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Benchmarking Mohair Production in Australia

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Foreword

The mohair industry has the infrastructure in place and a strong record of research and development to provide the foundation for the establishment of modern production systems. However the mohair industry has struggled to expand. The present project was based on the findings of a previous RIRDC project (DAV 205A) which identified ways to make mohair more attractive to investors. In particular, farmers reported that there was a lack of credible comparisons between mohair and other mainstream animal enterprises. The available financial information or access to it was insufficient to allow people to determine and gain confidence in the financial feasibility of mohair production. This project targeted the RIRDC Rare Natural Animal Fibre Research (2003-2008) Development Plan long-term strategies to: increase productivity on-farm; to communicate more effectively to interested parties; and to identify ways of increasing investment in mohair production.

The present project has investigated and quantified the financial performance of commercial mohair enterprises and made objective comparisons with wool production. It has also significantly increased knowledge about the drivers of profit in mohair enterprises, the effects of farm on mohair quality attributes and the factors associated with changes in mohair quality on farms.

This report provides:

1. New information on key financial performance indicators for mohair enterprises.
2. New objective data on the productivity and fibre quality of modern Australian Angora goats.
3. New objective data on factors affecting mohair quality and financial returns.
4. Comparative data on financial performance of mohair enterprises compared with wool enterprises.

The findings are exciting. First because they show greater returns from mohair production than wool. Second, they show significant opportunity exists for mohair producers to further increase profitability.

The report will be a useful for existing and new entrants to mohair production and for those wishing to study mohair production.

This report was funded from RIRDC Core Funds provided by the Australian Government and Industry funding.

This report, an addition to RIRDC's diverse range of over 1900 research publications, forms part of our Rare Natural Animal Fibre R&D program, which aims to identify constraints hindering and to find solutions for increasing mohair, cashmere and alpaca production.

Most of RIRDC's publications are available for viewing, downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

Peter O'Brien
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About the Author

As a Senior Animal and Fibre Research Scientist, Dr. Bruce McGregor has focussed on improving the production and quality of speciality fibre producing animals (mohair, cashmere, alpaca, super-fine wool). His interests include animal nutrition, farm management, fibre quality, fibre production and textile quality. He has published a number of other RIRDC reports that are available on the RIRDC internet site.

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The Rural Industries Research and Development Corporation funded this project. Riverina Fleece Testing Services, Albury and Sale sponsored the fleece testing services.

Abbreviations

DSE: dry sheep equivalent.
A DSE is the energy required to maintain the live weight of a non-breeding adult sheep weighing 45 kg, for one year. Other classes of live stock are rated relative to these sheep based on their energy requirements for growth, live weight and demands for pregnancy and lactation.

ha: hectare.

μm: the unit of measurement micrometre, which is equal to one thousandth of a millimetre.

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Executive Summary

What the report is about

This report provides factual evidence on the financial and production performance of real mohair farms for the first time. This process engaged mohair farmers in detailed record keeping and measurements of their animals. The project involved farm business economists in comparative financial studies of mohair and wool enterprises. Exhaustive statistical analyses have been used to quantify the changes in key production attributes of mohair enterprises.

This work is important as it will guide mohair producers and the industry to focus on key performance indicators of profit and production. The outcomes provide objective evidence that can be used to attract future investment into mohair enterprises.

Who is the report targeted at?

This report is written for the current and prospective mohair farmers, advisors and policy makers interested in the comparative performance of mohair and wool production.

Background

Since the establishment of mohair production in the mid 1970s, the industry has developed all the infrastructure required to grow and prosper and has a strong record of research and development that has provided objective data for the establishment of modern production systems. However the industry has been viewed by many as a hobby industry and has been perceived as unattractive to commercial farmers. Many entrants to the mohair industry have not been professional farmes. There has been a lack of credible financial comparisons between mohair and other mainstream animal enterprises which has prevented people from determining and gaining confidence in the financial feasibility of mohair production.

Aims/objectives

The project aimed to increase producers’ knowledge of the operation and benefits of enterprise benchmarking by collecting, evaluating and documenting the enterprise inputs and outputs, and financial returns. It also aimed to document lifetime performance of Angora goats.

The information generated will benefit the producers directly involved, the industry associations, mohair brokers, other mohair producers and stud breeders. The information can be used to inform other farmers, financial planners and bankers of the financial and production attributes of modern mohair enterprises. The information will help inform future investment by RIRDC.

Methods used

The project had two components: farm financial benchmarking based on financial records of commercial farm enterprises; and on-farm benchmarking with a focus on animal performance.

Comparisons were made between the financial returns from similar sized mohair and wool enterprises by working with the farm business economists who undertake farm and wool industry economic monitoring with the Victorian Department of Primary Industries.

The project evaluated Angora goats generated in genetic studies supported by RIRDC in addition to Angora goats managed in commercial flocks to document lifetime changes in production and mohair quality and to identify the factors affecting these parameters.

Results/key findings

There was considerable variation in the key performance indicators for mohair enterprises indicating substantial scope for some producers to increase profit.

Over three years the financial returns from mohair enterprises exceeded that from wool enterprises in terms of $/dry sheep equivalent and $/ha provided severely drought affected properties were removed. This was achieved despite the mohair enterprises grazing their goats at far lower stocking rate and by using far less phosphate fertilizer compared with the grazing intensity of sheep and phosphate use on the wool enterprises. These differences were counterbalanced by much higher average prices for mohair compared with fine wool ($13.15 per kg clean fibre compared with $8.33 per kg clean fibre). Average mohair prices were similar to those from 19 µm wool during the period under investigation.

Mohair gross margin was not related to stocking rate or weaning performance but was related to mohair income and supplementary feeding expenses. Mohair income and average prices were lower on farms with a higher proportion of does as this increased the proportion of lower value fleece.

Mohair fibre diameter increased rapidly as goats gained live weight. There were differences between farms in the amount of increase in fibre diameter as goats aged. There was also a large variation in mohair fibre diameter within age groups of does and variation differed between farms.

Implications for relevant stakeholders

The main implications arising from these findings were:

- Benchmarking the performance of mohair enterprises helps producers identify areas where profit can be significantly improved.
- There is significant scope for mohair enterprises to increase their profit.
- The mohair industry should use the superior gross margins from mohair production to attract investment into mohair from industries where the financial performance is lower.
- A greater focus on producing higher value mohair will considerably increase mohair profitability. This will not occur unless mohair producers, breed societies and selling agents focus on the main driver of mohair profit which is the mean fibre diameter of does.
- Mohair enterprises should focus their evaluation of mohair mean fibre diameter at ages of 18 months and older.
- A greater focus needs to be made in mohair enterprises on the management of the breeding herd and the nutritional management of Angora kids.
- Supplementary feeding decisions need to be carefully evaluated particularly during drought otherwise enterprises will lose substantial financial resources.
- Mohair producers need to evaluate the phosphate resources and balance on their farms and should consider their fertilizer practices and long-term soil and pasture sustainability.

Recommendations

- RIRDC and the industry should encourage and support mohair enterprises to benchmark their financial performance.
- Mohair producers, breed societies and selling agents need to focus on the main driver of increased mohair value which is reducing mohair mean fibre diameter of does.
- Mohair selling agents and the industry should encourage mohair producers to focus on management issues related to profit and mohair quality by being informed and by providing objectively based advisory information.
- Further evaluation of selection and culling practices in mohair enterprises should be undertaken.

1. Introduction

1.1. Background

Mohair production is a small established industry that exports $2.5 million pa in products. Since the establishment of mohair production in the mid 1970s, the industry has been viewed by many as a hobby industry and has been perceived as unattractive to commercial farmers (Chaffey and McGregor, 2004). This view is despite the fact the mohair has been exported at world parity prices throughtout this time, without subsides, price support or other types of protection afforded to the dairy, pork and wool industries. The mohair industry has all the infrastructure in place and has a strong record of research and development that has provided objective data for the establishment of modern production systems. It is now time to move the mohair industry from a fringe "hobby" industry into the commercial mainstream.

A previous RIRDC project (Chaffey and McGregor, 2004) identified ways to make mohair more attractive to investors. This project interviewed a range of commercial mohair and other farmers who made their investment decisions based on the compatibility of the enterprise to their farm system, the technical, financial and market feasibility of the enterprise and its comparative advantage with other possible courses of action. They were sceptical of information coming from within the mohair industry that is not sufficiently supported by fact. Despite this they form their opinions based on their own experiences, opinions of other farmers they respect and people that they regard as experts. In terms of establishing a larger mohair industry, substantial growth in mohair production will come from these commercial farmers establishing large-scale enterprises on suitable land with appropriate farming systems. These people will judge the mohair enterprise based on its profitability and the extent of satisfaction they derive from the enterprise. Appealing to other motives will fail.

Chaffey and McGregor (2004) found that farmers reported that there was a lack of credible comparisons between mohair and other mainstream animal enterprises. The available financial information or access to it was insufficient to allow people to determine and gain confidence in the financial feasibility of mohair production. The current information encouraged event orientated thinking, such as fear of one-year price events, rather than encouraging and enabling people to assess financial and enterprise trends over time and the important variables that drive the enterprise. In addition, most financial information such as price data is not available in electronic form. This makes it difficult and time consuming for anyone to construct their own financial assessments.

Chaffey and McGregor (2004) identified the need for more across industry benchmarks to develop a greater commercial focus. At industry meetings with mohair producers, an overwelming majority of participants identified benchmarking as a priority area for action (McGregor, 2004). Using benchmarking as a standard practice will enable Australian mohair producers to:

- define their own objectives more clearly (e.g. pasture production, breeding, harvesting, nutrition, kidding);
- extract more value from their activities;
- produce higher value mohair;
- reduce or optimising input costs;
- identify areas where they can improve performance of their own enterprise.

Development of mohair enterprise benchmarks will enable the mohair industry to promote itself as a professional, profitable industry.

1.2. Scope of investigations

The project aimed to increase producers' knowledge of the operation and benefits of enterprise benchmarking by collecting, evaluating and documenting the enterprise inputs and outputs, and gross margins. The project aimed to provide evidence in the form of objective data and new knowledge, which can be used in advisory and training information. This can improve the understanding of mohair production within the agricultural community. The project aimed to involve at least 10 farmers and 14 signed commitments to participate.

This work had two components:

1. Farm financial benchmarking based on financial records of farm enterprises; and
2. On-farm benchmarking with a focus on animal performance.

The following sections of this Chapter introduce the topics discussed in the body of this report.

1.3. Mohair enterprise financial benchmarking

The analysis of financial information from mohair farms was undertaken by farm business economists at the Victorian Department of Primary Industries in association with the project leader. For comparative purposes the same key performance indicators used for wool and other grazing industries were computed. To assist interpretation of the mohair financial data, data from Victorian wool enterprises involved with the Wool Farm Monitor project for the same financial years have been accessed. Because the size of farms influences the financial performance of enterprises the wool data has been extracted for two groups of wool farms closer to the physical size of mohair farms that participated in the mohair financial benchmarking:

a) the 30 wool enterprises with the lowest number of sheep based on dry sheep equivalents; and
b) the 30 wool enterprises with the lowest total animal dry sheep equivalents.

The results for financial benchmarks are discussed in Chapter 2.

1.4. On-farm benchmarking

Farmers were involved with a range of activities including: recording animal live weight, recording fleece weight, fleece sampling, and other farm record keeping. The project aimed to record details of fleece parameters over three years involving six shearing intervals, as Angora goats are shorn twice annually. Other activities were confined to the first year of the project. Submitted fleece samples were tested by the project and results provided to the farmer. As part of the project, Angora goats from a previous RIRDC supported genetic evaluation were included and by the end of the project detailed data for 12 consecutive fleeces up to 6 years of age were available. These goats were also slaughtered to provide data on carcass production from a range of genetic sources. The results for on-farm benchmarking are discussed in three components: Commercial farms (Chapter 3), Lifetime production of wether goats (Chapter 4) and meat production (Chapter 5).

2. Mohair enterprise financial benchmarks

2.1. Introduction

Benchmarking is a method of business improvement used by the largest corporations, such as banks, right down to small family businesses like corner stores, newsagents and farms. Benchmarking has been used by wool producers for over 35 years. Benchmarking provides solid evidence of how practices affect production and financial returns and can be used to identify "best practice". Benchmarking also provides details of the costs and returns for the best and worst performing farms.

This work engaged farmers in the collection and analyses of farm financial records for three financial years 2004/05, 2005/06 and 2006/07. Farmers completed a questionnaire covering details of farm practices, physical resources, inputs and outputs and details of labour and capital. These surveys commenced at the beginning of the project using data collected in the then recently completed financial year 2004/05 and are not in perfect synchrony with the production benchmarking data. The questionnaire used the format developed by the Victorian Department of Primary Industries Farm Monitor and Sheep Monitor Projects, which have operated for over 30 years (Quinn et al., 2005; Quinn and Whatley, 2005; Quinn et al., 2006; Quinn and English, 2007). Experiences gained from a previous goat meat benchmarking project (Ferrier and McGregor, 2002) and a cashmere production and processing benchmarking project (McGregor, 2006) were also used in designing the questionnaire and in developing some performance indicators.

2.2. Financial analyses

The most important financial benchmarks relate to financial returns per dry sheep equivalent (DSE) and returns per hectare of the enterprise (ha). A dry sheep equivalent is the standard unit for comparing grazing enterprises as it is based on the energy requirement to maintain a non-breeding sheep weighing 45 kg for one year. All grazing animals are rated in DSE units depending upon their size, growth rate and breeding activity. Pregnant and lactating animals have significantly higher DSE ratings than non-breeding animals. Based on farmer information the first step in any analysis is to determine the stocking rate (DSE/ha) of the farm. The DSE ratings used in these analyses for Angora goats were based on known best practice based on long-term research (McGregor, 2002a). The DSE ratings for Angora does were deliberately made higher than for Merino ewes as does were expected to have a higher fertility compared with Merino sheep. The DSE ratings for other Angora goats also include an allowance for the twice annual shearing which increase the energy requirement of Angora goats compared with Merino sheep, which are shorn only once annually (SCA, 1990; McGregor, 2002b, 2005a; McGregor and Butler, 2008a). The yearly average stocking rate (DSE/ha) for each farm was calculated on the average of monthly DSE ratings determined using the annual management cycle and the following values (these values are similar to DSE ratings for similar classes of sheep):

- Adult Angora wether, non-breeding doe, doe in first 2 month of pregnancy: 1.1;
- Pregnant doe, last 3 months: 1.3 increasing to 1.5;
- Lactating doe including their kids to weaning: 2.9;
- Weaner kid growing at 100 g/d: 0.9 increasing to 1.1;
- Bucks: 2.

The second step in the financial analysis is to use the financial data to determine the costs and income for each enterprise. The financial data have been determined on the actual stocking rates of Angora goats rather than a farm average, as Angora goats were kept in particular areas of each farm. Comparative data were analysed for other enterprises on farms such as beef cattle, wool sheep and crops but these results are confidential and have only been provided to the farmer and are not included in this report.

2.3. Mohair and wool enterprise financial performance

2.3.1. Year 1 2004/2005

The key performance indicators for mohair and wool farms are summarised in Table 2.1.The mohair enterprises in the present work had smaller farms than the wool enterprises and rainfall was similar. Wool enterprises had a stocking rate 50% higher than the mohair enterprises and they used about 25% more superphosphate. Reproductive performance in the mohair enterprises averaged 17% higher than that of wool enterprises. The average greasy fibre production performance indicators were higher in the wool enterprises compared with the mohair enterprises. However, there were a number of mohair enterprises with indicators that exceeded the average wool enterprise performance indicators (see the top of the range figures).

All the mohair enterprises had net clean mohair prices higher than the average greasy wool prices with the average mohair price more than 35% higher than the average clean wool price. As a consequence, the average Gross Margin/DSE for mohair was 89% or $11.66/DSE higher than the average wool Gross Margin for the smaller wool enterprises. There was one mohair enterprise with a gross margin less than the wool average. The Gross Margin for the smaller wool enterprises of $13.1/DSE, was the same as the statewide average for all wool producing properties. Given the lower stocking rate in mohair enterprises the effective Gross Margin/ha was about 23% or $30/ha higher than measured in the smaller wool enterprises but less than the average for all wool properties ($160/ha) as the larger wool properties had on average a higher stocking rate with the statewide average being 12.2 DSE/ha.

Table 2.1. Summary statistics from mohair enterprise benchmarking for the financial year 2004/2005 with key performance indicators. For comparison, key performance indicators are given for Victorian wool enterprises obtained from the 30 properties with the lowest number of sheep DSEs or the lowest total farm DSEs

	Mohair Enterprises		*Smallest Wool Enterprises*	
Parameter	**Average**	**Range**	**Sheep DSEs**	**Total DSEs**
Farm size, grazed area ha	328	[A]	474	430
Proportion of all livestock as goats	0.74	0.36-1.00	-	-
Proportion of all goats as does	0.71	0.59-0.83	-	-
Rainfall, mm	552	416-672	578	551
Stocking rate, DSE/ha	6.6	2.0-9.8	10.3	9.6
Superphosphate, kg P/ha	4.9	0-16.6	6.1	5.1
Kids/lambs born/100 females joined	94	49-126	80	77
Key Performance Indicators				
Greasy fibre production				
kg/head	4.29	2.9-5.9	5.4	5.2
kg/DSE	3.01	2.4-3.9	3.3	3.2
kg/ha	20.2	6.4-36.0	33.9	29.4
kg/ha/100 mm rainfall	3.4	1.0-6.3	6.0	5.4
Net mohair/wool price, $/kg clean	9.83	7.45-14.74	7.23	7.52
Average fibre diameter, μm	Not available[B]		19.4	19.1
Average yield, %	National average 85%		70	69
Gross margin $/DSE	24.76	9.64-35.97	13.08	14.30
Gross margin $/ha	159	39-227	129	135

[A] The range has been withheld as it might enable the identification of mohair properties.
[B] Mohair selling brokers pool mohair from different farms and individual farm identity is lost. Benchmarking fleece production data not available for this financial year 2004/05.

2.3.2. Year 2 2005/2006

The key performance indicators for mohair and wool farms are summarised in Table 2.2. On average, the mohair enterprises had smaller farms than the wool enterprises but average rainfall was similar. The wool enterprises had a stocking rate 80% higher than the mohair enterprises and they used 450% more superphosphate. Reproductive performance in the mohair enterprises averaged 24% higher than in the wool enterprises but on mohair farms it was more variable than in 2005/2006.

All the average greasy fibre production performance indicators were higher in the wool enterprises compared with the mohair enterprises. There were a number of mohair enterprises with indicators that exceeded the average wool enterprise performance indicators (see the top of the range figures).

All the mohair enterprises had net clean mohair prices higher than the average greasy wool prices with the average mohair price more than 100% higher than the average clean wool price. As a consequence, the average Gross Margin/DSE for mohair was 280% or $17.42/DSE higher than the average wool Gross Margin for the smaller wool enterprises. There were mohair farms with a gross margin less than the wool average. The Gross Margin for the smaller wool enterprises of $9.64/DSE, was $0.40 higher than the statewide average for all wool producing properties. Given the lower stocking rate in mohair enterprises the effective Gross Margin/ha was about 70% or $76/ha higher than measured in the smaller wool enterprises and greater than the average for all wool properties ($110/ha) despite the larger wool properties having a higher stocking rate with the statewide average being 12.4 DSE/ha.

Table 2.2. Summary statistics from mohair enterprise benchmarking for the financial year 2005/2006 with key performance indicators. For comparison, key performance indicators are given for Victorian wool enterprises obtained from the 30 properties with the lowest number of sheep DSEs or the lowest total farm DSEs

	Mohair Enterprises		*Smallest Wool Enterprises*	
Parameter	**Average**	**Range**	**Sheep DSEs**	**Total DSEs**
Farm size, grazed area ha	339	[A]	521	468
Proportion of all livestock as goats or sheep	0.79	0.34-1.00	0.80	0.94
Proportion of all goats as does	0.54	0.42-0.71	-	-
Rainfall, mm	550	412-885	536	527
Stocking rate, DSE/ha	6.2	1.7-10.6	11.1	11.4
Superphosphate, kg P/ha	1.2	0-5.4	5.4	5.8
Kids/lambs born/100 females joined	87	35-130	70	66
Key Performance Indicators				
Greasy fibre production				
kg/head	4.40	3.3-5.5	4.96	4.89
kg/DSE	2.44	1.4-3.3	3.16	2.99
kg/ha	15.8	5.6-26.5	35.1	33.3
kg/ha/100 mm rainfall	3.1	1.3-6.0	6.7	6.5
Net mohair/wool price, $/kg clean	15.98	13.54-18.05	7.73	7.78
Average fibre diameter, μm	Not available[B]		18.7	18.7
Average yield, %	National average 85%		69	69
Gross margin $/DSE	27.06	2.00-51.09	9.64	8.42
Gross margin $/ha	180.44	13.33-430.26	104.47	91.34

[A] The range has been withheld as it might enable the identification of mohair properties.
[B] Mohair selling brokers pool mohair from different farms and individual farm identity is lost. Benchmarking fleece production data does not cover all animals or fleece line to compute an average.

