Merino LINK

Engagement Education Exploration Exchange

August 2017 | www.merinolink.com | Issue 6

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Dates for the Diary

31st August 2017
South West Slopes Merino Breeders Field day – Harden

1st September 2017
FarmLink Research Spring Field Day – Temora

12th September 2017
MerinoLink Annual General Meeting - Young

Save the Date - 20th June 2018
MerinoLink Annual Conference & Dinner

Save the Date - 22nd June 2018
MerinoLink Conference Field Day

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Welcome to the sixth edition of
MerinoLink Limited Newsletter.

Welcome to the latest MerinoLink newsletter. As Merino breeders, we are currently experiencing a very positive period with wool and sheep meat prices all tracking well above recent times. It is an exciting time to be involved in the Merino industry and MerinoLink is certainly focusing on delivering to you the latest information to help you make informed decisions. 2017 has been very busy with the AWI, Merino lifetime Productivity (MLP) trial continuing to run at Temora and Cootamundra, lambs are on the ground and looking forward to a good spring. Earlier this year MerinoLink joined forces with the Monaro Farming Systems group and have started a joint sire evaluation (SE) being run at Cavan Station. To complete the circle of life within a Merino operation the wethers from the MLP and the Cavan SE with be put to the test with a recently approved AWI funded project to evaluate the wether progeny of these trials for wool and meat traits. We look forward to keeping you up to date with the latest information from all these projects.

In June 2017, we travelled to Goulburn to host our annual MerinoLink conference, luckily Goulburn delivered some unexpected beautiful weather for the 2 days, with 150 attendees the conference was a great success. The focus of the conference was research and development and the speakers covered a wide area of topics from sheep genetics right through to pastures. Our second day consisted of a field day held on a property just outside of Gunning NSW, special thanks to AWI Chairman, Wal Merriman for attending the day and showing his support for such events. The field day showcased the latest technology options in sheep handling, upright shearing and exclusion fencing, ram selection was a hot topic and a new Agriweb farm management tool was demonstrated. The field day produced a very positive vibe amongst producers and I believe that it reflects the great future the Merino industry has. Recent rains have certainly lifted the spirits of growers going into spring and with the ram buying season approaching I encourage everyone to focus on your breeding objective, select rams with ASBV's that will achieve your goals.

Richard Keniry
MerinoLink Chair
MerinoLink Limited

GullenGamble POLL MERINOS

The Right Balance Between Wool & Meat

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12th September, 2017

19th ANNUAL ON-PROPERTY RAM SALE

from 10am
Auction starts at 1pm

GullenGamble lets its Rams do the talking on visual and measured performance traits…

Topped the Clean Fleece Weight (CFW) combined visual and measured performance index – SEMEN AVAILABLE

Table 1. AMSEA Index values and Classer's Grade

Ram code	Breeders flock, Ram number	No of Progeny	AMSEA Indexes values: Fibre Production Plus	Merino Production Plus	Dual Purpose Plus	Wool Production Plus	Classer's Grade: Tops % (dev) Y^	Culls % (dev) Y
1	GullenGamble Poll, 121070	27	105	105	100	103	-7	-4
2		41	98	97	103	95	-2	-17
3		35	104	107	102	109	4	5
4		32	112	116	113	115	18	-14
5*		41	106	101	102	94	-4	3
6*		34	88	85	89	88	-9	7
7		31	99	89	82	84	-10	14
8		35	101	101	97	102	0	13
9		22	95	99	97	105	5	0
10		30	103	108	106	112	15	-22
11		37	87	93	109	100	-5	7
12		18	103	99	101	93	-5	7
Average performance		**32**	**100**	**100**	**100**	**100**	**17**	**26**

***The highest performing 3 sires for each trait (i.e. trait leaders) are highlighted by shading

MerinoLink Limited Sire Evaluation

Within Flock Analysis Site Report – 2016 Drop Yearling Assessments – Published 27.06.17

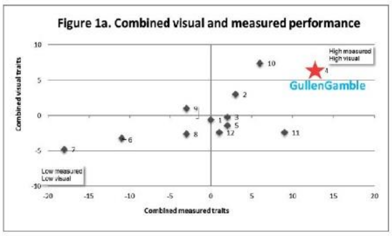


Figure 1a is based on an AMSEA Dual Purpose Plus (DP+) index
Based on a meat focused production system where surplus progeny are sold as lambs and a portion of ewes are joined to terminal sires.

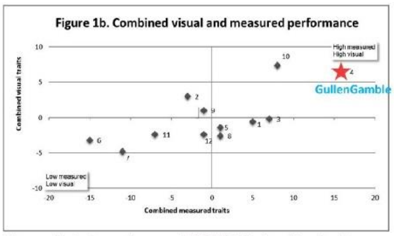


Figure 1b is based on an AMSEA Merino Production Plus (MP+) index
Based on a balanced wool and meat production system where surplus progeny are sold as hoggets.

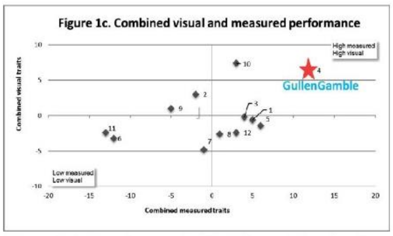
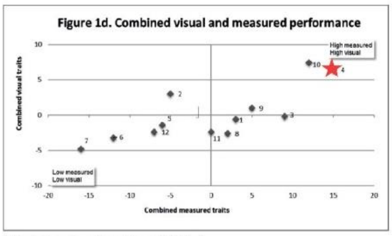


Figure 1c is based on an AMSEA Fibre Production Plus (FP+) index
Based on a wool focussed production system where wethers are retained, operating in an environment where worms cause economic losses.



Wool Production Plus (WP+)
Based on the MP+ production system with a greater emphasis on increasing fleece weight, while maintaining fibre diameter and a moderate emphasis on increasing body weight.

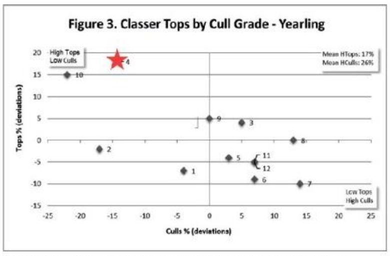


Figure 3 – Classer's Tops by Cull Grade (Yearling)
Describes performance for Classer's Tops Grade on the side axis and Cull Grade on the bottom axis. Sires that have above average Tops and below average Culls are in the top left-hand quadrant. Classer's Tops (23%), Flock (47%) and Cull (30%) is based on a visual assessment where the progeny performed well for growth, structurally sound with good wool.

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MerinoLink CONTACTS

MerinoLink Limited is a not for profit organisation that aims to facilitate sheep grower's and service providers link with information, knowledge and research.

MerinoLink's members are from a wide range of sheep businesses with varying production systems. The Members have been brought together by a common enthusiasm for profitable Merino sheep and a desire to continue to build their businesses, client businesses and the sheep industries profitability as a whole.

MerinoLink is committed to assisting our members make better use of past and current research. In addition, MerinoLink aims to build networks and add value to existing and future research and development.

MerinoLink recognise the opportunities to work together to develop research projects for the future improvement of the Australian Sheep industry.

We aim to provide all members with access to industry organisations and facilitate a two-way dissemination of information.

MerinoLink consist of producers and service providers moving our industry and members forward as fast and effectively as possible. This is made possible by MerinoLink's engagement with members and industry, education of members, exploration of research ideas and exchange of the results.

www.merinolink.com

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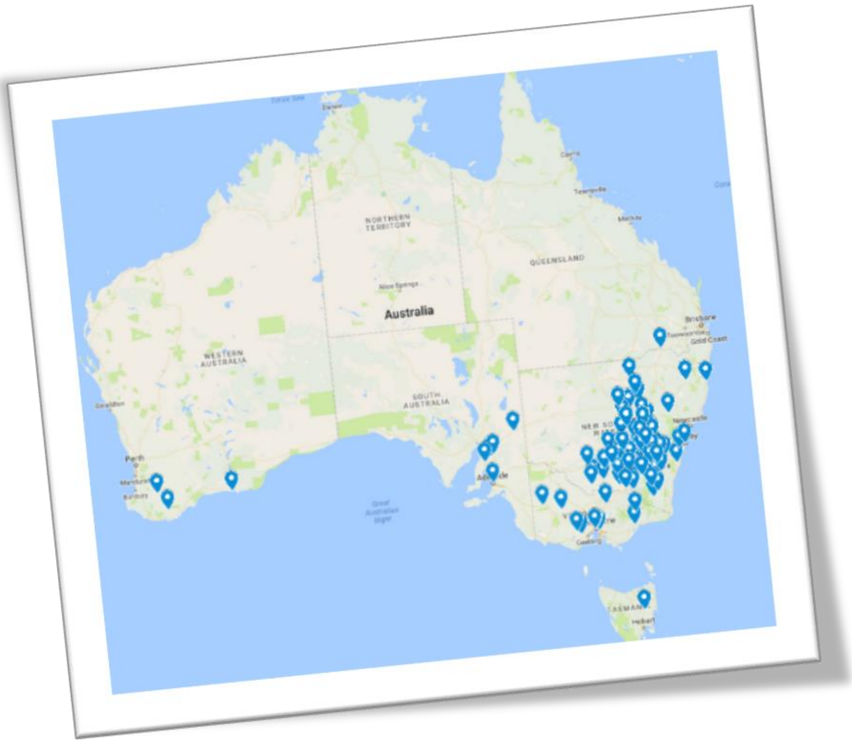

Merino Lifetime Productivity Project – MerinoLink Site Update

The Merino Lifetime Productivity (MLP) project has been designed to capture lifetime data from diverse enticement, genetics and Merino types that will help us better understand and deliver lifetime performance outcomes for the Australian Merino industry.

The project offers a unique opportunity to answer many industry questions. The MLP project runs on five sites where sire evaluation trial operates for the first two years and then the MLP project continues to measure the performance of ewe progeny over four to five joinings and annual shearings.

The ewe progeny will be annually assessed for visual and objective traits. Below is a list of sires participating at the MerinoLink site. The first assessment has been completed at 10 months of age. A summary of the latest within flock analysis is presented in this newsletter (page 5) as at the 11th August 2017. The full report can be downloaded from the MerinoLink website.

