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Merino Validation Project

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ABSTRACT

The Merino, although specifically developed as a wool-producing sheep breed, contributes significantly to prime lamb production. Traditionally, however, the Merino has not been selected for traits of importance to the sheepmeat industry. The MLA-funded Merino Validation Project involves 120 ram breeders nationally measuring wool, meat, reproductive and disease resistance trait on their ram breeding flocks to allow for increased rates of genetic gain for sheepmeat production in Merinos.

The on-farm data that continues to be collected throughout this project is used to estimate the genetic correlations between meat, wool, reproduction and disease traits in Merinos and to update the heritabilities for these traits. This will directly benefit Merino breeders though increased accuracy of estimated breeding values enabling more accurate selection decisions and greater rates of genetic gain.

EXECUTIVE SUMMARY

The Merino, although specifically developed as a wool-producing sheep breed, contributes significantly to prime lamb production. This makes the Australian Merino the most important genetic resource for both the lamb and sheep meat (mutton) industries in Australia. In addition, the contribution of wool and meat to the profitability of the Merino flocks is changing, as more value is being placed on carcase and reproductive characteristics. Even in traditional wool growing regions of Australia, and particularly Western Australia, the increased value of mutton has put extra pressure on prices that are paid for replacement sheep and on the mix of wethers to ewes.

There is a continuing change in emphasis among sheep producers nationally towards producing sheepmeat. This is evidenced by a younger Australian sheep flock, containing fewer wethers, a higher proportion of females and an increased proportion of crossbred and nonmerino breed sheep than a decade ago (Barrett, 2003). The Merino, however, continues to have a significant impact on the sheepmeat industry. For example, in WA, there has been little change in the proportion of ewes joined to Merino rams (78%), but similar changes in flock structure, indicating increased production of prime lambs from the Merino flock (Curtis, 2004).

Although growing in importance to the prime lamb industry, the Merino continues to be primarily selected for wool characteristics alone. Genetic improvement for carcase traits, disease resistance traits and reproductive traits requires knowledge of their heritability and the genetic relationships between these traits and wool traits. This information is just not available on the Australian Merino. The Merino Validation Project was designed to fill these gaps in knowledge of genetic parameters and to provide Merino ram breeders with accurate information about a range of traits to actively breed Merino sheep that are profitable for both the wool and sheepmeat industry.

The Merino Validation is an industry-supported project involving over 120 ram breeders nationally. The structure of the Merino Validation Project differs from previous investment in research and development in sheep genetic by funding bodies. Traditional investment has been primarily through research and demonstration flocks. In this project, the data being collected comes from on-farm measurements by breeders with key traits being measured through accredited procedures to ensure data consistency and integrity.

Participants in the Merino Validation project continue to measure wool traits of their breeding animals, but in addition, are funded to measure carcase traits (fat and eye muscle depth), reproductive traits (scrotal circumference) and disease resistance traits (faecal worm egg counts). The data provided by these industry flocks is sent to Merino Genetic Services to provide across-flock estimated breeding values for their animals. The data is also used to update the genetic parameter estimates used by Merino Genetic Services to allow for more efficient breeding programs for the ram breeding sector and better quality Merino genetics to be available for the commercial buyer.

Results from the project show a wide range in breeding values for all traits. In the 2002-drop animals there is a range of almost 19 kg in yearling weight. This range is accompanied by a range of 10 mm of fat depth and 12 mm of eye muscle depth at yearling age. The range of breeding values for wool traits are also large. These results indicate that there is significant genetic variation available for both ram breeders and ram buyers to utilise for increased rates of genetic gain in sheepmeat quality and quantity without loss of wool production. The Australia Merino can effectively be bred as a multi-purpose animal to suit individual breeding objectives to meet different market demands.

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1. BACKGROUND TO PROJECT & INDUSTRY CONTEXT

The Merino, although specifically developed as a wool-producing sheep breed, contributes significantly to prime lamb production. This makes the Australian Merino the most important genetic resource for both the lamb and sheep meat (mutton) industries in Australia. Of lambs slaughtered in 2001/02, 59% of the genes were of Merino origin, at least 80% of the genes in prime lamb dams were derived from the Merino, and 99.9% of sheep meat produced came directly from cull Merino wethers and ewes (Connell and Hooper, 2001). More importantly, the contribution of wool and meat to the profitability of the Merino flocks is changing, as more value is being placed on carcase and reproductive characteristics. Even in traditional wool growing regions of Australia, and particularly Western Australia, the increased value of mutton has put extra pressure on prices that are paid for replacement sheep and on the mix of wethers to ewes.

There is a continuing change in emphasis among sheep producers nationally towards producing sheepmeat. This is evidenced by a younger Australian sheep flock, containing fewer wethers, a higher proportion of females and an increased proportion of crossbred and nonmerino breed sheep than a decade ago (Barrett, 2003). The Merino, however, continues to have a significant impact on the sheepmeat industry. For example, in WA, there has been little change in the proportion of ewes joined to Merino rams (78%), but similar changes in flock structure, indicating increased production of prime lambs from the Merino flock (Curtis, 2004).

Although growing in importance to the prime lamb industry, the Merino continues to be primarily selected for wool characteristics alone. Genetic improvement for carcase traits, disease resistance traits and reproductive traits requires knowledge of their heritability and the genetic relationships between these traits and wool traits. This information is just not available on the Australian Merino. The Merino Validation Project was designed to fill these gaps in knowledge of genetic parameters and to provide Merino ram breeders with accurate information about a range of traits to actively breed Merino sheep that are profitable for both the wool and sheepmeat industry.

Participants in the Merino Validation project continue to measure wool traits of their breeding animals, but in addition, are funded to measure carcase traits (fat and eye muscle depth), reproductive traits (scrotal circumference) and disease resistance traits (faecal worm egg counts). The data provided by these industry flocks is sent to Merino Genetic Services to provide across-flock estimated breeding values for their animals. The data is also used to update the genetic parameter estimates used by Merino Genetic Services to allow for more efficient breeding programs for the ram breeding sector and better quality Merino genetics to be available for the commercial buyer.

2. OBJECTIVES

The overall aim of the Merino Validation Project was to increase the rates of genetic gain in the Merino industry for carcase, wool, reproduction and disease traits. This will allow the Australian Merino to play a more competitive role in the sheepmeat industry without loss of wool quality or quantity, hence providing more options for sheep producers. In order to meet this aim the following objectives were specified for the project:

1. Design, implementation and analysis of validation project for genetic improvement in Merinos;
2. Review of genetic parameters for analysis of Merino data, with recommendations to MLA on the adequacy of existing parameter sets and the need for further research in this area;
3. Increase the adoption of across flock genetic evaluation in the Merino industry, particularly through ongoing development and communication of Merino Genetic Services and participation in the development of a single genetic evaluation system for the Merino industry; and
4. Successful project co-ordination and management.