2.3.3. Year 3 2006/2007

The key performance indicators for mohair and wool farms are summarised in Table 2.3. On average, the mohair enterprises had smaller farms than the wool enterprises but in 2006/2007 average rainfall was about 18% lower. The wool enterprises had a stocking rate 110% higher than the mohair enterprises and they used nine times more superphosphate. Reproductive performance in the mohair enterprises averaged 10% less than in the wool enterprises. Drought on a number of mohair farms impacted severely upon production and financial performance. All the average greasy fibre production performance indicators were higher in the wool enterprises compared with the mohair enterprises. There were a number of mohair enterprises with indicators that exceeded the average wool enterprise performance indicators (see the top of the range figures).

All the mohair enterprises had net clean mohair prices higher than the average greasy wool prices with the average mohair price more than 35% higher than the average clean wool price. The average Gross Margin/DSE for mohair was 55% or $5/DSE less than the average wool Gross Margin for the smaller wool enterprises. The Gross Margin for the smaller wool enterprises of $9.64/DSE, was $0.88 higher than the statewide average for all wool producing properties. Given the lower stocking rate in mohair enterprises the Gross Margin/ha was zero or $114/ha lower than measured in the smaller wool enterprises. If two severely drought affected mohair properties were excluded, the average gross margin/DSE for mohair was 55% or $6.60/DSE more than those for smaller wool enterprises but the gross margin/ha was only 50% of the smaller wool enterprises or $56/ha lower.

Table 2.3. Summary statistics from mohair enterprise benchmarking for the financial year 2006/2007 with key performance indicators. For comparison, key performance indicators are given for Victorian wool enterprises obtained from the 30 properties with the lowest number of sheep DSEs or the lowest total farm DSEs

	Mohair Enterprises		*Smallest Wool Enterprises*	
Parameter	**Average**	**Range**	**Sheep DSEs**	**Total DSEs**
Farm size, grazed area ha	398	[A]	562	529
Proportion of all livestock as goats or sheep	0.73	0.24-1.00	0.82	0.92
Proportion of all goats as does	0.63	0.52-0.73	-	-
Rainfall, mm	404	230-901	478	478
Stocking rate, DSE/ha	5.0	1.8-8.3	10.5	10.6
Superphosphate, kg P/ha	0.5	0-1.5	4.6	4.4
Kids/lambs born/100 females joined	65	46-92	72	71
Key Performance Indicators				
Greasy fibre production				
kg/head	3.96	2.9-5.6	4.97	4.97
kg/DSE	2.27	1.8-3.3	3.18	3.17
kg/ha	10.8	5.9-20.1	32.9	33.4
kg/ha/100 mm rainfall	3.3	1.0-6.9	7.0	7.1
Net mohair/wool price, $/kg clean	13.65	10.54-14.68	9.97	10.22
Average fibre diameter, μm	Not available[B]		18.4	18.3
Average yield, %	National average 85%		67	67
Gross margin $/DSE	6.31[C]	-18.81-27.73	11.30	10.26
Gross margin $/ha	-0.35[C]	-155.71-92.87	114.10	106.10

[A] The range has been withheld as it might enable the identification of mohair properties.
[B] Mohair selling brokers pool mohair from different farms and individual farm identity is lost. Benchmarking fleece production data does not cover all animals or fleece line to compute an average.
[C] Average for farms not in severe drought: gross margin $/DSE 17.91; gross margin $/ha 57.75.

Table 2.4. The average and range in enterprise costs ($/DSE) for each year of the mohair financial benchmarking study

Year	2004/2005		2005/2006		2006/2007	
Parameter	**Average**	**Range**	**Average**	**Range**	**Average**	**Range**
Animal health	1.56	0.00- 4.08	1.93	0.77- 3.36	2.02	0.46- 3.35
Contract services	1.85	0.00- 5.88	1.59	0.00- 3.76	2.95	0.00- 5.73
Supplementary feed and agistment	3.91	0.00-12.14	5.77	0.00-11.24	16.31[A]	2.98-39.16
Pasture costs	0.38	0.00- 2.23	1.01	0.00- 2.71	1.06	0.00- 4.30
Casual labour	0.29	0.00- 1.50	0.03	0.00- 0.20	0.00	0.00- 0.00
Freight and cartage	0.36	0.00- 2.55	0.07	0.00- 0.44	0.35	0.00- 1.23
Shearing supplies	0.24	0.00- 0.84	0.06	0.00- 0.23	0.58	0.22- 1.43
Selling costs	3.59	1.85- 6.14	3.58	2.32- 5.13	3.13	1.66- 4.76
Other	1.29	0.00- 2.35	2.22	0.00- 6.43	1.62	0.00- 3.90
Total including selling costs	13.51	4.94-25.05	16.25	5.83-28.65	28.03[A]	10.28-57.49

[A] Average for farms not in severe drought: supplementary feed and agistment $6.57; total $14.68.

Table 2.5. The average and range in mohair profit per kg greasy ($/kg) for each year of the mohair financial benchmarking study

Year	2004/2005		2005/2006		2006/2007	
Parameter	**Average**	**Range**	**Average**	**Range**	**Average**	**Range**
Mohair net income	9.45	7.05-12.68	14.91	12.46-17.16	12.94	9.86-14.20
Goat trading profit	3.65	- 0.21-11.56	1.40	- 4.09- 6.95	2.10	0.40- 3.92
Total goat income	13.10	9.43-20.35	16.31	8.37-24.11	15.05	12.47-17.55
Enterprise costs	4.26	2.09- 6.80	6.59	2.39-11.95	12.56[A]	5.37-23.71
Overhead costs	7.45	3.91-14.30	9.41	4.33-12.16	13.01	5.43-22.01
Interest and lease	2.25	0.00- 5.83	2.60	0.00- 7.38	3.44	0.00-11.18

[A] Average for farms not in severe drought: enterprise costs $6.60.

2.3.4. Mohair enterprise costs and profit

The average and range in reported mohair enterprise costs for each year of the benchmarking study are shown in Table 2.4. There was a considerable range in reported enterprise cost within each year. The most significant costs were supplementary feed, agistment and mohair selling costs. The effect of these costs on mohair enterprise profit are investigated in section 2.4 of this report. The impact of drought is indicated by the increase in supplementary feed and agistment costs as the project proceeded and the rapid rise in the final year. One mohair enterprise spent $39/DSE during 2006/2007. Some of these costs may be under reported in an absolute or comparative sense compared to the cost structure for wool production. For example: 1. the reported low expenditures on items such as freight and animal health may represent either lack of records, transfers of materials between years or farmers delivering mohair to their selling agent and not recording a charge. These practices reflect the small scale of production compared with wool enterprises; 2. Low expenditure on casual labour and contract services and may be a consequence of farmers undertaking the shearing themselves.

The average and range in mohair profit per kg greasy for each year of the benchmarking study are shown in Table 2.5. There was a considerable variation in income, trading profit and costs within and between years indicating considerable scope for improvement within some enterprises. Average mohair net income rose during the study period and on one farm exceeded $17/kg greasy during 2005/06. During the three years the highest net mohair income was respectively 80%, 37% and 44% higher than the lowest net mohair income/kg greasy. Similarly, goat trading profit varied between farms and years with profits as high as $11.56/kg greasy but averages more typically $1.40 to $3.65.

2.3.5. Discussion of results

Comparing the key performance indicators of mohair and wool enterprises of similar grazing area and annual rainfall provided several significant contrasts. The mohair enterprises in this study grazed their goats far less intensively, that is the stocking rates were much lower, than similar sized wool enterprises. Mohair enterprises used far less phosphate fertilizer compared with the wool enterprises, suggesting pasture productivity would be lower in mohair enterprises. However these differences were counterbalanced by much higher average prices for mohair compared with the fine wool.

It would appear that in environments where grazing pressure is lower, that mohair production is economically competitive on smaller farm holdings. Part of the reason for the difference in the stocking rate of wool and mohair enterprises is the location of the farms as some mohair enterprises were located in more marginal rainfall country with undeveloped pastures whereas all the wool enterprises were in improved country in more reliable rainfall regions of Victoria (Quinn et al., 2005; Quinn and Whatley, 2005; Quinn et al., 2006; Quinn and English, 2007). This project was not able to control who participated in the mohair benchmarking and could not control the stocking rate of participants. The discovery of the lower stocking intensity on mohair enterprises compared with wool enterprises is a major findings of this work.

Mohair is a luxury fibre whose high price is a reward for producing fibre free of fault. Detailed market analysis of objectively tested lots of mohair has clearly quantified the discounts and premiums that apply to mohair (McGregor and Butler, 2004a). These issues will be discussed in another section of this report. However, mohair prices fluctuate as demand varies with the fashion cycle and world economic trends. This issue will be discussed in more detail in a latter section of this report. During the period under study mohair prices were high enough to offer a significant premium in returns per DSE and per ha over wool production.

The other key production indicator, reproductive rate, also showed a significant advantage towards the Angora goats. This occurred during generally dry periods where several goat producers had to conduct long-term supplementary feeding under drought conditions. In more ideal conditions the reproductive rate of Angora goats can average over 120%, and this performance was obtained by three different farms during the first two years. The reason for the surprisingly low reproduction rate on those farms reporting less than 70% kids has not been investigated, but drought and farm labour issues were mentioned by the farmers.

2.4. Analysis of mohair enterprise inputs and outputs

As would be expected rainfall, stocking rates, mohair production and mohair prices and various costs varied between years and farms and so the financial indicators also varied. Relationships between production, physical parameters and financial performance of mohair enterprises were investigated by simple regression analyses. The individual enterprise data from each of the years has been pooled for analyses, and year affects have not been quantified in this report. The following sections provide the results of investigations in various aspects of mohair enterprise management and profit.

2.4.1. Drivers of mohair production

Increasing rainfall was strongly associated with increasing mohair production per hectare (Fig. 2.1), however the relationship between mohair production per ha and stocking rate accounts for more of the variation in mohair production (Fig. 2.2). Increasing stocking rate increased mohair production per hectare (Fig 2.2) and per ha per 100 mm of rainfall (Fig. 2.3). Mohair production per goat was associated with increases in phosphate fertilizer application (Fig. 2.4) although there were only 8 farms that applied any phosphate. Mohair production also increased with increasing supplementary feeding (Fig. 2.5).

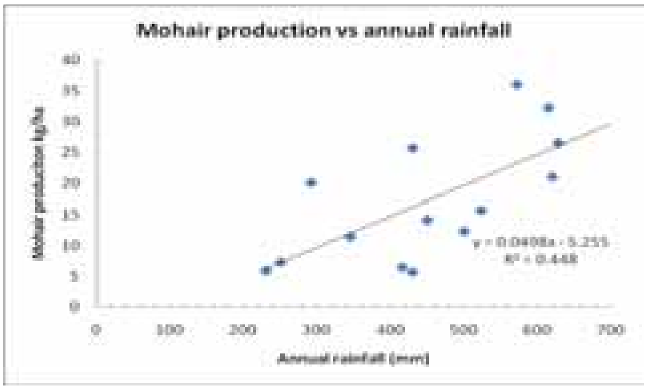


Fig. 2.1. The relationship between annual rainfall and mohair production per hectare

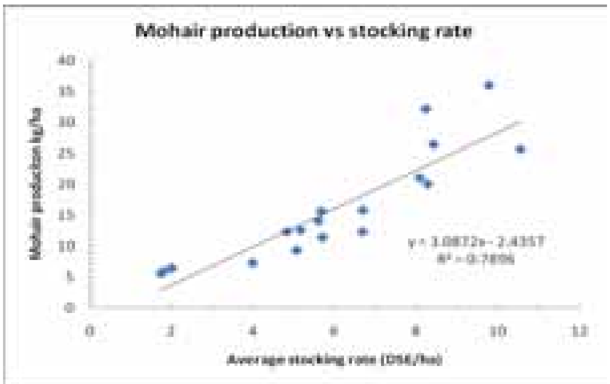


Fig. 2.2. The relationship between average stocking rate and mohair production per hectare

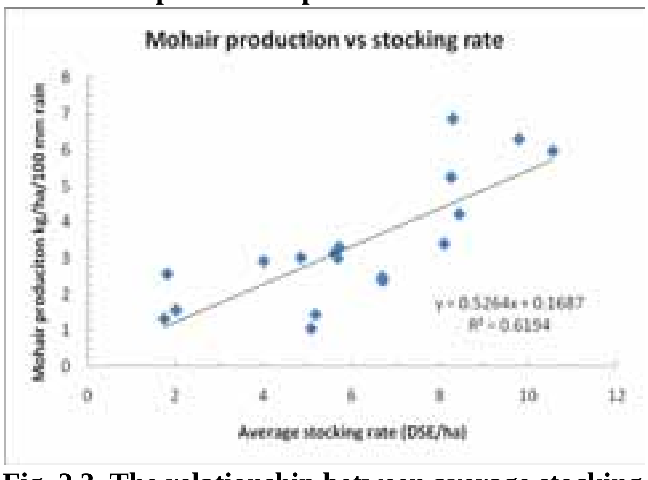


Fig. 2.3. The relationship between average stocking rate and mohair production per hectare per 100 mm of rainfall

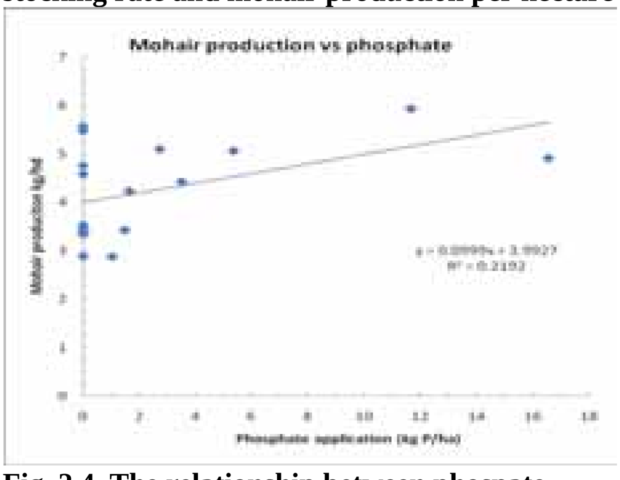


Fig. 2.4. The relationship between phospate fertilizer application and mohair production per head

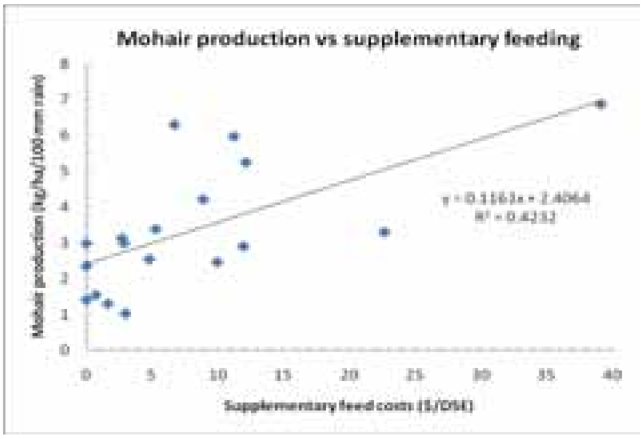


Fig. 2.5. The relationship between supplementary feed costs and mohair production per hectare per 100 mm of rainfall

KEY POINTS

Stocking rate was the major driver of mohair production per hectare.

Mohair producers were not maintaining soil phosphate reserves.

2.4.2. Drivers of mohair profit

Surprisingly mohair gross margins (difference between enterprise income and enterprise costs) were not related to average stocking rate (Fig. 2.6) but were related to rainfall (Fig. 2.7). Mohair gross margins declined rapidly with increasing enterprise costs per kg greasy mohair (Fig. 2.8) and per DSE (Fig. 2.9). Increasing supplementary feed costs resulted in reduced mohair gross margins (Fig. 2.10). Mohair gross margin increased as total goat income rose (Fig. 2.11) although the relationship was much weaker if two properties that used a lot of supplementary feed during severe drought were included.

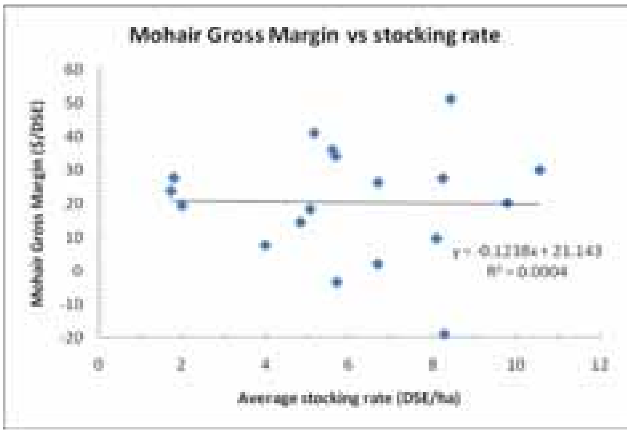


Fig. 2.6. The relationship between stocking rate and mohair gross margin

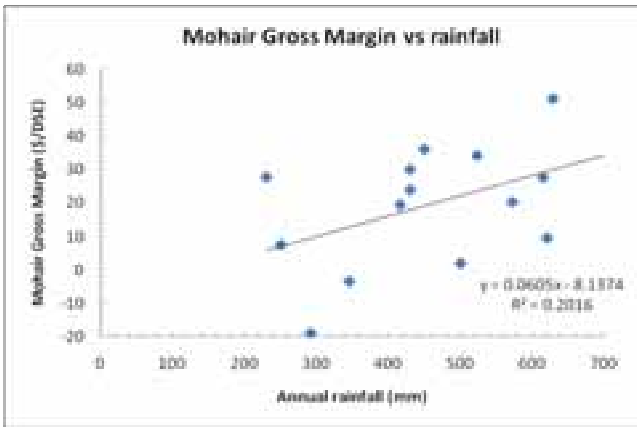


Fig. 2.7. The relationship between rainfall and mohair gross margin

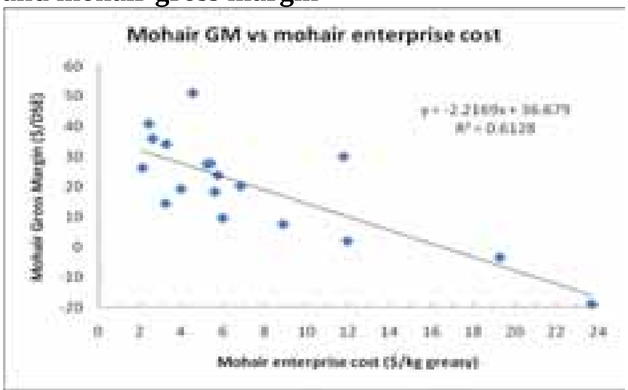


Fig. 2.8. The relationship between enterprise cost per kg greasy mohair and mohair gross margin

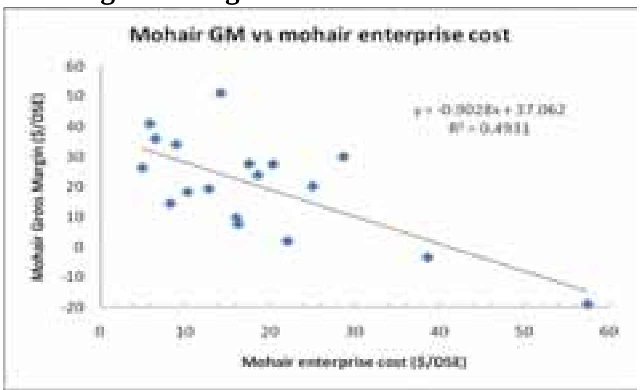


Fig. 2.9. The relationship between enterprise cost per DSE and mohair gross margin

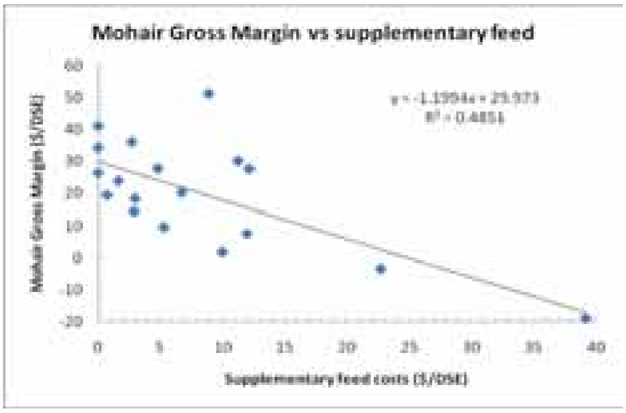


Fig. 2.10. The relationship between supplementary feeding cost and mohair gross margin

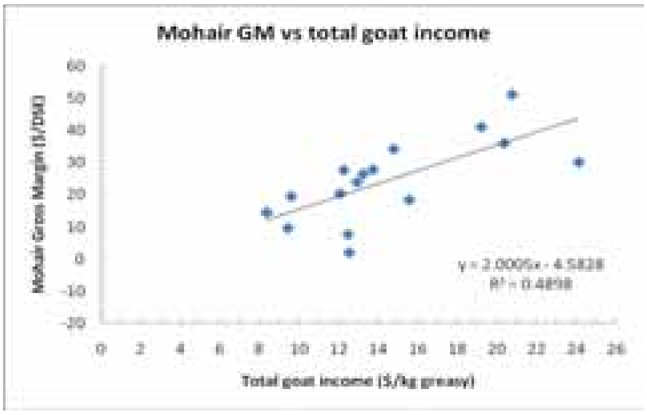


Fig. 2.11. The relationship between total goat income and mohair gross margin (2 drought farms removed)

KEY POINT

Mohair gross margin was not related to stocking rate but was related to mohair income and expenses.

