial.

Wool income per head shorn at each shearing was calculated from average clean fleece weight and the value per kg estimated from the arithmetic average of fibre diameter, staple length and the staple strength of the individuals in a sire group. This system for valuing the wool produced is akin to farmers selling the wool from the assessed animals as a single line of wool which is common practice for fine and medium wool producers. This will generate a lower value of production for each team than valuing individual fleeces because fibre diameter premiums are higher for finer wool.

#### Sale Value calculation

The individual animal LW, fat depth and condition score data used to calculate dressed weight and fat score were not adjusted because this detailed information was not available.

Sale animal value for each team was calculated as the average of the individual animal sale values. This is different to the method used for the wool - based on the average of the specifications - because when selling sheep each animal is individually assessed for sale and the price determined based on meeting the market specifications. In some cases, this is individual assessment of carcasses and in others it is simply a visual assessment down a draft. Therefore, the average of the individual animal values is more realistic than an evaluation of the average specification. This approach will generate a lower value of production because the discounts associated with being 'off-spec' increase when further from the optimum.

As described previously (section 7.14.1.2) the price of sale animals was determined from dressed weight and fat score. Weights and carcass characteristics had been assessed at multiple points during each year and the assessment closest to the annual shearing that included either a CS or fat depth was used to estimate sale value of the animals.

An adjustment to dressing percentage was not made for fleece length or time off feed because this information was difficult to derive and wouldn't have varied between teams so any error introduced will be the same for all teams. It was assumed that the animals had been off feed for 3 hrs prior to weighing.

## Flock Value calculation

Mortality and weaning rate have been included in the Flock VOP analysis. The inclusion reduces the value of production for sire groups that had higher mortality and increases the VOP for sire groups with high weaning rate. The estimates of mortality excluded the deaths that occurred from 'misadventure' or were deemed to be due to 'management failure'.

The Value of Production (VOP) for the entire flock is calculated "per ewe equivalent grazing pressure during the feed limiting period of the year". Grazing pressure was expressed per 'ewe equivalent' rather than DSE because using DSE would imply that adjustments were made to reflect energy requirements (LW differences between teams, LW gain for different animal classes and demands for pregnancy and lactation) which has not been done. The follower classes of animals were assumed to be 0.67 ewe equivalents and breeding age ewes were 1 ewe equivalent regardless of the number of lambs raised.

The number of breeding ewes in the flock of each age group accounted for the annual mortality as measured. All breeding age ewes were mated and any young ewes that were surplus to the number required to replace the flock were randomly selected for sale after the hogget shearing. The number of young ewes sold was dependent on the weaning rate and the ewes annual mortality. All wethers that were weaned were sold after the post-weaning shearing. The sale age strategy, selling surplus young ewes at approximately 18 mo after the hogget shearing and the entire wether drop at approximately 10 mo after the post-weaning shearing was the same for all teams at all sites, although there is some variation in the specific age when the animals were sold/valued.

The numbers of animals of each age stage at the beginning of the year was used to calculate the "ewe equivalent" grazing pressure and the number at the end of the year (at shearing) was used to calculate the wool and sale income of the flock. While VOP per ewe equivalent was chosen as the primary indicator of production value, it is important to note that it is not directly related to the overall profitability of the entire flock.

### 7.14.2.3. Fleece Value Change

FVC for each team was estimated using the annual fleece value for the ewes estimated in the value of production (VOP) analysis. The fleece value was estimated using 10-year median prices from adjusted sire means for CFW, FD, SS & SL averaged across the F1 ewe progeny at each shearing. An across site analysis was carried out that included Sire, Site, Year, Age (linear and quadratic effects) and Sire x Age. Site, Year was included as a factor with levels for each year at each site. This factor represents seasonal differences in feed availability and differences in the duration between shearings. The shearing duration at some sites and years was different to 12 months but changes in shearing date were consistent across the drops so were represented by the Site, Year term. The model was fitted as least squares regression and had an  $r^2$  of 0.91 and all coefficients in the model were significant ( $p < 0.05$ ). The coefficients for Sire x Age are the annual change in fleece value for each sire team (Table 21).

*Table 21: Average annual change in fleece value for each team, calculated from the value of fleece production analysis using 10-year median prices. Order of teams is from largest increase in value to largest reduction in value per year.*

Sire code	Sire name	Fleece value change (\$/yr)
6001212012122220	Terrick West Poll, 122220	2.02
6005312015150010	Lewisdale Poll, 150010 (Monty)	1.94
5000832015150610	Wanganella, 150610	0.93

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5038632016160950	Langdene, 160950	0.77
6006102016160001	Willandra Poll, 160001	0.71
5030112014140050	Orrie Cowie, 140050 (Trojan)	0.69
5041702013130519	Koorngal, 130519	0.55
6002402014140345	Greenfields Poll, 140345	0.49
5038842014141924	GRASS, 141924 (R15)	0.48
6014132016160137	Kerin Poll, 160137	0.43
5041882012120366	Greenland, 2.366	0.25
5044702013130240	Charinga, 130240 (Doc)	0.23
5017042012UGB060	Melrose, 12UGB060	0.16
5000482012120715	Haddon Rig, 2.715	0.14
6014142014014189	Gullen Gamble Poll, 014189	0.14
5000632013130850	Mumblebone, 130850	0.14
5038842014142194	GRASS, 142194 (R4)	0.09
5000132011110482	Trefusis, 110482	0.00
5101842014141077	Glen Holme, 141077 (Dohne)	-0.02
5003832011003542	Hazeldean, 11.3542 (Hugh)	-0.03
6010532013131026	Tuckwood Poll, 131026	-0.04
5004122012120175	Woodyarrup, 120175	-0.04
6011382014140757	Kiandra Poll, 140757	-0.17
6010502009090853	Stockman Poll, 090853 (Stilts)	-0.19
6010502013130707	Stockman Poll, 130707 (Pioneer)	-0.24
5045722011ESA004	The Mountain Dam, 11/ESA004	-0.47
5000632013130389	Mumblebone, 130389	-0.50
6013322012120912	Wallaloo Park Poll, 120912	-0.51
5092422014141989	Yiddinga, 141989	-0.51
6091472015150266	Anderson Poll, 150266	-0.52
6014422014140632	Pooginook Poll, 140632	-0.55
5035062009090137	East Mundalla, 090137 (Jonty)	-0.55
5048882012120092	Mokanger, 120092	-0.56
6008152009090918	Leahcim Poll, 090918	-0.65
6012712011110330	Rhamily Poll, 110330 (Benny)	-0.73
6005712013130641	Billandri Poll, 130641	-0.74
5041662015150039	Roseville Park, 150039	-0.75
6091542013130387	Ingle Poll, 130387	-0.79
5038552010100R56	One Oak No. 2, R56	-0.79
5041732013SB5585	Kurra-Wirra, SB5585	-0.80
5035432012120014	Glen Donald, 120014	-0.84
6010532012121021	Tuckwood Poll, 121021	-0.85
5050692012120012	Greendale, 120012	-0.86
6090392012120708	Boolading Blues Poll, 120708	-0.91
5032982010100919	Nerstane, 100919	-0.97
5000632014140026	Mumblebone, 140026	-0.98
6010902008082893	Pastora Poll, 082893	-1.03
5041662014140611	Roseville Park, 140611	-1.04
6005712013130087	Billandri Poll, 130087	-1.07

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5050502013130296	Bella Lana, 130296	-1.12
6008042012120046	Hannaton Poll, 120046	-1.13
5041662014140019	Roseville Park, 140019	-1.16
5092422013130374	Yiddinga, 130374	-1.17
5048002014145112	Boyanga, 145112	-1.17
6008272013130597	Claypans Poll, 130597	-1.17
6013432014140141	Wyambah Poll, 140141	-1.18
601449201313V741	Bundaleer Poll, 13V741	-1.23
5046542012120042	Glenpaen, 120042	-1.24
5036552013130941	Darriwell, 130941 (Buddha)	-1.26
6090402010100081	Merinotech WA Poll, 100081	-1.29
5046372010100248	Moojepin, 100248	-1.36
5047922011111424	Bogo, 111424	-1.42
6008152012123153	Leahcim Poll, 123153	-1.44
5002462013130380	Nareeb Nareeb, 130380	-1.45
5046372014140377	Moojepin, 140377	-1.48
6004432014145096	Ejanding Poll, 145096	-1.48
5015522012120043	Yalgoo, 120043	-1.48
6012502012207316	Centre Plus Poll, 207316	-1.49
5032982013130467	Nerstane, 130467	-1.50
5003832011000043	Hazeldean, 11.43	-1.55
5007322012120021	Mirani, 120021	-1.62
5040812011111265	Bundilla, 111265	-1.63
6002402013130599	Greenfields Poll, 130599	-1.75
5022502013130149	Wurrook, 130149	-1.87
5033582014140754	Wattle Dale, 140754	-1.89
6012362011110004	West Plains Poll, 110004 (Mercenary)	-1.89
6092282014140257	Connemara Poll, 140257	-2.07
6012502007707115	Centre Plus Poll, 707115	-2.08
6015022015150073	Moorundie Poll, NE73	-2.09
6005532013130660	Coromandel Poll, 130660	-2.09
5034852016160350	Bungulla, 160350	-2.12
5034712014140012	Miramoonna, 140012	-2.13
6092512014140477	Trigger Vale Poll, 140477	-2.16
5044552015150017	Grindon, 150017	-2.25
5000322001010036	Egelabra, HEK 1.36	-2.25
6001052013130545	Collinsville Poll, 130545 (Apollo)	-2.27
5004122015150329	Woodyarrup, 150329	-2.33
5000132015150282	Trefusis, 150282	-2.36
5041732013SR5681	Kurra-Wirra, SR5681	-2.47
6013942014140540	Mianelup Poll, M00540 (Expo)	-2.49
6012792015150697	Petali Poll, 150697	-2.50
5015522015150313	Yalgoo, 150313	-2.58
6006362015150680	RangeView Poll, 5-680	-2.65
6091472014140474	Anderson Poll, 140474	-2.66
5047732014140188	Karori, 140188	-2.66

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6000012012120020	Poll Boonoke, 120020	-2.67
5041662013132933	Roseville Park, 132933	-2.74
6014152015015305	Lachlan Merinos Poll, 015305	-2.83
5032982015150073	Nerstane, 150073	-2.84
50435820100Z266K	Edale, 10Z266K	-2.87
5045602013MVB123	Conrayn, MVB123	-2.88
6006102014140030	Willandra Poll, 140030 (Des)	-2.88
5038842012122190	GRASS, 122190 (P47)	-2.91
5023022014140055	Cressbrook, 140055	-2.95
5037642012121224	Wilgunya, 121224	-3.00
6091542015150087	Ingle Poll, 150087	-3.00
6014132015151911	Kerin Poll, 151911	-3.10
5000632015151367	Mumblebone, 151367	-3.11
5000832013130816	Wanganella, 130816	-3.14
5040442013H13017	DT Kenilworth, WH13017	-3.15
6013702014140027	Barloo Poll, 140027 (Eureka)	-3.15
6012892016160047	Avington Poll, 160047	-3.20
6012502014407185	Centre Plus Poll, 407185	-3.21
6091522011110264	Nearra Poll, 110264	-3.25
6005712015151280	Billandri Poll, 151280	-3.26
6008152013132624	Leahcim Poll, 132624	-3.36
6012792016160849	Petali Poll, 160849	-3.39
6010822015151058	Toland Poll, 151058	-3.41
5050112015150280	Tallawong Merinos, 150280	-3.58
5017472015155145	Eilan Donan, ED5145 (Harvey)	-3.59
5001532013132051	Cranmore, 132051	-3.60
5046372012120652	Moojepin, 120652	-3.65
6011612011110143	Hillcreston Park Poll, 110143	-3.71
5044832016160156	Hilltop, 160156 (HT156)	-3.73
5042942015150430	Alfoxton, 150430	-3.73
6015552016160095	Clovernook Poll, 160095	-3.73
6014352014140055	Bundilla Poll, 140055	-3.79
6014142012120018	Gullen Gamble Poll, 120018	-3.89
5015882012120101	Europambela, 120101	-3.92
5003832013004936	Hazeldean, 13.4936	-4.02
5047732015150222	Karori, 150222	-4.14
5050692014140141	Greendale, 140141	-4.34
5015522016160070	Yalgoo, 160070	-4.39
6013322015150422	Wallaloo Park Poll, 150422	-4.51

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#### 7.14.2.4. Team Value of Production

Balmoral

Table 22: Components of the Flock value of production (\$/ewe equivalent) of the Balmoral 2015 & 2016 drop F1 progeny using 10-year median prices.

Year drop	Flock	Breeders		Wool		CFA	Meat	
				Followers		Ewes	Followers	
				Ewes	Wethers		Ewes	Wethers
<b>2015 drop</b>		<b>104.94</b>	<b>46.09</b>	<b>11.50</b>	<b>17.31</b>	<b>8.00</b>	<b>11.17</b>	<b>10.87</b>
Billandri Poll, 130087	103.48	46.62	12.43	15.54	8.02	11.84	9.04	
Bogo, 111424	116.38	50.27	10.90	25.65	7.82	8.78	12.96	
Bundaleer Poll, 13V741	100.79	43.35	12.46	13.10	9.52	12.72	9.65	
Bundilla, 111265	110.69	43.55	13.31	15.02	9.24	13.11	16.47	
Centre Plus Poll, 207316	114.71	45.78	12.88	26.45	7.23	10.73	11.62	
Darriwell, 130941 (Buddha)	101.45	50.46	9.39	15.23	6.44	9.26	10.66	
Glenpaen, 120042	103.03	58.70	6.05	20.46	5.36	5.35	7.10	
Greenfields Poll, 130599	110.91	48.51	11.26	23.65	7.47	9.34	10.68	
Hazeldean, 11.43	111.24	48.59	12.44	16.21	8.97	11.09	13.94	
Kurra-Wirra, SR5681	92.42	47.89	5.38	20.88	7.52	4.47	6.28	
Leahcim Poll, 090918	99.79	42.91	9.94	18.48	9.00	10.84	8.61	
Leahcim Poll, 123153	98.55	42.14	10.23	17.55	9.25	10.50	8.88	
Merinotech WA Poll, 100081	96.55	44.35	11.96	11.56	8.65	11.83	8.21	
Mokanger, 120092	107.62	51.20	9.10	20.29	10.09	8.55	8.39	
Moojepin, 100248	106.42	34.52	14.29	12.18	9.16	17.74	18.54	
Mumblebone, 130389	92.48	37.63	12.43	12.80	6.46	12.94	10.21	
Mumblebone, 130850	107.27	34.11	15.68	14.37	6.91	19.18	17.02	
Nareeb Nareeb, 130380	100.63	44.61	14.75	12.31	5.35	14.33	9.29	
Nerstane, 130467	97.50	56.43	5.82	12.17	10.32	4.85	7.91	
One Oak No. 2, R56	109.23	54.18	10.20	19.50	7.63	8.92	8.81	
Roseville Park, 140019	99.29	44.28	11.29	12.56	9.91	11.53	9.73	
The Mountain Dam, 11/ESA004	106.94	44.99	13.09	17.51	6.95	12.18	12.24	
Tuckwood Poll, 121021	113.10	45.86	14.43	16.22	7.82	14.35	14.42	
Yalgoo, 120043	122.05	48.48	14.12	31.86	6.56	10.91	10.12	
Yiddinga, 130374	101.02	42.88	13.73	11.20	8.34	13.88	11.00	
<b>2016 drop</b>	<b>108.49</b>	<b>46.50</b>	<b>8.95</b>	<b>11.79</b>	<b>10.17</b>	<b>8.40</b>	<b>22.68</b>	
Centre Plus Poll, 707115	113.02	37.30	10.79	12.70	10.54	11.31	30.38	
GRASS, 142194 (R4)	113.06	41.47	11.05	12.17	11.10	10.61	26.66	
Glen Holme, 141077 (Dohne)	116.19	37.19	10.78	12.06	9.52	13.26	33.38	
Greendale, 120012	109.43	53.88	7.04	13.98	10.58	5.20	18.76	
Greenfields Poll, 140345	111.70	45.59	8.98	11.41	10.03	9.11	26.58	
Greenland, 2.366	100.17	47.75	6.21	9.33	11.19	5.87	19.83	
Hannaton Poll, 120046	108.16	42.34	10.97	12.52	8.55	9.56	24.21	
Hazeldean, 11.3542 (Hugh)	110.46	50.85	10.28	13.50	9.69	7.76	18.38	
Kiandra Poll, 140757	115.66	41.93	10.79	14.35	8.53	11.77	28.29	
Koorinal, 130519	104.40	50.41	7.41	12.29	8.84	6.07	19.38	
Kurra-Wirra, SB5585	103.01	46.35	9.11	9.99	11.42	7.94	18.21	
Leahcim Poll, 090918	103.04	41.62	9.32	10.87	9.98	9.63	21.61	
Melrose, 12UGB060	105.11	52.48	7.29	10.90	10.77	5.77	17.90	
Mumblebone, 130389	94.18	41.79	5.68	9.47	10.02	5.70	21.52	
Mumblebone, 140026	110.06	41.75	11.65	11.80	9.15	11.72	23.99	
Nerstane, 100919	107.66	49.61	7.72	11.56	11.65	6.71	20.42	
One Oak No. 2, R56	105.37	53.28	7.42	11.29	9.46	6.32	17.59	
Stockman Poll, 090853 (Stilts)	107.37	45.44	10.00	12.57	9.93	9.29	20.14	
Terrick West Poll, 122220	109.39	48.40	8.17	11.19	10.97	8.35	22.30	
The Mountain Dam, 11/ESA004	110.01	48.88	8.02	11.81	10.91	6.94	23.44	

Year drop	Flock	Breeders	Wool		CFA Ewes	Meat	
			Followers			Followers	
			Ewes	Wethers		Ewes	Wethers
Trefusis, 110482	100.29	51.98	6.36	10.15	11.76	5.30	14.74
Tuckwood Poll, 131026	119.79	43.07	12.17	13.07	10.23	12.52	28.73
Wallaloo Park Poll, 120912	101.43	50.28	6.75	10.79	10.67	5.95	16.99
Woodyarrup, 120175	121.56	51.89	11.01	12.25	10.53	9.46	26.42
Yiddinga, 141989	111.86	46.98	8.89	12.84	8.23	7.84	27.08

Pingelly

Table 23: Components of the Flock value of production (\$/ewe equivalent) of the Pingelly 2016 & 2017 drop F1 progeny using 10-year median prices.

Year drop	Flock	Breeders	Wool		CFA Ewes	Meat	
			Followers			Followers	
			Ewes	Wethers		Ewes	Wethers
<b>2016 drop</b>	<b>152.55</b>	<b>47.50</b>	<b>21.34</b>	<b>13.95</b>	<b>12.19</b>	<b>27.95</b>	<b>29.61</b>
Billandri Poll, 130641	166.25	50.23	26.03	15.30	11.60	32.62	30.46
Boolading Blues Poll, 120708	167.06	42.56	25.72	14.52	12.91	38.08	33.26
Claypans Poll, 130597	154.24	49.28	19.84	14.95	12.30	25.85	32.01
East Mundalla, 090137 (Jonty)	137.44	56.72	16.57	11.06	10.49	20.73	21.86
Ejanding Poll, 145096	162.05	43.69	23.47	14.62	11.41	31.27	37.59
Haddon Rig, 2.715	151.51	51.94	20.59	14.72	13.77	22.29	28.20
Hazeldean, 11.43	158.29	49.84	21.97	15.21	12.85	28.96	29.45
Ingle Poll, 130387	163.77	42.01	24.82	14.62	11.16	36.11	35.04
Leahcim Poll, 090918	148.40	42.06	21.20	14.76	11.80	27.93	30.64
Merinotech WA Poll, 100081	144.02	48.57	18.80	13.75	11.39	23.89	27.61
Moojepin, 140377	148.78	37.69	22.07	13.07	12.10	33.66	30.18
One Oak No. 2, R56	160.14	54.47	24.39	14.98	11.85	27.00	27.45
Rhamily Poll, 110330 (Benny)	154.26	48.24	21.12	12.87	13.76	28.86	29.41
West Plains Poll, (Mercenary)	135.25	54.41	15.47	12.47	13.57	16.31	23.03
Wyambah Poll, 140141	136.88	40.82	18.07	12.38	11.94	25.68	27.97
<b>2017 drop</b>	<b>144.34</b>	<b>52.77</b>	<b>13.01</b>	<b>15.19</b>	<b>15.78</b>	<b>18.57</b>	<b>29.03</b>
Anderson Poll, 140474	158.25	50.11	16.39	17.31	14.05	23.57	36.83
Barloo Poll, 140027 (Eureka)	142.15	53.69	13.51	14.67	15.64	17.97	26.68
Billandri Poll, 151280	152.86	59.83	12.24	19.32	14.84	13.79	32.85
Coromandel Poll, 130660	145.56	54.17	14.22	13.80	15.95	20.10	27.32
Cranmore, 132051	155.72	45.05	18.79	17.38	13.18	27.13	34.19
Edale, 102266K	132.04	60.32	8.28	14.56	14.96	10.29	23.62
Ingle Poll, 150087	146.98	46.78	14.85	15.12	16.81	23.89	29.54
Mianelup Poll, M00540 (Expo)	142.21	52.67	11.57	13.75	16.92	18.35	28.95
Moojepin, 120652	144.77	43.97	14.80	15.12	15.88	24.17	30.84
Moorundie Poll, NE73	137.71	61.10	9.53	14.07	17.34	12.41	23.25
Nearra Poll, 110264	151.31	44.60	15.24	14.68	16.12	24.08	36.60
Rangeview Poll, 5-680	139.50	58.63	11.26	15.12	17.09	13.56	23.84
Trigger Vale Poll, 140477	144.50	47.40	11.48	14.07	16.14	19.86	35.55
West Plains Poll, (Mercenary)	125.21	57.79	8.19	12.29	16.39	10.76	19.78
Woodyarrup, 150329	146.35	55.38	14.73	16.61	15.34	18.65	25.62

## MerinoLink

Table 24: Components of the Flock value of production (\$/ewe equivalent) of the MerinoLink 2016 & 2017 drop F1 progeny using 10-year median prices.