3. METHODOLOGY

In order to meet the project objectives the following steps were carried out:

1. Review of genetic parameters
2. Development of Merino Validation Project Protocol
3. Call for expression of interest
4. Acceptance of protocol
5. Implementation of Validation Project
6. Analysis of results

3.1 REVIEW OF GENETIC PARAMETERS

Reliable estimates of genetic parameters for traits influencing the profitability of Merinos are essential for accurate genetic evaluation of Merino data. A desktop review of genetic parameters for Australian Merino sheep was carried out to determine the adequacy of known estimates. This involved reviewing current parameter estimates from Merinos for carcase, wool, reproduction and disease traits.

The aim of the review was to:

- review existing genetic parameter estimates for the analysis of Merino data, including reference to correlations between carcase, reproduction and wool traits;
- report to Meat and Livestock Australia with recommendations regarding the adequacy of these estimates and their use in analysis of Merino data; and
- provide recommendations for further research in genetic parameter estimates.

This information was used to design the Merino Validation Project protocol.

3.2 DEVELOPMENT OF MERINO VALIDATION PROJECT PROTOCOL

Findings from the Review of Genetic Parameters included the lack of information on carcase, disease resistance and reproduction traits. While there are many parameter estimates for wool traits, there are very few estimates for carcase data and correlations between reproduction traits and wool and carcase traits. Given these findings, the protocol was developed to increase the data available on carcase traits, worm resistance and reproduction traits.

Carcase traits were to be measured by ultrasound scanning of male and female progeny at two ages (postweaning and yearling), worm resistance by a faecal egg count (FEC) test and reproduction traits by a scrotal circumference measurement on male progeny. Accredited LAMBPLAN scanners would do the live animal scanning and scrotal circumference measurements and FEC measurements by chosen veterinary laboratories. Letters inviting veterinary laboratories to quote for the FEC testing were sent to all labs on the Nemesis project register (from CSIRO, Armidale). Four Veterinary Health Laboratories were selected to provide faecal worm egg counting services for the project. Two providers were selected in Victoria, as there were no competitive quotes provided by laboratories in South Australia. The labs selected were:

- Veterinary Health Research Pty Ltd, Armidale NSW;
- Para-Site Diagnostic Services, Benalla Victoria;
- Para-Tech Veterinary Services, Willaura Victoria; and
- Sheep Management and Production Consultants, North Fremantle WA.

The project protocol was presented at the Inaugural Wool Science and Technology Conference in Hamilton 2002 (Appendix 1) and subsequently published in the Journal of Wool Technology and Sheep Breeding. It is summarized below.

Merino Validation Project Protocol

Trial participants must progeny test individual sires and record pedigree and management group information on all progeny. All progeny testing programs must maintain linkages both across years (within flocks) and across flocks. Funding will be available for three consecutive years for ultrasound scanning (postweaning and yearling age), scrotal circumference measurement and feacal egg count (FEC) measurement on 300 animals in each flock. Ultrasound scanning must be done by an accredited LAMBPLAN scanner and FEC samples sent to specified veterinary laboratories who will bill the project directly.

Required and optional measurements and records to be collected by Merino Validation Project flocks.

Type of trait	Required	Optional
Lambing and pedigree	Sire pedigree	Dam pedigree
	Year of birth	Date of birth
	Sex of animal	Birth type
	Management groups	Rearing type
Weights	Weaning weight	Birth weight
	Postweaning weight	
	Yearling weight	
	Hogget weight	
Wool	Hogget greasy fleece weight*	Hogget staple strength*
	Hogget yield*	Hogget staple length*
	Hogget fibre diameter*	Hogget curvature*
	Hogget coefficient of variation of fibre diameter*	Hogget coefficient of variation of curvature*
	Adult wool measurements	
Carcase (ultrasonic live measurements)	Postweaning eye muscle depth	
	Postweaning fat depth	
	Yearling eye muscle depth	
	Yearling fat depth	
Reproduction	Scrotal circumference	Number of lambs born
	Number of lambs weaned	
Disease	Faecal worm egg count	

*Measurements to be taken at hogget or yearling age

Merino Validation Project participants are required to pay membership to Merino Genetic Services (MGS) and a fee for data entry into the MGS database. Participants will be provided with free pedigree and performance recording software *Pedigree Wizard* and training in its use. Breeders must take responsibility for their own data and ideally this should be submitted throughout the MGS compatible *Pedigree Wizard* program. All animals with data submitted to the project will receive across-flock estimated breeding values from Merino Genetic Services.

3.3 CALL FOR EXPRESSIONS OF INTEREST

Advertisements calling for expressions of interest were placed in rural papers throughout Australia. This took place three times during the course of the project, in December 2001, 2002 and October 2003. The advertisements offered ram breeders the opportunity to improve the commercial value of their flocks and their clients' flocks by participating in the project (Appendix 2).

Interested ram breeders were sent an *Expression of Interest Form* (Appendix 3) to fill out and return. This form asked for contact details and details about their ram breeding flock. These details were used to assess the suitability of the ram breeding flock for participation in the project.

3.4 ACCEPTANCE OF PROTOCOL

Once accepted for participation in the project the ram breeder was asked to sign a copy of the project protocol (Appendix 4) indicating acceptance of the protocol and agreeing to adhere to it as required for participation in the project. From this point onwards the participant integrated the project protocol into routine flock management practices, contacting accredited scanners for ultrasound scanning and sending faecal egg samples to designated laboratories.

3.5 IMPLEMENTATION OF VALIDATION PROJECT

Participating ram breeders implemented the Merino Validation Project protocol into their management routines. In some cases this was easily slotted into their progeny testing procedures, and in others a new management system was implemented to accommodate the project protocol. The protocol was designed to add value to a simple a progeny testing scheme, allowing for flexibility of involvement. That is, all participants were required to take some measurements and others were considered optional for the more sophisticated progeny testing schemes.

3.6 ANALYSIS OF RESULTS

All participants sent their data to MGS (as per protocol) for analysis. They received (and continue to receive) estimated breeding values (EBVs) and index values on all animals with data submitted. The data becomes part of the larger MGS database that is now forming the backbone of the recently announced ASGD (Australian Sheep Genetics Database). Data included in this database is available for the estimation of genetic parameters to improve the accuracy of EBVs and selection decisions made by the ram breeders.