2.4.3. Impact of proportion of does in flock on mohair income

Income from mohair declined as the proportion of does in the flock increased (Fig. 2.12). The average decline in income was from $16/kg greasy at 42% does to $8/kg greasy at 83% does in the flock. Increasing the proportion of does in the flock was not related to an increase in mohair production/DSE (Fig. 2.13) this parameter only accounted for 5% of the variation in mohair production. However increasing the proportion of does in the flock was associated with a significant decline in the average price of mohair (Fig. 2.14).

Weaning percentage was higher on farms with a higher proportion of does in the flock provided normal kidding management was undertaken resulting in at least 70% weaning (Fig. 2.15).

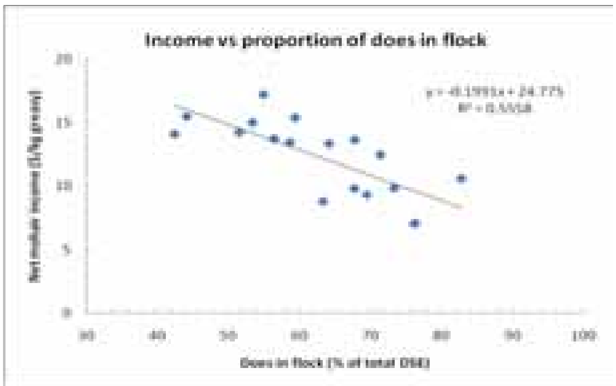


Fig. 2.12. The relationship between net mohair income and the percentage of does in the flock

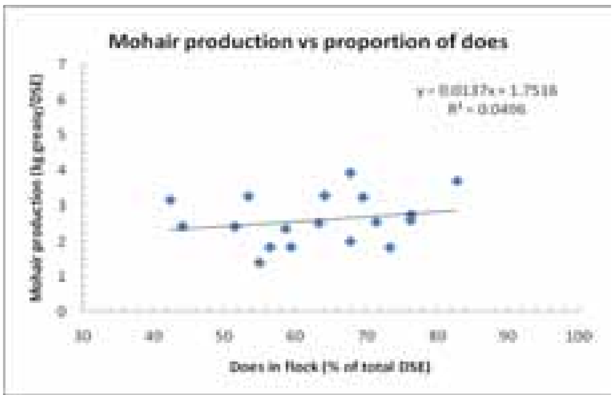


Fig. 2.13. The relationship between mohair production per DSE and the percentage of does in the flock

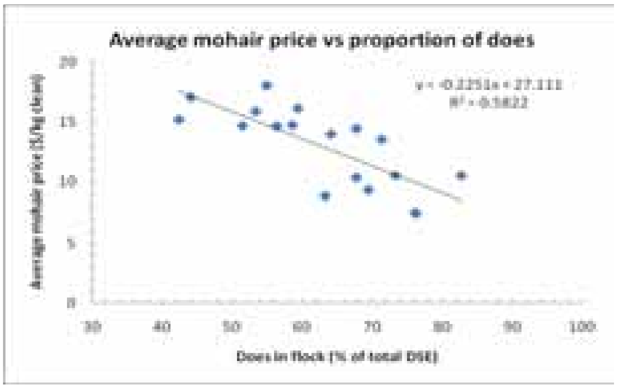


Fig. 2.14. The relationship between average mohair prices and the percentage of does in the flock

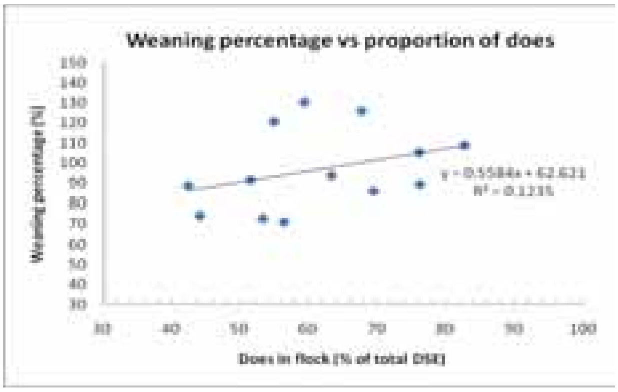


Fig. 2.15. The relationship between weaning percentage and the proportion of does in the flock for flocks with kidding percentage > 60%

KEY POINT

Mohair income and average mohair prices were lower on farms with a higher proportion of does in the flock.

2.4.4. Impact of weaning

Increasing the stocking rate of does joined per 100 mm of rain was associated with increasing weaning percentage (Fig. 2.16). While increasing weaning percent was associated with increased mohair production per ha (Fig. 2.17) it was not associated with either net mohair price (Fig. 2.18) or mohair Gross Margin per DSE (Fig. 2.19) as the percentage of variance accounted for was < 2% for the latter relationships.

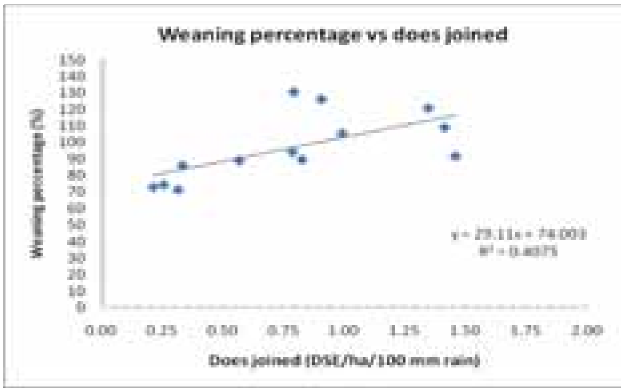


Fig. 2.16. The relationship between stocking rate of does joined per ha per 100 mm rain and weaning percentage for farms with kidding above 60%

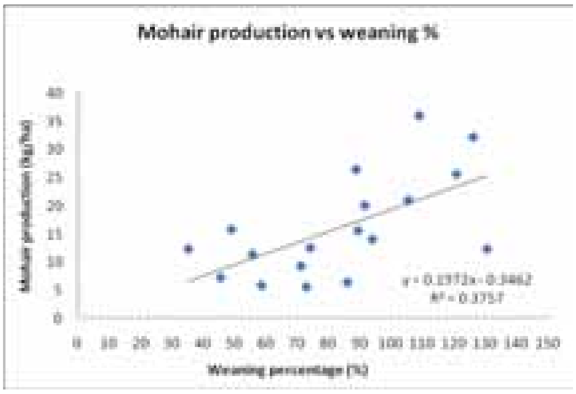


Fig. 2.17. The relationship between mohair production per ha and the weaning percentage

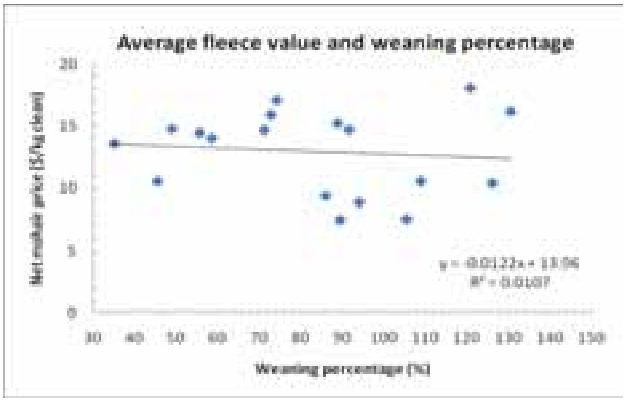


Fig. 2.18. The relationship between net mohair price and the weaning percentage

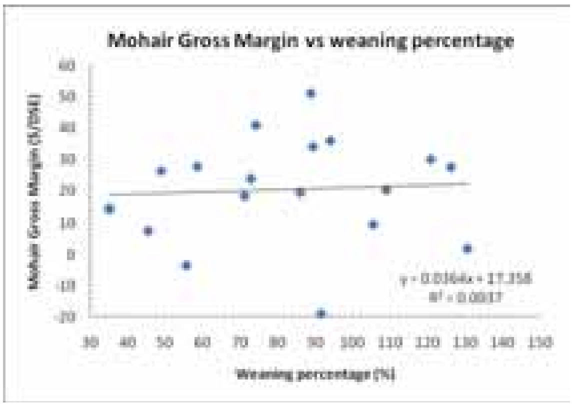


Fig. 2.19. The relationship between mohair gross margin per DSE and the weaning percentage

2.4.5. Mohair selling costs

Average mohair selling costs increased at a rate of 9.1% of the rate of increase in net mohair income (Fig. 2.19) although the relationship was poor only accounting for 4% of the variation. Increasing mohair selling costs were equally poorly related to mohair Gross Margin (Fig. 2.20) as the variation accounted for was only 4% (see R^2 value).

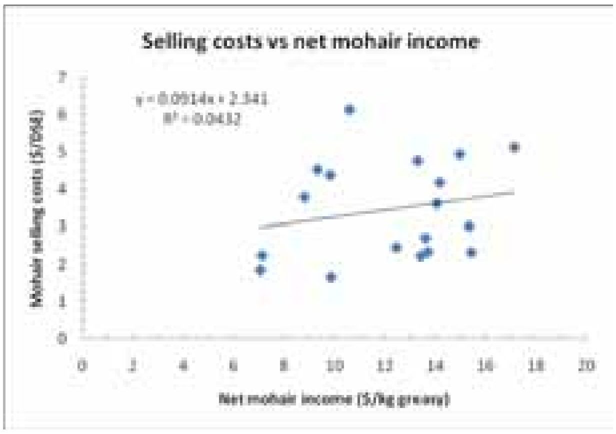


Fig. 2.19. The relationship between net mohair income and mohair selling costs

Fig. 2.20. The relationship between mohair selling costs and mohair gross margins (without 2 drought farms)

2.5. Discussion

Not surprisingly mohair production per ha increased as stocking rate increased, phosphate application increased and supplementary feeding increased. Surprisingly mohair gross margin was not related to stocking rate or to weaning percentage. Mohair gross margin increased with increasing total goat income and reduced markedly with increasing supplementary feeding.

Net mohair income per kg of greasy fleece production declined as the proportion of does in the flock increased primarily as average mohair price declined. While increasing the proportion of does in the flock was associated with increasing weaning percentage, and increasing weaning percentage was associated with increased mohair production per ha, increasing weaning percentage was not related to increasing mohair gross margin.

Therefore the most important factors associated with mohair gross margin in the project farms must be related to supplementary feeding and the decline in mohair income per kg of fleece as the proportion of does in the flock increases.

2.5.1. Supplementary feeding and fertilizer

Pasture is the cheapest form of feed for grazing animals. In most of Australia, the cheapest and most efficient method of increasing pasture production is to provide effective phosphorus fertilizer application. The labour costs of fertilisation are much lower than the labour requirements of supplementary feeding.

A rule of thumb is that one DSE requires 0.8 kg of phosphorus to maintain soil nutrient status. Fig. 2.21 shows the phosphorus fertilizer application for each farm and the calculated requirements based on the stocking rate. This analysis shows that most of the mohair farms did not apply the phosphorus required each year to replace the phosphorus that they took out of the farming systems resulting in most farms having a negative phosphorus balance. A negative balance may be appropriate in some years if the farm applies sufficient phosphorus in other years, which is what happened on the farms with the highest phosphorus application (Fig. 2.21). Increasing phosphorus balance was associated with increased mohair production per head (Fig. 2.22) although more data is preferred to provide a more convincing relationship as only 28% of the variation in mohair production is explained by phosphate application.

Increasing phosphorus application in deficient soils increases pasture production and is cheaper than supplementary feeding. As supplementary feeding costs are the major parameter reducing mohair gross margins (Fig. 2.10), it is suggested that supplementary feeding cost will be reduced if mohair farmers apply more phosphate fertilizer. Supplementary feeding is time consuming in preparation, purchasing and distributing and is also expensive.

There is a lack of data on the soil phosphate resources on these mohair enterprises and such data is required to determine appropriate phosphate and other soil management practices such as liming.

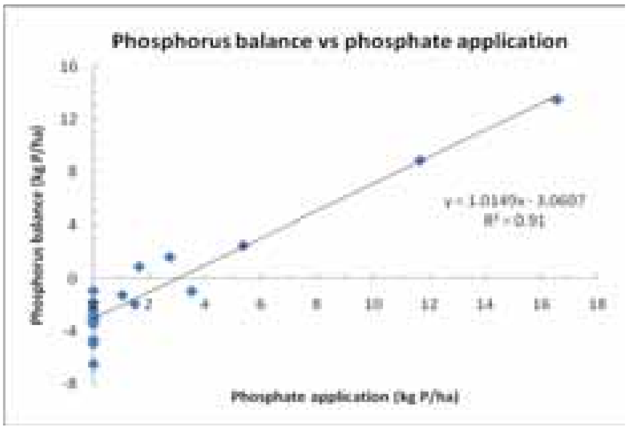


Fig. 2.21. The relationship between annual phosphate application and annual phosphorus balance per ha

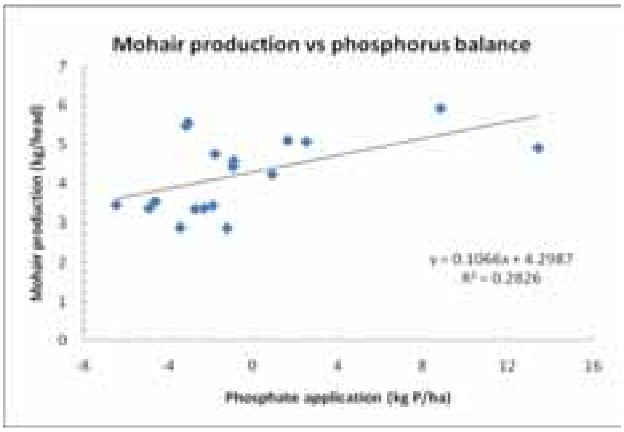


Fig. 2.22. The relationship between annual mohair production and annual phosphorus balance

2.5.2. Mohair income and the proportion of does

Net mohair income per kg of greasy fleece production declined as the proportion of does in the flock increased primarily as average mohair price declined. Increasing weaning percentage was not related to increasing mohair gross margin. These two observations indicate that on the farms in this study, mohair quality declined as the proportion of does in the flock and kidding rate increased. Clearly things related to reproduction and flock management are associated with the average mohair price. These observations are based over 3 years and on a number of farms and are not just a random event.

To investigate these possibilities an audit of fibre sales was made for each farm for each year. Unfortunately mohair fibre diameter is not directly measured on lots of mohair sent from individual farms to sale as is the case with bales of wool sent for sale as the mohair is pooled from farms into sale lines prior to the core testing of bales. Therefore the subjective assessments of mohair quality made when mohair is sold were used. The yearly average and range in clip composition based on various components are provided in Table 2.6. The different classer codes used for describing components of the mohair clip examined in Table 2.6 were:

Main line codes for mohair
Mean fibre diameter codes
Kid, kid (< 30 µm).
YG, young goat (30.1-32.0 µm).
FFH, fine fine-hair (32.1-34.0 µm).
FH, fine hair (34.0-36.0 µm)
H, hair (36.1-43.0 µm).
Length codes
A, 12-16 cm.
B, 10-12 cm.
C, 7-10 cm.

Fault line descriptors
Locks, < 7 cm length.
OG, overgrown mohair > 16 cm.
Stain, light and heavy stain including crutching and bellies.
2 Line, mohair with poor style.
K, mohair with kemp fibres.
Cotted, soft and hard cots.
V, vegetable matter contaminated.

Table 2.6. The average and range in mohair clip composition based on classing grades at sale for farms in the mohair benchmarking study.

Year	*2004/2005*[A]		*2005/2006*		*2006/2007*	
Clip component	**Average**	**Range**	**Average**	**Range**	**Average**	**Range**
% A or B length no fault	59.6	28.2-72.7	56.4	42.8-74.0	51.7	41.9-74.2
% A or B length (Kid, YG, FFH) no fault	42.9	26.1-58.4	45.9	25.4-59.6	43.1	18.3-63.5
% FH or H, including fault lines	28.2	3.3-56.3	21.3	1.3-40.5	18.6	1.9-47.1
% C length	14.6	0.9-43.7	14.0	3.4-28.5	22.3	3.8-34.0
% Stain	13.4	5.8-24.0	10.3	5.4-16.7	8.5	5.6-12.3
% Locks	3.6	0.0-13.8	2.3	0.0- 9.6	2.5	0.0- 8.7
% Cotted fibre	0.7	0.0- 1.5	1.4	0.0- 4.9	3.0	0.0-9.5
% 2 Line, V, K	12.0	0.4-22.4	17.8	2.7-29.0	14.2	1.3-25.1
% Fault (C, Stain, 2 Line, Cot, V, K, OG, Locks)	40.7	27.3-71.8	43.5	26.0-56.7	48.0	25.8-58.2

[A] Data for one farm used in financial data set were unavailable

There were large ranges in the composition of clips. Within a year on some farms the production of various highly discounted lines was 0 - 6% whereas on other farms the values ranged up to 24% stains, 43% C length, 13% locks, 29% 2 line, V and K, and 9% cotted. These average values and low values can be used as a benchmark for composition of annual mohair clips.

The relationships between the proportion of important components of the clip and the percentage of does on these farms and the average net income from mohair per kg greasy are shown in Figs. 2.23 and 2.24. A range of clip composition components were tested. The clip component (proportion of FH, H and stained fibre) accounted for more of the variation in average mohair price (50%) than other clip components, or when the proportion of FH and H was added with cotted fibre or locks, with or without stained fibre, or with other fault lines. Furthermore, this component was more strongly associated with the proportion of does in the flock than any other clip component (56% of variation in FH + H + Stain explained by proportion of does in the flock). The next best clip component in accounting for variation in models was the proportion of higher valued A and B length (Kid, YG and FFH, no fault fibre) (45% of variation in doe model and 16% of variation in mohair price model).

It was concluded that these parameters: proportion of FH, H and stained fibre; and proportion of mainline A and B length Kid, YG and FFH (no fault fibre), are useful benchmarking indices for comparing commercial mohair clips between years and between farms.

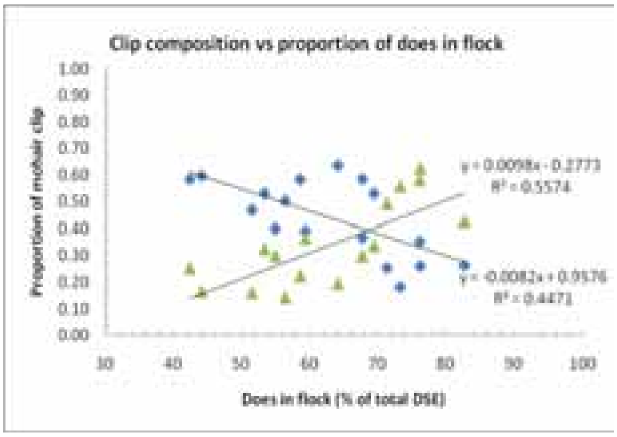


Fig. 2.23.

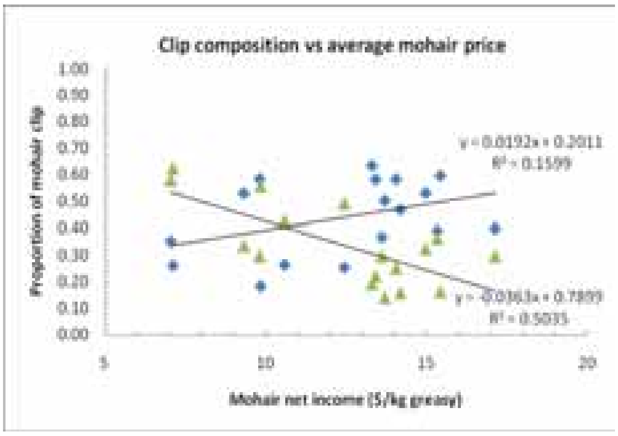


Fig. 2.24.