Year drop	Flock	Breeders	Wool		CFA Ewes	Meat	
			Followers			Followers	
			Ewes	Wethers		Ewes	Wethers
<b>2016 drop</b>	<b>160.28</b>	<b>59.93</b>	<b>22.62</b>	<b>11.71</b>	<b>10.04</b>	<b>29.50</b>	<b>26.48</b>
Bella Lana, 130296	147.09	48.95	18.65	10.40	12.12	29.10	27.85
Boyanga, 145112	158.49	51.96	22.79	11.48	9.48	32.69	30.08
Glen Donald, 120014	168.47	60.26	26.75	13.06	9.70	33.23	25.47
Greendale, 120012	165.00	67.23	25.27	11.70	10.38	28.80	21.62
Leahcim Poll, 090918	162.68	55.18	21.54	12.12	10.21	31.83	31.81
One Oak No. 2, R56	175.64	64.57	26.28	13.56	10.88	32.09	28.26
Pastora Poll, 082893	173.74	58.05	30.29	12.84	10.10	36.79	25.67
Poll Boonoke, 120020	162.82	59.18	26.44	12.27	9.87	31.95	23.10
Pooginook Poll, 140632	161.84	53.18	24.25	11.16	11.25	34.47	27.53
Roseville Park, 140611	138.22	65.63	15.69	10.27	7.35	18.94	20.34
Trigger Vale Poll, 140477	163.44	52.21	21.09	9.73	11.07	35.53	33.80
Wattle Dale, 140754	151.52	69.92	17.76	12.08	8.01	20.89	22.86
Wurrook, 130149	154.70	72.71	17.21	11.52	10.14	17.22	25.90
<b>2017 drop</b>	<b>164.15</b>	<b>67.09</b>	<b>17.77</b>	<b>13.60</b>	<b>14.79</b>	<b>17.78</b>	<b>33.12</b>
Bundilla Poll, 140055	188.48	61.58	28.39	16.74	14.66	28.24	38.87
Centre Plus Poll, 407185	167.57	66.13	19.39	13.10	17.81	19.61	31.53
Collinsville Poll, 130545 (Apollo)	165.03	66.70	18.24	12.92	14.82	18.05	34.31
DT Kenilworth, WH13017	171.56	73.03	17.39	14.26	13.60	16.24	37.04
Greendale, 140141	154.88	78.55	12.39	11.98	16.90	10.31	24.75
Lachlan Merinos Poll, 015305	166.80	62.91	19.78	14.09	14.70	21.01	34.32
Leahcim Poll, 132624	140.67	63.97	9.80	11.72	15.24	9.94	29.99
Tallawong Merinos, 150280	164.19	74.44	19.36	13.66	12.73	16.31	27.69
Toland Poll, 151058	172.22	53.20	24.87	15.36	12.05	28.47	38.28
Trefusis, 150282	161.71	66.70	18.86	12.79	15.86	18.09	29.42
Trigger Vale Poll, 140477	173.00	58.13	18.98	12.60	15.32	24.31	43.66
Wallaloo Park Poll, 150422	144.80	75.20	6.00	12.24	16.57	5.49	29.29
West Plains Poll, Mercenary	163.03	71.55	17.62	15.29	12.07	15.10	31.40

## Macquarie

Table 25: Components of the Flock value of production (\$/ewe equivalent) of the Macquarie 2017 & 2018 drop F1 progeny using 10-year median prices.

Year drop	Flock	Breeders	Wool		CFA Ewes	Meat	
			Followers			Followers	
			Ewes	Wethers		Ewes	Wethers
<b>2017 drop</b>	<b>154.20</b>	<b>57.41</b>	<b>19.01</b>	<b>16.47</b>	<b>11.52</b>	<b>23.68</b>	<b>26.12</b>
Centre Plus Poll, 707115	151.02	51.02	19.94	17.46	8.81	25.88	27.91
Collinsville Poll, 130545 (Apollo)	155.18	59.01	17.71	17.28	10.20	22.22	28.75
Darriwell, 130941 (Buddha)	153.52	59.79	19.93	15.16	9.12	24.59	24.93
GRASS, 122190 (P47)	155.76	54.54	19.90	16.70	11.63	26.41	26.59
GullenGamble Poll, 120018	159.07	61.15	20.20	17.50	12.38	22.53	25.31
Hazeldean, 13.4936	169.35	61.94	25.05	20.72	11.57	24.67	25.40
Kerin Poll, 151911	165.15	60.03	21.60	16.77	12.28	27.91	26.56
Moojepin, 120652	161.13	46.04	20.75	17.94	11.36	30.44	34.59
Mumblebone, 151367	130.78	54.99	11.70	13.23	12.03	15.64	23.19
Roseville Park, 132933	148.71	58.26	17.71	15.67	12.09	22.22	22.76

Year drop	Flock	Wool				CFA Ewes	Meat	
		Breeders	Followers		Followers		Wethers	
			Ewes	Wethers				
Trigger Vale Poll, 140477	152.80	51.89	16.43	14.46	10.97	27.35	31.69	
Wanganella, 130816	144.89	62.02	15.42	14.62	12.32	18.50	22.01	
West Plains Poll, (Mercenary)	150.85	59.92	20.29	14.73	13.40	22.71	19.81	
Wilgunya, 121224	156.95	56.86	19.79	18.97	12.09	23.13	26.10	
Willandra Poll, 140030 (Des)	157.87	63.70	18.68	15.82	12.54	20.93	26.19	
<b>2018 drop</b>	<b>150.27</b>	<b>60.99</b>	<b>14.19</b>	<b>13.61</b>	<b>15.59</b>	<b>13.21</b>	<b>32.67</b>	
Anderson Poll, 150266	154.88	49.31	15.53	13.29	15.72	17.75	43.28	
Centre Plus Poll, 707115	157.61	51.85	21.80	13.43	13.10	22.47	34.97	
Charinga, 130240 (Doc)	147.03	62.63	14.95	13.55	14.22	14.57	27.11	
GRASS, 141924 (R15)	144.93	60.79	11.89	12.61	15.90	12.29	31.44	
Glen Donald, 120014	141.14	64.66	13.33	12.76	15.75	10.24	24.40	
GullenGamble Poll, 014189	154.47	60.28	15.57	15.64	14.34	12.49	36.16	
Haddon Rig, 2.715	146.69	58.71	19.42	12.40	14.46	14.98	26.73	
Hazeldean, 11.3542 (Hugh)	156.22	66.10	15.60	14.95	13.26	12.36	33.95	
Kerin Poll, 160137	158.65	59.75	16.20	13.85	17.18	15.09	36.59	
Langdene, 160950	140.33	63.59	11.28	12.74	16.23	10.23	26.26	
Lewisdale Poll, 150010 (Monty)	137.59	65.83	7.95	10.44	17.20	7.39	28.77	
Orrie Cowie, 140050 (Trojan)	159.38	61.11	13.06	15.14	17.74	14.08	38.25	
Roseville Park, 150039	163.64	56.81	14.23	16.22	15.89	14.20	46.30	
Stockman Poll, 130707	147.07	61.76	12.34	16.13	17.15	11.12	28.57	
Wanganella, 150610	141.80	70.13	8.20	11.63	16.97	7.22	27.65	
Willandra Poll, 160001	152.88	62.59	15.77	12.92	14.37	14.90	32.32	

## New England

Table 26: Components of the Flock value of production (\$/ewe equivalent) of the New England 2017 & 2018 drop F1 progeny using 10-year median prices.

Year drop	Flock	Wool				CFA Ewes	Meat	
		Breeders	Followers		Followers		Wethers	
			Ewes	Wethers				
<b>2017 drop</b>	<b>114.42</b>	<b>47.33</b>	<b>8.73</b>	<b>16.09</b>	<b>9.50</b>	<b>5.88</b>	<b>26.90</b>	
Connemara Poll, 140257	110.48	51.13	9.13	16.81	9.18	3.34	20.89	
Conrayn, MVB123	105.58	44.17	7.98	14.55	9.27	5.75	23.86	
Cressbrook, 140055	141.09	60.05	14.97	29.04	8.95	4.00	24.07	
Egelabra, HEK 1.36	105.23	50.23	6.30	12.13	9.60	1.78	25.19	
Grindon, 150017	106.53	43.43	7.73	13.44	9.17	6.11	26.64	
Karori, 140188	104.87	48.33	7.90	14.77	9.98	3.50	20.39	
Miramooa, 140012	125.59	42.74	8.50	16.66	9.66	10.05	37.97	
Mirani, 120021	109.32	44.94	8.22	15.58	9.59	4.75	26.24	
Moorundie Poll, NE73	119.28	51.82	9.13	14.93	9.99	7.57	25.84	
Nerstane, 150073	124.21	46.19	9.46	15.64	9.83	9.87	33.22	
Petali Poll, 150697	118.01	42.00	10.67	16.78	8.78	9.23	30.56	
Trefusis, 150282	108.04	44.74	7.37	14.83	9.13	5.10	26.87	
Trigger Vale Poll, 140477	106.26	40.41	6.13	11.37	10.37	8.28	29.69	
West Plains Poll, Mercenary	113.19	49.06	8.08	15.49	9.75	4.92	25.89	
Yalgoo, 150313	118.67	50.72	9.41	19.28	9.20	3.93	26.11	
<b>2018 drop</b>	<b>122.02</b>	<b>50.79</b>	<b>8.61</b>	<b>10.63</b>	<b>12.43</b>	<b>11.11</b>	<b>28.45</b>	
Alfoxton, 150430	127.31	48.68	10.14	10.37	13.17	15.72	29.23	
Avington Poll, 160047	129.08	55.63	9.14	10.49	12.27	10.62	30.93	
Bungulla, 160350	123.91	50.57	7.53	9.74	12.26	12.05	31.77	
Clovernook Poll, 160095	105.74	49.15	4.70	7.77	14.53	7.51	22.09	

Year drop	Flock	Wool				Meat	
		Breeders	Followers		CFA Ewes	Followers	
			Ewes	Wethers		Ewes	Wethers
Cressbrook, 140055	135.83	60.40	12.90	14.65	12.21	11.87	23.80
Eilan Donan, ED5145 (Harvey)	122.71	49.36	8.04	9.95	12.52	11.49	31.34
Europambela, 120101	104.68	46.17	7.36	8.65	11.68	8.99	21.82
Hillcreston Park Poll, 110143	104.63	48.68	7.87	7.86	12.53	8.18	19.51
Hilltop, 160156 (HT156)	123.90	46.42	7.71	11.38	11.93	11.90	34.57
Karori, 150222	127.11	48.71	9.81	11.84	13.18	12.39	31.16
Nerstane, 150073	124.79	49.80	7.30	10.82	13.74	12.03	31.10
Petali Poll, 160849	120.65	46.45	8.21	9.37	11.73	11.15	33.74
Tallawong Merinos, 150280	130.66	58.39	7.54	12.08	11.74	9.04	31.88
Wurrook, 130149	125.27	51.16	9.71	12.92	10.74	12.08	28.66
Yalgoo, 160070	124.02	52.32	11.16	11.51	12.16	11.66	25.22

### 7.14.3. Gross Margins per DSE

#### 7.14.3.1. Data – Within site, across drop flock breeding values

Time of lambing and time of shearing was based on the practice at the trial site. Where management was altered during the trial the final management adopted has been evaluated.

The production level for each team at a site has been estimated from the average production level for each trait for each age group at the site with a deviation for each age group for each team based on half the estimated FBV for the relevant age stage.

The calculation was more detailed for number of lambs weaned which has been calculated from the FBVs of 3 traits: conception (CON), litter size (LS) and ewe rearing ability (ERA). The calculation requires estimating the proportion of ewes that are carrying 0, 1, 2 or 3 fetuses, which is calculated from the team conception and litter size using a general relationship between scanning percentage and ewe litter size proportions developed by Kearney and Thompson *pers comm.* in the Triplets project (MLA project L.LSM.0013). The number of lambs weaned was calculated from the number of lambs born of each litter size and the survival of the single, twin and triplet born lambs.

The mortality calculation was also more detailed than for the production traits. The FBV used to calculate differences in mortality is a FBV on cumulative survival from yearling age to each adult age stage. To convert to mortality the sign of the FBV was changed, such that a positive number reflected higher mortality. For the flock structure calculations in the gross margin an annual adjustment to mortality is required. To achieve this, the annual increment in the cumulative mortality was calculated and half of that values was added to the annual death rate in the GM flock structure calculation.

#### 7.14.3.2. Detailed Methodology

The GM was calculated for a flock with a specified age structure accounting for the differences in production between teams based on within site, across year flock breeding values (FBVs). Differences in carrying capacity for each team was based on estimating the DSE/hd for the teams from metabolic weight and reproductive outcomes. The flock GM includes income from:

- The annual wool clip
- the sale of cast-for-age ewes at the end of the trial period

- the sale of surplus young ewes and the wether progeny based on the sale age strategy.

And variable costs associated with:

- Husbandry and contract costs
- Supplement fed
- Infrastructure costs
- Labour

The flock represented was a self-replacing flock with the numbers of each age group at equilibrium. The number of sheep sold was balanced by the number of animals born and the mortality of animals in each age group.

The number of stock carried (stocking rate) was based on calculating a DSE/hd for each class of animal that reflects the energy requirement of the different age groups of each team (see more detail below). By adjusting the DSE/hd for each team to reflect the number of animals that are expected to be carried per hectare, it is then possible to compare the GM per DSE between teams because it is directly proportional to DSE/ha. GM/DSE is the measure used in this report.

Notes on interpreting the GM results:

- A GM is the income earned from a flock minus the variable costs. It is a valid method to compare profitability across flocks if the fixed costs do not change between teams. A challenge in ensuring this when comparing teams is to correctly calculate stocking rate and therefore correctly equating the fixed costs of the pasture resource. The assumptions about DSE/hd are therefore very important.
- The GM estimate is reflecting the management as implemented in the trial for time of lambing and time of shearing. The management has not been adjusted to suit each individual team.

DSE per head

The number of stock carried (stocking rate) was based on calculating a DSE/hd for each class of animal. This is based on the estimated maintenance requirements of the animals during the feed limiting period of the year which was estimated from:

- Sheep class and reproduction status. Dry sheep = 1 and reproducing sheep are 1 for dry, 1.4 for singles and 1.8 for multiples.
- Metabolic LW. The above values were scaled based on the metabolic weight of the team, determined from weight of adults plus the ALW FBV. This weight reflects the peak weight for the year.

The assumption made for the analysis was that the feed limiting period of the year coincided with the period when the ewes were lactating. Therefore, the DSE/hd for the ewes was selected based on the number of lambs at foot post lambing, rather than the number of lambs in utero.

Wool value

Wool income per head for each age group shorn was estimated from average clean fleece weight and the value per kg 'sweep the board, net in the bank' estimated from the team fibre diameter, staple strength and staple length (as described previously).

## Sale Value

Sale animal value for each team was calculated from dressed weight and fat score. The average DW and FS was calculated from the assessment closest to the annual shearing that included a fat depth assessment. Fat score was estimated from ultra sound fat depth at the c site plus half the FBV using Equation 2 as described in section 7.14.1.2 Sale sheep prices.

To account for the variation in dressed weight and fat score in a mob, while calculating sale value using average dressed weight and average fat score the grid adjustment was converted to a gradual change in price rather than a step up or step down. This reflects that if the average price is close to the step in the grid, some animals will be valued with the lower specs and some will be valued with the higher specs.

## Sensitivity Analysis

Two sensitivity analyses were carried out for the project

### Trait value

The contribution of traits to the Flock GM was tested for each trait for each team by calculating the Flock GM when the FBV was set to 0 for each trait individually. The contribution of the trait was calculated from the change in GM divided by the trait value, then averaged across the teams.

### Across age group variation

The proportion of the variation in GM that is captured by only using FBVs from early age stages was tested by calculating the GM using adult production of CFW, FD and LW estimated from the hogget FBV in place of the adult FBV. This is addressing the question of whether the variation between teams in trait change over a lifetime is an important contribution to difference in profit.

This sensitivity doesn't directly address the question of the importance of measuring adult animals. This would require calculating the GMs using the FBVs calculated from data that includes or excludes the adult measurements.

### 7.14.3.3. Team Gross Margin

#### Balmoral

Table 27: Gross margin and components of the gross margin for each of the 46 sires evaluated at Balmoral using 10-year median prices.

Team	GM (\$/DSE)	Wool income \$/DSE	Sales sheep \$/DSE	Costs \$/DSE
Mumblebone, 130389	25.9	36.4	22.3	32.8
Greenland, 2.366	27.1	39.6	19.6	32.2
Nareeb Nareeb, 130380	27.4	39.1	20.3	32.0
Roseville Park, 140019	28.0	38.2	21.6	31.9
Centre Plus Poll, 707115	28.1	35.9	23.6	31.5
Terrick West Poll, 122220	28.5	39.5	21.0	32.0
Leahcim Poll, 090918	28.5	38.7	21.8	32.1
Bundaleer Poll, 13V741	28.5	39.3	21.2	32.0
Kurra-Wirra, SB5585	28.7	40.3	20.8	32.4
Mumblebone, 130850	28.7	36.1	24.0	31.4
Kurra-Wirra, SR5681	28.9	42.4	20.2	33.8
Leahcim Poll, 123153	29.0	38.5	22.5	32.0
Glen Holme, 141077 (Dohne)	29.2	35.3	25.0	31.2
Greenfields Poll, 140345	29.2	38.6	21.9	31.3

Yiddinga, 130374	30.0	39.3	22.7	32.0
Nerstane, 130467	30.1	43.3	19.4	32.6
GRASS, 142194 (R4)	30.2	38.5	23.4	31.6
Moojepin, 100248	30.3	33.4	27.1	30.2
Hannaton Poll, 120046	30.3	40.2	22.5	32.4
Billandri Poll, 130087	30.5	41.7	21.9	33.1
Darriwell, 130941 (Buddha)	30.7	42.2	20.6	32.2
One Oak No. 2, R56	30.8	43.9	19.4	32.5
Mumblebone, 140026	30.8	38.4	24.5	32.1
Hazeldean, 11.43	30.9	39.7	22.6	31.4
Wallaloo Park Poll, 120912	31.0	42.9	20.7	32.7
Stockman Poll, 090853 (Stilts)	31.0	42.7	20.8	32.5
Melrose, 12UGB060	31.4	44.9	19.5	33.0
Kiandra Poll, 140757	31.4	38.3	24.6	31.5
Yiddinga, 141989	31.5	41.0	22.0	31.6
Trefusis, 110482	31.5	45.5	19.0	33.0
Merinotech WA Poll, 100081	31.6	41.3	23.1	32.8
Tuckwood Poll, 121021	31.6	39.6	23.2	31.1
Bundilla, 111265	31.6	37.8	24.7	30.8
Glenpaen, 120042	31.7	45.7	18.3	32.2
Nerstane, 100919	32.0	43.1	20.9	31.9
The Mountain Dam, 11/ESA004	32.2	42.6	21.7	32.1
Greenfields Poll, 130599	32.2	43.9	21.2	32.9
Centre Plus Poll, 207316	32.2	43.1	21.9	32.7
Woodyarrup, 120175	32.6	42.3	22.0	31.7
Mokanger, 120092	32.7	44.7	20.5	32.5
Tuckwood Poll, 131026	32.8	40.2	23.7	31.1
Koorngal, 130519	33.3	45.6	21.2	33.6
Bogo, 111424	33.3	43.2	22.2	32.1
Yalgoo, 120043	33.8	46.5	20.7	33.4
Hazeldean, 11.3542 (Hugh)	35.1	47.6	20.7	33.2
Greendale, 120012	36.4	48.7	20.5	32.8
Average	30.7	41.1	21.8	32.2
Range	10.6	15.4	8.9	3.6

Pingelly

Table 28: Gross margin and components of the gross margin for each of the 29 sires evaluated at Pingelly using 10-year median prices.