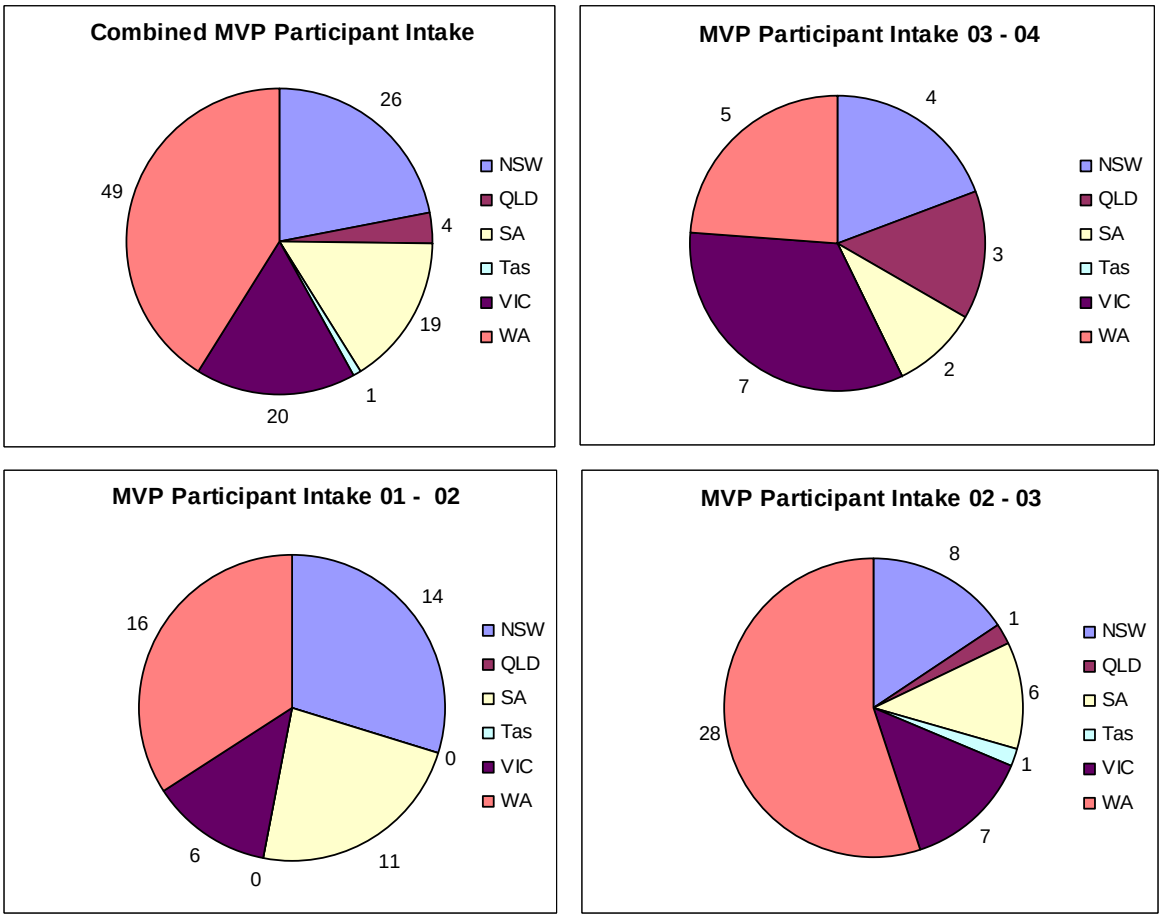
4. SUCCESS IN ACHIEVING OBJECTIVES

4.1 CLIENT PROFILE

The industry response to the project was overwhelming. Initial plans were to involve up to 30 ram breeders each year for three years. This was surpassed in the first two years with 47 and 51 ram breeders being accepted into the project in 01-02 and 02-03 respectively. At the time of writing there are currently 21 ram breeders flocks accepted into the project in 03-04, however, there remains another 27 ram breeders who have expressed an interest in being involved, but who are yet to return signed protocols. Intake figures by state are given below:

Intake Figures

01-02	NSW	QLD	SA	Tas	VIC	WA	**Total**
	14	0	11	0	6	16	47
02-03	NSW	QLD	SA	Tas	VIC	WA	
	8	1	6	1	7	28	51
*** 03-04**	NSW	QLD	SA	Tas	VIC	WA	
	4	3	2		7	5	21
Combined Totals	**NSW**	**QLD**	**SA**	**Tas**	**VIC**	**WA**	
	26	**4**	**19**	**1**	**20**	**49**	**119**
Percentages	**21.85%**	**3.36%**	**15.97%**	**0.84%**	**16.81%**	**41.18%**	



Western Australia and New South Wales have the highest proportions of participating ram breeding flocks (41 and 22 percent respectively) over all intake years. This is pleasing to see, given that they are the two states with the largest numbers of Merino sheep (Barrett *et al.,*2003).

The project has also been particularly successful in attracting Merino flocks from varying breeding philosophies (e.g. Soft Rolling Skin®, traditional stud Merino breeding, performance breeders etc). This may be due to the novelty of measuring carcase traits on sheep that are traditionally selected primarily on wool production. This innovation being new to participants from all breeding philosophies.

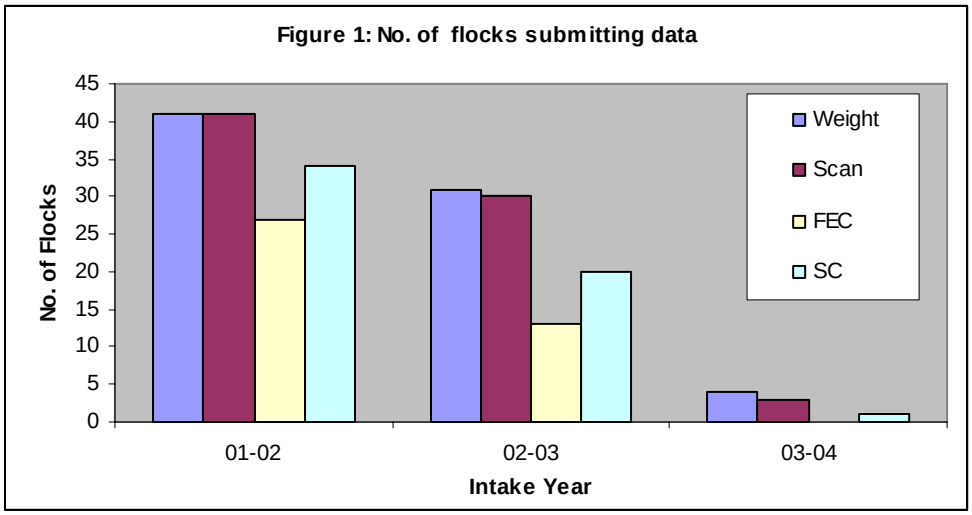
4.2 TRAIT MEASUREMENT AND DATA COLLECTION

The participating flocks have been responsible for collection of all data for the MVP and for submitting the data to the MGS database. The following is an analysis of data submitted to the MVP and provided by Mr Stephen Field (MGS database manager).

