final report

Project code: B.PRS.0509

Prepared by: Leo Cummins

SOUTH WEST PRIME LAMB GROUP Inc

Date published: 30 April 2008

ISBN: 9781741914368

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

.

Effect of using high & low EBV sires on growth and muscling in lambs.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

SOUTH WEST PRIME LAMB GROUP Inc. A0031362J
~Production~Marketing~Profit~

Final Report

Effect of using high & low EBV sires on growth and muscling in lambs.

PIRD 05/V03

SWPLG Inc. would like to thank the following:

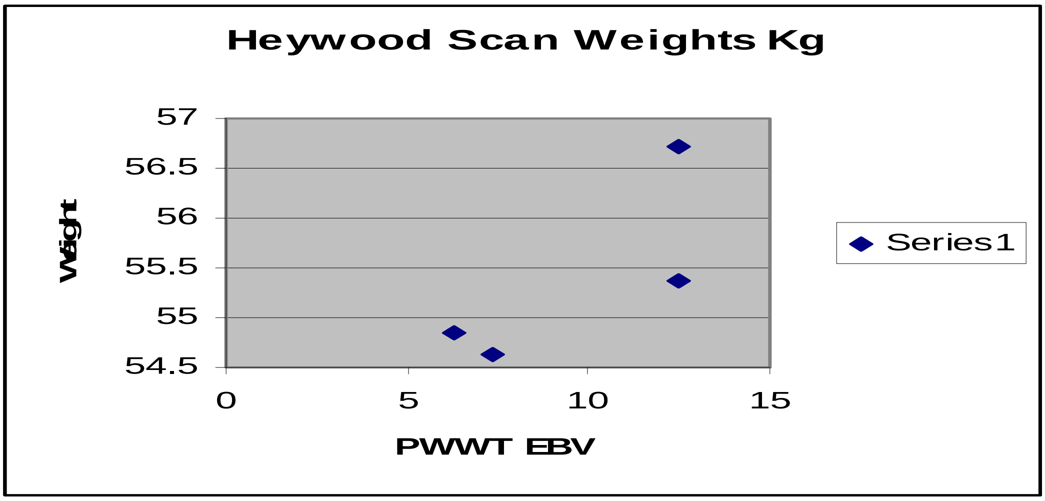
- Meat & Livestock Australia for funding the project through the PIRD program
- Dr Leo Cummins for co-ordinating the project
- David & Colleen Gordon, Howard & Gabrielle McCorkell, Trevor Smith & Matt Tonissen for running trials on their respective properties, and John Keiller & Ewan Price for supplying rams to two of the sites.

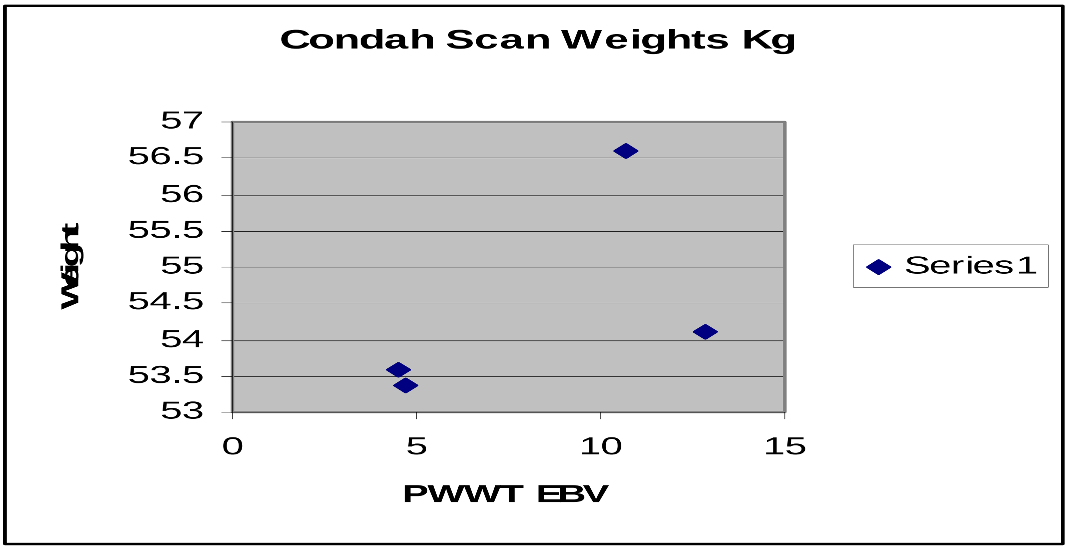
South West Prime Lamb Group Progeny Test PIRD 2006/2007