The relationship between the proportion of the mohair clip as mainline A or B length (Kid, YG and FFH) (closed blue diamond) and all FH and H fibre including fault lines plus all stained fibre (closed green triangle) with the percentage of does in the flock (Fig. 23) or the net mohair income (Fig. 24).

The data indicate that:

- mohair income per kg greasy declined with increasing proportion of does in the flock as:
  - An increasing proportion of the mohair produced on the farms was graded FH, H and stained;
  - Lower average mohair prices were associated with higher proportions of the mohair clip being graded as FH, H and stained.
- Mohair income per kg greasy increased as the proportion of the clip was graded A or B length and either Kid, YG or FFH.

Why is the proportion of mohair graded as FH, H and stain increasing as the proportion of does increase?

It is considered unlikely that the nutrition stresses associated with pregnancy and lactation would lead to mohair becoming coarser, as nutrition stresses either have no effect on fibre diameter, if the goats are well fed, or nutrition stresses make goats lose live weight and the mohair becomes finer (McGregor, 1998; see discussion in Chapter 4). Thus mohair should not be more likely to be graded coarser just because there are more breeding does.

It is possible that mohair from breeding does is considered to lose its style and character and so more is classed into FH or a 2 line (i.e. to a lower value fibre diameter grade) as mohair classing at selling agents is based on subjective evaluation rather than on objective diameter tests (McGregor, 2002b, 2007a). Mohair bales are objectively tested only after pooled lots have been prepared for sale.

It is understandable that the proportion of stained mohair is associated with the proportion of does in the flock. However the range in values for stained mohair suggests that it is possible to manage breeding Angora goats and mohair classing to restrict the proportion of stained mohair to less than 6% (see minimum values in Table 2.6). The proportion of stain was not related to the average mohair price and was only significant when added with FH and H. This suggests that there are differences in how some farmers manage their breeding does and class their mohair.

One possible explanation of the findings is that many Angora goat farms focus on breeding goats rather than on premium mohair production. A consequence of this is that farmers keep does to older ages when they are more likely to produce coarser mohair that will be graded FH and H. This benchmarking project did not collect data on the age structure of the participating farms so it is not possible to analyse the relationship between average doe age and mohair clip composition. The data from the fibre benchmarking (see next section) provide clear evidence that older Angora does produce coarser mohair and also that farms do differ in their fibre diameter and age relationships.

2.5.3. Impact of mohair quality on mohair value

Detailed analysis of objectively tested Australian mohair over four years has quantified the impact of variation in various attributes of commercial mohair (McGregor and Butler, 2004a). The main findings are summarised as they provide important directions for the optimisation of mohair value:

- With typical market conditions the maximum relative price of greasy mohair was reached at a mean fibre diameter of 25 μm, a relative price of only 50% of the maximum at 30 μm and a price of 10% of the maximum at 36 μm.
- There were large discounts for length (up to 48%) such that any management practice that can result in potential C length mohair (< 10 cm) reaching B length (10-12 cm) would result in an effective doubling of greasy mohair price.
- The increase in the relative value between poor style and superior style mohair was 43%.
- There were large discounts for kemp (up to 87%) and light stained mohair (70%).
- The discount for fault lines was proportionally higher when mean fibre diameter was low, and proportionally less serious when the mohair mean fibre diameter was high. The discount was also proportionally greater when the fault was more serious.
- Schlumberger dry yield was not used by agents in the prediction of raw mohair price despite the importance to processors as buyers used a flat 85% yield. Therefore, to this extent, prices for clean mohair are not transparent to producers and the industry should consider changing to price reporting on a clean basis.
- To obtain premium prices, producers should breed and manage to produce mohair of average to superior styles of A or B length, with mean fibre diameter < 30 μm, < 1% VM and free of kemp, stain and cots.

2.5.4. Mohair benchmark comparisons in South Africa

In South Africa, benchmarking during 1999-2001 demonstrated that mohair production was 50 to 100% more profitable than Merino wool or Dorper meat enterprises (van Zyl, 2002). The most recent report on benchmarking Angora goats in South Africa (Geyer, 2004) demonstrated that gross margins per dry sheep equivalent were higher (30 to 100%) from mohair compared with wool or meat production. No other record of benchmarking in the mohair industry has been located.

In South Africa, benchmarking is being used to promote mohair production, to identify best practices and for strategic planning for industry development. The industry development and promotion arm of the South African mohair industry, Action Angora, is aiming to use benchmark information to establish new Angora goat farmers. Geyer (2004) concluded that farmers apply different management practices dictated by their own circumstances and this results in different cost differences.

KEY POINTS

Higher average mohair prices were obtained in flocks where the proportion of does was lower as less mohair was graded FH, H and stained.

A greater focus on producing finer quality mohair on mohair breeding farms will considerably increase mohair profitability.

3. Benchmarks from commercial farms

3.1. Introduction

Following the advertising of the project via Mohair Australia and the three main mohair selling agents, 14 farms signed documentation to commit to participating in the project. The farms were based in New South Wales, Queensland, South Australia, Western Australia and Victoria. Because of confidentiality arrangements and the small size of the mohair industry in Australia it is not possible to identify the location or size of these farms.

3.2. Materials and methods

Angora goats were managed on each farm according to the farmer's practices and no direction was made to any participant regarding management. The benchmarking project encouraged and where possible assisted farmers to take at least the following production records: live weight measurements prior to shearing and mating and of weaner goats, weighing of fleeces and mid side sampling of fleeces. Farmers also provided further relevant information such as the date of birth and sex of all goats. Fleece samples were tested for mean fibre diameter attributes, fibre curvature, and where possible for clean washing yield and staple length. The project actively tested fleece samples for 3 years, covering 6 shearings from autumn 2006 until spring 2008.

Rainfall records were obtained either directly from the farmers own records or from the nearest Bureau of Meteorology recording site.

During the project, three farmers formally advised that they were withdrawing from participation, citing the impact of drought as their main reason for being unable to continue and several farmers never provided any fleece samples. Fleece data from the farms that withdrew have been included in the analyses wherever possible.

Summary results for each farm were prepared as box plots showing the mean and variation in attributes for each age at shearing. Complex statistical analyses were undertaken using REML repeated measures model for mean fibre diameter after log transformation (Payne, 2007). Separate terms were developed for fixed effects, random individual goat effects, random sire effects and random dam effects. Full details will be published shortly. Results are presented as graphs showing the predicted response curve for age, on the back-transformed scale, for does at each farm. These results provide objective benchmarks corrected for age, year and sex affects.

We calculated, using the model parameters, the "specific age repeatability ratio" (SARR, Butler and McGregor, 2002; McGregor and Butler, 2004b). SARR includes genetic factors, all environmental factors that persist over a lifetime (e.g. any prenatal nutritional factors on follicle development) and the interaction of these genetic and environmental factors. SARR differs from heritability and can have a different value for each Angora goat age. We also calculated, using the model parameters, "repeatable within animal correlations" (RAC, Butler and McGregor, 2002; McGregor and Butler, 2004b) between two ages as the correlation between the inherent life time animal factors at those two ages. This is defined as the correlation between the sum of all random factors pertinent to an individual animal, at two specific ages. A RAC between specific ages and a slope parameter associated with individual animal responses to age was also calculated (Butler and McGregor, 2002). The SARR and RAC are very objective benchmarks of the performance of farms regarding change in mohair mean fibre diameter with age of Angora goat.

3.3. Results

3.3.1. Rainfall

The monthly totals and long-term average rainfall for each farm are given in Table 3.1. During the period of study many farms experience periods of drought where rainfall was less than 70% of the long-term average rainfall. The effect of drought is clearly shown by the rainfall records for 2006, the first year of the project.

Table 3.1. Annual rainfall for years 2005 to 2008 and long term mean annual rainfall recorded at the farm or at the nearest recording site to farms who committed to the benchmarking study.

Farm	Annual Rainfall (mm)				Long term
	2005	2006	2007	2008	mean (mm)
1	560	317	535	415	470
2	304	144	463	286	331
3	480	310	356	397	454
4	412	251	334	266	380
5	616	591	598	764	691
6	982	494	869	907	811
7[A]	600	385	423	401	536
8	710	427	629	664	701
9	477	228	383	414	525
10	452	197	231	347	450
11	449	302	653	445	602
12	789	200	483	449	551
13	791	571	971	609	819
14	780	429	755	801	854
15	636	292	628	661	615
Average					586

[A] Farm 7 is a research flock discussed in Chapter 4

3.3.2. Flock age structure

The age structures of the mohair enterprises participating in this component of the work are summarised in Table 3.2. Most flocks were from the wheat-sheep climatic zone and three from the high-rainfall zone. Flock 7 was derived from the research herd at Horsham and transferred to Attwood. It is discussed in more detail in Chapters 4 and 5. Flock 7 is included as an internal benchmark as it is derived from 11 known sires and was closely monitored (Ferguson and McGregor, 2004, 2005). Excluding farm 7, there were at least 100 goats for each shearing up to the age of 5 years (10th shearing) and several farms had older goats. Accurate comparisons can be made at ages up to 3 years as almost all farms had each age represented at each shearing. The reliability of results is reduced at ages older than 5 years because of the fewer numbers of animal sampled. Much fewer males were sampled compared with does.

Table 3.2. Climate zone and number of does and wethers of each age for each farm included in the fleece analyses

Farm	Climate zone	Sex	Age of goat (years)														
			0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	8-13
1	Wheat-sheep	Buck	-	18	6	8	-	-	-	-	-	-	-	-	-	-	-
1	Wheat-sheep	Doe	20	56	73	61	20	16	16	5	13	9	7	1	-	2	-
1	Wheat-sheep	Wether	-	27	26	-	-	-	-	-	-	-	-	-	-	-	-
3	Wheat-sheep	Doe	109	129	104	104	46	65	19	31	9	9	-	1	-	-	1
4	Wheat-sheep	Doe	36	45	39	38	34	29	29	29	29	28	20	16	8	5	-
5	Wheat-sheep	Doe	9	-	10	-	11	-	-	-	-	-	-	-	-	-	-
7	Wheat-sheep	Wethers	270	240	238	80	67	67	80	82	79	78	78	78	-	-	-
8	Wheat-sheep	Buck	164	160	31	13	1	2	-	-	-	-	-	-	-	-	-
8	Wheat-sheep	Doe	354	369	278	132	52	23	-	-	-	-	-	-	-	-	-
8	Wheat-sheep	Wether	20	14	1	2	-	-	-	-	-	-	-	-	-	-	-
9	High rainfall	Doe	10	-	10	-	10	-	10	-	10	-	-	-	-	-	-
12	Wheat-sheep	Doe	62	83	47	46	37	39	39	40	40	39	28	28	15	14	-
13	High rainfall	Buck	37	110	65	33		3		1		2	-	-	-	-	2
13	High rainfall	Doe	169	209	245	58	13	80	1	61	1	24	17	12	1	8	12
13	High rainfall	Wether	29	75	8	10	3	6	-	-	-	1	-	1	-	-	1
15	High rainfall	Buck	2	-	63	10	-	-	-	-	-	-	-	-	-	-	-
15	High rainfall	Doe	78	74	43	15	-	1	-	-	-	-	-	-	-	-	-
Total			1369	1609	1287	600	291	331	194	249	181	190	150	137	24	29	16
Total without farm 7			1099	1369	1049	520	227	264	114	167	102	112	72	59	24	29	16

3.3.3. Animal and fleece attributes

There was a very wide range, as indicated by standard deviations and ranges, for all attributes measured (Table 3.3).

Table 3.3. Mean, standard deviation (SD) and range in measured attributes of sampled Angora goats from 9 commercial farms.

Attribute	Mean	SD	Minimum	Maximum	n
Age of goat (years)	1.8	1.44	0.5	13	5223
Birth weight (kg)	3.40	0.62	1.75	6.00	1872
Live weight (kg)	27.4	9.85	7.8	75.0	2908
Weaning weight (kg)	18.3	4.51	5.5	31.0	731
Greasy fleece weight (kg)	2.04	0.78	0.20	6.29	3881
Clean washing yield (%w/w)	83.7	5.88	54.8	99.6	3071
Clean fleece weight (kg)	1.84	0.66	0.34	5.19	2590
Staple length (cm)	11.2	2.84	2.0	20.1	4520
Mean fibre diameter (µm)	26.1	4.50	15.4	43.1	5220
Standard deviation of fibre diameter (µm)	6.53	1.48	3.56	16.62	3606
Coefficient of variation of fibre diameter (%)	24.9	4.57	1.23	49.4	5223
Fibre curvature (°/mm)	17.8	3.99	9.1	42.0	3346
Fibre curvature standard deviation (°/mm)	18.1	5.93	9	59.3	3346
Medullated fibre incidence (% number)	1.1	0.61	0.1	6.4	2137
Medullated fibre incidence (% w/w)	3.0	1.88	0.1	19.0	2137

3.3.4. Live weight of does

The live weights of does in autumn prior to mating are shown in Fig. 3.1. There was a large range in live weights between properties. At 2½ years the difference between Property 5 and Property 12 was 16 kg and this range will affect fleece production, kidding performance and mohair fibre diameter (McGregor, 1998).

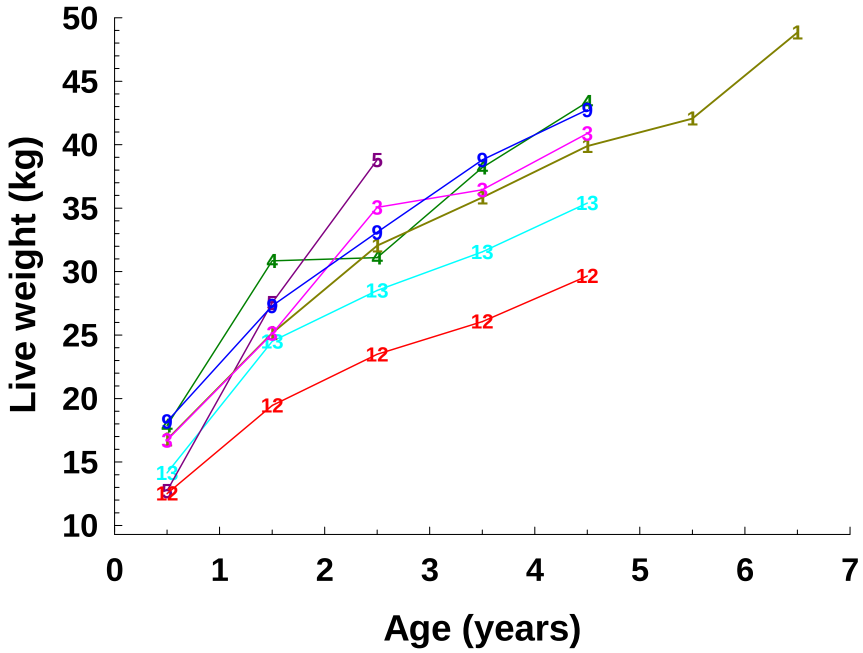


Fig. 3.1. Average live weights of Angora does of various ages weighed prior to mating. Farms are identified by their unique number.

3.3.5. Weaning weight of Angora goats

For the 2005 kidding, eight producers weighed their kids at weaning. Fig. 3.2 shows the weaning weights sorted from the lightest to the heaviest average weaning weight. The figure is presented as box plots with the average shown by the horizontal line in the centre of the box, and the range in live weights, see Fig. 3.3 for an explanation of the information in the box plot.

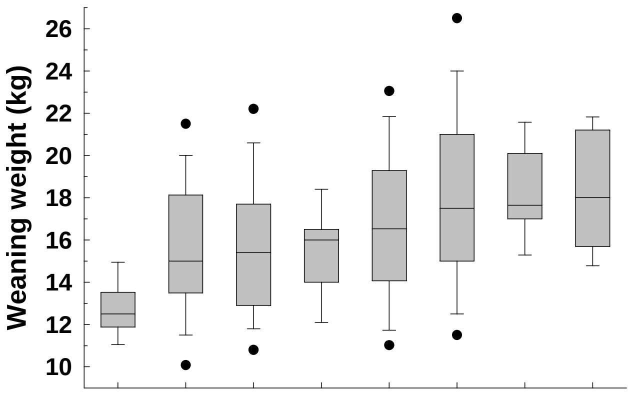


Fig. 3.2. Weaning weights from different properties sorted from the lowest to highest average

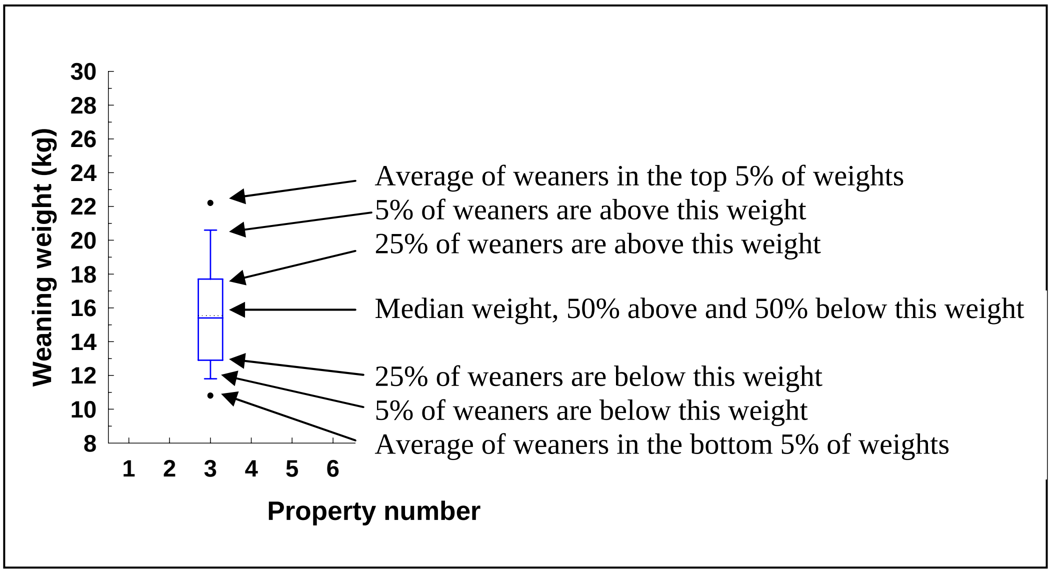


Fig. 3.3. An explanation of the information in the box plot

A different comparison from three flocks of weaners is shown in Fig. 3.4. This also shows that there was a great range in the percentage of weaners in different weight categories. Which flock of weaners is better? Even the flock with the greatest percentage of weaners greater than 20.0 kg still has 32% of weaners less than 16 kg.

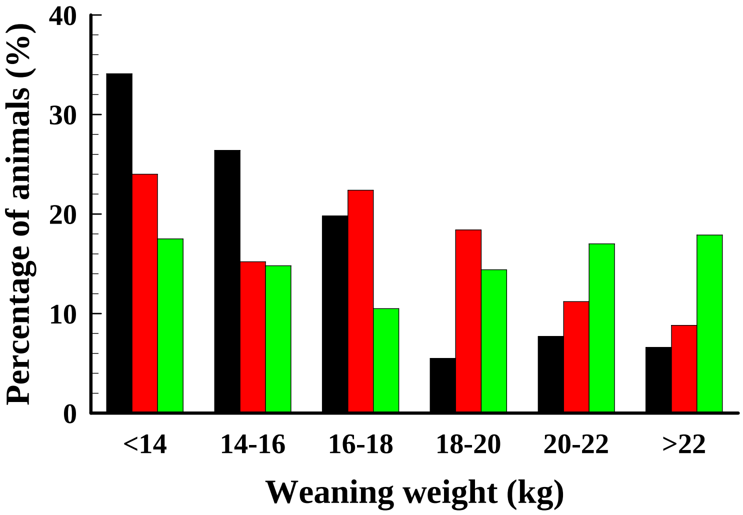


Fig. 3.4. The percentage of weaner Angora goats in different weight classes from three properties shown in different colours

3.3.6. Individual farm responses for fleece attributes

The variation with age for greasy fleece weight and mean fibre diameter for all farms are summarised in Figs. 3.5 and 3.6. There was considerable random variation between animals in mean fibre diameter.

There were significant farm by year season by age interactions (P = 3.1 x 10^{-16}). There were also separate growth curve variances and covariances for each farm (P = 3.6 x 10^{-10}). There were also other significant statistical effects detected such as sex but this report will focus on the most important findings relating to Angora does. These results mean that the responses of mohair mean fibre diameter to age differ at each farm.