Joined	Sire Name
2016	Bella Lana,130296
2016	Boyanga, 145112
2017	Bundilla, 140055
2017	Centre Plus Poll, 407185
2017	Collinsville, 130545 (Apollo)
2017	DT Kenilworth, WH13017
2016	Glen Donald,120014
2016	Greendale, 120012
2017	Greendale, 140141
2017	Lachlan, 305
2016 - Link	Leahcim Poll, 090918
2017	Leahcim Poll, 132624
2016 - Link	One Oake No. 2 R56
2016	Pastora Poll, 082893
2016	Poll Boonooke,PB2020
2016	Pooginook Poll,140632
2016	Roseville Park, 140611
2017	Tallawong, 150280
2017	Toland Poll, 151058
2017	Trefusis, 150282
2017 - Link	Trigger Vale Poll, 140477
2016	Trigger Vale Poll, 140477
2017	Wallaloo Park, WP 422
2016	Wattledale, 140754
2017 - Link	West Plains Poll (Mercenary), 110004
2016	Wurrook, 130149

Twin mob – ewes and lambs at tagging 19th June, 2017

2016 drop MLP ewes 15th July 2017

Table 1. Australian Merino Sire Evaluation Association (AMSEA) Index Values

Breeders flock, Ram number	No Of Female Progeny[2]	AMSEA Indexes values			
		Fibre Production Plus	Merino Production Plus	Dual Purpose Plus	Wool Production Plus
Bella Lana, 130296	28	97	97	115	97
Boyanga, 145112	41	82	80	93	83
Glen Donald, 120014	19	101	100	88	104
Greendale, 120012	20	121	116	100	108
Leahcim Poll, 090918	29	93	100	108	106
One Oak No. 2, R56	38	99	100	96	99
Pastora Poll, 082893	28	101	94	93	93
Poll Boonoke, 120020	29	102	100	98	102
Pooginook Poll, 140632	26	89	98	102	101
Roseville Park, 140611	16	105	102	97	97
Trigger Vale Poll, 140477	35	89	102	126	107
Wattle Dale, 140754	29	111	109	100	104
Wurrook, 130149	18	107	102	85	99
Average performance	**27**	**100**	**100**	**100**	**100**

Table 2. Major measured traits – Flock Breeding Values (within site report)

Breeders flock, Ram number	Horn/Poll	Flock Breeding Values (deviations)						
		GFW %	CFW %	FD um	WT *kg*			
		Y^	Y	Y	W	P	Y	H
Bella Lana, 130296	HH	-3.0	-5.0	0.6	0.5	1.0	1.8	2.7
Boyanga, 145112	PP	-11.0	-10.0	0.2	-0.9	-1.0	-0.7	-0.1
Glen Donald, 120014	HH	3.0	6.0	0.2	0.0	-0.1	-1.0	-1.1
Greendale, 120012	HH	3.0	2.0	-1.5	-1.3	-1.9	-2.0	-2.1
Leahcim Poll, 090918	PP	3.0	5.0	0.7	1.5	2.8	3.9	3.6
One Oak No. 2, R56	HH	-1.0	-1.0	-0.3	0.5	0.5	-0.1	-0.8
Pastora Poll, 082893	PP	-1.0	-3.0	-0.8	-0.6	-1.4	-2.2	-2.7
Poll Boonoke, 120020	PH	4.0	6.0	-0.5	-1.1	-1.8	-2.4	-2.9
Pooginook Poll, 140632	PH	2.0	1.0	1.0	0.3	0.9	1.3	1.8
Roseville Park, 140611	HH	-2.0	-4.0	-0.9	-0.6	-1.3	-1.6	-1.5
Trigger Vale Poll, 140477	PP	0.0	-1.0	2.6	3.2	5.7	8.2	9.5
Wattle Dale, 140754	PH	2.0	3.0	-0.9	-0.6	-1.3	-1.6	-2.2
Wurrook, 130149	HH	0.0	1.0	-0.5	-0.8	-1.9	-3.5	-4.0

Table 3. Other measured traits – Flock Breeding Values (within site report)

Breeders flock, Ram number	Flock Breeding Values (deviations)						
	FDCV %	SL mm	SS *N/ktex*	Curv deg/mm	Fat mm	EMD mm	WEC%
	Y^	Y^	Y^	Y^	Y	Y	P
Bella Lana, 130296	-1.2	2.8	1.6	-0.4	0.4	2.0	-26.0
Boyanga, 145112	-1.5	10.9	-2.7	-5.5	3.9	1.5	-1.0
Glen Donald, 120014	1.5	0.6	-1.2	-6.6	-1.2	-1.3	-22.0
Greendale, 120012	0.5	-1.9	0.6	1.7	-0.3	-0.9	-17.0
Leahcim Poll, 090918	-0.9	7.4	-2.4	-0.8	0.6	0.0	-2.0
One Oak No. 2, R56	0.8	-8.2	-0.1	4.3	-1.5	-1.0	45.0
Pastora Poll, 082893	1.7	-5.0	-3.5	4.1	-2.0	-0.2	-18.0
Poll Boonoke, 120020	1.2	1.6	-3.5	-5.4	-1.4	0.2	-4.0
Pooginook Poll, 140632	-0.8	4.4	2.2	-2.9	-0.1	0.2	54.0
Roseville Park, 140611	0.0	-7.9	-0.7	3.2	-0.5	-0.2	10.0
Trigger Vale Poll, 140477	-2.9	6.6	7.3	4.8	3.3	1.6	-21.0
Wattle Dale, 140754	-0.1	-2.6	0.9	3.8	-0.6	-0.4	19.0
Wurrook, 130149	1.7	-8.8	1.7	-0.4	-0.7	-1.5	6.0

Wether Extension Project

The Merino Wether Extension Project will value add to the existing Merino Lifetime Productivity (MLP) Project and Standard Sire Evaluation sites by measuring the yearling meat traits of the 2016 MerinoLink MLP F1 wethers and the adult wool and weight traits of the 2017 MerinoLink & Monaro Farming Systems Sire Evaluation (Yass) and the 2017 MLP F1 wethers. A total of 42 progeny groups and 40 Merino sires will be evaluated for additional traits under this project.

The three evaluations (mentioned above) have linkage to other Standard Sire Evaluations and the Merino Lifetime Productivity (MLP) project sites.

The Merino Wether Extension Project will assess the wether progeny for meat and wool traits at post weaning, yearling, hogget and adult stages to produce genetic and phenotypic comparisons. The data collected will also be used to generate a farming systems report to highlight the profitability per head and per hectare under different breeding objectives.

Drop	SIRE NAME
2016	Bella Lana, 130296
2016	Boyanga, 145112
2016	Glen Donald, 120014
2016	*Greendale,120012
2016	*Leachim Poll 090918
2016	*One Oak No. 2 R56
2016	Pastora Poll,082893
2016	Poll Boonooke, PB2020
2016	Pooginook Poll, 140632
2016	Roseville Park,140611
2016	Trigger Vale Poll, 140477
2016	Wattledale,140754
2016	Wurrook,130149
2017	Bundilla 140055 (MLP)
2017	Centre Plus Poll, 407185
2017	*Collinsville, 130545
2017	DT Kenilworth, WH13017
2017	Greendale, 140141
2017	Lachlan Merinos, 305
2017	Leahcim, 132624
2017	Tallawong, 150280
2017	Toland Poll, 151058
2017	Trefusis, 150282
2017	*Trigger Vale Poll, 140477
2017	Wallaloo Park, WP 422
2017	West Plains Poll, 110004
2017	Adina, 124156
2017	Bogo, 150051
2017	Boudjah, P005
2017	*Bundilla Poll, 140055
2017	Centre Plus WA, 338205
2017	Centre Plus, 307303
2017	*Centre Plus, 407185
2017	GRASS, 142000
2017	Greendale, 150018
2017	*Hazeldean, 11.3542
2017	Hazeldean, 15.3247

Drop	SIRE NAME
2017	Hazeldean,13.4936
2017	Nerstane, 150076
2017	Pooginook Poll, 153420
2017	Rocklyn Merinos, 120182
2017	Woodpark Poll, 150106

** = Link sires across sites and between years*

Trevor Pearce EMD Scanning July 2017

Pre - Weaning 2016

GENETIC ASSOCIATION OF SKIN THICKNESS WITH LAMB SURVIVAL FROM BIRTH TO WEANING, AND GROWTH AND WOOL TRAITS IN NEW ZEALAND ROMNEY SHEEP

M. Soltani-Ghombavani, V.S.R. Dukkipati and H.T. Blair

Institute of Veterinary, Animal and Biomedical science, Massey University, Palmerston North, New Zealand

SUMMARY

Lamb survival, as a trait of high economic importance with low heritability, might show more response to selection by considering traits of higher heritability, genetically correlated with survival, as a supplement to direct selection for the trait itself. This study aimed to estimate heritability and genetic association of skin thickness (ST), as a potential trait in indirect selection for lamb survival, with lamb survival from birth to weaning (SAW), and a few growth and wool traits including fat depth (FD), eye-muscle depth (EMD), weaning weight (WWT) and 12-month fleece weight (FWT) in New Zealand Romneys. Data for ST, FD, and EMD were collected using ultrasound scans on hoggets at 8-10 months. Appropriate animal and sire models were applied to estimate the genetic parameters using ASReml software. ST had an estimated heritability of 0.26, and showed genetic correlations of 0.27 (±0.22), 0.22 (±0.10), -0.18 (±0.12), -0.21 (± 0.12) and 0.27 (±0.12) with SAW, FD, EMD, WWT, and FWT, respectively. The preliminary estimates of heritability and genetic correlation of skin thickness with lamb survival, obtained in this study, might suggest the idea of considering this trait in selection for lamb survival, though its unfavourable correlation with other traits should also be considered.

INTRODUCTION

Lamb mortality is a major issue to sheep producers both in New Zealand and worldwide, not only due to economic losses but also as an animal welfare and management problem. Lamb survival rates of 75 to 97% has been reported in New Zealand (Hight and Jury 1970; Dalton *et al.* 1980; Gumbrell and Saville 1986), though mortality rates of up to 40% have been found on some farms (Fisher 2004). In countries like New Zealand, the UK and Australia, where lambing mostly takes place outdoor, thermoregulatory capacity of newborn lambs plays a major role in lamb survival due to its contribution to starvation-exposure mortality rates, as the second most common cause of lamb deaths in the neonatal period after dystocia (Kerslake *et al.* 2005; Everett-Hincks *et al.* 2007).