Team	GM (\$/DSE)	Wool income \$/DSE	Sales sheep \$/DSE	Costs \$/DSE
Wyambah Poll, 140141	49.9	45.2	41.1	36.3
Moojepin, 140377	51.2	44.7	42.4	35.9
Mianelup Poll, M00540 (Expo)	51.3	46.4	40.0	35.1
Cranmore, 132051	51.7	47.5	40.5	36.3
West Plains Poll, Mercenary	51.9	51.9	36.0	35.9
Rangeview Poll, 5-680	52.4	52.2	36.1	36.0
Leahcim Poll, 090918	52.4	48.7	39.8	36.1
Barloo Poll, 140027 (Eureka)	52.5	50.5	38.4	36.4
East Mundalla, 090137 (Jonty)	52.9	51.0	37.1	35.2
Rhamily Poll, 110330 (Benny)	53.0	47.6	40.6	35.3
Hazeldean, 11.43	53.7	50.7	38.5	35.5
Ingle Poll, 150087	53.7	48.2	41.1	35.6
Moojepin, 120652	53.8	46.3	43.6	36.0
Claypans Poll, 130597	54.0	50.1	39.5	35.6
Haddon Rig, 2.715	54.0	51.4	38.9	36.3

Ingle Poll, 130387	54.3	47.4	43.1	36.2
Edale, 10Z266K	54.6	52.5	38.4	36.3
Nearra Poll, 110264	55.1	44.9	46.0	35.8
Ejanding Poll, 145096	55.1	47.9	42.5	35.3
Boolading Blues Poll, 120708	55.3	46.4	44.3	35.4
Moorundie Poll, NE73	55.4	53.5	37.9	36.0
Woodyarrup, 150329	55.5	52.4	39.5	36.4
One Oak No. 2, R56	55.7	53.2	38.8	36.2
Trigger Vale Poll, 140477	56.0	44.0	47.1	35.1
Billandri Poll, 151280	57.0	54.7	38.4	36.0
Coromandel Poll, 130660	57.2	49.7	42.8	35.4
Billandri Poll, 130641	59.0	52.0	42.7	35.7
Merinotech WA Poll, 100081	59.2	50.8	45.0	36.6
Anderson Poll, 140474	63.4	48.9	51.1	36.6
Average	54.5	49.3	41.1	35.9
Range	13.5	10.7	15.1	1.5

## MerinoLink

Table 29: Gross margin and components of the gross margin for each of the 25 sires evaluated at MerinoLink using 10-year median prices.

Team	GM (\$/DSE)	Wool income \$/DSE	Sales sheep \$/DSE	Costs \$/DSE
Bella Lana, 130296	62.8	54.0	44.2	35.4
Wallaloo Park Poll, 150422	63.8	61.5	37.6	35.3
West Plains Poll, Mercenary	64.5	61.4	39.4	36.2
Lachlan Merinos Poll, 015305	64.7	57.8	42.7	35.8
Trigger Vale Poll, 140477	64.8	51.8	47.6	34.6
Leahcim Poll, 132624	65.2	57.4	43.2	35.4
Pooginook Poll, 140632	65.4	56.8	44.1	35.5
Poll Boonoke, 120020	65.6	61.8	39.8	36.0
Roseville Park, 140611	66.0	61.5	40.2	35.7
Trefusis, 150282	66.0	60.3	41.8	36.0
Boyanga, 145112	66.2	55.3	47.0	36.1
Toland Poll, 151058	66.8	55.1	48.2	36.4
Collinsville Poll, 130545 (Apollo)	66.9	57.8	44.9	35.8
Pastora Poll, 082893	67.3	63.0	40.0	35.7
Glen Donald, 120014	67.4	61.3	41.9	35.8
Leahcim Poll, 090918	67.6	56.3	46.9	35.6
Centre Plus Poll, 407185	67.8	60.2	43.3	35.7
Bundilla Poll, 140055	68.2	59.2	44.6	35.6
Greendale, 140141	68.3	64.9	38.9	35.4
Wattle Dale, 140754	68.6	64.1	40.7	36.2
One Oak No. 2, R56	70.2	63.2	42.9	35.9
Wurrook, 130149	70.8	65.3	41.9	36.4
Tallawong Merinos, 150280	71.1	66.2	41.1	36.2
Greendale, 120012	71.6	64.6	42.9	36.0
DT Kenilworth, WH13017	72.1	62.9	45.0	35.7
Average	67.2	60.1	42.8	35.8
Range	9.3	14.4	10.6	1.9

Macquarie

Table 30: Gross margin and components of the gross margin for each of the 30 sires evaluated at Macquarie using 10-year median prices.

Team	GM (\$/DSE)	Wool income \$/DSE	Sales sheep \$/DSE	Costs \$/DSE
Langdene, 160950	53.2	55.8	32.9	35.6
Charinga, 130240 (Doc)	54.6	55.3	34.9	35.6
Roseville Park, 132933	55.0	55.0	36.0	36.0
West Plains Poll, 110004 (Mercenary)	55.1	57.6	34.0	36.5
Glen Donald, 120014	55.2	56.5	34.9	36.1
Darriwell, 130941 (Buddha)	55.7	54.8	37.1	36.2
Mumblebone, 151367	56.3	51.1	41.2	36.0
Lewisdale Poll, 150010 (Monty)	56.7	54.7	37.0	35.0
Kerin Poll, 160137	56.7	52.9	38.6	34.8
Stockman Poll, 130707 (Pioneer)	57.0	57.2	35.5	35.6
Trigger Vale Poll, 140477	57.3	48.5	43.9	35.0
Anderson Poll, 150266	57.8	47.7	45.0	35.0
Kerin Poll, 151911	57.8	55.8	37.3	35.3
Wanganella, 130816	58.2	56.4	37.3	35.5
Collinsville Poll, 130545 (Apollo)	58.3	54.4	39.9	36.0
Hazeldean, 13.4936	58.8	60.5	35.1	36.8
Wilgunya, 121224	58.9	56.6	38.3	36.0
Moojepin, 120652	59.0	49.7	45.4	36.1
Haddon Rig, 2.715	59.3	57.5	38.8	36.9
Centre Plus Poll, 707115	59.9	51.2	44.6	35.9
Roseville Park, 150039	60.5	51.5	44.7	35.7
GRASS, 141924 (R15)	60.7	54.6	41.9	35.9
Gullen Gamble Poll, 014189	60.9	55.6	41.4	36.1
Orrie Cowie, 140050 (Trojan)	61.0	53.3	43.0	35.3
GRASS, 122190 (P47)	61.2	53.2	44.4	36.4
Gullen Gamble Poll, 120018	61.6	58.3	39.4	36.0
Wanganella, 150610	62.1	57.4	40.1	35.4
Willandra Poll, 160001	63.1	55.0	43.7	35.5
Willandra Poll, 140030 (Des)	65.9	59.1	42.9	36.1
Hazeldean, 11.3542 (Hugh)	66.3	59.6	43.4	36.7
Average	58.8	54.9	39.8	35.8
Range	13.1	12.8	12.5	2.0

New England

Table 31: Gross margin and components of the gross margin for each of the 29 sires evaluated at New England using 10-year median prices.

Team	GM (\$/DSE)	Wool income \$/DSE	Sales sheep \$/DSE	Costs \$/DSE
Clovernook Poll, 160095	37.6	40.5	29.0	32.0
Hillcreston Park Poll, 110143	37.9	43.2	29.2	34.5
Trefusis, 150282	38.3	41.3	30.0	33.0
Petali Poll, 160849	39.4	41.5	31.7	33.8
Grindon, 150017	39.5	40.4	32.1	32.9
Egelabra, HEK 1.36	39.9	44.9	28.6	33.5
Alfoxtton, 150430	40.1	41.5	31.6	33.0
Hilltop, 160156 (HT156)	40.3	42.0	31.0	32.6
Conrayn, MVB123	40.8	42.6	31.3	33.1
Mirani, 120021	40.9	43.1	31.4	33.5
Eilan Donan, ED5145 (Harvey)	41.0	42.2	31.8	33.0

Nerstane, 150073	41.1	42.3	31.0	32.1
Petali Poll, 150697	41.3	42.9	31.5	33.0
West Plains Poll, 110004 (Mercenary)	41.6	43.6	31.0	33.0
Europambela, 120101	41.9	42.2	34.0	34.3
Moorundie Poll, NE73	43.0	45.0	30.6	32.6
Karori, 140188	43.2	45.3	31.4	33.5
Miramoonna, 140012	44.2	40.6	36.4	32.7
Avington Poll, 160047	44.8	47.7	29.8	32.7
Trigger Vale Poll, 140477	44.8	36.0	41.0	32.1
Karori, 150222	45.0	45.8	32.6	33.3
Wurrook, 130149	45.2	47.0	31.7	33.6
Tallawong Merinos, 150280	46.3	48.6	31.4	33.7
Connemara Poll, 140257	46.3	47.7	33.1	34.6
Yalgoo, 160070	46.5	49.0	31.4	34.0
Yalgoo, 150313	47.1	48.4	32.3	33.6
Bungulla, 160350	49.8	43.8	39.2	33.2
Cressbrook, 140055	54.0	56.1	31.4	33.5
Average	42.9	44.1	32.0	33.2
Range	16.4	20.2	12.4	2.6

## 7.14.4. Profit per hectare

### 7.14.4.1. Data – Within project flock breeding values

Breeding values were estimated for each team in a within-project, across-site genetic analysis (Peter Wahinya *pers. comm.*), this analysis only included measurements for each sire from within the MLP project and didn't include on-farm measurement that have been contributed to the Sheep Genetics database. The breeding values selected for the financial analysis and their values for each team are detailed in Table 32.

Table 32: Within project breeding values for each team for the traits that have been valued in the modelling analysis.

Team	ALW	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5
Billandri Poll, 130087	-4.376	-0.216	10.48	12.47	0.73	0.85	2.70	3.68	2.3%	2.3%	7.0%	0.000%
Leahcim Poll, 123153	1.171	1.911	-10.07	-7.48	-0.64	-0.22	-6.25	3.03	0.4%	-19.2%	0.3%	0.548%
Leahcim Poll, 090918	-1.076	0.246	-10.24	-2.33	-0.12	-0.32	-1.94	6.13	3.4%	-14.7%	6.7%	-0.609%
Greenfields Poll, 130599	-5.458	-0.141	8.45	13.12	-0.83	-0.55	-3.85	-0.67	-0.8%	1.8%	7.1%	-0.114%
Roseville Park, 140019	2.04	-0.165	-5.75	-4.11	0.25	0.52	1.93	-0.53	4.1%	-2.1%	-8.7%	0.336%
Yalgoo, 120043	-5.86	0.897	-7.27	-2.43	-2.74	-2.18	-0.48	-4.40	-3.3%	-3.9%	3.7%	0.101%
One Oak No.2, R56	-1.522	-1.326	11.04	-2.71	-1.03	-1.07	-5.35	-11.23	1.2%	-3.0%	0.6%	-0.530%
Centre Plus Poll, 207316	-4.337	0.108	-5.52	-2.60	-1.51	-1.70	-2.74	1.62	2.2%	2.9%	-0.4%	-0.268%
Mumblebone, 130389	-4.066	1.872	-12.70	-4.55	0.90	1.44	0.44	4.93	3.0%	9.7%	-4.7%	0.087%
Kurra-Wirra, SR5681	-8.991	0.117	-2.06	-0.03	-0.03	-0.60	0.59	-5.29	1.5%	-12.2%	2.4%	-0.007%
Glenpaen, 120042	-0.471	-1.971	7.97	2.72	-1.32	-1.61	0.10	-2.48	-12.3%	-6.5%	-6.0%	-0.887%
Nareeb Nareeb, 130380	1.768	-1.893	-0.48	5.48	0.22	0.52	3.74	-0.30	-0.6%	21.3%	-4.0%	-0.443%
Hazeldean, 11.43	4.938	-0.75	3.49	7.46	-0.18	-0.59	-5.71	4.40	-2.8%	17.1%	-10.7%	0.487%
Mokanger, 120092	-0.744	-0.3	13.77	11.70	-0.14	-0.44	6.45	-11.23	-4.7%	-10.8%	-3.5%	-0.069%
Merinotech WA Poll, 100081	-2.708	2.823	-2.25	9.33	-0.21	0.83	6.66	3.69	5.3%	12.9%	-12.3%	-0.938%
Darriwell, 130941 (Buddha)	-0.008	-1.518	12.36	9.55	0.58	0.81	5.52	-7.24	0.7%	-2.6%	3.9%	-0.223%
Tuckwood Poll, 121021	5.742	-0.561	4.81	13.24	-0.29	0.23	-4.20	9.09	1.1%	6.1%	-0.1%	-0.436%
Moojepin, 100248	10.857	1.38	-15.37	8.80	0.25	2.06	-6.16	13.32	1.8%	7.3%	13.1%	0.496%
Nerstane, 130467	-3.956	-1.788	5.11	2.76	-0.41	-0.80	-1.42	2.61	-2.4%	-7.2%	-12.8%	-0.252%
Bogo, 111424	-1.013	0.216	-3.20	-5.21	-2.03	-1.92	-5.97	-3.17	2.9%	1.9%	2.6%	0.013%
Yiddinga, 130374	-0.613	0.549	-14.50	-3.23	-0.93	0.15	5.73	-4.03	0.4%	1.0%	1.1%	0.240%
The Mountain Dam, 11/ESA004	0.151	2.097	-2.39	3.22	-1.69	-0.68	-2.35	3.79	-3.0%	-8.2%	3.3%	0.188%

Team	ALW	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5
Bundilla, 111265	7.913	0.699	-1.63	17.69	-0.01	0.53	0.17	-6.37	3.2%	18.4%	-1.7%	-0.116%
Bundaleer Poll, 13V741	1.196	-0.186	-9.51	-5.98	-0.52	-0.45	3.26	-5.80	1.8%	-12.7%	1.9%	0.749%
Mumblebone, 130850	4.142	0.564	-6.34	-1.79	0.11	1.25	-2.05	10.80	3.7%	13.9%	9.0%	0.283%
Pooginook Poll, 140632	0.908	-0.468	-0.01	-1.41	0.29	0.38	0.74	2.83	6.2%	2.2%	-2.1%	0.539%
Trigger Vale Poll, 140477	4.885	2.79	-4.19	-0.45	1.67	2.58	-1.64	6.21	-1.3%	-15.2%	7.6%	0.140%
Bella Lana, 130296	1.297	-0.333	-13.70	-4.59	0.39	0.02	-8.41	3.41	9.4%	-6.6%	-5.6%	0.326%
Pastora Poll, 082893	-0.859	-2.202	-2.34	-3.08	-2.65	-1.78	-5.11	-8.30	3.5%	-8.2%	8.2%	0.801%
Wattle Dale, 140754	-3.041	-0.57	-1.25	9.26	-1.86	-1.48	0.90	-0.74	6.1%	-2.8%	-18.4%	-1.235%
Glen Donald, 120014	-0.581	-1.74	17.60	13.92	0.97	0.22	-6.77	0.59	-1.7%	7.6%	-11.6%	0.252%
Roseville Park, 140611	-1.1	-0.213	1.10	-3.78	-1.52	-1.44	-1.55	-6.27	-2.2%	-7.9%	-8.7%	-0.173%
Greendale, 120012	-3.17	0.165	0.87	4.93	-2.11	-2.46	-1.51	1.30	-4.9%	-8.7%	0.9%	-0.488%
Poll Boonoke, PB2020	-3.515	-1.686	6.90	11.63	-0.18	-1.15	-7.08	0.13	-11.7%	2.1%	6.5%	0.645%
Wurrook, 130149	-5.403	-1.383	5.52	13.26	-1.65	-0.99	-5.06	-6.91	1.9%	3.9%	-3.5%	-0.647%
Boyanga, 145112	-2.864	4.368	-17.14	-13.72	-0.95	-0.46	-6.09	7.91	0.4%	1.1%	7.0%	-0.320%
Haddon Rig, 2.715	-3.599	-1.077	14.33	12.88	0.89	0.97	1.47	-0.56	4.3%	7.1%	5.9%	0.653%
Ejanding Poll, 145096	2.761	0.729	2.88	5.75	1.47	0.99	5.40	12.32	2.5%	-7.7%	6.4%	0.513%
Rhamily Poll, 110330 (Benny)	5.531	-1.062	1.89	4.93	0.55	0.47	2.98	-8.27	-2.9%	5.2%	-5.2%	0.081%
Boolading Blues Poll, 120708	4.53	0.168	14.58	19.26	4.49	3.69	3.15	14.16	2.6%	12.3%	3.2%	-0.033%
West Plains Poll, (Mercenary)	-2.668	-0.816	7.79	0.13	-0.01	-0.49	-4.69	-4.54	-2.9%	-18.3%	1.4%	0.291%
Ingle Poll, 130387	-0.548	1.608	-16.73	-10.73	-1.37	-0.94	-2.21	-3.31	1.8%	19.4%	-4.6%	0.016%
Moojepin, 140377	-0.608	1.167	-8.85	-2.38	1.12	0.72	-4.41	21.68	1.9%	-0.8%	3.7%	0.438%
Billandri Poll, 130641	2.049	0.861	10.88	8.22	-0.26	-0.18	-1.97	0.96	1.1%	-5.1%	8.7%	-0.369%
Claypans Poll, 130597	1.347	0.219	13.15	5.06	0.66	0.17	2.35	-6.84	-1.3%	0.3%	-3.3%	-0.118%
East Mundulla, 090137 (Jonty)	3.932	-1.977	17.29	12.09	0.58	-0.07	-7.27	-7.25	-4.9%	-9.5%	-0.8%	-0.665%
Wyambah Poll, 140141	-2.969	1.911	-5.68	-1.03	1.98	1.79	1.58	17.82	-4.3%	-0.6%	-3.2%	0.271%
Woodyarrup, 120175	3.093	-1.962	12.57	15.44	-0.47	-0.08	-2.68	0.32	4.6%	-3.4%	0.5%	-0.055%
Hannaton Poll, 120046	-1.847	0.921	-7.61	-1.07	-0.69	-0.82	-3.57	-4.19	8.6%	-5.5%	6.0%	-0.015%
Wallaloo Park Poll, 120912	-3.414	0.885	-10.88	-5.86	-1.99	-1.50	-5.36	1.43	-9.9%	2.7%	-6.6%	-0.384%
Koorinal, 130519	-8.269	2.739	-5.70	-7.22	-2.15	-1.31	5.88	-15.31	6.3%	-11.6%	3.8%	-0.350%