Following statistical analyses to adjust for year, season and sex, the changes in mean fibre diameter with age of does on selected farms are shown in Fig. 3.7. These farms provided the most continuous sampling during the benchmarking period. For ages of 5 years and older unless the sampling was representative of the population these outlying data points are not shown. The same symbols have been used in all graphs for year and season of shearing.

The specific age repeatability ratio for the logarithm of mean fibre diameter (SARR) varied between farm and age (Fig. 3.8). A majority of the variation between animals of the same sex and age at the same farm, year and season, is due to inherent between animal variation in mean fibre diameter. However, the proportion of variation that is repeatable differs greatly between farm and age. On most farms from about 12 to 18 months of age the SARR increases with age. Below this age the response in SARR changes with age, with responses differing between farms with some showing increases and other decreases in SARR.

The repeatable within animal correlation (RAC) between the mean fibre diameter at a given age and the slope parameter for change in mean fibre diameter is shown in Fig. 3.9. The RAC show large differences between farms and ages and differ at different ages of shearing.

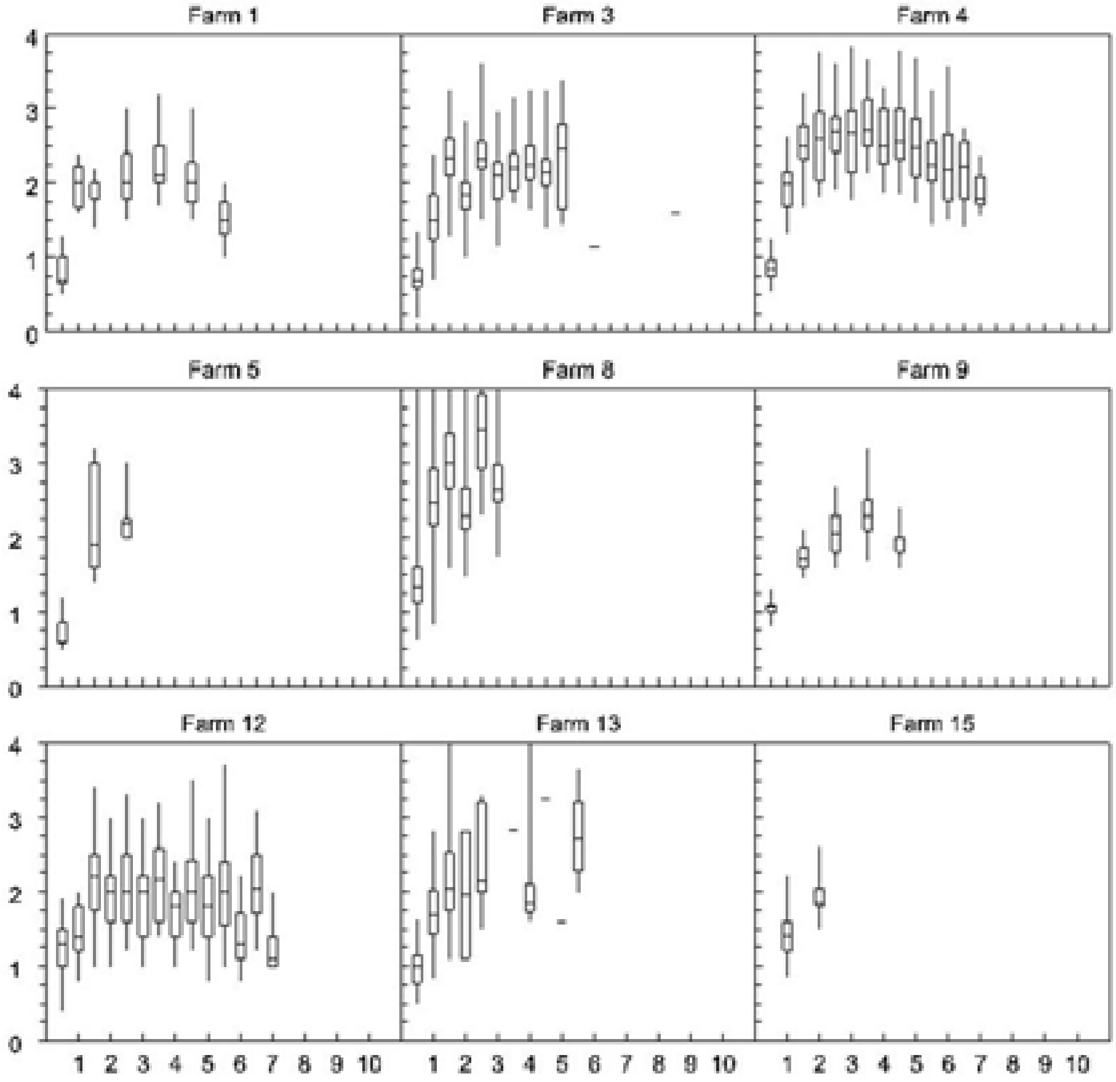


Fig. 3.5. The greasy fleece weight of all mohair fleeces measured on 9 commercial farms. The vertical axis is greasy fleece weight (kg) and the horizontal axis is age in years. Some farms did not participate for the entire period of 3 years. Some farms provided data for more than 3 years. Caution is needed in interpreting the data as, years, ages, animals and sexes are not equally represented. Notes on box plots are provided in Fig. 3.2.

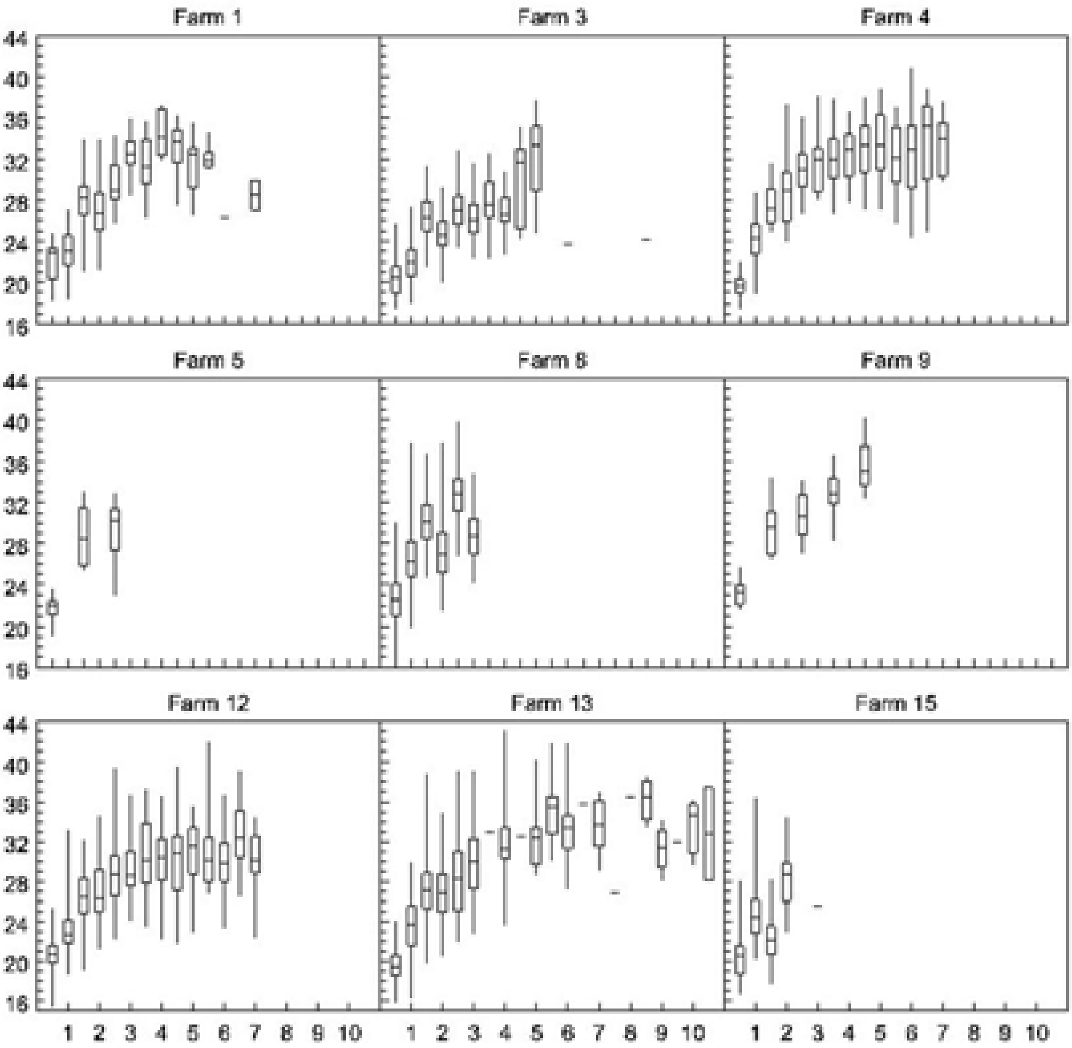


Fig. 3.6. The mean fibre diameter of all mohair samples provided by 9 commercial farms. The vertical axis is fibre diameter (μm) and the horizontal axis is age in years. Some farms did not participate for the entire period of 3 years. Some farms provided data for more than 3 years. Caution is needed in interpreting the data as, years, ages, animals and sexes are not equally represented. Notes on box plots are provided in Fig. 3.2.

Fig. 3.7. The variation in mean fibre diameter of mohair sampled from Angora does at shearing during the period 2005 to 2008. Summer grown mohair was harvested from January to July, winter grown mohair was harvested from August to December.

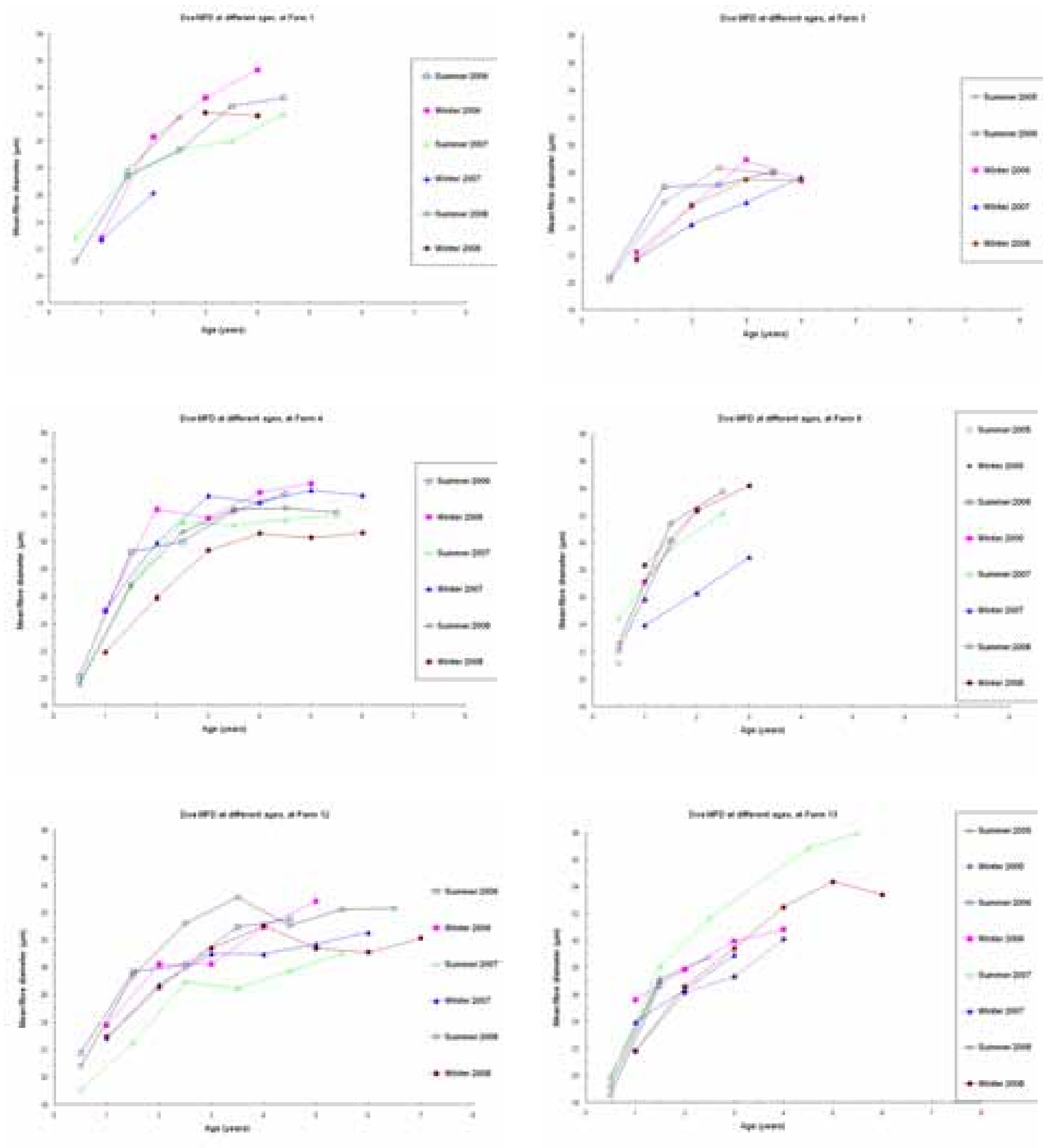


Fig. 3.8. The specific age repeatability ratio (SARR) for the logarithm of mohair mean fibre diameter for different farms and ages for commercially farmed Australian Angora goats. Each symbol and line represents a different farm.

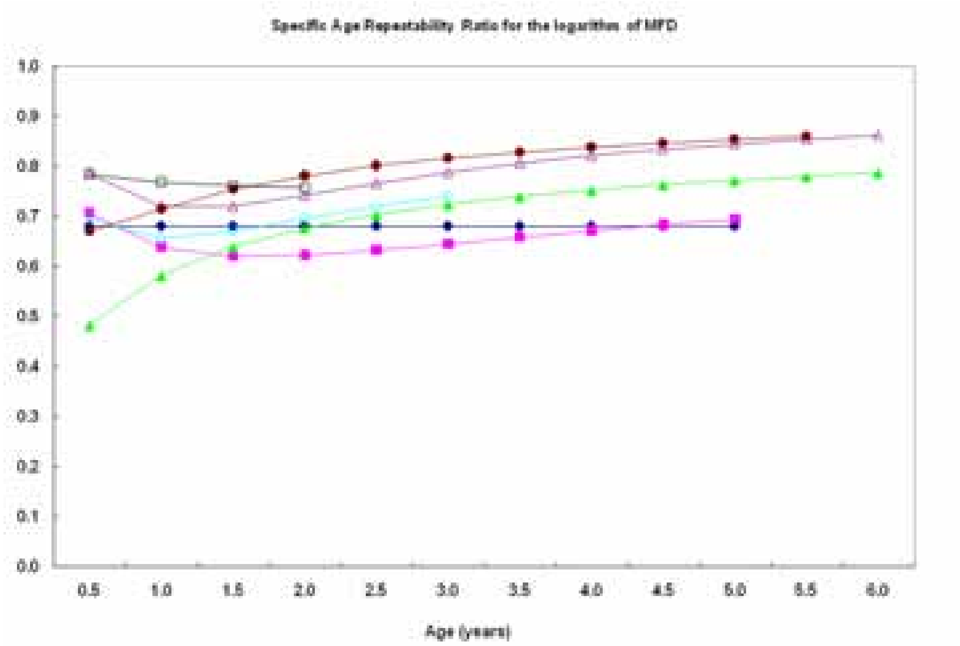
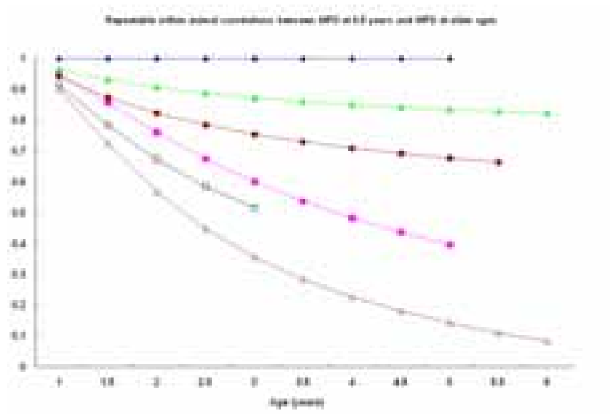
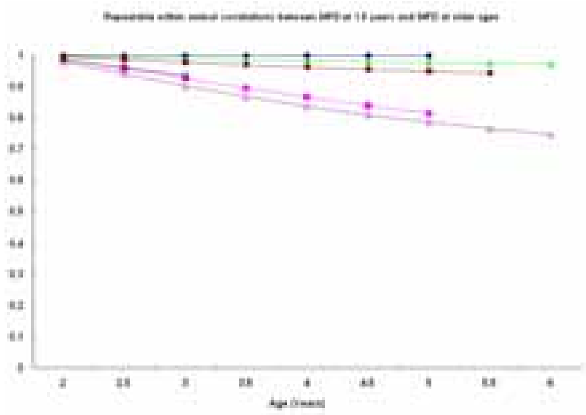
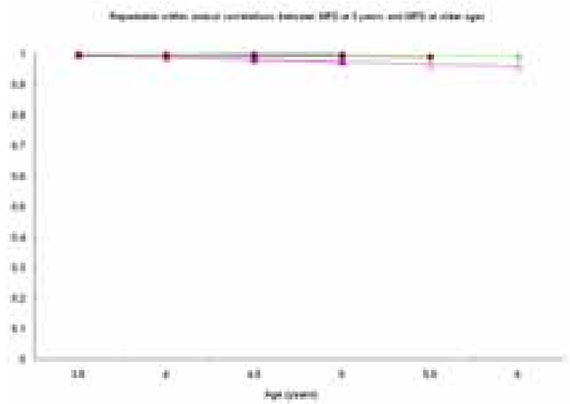


Fig. 3.9. The repeatable within animal correlation (RAC) between mohair mean fibre diameter at a given age and the slope parameter for change in mean fibre diameter for ages at measurement of 0.5, 1.5 and 3.0 years of age. Each symbol and line represents a different farm. Symbols are the same as for Fig. 3.8.







3.4. Discussion

3.4.1. Weaning weight

It is clear that there is a considerable range in the weaning weights both within and across Australian mohair enterprises. Some farms clearly wean goats at heavier weights than others. Many questions arise including:

1. Production issues: Does the great range in weaning weights compromise production, reproduction and financial returns? If there is a lot of time spent managing 11 to 13 kg weaners is this worthwhile if greater returns can be made on improving the 14 to 18 kg weaners? Are farmers put off buying Angora goats when they see all the small weaners needing extra care and attention? Do small doe weaners produce the same number of kids compared with larger doe weaners when they reach the breeding herd? Are there mating, feeding or rearing strategies that can reduce the large variation within these mobs of weaners?
2. Financial issues: Does the large range in weaning weight support the earlier findings that higher weaning percentages have no positive impact on gross margins (see Chapter 2). Can the industry as a whole lift financial returns if weaning weights are increased or made more compact?

The heaviest of the weaners in some flocks could be mated in their first year if they continued to be fed well as the recommended minimum mating weight for Angora goats is 25 kg (McGregor, 1982a, 1989, 2001, 2007b). Some of these heavier weaned goats such as cull doe weaners or wethers could be sold for meat into the capretto market. For the remaining weaners, especially those less than 16 kg, they will struggle to reach mating weights the following year.

Improved nutritional management of Angora kids has been identified as an important method to reduce average life time mohair fibre diameter. Improved nutrition of lactating does leads to higher skin follicle development resulting in finer mohair later in life (McGregor, 1994, 1995) with a resulting increase in commercial value.

3.4.2. Live weight

It is clear that Angora does on commercial Australian farms continued to gain live weight throughout their life and do not reach their mature size until at least 5 years of age (Fig. 3.1). This pattern of growth means that mohair enterprises must maintain adequate nutritional provision to enable these does to continue to grow after kidding. However, older and heavier does produce coarser and less valuable mohair. The value of does can therefore only be maximised by optimising reproductive performance. It is apparent from the kidding key performance indicators provided in Chapter 2 that on many occasions, mohair enterprises have been unable to optimise reproductive performance of the doe flock.

Reproductive performance is optimised by nutritional, mating and live weight management. At 18 months of age, when most Angora does are mated for the first time, it is recommended that does weight at least 25 kg. There were several properties where does averaged less than 25 kg at 18 months of age and this is related to depressed kidding performance of the flock. For example, in Flock 12 the average live weight of monitored does was 24.7 kg (Fig. 3.1) and the weaning performance was 46%.

Mohair enterprises should consider setting key live weight targets for their breeding does. It is suggested that mohair enterprises undertake routine live weight monitoring particularly of kids and reproducing does to ensure that key targets are met or management adjusted to assist animals reach the targets.