Due to a low heritability of lamb survival (Lopez-Villalobos and Garrick 1999; Brien *et al.* 2010), indirect selection, based on selection for other easy-to-measure traits of higher heritability that are genetically correlated with survival can be considered as a supplement to direct selection for the trait itself. Skin thickness as a trait of moderate to high heritability (Slee *et al.* 1991; Gregory 1982a) has been shown to be associated with cold tolerance (Samson and Slee 1981), as a component of lamb survival, which is moderately to highly heritable itself (Wolff *et al.* 1987; Slee *et al.* 1991).

Hence, selection for skin thickness might be a potential alternative to selection for cold resistance and consequently lamb survival. Unlike cold resistance, whose assessment needs laboratory-based techniques that are not feasible for breeders, skin thickness could be easily measured in the field using objective techniques like ultrasonography (Brown *et al.* 2000). Prior to implementing this trait in selection for lamb survival, it is inevitable to first estimate its heritability and genetic association with other economic traits. Although a limited number of studies were undertaken for estimating these parameters (Slee *et al.* 1991; Gregory 1982a; Gregory 1982b; Coy 1983; Hynd *et al.* 1996), the size of populations in those experiments were too small. Therefore, the objective of this study was to estimate heritability for ultrasonographically measured traits (skin thickness, subcutaneous fat depth, and eye muscle depth), lamb survival and some growth and wool traits (weaning weight, and fleece weight at 12 months). Also, genetic correlation of skin thickness (as the proposed trait influencing lamb survival) with other traits of interest was estimated.

MATERIALS AND METHODS

Data collection. Data for skin thickness, fat depth and eye muscle depth were collected by ultrasonography on four Terminal Romneys for Increased Genetic Gain (TRIGG) farms in the Manawatu region of New Zealand as part of routine farm operations using ultrasound at approximately 8 months of age, during 2011 to 2015. A commercial operator took measurements using an ultrasound scanning machine (Sonosite M Turbo) with a 38mm probe at 7.5 MHz set at a depth of 40 mm on the left dorsal loin region of the lambs around the 12th rib. Live weight was also recorded at scanning. For three out of four farms the ultrasound data were recorded only during 2011 to 2014. Additional data on date of birth, sex, flock, birth rank, rearing rank, dam age, dam and sire identities, status of lamb at weaning (alive or dead), weaning weight, weaning date, fleece weight at 12 months, and age at shearing were obtained from the Sheep Improvement Limited (SIL) database. Data cleaning was done so that records with dam age of 9 years or more (n=9), birth ranks of 4 and 5 (n=114), and rearing rank of 4 (n=20) were removed from the data because of their small numbers. Also, lambs of unknown parents in the pedigree (n=408) were excluded from the analysis. After data cleaning and editing for incorrect pedigree and outlier values, the data set had 24,097 lambs born to a total of 199 sires and 6,413 dams.

Statistical analysis. Univariate procedure in SAS software (SAS, 2015) was used to check for normality and edit the data (removing outlier observations). Data were analysed by the PROC MIXED procedure in SAS software (SAS, 2015) to identify significant fixed effects to be included in the final models. Sex, birth year, and birth flock were included as fixed effects for all the traits. Furthermore, for all the traits except skin thickness, dam age was included in the final models. Also, weight at ultrasonography was considered as a covariate for the analysis of skin thickness, fat and eye muscle depth. Birth rank was included as fixed effect in the analysis of survival at weaning, and rearing rank for the other traits excluding skin thickness. In addition, age at weaning and age at fleece weight measurement were considered as covariates in the models analysing the traits weaning weight and fleece weight at 12 months, respectively. Also, all the significant two-way interactions between these fixed effects were included in the final models. (Co)variance components were estimated by Restricted Maximum Likelihood (REML) procedure using the ASREML software (Gilmour *et al*. 2015). Appropriate animal models were used for estimation of heritability for all the traits. The random effects included direct additive genetic effect for all the traits, and also maternal genetic and maternal environmental effects for the traits survival at weaning and weaning weight.

Because survival was coded as a binary trait, a generalized linear model analysis was performed, assuming a binomial distribution for this trait and using both logit and probit link functions. For all other traits, a linear animal model was used assuming normal distribution. Genetic correlations were estimated using bivariate analyses applying the best models determined in the univariate analyses. In the bivariate model where survival was included as a trait, a sire model was used and only those sires with at least 50 and 30 records of their progeny for lamb survival and skin thickness, respectively, were included in the analysis. In those models, lamb survival was considered as a threshold trait and skin thickness as normal trait. It should be noted that the statistical analysis was performed using the skin thickness data only from those animals that were alive until ultrasound scanning (at around 8 months age) and this might have led to bias in the resulting genetic correlation of lamb survival with skin thickness.

RESULTS AND DISCUSSION

Number of observations, mean, standard deviation (SD), minimum (Min), maximum (Max), and coefficient of variation (CV) for the analysed traits are presented in Table 1. As shown, ultrasound skin thickness in this study, recorded at around 8 months of age, had a mean of 2.92 mm (Table 1), which is consistent with a report by Jopson *et al.* (2000) in new-born Coopworth lambs in New Zealand, though skin thickness was measured using skinfold callipers in their experiment. In the current study ewe lambs had significantly (P<0.01) thicker skin compared to males (3.24 vs. 2.87), while Jopson *et al*. (2000) did not find any significant difference between ewe and ram lambs. On the other hand, neither birth rank nor age of dam had any significant effect on skin thickness when adjustment was made for live weight at measurement, both of which are in agreement with the study by Jopson *et al*. (2000). Also, skin thickness was significantly affected by both birth flock and year in the present study.

Table 1. Descriptive statistics and number of records for the traits analysed

Trait	No. of records	Mean	SD	Min.	Max.	CV
Survival at weaning (%)	23976	0.81	0.39	0	1.00	47.99
Skin thickness (mm)	6082	2.92	0.50	1.50	5.00	17.20
Fat depth (mm)	6171	2.86	1.43	1.00	12.00	50.02
Eye muscle depth (mm)	4389	25.60	3.14	4.00	38	12.25
Weaning weight (kg)	18657	28.68	6.10	10.00	57.00	21.25
Fleece weight at 12 months (kg)	5426	3.32	0.67	1.60	5.80	20.29

Table 2 presents heritability estimates for the traits of interest and genetic correlation of skin thickness with other traits. As expected, lamb survival at weaning had low direct and maternal heritability estimates, which is in line with several other studies (Lopez-Villalobos and Garrick 1999; Brien *et al*. 2010). As mentioned at the outset, this finding shows that direct genetic selection for this trait is not promising. On the other hand, skin thickness as the main trait of interest considered for indirect selection for lamb survival showed a moderate heritability of 0.26±0.04, which confirms the results from previous studies showing this trait to be heritable (Slee *et al*. 1991; Gregory 1982a). Furthermore, skin thickness showed a positive genetic correlation (0.27±0.22) with lamb survival at weaning, which is favourable and consistent with the results from a study by Jopson *et al*. (2000) that showed 2.7% increase in lamb survival from tagging until weaning for each millimetre of increase in skin thickness in Coopworth sheep. This finding could be attributed to the effect of skin thickness on improved thermoregulation.

Table 2. Estimates (±SE) of the direct (h_a^2) and maternal (h_m^2) heritabilities and maternal environmental (me^2) effects for each trait, and genetic correlations (r_g) with skin thickness

Trait	h_a^2	h_m^2	me^2	r_g
Survival at weaning (using probit link)	0.033 ± 0.01	0.061 ± 0.02	0.008 ± 0.02	0.27 ± 0.22
Survival at weaning (using logit link)	0.035 ± 0.01	0.053 ± 0.02	0.016 ± 0.017	-
Skin thickness	0.26 ± 0.04	-	-	-
Fat depth	0.36 ± 0.04	-	-	0.22 ± 0.10
Eye muscle depth	0.39 ± 0.05	-	-	-0.18 ± 0.12
Weaning weight	0.33 ± 0.04	0.17 ± 0.03	0.14 ± 0.02	-0.21 ± 0.12
Fleece weight at 12 months	0.50 ± 0.04	-	-	0.27 ± 0.12

There was also a favourable positive genetic correlation of 0.27±0.12 between skin thickness and fleece weight at 12 months. Similarly, Gregory (1982b) found a significant genetic correlation of 0.39 between skin thickness and clean fleece weight in South Australian Merino sheep. Contrary to this, Hynd *et al*. (1996) indicated a slight negative correlation between skin weight (as an indicator of thickness) and clean fleece weight. Unfavourably, the genetic correlation of skin thickness and fat depth was positive with a value of 0.22±0.10. In agreement with this, Jopson *et al*. (2000) showed that lambs from lines selected for high backfat depth had thicker skins than those selected for low backfat depth. Also, unfavourable genetic correlations of -0.18±0.12 and -0.21±0.12 were found between skin thickness and the traits eye muscle depth and weaning weight, respectively.

CONCLUSION

The preliminary estimates of heritability of skin thickness, together with its favourable genetic correlation (although with a high standard error) with lamb survival at weaning obtained in this study, suggests the idea of considering this trait as a likely attribute in indirect selection of lamb survival in selection programs. However, its inclusion should be with caution due to its unfavourable genetic correlation with fat depth, eye muscle depth, and weaning weight, as well as high standard errors associated with them. Otherwise, selection of animals with thicker skin might result in lambs with improved survival as well as increased fleece weight, but with a greater fat depth, and less muscle depth and lower weaning weight.

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The Ram Selection Process – using both visual selection and ASBV's

Luke Stephens, Technical Specialist, Sheep Breeding, NSW DPI Armidale

1.Have a SMART objective of what you want to achieve. Too often the question do you have a plan for your sheep is met by blank stares or indecisive responses. A Specific Measurable Achievable Realistic & Time bound objective helps set you on the path to increasing productivity and profitability. An example of a SMART objective may be "I want to increase clean fleece weight by 5% in the next two years

2.Know where you are starting from: knowing the production levels and potential of your ram team is crucial in knowing where to go next. Tools like Ramselect Plus now allow you to keep an updated list of the rams you have purchased. This is a great initiative as ASBVs change over time so having the most up to date info can help influence your breeding decisions

3.Have a clear list of rams that you want to look at before arriving for inspection: The ram sellers job is to provide enough rams to suit the varying objectives of his clients. So not every ram that is there is going to be for your objective. Spending the time to go through the catalogue and identify the rams for your objectives will save you valuable time when arriving to a sale or inspection

4.Take the time to inspect each ram thoroughly. This is probably the most key point in this article. Using objective data is a great way to identifying the rams that have the production potential to make you money. However, these rams have to meet your assessment. The four Ts are very important when visually inspecting rams: Teeth Testicle Tossle and Toes. There are publications such as the visual scores guide and the guide to classing merino sheep that can add value here.