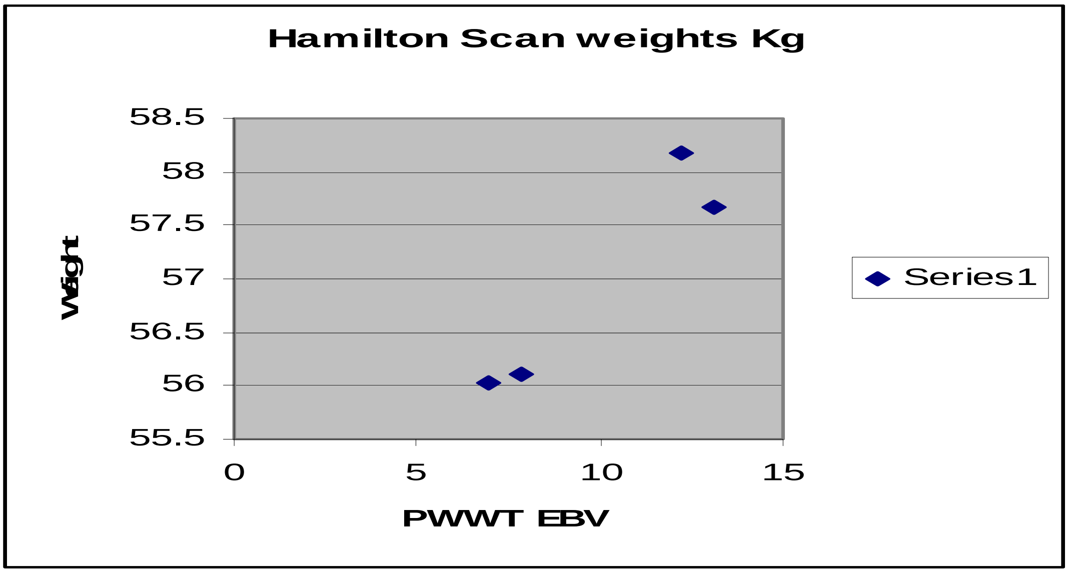
What we were trying to do:
We aimed to examine how to use Australian Sheep Breeding Values (formerly Lambplan EBVs) to choose sires to maximize the commercial returns to our members for prime lamb production.
We were particularly keen to look at the importance of growth and muscle EBVs in terminal sires
.
How we did it:
Three farms each made available approximately 120 crossbred ewes for mating in February 2006. On each farm these ewes were randomly colour tagged into 4 groups. They were synchronized using progestagen sponges and naturally mated with selected groups of terminal sires over a period of one and a half days. The ewes were pregnancy scanned in April and those which had conceived to this synchronized mating retained. When these ewes lambed the lambs were tagged at birth and identified with their mothers and litter size and sex recorded. The ewes and lambs were grown out and the first weighting was in November 2006 just prior to a field day held by the group. The lambs were then weaned and grown on until the owners felt they were ready to slaughter. At this point the lambs were weighed and ultrasound scanned (fat and muscle depth) and then they were sold. On one farm the lambs were Viascanned at slaughter. The final liveweights were taken between December 2006 and January 2007.
The rams used on each farm came from a single pedigreed Lambplan flock. In one farm these were from a neighbour of the owner of the ewe flock and on the other 2 they came from pedigreed flocks of the same owner. The rams were chosen as 4 contrasting teams for Post Weaning growth and muscle EBVs. From the available rams in each flock, we chose 4 teams of rams, the first which had both High Growth and High Muscle, the second with High Growth and Low Muscle, the third with Low Growth and High Muscle and the forth with Low Growth and Low Muscle. Each team of rams consisted of between 2 to 5 rams. The majority of these rams were young 2005 drop animals.

Results
The results were subject to a standard statistical analysis carried out by Mr. G Kearney to predict the adjusted means. We were interested in the effects of sire group mean EBV on those measure which might have a commercial impact on the value of the lamb.
It was clear that both sex and litter size effects were large and need to be taken into account before we could consider the effects of these EBVs.
The main results where we selected sires for either Growth or Muscle are shown in the following 6 figures. It seems fairly clear that the differences in EBVs are having the expected effects on progeny performance.

In other words selecting sires for extra growth EBVs result in higher sale weights. Using Post weaning weight EBV tended to overestimate the differences in actual weaning weight but was much closer to the differences recorded presale. Selecting sires for increased eyemuscle depth resulted in lambs with increased eyemuscle areas.