Team	ALW	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5
Greenland, 2.366	-0.924	-0.816	0.02	-0.28	0.91	0.92	7.71	-10.52	-2.6%	-10.5%	-1.1%	0.313%
Tuckwood Poll, 131026	5.424	0.18	-6.71	-0.93	-1.59	-0.79	-1.32	8.93	2.1%	4.3%	8.4%	0.415%
Kurra-Wirra, SB5585	-1.428	-0.192	-2.17	4.64	0.38	0.27	2.95	2.62	0.7%	-17.0%	4.7%	0.595%
Centre Plus Poll, 707115	3.194	1.329	-15.22	1.46	-0.44	-0.31	-4.40	7.23	5.1%	24.0%	1.2%	0.787%
Terrick West Poll, 122220	1.841	-1.224	-3.94	-10.99	-1.26	-0.77	-5.08	-13.15	3.3%	14.0%	-0.3%	-0.791%
Glen Holme , 141077 (Dohne)	9.282	-0.369	-11.60	-12.91	-0.13	0.03	-0.26	-7.91	6.8%	23.3%	0.6%	-0.679%
Nerstane, 100919	0.082	-0.162	8.99	19.84	-0.12	0.30	1.44	5.60	-7.1%	-8.8%	-1.0%	0.071%
GRASS, 142194 (R4)	1.563	0.654	9.81	21.60	1.61	2.76	-0.11	-2.26	3.6%	-6.4%	10.2%	0.791%
Melrose, 12UGB060	-5.406	-0.513	4.81	11.43	-0.83	-0.47	1.61	-6.97	-8.3%	-3.4%	-2.6%	0.057%
Yiddinga, 141989	2.187	-0.783	2.88	12.33	-0.64	0.28	0.31	-9.23	-0.2%	-2.7%	5.3%	0.288%
Stockman Poll, 090853 (Stilts)	-2.203	-0.591	-1.59	5.43	-1.10	-0.96	2.17	-4.03	1.5%	8.0%	1.0%	-0.091%
Hazeldean, 11.3542 (Hugh)	-5.276	1.266	4.36	6.33	-1.83	-1.55	1.64	-7.26	-2.6%	3.9%	4.0%	-0.359%
Kiandra Poll, 140757	4.118	0.756	-21.87	-16.59	-2.45	-2.11	-6.58	-9.75	7.2%	23.1%	-3.6%	-0.618%
Trefusis, 110482	-5.467	0.027	3.57	6.45	-1.08	-0.80	2.92	-0.79	-7.8%	-19.3%	-6.4%	0.609%
Mumblebone, 140026	-1.259	0.579	-5.38	7.22	0.49	0.24	1.08	4.51	7.5%	12.0%	0.0%	-0.226%
Greenfields Poll, 140345	3.785	-1.101	-5.30	1.53	-0.58	-0.22	-2.52	1.29	-3.4%	8.3%	3.2%	0.147%
GRASS 122190, P47	-1.885	0.045	1.53	8.29	1.45	1.73	1.84	-2.58	0.7%	21.4%	-3.1%	-0.526%
Kerin Poll, 151911	4.24	-2.598	8.65	10.67	-0.57	-0.70	-0.23	6.62	4.8%	2.3%	0.3%	0.174%
Hazeldean, 13.4936	-2.938	-2.109	10.16	9.96	-0.49	-0.58	0.90	1.92	0.9%	7.6%	3.2%	-0.409%
Mumblebone, 151367	-1.91	-0.093	-10.73	3.25	0.58	1.50	-2.03	9.01	-1.4%	-9.3%	-10.3%	-0.856%
Moojepin, 120652	-0.089	4.206	-11.88	-6.89	0.35	1.01	-5.25	16.11	-2.1%	9.5%	8.7%	0.894%
Wilgunya, 121224	0.424	-0.702	1.42	6.48	-0.64	-0.51	1.89	-6.53	0.4%	-5.1%	3.3%	0.158%
Collinsville Poll, Apollo	-0.47	-0.252	13.80	13.38	1.62	1.83	4.17	-6.19	-0.1%	5.9%	-1.0%	-0.190%
Roseville Park, 132933	-0.967	-1.248	1.91	0.59	-0.62	-0.25	2.88	-5.56	-4.9%	2.8%	-4.0%	0.291%
Willandra Poll, 140030 (Des)	-0.352	1.395	11.16	13.44	-0.64	-0.25	-3.13	-4.12	-4.1%	6.0%	-4.6%	0.230%
Wanganella, W130816	2.643	-1.128	9.58	13.09	0.03	0.12	-1.00	-2.82	-10.7%	0.6%	-2.3%	-0.443%
Gullen Gamble Poll, 120018	-1.047	-0.528	12.52	12.46	-0.08	-0.42	-6.79	7.87	-4.3%	2.0%	-5.5%	0.221%
Greendale, 140141	-1.832	-1.206	5.08	4.06	-2.14	-2.03	-3.74	3.46	-11.1%	-14.1%	-2.1%	0.002%
Tallawong Merinos, 150280	-4.301	-1.938	6.63	14.26	-1.56	-0.83	10.84	-4.28	-2.1%	4.0%	-2.2%	-0.847%

Team	ALW	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5
Leahcim Poll, 132624	-1.048	1.374	-9.47	2.26	-0.72	-0.01	-3.18	6.41	-6.0%	-14.4%	-1.7%	-0.018%
Lachlan Merinos Poll, 305	0.803	-1.443	3.82	7.41	0.84	0.88	3.39	-4.15	6.2%	5.2%	-3.8%	-0.014%
Wallaloo Park Poll, 150422	-0.322	-1.875	16.78	17.37	1.00	0.40	-0.96	14.12	-10.3%	-12.5%	-3.2%	0.023%
DT Kenilworth, WH13017	0.09	0.207	5.63	13.24	-0.64	-0.22	-1.27	3.13	1.6%	-2.9%	-4.2%	-0.429%
Bundilla Poll, 140055	0.806	-0.864	-1.18	1.27	-0.50	-0.64	-1.16	-5.22	7.6%	4.3%	6.4%	0.359%
Trefusis, 150282	-1.164	-2.037	4.28	-5.21	0.10	0.44	8.00	-0.83	-1.7%	22.1%	-9.9%	0.010%
Toland Poll, 151058	-0.658	1.362	-16.90	-8.02	-0.10	0.73	2.93	11.30	13.8%	16.6%	2.5%	-0.082%
Centre Plus Poll, 407185	0.651	-0.696	-4.72	3.02	-1.46	-1.16	-2.04	3.40	1.4%	6.2%	1.3%	-0.016%
Coromandel Poll, 130660	4.474	0.546	4.96	6.81	-0.21	-0.15	-2.58	-4.50	1.0%	2.1%	-0.5%	-0.126%
Billandri Poll, 151280	-0.762	0.333	9.07	14.34	-0.55	-0.67	-1.53	4.80	3.0%	-20.3%	9.4%	-0.743%
Woodyarrup, 150329	-0.796	0.192	9.82	12.39	0.68	0.81	2.84	4.14	1.4%	13.8%	-4.8%	-0.020%
Barloo Poll, 140027 (Eureka)	-2.97	0.087	6.65	5.15	0.68	0.93	-0.34	-6.21	0.2%	-6.2%	2.2%	0.265%
Cranmore, 13.10	0.335	-0.228	-3.99	3.84	0.58	0.24	0.18	3.67	5.0%	19.6%	8.6%	-0.046%
Nearra Poll, 110264	4.098	2.394	-16.82	-9.58	-0.48	0.19	-3.14	-1.25	3.8%	18.1%	-3.7%	0.166%
Edale, 10Z266K	-1.177	0.948	11.98	8.04	0.53	0.03	1.40	-0.02	5.7%	-12.6%	-9.2%	-0.689%
Moorundie Poll, NE73	0.334	-0.618	15.10	21.85	0.01	-0.66	-5.50	2.06	-5.0%	-5.1%	0.2%	0.133%
Range View Poll, 5-680	-0.98	-0.291	2.84	4.08	-0.15	-0.23	0.23	-4.49	-7.8%	-12.6%	5.8%	0.278%
Ingle Poll, 150087	2.478	1.332	-6.12	-0.74	-0.21	-0.19	6.21	3.33	2.0%	3.9%	-1.1%	0.580%
Mianelup Poll, M00540 (Expo)	5.899	0.237	2.38	6.80	1.05	1.25	-1.52	-0.16	-0.3%	-2.1%	0.4%	-0.062%
Anderson Poll, 140474	-1.061	2.985	0.75	5.71	0.76	1.37	-2.23	4.92	2.0%	29.1%	-7.6%	-0.531%
Miramoonna, 140012	0.245	2.088	1.76	21.44	0.72	1.37	1.38	14.56	-0.3%	17.3%	-3.0%	-0.143%
Grindon, 150017	-2.984	1.197	-34.91	-27.23	-2.85	-1.79	-4.40	-19.41	0.0%	-11.8%	1.0%	-0.613%
Petali Poll, 150697	-0.858	0.096	2.99	21.95	0.33	0.26	3.20	6.92	5.4%	17.7%	-2.2%	0.322%
Cressbrook, 140055	-3.421	-1.767	-1.18	-5.73	-3.68	-3.32	-8.65	-0.33	3.8%	-5.2%	1.9%	-0.991%
Nerstane, 150073	3.177	-1.431	4.04	19.58	-0.15	0.09	-0.66	5.39	0.3%	-1.5%	1.7%	0.087%
Connemara Poll, 140257	-7.407	0.663	-0.40	-4.71	-2.17	-1.50	-3.65	-1.25	1.8%	-12.8%	-3.2%	-0.157%
Mirani, 21.2	-2.814	0.096	-3.17	-6.07	-0.72	-0.01	8.56	-6.93	4.1%	-0.8%	0.9%	0.505%
Conrayn, MVB123	-1.983	-0.201	-1.19	5.61	-0.26	0.15	1.47	-8.89	1.4%	-4.9%	-3.7%	-0.503%
Egelabra, HEK 1.36	-3.623	-1.464	8.76	-3.19	0.42	-0.24	8.69	-13.50	-3.6%	-29.7%	4.8%	0.762%

Team	ALW	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5
Yalgoo, 150313	-5.307	0.132	3.83	8.93	-1.75	-1.38	-0.09	-10.17	-0.2%	-11.4%	5.8%	0.406%
Karori, 140188	-5.181	0.201	-6.93	-2.41	-1.24	-1.43	-1.94	-11.00	-4.3%	-22.4%	2.8%	-0.015%
Wanganella, 150610	1.349	0.657	16.28	26.38	0.61	0.10	-1.49	8.17	-17.5%	-8.2%	-2.4%	-0.046%
Willandra Poll, 160001	2.243	0.3	10.24	14.18	0.73	0.40	-0.84	-4.28	5.1%	0.5%	-1.4%	-0.402%
Langdene, 160950	1.661	-2.709	3.32	13.70	0.01	-0.10	2.59	1.02	-1.1%	-9.3%	-7.2%	0.126%
Gullen Gamble Poll, 14189	-1.073	0.141	5.26	23.61	0.47	0.52	-1.37	6.60	1.2%	4.2%	-0.3%	-0.691%
Kerin Poll, 160137	5.104	-1.572	10.21	12.98	1.40	1.35	1.78	13.67	2.4%	-15.8%	6.1%	0.146%
Roseville Park (Poll), 150039	1.928	3.549	-8.59	-1.48	-0.38	-0.12	2.05	-1.51	2.4%	13.0%	1.8%	-0.192%
Stockman Poll, Pioneer	3.242	-2.007	-5.03	-7.74	-1.97	-1.61	1.40	-7.38	-2.1%	0.0%	-2.5%	0.367%
Lewisdale Poll, Monty 10	3.159	-0.369	22.77	22.34	2.77	2.65	1.09	-0.23	-9.9%	-20.7%	7.1%	-0.132%
Anderson Poll, 150266	5.108	1.812	-19.05	-7.02	-0.31	-0.14	3.09	-1.84	0.7%	15.5%	-4.6%	0.120%
Charinga, 130240 (Doc)	2.14	-2.802	7.46	-1.74	-0.45	-0.71	-2.18	-4.59	-2.3%	-4.1%	4.6%	0.019%
GRASS 141924, R15	1.25	-0.012	6.06	-12.85	-0.19	0.33	1.12	-4.29	3.3%	-10.0%	1.0%	-0.050%
Orrie Cowie, 140050 (Trojan)	4.31	-0.219	2.28	-10.31	-0.66	-1.00	-5.75	-1.67	0.1%	1.0%	-0.8%	-0.093%
Avington Poll, 160047	0.463	-1.338	-3.93	-7.17	-2.92	-1.87	2.46	-17.36	1.3%	-7.9%	2.2%	-0.398%
Clovernook Poll, 160095	5.085	-0.18	-4.04	2.49	-0.03	0.29	-6.93	17.60	-29.1%	-2.9%	-2.5%	0.195%
Karori, 150222	-0.845	1.389	-2.77	7.10	-1.25	-0.67	11.39	1.85	2.9%	-0.5%	1.2%	0.250%
Alfoxton, 150430	1.064	-1.131	4.71	3.24	-0.36	0.16	-3.26	-7.71	4.2%	24.4%	-1.1%	0.004%
Eilan Donan, 5145 (Harvey)	0.41	-1.248	7.22	-5.48	0.08	0.20	2.39	-10.26	4.8%	1.7%	2.5%	0.284%
Yalgoo, 160070	-3.255	-0.813	7.07	11.78	-1.52	-1.70	-2.45	3.11	1.8%	4.6%	0.5%	-0.216%
Petali Poll, 160849	-2.659	1.593	-5.31	-8.88	-0.10	-0.30	-2.63	-3.02	1.4%	4.7%	-1.9%	-0.194%
Europambela, 120101	-7.91	2.787	-25.12	-31.62	-2.10	-1.17	6.71	-22.82	0.8%	-10.6%	4.9%	0.190%
Bungulla, 160350	-1.467	4.974	11.26	18.02	0.47	0.91	0.49	11.97	3.0%	-9.3%	1.8%	0.323%
Hilltop, HT Poll 156	1.223	-0.36	-3.54	4.75	-0.22	-0.36	0.80	0.73	-1.7%	7.3%	-1.6%	-0.072%
Hillcreston Park Poll, 110143	-7.043	0.48	-12.22	-29.40	-1.23	-1.73	0.00	-19.77	1.5%	-14.8%	2.7%	0.003%
Average	-0.179	0.038	0.410	3.666	-0.322	-0.140	-0.344	-0.433	0.000	0.000	0.000	0.000%

#### 7.14.4.2. Detailed Methodology

The profit analysis was carried out with the deterministic steady-state equilibrium mode of the Australian Farm Optimisation model (AFO) (Young *et al.* 2023, 2024). AFO is a major upgrade on the MIDAS model which has previously been used to calculate the profitability of teams in sire evaluations and wether trials (Windsor and Young 1999, Clarke *et al.* 2019). The model calculates the profitability of the whole flock based on the productivity of each class of stock (including clean fleece weight, fibre diameter, staple strength, staple length, liveweight, weaning rate and mortality), commodity prices and the farm carrying capacity calculated in a detailed feed budget. The model is briefly described below.

As an optimising model it calculates for each genotype the optimal management for stocking rate, nutrition profile, pasture grazing intensity and rate of grain feeding that will maximise profitability and optimise productivity of the animals in the flock. The model accounts for changes in age structure linked to weaning rate and mortality, and the change in ewe energy requirements that result from increasing lamb survival or altering the number of ewes pregnant or lactating with singles or twins. Furthermore, the model optimises sale age strategy and time of sale within year, accounting for feed requirements, growth potential and carcass specifications. Therefore, it is possible to evaluate each genotype when optimally managed for that genotype, rather than as managed in the genetic evaluation. However, in order to predict production levels with different management the calibration of each genotype is more complex.

Three existing regional versions of the AFO model were used, each representing a typical farm in regions with different length growing seasons. On each farm the flock was a self-replacing Merino flock, mating Merino ewes to Merino rams. Management was on an annual cycle of lambing and shearing and the timing varied with region but was fixed for the genotypes in that region. The regions were selected to represent diversity in the feed supply through the year. There was variation in the length of the growing season and the proportion of the farm allocated to cropping, which affects the availability of stubbles during the summer/autumn period. The models have been calibrated using local knowledge to represent current farm-management technology, including pasture species, machinery complements and inputs used. Tasks contracted and crop and livestock options considered are all consistent with those used by farmers in the modelled region. The husbandry program was based on regional best practice management and there was minimal production penalty associated with disease.

*Flock management.* Ewes entered the breeding flock at mating at 19 months of age and remained in the flock for 4 or 5 breeding opportunities, whichever was most profitable for the genotype. Young ewes that were surplus to requirements for replacing the flock were sold after the hogget shearing prior to entering the breeding flock. Wethers were sold between weaning and up to 3.5 years of age at any of 6 time points per year, the selection was based on maximising profit for the genotype. They were shorn annually at the main shearing and shorn again prior to sale if fleece weight was sufficient.

*The south-western region of Victoria (SWV).* This model represents a 'typical' farm in the Hamilton region in south-west Victoria (Young *et al.* 2010). The total area of the farm was 1000 ha and comprised of three land management units. There was no crop on the farm and the standard pasture grown on all land management units was a highly productive perennial ryegrass pasture with high fertiliser rates and best grazing management practices. The average annual rainfall was 686mm, the average break of season occurred in the first week of April and the growing season length was 9 months. The flock lambed in August, and the annual shearing was in January.

*The Great Southern region of Western Australia (GSW).* The Great Southern region in Western Australia is characterised by winter-dominant rainfall that supports a mix of cropping and livestock enterprises. The location modelled was 500–550 mm rainfall with a 6-month growing season. The model represented a typical 2130 ha farm that includes three LMUs with varying productivity and optimal land use (Young *et al.* 2024). There was 50% of the farm in crop and 50% was pasture. The flock lambed in July, and the annual shearing was in January.

*The cereal sheep zone of Western Australia (CSZ).* The region selected for the cereal sheep zone was the eastern wheatbelt of WA. The eastern wheatbelt is a winter rainfall region with an annual rainfall of approximately 300mm with the majority occurring from May to October. The farm system was cropping dominant farming system with 80% of the farm in crop and 20% as pasture, therefore there was an abundance of crop stubbles available for grazing in summer and autumn. The model represented a 6093 ha farm that included seven LMUs with varying productivity and optimal land use (Young 2024). The flock lambed in May, and the annual shearing was in November.

*Feed budget.* For this analysis the assumptions of the Australian Feeding Standards (Freer *et al.* 2012) were used in the AFO livestock generator to generate the energy requirement and production parameters for the mathematical programming model. The important assumptions include:

- intake is a function of SRW, the age of the animal relative to maturity and the condition score of the animal.
- the energy requirement for maintenance is related to metabolic liveweight ( $LW^{0.75}$ ) and age, and as such the variation between the teams in maintenance requirement is only due to liveweight and there is no variation in the efficiency of tissue gain per MJ of energy stored.
- Partitioning and body composition is calculated from the current LW relative to mature LW and varies very little with level of intake and partitioning of energy retained is controlled by the relative size of the animal, hence there is very little variation between the teams. The effect of partitioning on energy requirements and the financial implications is examined in the GEPEP MLP add-on project.

Production assumptions, breeding values and calibration.

The genotype evaluated in the profit analysis was a first cross between the foundation ewe base and the individual sire teams. The ewe base was a medium wool Merino and was the same across regions. The standard production levels for a team with breeding values of 0 for all traits, run in the Great Southern of WA, are described in Table 33. The production level changes across region due to difference in nutrition, however, the coefficients in the livestock generator that are used to calculate the production are constant across region.

Table 33. Traits that were valued in the modelling analysis, the breeding value description and the class of sheep that were calibrated to achieve the target production. This production level is for a flock with 0 for all breeding values.

Parameter	Breeding value	Sheep class	Units	Production
Adult ewe weight	AWT	Ewes at 3.5yo, previous LSLN <sup>1</sup> 11	%	60
Yearling fat depth <sup>2</sup>	YFAT		mm	
Clean fleece weight	ACFW	Single bearing 3.5yo ewe	kg clean	3.8
	YCFW	1.5 yo ewe	kg clean	3.1
Fibre diameter	AFD	Single bearing 3.5yo ewe	µm	19.0
	YFD	1.5 yo ewe	µm	18.0
Staple strength	ASS	Single bearing 3.5yo ewe	N/kTex	35
Staple length	ASL	Single bearing 3.5yo ewe	Mm	100
Conception	CON	Adult ewes 2, 3, 4, and 5yo	%	92
Litter size	LS	Adult ewes 2, 3, 4, and 5yo	%	140
Twin Lamb survival	ERA	Adult ewes 2, 3, 4, and 5yo	%	70
Ewe survival	SURV_YA5	Yearling to A5	%	75

<sup>1</sup> LSLN is Litter size lactation number, this is alternative terminology to birth type-rear type (BTRT). BTRT is used to describe the status of all animals when it was born. Whereas LSLN is the status of the ewe during each reproduction cycle, 11 is pregnant with a single and raised a single.

<sup>2</sup> Yearling fat depth was not calibrated using the same method as the other traits.

Following a process implemented by Walmsely *et al.* (2013), selected coefficients in the AFO livestock generator (a simulation model with fixed feed supply) that control the productivity and energy requirements of the animals were calibrated to match the target productivity associated with the selected breeding values. These coefficients are termed the calibration coefficients. The target productivity for each trait of each team was the productivity of the standard genotype (Table 33) plus half estimated breeding value for the relevant trait and age stage for the team (Table 32).

A list of the breeding value traits, the calibration traits and the selected calibration coefficients that were optimised are in Table 34 and each is discussed in more detail below. The calibration traits in the simulation model relate to ewes with a specific litter size and lactation number (LSLN). This was because the FBVs for the fleece traits and weight traits are corrected for annual LSLN and hence the deviation in the BV is relevant to the deviation of the ewes that was pregnant with and raised a single lamb. Each production trait has a calibration coefficient that is closely linked to the final production level; however, the calibration coefficients often impact other traits, hence the calibration coefficients need to be fitted simultaneously not individually. For example, the wool production coefficients mostly affect CFW, however, they also affect the LW traits through the change in energy requirement when CFW changes. Similarly altering standard reference weight alters LW primarily but it also changes CFW because of the impacts on intake, for which an estimate is made in the model but there is remaining variation.