The final key point in ram selection is to have a plan and be willing to stick to it. The most outstanding performing sheep that doesn't meet your assessment visually is not the ram for you. On the flip side of this the same is true. The most outstanding looking rams with poor production potential is not the ram for you. As most rams are sold in the open market you are not always going to get the rams for you every time, but it is important to set a ceiling of which production levels you are willing to go to and not go below that. The only way that you are going to stay ahead in your sheep enterprise is to make increases in profit annually that are more than the rise in cost of production.

Luke can be contacted at luke.stephen@dpi.nsw.gov.au

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Growing up on a sheep farm in southern Tasmania, I have been involved in merino and meat sheep operations from a very young age. This early exposure nurtured my passion for agriculture and the sheep industry, and it was this passion that was the driving force behind the decision to undertake my secondary education at Yanco Agricultural High School. During my time spent at Yanco Ag I was involved in the Sheep Show Team and also completed my certificate in wool classing and Certificate III in Agriculture. From my studies, I made the decision that I wanted to pursue a career in the agriculture industry and it is for this reason that I chose to study a Bachelor of Agricultural Science degree at Charles Sturt University.

I am currently in my fourth and final year of the degree which involves a 12-week block of industry placement. The placement aims to improve students technical, and generic skill bases, as well as provide the opportunity to network and gain contacts within a chosen industry. I was fortunate enough to have Sally Martin Consulting take me on for my placement.

During my time with Sally I have had the opportunity to be involved with many different activities and aspects of the merino industry, which has allowed me to learn many new and valuable skills.

As part of my placement I was able to attend the MerinoLink Annual Conference, which I saw as a really great opportunity for me to make contacts within the industry. I also got a lot out of the conference because it allowed me to relate the relevance of some of the things we have learnt in our course to what is going on in the sheep industry. I would, and will do in the future, highly recommend it to other young people who are interested in the sheep industry.

Charles Sturt Uni – 4th Year Work Placement – Rachael Gawne

I grew up and went to school in Narrandera, NSW always having a passion for agriculture and animals. In 2017 I graduated as an Animal Scientist from Charles Sturt University in Wagga Wagga, a degree that allowed me to not only learn more about the management of different livestock-based production systems but also taught all the related genetics, nutrition and health aspects that went with it.

Throughout my studies I was exposed to a few very different animal industries, my views on which industry would be right for me changed a lot over the 4 years. During my final year I was introduced to Lexi Cesnik whilst competing in the National Merino Challenge and having decided I hadn't learnt enough about the sheep and wool industry, I contacted her to organise some work placement. Lexi was more than eager to take me under her wing and show me what a career in the sheep and wool industry could look like, and I tell you what, she did an amazing job! After only a few short weeks it was very clear to me that I had finally found an industry that I was eager to wake up every morning and be involved in, and from that point forward I made it my goal to learn as much as I could and build my skill set from the ground up. This led to me spending almost every spare day I had for the last 8 months of my degree volunteering with both Sally Martin and Marty Moses's businesses with any jobs or projects that might be going on and travelling around the country side with Lexi taking in as much as I could. This work-placement led on to casual employment with Sally for the next few months.

In March this year, after demonstrating my growing passion for the sheep and wool industry, and my eagerness to learn as much as I can possibly handle about this fantastic industry, I was fortunate enough to be awarded co-recipient of the prestigious Peter Westblade Scholarship, to which I am still beyond great-full for!
Fast forward a few more months and I am now working full time with Sally Martin Consulting, with my role including admin and data collection work for the various MerinoLink projects that are currently taking place. I was lucky enough this year that my position took me to my first MerinoLink Conference which I thoroughly enjoyed. It was such a great opportunity to not only hear what guest speakers had to say about a range of different topics relevant to our industry, but also a great opportunity to meet all the passionate industry members and talk to them about their views and opinions on where our industry is headed.

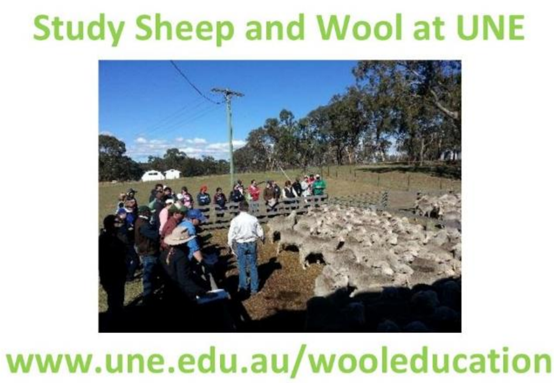
I am very much looking forward to continuing to work with MerinoLink into the future and learning more from all the passionate sheep and wool industry members I am sure I will meet along the way.

Megan Rogers, Sheep Connect NSW, Adele Offley, Mosses & Son, Grace Cornish, CSU Student and Rachael Gawne, Sally Martin Consulting at the recent Graham Centre Sheep Forum, Wagga Wagga

Study Sheep & Wool at UNE

UNE is the only University in Australia to offer a comprehensive range of specialised sheep and wool units, developed by industry. The units are financially supported by the Australian Wool Education Trust (AWET) and have been running at UNE for the past 10 years. Student numbers studying sheep and wool has grown 3-fold since the program began. Students from 8 other Universities across the country are studying the units as electives within their agricultural or animal science degrees. During this time we have had encouraging success in placing our sheep and wool graduates into the industry. Elders have employed four of our graduates in recent years, Will Chaffey Wool Manager in Dubbo, Brett Smith Wool Manager in Walgett and Samantha Wan and Sarah Ryan Wool Technical Officer's and wool auctioneers based in Melbourne Wool Selling Centre.

Most recently, Peta Bradley, a fourth-year UNE Rural Science student was appointed as the MERINOSELECT Development Officer with Sheep Genetics Australia. A role she will take up full-time at the end of this year. Peta is currently an AWET undergraduate scholarship holder, which has provided her with financial support whilst studying plus the opportunity to gain industry work experience. Peta actually chose to study at UNE because of the specialised sheep and wool units on offer and the availability of the Sheep CRC and Sheep Genetics on campus.



Research to improve lamb survival

Research at the Graham Centre for Agricultural Innovation is investigating if adding calcium and magnesium to the diets of pregnant ewes can boost lamb survival.

The Charles Sturt University (CSU) led project, funded by Australian Wool Innovation (AWI), was outlined at the Graham Centre's sheep forum. CSU lecturer in whole farm management and Graham Centre researcher Dr Shawn McGrath says the research follows a 2016 study of ewe flocks in NSW, Victoria, South Australia and Western Australia.

"The preliminary results of this on-farm study showed there may be some relationship between lamb survival and the calcium and magnesium status of ewe flocks," Dr McGrath said.

"We know that clinical hypocalcaemia or low calcium levels in blood, and hypomagnesaemia or low magnesium levels in blood, can compromise the health of the ewes and result in death. "A review of scientific literature has identified that even when the ewe is not showing clinical signs, there are a number of mechanisms by which the calcium and magnesium status may have a role in the poor survival of newborn lambs."

An experiment this year will put that to the test, comparing lamb survival when ewes are supplemented with calcium and magnesium compared to when no supplements are fed.

"The experiments will be conducted on five farms across NSW, South Australia and Western Australia with interstate trials managed by the South Australian Research and Development Institute (SARDI) and Murdoch University," Dr McGrath said.

"Our aim is to see if the possible benefits to lamb survival identified in the literature can be demonstrated on farm." The research is led by Graham Centre Director Professor Michael Friend and involves Dr McGrath, Dr Susan Robertson and Dr Marie Bhanugopan from CSU; Dr Janelle Jenkins from SARDI and Dr Serina Hancock from Murdoch University.

Take home messages:

- A CSU-led project is investigating the link between calcium and magnesium deficiencies and lamb survival.
- On-farm surveys in 2016 identified a possible link.
- A review of the literature has identified a number of mechanisms by which low calcium and magnesium status in ewes could be implicated in low lamb survival.

A research project commenced in 2016 to consider the question, 'Are deficiencies in calcium and magnesium implicated in lamb mortalities in sheep flocks in Australia?' The research was sponsored by AWI and was headed by the Graham Centre, with collaborators in New South Wales, Victoria, South Australia and Western Australia. In 2016 ewe flocks were monitored during the lambing period, including collection of soil and pasture samples between 30 days prior to lambing and lamb marking, and blood and urine samples from ewes just before lambing and at lamb marking. Survival was monitored on a flock basis. In the local area participating flocks were located at Holbrook, Wagga Wagga and Junee. The preliminary results indicate that there may be some relationship between lamb survival and the calcium and magnesium status of ewe flocks.

It is well known that clinical hypocalcaemia (low calcium levels in blood) and hypomagnesaemia (low magnesium levels in blood) can compromise ewe health and result in death. A subsequent literature review has identified mechanisms by which subclinical hypocalcaemia and hypomagnesaemia could have a role in poor survival in new born lambs, or conversely, how supplementation with calcium and magnesium may improve lamb survival. On the basis of this a new experiment will be run in 2017 that will include a comparison of supplementation with calcium and magnesium compared to no supplementation, to see if the possible benefits to lamb survival identified from the literature can be demonstrated on farm.

International effort to deliver perennial wheat

Australian farmers are a step closer to growing perennial wheat to produce dual purpose grazing and grain crops as a direct result of collaboration between NSW Department of Primary Industries (DPI) and United States researchers. NSW DPI technical officer, Matthew Newell, has returned from The Land Institute (TLI), a non-profit research organisation in Kansas, with 18 new lines of wheat to bolster 20 existing lines currently under investigation in central west NSW.

“DPI evaluation trials demonstrated perennial cereal crops could be produced in Australia with the potential to boost sustainability,” Mr Newell said. “Now with 18 new TLI lines, 10 of which are registered Kernza® lines, we plan to expand our research with a view to developing a robust perennial wheat suited to grazing and grain production under Australian conditions.”