3.4.3. Mohair quality

Mohair mean fibre diameter increased from age 0.5 years up to ages 3 to 4 years depending upon the farm. There were differences between the years and season in the rate of increase with age. The maximum average mean fibre diameter reached with age varied between farms and years and seasons. The average differences between years and seasons can be quite large, e.g. Flock 12 ranged between about 26 and 33 um at Age 3.5 years.

As there was no evidence of a plateau in the response of mean fibre diameter to age, it must be concluded that mean fibre diameter will continue to increase past the ages in this analysis. This is supported by findings in Chapter 4 that increases in mean fibre diameter are related to increases in live weight of the Angora goats. In the analyses conducted in this chapter not all farms weighed their goats so age was used but the shape of the live weight curves and the mean fibre diameter curves with age are similar (Fig. 3.1 and 3.7).

The repeatable variation between animals (SARR) is the most important source of variability because not only is there a lot of variability between animals but the repeatability of this variability between animals is high (60 to 80%). This is critical issue for mohair enterprises and it impacts on enterprise profitability via the impacts on mohair value.

The SARR includes variation due to heritability and permanent environmental affects. As SARR averages 0.60 to 0.80 (Fig. 3.8) the remaining variation is caused by factors that are non-permanent effects including measurement error and one off factors.

We can estimate the size of the permanent environmental affects in these Angora goats by subtracting the heritability of mean fibre diameter in mohair from the SARR. The average heritability for mean fibre diameter in mohair is about 0.30 (range 0.08 to 0.51, Ferguson and McGregor, 2005). Thus the average proportion of variation due to non-genetic repeatable affects is 0.3 to 0.5. This is of significant practical and financial importance.

If farmers have Angora goats with a high repeatability (0.7 – 0.8) and low heritability for mean fibre diameter then it is good to keep animals for their lifetime provided that they are good at 3 years of age. It is not as good to rely on progeny of these does as the heritability of mean fibre diameter in mohair is low (0.30 average) and so there will be a lot of variation in the progeny cohorts.

These non-genetic repeatable effects are likely to be related to differences in nutritional conditions for does and nutritional management of kids.

The repeatable correlations (RAC, Fig. 3.9) show large differences between farms and ages. On all farms, if an Angora goat is producing fine mohair at age 3 it will continue to perform at this level. However breeders want to know when to select their animals. This depends on the degree of correlation that breeders seek. The correlations are high for the next shearing for all farms and ages but they decline for subsequent shearings up to age 3 years. It appears to be a waste of money to test at too young an age, particularly on farms where the RAC is low. Testing at 18 months is preferred to earlier testing. Testing at ages older than 18 months improves the repeatable correlations.

4. Lifetime performance of Angora wethers

4.1. Materials and Methods

The Angora goats grazed at Attwood were included for benchmarking purposes as their genetic origins were derived from nine farms of different genetic background and represented a cross-section of the existing Australian industry.

4.1.1. Location and environmental conditions

Goats were managed at two sites. They were born in spring 2002 on “Sylvania Park” 15 km east of Horsham (36º43'00"S, 142º14'30"E, altitude 130 m), in the northwest of Victoria, Australia. Daily rainfall records were available from a Bureau of Meteorology recording station located 5 km to the north of the site (Longerenong) with long-term average rainfall data available since 1860.

Following shearing at 18 months of age the wether goats were transferred to the Department of Primary Industry, Attwood, Victoria (37°40’S, 144°53’E, altitude 135 m). Daily rainfall records were available from a Bureau of Meteorology station located 2.5 km to the west of the site and long-term average rainfall data available since 1970.

4.1.2. Animals and their management

The goats were conceived following artificial insemination to known sires as part of a genetic study. Sires were grouped as one of three strains: pure South African, pure Texan or mixed (predominantly 50:50 South African Texan mixture). At birth, kids were identified with their dam, birth weight and sex recorded and kids identified with individually numbered ear-tags. Further details are provided elsewhere (Fergusson and McGregor, 2005). The soils were alluvial deposits from the Wimmera River. Pastures were annual with grazing of cereal crop stubbles over summer-autumn periods. Drinking water was supplied from the Wimmera River. Shelter was available in the form of covered and enclosed shedding.

At Attwood, the soils were based on weathered granite. Goats were grazed as one flock, at near the recommended stocking rate of 10 dry sheep equivalents/ha on 10 ha of improved annual pasture divided into six paddocks. Goats were moved between paddocks every week or more frequently to match feed requirements.

During most years in autumn and winter, pastoral conditions were affected by drought, and supplementary feeding of whole barley grain with whole sweet lupin grain or similar legume grain (80:20 mix) at feeding rates of 150 to 250 g/goat/day, following Australian practice (McGregor, 2005a), was provided from mid May to early September to reduce live weight losses and maintain healthy animals. To this grain mixture crushed limestone was added at a rate of 25 g/ kg. Grain feeding was phased out as soon as pastoral conditions enable live weight gain. The pasture was composed of the following annual species: Annual rye grass *(Lolium rigidum)*, Subterranean clover (*Trifolium subterranean)*, Brome grass *(Bromus mollis)*, Silver grass *(Vulpia spp.)*, Barley grass *(Hordeum leporinum)*, Cape weed *(Cryptostemma calendula)*, with a number of other grasses and weeds making a minor contribution. A mineralised stock block was always available (Ridley AgriProducts Pty. Ltd.) with the following content: Minimum content Ca 49 g/kg; P 10 g/kg; S 20 g/kg; Cu 600 mg/kg; Co 60 mg/kg; I 60 mg/kg; Zn 1000 mg/kg; Fe^{+2} 1100 mg/kg; Se 5 mg/kg; based on NaCl 0.75 to 0.85. Fresh water was provided in all paddocks. Shelter was available in the form of covered and enclosed shedding that was always accessible and could accommodate all goats.

Generally the goats were shorn every six months during the period of study and were given a full crutching and wigging three months prior to any full shearing. The same shearer was used throughout the study. Some goats were subject to altered shearing regimens during a two year period from age 1.5 to 3.5 years (McGregor and Butler, 2008b) and these records have been either omitted from this report, or where necessary the fleece records have been analysed including treatment. Goats were vaccinated against 5 in 1 *Clostridia spp*. and "drenched" with an effective antihelmintic to control gastro-intestinal parasites no more frequently than once per year. All goats were weighed to the nearest 0.2 kg almost every month and one day prior to any shearing. At each weighing body condition score was also recorded (McGregor 1983a, 1992, 2005a). Goats were then fasted overnight prior to shearing or crutching and returned to pasture together following shearing.

4.1.3. Mohair evaluation

At crutching and shearing, fleeces, pieces, bellies and locks and samples were weighed to the nearest 1 g. Mid side samples were taken at shearing, identified and stored in a plastic bag. A range of objective and subjective evaluations were completed on the mid side sample prior to testing the sample (McGregor, 2007a; McGregor and Butler, 2008b). Three staples from the mid side sample were assessed for attributes in the following order: staple definition, staple tip shape, style, character, staple fibre entanglement, staple length. The assessed length was not the longest fibres in the staple tip but was subjectively determined with the aim of measuring to the point where most of the fibres were present before any significant narrowing of the staple near the tip, as per industry selling broker practice. Following laboratory evaluation, the mid side samples were tested for clean washing yield, mean fibre diameter, fibre diameter variation, fibre curvature and medullated fibre content (using the OFDA100) following international wool testing standard methods (IWTO-19, IWTO-47, IWTO-57). Clean fleece weight was determined as: total greasy fleece weight including weight of crutchings (kg) × clean washing yield (%).

Following sampling, mohair was separated into mainlines and outsort fibre. Mohair from each shearing was generally sold in one batch via a commercial mohair agent (Australasian Mohair Trading, Sunshine, Victoria). The commercial agent sold the mohair following grading into their commercial lines and provided details of quantities and prices for each line.

Carcasses were evaluated following slaughter in November 2008, at 6 years of age and full details of methods and results are provided in a latter section of this report.

4.1.4. Statistical analyses

Data have been analysed in two ways, detailed analyses of lifetime changes and a commercial evaluation of fleece production based on measurements and sale data.

4.1.4.1. Lifetime changes

A complex REML repeated measures model for MFD after log transformation was developed (Payne, 2007). Separate terms were developed for fixed effects, random individual goat effects, random sire effects and random dam effects. Full details will be published shortly.

Data were included from all shearings from 0.5 years of age to 6 years of age. While the analysis includes the data for age 1.5 years in the model, they are not further reported because they are considered to be an anomalous group of data as a suitable live weight was not taken just prior to shearing and the nearest available live weight data are suspect. The various terms used to fit the data for age 1.5 years into the model are not significant for any other age. Data for age 0.5 years was excluded as the data are significantly affected by maternal factors and those associated with variations in date of birth which are not significant at later ages. The main results are provided in graphical form.

Fleece free live weight was calculated as: (live weight the day before shearing) – (greasy fleece weight).

4.1.4.2. Commercial evaluation

When the REML model was used to predict the main effect of weaning weight on mohair fibre diameter, the relative value of mohair was predicted using the outcome from detailed analyses of mohair prices (McGregor and Butler, 2004a).

For different ages from 2 years of age, the proportion of the total quantity and value of each commercial grade of mohair sold has been determined based on the selling agent documentation. The proportions of the total fibre sold in various fibre length and fibre diameter grades has been summarises in pie charts. Sale average prices for mohair have been determined on a greasy and clean mohair basis and tabulated with the mean mid side fibre diameter determined from goats included in the sale data. Clean mohair sale data has been compared with monthly sale data for wool based on different fibre diameter indicator prices calculated from all southern market wool prices and obtained from the Wool desk wool monitor data base (Wool desk, 2009). The ratio of prices received for mohair sold from the goats has been determined against similar fibre diameter wool and 19 µm wool for the period under consideration (September 2004 to October 2008).

4.2. Results

4.2.1. Rainfall

The monthly totals and long-term average rainfall at the site are given in Table 4.1. During the period of study only one year exceeded the long term mean annual rainfall (2005) and that was as a result of an abnormal 200 mm of rain in February.

Table 4.1. Monthly rainfall and long term mean monthly rainfall recorded at: Longerenong, 5 km north of the experimental site between 2002 and February 2004 and at Melbourne International Airport, 2.5 km west of the experimental site (37°40'S, 144°53'E) between March 2004 and November 2008.

Month	Rainfall (mm)							Long term mean (mm)	
	2002	2003	2004	2005	2006	2007	2008	Longerenong [1]	Melbourne Airport [2]
January	10.8	4.0	9.6	23.4	50.6	24.2	38.8	24.2	42.7
February	9.0	56.0	2.2	200.6	58.8	13.0	31.2	23.6	43.3
March	15.2	4.6	20.2	6.6	13.2	39.4	23.2	22.6	36.0
April	17.4	7.6	49.0	26.0	43.2	29.2	9.8	29.1	44.8
May	20.2	35.8	18.2	8.0	40.4	41.0	36.2	42.9	41.0
June	22.0	66.6	24.2	31.0	10.4	45.4	12.6	44.4	38.0
July	24.6	29.2	27.8	21.0	39.4	41.2	38.2	42.5	36.3
August	15.6	0.0	69.4	57.6	27.2	17.6	46.0	43.5	46.1
September	31.0	24.0	47.8	39.4	38.4	8.2	16.8	40.4	46.0
October	14.4	59.8	45.2	69.0	8.4	5.6	11.4	42.2	53.9
November	32.6	8.8	113.0	64.6	39.0	74.6	46.8 [3]	30.6	59.1
December	21.2	23.2	59.2	48.0	15.8	83.2	90.0	27.3	48.6
Total	**234.0**	**319.6**	**485.8**	**597.8**	**384.8**	**422.6**	**401**	**413.7**	**536.2**

[1] For 119 years between 1860 and 2008; [2] For the period from 1970 when records began until the end of 2008; [3] 11.8 mm rain to 11 November when experiment concluded

4.2.2. Animal and fleece attributes

There was a very wide range, as indicated by standard deviations and ranges, for all attributes measured (Table 4.2).

Table 4.2. Mean, standard deviation (SD) and range in measured attributes of sampled Angora goats grazed at Attwood from age 1.5 to 6 years

Attribute	Mean	SD	Minimum	Maximum
Live weight at shearing (kg)	47.5	11.14	21.8	75.5
Greasy fleece weight (kg)	2.32	0.659	0.76	4.64
Clean washing yield (%w/w)	85.6	5.54	63.6	97.7
Clean fleece weight (kg)	1.98	0.588	0.61	3.85
Staple length (cm)	13.4	2.00	8.5	19.0
Average staple definition score	3.1	0.81	1	5
Total staple style	0.6	0.58	0	3
Total staple character	11.5	2.88	4.5	21
Average staple tip shape score	2.3	1.13	1	5
Average staple fibre entanglement score	3.4	0.92	1	5
Mean fibre diameter (µm)	32.4	4.13	19.6	47.5
Coefficient of variation of fibre diameter (%)	25.3	4.05	15.8	38.4
Fibre curvature (°/mm)	13.1	2.66	8.0	28.5
Fibre curvature standard deviation (°/mm)	13.9	3.48	8.0	28.0
Medullated fibre incidence (% number)	1.5	0.71	0.2	4.3
Medullated fibre incidence (% w/w)	3.5	1.8	0.5	14.2

4.2.3. Live weight

The live weight measurements of the Angora wethers grazed at Attwood are shown in Fig. 4.1. Average live weight increased from about 23 kg at 18 months of age to 64 kg at 75 months of age. Angora goats grew rapidly in most spring and summer periods and lost weight during late autumn and during winter periods when drought conditions prevailed.

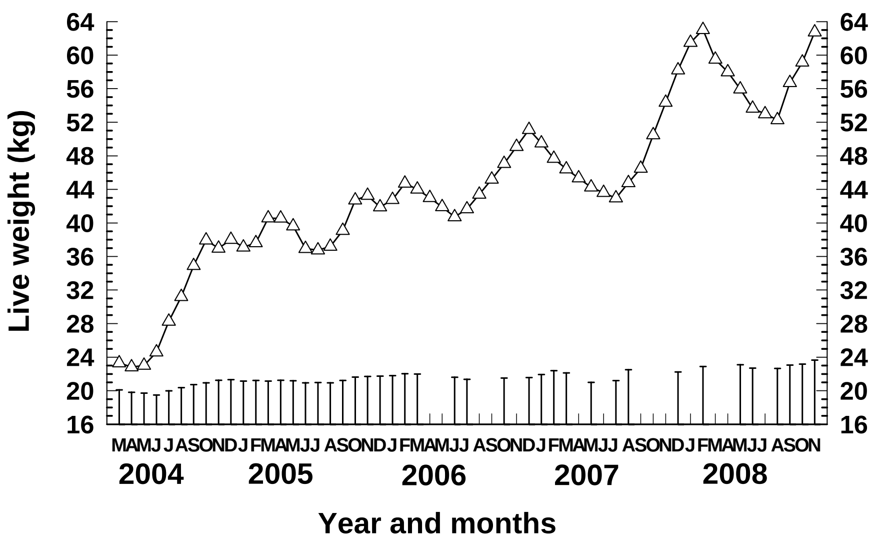


Fig. 4.1. The mean live weight of Angora wether goats grazed near Melbourne on annual temperate pastures from 1½ to 6¼ years of age. The vertical bars indicate the standard deviation of the population. Where goats were not weighed on the dates with missing s.d. bars the graph values have been interpolated.

4.2.4. Mohair fibre diameter

The most significant effects on mohair mean fibre diameter were: fleece-free live weight at shearing, weaning weight, age at shearing, sire, season and individual animal effects. Only the most significant results for fleece-free live weight, weaning weight and age are discussed in this report.

Mean fibre diameter increased with increases in fleece-free live weight (Fig. 4.2, $P = 6.2 \times 10^{-7}$). The results for 1, 2, 4 and 5 years of age overlay one another. The results for 2.5, 3 and 3.5 years appear higher and this may be associated with the better than average seasonal grazing conditions during this period. For 6 years of age the mean fibre diameters are lower than the other ages and this may reflect the poorer seasonal grazing conditions with dry conditions mostly prevailing. None-the-less, the overwhelming factor affecting mohair mean fibre diameter was live weight.

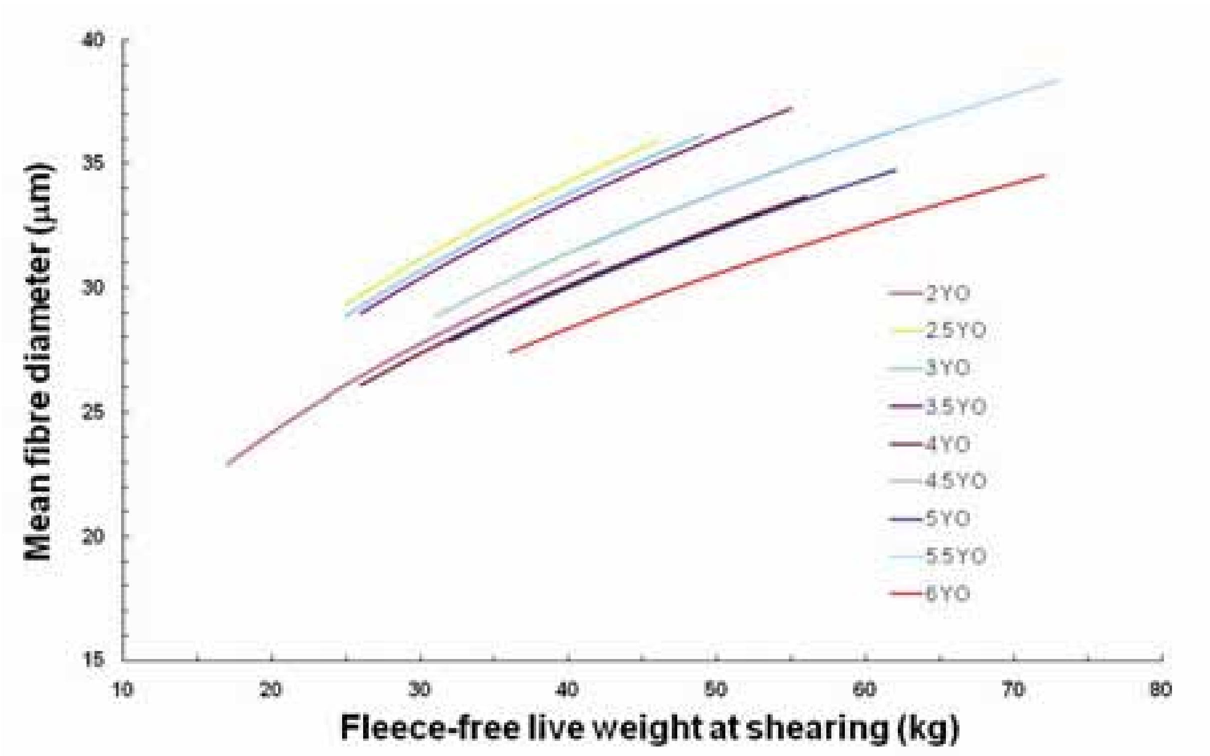


Fig. 4.2. Relationship between mean fibre diameter, adjusted for genetic origin, weaning weight, and fleece free live weight at different ages of Angora wether goats from 9 genetic origins. For each age only the range in actual fleece-free live weight is shown. Age in years shown as YO.

Weaning weight also affected mohair mean fibre diameter of Texan strain wethers ($P = 0.00016$, Fig. 4.3). The results in Fig. 4.3 are presented for goats at age 4 and at a fleece free live weight of 45 kg. At lighter weights the lines move down (finer) and at heavier weights the lines more up (coarser) in parallel to the lines shown. For South African and mixed breed goats there was no significant effect of weaning weight.

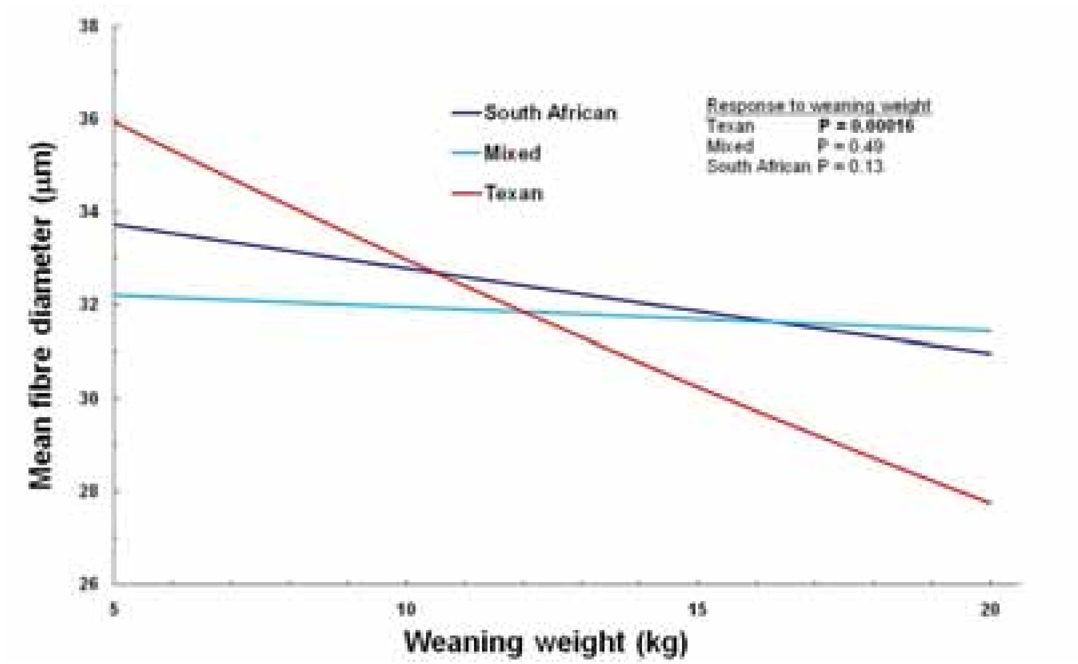


Fig. 4.3. Relationship between mean fibre diameter and weaning weight of different genetic origins for 45 kg Angora wether goats shorn at 4 years of age.