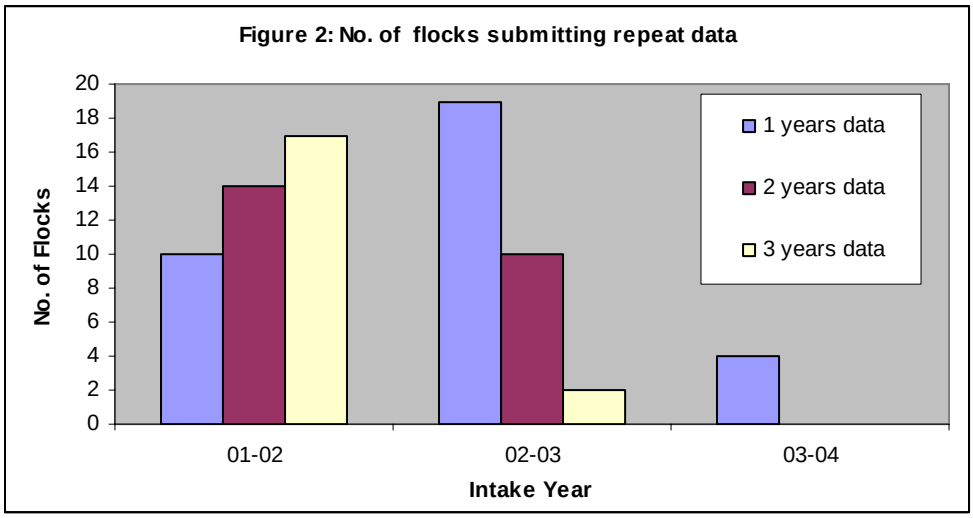
4.2.1 Data Submission

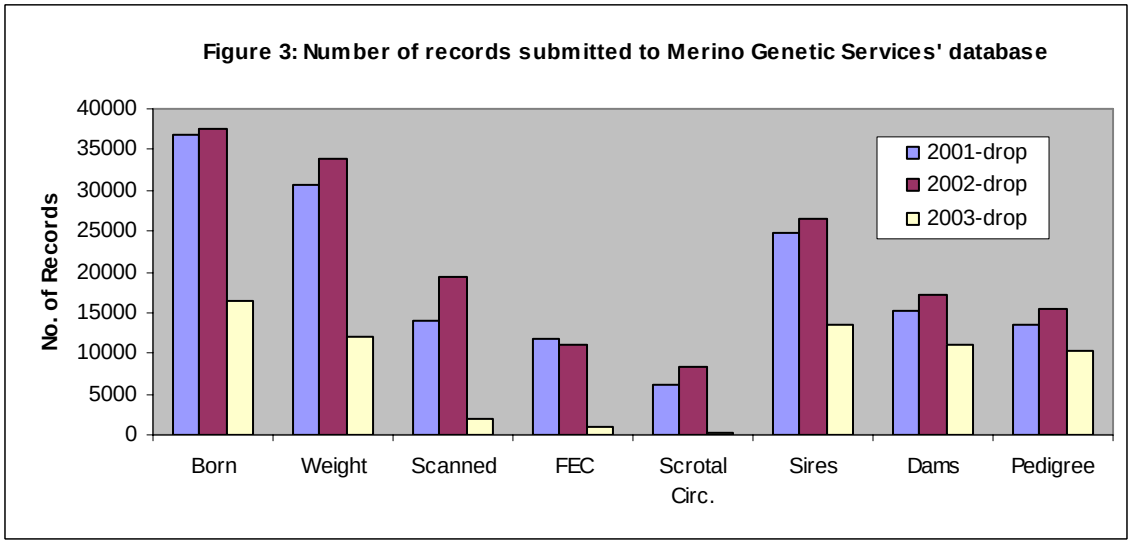
Data has been submitted to the project by 41 of the 47 participants from the 01-02 intake, 31 from the 51 02-03 intake and 4 from the 03-04 intake. There are still a number of participants from the first intake who are collecting data from their first progeny test, as they began a progeny testing system at the time of joining the project. Similarly, there will be participants from the second and third intake who will not collect their first results until later in 2004.

Numbers of flocks submitting FEC data will remain lower than numbers submitting weight and scan data. This is due to worm burdens not reaching high enough levels in some flocks. The worm burden is a function of both management and seasonal conditions. The drought of 2001-2002 meant that many flocks were not able to take FEC samples due to low worm numbers.



Ten flocks from the first intake year (01-02) have only submitted one year of data (Figure 2), while others from that intake have submitted two or three years (14 and 17 flocks respectively). Some of the flocks starting in 02-03 intake have already submitted two years data (10 flocks).



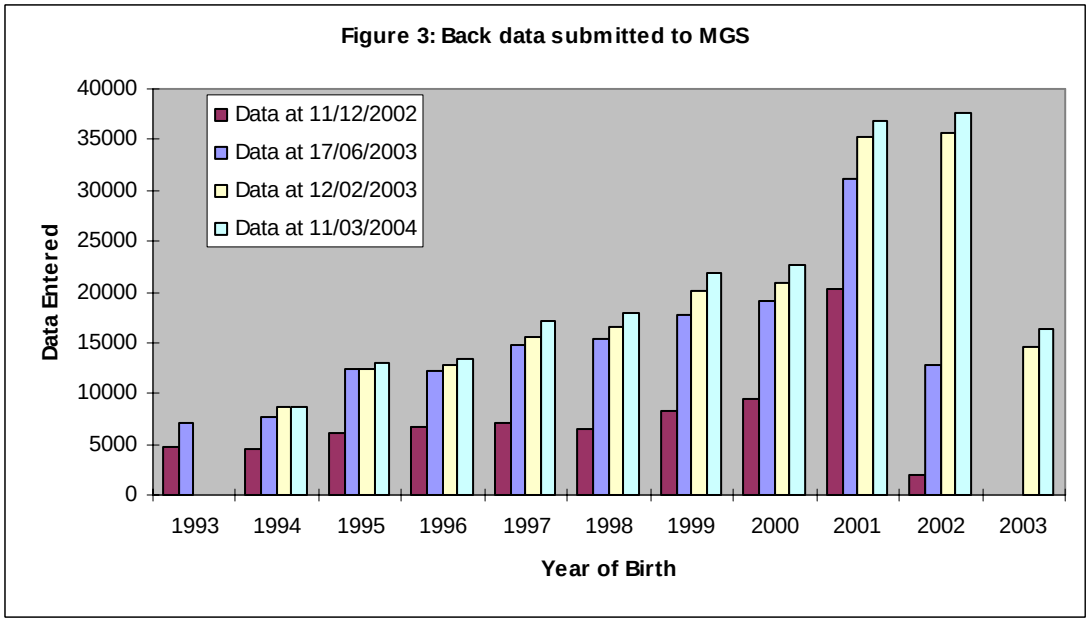


Almost 91,000 records on individual animals have been submitted to the MVP (Figure 3). It is pleasing to see that of the animals born in 2001 and 2002, approximately 90% have weights recorded (86% and 92% respectively). In terms of pedigree recording, participants are increasing their recording of sire and dam pedigree information. Only 36% of animals born in 2001 had full pedigree information, while of those born in 2002 and 2003 there is increasing amounts of full pedigree (42% and 63% respectively). The 2003-drop figure is likely to go down, however, as more records are entered into the database.