Kernza® is an intermediate wheatgrass, a perennial relative of traditional annual wheat, which is commercially available in a staged release to select US restaurants and a brewing company producing Long Root Ale, a beer named after the plant’s root system. Mr Newell said the aim in Australia is to develop perennial cereals as dual purpose crops to better integrate livestock and cropping enterprises. The forage of perennial wheat has high energy and digestibility levels, while the grain has a high protein content.

“These dual-purpose crops could provide valuable winter forage for livestock, at a time when pasture growth is limited, and in the right conditions be harvested for grain,” he said. “It would give farmers the opportunity to spell pastures while the wheat crop is grazed, increasing feed availability and generating pasture growth to increase carrying capacity and farm productivity.”

Designing dual purpose cropping systems based on perennial crops could help adapt to climate variability by putting extra flexibility into local farming systems. In marginal cropping areas, particularly in drought years, perennial wheat may allow farmers to vary their inputs, reduce costs and deliver environmental benefits.

Perennial crops are in the ground for several years and can take advantage of out-of-season rain, which helps increase water-use efficiency, reduce soil acidification and salinisation and has the potential to reduce erosion.

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Perennial crop research at NSW Department of Primary Industries Cowra

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Abstract
Designing agricultural production systems based on perennial grain crops has the potential to sustainably integrate cropping and livestock systems particularly in higher rainfall environments. Over the last 10 years, perennial crop research in Australia has demonstrated the potential whole-farm economic benefits, evaluated a range of breeding material over several years and examined aspects of perennial cropping systems. This paper summarises that effort and highlights the potential value of a dual purpose perennial cropping system from both an economic and ecological stand point. There are several technical challenges to the commercial deployment of perennial crops, concerning persistence, stability of grain yield and complementarity between grain crops and legumes grown in mixtures. However, with continued global research, these challenges can be overcome allowing new perennial grain crops to successfully integrated into the market.

Key words: Perennial wheat, persistence, polyculture,

Introduction
World food security depends on annual based cropping systems that produce grains. Cereals, oilseeds and legumes occupy 70% of our agricultural land and comprise the vast majority of calorie intake across a growing population(Glover and Reganold 2010). Modern Agriculture's ability to meet the increasing demand for agricultural products has hinged on simplifying traditional agroecosystems and increased yields through the use of external inputs of energy and chemicals (Bommarco *et al.* 2013). The intensification of agricultural production has been successful in meeting global food demand by increasing productivity per unit area. However, this has come at a substantial environmental cost such as soil degradation caused by the run-down of organic matter in cropping soils and disruption of the hydrological balance within landscapes by the replacement of endemic perennial based vegetation with annual based crop and pasture systems (Lefroy and Stirzaker 1999). Much has been written about the ability to restore function to the landscape and reverse degradation through the use of perennial plants (Crews *et al.* 2016). This has led some to suggest that our agricultural systems need to be "redesigned" to reduce the negative impacts of current agricultural practice on the environment while increasing agricultural output and landscape resilience (Fedoroff 2015). Developing perennial cereal crops has the potential to offer a more environmentally sustainable grain production system into the future. Reductions in soil erosion, salinity and acidification as well as reduced cost and increased diversity in agricultural production are some of the proposed benefits of incorporating this novel technology (Culman *et al.* 2010).
There is a global effort to perennialise some of our major crops, with around 19 perennial species under development (Kantar *et al.* 2016). Perennial crops can be derived either through direct domestication of a perennial species with selection for improved grain attributes, or through hybridizing annual crop species with a perennial relative to install the perennial habit**.** Perennial sorghum (*Sorghum bicolor x S. halepense*) and perennial rice *(Oryza sativa x O. longistaminata)* are nearing commercial deployment in Sub-Saharan Africa and Asia respectively. In North America, domestication of a perennial relative of wheat, intermediate wheatgrass (*Thinopyrum intermedium*) or Kernza (Jungers *et al.* 2017),has made its way into the commercial supply chain in small niche markets as beverages, baked goods and side dishes, with further interest from larger milling companies to increase its use across a range of cereal products. With a high demand for sustainably produced food the successful integration of perennial grain into commercial cropping and food processing systems appears promising. The challenge for researchers will be in the continual development of well adapted material and agronomy packages to support commercial production.

Perennial Cereal Research in Australia

Initial Evaluation
The majority of the research conducted on perennial crops in Australia has occurred at the Cowra Agricultural Research and Advisory Station. The focus for Australian research has concentrated on perennial wheat, derived from tall wheatgrass (*Th. ponticum*) or intermediate wheatgrass crossed with various annual wheats. These hybrids have the

greatest potential to fit into our current production systems. Initial modelling by Bell *et al.* (2008) suggested perennial wheat producing 40% of the grain yield of annual wheat and an additional 800 kg/ha of grazable biomass over autumn and winter would provide an economically viable addition to current production systems. Since then a range of international breeding material has been evaluated (Hayes *et al.* 2012), with a number of lines showing ability to persist and produce grain for up to four years (Larkin *et al.* 2014). This work demonstrated the proof of concept that it was biologically feasible to grow perennial cereals under Australian conditions.

Grain and Graze Potential

The economic analysis undertaken in Australia identified that profitability of perennial cereals was enhanced if they could be used for both grazing and grain production. This is supported by the initial field evaluation which concluded that early generation perennial wheat was likely to be best adapted to higher rainfall environments in SE Australia (Hayes *et al.* 2012), where grazing is the dominant enterprise. An initial field study was undertaken to assess the tolerance of four experimental lines of perennial wheat to defoliation, compared to one line of Kernza and a commercial annual winter wheat, cv. EGA Wedgetail which was re-sown annually (Newell and Hayes 2017). The study also examined the forage quality and mineral composition of the breeding lines in order to establish their suitability for animal production. In the first year of the experiment, several of the perennial wheat lines were able to exceed the benchmark of 40% of the grain yield of annual wheat (Table 1). A significant finding of the study was that there was no significant difference in grain yield between Wedgetail wheat and three of the four hybrid lines in the second year of the study, with one line yielding 60% more than the annual wheat control. This result highlights the importance of being able to monitor perennial crop performance over a longer timeframe, because in contrast to annual plants, the relative performance of perennials is not usually favourable in the establishment year. Harvest index (HI) for the annual wheat was significantly higher than all perennial species in both years, indicating a greater proportion of assimilate being allocated into grain yield. The lower HI of the hybrid wheats could suggest that some plant resources are being used to drive post-harvest regrowth. Lines were grown as spaced plants and therefore changes in plant density could be closely monitored. Much of the decline in perennial wheat yield over time previously reported is likely to be attributed to plant mortality rather than reduced yield potential.

Table 1. Yearly grain yield (grams/plant) and harvest index (HI) of Kernza, perennial wheat lines (PW) and annual wheat (Wedgetail) (Source: Newell and Hayes, 2017).

	Year 1		Year 2	
Entries	Yield	HI	Yield	HI
Kernza	3.4	5.6	2.8	2.9
PW1	14.7	22.6	17.7	22.5
PW2	11.2	14.2	21.4	15.7
PW3	6.9	15.3	8.1	10.2
PW4	13.1	21.1	30.0	24.7
Wedgetail	30.7	44.7	18.6	41.8
***l.s.d* Yield (*P* = 0.05)**	5.89			
***l.s.d* HI (*P* = 0.05)**	2.75			

Table 2. Crude protein, dry matter digestibility (DMD), metabolisable energy (ME), neutral detergent fiber (NDF), acid detergent fiber (ADF) and ash content of forage averaged over winter and spring from Kernza, perennial wheat lines (PW) and annual wheat (Wedgetail) (Source: Newell and Hayes, 2017)

Entries	Crude protein (%)	DMD (%)	ME (MJ/kg DM)	NDF (%)	ADF (%)	Ash Content (%)
Kernza	32.8	91.2	14.1	31.9	12.4	12.8
PW1	24.4	84.0	12.8	39.5	20.2	11.7
PW2	25.1	89.0	13.7	39.7	18.5	9.9
PW3	26.5	87.0	13.7	38.0	18.2	11.2
PW4	25.0	83.7	13.3	40.0	21.0	12.3
Wedgetail	20.3	85.0	12.8	39.0	19.5	9.0
***l.s.d* (*P* = 0.05)**	1.29	1.97	0.34	1.92	2.31	2.04

Digestibility, metabolisable energy and fibre content of the perennial lines averaged over winter and spring were similar to that of annual wheat, with crude protein observed to be 62% and 25% greater in the Kernza and the perennial wheats, respectively, compared to Wedgetail (Table 2). In some cases, cumulative biomass of the perennial lines over a 12 month period was more than 3 times greater than that of annual wheat. This is largely attributed to post harvest regrowth observed during summer and autumn. The winter herbage of the perennial lines generally had a higher proportion of Ca, Mg, K and P but lower proportion of Na compared to annual wheat. The study concluded that perennial wheat would provide valuable feed for livestock over a longer grazing window compared to annual wheat. However, due to the imbalance in forage mineral content, livestock grazing perennial wheat during winter are likely to still require Ca/Mg mineral supplementation to mitigate the risk of nutritional disorders in late pregnant or lactating ewes, as recommended in annual grazing wheats. Future research should consider the implications for the grazing enterprise of growing perennial crops in mixtures with a legume, rather than in pure swards.

Polycultures

The vision for perennial grain agriculture is to move away from the simplified monoculture agroecosystem of modern annual cropping to one that mimics natural ecosystems, containing a diverse range of complimentary species (polyculture). A pilot study was undertaken to investigate the impact on crop yield, total biomass and nitrogen fixation in swards sown to experimental perennial wheat lines grown in mixtures with subterranean clover (*Trifolium subterraneum*) in various spatial arrangements (Hayes *et al.* 2016). It was found that clover biomass and regeneration was substantially reduced when grown amongst a vigorous crop canopy (Mix treatment) (Table 3), leading to a reduction in nitrogen fixation of 30-90%. Spatially separating the perennial crop from the legume in alternate drill rows (1_{crop}:1_{clover}) more than doubled legume biomass and reduced weed incursion by 37% compared to where the two species were sown in the same drill row. However, excluding the crop from alternate drill rows inhibits the ability of the crop to achieve complete canopy cover and has a tendency to lower grain yield. The inability of the perennial crop to compensate for wider row spacing facilitates greater legume survival within the crop canopy and increases overall productivity (crop + legume biomass) of the system. With better integration of livestock and cropping components, the shortfall in grain yield could potentially be alleviated by the extra grazable dry matter produced by the spatial separation of species. The combination of crop and legume in grazable biomass may also improve the overall quality of the forage and limit the need for mineral supplementation of grazing animals.