The above calibration approach differs from that taken by Wallace *et al.* (2021) who calibrated the GrassGro model (Moore *et al.* 1997) to represent those teams measured at the Macquarie MLP site. Their approach was to use the adjusted sire group means (calculated from a standard production level plus half the BV of the trait) for SRW, GFW, yield and FD as the inputs parameters for the GrassGro simulation model. The coefficients adjusted were not specified, but they likely were the same as the calibration coefficients used in this study. Weaning rate was handled differently and they used a similar approach as used in this study of varying a calibration coefficient to achieve a match between the deviation in weaning rate and the weaning rate BV. However, weaning rate was calibrated by only altering the conception coefficient and didn't represent difference in litter size and ewe rearing ability. Their report implied by omission that the coefficients were fitted

individually rather than concurrently because there was no description of how the coefficients were optimised if done concurrently.

*Table 34: The coefficients that were adjusted to achieve the measured level of production in the AFO livestock data generator. The coefficients have a description and (variable name) the majority correspond to the parameters described by Freer et al. (2012). However, for SS, ewes pregnant, litter size and ewe rearing ability the coefficients are specific to AFO.*

Breeding Value	Simulation model calibration trait	Calibration coefficient
AWT	Pre-joining LW of adult ewes LSLN 11	Standard reference weight (SRW)
ACFW	CFW of 3.5yo ewes with LSLN 11	Std fleece weight (SFW)
YCFW	CFW of 1.5 yo ewes	
AFD	FD of 3.5yo ewes with LSLN 11	Std fibre diameter (SFD)
YFD	FD of 1.5 yo ewes	
SS	SS of 3.5yo ewes with LSLN 11	Intrinsic SS (cw[16])
SL	SL of 3.5yo ewes with LSLN 11	Follicle number (cw[11])
CON	Average % pregnant of 2 to 5yo ewes	RR 0-1 cut-off (cl0[25,0])
LS	Average litter size of 2 to 5yo ewes	RR 1-2 cut-off (cl0[25,1])
ERA	Average survival of twin born lambs of 2 to 5 yo ewes	Lamb survival intercept (cu2[8,-1])
SURV	Survival of ewes: yearling to 5½ yo shearing	Basal mortality (cd[1])

#### Weight traits

The SRW coefficient was the calibrating coefficient for AWT and the target trait is the LW of a 3.5yo ewe at joining that was pregnant with and reared a single in the previous reproduction cycle. Changing SRW affects normal birth weight and the normal growth curve. However, the BVs for weaning weight and yearling weight were not calibrated but rather varied between teams based on the SRW and the normal growth curve.

#### Clean fleece weight

The standard fleece weight (SFW) coefficient was the calibrating coefficient for the ACFW breeding value and the target trait was the average CFW of adult ewes that were pregnant with and reared a single lamb during the reproduction cycle that impacted the wool shorn. The SFW coefficient also affects the wool growth of other age groups, post weaning, yearling and the wethers. The YCFW breeding value was also calibrated using a new coefficient that was added that scaled the SFW during the first 18 months of life. As such, differences in PCFW were controlled by the YCFW breeding value.

#### Fibre diameter

Similar to CFW, fibre diameter was calibrated using the standard fibre diameter (SFD) and a new coefficient that was added to scale SFD early in life.

#### Staple strength

Intrinsic staple strength was the calibration coefficient for ASS. This coefficient affects SS for the whole of life based on the annual fibre profile, however, the calibration of YSS was not separated as it was for CFW and FD. SS affects wool price and has no other effect in the model calculations.

#### Staple length

Follicle density was the calibration coefficient for staple length. For a given CFW and FD, a higher follicle density results in a shorter fibre on the assumption that the density of wool is a constant. As for SS there was no age-based calibration.

## Reproduction

Reproduction was calibrated representing the 3 component traits (conception, litter size and ewe rearing ability). Each component had a separate calibrating coefficient. The calibration trait for ewe rearing ability was the survival of twin born lambs rather than average lamb survival because average lamb survival is dependent on litter size given the big effect of BT on lamb survival.

## Ewe Survival

The calibration coefficient for ewe survival was basal mortality which is the non-reducible daily mortality of all stock classes in the flock. As such, it alters the mortality of the young ewes and the wethers. The definition of the calibration trait is the survival of ewes that were pregnant with and raised a single from shearing at yearling age to shearing at 5.5yo. As such, total flock mortality will vary with reproduction rate and the varying proportion of empty, single- and twin-bearing ewes.

The calibration algorithm

The AFO livestock data generator was set with the time of lambing and shearing for the Great Southern region of WA (as described above). The coefficients were calibrated using the differential evolution approach (Storn and Price 1995) using the algorithm as implemented in the SciPy package ([https://docs.scipy.org/doc/scipy/reference/generated/scipy.optimize.differential\\_evolution.html](https://docs.scipy.org/doc/scipy/reference/generated/scipy.optimize.differential_evolution.html)). The objective was to minimise the sum of the square of the ratio of the deviation of the simulated target trait from the target value, as a proportion of the standard deviation of the phenotypes of the 134 teams (Equation 1).

$$Objective = \sum_i^T \left( \frac{Simulated\ value_i - target\ value_i}{std\ dev\ of\ target\ value_i} \right)^2 \quad \dots\dots\dots \text{Equation 1}$$

where T is the number of target traits.

The optimisation of the coefficients resulted in the maximum deviation of the target traits from the target values of less than 0.1% (4g CFW, 0.02μ, 70g LW), so the representation of the 134 different teams has little error associated with coefficient calibration. The adjusted coefficients were used to generate the livestock production levels used in the mathematical programming model (described in detail in the appendix).

After the genotypes were calibrated, the coefficients generated (see Appendix Table 35) were used to represent the teams in subsequent runs of the mathematical programming (MP) model. This allows the effect of varying nutrition to be estimated and included in the analysis, so teams can be evaluated with varying nutrition that is not possible in a paddock trial setting because of the resources required to run the animals under multiple nutrition environments. For each team the nutrition profile was optimised by comparing about 500 nutrition profiles for the ewes and the wether progeny and selecting the option that maximised profit.

This approach of calibrating the coefficients for each team to match the breeding value for the team, is a novel approach and needs further development. One of the difficulties is selecting the calibration coefficient to adjust for each breeding trait (Table 34). This is straight forward if the physiology of the genetic change is understood but often that is not the case. In this analysis an attempt was made to include the breeding values for weaning weight (WWT) and yearling weight (YWT) along with adult weight. However, this was not successful because the magnitude of the changes in the calibration coefficients that were required to match the change in WWT and YWT made the optimisation model unstable.

Hence, these traits were not included, however, this is an avenue that deserves further exploration.

#### Wool value

Wool income per head for each age group shorn was estimated from average clean fleece weight and the value per kg 'sweep the board, net in the bank' estimated from the team fibre diameter, staple strength and staple length (see description of wool price).

#### Sale Value

Sale animal value for each team was calculated for each sale time option from dressed weight and fat score. The average DW and FS was calculated from the simulated values and varied with nutrition. Fat score was estimated from condition score plus half the FBV using Equation 1 as described in section 7.14.1.2 Sale sheep prices.

An adjustment to dressing percentage for fleece length or time off feed was not necessary because fleece free conceptus free weight was simulated and used for the calculation.

To account for the variation in dressed weight and fat score in a mob, while calculating sale value using average dressed weight and average fat score, the grid adjustment was calculated for 5 separate levels selected from a normal distribution for each of weight and condition score. The 25 options were averaged to derive the average sale price. This reflects that if the average price is close to the step in the grid, some animals will be valued with the lower specs and some will be valued with the higher specs.

#### Sensitivity Analysis

Sensitivity analysis was carried out on the prices received (as described in a previous section) and the feed supply (as controlled by the regions previously described). Further sensitivity analyses were carried out to test the importance of the analysis methodology and assumptions, and the extra detail that is represented in the modelling analysis over a gross margins analysis. The options tested were:

- Fixed nutrition profile, fixed supplementary feeding and stocking rate set using assumptions consistent with a gross margins analysis (fixed DSE/ha with variation in DSE/hd based on metabolic standard reference weight). When compared to the fully optimised model this is a representation of using the feed budgeting assumptions as used in a gross margins analysis.
- Fixed age structure compared with optimised age structure both with a fixed nutrition profile. This demonstrates the importance of matching the age structure with the genotype, such as retaining high wool production genotypes for longer and selling high growth wether progeny early as a finished lamb. Note: this comparison is not capturing the full value of representing different sale age because it is missing the option of altering feeding of the sale animals to target markets based on genotype. However, it is difficult to design a sensitivity analysis that separates the value of targeted feeding of sale animals from feeding of the animals that are being retained.

### 7.14.4.3. Fitted coefficients

Table 35: Optimised coefficients for the livestock data generator that represent the 134 teams

Trait	ALW	ACFW	YCFW	AFD	YFD	ASS	ASL	Con	LS	ERA	Mortality
Coefficient	SRW	SFW	scalar	SFD	adjuster	ISS	density	ClO[25,0]	ClO[25,0]	Cu2[8,12]	cd[1]
Billandri Poll, 130087	56.84	3.903	0.7183	18.97	1.079	43.135	6E+07	1.665	5.1824	2.0389	9.09E-05
Leahcim Poll, 123153	59.028	3.581	0.72163	18.34	1.045	37.936	6E+07	1.9425	5.8567	1.7705	1.02E-04
Leahcim Poll, 090918	58.049	3.568	0.73997	18.59	1.179	40.603	6E+07	1.6725	5.6586	1.9881	1.04E-04
Greenfields Poll, 130599	56.332	3.864	0.72645	18.2	1.079	39.529	7E+07	1.8419	5.1809	2.0557	9.28E-05
Roseville Park, 140019	59.485	3.657	0.71879	18.78	1.058	42.821	6E+07	1.6935	5.4619	1.5119	9.14E-05
Yalgoo, 120043	55.964	3.598	0.72744	17.27	1.048	41.533	7E+07	1.9778	5.3102	1.9542	9.64E-05
One Oak No.2, R56	58.093	3.926	0.66883	18.12	1.041	38.215	7E+07	1.8155	5.3876	1.8116	9.66E-05
Centre Plus Poll, 207316	56.675	3.634	0.72136	17.89	1.162	40.316	6E+07	1.6786	5.1776	1.8142	9.23E-05
Mumblebone, 130389	56.724	3.513	0.74036	19.08	1.047	42.029	5E+07	1.6285	5.0442	1.6885	8.67E-05
Kurra-Wirra, SR5681	54.621	3.672	0.71658	18.59	1.211	41.936	6E+07	1.6095	5.3719	1.9566	1.00E-04
Glenpaen, 120042	58.49	3.88	0.69561	17.98	1.132	41.697	7E+07	2.5075	5.5776	1.6152	1.05E-04
Nareeb Nareeb, 130380	59.462	3.745	0.73364	18.76	1.076	43.201	6E+07	2.0154	5.0101	1.6407	8.28E-05
Hazeldean, 11.43	60.89	3.827	0.72762	18.57	1.191	38.434	6E+07	2.2203	5.2003	1.4276	8.13E-05
Mokanger, 120092	58.439	3.976	0.70634	18.56	1.138	45.006	7E+07	2.1722	5.6171	1.6875	1.01E-04
Merinotech WA Poll, 100081	57.439	3.696	0.75128	18.53	0.991	45.896	6E+07	1.4665	5.0005	1.4712	8.85E-05
Darriwell, 130941 (Buddha)	58.782	3.955	0.70439	18.91	1.038	44.766	6E+07	1.8854	5.4256	1.891	9.50E-05
Tuckwood Poll, 121021	61.262	3.852	0.74251	18.52	1.055	39.267	6E+07	2.0057	5.4158	1.7076	9.05E-05
Moojepin, 100248	63.336	3.525	0.80407	18.82	0.943	38.277	5E+07	2.0919	5.549	2.061	8.48E-05
Nerstane, 130467	56.92	3.816	0.70384	18.42	1.157	40.951	6E+07	1.9741	5.4294	1.4755	9.92E-05
Bogo, 111424	58.178	3.687	0.70555	17.64	1.084	38.286	7E+07	1.7109	5.2921	1.8617	9.12E-05
Yiddinga, 130374	58.227	3.497	0.75293	18.19	0.99	45.411	6E+07	1.8973	5.3413	1.8124	9.17E-05
The Mountain Dam, 11/ESA004	58.677	3.707	0.73166	17.81	0.974	40.351	6E+07	2.1123	5.5802	1.8703	9.78E-05
Bundilla, 111265	62.179	3.751	0.781	18.67	1.107	41.994	6E+07	1.9103	5.2226	1.6376	8.11E-05
Bundaleer Poll, 13V741	59.061	3.59	0.72507	18.4	1.108	43.74	6E+07	1.8488	5.6899	1.8162	9.65E-05
Mumblebone, 130850	60.464	3.655	0.72997	18.72	0.942	40.384	5E+07	1.7783	5.1971	1.9978	8.23E-05
Pooginook Poll, 140632	59.064	3.75	0.70841	18.79	1.071	42.243	6E+07	1.4722	5.3209	1.7041	8.74E-05
Trigger Vale Poll, 140477	60.751	3.696	0.72676	19.49	0.965	40.988	5E+07	2.1379	5.88	1.9482	1.01E-04
Bella Lana, 130296	59.073	3.518	0.74557	18.86	1.214	36.69	5E+07	1.1001	5.5077	1.6028	9.29E-05
Pastora Poll, 082893	58.245	3.703	0.7099	17.33	0.968	38.148	7E+07	1.668	5.5114	2.0324	9.32E-05
Wattle Dale, 140754	57.269	3.712	0.74712	17.71	1.103	42.185	7E+07	1.3819	5.3097	1.3217	9.87E-05
Glen Donald, 120014	58.58	4.041	0.7019	19.1	1.198	37.557	6E+07	2.0157	5.2105	1.4674	8.76E-05
Roseville Park, 140611	58.147	3.761	0.69591	17.89	1.07	40.636	7E+07	2.0371	5.5311	1.5486	9.91E-05

Trait	ALW	ACFW	YCFW	AFD	YFD	ASS	ASL	Con	LS	ERA	Mortality
Coefficient	SRW	SFW	scalar	SFD	adjuster	ISS	density	CI0[25,0]	CI0[25,0]	Cu2[8,12]	cd[1]
Greendale, 120012	57.232	3.748	0.7252	17.58	1.205	40.708	7E+07	2.1245	5.5017	1.8397	1.02E-04
Poll Boonoke, PB2020	57.159	3.848	0.72718	18.53	1.306	37.517	6E+07	2.4067	5.3013	2.0127	9.28E-05
Wurrook, 130149	56.319	3.815	0.73654	17.8	1.037	38.815	7E+07	1.6688	5.1229	1.7412	9.33E-05
Boyanga, 145112	57.206	3.443	0.72387	18.18	1.041	38.246	6E+07	1.8427	5.2742	2.0169	9.44E-05
Haddon Rig, 2.715	57.238	3.971	0.7079	19.05	1.067	42.553	6E+07	1.5267	5.0927	1.9947	8.43E-05
Ejanding Poll, 145096	59.904	3.807	0.72322	19.38	1.18	45.235	5E+07	1.8333	5.6137	1.9343	9.40E-05
Rhamily Poll, 110330 (Benny)	61.122	3.802	0.72463	18.93	1.121	43.583	6E+07	2.2414	5.4556	1.568	9.00E-05
Boolading Blues Poll, 120708	60.849	4.012	0.72964	20.87	1.211	43.725	5E+07	1.8663	5.2406	1.8169	8.45E-05
West Plains Poll, (Mercenary)	57.516	3.867	0.6872	18.62	1.136	38.609	7E+07	2.0334	5.7295	1.8496	1.03E-04
Ingle Poll, 130387	58.258	3.458	0.73423	17.98	1.068	40.535	6E+07	1.8063	4.9668	1.6491	8.16E-05
Moojepin, 140377	58.292	3.593	0.73508	19.2	1.193	39.28	5E+07	1.7951	5.3683	1.8897	9.12E-05
Billandri Poll, 130641	59.68	3.94	0.70531	18.51	1.07	40.608	6E+07	1.9116	5.5402	2.0156	9.69E-05
Claypans Poll, 130597	59.385	3.975	0.68808	18.96	1.131	43.19	6E+07	2.0434	5.4176	1.6675	9.34E-05
East Mundulla, 090137 (Jonty)	60.555	4.057	0.69828	18.93	1.176	37.388	6E+07	2.2995	5.7305	1.7101	1.02E-04
Wyambah Poll, 140141	57.261	3.638	0.72761	19.61	1.135	42.581	5E+07	2.1019	5.3315	1.7189	9.39E-05
Woodyarrup, 120175	60.16	3.973	0.72329	18.41	1.048	40.347	6E+07	1.6712	5.5118	1.7551	9.33E-05
Hannaton Poll, 120046	57.758	3.609	0.73487	18.3	1.163	39.732	6E+07	1.1301	5.3914	1.9745	9.41E-05
Wallaloo Park Poll, 120912	56.999	3.548	0.72893	17.66	1.057	38.599	6E+07	2.3446	5.2874	1.6306	9.69E-05
Koorungal, 130519	54.911	3.614	0.70466	17.55	0.967	45.299	7E+07	1.2322	5.3528	1.9883	1.00E-04
Greenland, 2.366	58.217	3.743	0.71126	19.09	1.084	46.227	6E+07	2.0631	5.5972	1.7551	9.85E-05
Tuckwood Poll, 131026	61.007	3.654	0.73449	17.88	1.006	40.891	6E+07	1.9327	5.4413	1.9653	8.76E-05
Kurra-Wirra, SB5585	57.969	3.704	0.73518	18.83	1.149	43.122	6E+07	1.854	5.7166	1.9315	1.00E-04
Centre Plus Poll, 707115	59.958	3.498	0.77442	18.45	1.175	39.17	5E+07	1.6374	4.9629	1.7695	7.41E-05
Terrick West Poll, 122220	59.456	3.686	0.68907	18.03	0.987	40.725	7E+07	1.7524	5.1296	1.7436	8.75E-05
Glen Holme , 141077 (Dohne)	62.698	3.584	0.71067	18.62	1.062	41.758	6E+07	1.625	5.1482	1.6879	7.96E-05
Nerstane, 100919	58.756	3.899	0.74774	18.57	1.08	42.65	6E+07	2.3064	5.6113	1.7475	9.98E-05
GRASS, 142194 (R4)	59.456	3.919	0.7514	19.43	0.966	41.822	6E+07	1.7151	5.5376	2.0696	9.17E-05
Melrose, 12UGB060	56.282	3.804	0.73268	18.21	1.077	42.396	7E+07	2.2219	5.3387	1.7674	9.76E-05
Yiddinga, 141989	59.653	3.805	0.74489	18.33	1	41.921	7E+07	2.0005	5.5016	1.907	9.31E-05
Stockman Poll, 090853 (Stilts)	57.675	3.709	0.73594	18.09	1.119	43.157	7E+07	1.7801	5.139	1.8288	8.86E-05
Hazeldean, 11.3542 (Hugh)	56.365	3.796	0.71783	17.71	1.074	42.682	7E+07	1.951	5.1563	1.9571	9.34E-05
Kiandra Poll, 140757	60.29	3.387	0.73356	17.47	1.09	37.964	6E+07	1.4543	4.9961	1.6239	8.04E-05
Trefusis, 110482	56.211	3.784	0.72027	18.08	1.072	42.874	7E+07	2.2	5.6977	1.6639	1.04E-04
Mumblebone, 140026	58.067	3.649	0.75589	18.88	1.206	42.588	6E+07	1.2784	5.0467	1.7877	8.52E-05