The impact of weaning weight on the relative value of mohair produced by Texan Angora goats is summarised in Table 4.3. The valuation in Table 4.3 is based on the comprehensive analysis of the factors that affect sale prices of Australian mohair (McGregor and Butler, 2004a). Table 4.3 shows that the value of mohair produced at age 4 years for kids weaned at 12 and 16 kg weaning weight is substantially less than the value of mohair produced from kids weaned at 20 kg live weight.

Table 4.3. The effect of weaning weight on the mean fibre diameter of mohair and the relative value of mohair produced by 4-year-old Texan wethers. Relative value of mohair determined from McGregor and Butler (2004).

Weaning weight (kg)	Mean fibre diameter at 4 years of age (µm)	Value of mohair relative to 25 µm mohair (%)	Total value of 4 kg of mohair when 25 µm mohair is $20/kg ($/kg)
12	32	30	24
16	30	50	40
20	28	75	60

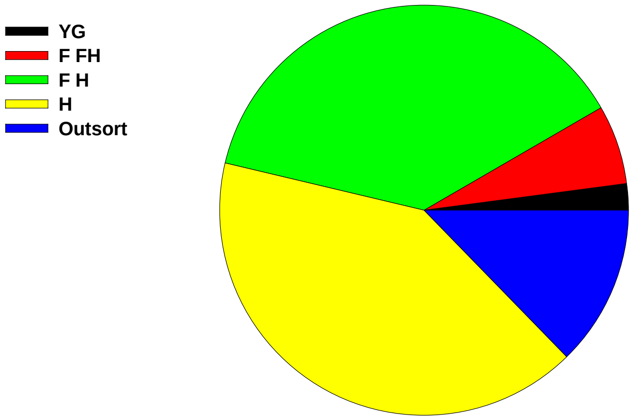
What weaning weights are typical of commercial Australian farms? Farmers in the benchmarking project weighed their weaners in the first year of the project (Fig. 3.3). As can be seen in Fig. 3.3, many farms have an average weaning weight of no more than 16 kg and half or more of almost all weaners are lighter than 16 kg. Table 4.3 indicates that by age 4, the potential lost income per year from Texan origin goats weaned at 16 kg or less is almost $20/goat and over 5 years may be up to $100/goat.

4.2.5. Commercial value of mohair

The proportion of total mohair production and total sale value of mohair following classing into various grades is summarised in Table 4.4. The proportion of mohair sold in the different fibre diameter grades when averaged over the period from shearing at 2 years of age to shearing at 6 years of age is illustrated in Fig. 4.4. Details for the three shearings at 6, 12 and18 months of age are provided elsewhere (Fergusson and McGregor, 2005).

Fig. 4.4. The average proportion of mohair sold in different fibre diameter classes as determined by the selling agent from mohair grown by 1.5 to 6 year old Angora goats. The subjective fibre diameter classes and their intended objectively measured ranges are:

YG, young goat (30.1-32.0 µm).
F FH, fine fine-hair (32.1-34.0 µm).
FH, fine hair (34.0-36.0 µm)
H, hair (36.1-43.0 µm).
Outsorts = other fibre.



The proportion of mohair sold in the different fibre length grades when averaged over the period from shearing at 2 years of age to shearing at 6 years of age is illustrated in Fig. 4.5. Details for the three shearings at 6, 12 and18 months of are provided elsewhere (Fergusson and McGregor, 2005).

Fig. 4.5. The average proportion of mohair sold in different fibre length classes as determined by the selling agent from mohair grown by 1.5 to 6 year old Angora goats. The fibre length ranges were:

A, 12-16 cm.
B, 10-12 cm.
C, 7-10 cm.
Locks, < 7 cm.
AB, used for mixed A and B length fibre of poor style (2) or kempy (K).
Stain, light and heavy stain including crutching and bellies.
Cot, soft cots from under the chin.

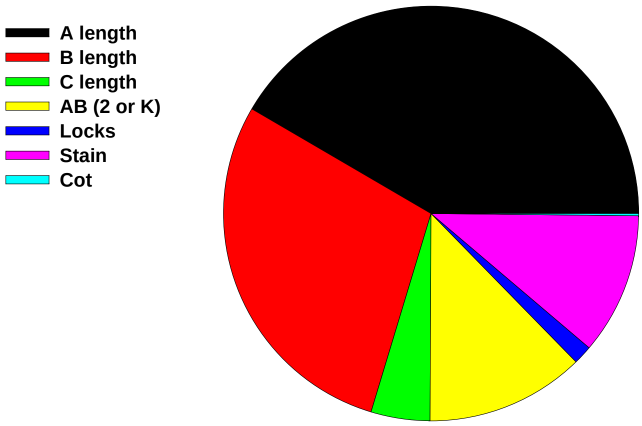


Table 4.4. Proportion of total mohair production (kg) and of total sale value ($) classed into various grades by commercial selling agents for mohair grown by adult Angora wether goats grazed at Attwood from 18 months to 6 years of age. Data for period August 2004 and October 2008.

Description	Age of goat (years)															
	2, 2.5 & 3		3.5		4		4.5		5		5.5		6		Average	
	kg	$	kg	$	kg	$	kg	$	kg	$	kg	$	kg	$	kg	$
A YG	0.060	0.086													**0.013**	**0.021**
B YG	0.039	0.051													**0.009**	**0.012**
YG2	0.043	0.062													**0.010**	**0.015**
A F FH	0.076	0.075													**0.017**	**0.018**
B F FH	0.111	0.092	0.083	0.092					0.126	0.153					**0.047**	**0.054**
A FH	0.092	0.103	0.309	0.333	0.140	0.163					0.324	0.384	0.247	0.311	**0.163**	**0.176**
B FH	0.143	0.148	0.222	0.224			0.195	0.199	0.406	0.438					**0.120**	**0.144**
FH2	0.053	0.072	0.012	0.013	0.046	0.048							0.114	0.138	**0.035**	**0.037**
FH K			0.022	0.022							0.057	0.063			**0.012**	**0.011**
C FH	0.047	0.034					0.135	0.127	0.196	0.190					**0.045**	**0.043**
A H	0.087	0.099	0.191	0.190	0.403	0.423					0.366	0.358	0.345	0.313	**0.209**	**0.193**
B H	0.122	0.127	0.093	0.082	0.021	0.022	0.630	0.646	0.084	0.082					**0.118**	**0.140**
H K					0.224	0.209					0.117	0.092	0.106	0.061	**0.068**	**0.051**
C H K	0.016	0.005													**0.004**	**0.001**
LOCKS	0.026	0.003			0.041	0.014	0.010	0.002			0.004	0.001	0.003	0.001	**0.014**	**0.004**
L STN	0.073	0.039	0.068	0.044	0.105	0.104	0.030	0.026	0.154	0.125	0.123	0.097	0.158	0.159	**0.101**	**0.073**
H STN	0.011	0.003			0.014	0.007			0.035	0.013	0.009	0.005	0.022	0.013	**0.013**	**0.005**
COT S					0.007	0.009							0.005	0.005	**0.002**	**0.002**

The average fleece value received for mohair grown by the Angora wether goats grazed at Attwood between 2004 and 2008 is summarised in Table 4.5. Because of the way the mohair was sold during 2004 and 2005 it is not possible to separate the returns from each of these shearings and the data has been combined. The price of mohair rose during the period 2004 to 2006 with the maximum prices received in early 2006. Mohair prices declined from mid 2007 as the world economic recession reduced demand (Fig. 4.6). During the period from 2004 until spring 2007, 32 µm mohair sold for a multiple of 2.5 to 3.5 times the price of 32 µm wool (Fig. 4.7). During 2008, 32 µm mohair sold for 1.5 to 2 5 times the price of 32 µm wool (Fig. 4.8).

Table 4.5. The average fleece value and average mid side mean fibre diameter of mohair grown by Angora wether goats of various ages grazed at Attwood from 2004 to 2008.

Age of goat (years)	Years	Average mid side mean fibre diameter (µm)	Average value $/kg greasy inc GST	Average fleece $/kg clean inc GST
2, 2.5 & 3	2004, 2005	27.4, 32.6, 32.1	9.18	10.80
3.5	2006	34.1	12.85	14.52
4	2006	32.6	9.42	11.01
4.5	2007	32.8	9.99	11.89
5	2007	31.2	8.15	9.53
5.5	2008	36.2	5.84	6.83
6	2008	32.2	4.37	5.11

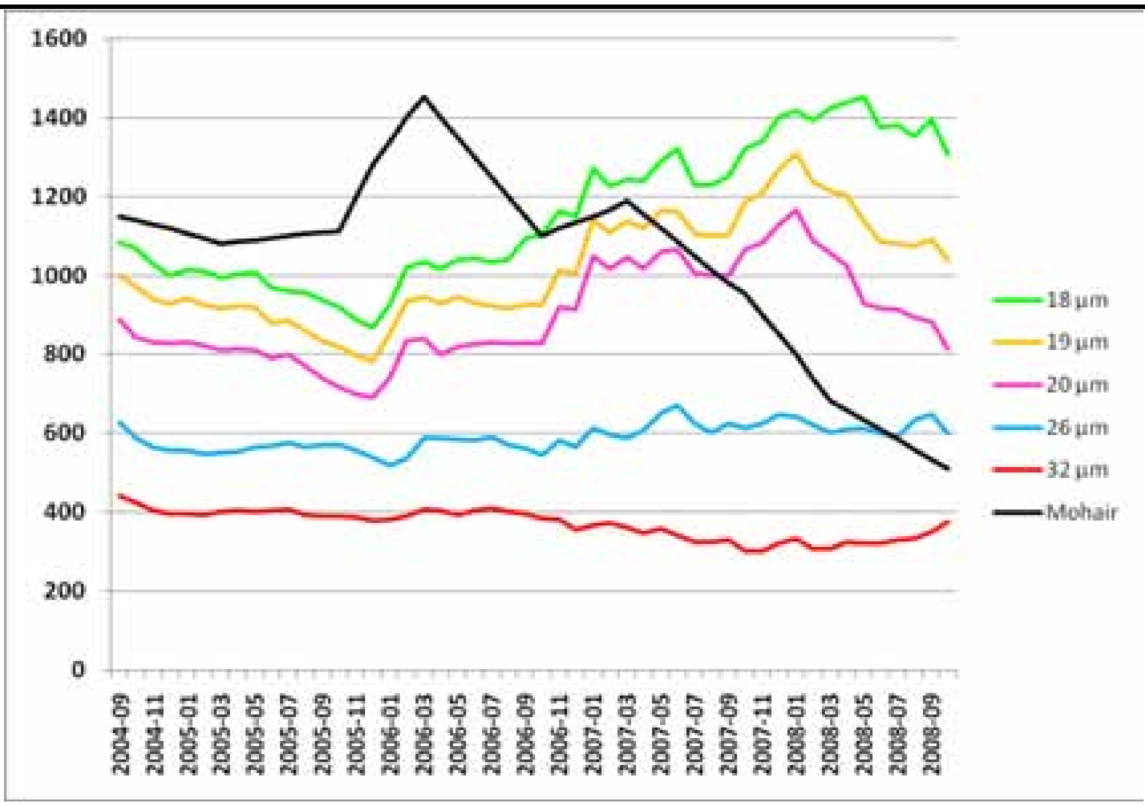


Fig. 4.6. The actual average price of mohair sold from wether goats at Attwood and Australian wool of different mean fibre diameter based on monthly sale data (Australian cents/kg clean fibre). Mohair prices have been interpolated. Source of wool prices, Wool desk (2009).

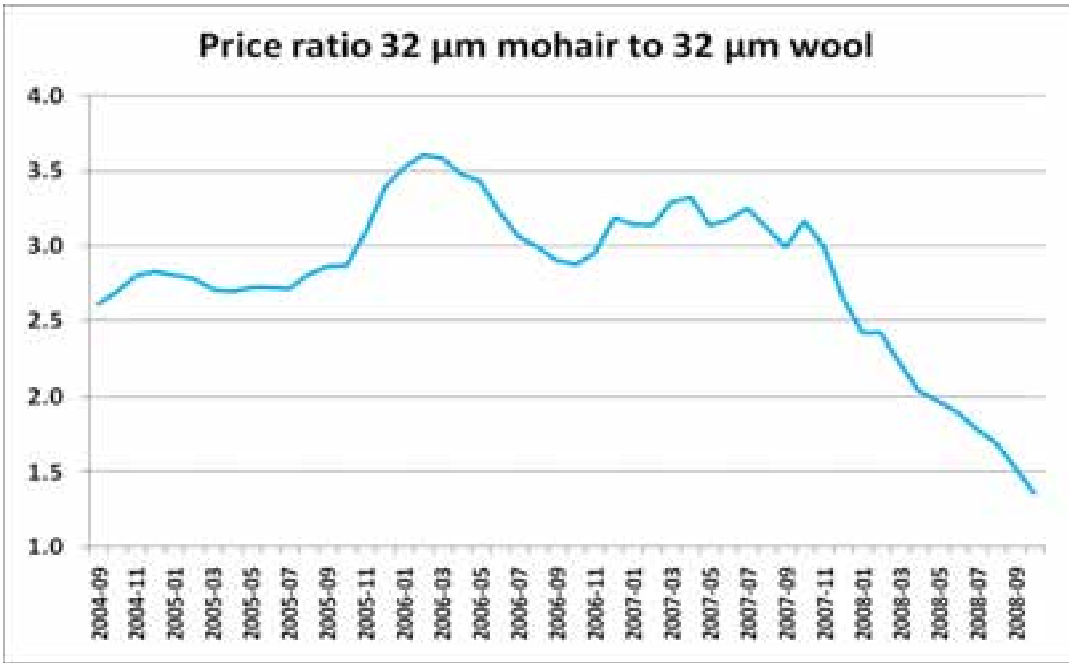


Fig. 4.7. The ratio of prices received for mohair grown by wether goats at Attwood compared with prices received for 32 µm wool based on the southern market price (Wool desk, 2009).

Over the seven shearings between 2004 and spring 2007, the mean fibre diameter of the mohair produced by the adult wether Angora goats averaged 31.8 µm and the average price received during this period was $9.93 per kg greasy mohair or $11.61 per kg clean mohair (Table 4.5). For wool production to achieve a similar average greasy price during the same period, the mean fibre diameter would have needed to average 19 µm. The ratio of the price received for this adult mohair compared with the 19 µm wool price is shown in Fig. 4.8. Over of the period from September 2004 to October 2008 the adult mohair realised a 6% higher price than 19 µm fleece wool.

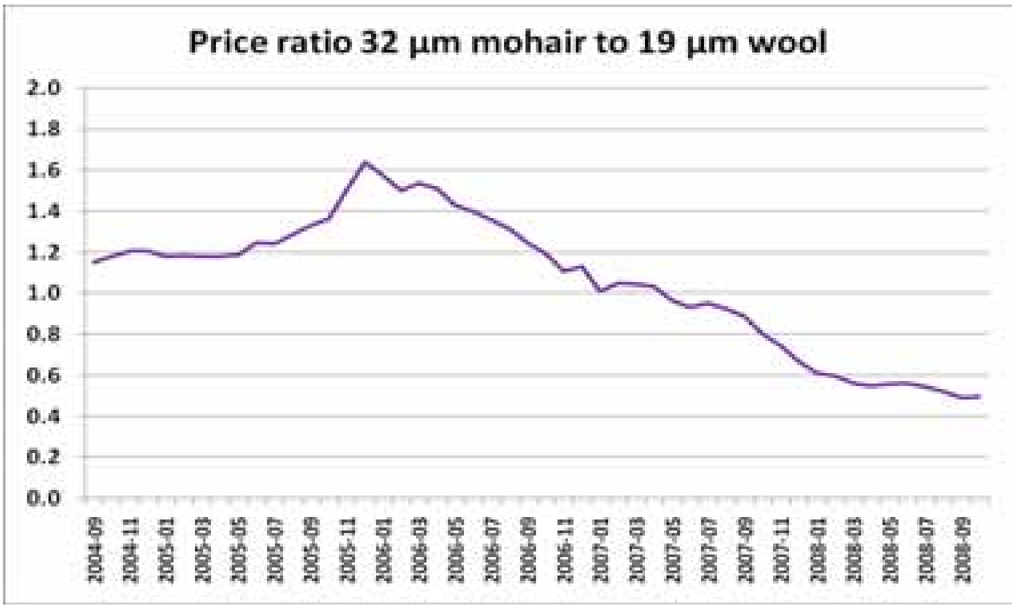


Fig. 4.8. The ratio of prices received for mohair grown by wether goats at Attwood compared with prices received for 19 µm fleece wool based on the southern market price. Source of wool prices, Wool desk (2009).

5. Meat production from Angora goats

5.1. Introduction

Meat production is an important component of the financial returns from all fibre and wool producing systems of animal production. The Australian mohair industry imported South African and Texan Angora goat strains in the mid 1980s but these were not released from quarantine until the early 1990s. While the production and quality of mohair from the new genetics has been investigated, there are no Australian scientific reports on the meat production potential of the new Angora goat genetics. This project has evaluated the total economic value of the Angora wether goats whose mohair was the subject of detailed investigations described in Chapter 4 by quantifying their carcass production, carcass quality and economic value. The financial returns from the meat sales have been compared with the financial return from sheep sold during the same period.

5.2 Methods

5.2.1. Carcass production and evaluation

Full details of the animals, their management and origin are provided in Chapter 4. In the six months prior to slaughter, supplementary drought feeding was supplied at a rate of 250 to 310 g/goat/d depending on pastoral conditions between late March and mid August 2008. In the year prior to slaughter goats were shorn in February and September 2008 and vaccinated against 5 in 1 *Clostridia spp*. All goats were weighed to the nearest 0.2 kg (Fig. 4.1). At each weighing body condition score was recorded (McGregor 1983a, 1992, 2005a).

Two week prior to slaughter the eye muscle depth (mm) and subcutaneous fat depth (mm) of the goats were determined by ultrasonic scanning (Advanced Livestock Services, Hamilton). Goats were measured for withers height, girth and body length circumference (cm, measurement C1 see Couchman and McGregor, 1983), to the nearest cm using a steel tape measure. Prior to slaughter the goats were weighed and body condition scored. Transport to the meat works at Wodonga, Victoria (300 km) commenced two days later. Goats were fasted for 24 hours prior to slaughter with fresh water available.

Goats were slaughtered by Wodonga Food Processing on 11 November 2008. Standard carcasses were produced (Aus-Meat, 2001) and hot carcass weight recorded by electronic scales to the nearest 0.2 kg. Following chilling for 4 hours carcasses were carefully inspected to ensure conformance with the standard carcass requirements. Tissue depth at the GR site (13^{th} rib) was measured with a GR knife (mm, A.L. Franklin, Sydney). Following slaughter payment was made by Ascot Meat Products Pty. Ltd., based on their standard payment grid based on carcass weight. The costs of transport to the abattoir, various compulsory deductions for government duties and statuary levies were recorded.

5.2.2. Statistical analysis

Mean, range and variance (s.d.) were determined for all measurements. Data were analysed using general linear modelling (GenStat 11.1, Payne, 2007) with terms being accepted or rejected on the basis of F-tests ($P<0.05$). Other data for the goats were available for analysis from previous studies including sire, birth date, birth weight and dam age and eye muscle depth and subcutaneous fat depth at 14 months of age (Ferguson and McGregor, 2005). The average net price was determined per goat. Data for sheep sales were obtained from weekly summary data compiled by the Meat and Livestock Authority for the main sale yards in south-eastern Australia and published in rural newspapers.