4.2.2 Backdata

Merino Validation Project participants are encouraged to submit backdata to the Merino Genetic Services database at no extra cost. This data is an important part of the project, providing links and pedigree information for more accurate EBV calculations and parameter estimation.

There is a constant flow of backdata being submitted by participating flocks (Figure 3). Data submitted on animals prior to the 2001-drop animals now accounts for 114,842 records.



4.2.3 Estimated Breeding Values and Index Averages

All participants receive estimated breeding values (EBVs) and index values on all animals with records submitted to the MGS database. The use of this data has been evident when visiting on-farm field days of participating flocks. Many ram breeders are now including EBVs and index values in sale catalogues and providing the information on pen cards for sheep on display.

4.3 DATA ANALYSIS

The data provided by participating MVP flocks is included in the MGS database. This database is used for analysis of genetic parameters, including heritabilities and genetic and phenotypic correlations. A number of analyses have been carried out using this data during the course of the project. Papers and reports resulting from these analyses are given in the reference list at the end of this report.

4.4 ACROSS FLOCK

All participants in the MVP receive across-flock estimated breeding values. This industry group is the largest single group of Merino ram breeders receiving across-flock EBVs nationally, and provides enormous opportunity for increased genetic gain. The range of EBVs available from these flocks is shown below (Table 1). The range of EBVs allow for significant gain in wool, carcase, reproduction and disease traits in the existing Australian Merino population.

Table 1. Range of Estimated Breeding Values (EBVs) from 2002-drop animals (Merino Genetic Services run dated 15/02/2004)

Trait		Min	Max	Range
Yearling Weight	(kg)	-8.29	10.68	18.97
Yearling Fat	(mm)	-4.12	7.91	12.03
Yearling Eye Muscle Depth	(mm)	-4.73	5.12	9.85
Hogget Fibre Diameter	(microns)	-3.17	3.47	6.64
Hogget Clean Fleece Weight	(kg)	-0.81	1.25	2.06
Hogget Staple Strength	(N/ktex)	-14.39	14.42	28.81
Hogget Scrotal Circumference	(cm)	-4.22	3.54	7.76
Yearling FEC		-3.95	2.90	6.85

In December 2003, Meat and Livestock Australia and Australian Wool Innovation announced a joint initiative to develop the Australian Sheep Genetics Database (ASGD). This database will be the single provider of EBVs to the Australian sheep industry. MVP participants have been providing their data to MGS which now forms a significant component of the data to the ASGD. Participants in the MVP can be assured of being provided with the most accurate and relevant genetic information on their animals through this involvement.

4.5 PROJECT CO-ORDINATION AND MANAGEMENT

The Merino Validation Project was co-ordinated by a team from the Department of Agriculture Western Australia, based in South Perth and Narrogin. The major role of this team was to develop and implement the MVP. Following the signing up of project participants, project co-ordination required a high level of communication between project participants and other stakeholders (e.g. MLA, MGS, scanners, veterinary laboratories and industry). This was achieved through:

- technical reports and papers;
- newsletter development and distribution;
- presentations at conferences;
- participant workshops;
- Pedigree Wizard software training ;
- on-farm visits; and
- grower meetings.

4.5.1 Commmunications

Copies of the following communications are listed in the Project Reference list in this report.

Technical Reports
A technical report titled “A review of genetic parameters for analysis of Merino data” was written with recommendations to MLA on the adequacy of existing parameters and the need for further research.

Conferences
Papers outlining the MVP protocol and developments were presented at the following conferences:

- SRS conference;
- The Inaugural Wool Industry Science and Technology Conference;
- Conference of the Association for the Advancement of Animal Breeding and Genetics;
- Western Australian Sheep Updates

Newsletters
The first MVP newsletter was distributed in May 2002. This went to all participants, all project staff, collaborating vet labs, scanners and any other interested party. There have been five newsletters throughout the course of the project. These have been primarily distributed electronically through e-mail, however, a number of hard copies have also been produced for participants as requested.

4.5.2 Field Days

The MVP was a topic of interest for a number of field days and MVP staff and Merino Genetic Services Staff were invited to speak on numerous occasions about the project. Examples of these include:

- Badgingarra Central Test Sire Evaluation field day, Badgingarra, WA (14 August 2002)
- Australian Merino Society AGM, Cottesloe, WA (16 August 2002)
- AMS Central Nucleus Distribution Day, Shackleton WA (26 September 2002)
- "More profit from Merinos" day (28 June 2002). This was held at Kevin Keatley's "Hyfield" property in Kojonup WA.

In addition to this the project had a presence at a number of larger field days. These included:

- Wagin Woolorama
- Dowerin Machinery Field Day
- Walcha Ram Breeders Field Day

4.5.3 State Participant Workshops and Pedigree Wizard Training

A number of participant workshops were run throughout the country. The aim of these meetings was to meet MVP participants and to assist them with all aspects of the project (e.g. protocol, measurement, understanding of results). These meetings were usually accompanied by a Pedigree Wizard training afternoon, which was designed to assist participants with data management and recording.
Workshops were run at:

- Armidale, NSW – 15 March 2002. This meeting was well attended with eight ram breeding families participating. The trial protocol was run past this group which assisted with the development of the final protocol.
- Katanning, WA - Thursday 22 August 2002. Meeting with WA SAMM breeders.
- Katanning, WA - 11 June 2002. Meeting of WA participants (11), scanners (3) representatives from the Stud Merino Breeders (1) and Wesfarmers (1)
- "Bundilla", NSW - 11 November 2002.
- Walcha, NSW - 3 December 2002
- Meeting with Victorian participants, 17 October 2002).
- Roseworthy College, SA – 12 March 2003
- Moora, WA – 21 March 2003
- Katanning, WA – 25 March 2003

These grower meetings have been very successful in keeping all stakeholders involved in the development and implementation of the project. It has allowed participants to meet each other and discuss project requirements and the practical implementation of project protocol.

5. IMPACT ON MEAT AND LIVESTOCK INDUSTRY – NOW AND IN FIVE YEARS TIME

During the course of the project there have been significant changes in the sheep industry. The proportion of ewes in the Merino flock has increased over the last ten years, as has the proportion of crossbred and other breed sheep (Barrett *et al.,* 2003). This reflects the increase in profitability of sheepmeat relative to wool production. Merinos will continue to play an important role in the sheep meat industry, being able to increase both quality and quantity of meat on these animals will lead to significant changes in the prime lamb and mutton industries.

Merino breeders are recognising the importance of sheepmeat to their profitability and are embracing modern genetic technology in their breeding programs. This is evidence by the enormous industry interest in the MVP and the fact that within three years over 120 ram breeders nationally are receiving across flock EBVs for use in their selection decisions. Genetic change, however, is slow and it will take a few years before the sorts of changes mentioned above will be seen in the industry.