Trait Coefficient	ALW SRW	ACFW SFW	YCFW scalar	AFD SFD	YFD adjuster	ASS ISS	ASL density	Con CI0[25,0]	LS CI0[25,0]	ERA Cu2[8,12]	Mortality cd[1]
Greenfields Poll, 140345	60.287	3.672	0.73742	18.38	1.077	40.299	6E+07	2.2258	5.3453	1.8243	8.84E-05
GRASS 122190, P47	57.867	3.763	0.73505	19.35	1.074	42.913	6E+07	1.8404	4.89	1.7078	8.29E-05
Kerin Poll, 151911	60.637	3.911	0.72103	18.37	1.134	41.784	6E+07	1.6842	5.4245	1.7356	8.89E-05
Hazeldean, 13.4936	57.478	3.904	0.71181	18.38	1.114	41.619	7E+07	1.7984	5.1258	1.9043	9.01E-05
Mumblebone, 151367	57.657	3.557	0.76109	18.93	1.02	40.623	5E+07	1.9733	5.5355	1.5152	1.03E-04
Moojepin, 120652	58.509	3.543	0.73029	18.82	1.014	38.722	5E+07	2.0599	5.1993	2.0372	8.44E-05
Wilgunya, 121224	58.85	3.772	0.72979	18.33	1.107	42.918	6E+07	1.919	5.4979	1.8669	9.51E-05
Collinsville Poll, Apollo	58.602	3.977	0.71193	19.43	1.048	44.169	6E+07	1.924	5.2386	1.7529	9.02E-05
Roseville Park, 132933	58.235	3.775	0.70806	18.33	1.032	43.404	7E+07	2.1802	5.3223	1.6735	9.17E-05
Willandra Poll, 140030 (Des)	58.614	3.933	0.72032	18.31	1.047	39.89	7E+07	2.1523	5.2666	1.6507	8.96E-05
Wanganella, W130816	59.907	3.921	0.72502	18.66	1.099	41.037	6E+07	2.523	5.5095	1.681	9.77E-05
Gullen Gamble Poll, 120018	58.312	3.953	0.71266	18.58	1.155	37.667	6E+07	2.1446	5.3286	1.6347	9.20E-05
Greendale, 140141	57.848	3.825	0.70869	17.57	1.091	39.607	7E+07	2.4278	5.7013	1.739	1.05E-04
Tallawong Merinos, 150280	56.816	3.839	0.73642	17.85	1.024	48.247	7E+07	1.9468	5.1784	1.7645	9.53E-05
Leahcim Poll, 132624	58.047	3.582	0.75313	18.29	1.047	39.958	6E+07	2.2339	5.7062	1.7393	1.03E-04
Lachlan Merinos Poll, 305	59.062	3.814	0.72516	19.06	1.102	43.496	6E+07	1.4673	5.2531	1.6582	8.81E-05
Wallaloo Park Poll, 150422	58.647	4.029	0.71479	19.12	1.194	41.278	6E+07	2.4302	5.7009	1.6917	1.03E-04
DT Kenilworth, WH13017	58.744	3.842	0.73782	18.32	1.069	40.986	6E+07	1.8289	5.4308	1.6565	9.60E-05
Bundilla Poll, 140055	59.023	3.729	0.72149	18.4	1.138	41.227	6E+07	1.3187	5.2645	1.9551	8.67E-05
Trefusis, 150282	58.204	3.813	0.68143	18.68	0.991	47.581	6E+07	2.0058	4.9161	1.5158	8.07E-05
Toland Poll, 151058	58.226	3.454	0.74501	18.61	1.013	43.623	5E+07	-0.0142	4.9309	1.8518	8.09E-05
Centre Plus Poll, 407185	58.904	3.669	0.73958	17.93	1.099	40.619	6E+07	1.8604	5.2621	1.804	8.92E-05
Coromandel Poll, 130660	60.693	3.85	0.7204	18.55	1.096	40.305	6E+07	1.9811	5.4617	1.7103	9.15E-05
Billandri Poll, 151280	58.388	3.897	0.72964	18.36	1.149	40.834	6E+07	1.7049	5.8027	2.0728	1.07E-04
Woodyarrup, 150329	58.425	3.908	0.72135	18.96	1.082	43.177	6E+07	1.819	5.0623	1.6494	8.45E-05
Barloo Poll, 140027 (Eureka)	57.397	3.846	0.70717	18.96	1.042	41.204	6E+07	1.8446	5.4203	1.8755	9.53E-05
Cranmore, 13.10	58.813	3.679	0.74004	18.93	1.195	42.03	6E+07	1.5711	4.961	2.0286	8.05E-05
Nearra Poll, 110264	60.322	3.475	0.74032	18.44	1.031	40.047	6E+07	1.7731	5.1162	1.622	8.06E-05
Edale, 102266K	58.234	3.944	0.70022	18.89	1.156	42.46	6E+07	1.4647	5.5856	1.5377	1.01E-04
Moorundie Poll, NE73	58.946	4.003	0.73437	18.64	1.254	38.254	6E+07	2.2128	5.5228	1.7791	9.65E-05
Range View Poll, 5-680	58.218	3.791	0.71641	18.56	1.117	41.332	6E+07	2.3136	5.6732	1.9606	1.01E-04
Ingle Poll, 150087	59.693	3.652	0.73207	18.55	1.123	45.492	6E+07	1.8656	5.361	1.7142	8.75E-05
Mianelup Poll, M00540 (Expo)	61.289	3.812	0.72933	19.18	1.078	40.9	6E+07	2.101	5.6032	1.7206	9.39E-05
Anderson Poll, 140474	58.232	3.753	0.72945	19.01	1.019	40.538	6E+07	1.7729	4.7579	1.5746	7.79E-05

Trait	ALW	ACFW	YCFW	AFD	YFD	ASS	ASL	Con	LS	ERA	Mortality
Coefficient	SRW	SFW	scalar	SFD	adjuster	ISS	density	CI0[25,0]	CI0[25,0]	Cu2[8,12]	cd[1]
Miramoota, 140012	58.805	3.776	0.77853	19	1.084	42.866	5E+07	1.9565	5.0374	1.6862	8.38E-05
Grindon, 150017	56.932	3.139	0.74163	17.25	0.987	39.249	7E+07	1.8704	5.5613	1.8369	1.04E-04
Petali Poll, 150697	58.34	3.792	0.77547	18.8	1.207	43.888	6E+07	1.5012	4.9564	1.721	7.97E-05
Cressbrook, 140055	57.119	3.712	0.69627	16.81	1.041	35.976	8E+07	1.5792	5.3663	1.8711	9.97E-05
Nerstane, 150073	60.103	3.828	0.76508	18.58	1.138	41.53	6E+07	1.993	5.5016	1.7884	9.30E-05
Connemara Poll, 140257	55.336	3.708	0.69579	17.54	0.979	41.982	7E+07	1.6287	5.431	1.7749	1.01E-04
Mirani, 21.2	57.374	3.68	0.70193	18.28	0.972	46.715	7E+07	1.5703	5.2879	1.8334	9.02E-05
Conrayn, MVB123	57.747	3.718	0.73501	18.51	1.066	42.594	6E+07	1.7927	5.416	1.694	9.79E-05
Egelabra, HEK 1.36	57.084	3.88	0.67308	18.83	1.14	46.302	7E+07	2.0465	6.0099	1.9639	1.08E-04
Yalgoo, 150313	56.324	3.788	0.7279	17.75	1.074	41.798	7E+07	1.8111	5.47	2.0134	9.80E-05
Karori, 140188	56.234	3.608	0.72624	18.02	1.169	40.712	7E+07	2.0466	5.7688	1.9203	1.08E-04
Wanganella, 150610	59.378	4.029	0.74468	18.93	1.234	40.793	6E+07	2.7311	5.6969	1.6947	1.03E-04
Willandra Poll, 160001	59.763	3.929	0.72652	19	1.167	41.35	6E+07	1.606	5.3995	1.71	9.26E-05
Langdene, 160950	59.397	3.811	0.74748	18.65	1.171	42.79	6E+07	2.0416	5.637	1.5577	9.79E-05
Gullen Gamble Poll, 14189	58.241	3.83	0.77253	18.87	1.181	40.872	6E+07	1.826	5.2481	1.7792	9.34E-05
Kerin Poll, 160137	61.005	3.942	0.72345	19.35	1.107	42.868	5E+07	1.8977	5.8746	1.9001	9.99E-05
Roseville Park (Poll), 150039	59.444	3.607	0.73828	18.47	1.096	43.169	6E+07	1.823	5.1583	1.8031	8.57E-05
Stockman Poll, Pioneer	60.029	3.675	0.70406	17.68	1.036	42.325	7E+07	2.1426	5.4921	1.667	9.18E-05
Lewisdale Poll, Monty 10	60.25	4.147	0.71294	20	1.089	42.337	6E+07	2.5002	6.0041	1.9555	1.08E-04
Anderson Poll, 150266	60.735	3.441	0.75861	18.53	1.141	43.762	5E+07	2.0239	5.2195	1.5868	8.31E-05
Charinga, 130240 (Doc)	59.675	3.882	0.68369	18.42	1.093	41.237	6E+07	2.1224	5.5439	1.8868	9.56E-05
GRASS 141924, R15	59.259	3.855	0.65119	18.55	0.92	42.637	6E+07	1.736	5.6166	1.7903	9.77E-05
Orrie Cowie, 140050 (Trojan)	60.588	3.804	0.67193	18.33	1.091	38.472	6E+07	2.0377	5.4882	1.7034	9.23E-05
Avington Poll, 160047	58.804	3.682	0.70153	17.2	0.928	43.11	8E+07	1.8632	5.5587	1.8337	9.91E-05
Clovernook Poll, 160095	60.803	3.701	0.73604	18.65	1.079	37.043	5E+07	3.1695	5.7806	1.6489	1.03E-04
Karori, 150222	58.251	3.696	0.74605	18.02	1.06	48.613	6E+07	1.7139	5.3461	1.819	9.15E-05
Alfoxtan, 150430	59.224	3.829	0.70882	18.46	1.007	39.24	7E+07	1.6563	4.8932	1.7293	7.73E-05
Eilan Donan, 5145 (Harvey)	58.925	3.87	0.6719	18.68	1.01	42.948	7E+07	1.5892	5.324	1.8429	8.91E-05
Yalgoo, 160070	57.296	3.851	0.7274	17.87	1.169	40.324	7E+07	1.7299	5.1722	1.8285	9.08E-05
Petali Poll, 160849	57.422	3.645	0.69943	18.58	1.109	40.271	6E+07	1.7778	5.1958	1.7509	9.11E-05
Europambela, 120101	54.857	3.288	0.68408	17.6	0.924	45.866	7E+07	1.6923	5.38	2.0141	9.92E-05
Bungulla, 160350	58.112	3.93	0.73414	18.86	1.053	42.076	6E+07	1.686	5.5154	1.8464	9.58E-05
Hilltop, HT Poll 156	59.164	3.691	0.74146	18.54	1.168	42.378	6E+07	2.0676	5.2765	1.7146	8.97E-05
Hillcrestan Park Poll, 110143	55.372										1.02E-04

#### 7.14.4.4. Team profitability – Growing season environment and market prices

Table 36: Profit \$/ha for each team in each growing season and price scenario. Note: Teams are in order of the medium growing season and 10 year price scenario.

Sire Name	Long Growing Season			Medium Growing Season			Short Growing Season		
	5yr	10yr	20yr	5yr	10yr	20yr	5yr	10yr	20yr
Alfoxtton, 150430	703 ( 39)	457 ( 25)	179 ( 28)	745 ( 17)	470 ( 1)	249 ( 6)	239 ( 29)	201 ( 25)	174 ( 25)
Yalgoo, 160070	769 ( 4)	476 ( 2)	194 ( 7)	782 ( 4)	469 ( 2)	248 ( 8)	249 ( 2)	205 ( 1)	176 ( 1)
Pastora Poll, 082893	773 ( 2)	471 ( 6)	196 ( 3)	799 ( 2)	468 ( 3)	253 ( 2)	246 ( 4)	201 ( 14)	175 ( 8)
Woodyarrup, 120175	722 ( 25)	472 ( 5)	193 ( 8)	736 ( 21)	464 ( 4)	250 ( 4)	240 ( 25)	202 ( 10)	175 ( 12)
Kerin Poll, 151911	728 ( 19)	467 ( 11)	192 ( 9)	745 ( 16)	463 ( 5)	248 ( 7)	241 ( 15)	202 ( 11)	175 ( 11)
Hazeldean, 13.4936	726 ( 21)	463 ( 15)	181 ( 22)	755 ( 10)	463 ( 6)	242 ( 23)	244 ( 11)	203 ( 5)	175 ( 4)
Bundilla Poll, 140055	725 ( 24)	462 ( 16)	186 ( 16)	747 ( 14)	463 ( 7)	246 ( 11)	240 ( 26)	200 ( 32)	174 ( 23)
Avington Poll, 160047	771 ( 3)	464 ( 14)	196 ( 4)	794 ( 3)	462 ( 8)	255 ( 1)	244 ( 10)	200 ( 39)	175 ( 14)
Tallowong Merinos, 150280	752 ( 9)	471 ( 7)	188 ( 14)	771 ( 6)	462 ( 9)	244 ( 17)	247 ( 3)	205 ( 2)	176 ( 2)
Haddon Rig, 2.715	685 ( 57)	460 ( 20)	174 ( 41)	714 ( 36)	461 ( 10)	243 ( 19)	237 ( 37)	203 ( 7)	174 ( 19)
Cressbrook, 140055	812 ( 1)	469 ( 9)	200 ( 1)	827 ( 1)	460 ( 11)	253 ( 3)	251 ( 1)	202 ( 13)	176 ( 3)
Greenfields Poll, 130599	736 ( 14)	469 ( 10)	183 ( 18)	752 ( 11)	459 ( 12)	241 ( 25)	243 ( 12)	203 ( 3)	175 ( 10)
Billandri Poll, 130641	731 ( 17)	477 ( 1)	197 ( 2)	715 ( 31)	458 ( 13)	244 ( 16)	237 ( 41)	201 ( 24)	174 ( 34)
Tuckwood Poll, 131026	743 ( 11)	467 ( 12)	196 ( 5)	741 ( 19)	455 ( 14)	247 ( 10)	238 ( 32)	199 ( 48)	173 ( 39)
Yalgoo, 150313	764 ( 6)	472 ( 4)	191 ( 11)	765 ( 8)	455 ( 15)	244 ( 15)	245 ( 8)	202 ( 9)	175 ( 9)
Hazeldean, 11.3542 (Hugh)	769 ( 5)	474 ( 3)	194 ( 6)	775 ( 5)	454 ( 16)	249 ( 5)	245 ( 7)	202 ( 8)	175 ( 6)
Terrick West Poll, 122220	705 ( 37)	441 ( 52)	172 ( 48)	737 ( 20)	453 ( 17)	240 ( 29)	236 ( 48)	198 ( 80)	172 ( 55)
Wurrook, 130149	743 ( 12)	461 ( 17)	179 ( 27)	761 ( 9)	453 ( 18)	241 ( 26)	245 ( 6)	203 ( 4)	175 ( 7)
One Oak No. 2, R56	722 ( 27)	454 ( 28)	180 ( 24)	746 ( 15)	452 ( 19)	244 ( 18)	240 ( 24)	200 ( 26)	174 ( 22)
Petali Poll, 150697	699 ( 42)	458 ( 22)	177 ( 34)	711 ( 38)	451 ( 20)	241 ( 27)	240 ( 21)	203 ( 6)	175 ( 5)
Eilan Donan, ED5145 (Harvey)	685 ( 56)	446 ( 45)	173 ( 46)	714 ( 35)	450 ( 21)	242 ( 22)	234 ( 64)	199 ( 53)	172 ( 54)
Yiddinga, 141989	710 ( 32)	460 ( 19)	185 ( 17)	721 ( 30)	450 ( 22)	240 ( 28)	237 ( 42)	201 ( 22)	174 ( 33)
Cranmore, 132051	686 ( 55)	447 ( 43)	172 ( 53)	706 ( 42)	449 ( 23)	238 ( 36)	236 ( 45)	200 ( 42)	173 ( 44)
Darriwell, 130941 (Buddha)	676 ( 69)	448 ( 40)	171 ( 55)	696 ( 51)	449 ( 24)	237 ( 45)	235 ( 55)	200 ( 35)	173 ( 38)
Stockman Poll, 090853 (Stilts)	725 ( 22)	455 ( 26)	177 ( 33)	741 ( 18)	447 ( 25)	238 ( 41)	242 ( 13)	201 ( 18)	174 ( 18)
Billandri Poll, 130087	677 ( 67)	450 ( 36)	167 ( 59)	692 ( 55)	447 ( 26)	232 ( 61)	235 ( 52)	201 ( 17)	174 ( 32)

Sire Name	Long Growing Season			Medium Growing Season			Short Growing Season		
	5yr	10yr	20yr	5yr	10yr	20yr	5yr	10yr	20yr
Karori, 150222	736 ( 15)	466 ( 13)	190 ( 12)	733 ( 24)	446 ( 27)	247 ( 9)	241 ( 17)	201 ( 16)	174 ( 17)
Bundilla, 111265	703 ( 38)	461 ( 18)	188 ( 13)	700 ( 47)	445 ( 28)	245 ( 14)	233 ( 69)	199 ( 50)	172 ( 53)
Bogo, 111424	747 ( 10)	457 ( 23)	186 ( 15)	750 ( 13)	445 ( 29)	246 ( 12)	242 ( 14)	199 ( 49)	174 ( 24)
Billandri Poll, 151280	732 ( 16)	470 ( 8)	192 ( 10)	715 ( 32)	444 ( 30)	245 ( 13)	239 ( 28)	201 ( 19)	175 ( 16)
Mumblebone, 130850	681 ( 65)	445 ( 46)	172 ( 47)	683 ( 64)	443 ( 31)	234 ( 49)	229 (102)	197 ( 93)	171 ( 95)
Moorundie Poll, NE73	708 ( 35)	457 ( 24)	180 ( 26)	708 ( 41)	443 ( 32)	234 ( 51)	240 ( 27)	202 ( 12)	175 ( 15)
Coromandel Poll, 130660	701 ( 41)	453 ( 30)	182 ( 21)	687 ( 61)	442 ( 33)	238 ( 37)	233 ( 70)	199 ( 57)	172 ( 61)
Charinga, 130240 (Doc)	698 ( 43)	443 ( 48)	173 ( 44)	713 ( 37)	442 ( 34)	233 ( 58)	237 ( 39)	200 ( 47)	173 ( 41)
Nerstane, 150073	694 ( 49)	452 ( 33)	177 ( 35)	701 ( 46)	441 ( 35)	236 ( 48)	238 ( 35)	201 ( 21)	174 ( 26)
Tuckwood Poll, 121021	696 ( 45)	453 ( 31)	180 ( 25)	701 ( 45)	441 ( 36)	238 ( 38)	235 ( 53)	200 ( 43)	173 ( 49)
Centre Plus Poll, 407185	721 ( 28)	448 ( 39)	178 ( 30)	734 ( 23)	440 ( 37)	239 ( 33)	241 ( 18)	200 ( 27)	174 ( 27)
Stockman Poll, 130707 (Pioneer)	715 ( 30)	437 ( 58)	173 ( 42)	731 ( 25)	439 ( 38)	237 ( 46)	237 ( 38)	198 ( 67)	172 ( 52)
Wilgunya, 121224	709 ( 33)	452 ( 32)	178 ( 32)	715 ( 34)	439 ( 39)	238 ( 40)	238 ( 31)	200 ( 36)	173 ( 37)
Koorinal, 130519	738 ( 13)	449 ( 38)	176 ( 37)	735 ( 22)	439 ( 40)	243 ( 19)	240 ( 23)	199 ( 54)	173 ( 48)
Kiandra Poll, 140757	725 ( 23)	433 ( 69)	173 ( 43)	731 ( 26)	438 ( 41)	238 ( 42)	236 ( 46)	196 (107)	171 ( 94)
GRASS, 142194 (R4)	648 (104)	447 ( 44)	172 ( 51)	639 (109)	438 ( 42)	234 ( 50)	228 (108)	198 ( 73)	172 ( 76)
Willandra Poll, 160001	681 ( 63)	451 ( 34)	178 ( 31)	671 ( 75)	438 ( 43)	239 ( 35)	234 ( 65)	200 ( 41)	173 ( 45)
Willandra Poll, 140030 (Des)	711 ( 31)	458 ( 21)	182 ( 20)	710 ( 39)	437 ( 44)	241 ( 24)	237 ( 36)	200 ( 30)	174 ( 35)
Greendale, 120012	759 ( 8)	454 ( 27)	183 ( 19)	751 ( 12)	436 ( 45)	239 ( 34)	246 ( 5)	201 ( 15)	175 ( 13)
Nareeb Nareeb, 130380	653 ( 95)	420 ( 94)	153 ( 95)	682 ( 65)	436 ( 46)	227 ( 79)	233 ( 72)	198 ( 72)	172 ( 70)
Roseville Park, 150039	695 ( 48)	443 ( 47)	173 ( 45)	689 ( 59)	435 ( 47)	238 ( 44)	232 ( 82)	197 ( 99)	171 ( 98)
Mirani, 120021	688 ( 54)	436 ( 63)	164 ( 67)	696 ( 52)	435 ( 48)	234 ( 52)	234 ( 57)	198 ( 65)	172 ( 62)
Glen Holme, 141077 (Dohne)	682 ( 60)	437 ( 60)	172 ( 52)	700 ( 48)	435 ( 49)	242 ( 21)	227 (113)	195 (116)	171 (111)
Centre Plus Poll, 707115	693 ( 52)	438 ( 57)	169 ( 56)	690 ( 57)	434 ( 50)	240 ( 30)	234 ( 66)	198 ( 77)	171 ( 82)
Lachlan Merinos Poll, 015305	646 (107)	425 ( 88)	155 ( 87)	670 ( 77)	434 ( 51)	229 ( 73)	231 ( 91)	198 ( 69)	172 ( 72)
Bungulla, 160350	682 ( 61)	454 ( 29)	177 ( 36)	666 ( 83)	433 ( 52)	238 ( 39)	232 ( 80)	198 ( 66)	172 ( 60)
Moojepin, 100248	671 ( 74)	441 ( 50)	174 ( 39)	658 ( 92)	433 ( 53)	233 ( 60)	223 (128)	194 (119)	170 (119)
Gullen Gamble Poll, 014189	673 ( 71)	441 ( 51)	165 ( 64)	674 ( 68)	433 ( 54)	231 ( 69)	236 ( 47)	201 ( 23)	174 ( 31)