Heywood Scan Weights Kg
57
56.5
56
55.5
55
54.5
Weight
0
5
10
15
PWWT EBV
Series1

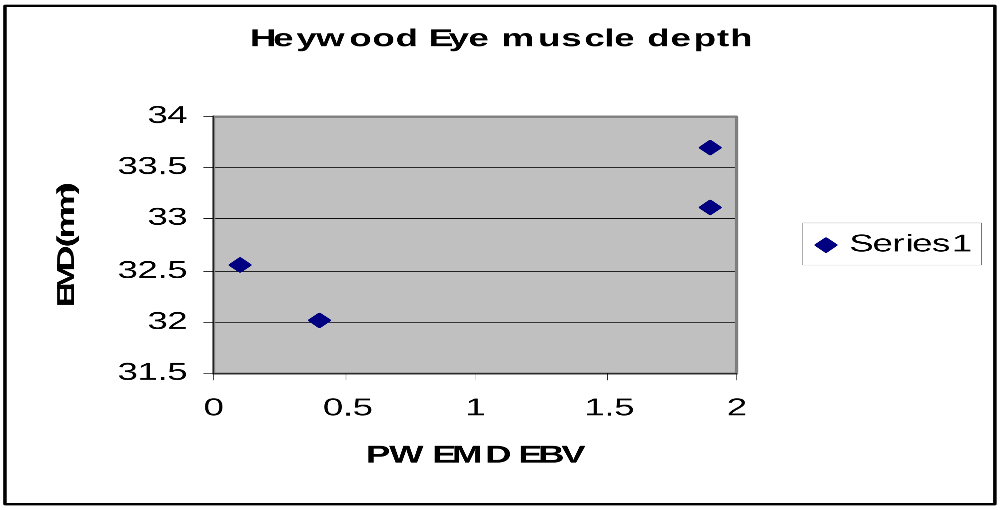

Condah Scan Weights Kg
57
56.5
56
55.5
55
54.5
54
53.5
53
Weight
0
5
10
15
PWWT EBV
Series1

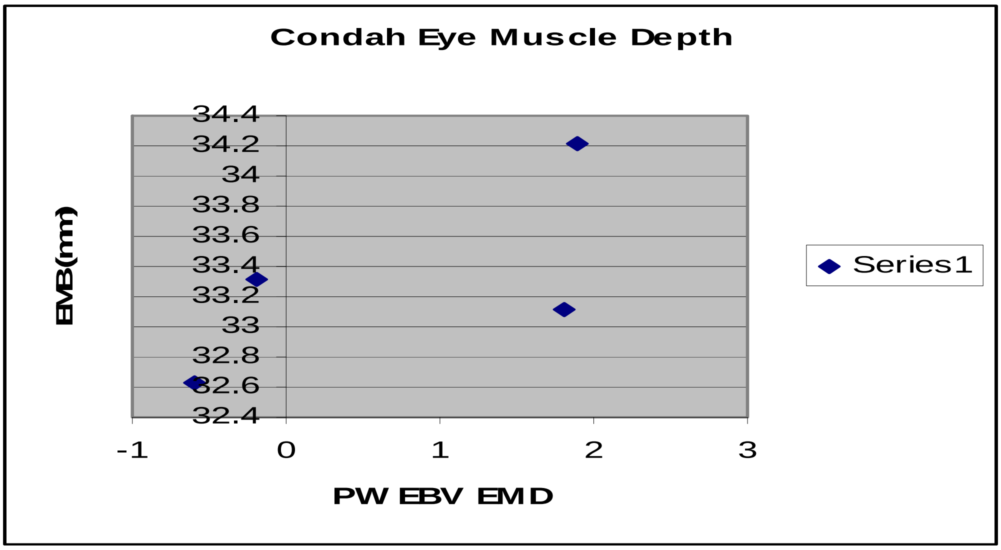

Hamilton Scan weights Kg
58.5
58
57.5
57
56.5
56
55.5
Weight
0
5
10
15
PWWT EBV
Series1