6. CONCLUSIONS AND RECOMMENDATIONS

The structure of the Merino Validation Project differs from previous investment in research and development in sheep genetic by funding bodies. Traditional investment has been primarily through research and demonstration flocks. In this project, the data being collected comes from on-farm measurements by breeders with key traits being measured through accredited procedures to ensure data consistency and integrity. The belief is that innovation of research and development will be enhanced if the information received by participants is relevant to their own flocks. In addition, the transfer of information from the ram breeder to their commercial client will be enhanced if the ram breeder is aware of how that data has been obtained.

The Merino Validation Project also provides a unique vehicle for additional research. A network of up to 150 linked ram-breeding flocks is an ideal setup to test new measurements in the field or validate research findings on industry flocks. Some examples of these include measuring new traits (e.g. temperament flight tests) or new measurements for existing traits (e.g. staple strength).

It is recommend that the project continues for at least another two years to allow each participant to collect three years data. With participants already signed up, administration of the project could be carried out by Merino Genetic Services. There is a role, however, for a national co-ordinator to continue one-on-one support for participants to ensure that the information received is adopted by both them and their commercial clients.

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9. APPENDICES

Appendix 1 – Paper from Proceedings Wool Industry Science & Technology Conference 2002
Appendix 2 – Call for expressions of interest
Appendix 3 – Expression of Interest forms
Appendix 4 – Merino Validation Project Protocol

APPENDIX 1

An Opportunity for Simultaneous Improvement of Wool and Meat Traits in Merinos

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Summary

Continued fluctuations in the wool market have meant that many Merino breeders have become interested in improving returns from the prime-lamb side of their sheep enterprise. Merino ram breeders throughout Australia are being given the opportunity to simultaneously improve wool and meat quality and quantity while also improving reproduction rates and resistance to internal parasites. Through participation in the Merino Validation Project, 50 ram breeders will receive across-flock estimated breeding values (EBVs) for wool, meat, reproduction and disease traits. Over the next 2 years, another 60 ram breeders will be involved in the trial.

The Merino Validation Project is an industry-supported project aiming to improve the accuracy of selection for carcase traits in Merinos while maintaining or improving wool production. The on-farm data that is collected throughout the project will be used to estimate the genetic correlations between meat, wool, reproduction and disease traits in Merinos and to update the heritabilities for these traits.

Keywords: Merino, wool quality, meat quality, genetic evaluation, genetic correlations.

Introduction

The Merino, although specifically developed as a wool-producing breed, contributes significantly to prime lamb production. Of the lambs slaughtered in 2001/02, 59% of the genes were of Merino origin, at least 80% of the genes of prime-lamb dams were Merino, and 99.9% of sheepmeat produced in Australia was Merino-based. It is important to note that from a total population of 47 million Merino ewes, approximately 45% are joined to rams for the intention of lamb production (Australian Prime Lamb Industry 2001).

Merino breeders in Australia have traditionally selected animals for breeding predominantly on wool traits. With frequent fluctuations in the wool market, many Merino breeders are interested in producing a heavy-cutting, high-quality Merino fleece on a large-bodied Merino ewe, which can be used for prime-lamb production. In addition to this, both the wool and lamb industries are interested in sheep that are resistant to internal parasites and that have high reproductive rates. There is considerable interest in breeding animals simultaneously for wool, meat, reproductive and disease traits. This will require improved knowledge of the heritabilities and genetic correlations for these traits. The Merino Validation Project aims to use on-farm data from Australian Merino flocks to estimate these genetic parameters.

Reliable estimates of genetic parameters for traits influencing the profitability of Merinos are essential for genetic improvement. Merino Genetic Services™ (MGS) provides genetic information for the Merino industry through the provision of breeding values and index information. These multi-trait breeding values are estimated using OVIS, a software program developed to estimate breeding values (EBVs) for sheep breeders participating in LAMBPLAN™ and MGS (Brown *et al.* 2000; Brown *et al.* 2001). This software relies on the use of appropriate genetic and phenotypic parameter estimates (such as heritabilities and correlations between traits) for accurate breeding value estimation.

Most genetic parameter estimates for the Australian Merino have been derived from the four main genetic resource flocks. These flocks have been documented by Ponzoni and Gifford (1993) and further described by Ponzoni and Fenton (2000). They are:

- CSIRO fine-wool flock (New South Wales);
- Trangie D flock (New South Wales);
- Katanning Base flock (Western Australia); and
- Turretfield Merino resource flock (South Australia).

Most of the genetic parameter estimates for Merinos are based on measurements taken at 10 and 16 months and as adults with 6 to 12 months' wool growth. While there are many parameter estimates for wool traits (Ponzoni and Fenton 2000), there are very few estimates for carcase data from these sheep and very little information on phenotypic and genetic correlations between reproduction and wool traits, even though the information to calculate these correlations would be available. Other parameter estimates have come from sheep at Longreach and Julia Creek in Queensland (Rose and Pepper 1999) and at Camden in New South Wales (Vaez Torshizi *et al.* 1995).

The only published estimates on meat traits in Australian Merinos are from recent trials in New South Wales reported by Safari *et al.* (2001) and Fogerty *et al.* (2001) and in Western Australia reported by Davidson *et al.* (2002). The genetic parameters estimated from these two trials have arisen from data on only 1,045 and 2,082 animals respectively. Both studies showed that scanned eye-muscle depth and fat depth are moderately heritable in Merinos. The only significant genetic correlation between meat and wool traits (on the live animal) given by Fogerty *et al.* (2001) was a favourable negative genetic correlation between fat at the GR site and clean fleece weight (–0.34 ± 0.16). The small numbers of animals involved in these trials, combined with the lack of information on correlations between meat and wool traits, demonstrate a need for more accurate genetic parameter estimates.

The Merino Validation Project differs from previous trials to investigate genetic parameters in that it will use on-farm data from participating flocks to estimate the genetic parameters for meat, wool, disease and reproduction traits in the Merino. While on-farm data is not ideal for balanced statistical analysis, it is valued highly through ownership of contributing participants who have collected the data.

In addition to the research aspect of the trial, participating ram breeders will receive across-flock estimated breeding values (EBVs) for all their animals from MGS. MGS is the system used in Australia to describe the genetic worth of animals for 47 sheepmeat and wool traits. These EBVs can be used to help select genetically superior animals from the breeder's own flock or trait leaders from external flocks.

Materials and Methods

Trial Participants

In 2002, there are 50 Merino breeders from throughout Australia involved in the trial. These participants come from Queensland, New South Wales, Victoria, South Australia and Western Australia. They also represent a range of breeding philosophies, including SRS/Elite, traditional and objective measurement. It is planned to involve another 30 breeders each year for the next 2 years. The participants will all measure, on average, 250 progeny each year (in some cases, participants will be measuring up to 2,500 progeny each year). This will involve body weight, wool measurements, live animal scans, scrotal circumferences and worm egg count measurements on approximately 60,000 animals over a 3-year period.