Table 3 The effect of row arrangement on perennial crop grain yield (kg/ha), clover dry matter (t/ha), clover germination (plants m^{-2}) and weed incursion (%) (Source: Hayes *et al.* 2016)

Drill row configuration	Grain Yield (kg/ha)	Legume herbage (t/ha)	Clover germination year 2 (plants m$^{-2)}$	Weed (%)
1_{crop}:1_{clove}r	939	2.23	230	14
Mix	1030	0.97	78	37.3
Nil Legume	1240	0.05	0	55
l.s.d (***P*=0.05**)	ns	0.29	46	8.7

The profitability of perennial cropping systems based on crop-legume mixtures is enhanced by reduced nitrogen fertiliser costs. When estimates of the total inputs of fixed N from the clover were compared with the amounts of N removed in grain by the different perennial wheat treatments, it appears feasible that a companion legume could fix sufficient N to maintain the N balance of a perennial cropping system producing 1.5-2.0 t grain/ha each year.
More research is required to refine management strategies and define yield potential of perennial crops grown as polycultures. A range of management strategies should be tested in future research to manipulate competition dynamics between crop and legume species to optimise production, including choice of companion species, seeding density and spatial configurations.

Conclusion

The future for perennial crops appears promising as current research has demonstrated that a genuinely perennial cereal crop is biologically feasible in Australian environments and that perennial cereals can contribute significantly to a dual purpose grain and graze production system. Global demand for sustainably produced grain is growing and initial deployment of current perennial grains into this market has shown success with the release of products such as Long Root Ale and significant investment by General Mills in other perennial cereal product development in the United States.

However there are several technical aspects requiring further research to progress perennial cereals towards large-scale commercialization. Future perennial crop research needs to focus on several key areas to improve persistence through adaptation to local environments, stabilising grain yield over time and improve end use grain quality. Development of a novel cropping system will also be an important component of research to move away from crop monocultures and produce profitable perennial mixtures of cereals and legumes. This will require global collaboration between organisations and development of multidisciplinary teams across the development pipeline to successfully integrate perennial crops into commercial cropping and food processing systems.

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Newell MT, Hayes RC (2017) An initial investigation of forage production and feed quality of perennial wheat derivatives. *Crop and Pasture Science* **In Review**

Genomic testing – what happens without any phenotypic data?

If you are considering genomically testing animals, for example the 15k genomic test without phenotypic measurement you need to consider the reporting accuracies thresholds. To get reportable ASBVS in traits such as yfd, ydcv, pfec, yss, ysl you need to at the very least have full pedigree with the highest possible mid-parent accuracies.

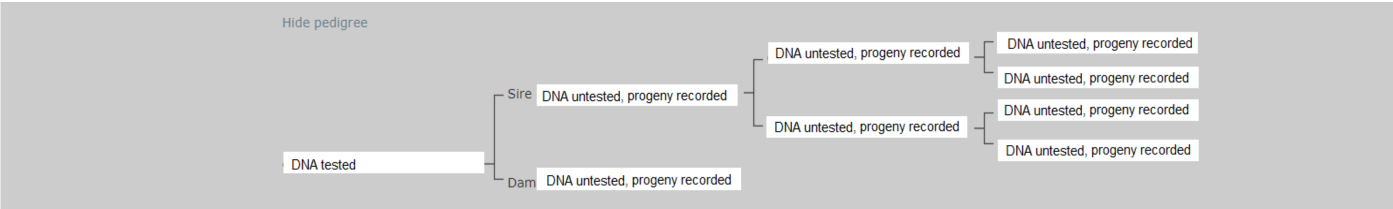
To increase mid-parent accuracies you will need to have deep pedigrees and ancestors with highly accurate ASBVS for the particular traits of interest. To further increase chances of meeting reportable thresholds, testing lambs with close relationships to the reference population will also assist.

To have close relationships to the reference population:

- Use sires and/or grandsires that are genomic tested with highly accurate breeding values for the mentioned traits
- This could mean testing sire teams each year
- Asking AI sires to also be tested if they are not

Accuracy can also be added to by measuring the trait (care should be taken not to selectively record!!!). Below are some examples of how the accuracies have affected the reporting thresholds.

Example 1 – Good sire pedigree, poor maternal pedigree

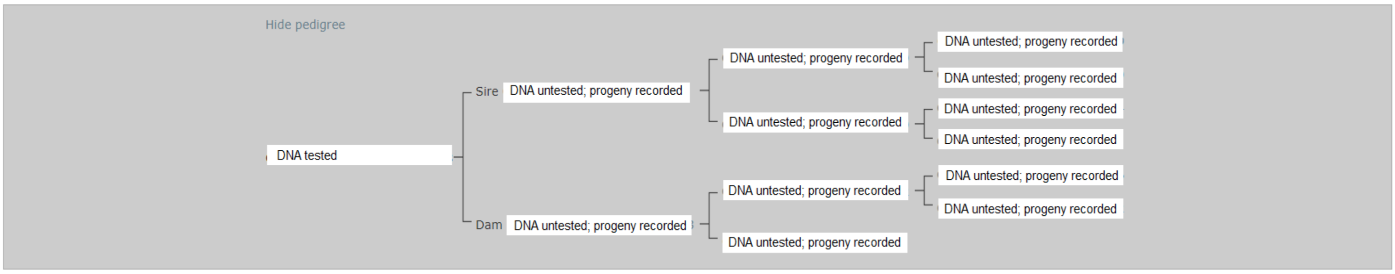


MERINO ASBVs - 24/07/2017

View all traits	YWT	AWT	YEMD	YFAT	YCFW	YFD	YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	LMY	IMF	SHEARF5	INBREEDING	BREED	POLL	FP	FP+	MP	MP+	DP	DP+
DNA tested	6.7 57%	5.2 53%	-	-	15.3 50%	-	-	-	-	-	-	-	-	-	0.14 40%	-0.37 41%	-0.3 33%	0%	1.00 53%	PH	132 24%	136 23%	142 24%	146 24%	137 21%	146 22%
Averages View Percentiles	3.5	2.9	0.2	0.0	10.4	-1.0	-0.6	5.0	0.4	-9	1%	-0.1	-0.1	0.0	0.36	-0.16	0.8	0%	0.98	0	125	128	130	133	123	133

Observed Traits	bodywt
Animal	✓
Progeny	

Example 2 – Good sire pedigree, better maternal pedigree, no ancestral genotyping

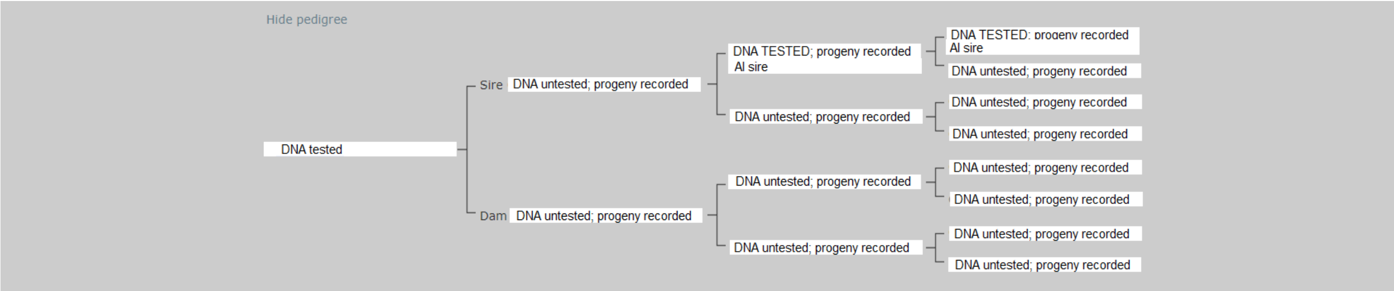


MERINO ASBVs - 24/07/2017

View all traits	YWT	AWT	YEMD	YFAT	YCFW	YFD	YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	LMY	IMF	SHEARF5	INBREEDING	BREED	POLL	FP	FP+	MP	MP+	DP	DP+
DNA tested	6.1 64%	4.2 61%	0.4 44%	0.2 42%	12.0 57%	-1.4 63%	-1.9 56%	7.3 53%	-	-	-	-	-	-	0.18 44%	-0.31 45%	0.8 37%	3%	1.00 80%	PP	138 28%	142 29%	144 28%	148 29%	135 24%	145 26%
Averages View Percentiles	3.5	2.9	0.2	0.0	10.4	-1.0	-0.6	5.0	0.4	-9	1%	-0.1	-0.1	0.0	0.36	-0.16	0.8	0%	0.98	0	125	128	130	133	123	133

Observed Traits	bodywt
Animal	✓
Progeny	

Example 3 - Good sire pedigree, good maternal pedigree, ancestral genotyping

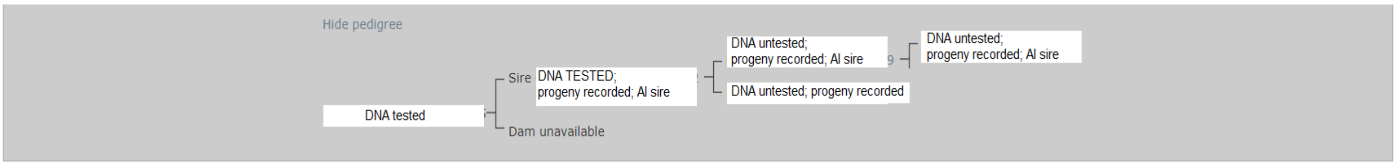


MERINO ASBVs - 24/07/2017

View all traits	YWT	AWT	YEMD	YFAT	YCFW	YFD	YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	LMY	IMF	SHEARF5	INBREEDING	BREED	POLL	FP	FP+	MP	MP+	DP	DP+
DNA tested	9.5 64%	7.7 62%	0.4 48%	0.4 46%	20.8 58%	-1.9 63%	-0.9 57%	7.5 52%	-	-	2% 22%	-	-	-	0.05 48%	-0.13 47%	0.1 39%	5%	1.00 100%	PH	150 29%	156 32%	164 28%	170 32%	155 24%	170 30%
Averages View Percentiles	3.5	2.9	0.2	0.0	10.4	-1.0	-0.6	5.0	0.4	-9	1%	-0.1	-0.1	0.0	0.36	-0.16	0.8	0%	0.98	0	125	128	130	133	123	133