5.3. Results

5.3.1. Attributes of Angora goats and carcasses

The mean, s.d., and range for average live weight and for body and carcass attributes for goats are provided in Table 5.1.

Table 5.1. Mean, standard deviation and range in average live weight and for body and carcass measurements of Angora wethers slaughtered at six years of age (n=78)

Attribute	Mean	SD	Minimum	Maximum
Average live weight (kg) 7/11/08	62.8	7.66	35.8	77.5
Average live weight (kg) 27/10/08	61.7	7.36	36.4	76.0
Condition score 7/11/08	2.7	0.63	1.0	4.3
Condition score 27/10/08	2.8	0.69	1.0	4.3
Wither height (cm)	63.7	3.84	55	73.5
Girth (cm)	96.4	5.66	79	107
Body circumference anterior-posterior (cm)	187.3	8.7	162	207
Eye muscle depth (mm)	28	3.4	17	35
Subcutaneous fat depth (mm)	3.1	0.98	1	6
Carcass weight (kg)	24.4	3.87	11.6	33.2
GR tissue depth (mm)	14.6	5.08	1	27
Birth weight (kg)	2.9	0.54	1.6	4.2

5.3.2. Prediction equations for carcass and other attributes

5.3.2.1. Carcass weight

The best prediction equation for the carcass weight included terms for live weight, subcutaneous fat depth, eye muscle depth and sire and other terms were not significant (Tables 5.2, 5.3). The percentage of variance accounted for was 91.5% and the residual standard deviation recorded was 1.13. Live weight accounted for 83.8% of the variation in carcass weight with subcutaneous fat depth and eye muscle depth accounting for a further 5.3% and sire a further 2.4% of the variation (Table 5.4).

Farmers can obtain almost as good a prediction of carcass weight without the cost of external contractors needed to measure subcutaneous fat depth and eye muscle area by using live weight and body condition scores which together accounted for 87.2% of the variation (Table 5.4). The regression coefficients indicate that when used separately, for each 1 kg increase in live weight, carcass weight increased by 463 g, while for each 1 unit increase in body condition score carcass weight increased by 4.6 kg (Table 5.2) but when used together the coefficients were 380 g and 1.53 kg respectively (Table 5.2).

Body condition score and GR tissue depth accounted for similar proportions of the variation in carcass weight. GR tissue depth is not a practical measurement for producers to estimate carcass weight as it can only be measured in the abattoir on carcasses (Table 5.4).

Differences between sires were significant ($P = 0.002$, Table 5.3) with a sire range of 2.78 kg in the carcass weight of their progeny at 6 years of age (Table 5.2).

Table 5.2. Regression constants, correlation coefficient and probability (*P*-value) for relationships between carcass weight (kg) and live weight (kg, 7 November 2008), subcutaneous back fat depth (mm, October 2008), eye muscle depth (mm, October 2008), body condition score (7 November 2008), GR tissue depth (mm, at slaughter) and sire. (Pooled data, n = 78).

Dependant variate	Fitted parameters	Estimate	se	RSD	R^2	*P*-value
Carcass weight	Constant	-4.2	1.5	1.13	91.5	**2.2×10^{-32}**
	Live weight 7/11/08	0.343	0.0239			
	Subfat10/08	0.77	0.216			
	Sire	-0.80 to +2.03	0.55 to 0.70			
	EMD10/08	0.17	0.064			
Carcass weight	Constant	11.9	1.31	2.59	55.1	**4.3×10^{-15}**
	Body condition score	4.6	0.47			
Carcass weight	Constant	-4.6	1.5	1.56	83.8	**5.1×10^{-32}**
	Live weight 7/11/08	0.463	0.0232			
Carcass weight	Constant	-3.6	1.3	1.38	87.2	**1.1×10^{-34}**
	Live weight 7/11/08	0.380	0.0274			
	Body condition score	1.53	0.332			
Carcass weight	Constant	15.95	0.875	2.53	57.8	**6.2×10^{-16}**
	GR	0.58	0.057			

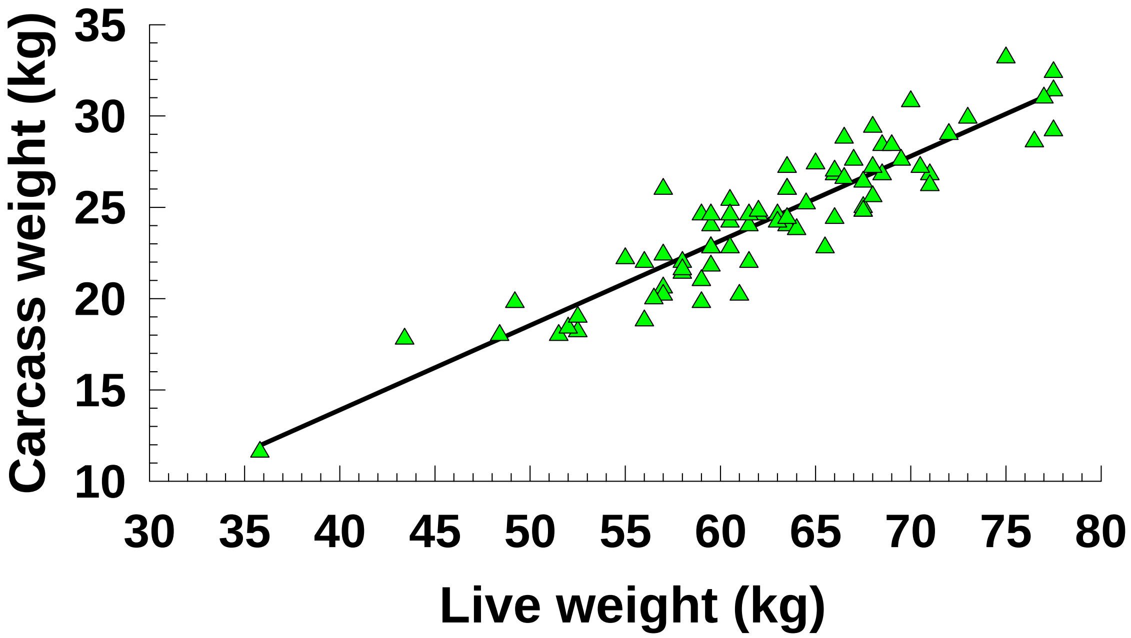


Fig. 5.1. The relationship between the carcass weight and the live weight of Angora wether goats slaughtered at 6 years of age.

Table 5.3. A list of the statistical significance of included terms in the final model for predicting the carcass weight of Angora goats. Values in bold are significant at *P* < 0.05.

Adjustment to model	F value	Degrees of freedom	*P*-value
Terms retained			
Live weight (7/11/2008)	205.63	1, 65	**8.3×10^{-22}**
Subcutaneous fat depth 10/08	9.97	1, 65	**0.002**
Sire	3.33	9, 65	**0.002**
Eye muscle depth 10/08	7.32	1, 65	**0.009**

Table 5.4. Variance in the carcass weight accounted for by live weight, subcutaneous fat depth, sire, eye muscle depth, body condition score and GR tissue depth.

Terms in model	Residual S.D.	Residual variance	% Variance accounted for by model
None	3.87	14.98	0
Sire	3.62	13.10	13.6
Body condition score	2.59	6.71	55.1
GR tissue depth	2.53	6.40	57.8
Subcutaneous fat depth and eye muscle depth	2.34	5.48	63.4
Live weight	1.56	2.43	83.8
Live weight and sire	1.39	1.93	87.1
Live weight and body condition score	1.38	1.90	87.2
Live weight, body condition score and sire	1.28	1.64	89.1
Live weight, subcutaneous fat depth and eye muscle depth	1.28	1.64	89.1
Full model; live weight, subcutaneous fat depth, sire, and eye muscle depth	1.13	1.28	91.5

5.3.2.2. Eye muscle depth

The best prediction equation for the eye muscle depth included terms for body condition score and carcass weight and other terms (interactions or square functions) were not significant (Table 5.5). The percentage of variance accounted for was 66.4% and the residual standard deviation recorded was 1.81. Carcass weight accounted for 55.5% of the variation in eye muscle depth with body condition score accounting for a further 10.9% (Table 5.5).

Neither live weight nor GR tissue depth were as reliable predictors of eye muscle depth compared with body condition score and carcass weight. The precision for the regression for eye muscle depth was not improved by the addition of sire ($P = 0.47$).

The on-farm measurements of live weight and body condition score used together accounted for nearly 58% of the total variation in eye muscle depth or 87% of that accounted for by the best model. Body condition score alone accounted for 51.4% of the variation or 77% of that accounted for by the best model. It is therefore appears practical and reasonably reliable to use body condition score with or without live weight as an indirect measure to select goats for eye muscle depth.

Table 5.5. Regression constants, correlation coefficient and probability (*P*-value) for relationships between eye muscle depth (EMD, mm) and live weight (kg), body condition score, carcass weight (kg) and GR tissue depth (GR, mm).

Dependant variate	Fitted parameters	Estimate	se	RSD	R^2	*P*-value
EMD	Constant	2.4	2.39	2.54	44.5	**1.6×10^{-11}**
	Live weight	0.30	0.038			
EMD	Constant	21.5	0.86	2.47	48.1	**1.7×10^{-12}**
	GR	0.47	0.056			
EMD	Constant	17.7	1.21	2.39	51.4	**1.4×10^{-13}**
	Body condition score	3.9	0.43			
EMD	Constant	12.2	1.66	2.27	55.5	**3.1×10^{-15}**
	Carcass weight	0.66	0.067			
EMD	Constant	11.3	2.13	2.23	57.8	**5.1×10^{-15}**
	Body condition score	2.6	0.53			
	Live weight	0.16	0.044			
EMD	Constant	14.2	1.77	2.20	58.8	**2.1×10^{-15}**
	GR	0.20	0.077			
	Carcass weight	0.46	0.10			
EMD	Constant	13.6	1.34	1.81	66.4	**3.4×10^{-18}**
	Body condition score	1.7	0.49			
	Carcass weight	0.42	0.081			

5.4. Financial returns from carcass production

5.4.1. Angora wether goats

The financial returns and direct selling costs for adult Angora goats are provided in Table 5.6. Most of the carcass weight sold (88%) achieved the heaviest category for sale. The average sale price per goat was $36. After direct costs were deducted the net sale price was $25.56 per goat.

5.4.2. Commercial wether sheep

The average sale prices for wether sheep during the preceding week, the week of sale and the week following the sale of Angora goats during November 2008 are summarised for different selling centres in Table 5.7.

Prices for 18.1-24 kg wether sheep during the week of sale of the Angora goats ranged from 146 to 186 c/kg carcass weight with the lower prices for sheep with fat scores of 2 and the higher prices for sheep with fat scores of 3. Similar prices were achieved for heavier wether sheep > 24 kg (148 to 191 c/kg carcass weight). Prices for wether sheep firmed the following week as widespread rainfall was received across much of Victoria resulting in reduced yarding and firmer demand for sheep.

Table 5.6. The distribution of carcass weights, price per kg, net sales, selling costs and average sale and average net return for 6 year old Angora goats sold in November 2008.

Item	Quantity (kg)	Price $/kg	Total costs $	Total sales $
Carcasses < 12 kg	11.6	1.20		13.92
Carcasses 16-20 kg	206.6	1.30		268.58
Carcasses > 20 kg	1686.6	1.50		2529.9
Sub Total				***2812.40***
Average sales $/goat				$36.06
Less levies	78 goats	$ 0.377/head	29.41	
Duty	78 goats	$ 0.120/head	9.36	
Transport	78 goats	$10/head	780.00	
Sub Total			***818.77***	
Total Net $				**1993.63**
Average Net $/goat				$25.56

Table 5.7. Meat market sales for wether sheep during November 2008. Values are the average estimated c/kg carcass weight for three carcass weight categories. The range in prices indicates low and high fat score within a carcass weight category. Source MLA market reports published in the rural news (The Weekly Times 2008a,b,c,d). The column shaded grey corresponds to the week in which the Angora wethers were sold.

Market	Category weight kg	Fat score range	Average selling prices (c/kg carcass weight) for the week			
			30/10 to 4/11	6 to 10/11	11 to 17/11	18 to 21/11
Ballarat	14.1-18	1-2	122		145	107-119
Bendigo	14.1-18	1-2	138	150-162		149
Wagga Wagga	14.1-18	1-2		126-135	170	76-156
Ballarat	18.1-24	2-3	159		146-173	156-169
Bendigo	18.1-24	2-3	144	156-169	163-178	167-184
Wagga Wagga	18.1-24	2-3	160	129-192	153-186	172-211
Ballarat	> 24.0	3-4	150		148-191	189
Bendigo	> 24.0	3-4	153	148-169	159	182-192
Wagga Wagga	> 24.0	3-4	228		180	254

5.5. Discussion

5.5.1. Goat meat production

The live weight of 6 year old Angora wethers ranged from 35 to 77 kg in late spring with mean weight of 62.8 kg. These adult goats produced an average carcass of 24.4 kg equivalent to 39% of live weight.

Regression equations indicate that for each extra kg of live weight, the carcass weight of these 6 year old Angora wethers increased by 0.46 kg. This value is lower than reported for younger Australian Angora, cashmere and dairy goats slaughtered following periods of continual live weight gain (Table 5.8) but higher than that reported for Australian cashmere goats slaughtered after live weight maintenance or loss in mid summer or autumn (McGregor et al, 1988; McGregor, 1990). The highest value of 0.57 kg for each extra kg of live weight in Table 5.8 (McGregor, 1983b) relates to the carcass gain for severely drought affected Angora wethers that were fed high energy grain diets for several months.

It would be expected that the regression constant for older goats be higher than for younger goats as during growth and maturation an increasing proportion of the total body mass develops into fat deposits that are included in the commercial carcass (McGregor, 1985). These organs have a relative growth coefficient greater than 1, meaning that they grow faster than the entire body as a whole. The carcass grows faster than the body (+ 1.5%) as the perirenal fat (+6,8%) which is included in the standard carcass, and subcutaneous fat deposits (+7.8%) grow faster than the body of an Angora goat as a whole (McGregor, 1992). Counteracting the relative growth of the carcass is the relative growth of organs not included in the carcass such as skin (+3.6%), horns and the internal deposits of omental fat (+7.4%) but most other organs grow slower than the entire body.

Table 5.8. Regression constants (± s.e.) and correlation coefficient for relationships between carcass weight (kg) and live weight (kg) for Australian goats (Wethers, W; Mixed sex wethers and does, M) from published sources.

Regression	Constant	RSD	R^2	Breed (Age years)	Sex	Authority
0.463 (0.023)	-4.6	1.56	84	Angora (6)	W	Present work
0.488 (0.018)	-1.3	0.45	90	Angora (0.4)	M	McGregor, 1996
0.523 (0.021)	-2.3	1.00	96	Angora (0.5 to 4)	W	McGregor, 1992
0.492 (0.039)	-2.9	1.03	92	Angora (4)	W	McGregor, 1984
0.574 (0.037)	-1.7	0.57	94	Angora (2)	W	McGregor, 1983b
0.450 (0.031)	-0.9	0.46	88	Cashmere (0.3)	M	McGregor et al., 1988
0.515 (0.025)	-1.7	0.94	88	Cashmere (0.6)	M	McGregor et al., 1988
0.500 (0.011)	-1.5	0.57	96	Cashmere (0.3 to 0.6)[1]	M	Derived from McGregor et al., 1988
0.434 (0.014)	-0.8	1.64	90	Cashmere (2.5 to 4.5)	W	McGregor, 1990
0.504 (0.025)	-1.4		97	Saanen (0.3 to 3)	W	McGregor, 1982b

[1] Combined data for ages 0.3 and 0.6 years.

The lower carcass weight regression constant for the goats in the present study compared with other reports for Australian goats may indicate that these goats had not fully compensated for live weight and body fat reserves lost during the long period of slow body weight loss from the previous summer February until August 2008 (Fig. 4.1) despite excellent nutritional conditions for 3 months prior to slaughter. The nutritional conditions during the 3 months prior to slaughter allowed the goats to gain live weight at an average of 117 g/d. However this may not be sufficient time to allow the Angora wethers to fully restore body fat reserves to those expected in fully mature animals. The evidence for this are the number of goats which had body condition scores ≤ 2 (13/78 or 16%) in November 2008 compared with only 3% (2/79) in February 2008. The growth rate in the spring of 2007 averaged 129 g/d over four months to mid December indicating a higher level of energy intake.

Grazing requirements of the Angora goats in the period just prior to slaughter would be 40% more than the standard used for determining livestock carrying capacity, the dry sheep equivalent (DSE) which is based on 45 kg wether sheep. In other words the DSE of these adult Angora wethers was 1.4 DSE.

5.5.2. Financial returns from goat meat production

The financial returns from Angora goats slaughtered for meat were about 10% less than similar sized sheep. The prices for Angora goat meat are about 10% less than those for Australian rangeland goats, whose premium is partly related to the quantity of these goats available in larger consignments. There has been a view that Angora goats are too fat for the commodity market but this view overlooks the facts that carcasses from Merino sheep are fatter than similar sized Angora goats and Merino sheep of greater body condition score obtain higher prices in the market (Table 5.7). Provided Angora goats are supplied in the appropriate body condition there should be no objection on the basis of carcass fatness as body condition score is a good predictor of carcass fatness in Angora goats (McGregor, 1992; present work).

As demonstrated in this work, mature Angora goats produce large carcasses that provide a high return per head. In more favourable market conditions for meat, as prevailed during 2006 and 2007, when Angora carcass prices exceed \$1.80 c/kg, the return from carcass sales of heavy Angora goats (carcass weight > 20 kg) is likely to range from \$36 to \$50 per head.

6. Implications

There was considerable variation in the key performance indicators for mohair enterprises. Over three years the financial returns from mohair enterprises exceeded that from wool enterprises. This was achieved despite the mohair enterprises grazing their goats far less intensively (at lower stocking rates) and by using far less phosphate fertilizer compared with the grazing intensity of sheep and phosphate use on the wool enterprises. These differences were counterbalanced by much higher average prices for mohair compared with fine wool. Average mohair prices were similar to those from 19 µm wool. Mohair gross margin was not related to stocking rate or weaning rate but was related to mohair income and supplementary feeding expenses owing to drought. Mohair income and average mohair prices were lower on farms with a higher proportion of does in the flock as the proportion of lower value fleece was higher.

Mohair fibre diameter increased rapidly as goats gained live weight. There were significant differences between farms in the amount of increase in fibre diameter as goats aged. There was also a large variation in mohair fibre diameter within age groups of does and this variation differed between farms.

Financial returns from the sales for meat at the end of commercial mohair production were broadly similar to returns obtained for similar sized sheep.

6.1. Implications

The main implications arising from these findings were:

- Benchmarking the performance of mohair enterprises helps producers identify areas where profit can be significantly improved.
- There is significant scope for mohair enterprises to increase their profit.
- The mohair industry should use the superior gross margins from mohair production to attract investment into mohair from industries where the financial performance is lower.
- A greater focus on producing higher value mohair will considerably increase mohair profitability. This will not occur unless mohair producers, breed societies and selling agents focus on the main driver of mohair profit which is the mean fibre diameter of does.
- Mohair enterprises should focus their evaluation of mohair mean fibre diameter at ages of 18 months and older.
- A greater focus needs to be made in mohair enterprises on the management of the breeding herd and the nutritional management of Angora kids.
- Supplementary feeding decisions need to be carefully evaluated particularly during drought otherwise enterprises will lose substantial financial resources.
- Mohair producers need to evaluate the phosphate resources and balance on their farms and should consider their fertilizer practices and long-term soil and pasture sustainability.

6.2. Recommendations:

- RIRDC and the industry should encourage and support mohair enterprises to benchmark their financial performance.
- Mohair producers, breed societies and selling agents need to focus on the main driver of increased mohair profit which is reducing mohair mean fibre diameter of does.
- Mohair selling agents and the industry should encourage mohair producers to focus on management issues related to profit and mohair quality by being informed and by providing objectively based advisory information.
- Further evaluation of the selection and culling practices in mohair enterprises should be undertaken by further analysis of data collected in the present study.

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Benchmarking Mohair Production in Australia

RIRDC Publication No. 09/171

By Bruce McGregor

Since the establishment of mohair production in the mid 1970s, the industry has developed the infrastructure required to grow and prosper and has a strong record of research and development that has provided objective data for the establishment of modern production systems. However the industry has been viewed by many as a hobby industry and has been perceived as unattractive to commercial farmers.

This report provides factual evidence on the financial and production performance of real mohair farms for the first time. This process engaged mohair farmers in detailed record keeping and measurements of their animals. The project involved farm business economists in comparative financial studies of mohair and wool enterprises.

This research will guide mohair producers and the industry to focus on key performance indicators of profit and production. The outcomes provide objective evidence that can be used to attract future investment into mohair enterprises.

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