Sire Name	Long Growing Season			Medium Growing Season			Short Growing Season		
	5yr	10yr	20yr	5yr	10yr	20yr	5yr	10yr	20yr
Yalgoo, 120043	762 ( 7)	448 ( 41)	179 ( 29)	765 ( 7)	433 ( 55)	238 ( 43)	245 ( 9)	200 ( 34)	174 ( 20)
Miramoonna, 140012	652 (100)	433 ( 70)	160 ( 78)	643 (105)	433 ( 56)	231 ( 68)	231 ( 89)	199 ( 55)	172 ( 80)
Mokanger, 120092	693 ( 50)	449 ( 37)	175 ( 38)	693 ( 54)	432 ( 57)	234 ( 54)	236 ( 44)	200 ( 28)	173 ( 36)
Poll Boonoke, 120020	702 ( 40)	439 ( 53)	164 ( 68)	715 ( 33)	432 ( 58)	227 ( 81)	238 ( 30)	201 ( 20)	174 ( 21)
East Mundalla, 090137 (Jonty)	661 ( 86)	434 ( 68)	166 ( 61)	664 ( 85)	432 ( 59)	227 ( 82)	231 ( 84)	198 ( 68)	172 ( 66)
Hannaton Poll, 120046	706 ( 36)	443 ( 49)	172 ( 49)	704 ( 43)	431 ( 60)	240 ( 31)	235 ( 50)	199 ( 58)	172 ( 56)
DT Kenilworth, WH13017	697 ( 44)	447 ( 42)	174 ( 40)	692 ( 56)	431 ( 61)	237 ( 47)	238 ( 34)	200 ( 29)	174 ( 30)
Orrie Cowie, 140050 (Trojan)	695 ( 47)	437 ( 61)	172 ( 50)	684 ( 62)	430 ( 62)	234 ( 53)	231 ( 93)	196 (106)	171 ( 92)
The Mountain Dam, 11/ESA004	722 ( 26)	451 ( 35)	181 ( 23)	703 ( 44)	430 ( 63)	239 ( 32)	236 ( 49)	198 ( 74)	172 ( 64)
Mumblebone, 140026	665 ( 82)	430 ( 74)	158 ( 82)	670 ( 78)	430 ( 64)	233 ( 59)	234 ( 61)	199 ( 60)	172 ( 58)
Toland Poll, 151058	666 ( 81)	426 ( 83)	155 ( 88)	667 ( 80)	430 ( 65)	231 ( 66)	230 ( 94)	197 ( 98)	171 (107)
Greenfields Poll, 140345	681 ( 64)	432 ( 71)	165 ( 62)	694 ( 53)	429 ( 66)	226 ( 89)	233 ( 71)	197 ( 86)	172 ( 79)
Claypans Poll, 130597	666 ( 80)	439 ( 56)	168 ( 57)	659 ( 90)	429 ( 67)	234 ( 57)	231 ( 86)	199 ( 59)	172 ( 69)
Greendale, 140141	731 ( 18)	439 ( 55)	171 ( 54)	725 ( 29)	429 ( 68)	230 ( 70)	241 ( 19)	200 ( 44)	174 ( 28)
Woodyarrup, 150329	662 ( 85)	437 ( 59)	164 ( 69)	666 ( 82)	429 ( 69)	231 ( 67)	234 ( 63)	200 ( 37)	173 ( 50)
Pooginook Poll, 140632	659 ( 89)	428 ( 77)	158 ( 81)	672 ( 74)	428 ( 70)	230 ( 71)	232 ( 83)	197 ( 87)	171 ( 87)
GRASS, 141924 (R15)	672 ( 72)	434 ( 66)	165 ( 63)	674 ( 70)	428 ( 71)	234 ( 55)	228 (106)	195 (110)	171 (100)
Wattle Dale, 140754	708 ( 34)	426 ( 81)	161 ( 74)	709 ( 40)	427 ( 72)	232 ( 62)	241 ( 16)	200 ( 33)	174 ( 29)
Centre Plus Poll, 207316	719 ( 29)	434 ( 67)	165 ( 66)	725 ( 28)	427 ( 73)	231 ( 65)	241 ( 20)	200 ( 46)	173 ( 43)
Gullen Gamble Poll, 120018	679 ( 66)	435 ( 65)	163 ( 71)	684 ( 63)	426 ( 74)	226 ( 86)	237 ( 39)	200 ( 38)	173 ( 40)
Roseville Park, 132933	670 ( 75)	423 ( 90)	155 ( 89)	688 ( 60)	425 ( 75)	223 ( 97)	234 ( 58)	198 ( 64)	172 ( 68)
Boolading Blues Poll, 120708	611 (125)	425 ( 85)	153 ( 93)	615 (126)	425 ( 76)	222 (103)	224 (125)	197 (100)	171 (108)
Nerstane, 100919	673 ( 70)	439 ( 54)	166 ( 60)	665 ( 84)	425 ( 77)	228 ( 77)	234 ( 62)	200 ( 40)	173 ( 47)
Melrose, 12UGB060	692 ( 53)	432 ( 72)	158 ( 83)	699 ( 49)	424 ( 78)	223 ( 96)	238 ( 33)	200 ( 31)	173 ( 42)
Connemara Poll, 140257	727 ( 20)	436 ( 62)	165 ( 65)	726 ( 27)	424 ( 79)	232 ( 64)	240 ( 22)	199 ( 56)	173 ( 46)
Trefusis, 150282	640 (114)	409 (113)	143 (116)	675 ( 67)	424 ( 80)	224 ( 93)	232 ( 81)	198 ( 76)	171 ( 85)
Collinsville Poll, 130545 (Apollo)	626 (122)	426 ( 84)	154 ( 91)	632 (115)	423 ( 81)	226 ( 88)	229 (104)	199 ( 63)	171 ( 86)
Ingle Poll, 150087	682 ( 62)	435 ( 64)	167 ( 58)	664 ( 86)	422 ( 82)	234 ( 56)	231 ( 85)	197 ( 89)	171 ( 92)

Sire Name	Long Growing Season			Medium Growing Season			Short Growing Season		
	5yr	10yr	20yr	5yr	10yr	20yr	5yr	10yr	20yr
Roseville Park, 140611	693 ( 51)	425 ( 86)	162 ( 72)	689 ( 58)	421 ( 83)	229 ( 72)	235 ( 51)	197 ( 90)	172 ( 65)
Glenpaen, 120042	695 ( 46)	425 ( 87)	160 ( 77)	697 ( 50)	421 ( 84)	228 ( 75)	236 ( 43)	199 ( 52)	173 ( 51)
Merinotech WA Poll, 100081	652 ( 99)	421 ( 93)	151 (100)	643 (104)	420 ( 85)	228 ( 76)	231 ( 88)	197 ( 97)	171 (101)
Wanganella, 130816	659 ( 90)	428 ( 78)	159 ( 79)	672 ( 73)	420 ( 86)	224 ( 92)	231 ( 90)	198 ( 78)	172 ( 74)
Edale, 10Z266K	659 ( 88)	430 ( 75)	160 ( 75)	644 (103)	420 ( 87)	232 ( 63)	231 ( 87)	198 ( 75)	172 ( 78)
Hazeldean, 11.43	667 ( 78)	424 ( 89)	160 ( 76)	671 ( 76)	419 ( 88)	229 ( 74)	234 ( 68)	198 ( 79)	172 ( 75)
Kerin Poll, 160137	641 (113)	432 ( 73)	163 ( 70)	635 (112)	419 ( 89)	226 ( 87)	227 (112)	197 ( 88)	171 ( 89)
Rhamily Poll, 110330 (Benny)	639 (115)	416 (104)	153 ( 92)	641 (107)	419 ( 90)	223 ( 99)	228 (107)	196 (102)	171 (106)
Anderson Poll, 140474	634 (119)	415 (105)	147 (108)	632 (114)	419 ( 91)	227 ( 78)	228 (109)	196 (104)	171 (113)
Barloo Poll, 140027 (Eureka)	642 (112)	422 ( 91)	150 (102)	643 (106)	418 ( 92)	223 ( 98)	230 ( 97)	197 ( 85)	171 ( 90)
Hilltop, 160156 (HT156)	671 ( 73)	426 ( 82)	159 ( 80)	677 ( 66)	418 ( 93)	227 ( 83)	234 ( 59)	198 ( 71)	172 ( 71)
Langdene, 160950	652 ( 98)	415 (106)	150 (104)	662 ( 88)	418 ( 94)	223 (100)	234 ( 67)	199 ( 51)	172 ( 59)
West Plains Poll, 110004 (Mercenary)	663 ( 84)	421 ( 92)	153 ( 94)	660 ( 89)	418 ( 95)	221 (106)	232 ( 78)	198 ( 82)	171 ( 83)
Conrayn, MVB123	657 ( 92)	419 ( 98)	150 (101)	656 ( 94)	418 ( 96)	224 ( 94)	232 ( 79)	198 ( 84)	171 ( 87)
Egelabra, HEK 1.36	653 ( 96)	419 ( 99)	149 (106)	653 ( 96)	417 ( 97)	219 (112)	230 ( 99)	197 ( 94)	171 ( 84)
Glen Donald, 120014	638 (117)	418 (102)	150 (103)	652 ( 99)	417 ( 98)	222 (101)	233 ( 73)	200 ( 45)	172 ( 57)
Ejanding Poll, 145096	644 (111)	428 ( 76)	161 ( 73)	618 (125)	417 ( 99)	227 ( 85)	227 (114)	197 ( 96)	171 ( 99)
Mianelup Poll, M00540 (Expo)	634 (118)	419 ( 96)	156 ( 86)	619 (123)	415 (100)	222 (102)	224 (123)	195 (113)	171 (114)
Rangeview Poll, 5-680	666 ( 79)	428 ( 79)	156 ( 85)	663 ( 87)	414 (101)	220 (107)	232 ( 76)	198 ( 83)	171 ( 81)
Nearra Poll, 110264	657 ( 91)	414 (107)	153 ( 96)	654 ( 95)	413 (102)	227 ( 84)	226 (119)	193 (121)	170 (121)
Kurra-Wirra, SR5681	661 ( 87)	409 (114)	140 (118)	667 ( 81)	413 (103)	216 (118)	232 ( 75)	197 ( 95)	171 ( 97)
GRASS, 122190 (P47)	608 (128)	403 (119)	136 (123)	623 (121)	413 (104)	216 (119)	227 (111)	197 ( 92)	171 (104)
Bundaleer Poll, 13V741	668 ( 76)	420 ( 95)	155 ( 90)	657 ( 93)	412 (105)	225 ( 90)	230 ( 98)	195 (108)	171 (102)
Kurra-Wirra, SB5585	646 (108)	418 (101)	149 (107)	638 (110)	412 (106)	221 (105)	231 ( 92)	197 ( 91)	171 ( 96)
Ingle Poll, 130387	676 ( 68)	414 (108)	151 ( 98)	673 ( 72)	410 (107)	227 ( 80)	232 ( 77)	195 (112)	171 (110)
Yiddinga, 130374	664 ( 83)	417 (103)	151 ( 97)	659 ( 91)	409 (108)	225 ( 91)	230 ( 95)	196 (105)	171 (103)
Trefusis, 110482	682 ( 59)	419 ( 97)	151 ( 99)	673 ( 71)	409 (109)	218 (114)	234 ( 60)	199 ( 62)	172 ( 67)
Petali Poll, 160849	651 (101)	409 (112)	145 (113)	646 (101)	408 (110)	220 (109)	228 (105)	195 (114)	171 (115)

Sire Name	Long Growing Season			Medium Growing Season			Short Growing Season		
	5yr	10yr	20yr	5yr	10yr	20yr	5yr	10yr	20yr
Wanganella, 150610	647 (106)	427 ( 80)	157 ( 84)	636 (111)	408 (111)	220 (110)	230 ( 96)	199 ( 61)	172 ( 63)
Moojepin, 120652	638 (116)	409 (115)	144 (114)	629 (117)	407 (112)	217 (116)	223 (127)	193 (125)	170 (126)
Nerstane, 130467	654 ( 94)	403 (118)	140 (119)	651 (100)	406 (113)	217 (115)	235 ( 54)	198 ( 81)	172 ( 77)
Wallaloo Park Poll, 150422	627 (121)	411 (109)	144 (115)	629 (118)	405 (114)	213 (122)	229 (101)	198 ( 70)	172 ( 73)
Anderson Poll, 150266	648 (105)	406 (116)	147 (109)	630 (116)	404 (115)	223 ( 95)	225 (121)	193 (123)	170 (125)
Leahcim Poll, 090918	652 ( 97)	410 (111)	145 (111)	640 (108)	402 (116)	221 (104)	229 (100)	195 (109)	171 (105)
Karori, 140188	685 ( 58)	411 (110)	147 (110)	674 ( 69)	402 (117)	216 (117)	235 ( 56)	196 (101)	171 ( 91)
Roseville Park, 140019	622 (123)	397 (121)	137 (121)	625 (119)	401 (118)	220 (111)	226 (118)	194 (118)	170 (117)
Lewisdale Poll, 150010 (Monty)	603 (129)	418 (100)	149 (105)	592 (129)	400 (119)	211 (128)	221 (130)	196 (103)	171 (112)
Greenland, 2.366	609 (126)	395 (122)	132 (125)	614 (127)	398 (120)	213 (123)	226 (120)	195 (111)	171 (116)
Boyanga, 145112	655 ( 93)	402 (120)	141 (117)	653 ( 98)	398 (121)	215 (120)	226 (117)	193 (128)	170 (127)
Bella Lana, 130296	614 (124)	385 (127)	130 (127)	620 (122)	396 (122)	218 (113)	224 (124)	193 (122)	170 (123)
Leahcim Poll, 123153	649 (103)	405 (117)	145 (112)	624 (120)	396 (123)	220 (108)	225 (122)	193 (126)	170 (124)
Trigger Vale Poll, 140477	592 (130)	394 (124)	138 (120)	567 (131)	389 (124)	212 (125)	215 (134)	191 (131)	169 (132)
Wallaloo Park Poll, 120912	668 ( 77)	392 (125)	136 (122)	669 ( 79)	389 (125)	212 (126)	232 ( 74)	195 (115)	171 (109)
Moojepin, 140377	608 (127)	389 (126)	130 (126)	602 (128)	389 (126)	211 (127)	223 (126)	194 (120)	170 (122)
Leahcim Poll, 132624	634 (120)	394 (123)	135 (124)	618 (124)	388 (127)	214 (121)	227 (115)	194 (117)	170 (118)
Hillcreston Park Poll, 110143	650 (102)	383 (128)	127 (128)	653 ( 97)	383 (128)	213 (124)	229 (103)	193 (124)	170 (120)
Mumblebone, 130389	581 (131)	370 (130)	112 (131)	584 (130)	380 (129)	203 (131)	221 (129)	193 (127)	169 (130)
Europambela, 120101	646 (109)	378 (129)	123 (129)	645 (102)	376 (130)	211 (129)	228 (110)	192 (130)	169 (128)
Grindon, 150017	646 (110)	365 (131)	121 (130)	633 (113)	361 (131)	207 (130)	226 (116)	191 (133)	169 (129)
Clovernook Poll, 160095	567 (132)	353 (133)	106 (132)	565 (132)	360 (132)	192 (134)	216 (133)	191 (134)	169 (133)
Wyambah Poll, 140141	549 (134)	356 (132)	102 (133)	544 (134)	360 (133)	194 (133)	217 (132)	191 (132)	169 (134)
Mumblebone, 151367	556 (133)	350 (134)	100 (134)	554 (133)	358 (134)	194 (132)	220 (131)	192 (129)	169 (131)
Average (\$/ha)	679	432	163	682	427	230	234	198	172
Range (\$/ha)	263	127	100	283	111	63	36	15	7
Range (\$/DSE)	12.39	5.35	5.09	20.53	6.37	6.54	18.86	5.02	8.33

#### 7.14.4.5. Team Economic Values for each Trait

The economic value of the deviation in the breeding value for each trait for each team (Table 37) was calculated by multiplying the BV of the trait by the fitted economic value for that trait (Table 5). This provides a financial picture of the contribution of each trait to the profitability of the sire team. Participants in the trial can use this information to examine the strengths and weaknesses of their sire against this broad cross section of industry sires. If the individual entrant is then related to the sire's contemporaries in the stud at the time of selection this would provide a financial comparison of the balance of the traits in the stud versus the industry.

There is some difference between the calculated profit (Table 36) and the estimate using the EV of the traits with an index approach ( $r^2$  0.91).

Table 37: The economic value of the breeding value for each team for the traits that have been valued in the profit analysis, using 10-year prices and averaged across the 3 regions. Note: Teams are in the order of profit calculated for the medium growing season and 10 year price scenario.