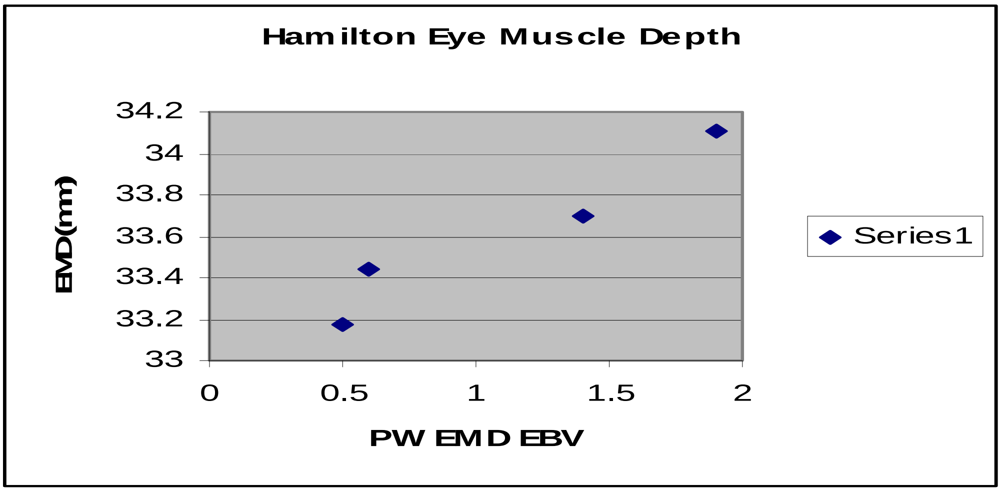
This series of figures shows the Scanning weights (Pre-sale weights). All six groups sired by High Growth EBV rams were heavier than their mates sired by Low Growth EBV sires and on each farm this difference was statistically significant although there is quite a bit of variation between some of the teams. Averaged over the 3 farms a difference of 6 Kg in PWWT EBV resulted in difference of 1.7 Kg in preslaughter liveweight. These slaughter ages are about one month earlier than the age used in the definition of Post Weaning for Lambplan, so this may be a reason that the difference observed is slightly less than the 3Kg expected.

It is worth considering that 1.7 kg of extra liveweight should translate to about 0.8 extra kg of carcass weight. If this is valued at $3.50 per kg then each lamb is worth $2.80 more. If a ram sires 60 lambs per year and stays in service for 3 years then the value of the extra lamb sold is $504 during his lifetime. This of course is an oversimplification of the true situation but gives good indication of the importance of buying better rams.

Averaged over the 3 farms, wether lambs weighed 3 Kg more than ewe lambs and singles averaged 5 Kg more than twins.