Trial Protocol

Trial participants must progeny test individual sires and record pedigree and management group information on all progeny. It is essential that all progeny-testing programs maintain linkages both across years (within flocks) and across flocks. To achieve across-flock linkage, links must be established between participating flocks or between participants and other MGS clients. To achieve adequate linkage, preference was given to those studs that have utilised outside sires on a consistent basis. In addition, the protocol for the Merino Validation Project recommends that breeders use link sires across years and aim to have one link to outside sires on an annual basis.

Essential and optional measurements and records to be collected on progeny-tested animals are shown in Table 1. This list does not limit the measurement of novel wool or meat traits and can be extended to include optional subjectively assessed style traits, such as those mentioned by Brown *et al.* (2002a, b).

Data Analysis

All animals with data submitted to the project will receive across-flock EBVs from MGS. These will provide participants with tools for selection of their Merinos based on their assessment of the market signals. The information provided will allow for selection on wool or carcase traits alone or, alternatively, for a dual-purpose Merino. The breadth of data coming from all over Australia will provide a snapshot of the Merino industry nationally, highlighting the range of genetic values available for each of the traits recorded. In many cases, this identification of elite sires will allow for accelerated rates of genetic gain within participating flocks.

Table 1. Required and optional measurements and records to be collected by Merino Validation Project teams.

Type of trait	Required	Optional
Lambing and pedigree	Sire pedigree	Dam pedigree
	Year of birth	Date of birth
	Sex of animal	Birth type
	Management groups	Rearing type
Weights	Weaning weight	Birth weight
	Postweaning weight	
	Yearling weight	
	Hogget weight	
Wool	Hogget greasy fleece weight*	Hogget staple strength*
	Hogget yield*	Hogget staple length*
	Hogget fibre diameter*	Hogget curvature*
	Hogget coefficient of variation of fibre diameter*	Hogget coefficient of variation of curvature*
Carcase (ultrasonic live measurements)	Postweaning eye-muscle depth	
	Postweaning fat depth	
	Yearling eye-muscle depth	
	Yearling fat depth	
Reproduction	Scrotal circumference	Number of lambs born
		Number of lambs weaned
Disease	Faecal worm egg count	

*Measurements to be taken at hogget or yearling age.

The analysis of progeny-test data will be carried out using OVIS (Brown *et al.* 2001) The model fitted by this software includes direct genetic, maternal genetic, direct maternal genetic covariance, permanent environment due to dam, interaction between sires and flocks, and residual effects. There are 47 traits available, including growth, carcase, wool, fitness and fertility measured at a maximum of 7 ages (birth, weaning, post-weaning, yearling, hogget, adult and carcase). The EBVs are computed with a model, including genetic groups for base animals and accommodating for different levels of variance between contemporary groups. The data will also allow us to investigate genotype by environment and sire by flock interactions.

Further, with some of the participants being from different market segments, there is the opportunity to look at the correlations between subjectively assessed wool-quality traits and their correlations with all other traits collected throughout the study. For example, crimp definition is seen as a future market discriminator; as such, better genetic information on this trait will assist breeders and commercial producers in making selection decisions with lower risk.

Results

Preliminary data from the trial is presented in Table 2. While it is important to understand the genetic relationships between traits, to make genetic progress requires variation in the trait, as well as that trait being heritable. Table 2 shows the genetic range in key traits from the MGS database, which includes data from Merino Validation Project participants. Clearly, the opportunities for genetic improvement are very large.

Table 2. Genetic variation in key wool and non-wool traits from the MGS database (180,000 animals).

	Estimated breeding values		
Trait	Range	Min.	Max.
Yearling weight (kg)	18.95	–6.6	12.35
Hogget GFW (kg)	3.33	–1.54	1.79
Hogget FD (μm)	8.48	–3.96	4.52
Yearling fat (mm)	8.00	–3.14	4.86
Yearling EMD (mm)	6.63	–3.50	3.13
NLW (%)	66.9	–26.3	40.6
Hogget staple length (mm)	22.52	–9.35	13.17
Hogget staple strength (N/ktex)	33.53	–13.26	20.27

Discussion

The range in EBVs found in the Australian Merino population is significant. The range in fat and eye-muscle depth is comparable with that found in the terminal-sire sheep breeds (A. Ball, pers. comm.). This genetic variation allows for significant genetic gain in meat characteristics from Merino sheep.

The structure of the Merino Validation Project differs from previous investment in research and development (R&D) in sheep genetics by funding bodies. Traditional investment has been primarily through research and demonstration flocks. In this project, the physical data collected will come from on-farm measurements by breeders with key traits being measured through accredited procedures to ensure data consistency and integrity. The belief is that the Innovation component of R, D and Innovation will be enhanced if the information received by participants is relevant to their own flock and breeding program. In addition, the transfer of information from the ram breeder to the commercial client will be enhanced if the ram breeder is aware of how that data has been obtained.

Acknowledgments

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APPENDIX 2

APPENDIX 3

APPENDIX 3

MEAT & LIVESTOCK AUSTRALIA

Merino Validation Project

Thank you for your interest in participating in Meat and Livestock Australia's Merino Validation Project. To ensure the success of the research project and eligibility for MLA funding the following Expression of Interest form must be completed.

Please answer the following questions and return to Bronwyn Clarke via **Fax : (08) 9367 8078 or Mail : Department of Agriculture, Locked Bag 4, Bentley Delivery Centre WA 6983**

Contact details

Last Name: _____ First Name: _____

Property Name: _____

Address: _____

_____

State: _____ Postcode: _____

Phone: _____ Fax: _____

Email: _____

Ram breeding flock details

Stud or flock code: _____

Merino or Poll Merino: _____

No. of rams progeny tested each year (single sire mated): _____

No. of ewes mated per ram joined: _____

Average marking percentage from the matings above:

How many progeny are measured each year: _____

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Which of the following measurements do you currently take and for how many years have you collected this data:

☐ sire pedigree	years collected: _____
☐ ewe pedigree	years collected: _____
☐ birth weight	years collected: _____
☐ weaning weight	years collected: _____
☐ post-weaning weight	years collected: _____
☐ yearling weight	years collected: _____
☐ hogget weight	years collected: _____
☐ adult weight	years collected: _____
☐ post-weaning muscle and fat scanning	years collected: _____
☐ yearling muscle and fat scanning	years collected: _____
☐ hogget greasy fleece weight	years collected: _____
☐ hogget yield	years collected: _____
☐ hogget fibre diameter	years collected: _____
☐ hogget CV of fibre diameter	years collected: _____
☐ hogget curvature	years collected: _____
☐ hogget staple strength	years collected: _____
☐ hogget staple length	years collected: _____
☐ hogget faecal worm egg count	years collected: _____

In the last 5 years where have you sourced your Rams and or Semen from?
Please list the Stud's name and the Rams tag number.