Observed Traits	bodywt
Animal	✓
Progeny	

Example 4 – Sire pedigree with close DNA, no maternal pedigree

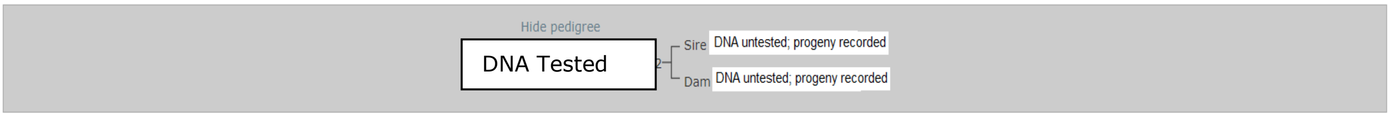


MERINO ASBVs - 24/07/2017

View all traits	YWT	AWT	YEMD	YFAT	YCFW	YFD	YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	LMY	IMF	SHEARF5	INBREEDING	BREED	POLL	FP	FP+	MP	MP+	DP	DP+
DNA tested	5.8 69%	4.6 66%	0.3 60%	-0.2 51%	13.3 51%	-	-0.8 50%	-	-	-10 35%	-	-	-	-	1.19 53%	-0.62 44%	4.1 40%	0%	1.00 33%	PP	132 25%	141 27%	143 27%	151 29%	135 25%	155 30%
Averages View Percentiles	3.5	2.9	0.2	0.0	10.4	-1.0	-0.6	5.0	0.4	-9	1%	-0.1	-0.1	0.0	0.36	-0.16	0.8	0%	0.98	0	125	128	130	133	123	133

Observed Traits	scan	bodywt
Animal	✓	✓
Progeny		

Example 5 – Full shallow pedigree, no DNA history



MERINO ASBVs - 24/07/2017

View all traits	YWT	AWT	YEMD	YFAT	YCFW	YFD	YDCV	YSL	YSS	YWEC	NLW	EBWR	EBCOV	LDAG	LMY	IMF	SHEARF5	INBREEDING	BREED	POLL	FP	FP+	MP	MP+	DP	DP+
DNA tested	-1.2 47%	-	-	-	18.7 46%	-	-	-	-	-	-	-	-	-	-	-0.30 34%	-	0%	1.00 7%	HH	134 19%	-	134 21%	-	-	-
Averages View Percentiles	3.5	2.9	0.2	0.0	10.4	-1.0	-0.6	5.0	0.4	-9	1%	-0.1	-0.1	0.0	0.36	-0.16	0.8	0%	0.98	0	125	128	130	133	123	133

Observed Traits	gfw
Animal	✓
Progeny	

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Jim Walsh Veterinary & nutrition advisor			Coopers Animal Health

Trial outline

Six breed types of ewes are being compared for prime lamb and wool production. A total of 252 ewe lambs from 6 breed-types, each represented by 42 ewes are being joined to terminal sire rams. Each breed type group was randomly selected from 3 properties, 14 ewe lambs per property after an allowance for culling. Selection preference was true commercial flocks rather than commercial flocks attached to studs. The ewes are normally run together as one mob, except when lambing in their separate breed groups or after pregnancy scanning when dry ewes, ewes carrying singles and ewes carrying multiples are separated **for differential feeding to match targets suggested in the 'Lifetime Ewe' program**. Dry ewes may be run separately until weaning to avoid overfeeding. It is planned to run the trial for at least four adult lambings; with satisfactory progress the trial could be extended.

The breed-types are listed below.

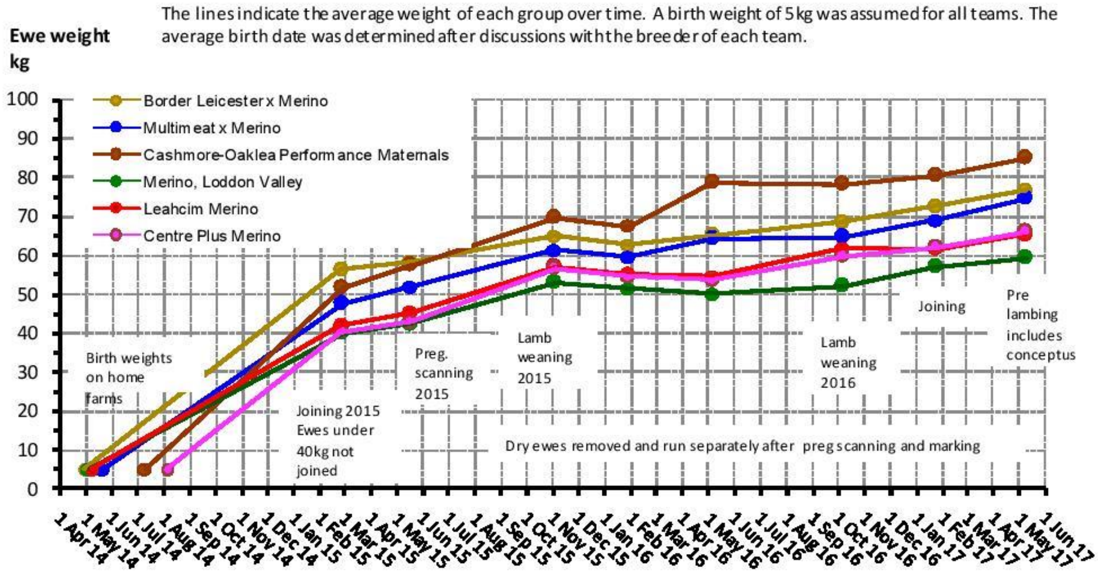
Breed type	***Background***
Border Leicester x Merino Crossbred ewes	The most common prime lamb mother in the Elmore and northern districts. The time ewes were sourced with the help of the Victorian State Committee of the Australian Border Leicester Association.
Multimeat x Merino Crossbred ewes	Multimeats are a composite breed based on White Suffolk genetics. They supply rams that are DNA tested to carry 2 copies of the Booroola fertility gene. These rams breed first cross ewes from Merinos. The first cross lambs carry one copy of the gene. Multimeat breeders claim these ewes consistently rear 30% more lambs than normal crossbreds.
Cashmore-Oaklea Performance Maternals (Composites)	Cashmore-Oaklea Performance Maternals (Composites) have bred sheep from the following breeds: Coopworth, Border Leicester, East Friesian, Finn, SAMM (South African Meat Merino), Texel, Poll Dorset, White Suffolk, Merino, Corridale, NZ Romney and Perendale. They have achieved a reputation for good lambing percentages that are assisted by the hybrid vigour between the various breeds.
Merino Loddon Valley	The second most common prime lamb mother in the Elmore and northern districts. Rams are predominantly Peppin genetics but some studs contain some South Australian Merino genetics. Ewes were sourced with the help of the Loddon Valley Stud Merino Breeders Association from three properties in northern Victoria that use Loddon Valley Merino rams.
Leahcim Merinos	Leahcim is a South Australian Merino stud that has a long history of selecting a meat type merino with low wrinkle, bare points, no need to mules but with high quality wool. The stud sells 700 rams annually and many studs and commercial flocks in Victoria are introducing Leahcim genetics.
Centre Plus Merino	Centre Plus is a group breeding scheme and registered Merino stud and in Central West NSW that aims to produce dual purpose sheep. This Merino strain has achieved a good reputation from the high dual purpose and fine wool index ASBVs on the Sheep Genetics Australia website.

The Elmore Field Days sheep trials committee need to script read results before they are passed on to the media by participating groups. They are concerned that selected information may be used out of context without presenting the full situation and results. When breed groups use the results in their promotions it is expected the Elmore Field Days will be acknowledged.

Summary to December 2016

Ewe weight & condition score

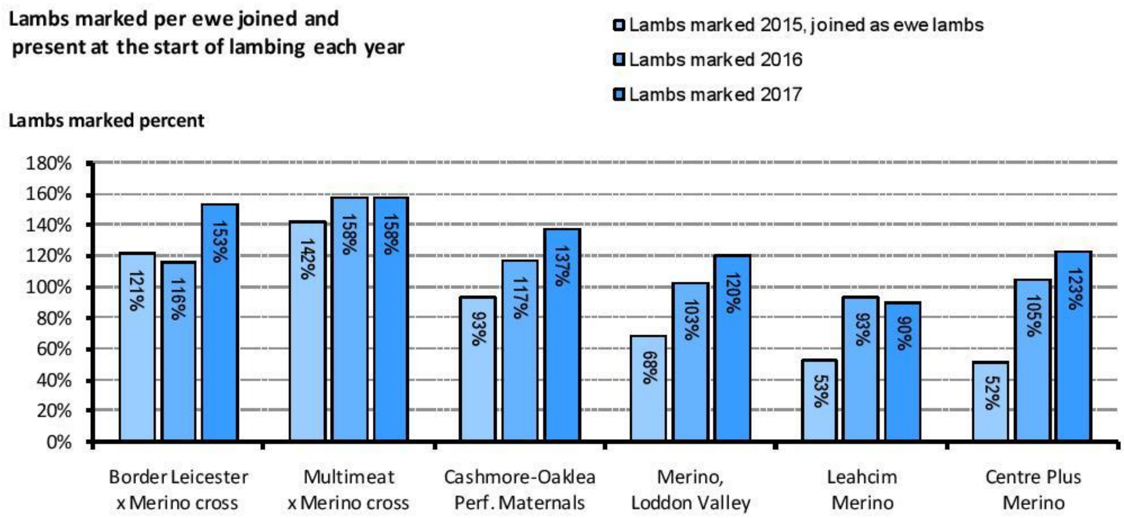
Ewe weights, fleece free, from birth on farms of origin and after arrival at Elmore