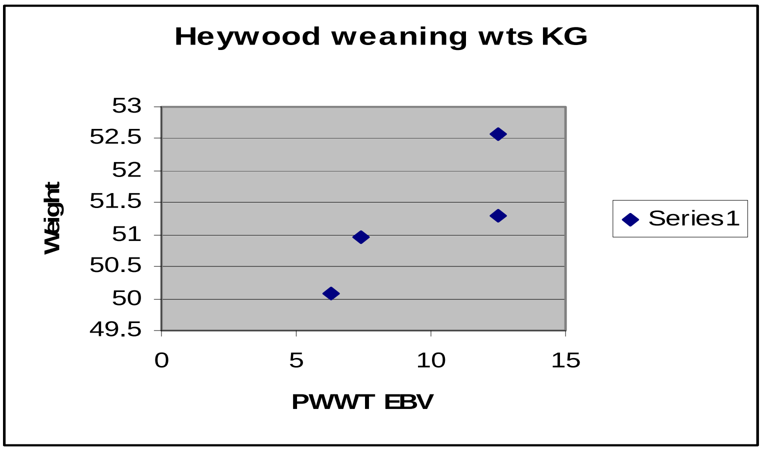


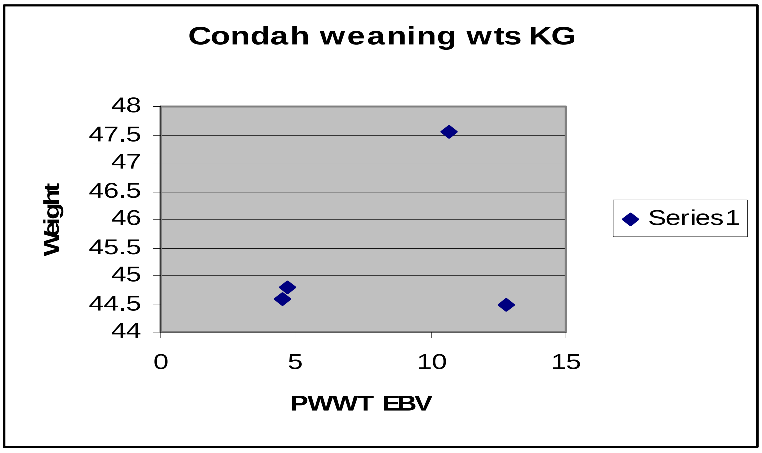


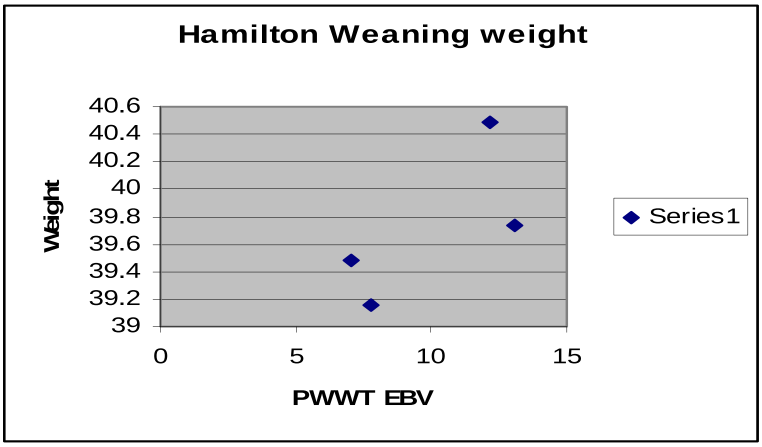
In the above series of graphs 5 of the 6 groups of lambs sired by the High muscle rams had bigger eyemuscles. In the Heywood and Condah groups the High growth High Muscle group had the largest eyemuscle area. Averaged over the 3 farms, a difference of 1.7 mm in EBV resulted in a difference of 0.8 mm in eye muscle depth.

In most cases at the moment Eye muscle depth does not have a direct monetary value at sale, but the consumers would like animals with large muscles and the optimum amount of fat