_____

_____

Have you been involved in Central Test Sire Evaluation schemes (Eg. entered rams in Yardstick CTSE scheme in 1997 and 1999)
Please state the site and the Rams entered.

_____

_____

You will be advised if you have been selected as a participant in this research project.

Thank you

Meat and Livestock Australia

APPENDIX 4

APPENDIX 4

MEAT & LIVESTOCK AUSTRALIA

Merino Validation Project Protocol

The Meat and Livestock Australia (MLA) MERINO VALIDATION PROJECT (MVP) is a Merino genetics research and development project involving collaborating Merino ram breeders throughout Australia and MLA Merino Genetic Services (MGS). The MVP will run for a three-year period and this document outlines the on-farm protocol under which participants will be required to work. Ram breeders participating in the MVP will be required to sign a copy of this document as acceptance of these protocols and as an agreement to provide information for animals tested in years 2004, and 2005.

A: Costs to be incurred by the ram breeder

As a participating ram breeder you will be required to pay MGS membership and a fee for data entry into the MGS database. The data entry fees are significantly lower than those paid by breeders not involved in the MVP.

- MGS membership: $165 per stud
- MGS data processing: $1.32 per animal for the 1st 300 new animals entered into the MGS Database each year (a once only cost for each individual animal) and $0.50 per animal for all subsequent animals.
- Previous data/pedigree (prior to 2002 drop): no cost

B: Progeny testing protocol

One of the main requirements for participation in the MVP is to continue to use single sire matings (either in the paddock or through AI) for progeny testing of individual sires. It is desirable that where possible ewes should be run together throughout pregnancy, split into more manageable groups at lambing (mating sire groups) and re-grouped into sire linked multiple sire groups as soon after lamb tagging as possible. From weaning to hogget fleece measurement time it is preferable that the lambs be run together (sexes may be split). Management group identification is a vital prerequisite for accurate genetic evaluation.

Two forms of sire linkage must be maintained throughout the MPV. To achieve across flock linkage there must be at least one link established between your flock and that of at least one other participant or MGS client. To achieve within flock linkage, at least one sire must be used over two years to link years.

C: Data – measurements and records

As a MVP participant you will be provided with free pedigree and performance recording software *Pedigree Wizard* and training in its use. It is important that breeders take responsibility for their own data and ideally this should be submitted through the MGS compatible *Pedigree Wizard* program.

D: Progeny Testing Activities and Records

All progeny testing activities that take place throughout the year are shown in the attached MGS calendar. These required and optional measurements and records are detailed below.

Required measurements and records (at breeders cost):

- Sire pedigree
- Year of birth
- Sex of animal
- Management groups
- Weaning weight
- Hogget weight (take at wool sampling time)
- Wool measurements
  - hogget GFW
  - hogget yield
  - hogget FD
  - hogget CV of FD

MLA required measurements (MLA will pay for measurements on the 1st 300 animals for):

- Liveweight at scanning at both post-weaning (8 – 9 months) and at yearling (11 – 13 months)
- Ultrasound scanning for fat depth and eyemuscle depth at both post-weaning and yearling
- (NB>. As all sheep should be above 30 kilograms liveweight before scanning, some genotypes could need to be scanned at an older age – say at yearling and at hogget ages)
- Scrotal circumference (rams) at yearling age when scanning takes place
- FEC at yearling age – when appropriate for your environment

Optional measurements and records (at breeders cost):

- Dam pedigree
- Birth date (if you can't get actual birth date at least record lamb birth date to within one week)
- Birth weight (to be collected within first 24 hours)
- Birth type (single/twin/etc)
- Rearing type (single/twin/etc)
- Extra hogget wool measurements
  - hogget curvature
  - hogget CV of curvature
  - staple strength
  - staple length
  - hogget fibre diameter profiles
  - any other measurements you have
- Adult wool measurements (as for required and optional hogget measurements)

E: Scanning and FEC measurements

Scanning must be done by an accredited LAMBPLAN scanner (see Appendix 1) who will bill the project directly.

FEC samples must be taken by the ram breeders and sent to specified vet labs (see Appendix 2) which will bill the project directly for analysis of the samples.

I _____ of _____ agree to the above protocol and will adhere to it as is required for participation in the MLA Merino Validation Project.

Signature: _____ Date: _____

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Appendix 1

LAMBPLAN Accredited Ultrasound Scanners

Alan Luff	Alan Luff Scanning Services 22 Nambucca Court Cowra NSW 2794	Phone (02) 6342 3708 Fax (02) 6342 3708 Email luffalan@allstate.net.au
Tamesha Gardner	Stocksmart RMB 609 Kojonup WA 6395	Phone (08) 9832 8128 Fax (08) 9832 8004 Mobile 0408 001 353 Email stocksmart@bigpond.com
David Mitchell	The Mitchell Veterinary Hospital 119 Federal Street Narrogin WA 6312	Phone (08) 9881 3881 Work Phone (08) 9881 3886 After Hours Fax (08) 9881 3853 Email mitchvet@wn.com.au
Peter Moore	Scanwest Livestock Services PO Box 4 Williams WA 6391	Phone (08) 9885 8080 Fax (08) 9885 1463 Mobile 0427 176 332 Email scanwest@wn.com.au
Steve Milne	Advance Livestock Services PO Box 683 Hamilton VIC 3300	Phone (03) 5578 6327 Fax (03) 5573 3202 Mobile 0428 786 327 Email milne@ansonic.com.au
Stephen Parker	Advance Livestock Services PO Box 683 Hamilton VIC 3300	Phone (03) 5599 2476 Fax (03) 5573 3202 Mobile 0429 992 476 Email longford@ansonic.com.au
Stefan Spiker	Advance Livestock Services PO Box 683 Hamilton VIC 3300	Phone (03) 5573 3201 Fax (03) 5573 3202 Mobile 0427 733 201 Email als@ansonic.com.au

Contact LAMBPLAN (02 6773 2948) for a latest update on accredited scanners.

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Appendix 2

Participating Vet Labs for FEC analysis

Dr Bruce Chick
Veterinary Health Research Pty Ltd
Colin Blumer Animal Health Laboratory
Private Bag
West Armidale NSW 2350
Phone (02) 6771 1358
Fax (02) 6772 5184
Email cborin@vhr.com.au

Tricia Veale
Para-Site Diagnostic Services
"Woodford Green"
5 Grant Drive
Benalla VIC 3672
Ph/Fax (03) 5762 1515
Email triciav@cnl.com.au

Dr David Hucker
Para-Tech Veterinary Services
RMB 471
Willaura VIC 3379
Phone (03) 5350 3252
Fax (03) 5350 3276
Email dhucker@ansonic.com.au

Dr Kevin Bell
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75 Thompson Road
North Fremantle WA 6159
Phone (08) 9433 2444
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