Team	AWT	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5	Total
Alfoxton, 150430	0.10	0.16	1.11	-0.06	0.08	-0.24	-0.37	0.04	1.09	2.80	-0.27	0.01	104.44
Yalgoo, 160070	-0.24	0.11	1.71	1.21	2.31	1.27	-0.26	-0.02	0.47	0.53	0.12	-0.11	107.10
Pastora Poll, 082893	-0.05	0.30	-0.71	-1.01	4.50	1.33	-0.60	0.05	0.91	-0.94	2.02	0.47	106.26
Woodyarrup, 120175	0.26	0.27	3.13	1.76	0.29	-0.05	-0.29	0.00	1.19	-0.39	0.12	-0.02	106.26
Kerin Poll, 151911	0.35	0.35	2.12	1.05	0.49	0.46	0.01	-0.04	1.25	0.26	0.07	0.11	106.47
Hazeldean, 13.4936	-0.22	0.29	2.51	0.94	0.32	0.35	0.16	-0.01	0.23	0.87	0.78	-0.22	106.01
Bundilla Poll, 140055	0.08	0.12	-0.41	-0.36	0.34	0.41	-0.10	0.03	1.97	0.49	1.57	0.22	104.36
Avington Poll, 160047	0.05	0.18	-1.12	-1.62	5.02	1.40	0.35	0.10	0.34	-0.91	0.54	-0.21	104.13
Tallawong Merinos, 150280	-0.32	0.26	1.60	1.58	2.39	0.56	1.40	0.02	-0.54	0.46	-0.55	-0.47	106.40
Haddon Rig, 2.715	-0.27	0.15	3.58	1.38	-2.34	-0.91	0.23	0.00	1.12	0.81	1.45	0.38	105.58
Cressbrook, 140055	-0.25	0.24	-0.41	-1.40	6.49	2.59	-1.04	0.00	0.99	-0.60	0.46	-0.55	106.51
Greenfields Poll, 130599	-0.41	0.02	2.07	1.41	0.98	0.33	-0.44	0.00	-0.21	0.21	1.74	-0.05	105.67
Billandri Poll, 130641	0.17	-0.11	2.70	0.68	-0.11	0.03	-0.20	-0.01	0.29	-0.59	2.14	-0.20	104.79
Tuckwood Poll, 131026	0.44	-0.02	-1.83	-0.69	2.45	0.53	-0.12	-0.06	0.55	0.49	2.06	0.25	104.05
Yalgoo, 150313	-0.40	-0.01	0.88	0.79	2.76	1.01	0.03	0.06	-0.05	-1.31	1.42	0.24	105.43
Hazeldean, 11.3542 (Hugh)	-0.40	-0.16	1.02	0.40	2.91	1.15	0.25	0.04	-0.67	0.45	0.98	-0.19	105.77
Terrick West Poll, 122220	0.16	0.17	-1.12	-2.19	1.81	0.51	-0.59	0.08	0.86	1.60	-0.08	-0.44	100.76
Wurook, 130149	-0.41	0.19	1.32	1.43	2.57	0.69	-0.59	0.04	0.49	0.45	-0.87	-0.36	104.96
One Oak No. 2, R56	-0.10	0.18	2.74	-0.95	1.36	0.76	-0.63	0.07	0.31	-0.35	0.14	-0.29	103.25

Team	AWT	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5	Total
Petali Poll, 150697	-0.05	-0.01	0.66	2.73	-1.26	-0.33	0.44	-0.05	1.40	2.03	-0.55	0.20	105.23
Eilan Donan, ED5145 (Harvey)	0.05	0.17	1.75	-1.37	-0.78	-0.27	0.34	0.06	1.25	0.19	0.61	0.17	102.18
Yiddinga, 141989	0.18	0.11	0.64	1.29	0.60	-0.34	0.08	0.05	-0.05	-0.31	1.30	0.18	103.74
Cranmore, 132051	0.04	0.04	-1.13	0.03	-1.74	-0.31	0.07	-0.03	1.30	2.25	2.11	-0.01	102.60
Darriwell, 130941 (Buddha)	0.01	0.21	3.08	0.88	-1.74	-0.77	0.73	0.04	0.18	-0.30	0.96	-0.11	103.17
Stockman Poll, 090853 (Stilts)	-0.16	0.08	-0.51	0.26	1.50	0.66	0.31	0.02	0.39	0.92	0.24	-0.04	103.69
Billandri Poll, 130087	-0.33	0.03	2.59	1.32	-2.02	-0.81	0.38	-0.03	0.60	0.26	1.72	0.01	103.74
Karori, 150222	-0.05	-0.18	-0.82	0.51	1.79	0.43	1.47	-0.01	0.75	-0.06	0.29	0.16	104.28
Bundilla, 111265	0.63	-0.09	-0.53	2.10	-0.60	-0.54	0.06	0.04	0.83	2.11	-0.42	-0.05	103.54
Bogo, 111424	-0.07	-0.02	-0.93	-1.33	3.30	1.45	-0.70	0.02	0.75	0.22	0.64	0.02	103.34
Billandri Poll, 151280	-0.05	-0.04	2.23	1.59	0.45	0.43	-0.15	-0.03	0.78	-2.33	2.31	-0.41	104.79
Mumblebone, 130850	0.34	-0.07	-1.74	-0.81	-0.83	-1.13	-0.21	-0.07	0.96	1.59	2.21	0.17	100.41
Moorundie Poll, NE73	0.04	0.09	3.78	2.72	-0.65	0.42	-0.65	-0.02	-1.30	-0.59	0.05	0.09	104.00
Coromandel Poll, 130660	0.36	-0.07	1.17	0.47	-0.21	0.00	-0.28	0.03	0.26	0.24	-0.13	-0.06	101.79
Charinga, 130240 (Doc)	0.18	0.38	1.82	-0.81	0.26	0.46	-0.23	0.03	-0.59	-0.47	1.13	0.02	102.17
Nerstane, 150073	0.26	0.20	0.93	2.38	-0.34	-0.19	-0.04	-0.04	0.08	-0.17	0.41	0.06	103.55
Tuckwood Poll, 121021	0.46	0.08	1.13	1.43	-0.06	-0.30	-0.48	-0.06	0.29	0.70	-0.03	-0.24	102.92
Centre Plus Poll, 407185	0.06	0.10	-1.32	-0.10	2.19	0.83	-0.21	-0.02	0.36	0.71	0.32	0.00	102.92
Stockman Poll, (Pioneer)	0.27	0.27	-1.40	-1.70	3.19	1.20	0.22	0.04	-0.54	0.00	-0.62	0.22	101.14
Wilgunya, 121224	0.05	0.10	0.26	0.42	0.61	0.30	0.28	0.04	0.11	-0.59	0.81	0.10	102.49
Koorungal, 130519	-0.63	-0.36	-1.57	-1.63	3.53	0.95	0.78	0.09	1.63	-1.33	0.93	-0.19	102.21
Kiandra Poll, 140757	0.34	-0.10	-5.74	-3.03	4.11	1.60	-0.78	0.06	1.87	2.65	-0.89	-0.34	99.75
GRASS, 142194 (R4)	0.14	-0.08	2.42	2.68	-3.72	-2.36	0.03	0.01	0.93	-0.74	2.51	0.46	102.29
Willandra Poll, 160001	0.19	-0.04	2.53	1.57	-2.03	-0.44	-0.06	0.02	1.32	0.06	-0.35	-0.22	102.56
Willandra Poll, 140030 (Des)	-0.01	-0.18	2.77	1.46	0.62	0.09	-0.35	0.02	-1.06	0.69	-1.14	0.14	103.05
Greendale, 120012	-0.23	-0.02	0.12	0.19	3.46	1.88	-0.15	-0.01	-1.27	-1.00	0.22	-0.27	102.92
Nareeb Nareeb, 130380	0.15	0.26	-0.23	0.27	-1.05	-0.54	0.51	0.00	-0.15	2.44	-0.99	-0.24	100.44
Roseville Park, 150039	0.16	-0.47	-2.32	-0.77	0.11	-0.01	0.30	0.01	0.62	1.49	0.44	-0.10	99.47
Mirani, 120021	-0.21	-0.01	-0.92	-1.45	0.77	-0.11	1.12	0.04	1.06	-0.09	0.22	0.30	100.72

Team	AWT	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5	Total
Glen Holme, 141077 (Dohne)	0.74	0.05	-3.09	-2.48	-0.37	-0.14	0.01	0.05	1.76	2.67	0.14	-0.37	98.97
Centre Plus Poll, 707115	0.26	-0.17	-4.03	-0.33	0.22	0.14	-0.51	-0.05	1.32	2.75	0.29	0.46	100.37
Lachlan Merinos Poll, 015305	0.08	0.20	0.88	0.56	-2.25	-0.82	0.47	0.02	1.61	0.60	-0.94	0.00	100.40
Bungulla, 160350	-0.10	-0.66	2.79	2.14	-1.53	-0.85	0.10	-0.08	0.78	-1.07	0.44	0.20	102.17
Moojepin, 100248	0.86	-0.18	-4.06	0.77	-1.10	-1.78	-0.73	-0.08	0.47	0.84	3.22	0.30	98.51
Gullen Gamble Poll, 014189	-0.07	-0.01	1.25	2.98	-1.54	-0.53	-0.13	-0.04	0.31	0.48	-0.08	-0.38	102.24
Yalgoo, 120043	-0.44	-0.12	-1.98	-0.91	4.67	1.66	-0.02	0.02	-0.85	-0.45	0.91	0.07	102.57
Miramoonna, 140012	0.03	-0.27	0.35	2.66	-2.01	-1.23	0.22	-0.09	-0.08	1.98	-0.74	-0.07	100.74
Mokanger, 120092	-0.04	0.05	3.44	1.20	-0.34	0.25	0.85	0.07	-1.22	-1.24	-0.87	-0.03	102.11
Poll Boonoke, 120020	-0.26	0.23	1.67	1.19	-0.27	0.82	-0.84	0.00	-3.03	0.24	1.60	0.38	101.72
East Mundalla, 090137 (Jonty)	0.32	0.27	4.35	1.26	-1.74	-0.05	-0.87	0.04	-1.27	-1.09	-0.20	-0.37	100.65
Hannaton Poll, 120046	-0.13	-0.12	-2.07	-0.71	0.72	0.55	-0.40	0.02	2.23	-0.63	1.47	0.00	100.95
DT Kenilworth, WH13017	0.02	-0.02	1.35	1.43	0.61	0.06	-0.12	-0.02	0.42	-0.33	-1.04	-0.23	102.12
Orrie Cowie, 140050 (Trojan)	0.35	0.03	0.48	-2.09	0.65	0.70	-0.68	0.01	0.03	0.11	-0.20	-0.04	99.36
The Mountain Dam, 11/ESA004	0.03	-0.28	-0.72	-0.07	2.63	0.44	-0.25	-0.03	-0.78	-0.94	0.81	0.12	100.97
Mumblebone, 140026	-0.08	-0.07	-1.49	0.53	-1.56	-0.31	0.18	-0.03	1.95	1.37	0.00	-0.12	100.36
Toland Poll, 151058	-0.04	-0.18	-4.46	-1.75	-0.44	-0.71	0.41	-0.07	3.58	1.90	0.61	-0.03	98.83
Greenfields Poll, 140345	0.31	0.15	-1.47	-0.32	0.49	0.06	-0.27	-0.01	-0.88	0.95	0.78	0.10	99.90
Claypans Poll, 130597	0.12	-0.02	3.28	0.21	-1.89	-0.25	0.34	0.04	-0.34	0.03	-0.82	-0.05	100.65
Greendale, 140141	-0.13	0.17	1.20	0.06	3.50	1.53	-0.43	-0.02	-2.88	-1.62	-0.52	0.01	100.88
Woodyarrup, 150329	-0.05	-0.02	2.42	1.30	-1.93	-0.77	0.40	-0.03	0.36	1.58	-1.19	0.00	102.09
Pooginook Poll, 140632	0.08	0.07	-0.11	-0.76	-1.17	-0.42	0.14	-0.02	1.61	0.25	-0.52	0.32	99.47
GRASS, 141924 (R15)	0.11	0.01	1.45	-2.47	-0.26	-0.38	0.18	0.02	0.86	-1.15	0.24	-0.02	98.60
Wattle Dale, 140754	-0.22	0.08	-0.43	0.84	2.96	1.09	0.16	0.00	1.58	-0.32	-4.53	-0.69	100.51
Centre Plus Poll, 207316	-0.32	-0.01	-1.53	-0.94	2.29	1.26	-0.30	-0.01	0.57	0.33	-0.10	-0.14	101.10
Gullen Gamble Poll, 120018	-0.07	0.08	3.12	1.31	-0.46	0.23	-0.81	-0.05	-1.11	0.23	-1.36	0.14	101.25
Roseville Park, 132933	-0.06	0.17	0.39	-0.46	0.58	0.09	0.40	0.03	-1.27	0.32	-0.99	0.18	99.39
Boolading Blues Poll, 120708	0.37	-0.02	3.65	2.33	-9.29	-3.11	0.44	-0.09	0.68	1.41	0.78	-0.01	97.14
Nerstane, 100919	0.02	0.03	2.21	2.42	-0.38	-0.36	0.22	-0.04	-1.84	-1.01	-0.25	0.05	101.07

Team	AWT	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5	Total
Melrose, 12UGB060	-0.41	0.07	1.13	1.16	0.98	0.27	0.24	0.04	-2.15	-0.39	-0.64	0.05	100.35
Connemara Poll, 140257	-0.56	-0.08	-0.21	-1.25	3.57	1.10	-0.41	0.01	0.47	-1.47	-0.79	-0.08	100.28
Trefusis, 150282	-0.08	0.28	1.00	-1.33	-0.82	-0.47	1.04	0.00	-0.44	2.53	-2.44	0.02	99.30
Collinsville Poll, 130545 (Apollo)	-0.02	0.04	3.45	1.45	-3.75	-1.60	0.56	0.04	-0.02	0.68	-0.25	-0.10	100.47
Ingle Poll, 150087	0.21	-0.17	-1.68	-0.66	-0.21	0.04	0.82	-0.02	0.52	0.45	-0.27	0.34	99.36
Roseville Park, 140611	-0.07	0.03	0.18	-1.11	2.30	1.06	-0.15	0.04	-0.57	-0.91	-2.15	-0.09	98.56
Glenpaen, 120042	-0.02	0.27	1.95	-0.14	1.92	1.20	0.05	0.01	-3.19	-0.75	-1.48	-0.49	99.33
Merinotech WA Poll, 100081	-0.20	-0.37	-0.69	0.85	-0.21	-0.79	0.88	-0.03	1.38	1.48	-3.03	-0.52	98.74
Wanganella, 130816	0.22	0.16	2.36	1.41	-0.68	-0.21	-0.08	0.01	-2.77	0.07	-0.57	-0.24	99.67
Edale, 10Z266K	-0.08	-0.12	2.98	0.65	-1.65	-0.14	0.22	0.00	1.48	-1.45	-2.27	-0.38	99.25
Hazeldean, 11.43	0.40	0.11	0.79	0.57	-0.27	0.36	-0.67	-0.03	-0.72	1.96	-2.64	0.29	100.15
Kerin Poll, 160137	0.41	0.22	2.52	1.39	-3.33	-1.21	0.27	-0.09	0.62	-1.81	1.50	0.10	100.59
Rhamily Poll, 110330 (Benny)	0.45	0.15	0.38	0.19	-1.68	-0.49	0.42	0.05	-0.75	0.60	-1.28	0.06	98.07
Anderson Poll, 140474	-0.07	-0.39	0.09	0.30	-2.09	-1.23	-0.24	-0.03	0.52	3.34	-1.87	-0.29	98.03
Barloo Poll, 140027 (Eureka)	-0.22	-0.01	1.61	0.22	-1.93	-0.87	0.00	0.04	0.05	-0.71	0.54	0.16	98.89
Hilltop, 160156 (HT156)	0.11	0.05	-1.02	0.16	-0.19	0.18	0.14	-0.01	-0.44	0.84	-0.40	-0.03	99.40
Langdene, 160950	0.14	0.37	0.75	1.50	-0.63	-0.03	0.37	-0.01	-0.28	-1.07	-1.78	0.08	99.41
West Plains Poll, (Mercenary)	-0.19	0.11	1.90	-0.53	-0.60	0.28	-0.54	0.03	-0.75	-2.10	0.34	0.18	98.13
Conrayn, MVB123	-0.14	0.03	-0.41	0.29	-0.12	-0.24	0.23	0.05	0.36	-0.56	-0.91	-0.27	98.30
Egelabra, HEK 1.36	-0.27	0.20	2.15	-1.02	-1.43	0.08	1.13	0.08	-0.93	-3.41	1.18	0.45	98.21
Glen Donald, 120014	-0.03	0.24	4.43	1.53	-2.50	-0.29	-0.80	-0.01	-0.44	0.87	-2.86	0.16	100.29
Ejanding Poll, 145096	0.23	-0.09	0.64	0.31	-3.46	-0.92	0.72	-0.08	0.65	-0.88	1.57	0.31	99.00
Mianelup Poll, M00540 (Expo)	0.47	-0.03	0.51	0.47	-2.65	-1.13	-0.15	0.00	-0.08	-0.24	0.09	-0.02	97.25
RangeView Poll, 5-680	-0.06	0.04	0.63	0.06	-0.33	0.07	0.07	0.03	-2.02	-1.45	1.42	0.17	98.64
Nearra Poll, 110264	0.33	-0.32	-4.44	-1.98	0.30	-0.27	-0.35	0.01	0.99	2.07	-0.91	0.11	95.55
Kurra-Wirra, SR5681	-0.69	-0.01	-0.64	-0.55	-0.57	0.38	0.12	0.03	0.39	-1.40	0.59	0.01	97.65
GRASS, 122190 (P47)	-0.13	0.00	0.29	0.69	-3.42	-1.52	0.27	0.01	0.18	2.45	-0.77	-0.29	97.78
Bundaleer Poll, 13V741	0.11	0.03	-2.55	-1.44	0.38	0.25	0.45	0.03	0.47	-1.46	0.46	0.44	97.17
Kurra-Wirra, SB5585	-0.10	0.03	-0.67	0.15	-1.36	-0.34	0.41	-0.02	0.18	-1.95	1.15	0.35	97.85

Team	AWT	YFAT	ACFW	YCFW	AFD	YFD	ASS	ASL	CON	LS	ERA	SURV Y-A5	Total
Ingle Poll, 130387	-0.03	-0.21	-4.41	-2.15	2.03	0.65	-0.23	0.02	0.47	2.22	-1.14	0.02	97.23
Yiddinga, 130374	-0.03	-0.07	-3.84	-1.03	1.18	-0.23	0.76	0.02	0.11	0.11	0.27	0.15	97.39
Trefusis, 110482	-0.41	0.00	0.81	0.42	1.47	0.54	0.41	0.00	-2.02	-2.21	-1.58	0.36	97.78
Petali Poll, 160849	-0.19	-0.21	-1.47	-1.88	-0.42	0.13	-0.29	0.02	0.36	0.54	-0.47	-0.10	96.02
Wanganella, 150610	0.12	-0.08	4.09	3.39	-1.79	-0.19	-0.14	-0.05	-4.54	-0.94	-0.59	-0.01	99.26
Moojepin, 120652	0.01	-0.56	-3.16	-1.58	-1.29	-0.94	-0.61	-0.10	-0.54	1.09	2.14	0.52	94.97
Nerstane, 130467	-0.29	0.24	1.21	-0.14	0.16	0.54	-0.13	-0.02	-0.62	-0.83	-3.16	-0.13	96.84
Wallaloo Park Poll, 150422	-0.01	0.26	4.22	2.05	-2.54	-0.44	-0.08	-0.09	-2.67	-1.43	-0.79	0.03	98.49
Anderson Poll, 150266	0.41	-0.24	-5.01	-1.60	-0.02	0.00	0.43	0.01	0.18	1.78	-1.14	0.08	94.89
Leahcim Poll, 090918	-0.07	-0.03	-2.74	-0.90	-0.39	0.15	-0.20	-0.04	0.88	-1.69	1.65	-0.33	96.28
Karori, 140188	-0.39	-0.02	-1.89	-0.91	1.77	1.05	-0.20	0.07	-1.11	-2.57	0.69	0.00	96.48
Roseville Park, 140019	0.17	0.03	-1.59	-1.16	-1.09	-0.53	0.28	0.00	1.06	-0.24	-2.15	0.20	94.99
Lewisdale Poll, 150010 (Monty)	0.26	0.05	5.76	2.79	-5.96	-2.27	0.18	0.00	-2.57	-2.37	1.74	-0.06	97.56
Greenland, 2.366	-0.06	0.11	-0.10	-0.59	-2.37	-0.86	1.01	0.06	-0.67	-1.21	-0.27	0.19	95.24
Boyanga, 145112	-0.21	-0.58	-4.52	-2.60	1.22	0.26	-0.72	-0.05	0.11	0.12	1.72	-0.17	94.58
Bella Lana, 130296	0.12	0.05	-3.63	-1.23	-1.38	-0.13	-1.01	-0.02	2.44	-0.76	-1.38	0.20	93.26
Leahcim Poll, 123153	0.11	-0.25	-2.70	-1.67	0.62	0.07	-0.74	-0.02	0.11	-2.20	0.07	0.33	93.71
Trigger Vale Poll, 140477	0.40	-0.37	-1.18	-0.62	-3.84	-2.21	-0.16	-0.04	-0.34	-1.74	1.87	0.09	91.85
Wallaloo Park Poll, 120912	-0.25	-0.11	-2.91	-1.42	3.21	1.10	-0.63	-0.01	-2.57	0.31	-1.63	-0.21	94.88
Moojepin, 140377	-0.03	-0.15	-2.39	-0.90	-2.78	-0.70	-0.51	-0.14	0.49	-0.09	0.91	0.26	93.97
Leahcim Poll, 132624	-0.07	-0.18	-2.55	-0.21	0.77	-0.10	-0.36	-0.04	-1.55	-1.65	-0.42	0.00	93.64
Hillcreston Park Poll, 110143	-0.54	-0.06	-3.25	-4.94	1.76	1.30	0.04	0.12	0.39	-1.70	0.66	0.01	93.80
Mumblebone, 130389	-0.30	-0.25	-3.38	-1.23	-2.36	-1.28	0.10	-0.03	0.78	1.11	-1.16	0.06	92.06
Europambela, 120101	-0.60	-0.37	-6.58	-5.27	3.44	0.84	0.88	0.14	0.21	-1.22	1.20	0.12	92.79
Grindon, 150017	-0.22	-0.16	-9.10	-4.62	4.88	1.34	-0.51	0.12	0.00	-1.35	0.24	-0.34	90.29
Clovernook Poll, 160095	0.41	0.03	-1.15	-0.18	-0.56	-0.35	-0.82	-0.11	-7.54	-0.33	-0.62	0.12	88.90
Wyambeh Poll, 140141	-0.22	-0.25	-1.57	-0.70	-4.44	-1.57	0.24	-0.11	-1.11	-0.07	-0.79	0.17	89.57
Mumblebone, 151367	-0.14	0.02	-2.87	-0.06	-1.74	-1.33	-0.21	-0.06	-0.36	-1.07	-2.54	-0.48	89.17
Average	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

#### 7.14.4.6. References for Profit per hectare

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