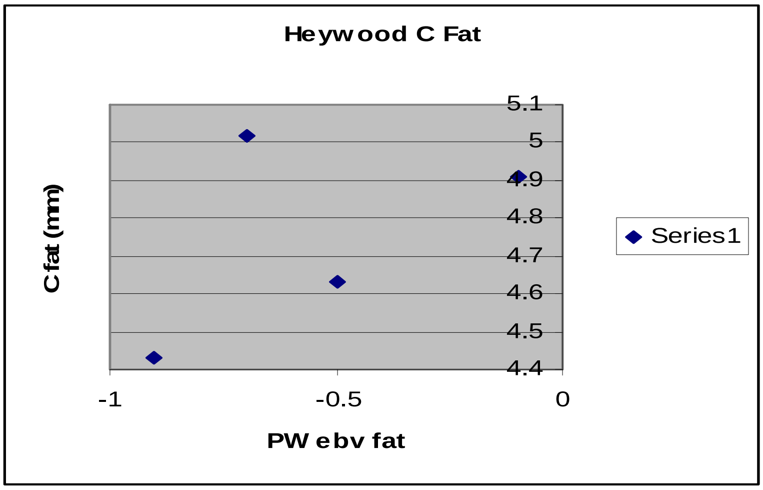
Further Detailed Results

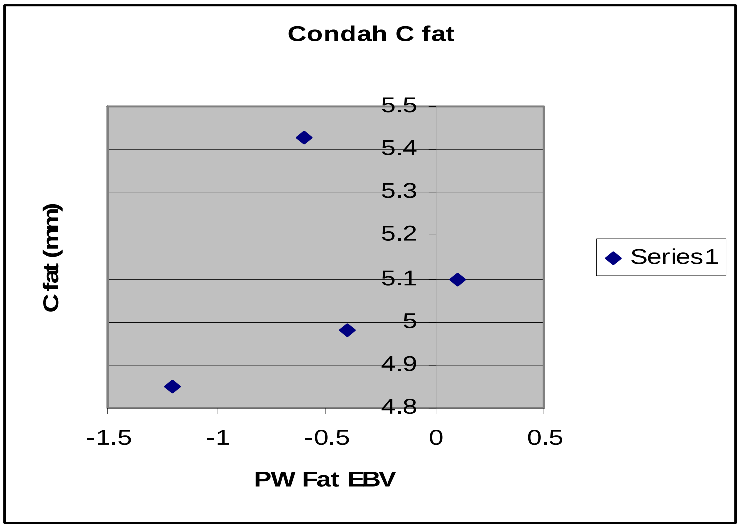


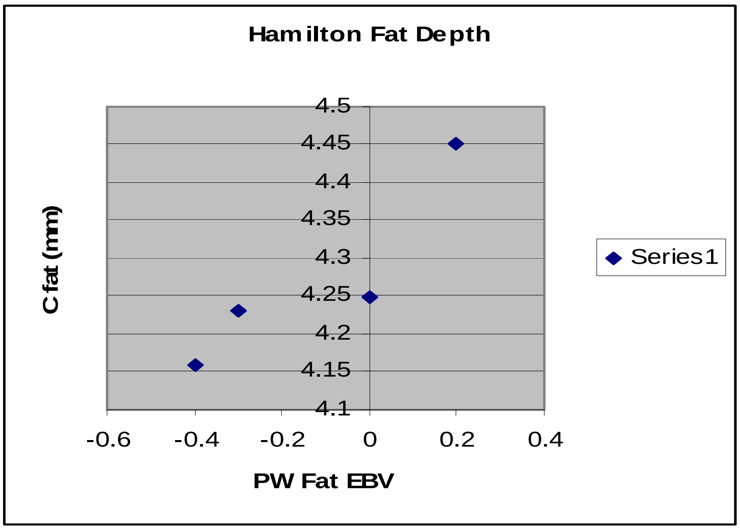




This series of figures shows the weaning weights at each site plotted against the mean PWWT EBV of the ram teams. Five out of the six groups sired by High Growth EBV rams were heavier than their mates which had been sired by low growth EBV sires. For the Heywood group this difference was statistically significant. Averaged over the 3 farms a difference of 6Kg in PWWT resulted in 1.2 Kg of extra weaning weight. In looking at this it is worth remembering that PWWT EBV have been calculated for animals at 7.5 months of age and using them to predict differences at weaning are likely to be imprecise. Nevertheless selection for growth at one age is likely to some impact on growth at other ages. If you get paid for differences at weaning then weaning age EBVs are likely to be more useful than the more commonly quoted Post Weaning EBVs.







In this series of figures it is clear the EBV for fat is influencing the fat depth of the lambs at scanning time in spite of the fact that Fat depth was not considered when choosing the ram teams. The GR fat measurement used in abattoirs is approximately 3 times the C measurement

Tables of Results

Table 1 Weaning Weights (Kg) from Heywood (n = 121)

Main Effects					difference	SED
Sex	E	49.57	W	52.88	-3.31	0.74
Birth Type	S	54.23	T	48.22	6.01	0.79
Growth	H	51.94	L	50.52	1.42	0.72
Interaction						
Muscle		H		L		
Growth	H	51.31		52.57	-1.26	
	L	50.95		50.09	0.86	
Difference		0.36		2.48		1.03
Average effect of Muscle		51.13		51.33		

SED = standard error of difference (very approximately differences have to be greater than SED x 2 to be statistically significant)
E = ewe, W = wether, S = single, T = twin, H = high and L = low.

The effect of growth was significant (P = 0.04) with high EBVs for growth having heavier lambs and the interaction term approached significance (p = 0.07). On average muscle EBVs were having little effect on weaning weight; however within the low muscle group high growth animals were heavier than low growth animals.

Table 2 Scan Weights (Kg) from Heywood (n = 105)

Main Effects					difference	SED
Sex	E	54.04	W	56.73	-2.65	0.81
Birth Type	S	57.89	T	52.89	5.0	0.85
Growth	H	56.04	L	54.74	1.3	0.80
Interaction						
Muscle		H		L		
Growth	H	55.37		56.71	-1.34	
	L	54.62		54.85	-0.23	
Difference		0.75		1.86		1.15
Average effect of Muscle		55.00		55.78		

The effect of growth EBV approached significance (P = 0.08). There seemed to be no effect of muscle EBV on this measure of growth

Table 3 Fat Depth (C mm) from Heywood (n = 121)

Main Effects					difference	SED
Sex	E	4.90	W	4.60	0.3	0.16
Birth Type	S	5.06	T	4.44	0.62	0.17
Growth	H	4.53	L	4.97	-0.44	0.16
Interaction						
Muscle		H		L		
Growth	H	4.63		4.43	0.2	
	L	4.91		5.02	-0.11	
Difference		-0.28		-0.59		0.23
Average effect of Muscle		4.77		4.73		

Growth EBVs did have a significant effect (P = 0.001) on fat depth, with the low growth group being slightly fatter than the high growth group although this effect is quite small amounting to a difference at the GR site of about ¼ of a fat score.