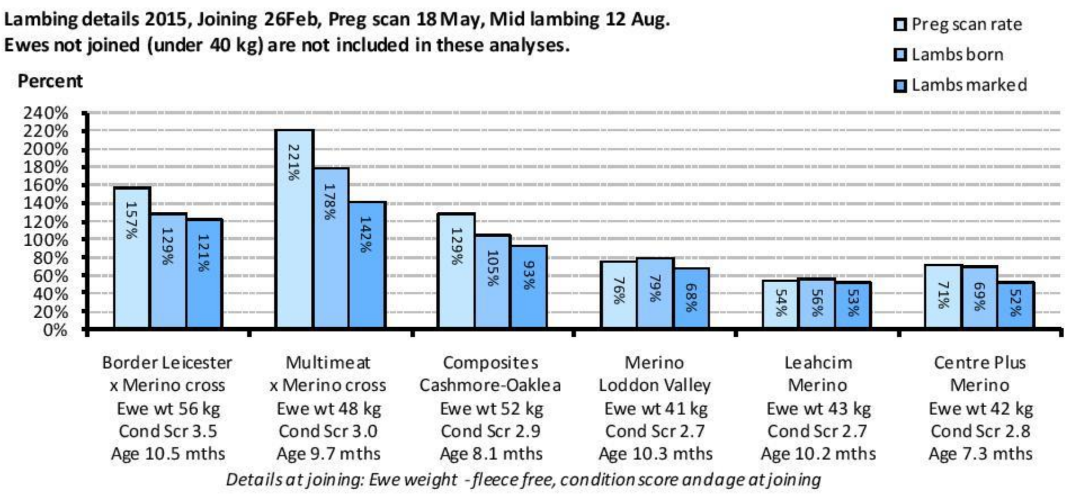


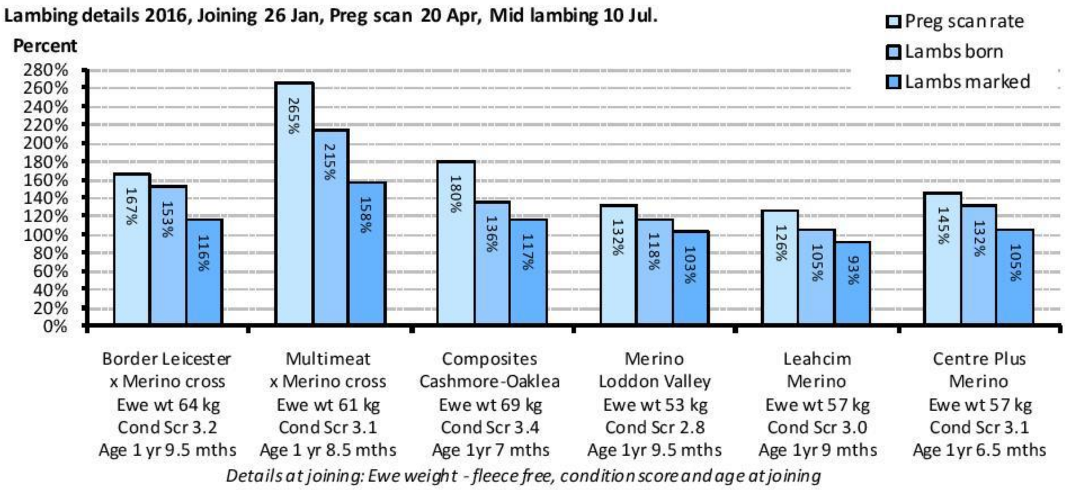
Ewe condition score over time

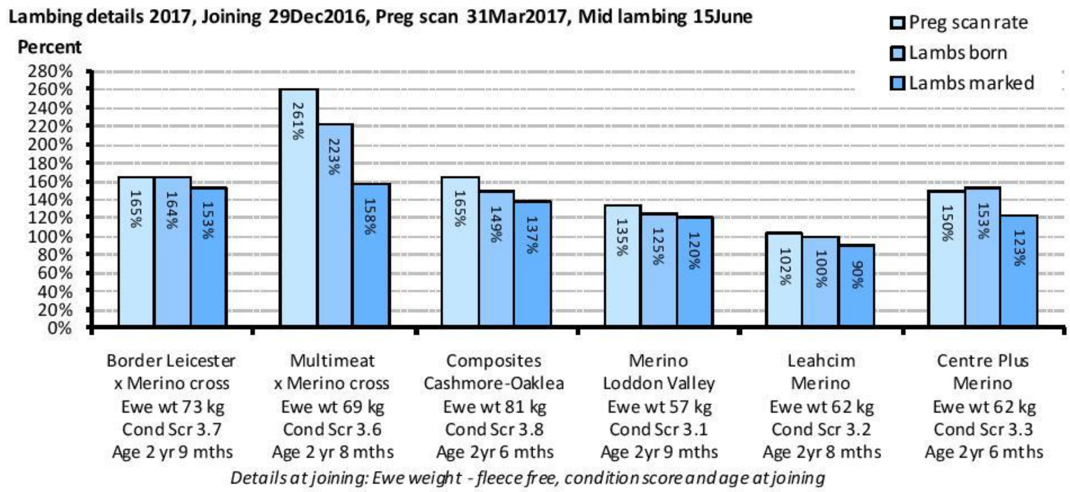
Date	Border Leicester x Merino	Multimeat x Merino	Cashmore-Oaklea Performance Maternals	Merino, Loddon Valley	Leahcim Merino	Centre Plus Merino
26 Feb 2015, joining	3.5	3.0	2.9	2.7	2.7	2.8
18 May 2015	4.0	3.8	3.8	3.2	3.2	3.1
3 Nov 2015	3.0	3.0	3.1	2.8	3.0	3.2
28 Jan 2016, joining	3.2	3.1	3.4	2.8	3.0	3.1
6 May 2016	2.9	3.0	3.9	1.7	1.8	2.0
7 Oct 2016	3.5	3.2	3.6	3.0	3.2	3.0
23 Jan 2017	3.7	3.6	3.8	3.1	3.1	3.3
9 May 2017	4.0	3.8	4.0	3.2	3.2	3.4

Lambing details









Comment of embryo mortality

During lambing dead lambs were picked up at least daily, this was added to the number of lambs marked to calculate the number of lambs born. It is obvious there are some large differences between the pregnancy scanning rate and the number of lambs born. This suggests embryo-foetal mortality may be a factor in some breeds – assuming the pregnancy scanning and estimates of lambs born were accurate. All ewes received the full Coopers Campylobacter vaccine program, a New Zealand developed vaccine to prevent abortions caused by the Campylobacter bacteria, mainly a problem in young ewes. An experienced veterinarian suggested the cause as higher embryo-foetal mortality in ewes carrying multiple births may be due to competition for a limited supply of nutrients from the placenta by multiple embryos-foetuses.

Pregnancy scanning 20April2016

Team	Border Leicester x Merino	Multimeat x Merino	Composites Cashmore-Oaklea	Merino, Loddon Valley	Leahcim Merino	Centre Plus Merino
Ewe age at mid joining, for 2016 joining. Age in months	21.5	20.7	19.1	21.3	21.2	18.3
Average ewe weight at joining, on 28Jan2016 includes 16 weeks wool, kg	64.4	61.2	69	53.2	56.7	56.6
Ewes scanned as dry	3%	3%	11%	5%	5%	5%
Ewes scanned as carrying singles	32%	13%	8%	58%	66%	49%
Ewes scanned as carrying twins	63%	25%	69%	38%	27%	41%
Ewes scanned as carrying triplets	3%	35%	11%		2%	5%
Ewes scanned as carrying quads		25%				
Pregnancy scanning. Number of foetus per ewe	167%	265%	180%	132%	126%	145%

Pregnancy scanning 30March2017

Team	Border Leicester x Merino	Multimeat x Merino	Composites Cashmore-Oaklea	Merino, Loddon Valley	Leahcim Merino	Centre Plus Merino
Ewe age at mid joining, for 2016 joining. Age in months	2 yr 9 mths	2 yr 8 mths	2 yr 6 mths	2 yr 9 mths	2 yr 8 mths	2 yr 6 mths
Average ewe weight at joining, on 23Jan2017, fleece free	72.6	69.1	80.6	57.0	61.6	62.1
Ewes scanned as dry	0%	3%	0%	3%	13%	3%
Ewes scanned as carrying singles	38%	8%	43%	59%	72%	45%
Ewes scanned as carrying twins	59%	33%	49%	38%	15%	52%
Ewes scanned as carrying triplets	3%	38%	9%			
Ewes scanned as carrying quads		20%				
Pregnancy scanning. Number of foetus per ewe	165%	261%	165%	135%	102%	150%

Preg scanning results 2016 & 2017 by team and breed

Breed	Team	Ewe Wt 28Jan2016, Fleece free kg	Ewe Condition Score 28Jan2016	Pregnancy scanning. Number of foetus per ewe 20Apr2016	Ewe Wt 23Jan2017, Fleece free kg	Ewe Condition Score 23Jan2017	Pregnancy scanning. Number of foetus per ewe 31Mar2017
BorderLeicester x Merino cross	1	64.3	3.4	1.73	75.1	3.88	1.73
	2	61.1	3.0	1.43	72.8	3.69	1.69
	3	62.7	3.2	1.85	69.8	3.54	1.54
Breed average		**62.7**	**3.2**	**1.67**	72.6	3.70	1.65
Multimeat x Merino cross	4	63.3	3.0	3.00	72.6	3.77	3.14
	5	54.5	3.3	2.25	64.6	3.55	1.75
	6	61.1	3.1	2.71	70.1	3.57	2.93
Breed average		**59.7**	**3.1**	**2.65**	69.1	3.63	2.61
Cashmore-Oaklea Performance Maternals	7	66.0	3.1	1.92	82.1	3.68	1.71
	8	70.7	3.5	1.70	79.0	3.82	1.67
	9	66.1	3.6	1.77	80.6	3.88	1.58
Breed average		**67.6**	**3.4**	**1.80**	80.6	3.79	1.65
Merino LoddonValley	10	48.5	3.0	1.31	53.8	3.08	1.46
	11	54.0	2.9	1.36	59.2	3.11	1.43
	12	51.8	2.5	1.31	58.0	3.08	1.15
Breed average		**51.4**	**2.8**	**1.32**	57.0	3.09	1.35
Leahcim Merino	13	51.7	2.9	1.08	58.2	3.13	1.00
	14	57.6	3.0	1.64	65.9	3.32	1.07
	15	55.6	3.0	1.07	60.6	3.00	1.00
Breed average		**54.9**	**3.0**	**1.26**	61.6	3.15	1.02
CentrePlus Merino	16	57.3	3.3	1.64	64.5	3.38	1.54
	17	53.6	3.0	1.08	61.4	3.21	1.31
	18	53.2	2.9	1.64	60.6	3.25	1.64
Breed average		**54.7**	**3.1**	**1.45**	62.1	3.28	1.50

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