Table 4 Eye Muscle Depth (mm) from Heywood (n = 121)

Main Effects					difference	SED
Sex	E	32.93	W	32.75	0.18	0.35
Birth Type	S	33.67	T	32.01	1.66	0.37
Growth	H	32.85	L	32.83	0.02	0.34
Interaction						
Muscle		H		L		
Growth	H	33.69		32.02	1.67	
	L	33.11		32.55	0.56	
Difference		0.58		-0.53		0.48
Average effect of Muscle		33.4		32.29		

In this case the growth EBV has not influenced the muscle depth measurement however there is a significant growth by muscle interaction (P <0.001). In the high growth group those from the high muscle EBV group had larger muscles.

Table 5 Carcass Weights (Kg) from Heywood (n= 105)

Main Effects					difference	SED
Sex	E	23.32	W	24.67	1.35	0.39
Birth Type	S	25.67	T	22.32	3.35	0.40
Growth	H	24.30	L	23.69	0.61	0.38
Interaction						
Muscle		H		L		
Growth	H	24.16		24.43	-0.27	
	L	23.97		23.42	0.55	
Difference		0.19		1.01		0.55
Average effect of Muscle		24.07		23.93		

The EBV for growth did not have a statistically significant effect on carcass weight however the difference was in the right direction with carcasses from high growth EBV sires weighing an average of 0.6 kg more than those from the low growth EBV sires. There was a significant growth x muscle interaction (P = 0.017) with the lightest carcass weights in the low growth low muscle EBV group.

Table 6 Slaughter Dressing Percentage (%) from Heywood (N = 105)

Main Effects					difference	SED
Sex	E	43.11	W	43.44	0.33	0.36
Birth Type	S	44.34	T	42.22	2.12	0.38
Growth	H	43.31	L	43.24	0.07	0.36
Interaction						
Muscle		H		L		
Growth	H	43.57		43.06	0.51	
	L	43.84		42.65	1.19	
Difference		0.27		0.41		0.51
Average effect of Muscle		43.71		42.86		

The main effect of the growth EBVs did not influence dressing % but there was a significant interaction between growth and muscle and carcasses with the lowest dressing % came from the low growth low muscle EBV group.

Table 7 Viascan yield (% lean meat in the carcass) from Heywood (n = 105)

Main Effects					difference	SED
Sex	E	52.97	W	53.54	-0.57	0.46
Birth Type	S	52.10	T	54.40	-2.3	0.48
Growth	H	53.20	L	53.31	0.11	0.46
Interaction						
Muscle		H		L		
Growth	H	52.99		53.41	-0.42	
	L	53.11		53.51	-0.4	
Difference		-0.12		-0.10		0.65
Average effect of Muscle		53.05		53.46		

Birth type was the only factor significantly effecting Viascan yield. It is worth pointing out that Viascan yield is dependant on both fat and muscle and this relationship is complex. For example looking at this phenotypic data without reference to the sire groups, there is a negative correlation (-0.5) between the viascan yield and the fat scan. Surprisingly there is also a negative correlation (-0.36) between viascan yield and muscle depth but the complicating factor is that there is positive correlation (+0.35) between muscle depth and fat depth. Thus increased muscle will result in increased lean meat yield only after fat depth has been accounted for.

Table 8 Weaning weight (Kg) from Condah (n = 94)

Main Effects					difference	SED
Sex	E	43.93	W	46.79	-2.86	0.90
Birth Type	S	47.88	T	42.83	5.05	1.05
Growth	H	46.01	L	44.70	1.31	0.87
Interaction						
Muscle		H		L		
Growth	H	47.54		44.49	3.05	
	L	44.59		44.81	-0.22	
Difference		2.95		-0.32		1.25
Average effect of Muscle		46.07		44.65		

The lambs sired by the high growth EBVs had heavier weaning weights but this was not statistically significant. The interaction between growth and muscle EBV approached significance (P = 0.08), in the high growth group those from the high muscle sires had higher weaning weights

Table 9 Scanning weights at Condah (n = 94)

Main Effects					difference	SED
Sex	E	52.84	W	55.99	-3.15	1.01
Birth Type	S	57.0	T	51.83	5.17	1.19
Growth	H	55.36	L	53.47	1.89	0.98
Interaction						
Muscle		H		L		
Growth	H	56.61		54.11	2.5	
	L	53.57		53.37	0.2	
Difference		3.04		0.74		1.41
Average effect of Muscle		55.09		53.74		

The lambs sired by the high growth EBV rams had heavier (P = 0.05) liveweights at scanning (pre-slaughter liveweight)

Table 10 Fat depth (C mm) at Condah (n = 94)

Main Effects					difference	SED
Sex	E	4.96	W	5.22	-0.26	0.17
Birth Type	S	5.59	T	4.60	0.99	0.19
Growth	H	5.14	L	5.04	0.1	0.16
Interaction						
Muscle		H		L		
Growth	H	5.43		4.85	0.58	
	L	5.10		4.98	0.12	
Difference		0.33		-0.13		0.23
Average effect of Muscle		5.27		4.92		

The main effects of growth were not significant, but the growth x muscle interaction approached statistical significance (P = 0.06). In the high growth group, those from the high muscle group tended to be fatter

Table 11 Eyemuscle depth (mm) at Condah (n = 94)

Main Effects					difference	SED
Sex	E	33.02	W	33.63	-0.61	0.41
Birth Type	S	34.10	T	32.54	1.56	0.47
Growth	H	33.43	L	33.22	0.21	0.39
Interaction						
Muscle		H		L		
Growth	H	34.22		32.63	1.59	
	L	33.11		33.32	0.21	
Difference		1.11		0.69		0.56
Average effect of Muscle		33.67		32.98		

The main effects of growth were not significant, but the growth x muscle interaction was significant (P = 0.035). The high muscle group animals in the high growth group had a greater eyemuscle depth.

Table 12 Weaning weight (Kg) at Hamilton (n = 119)

Main Effects					difference	SED
Sex	E	38.93	W	40.50	-1.57	0.74
Birth Type	S	42.37	T	37.05	5.32	0.79
Growth	H	40.11	L	39.32	0.79	0.77
Interaction						
Muscle		H		L		
Growth	H	40.48		39.74	0.74	
	L	39.15		39.48	0.33	
Difference		1.33		0.26		1.09
Average effect of Muscle		39.82		39.61		

Weaning weight in these Hamilton lambs was not significantly influenced by growth or muscle EBVs

Table 13 Scan weight (Kg) at Hamilton (n = 110)

Main Effects					difference	SED
Sex	E	55.37	W	58.60	-3.23	1.15
Birth Type	S	59.85	T	54.12	5.73	1.25
Growth	H	57.91	L	56.06	1.85	1.21
Interaction						
Muscle		H		L		
Growth	H	58.17		57.66	0.51	
	L	56.10		56.03	0.07	
Difference		2.07		1.63		1.71
Average effect of Muscle		57.14		56.85		

The preslaughter weight of these Hamilton lambs was effected by the growth EBVs (P = 0.059)

Table 14 Fat depth (C mm) at Hamilton (n=110)

Main Effects					difference	SED
Sex	E	4.37	W	4.18	0.19	0.18
Birth Type	S	4.55	T	4.0	0.55	0.2
Growth	H	4.20	L	4.35	-0.15	0.19
Interaction						
Muscle		H		L		
Growth	H	4.23		4.16	0.07	
	L	4.45		4.25	0.2	
Difference		-0.22		-0.09		0.23
Average effect of Muscle		4.34		4.21		

The EBVs for growth and muscle did not significantly influence fat depth in these lambs

Table 15 Eyemuscle depth (mm) at Hamilton (n= 110)

Main Effects					difference	SED
Sex	E	33.66	W	33.55	0.11	0.51
Birth Type	S	34.31	T	32.90	1.41	0.55
Growth	H	33.57	L	33.64	-0.07	0.53
Interaction						
Muscle		H		L		
Growth	H	33.70		33.44	0.26	
	L	34.11		33.17	0.94	
Difference		0.41		0.27		0.75
Average effect of Muscle		33.91		33.31		

The EBVs for growth and muscle did not significantly eyemuscle depth in these lambs

Statistics

The Method used here was REML (Restricted Maximum Likelihood). This has the advantage that it takes into account the fact that there are different numbers of animals in the different treatment cells (ie. Different degrees of freedom due to differences in conception rates, litter size, deaths etc) and then estimates the mean and variance. The initial model took each factor and considered a linear model to look at the main effects and the interactions between these which influenced the outcome. Examination of this data showed that most of the interactions were not significantly influencing the outcome and it was possible to consider a reduced model to best estimate the effects we were looking for.

Typically the final model took the form:

Weaning weight = Constant + Growth + Growth*X*Muscle +Sex + Birth type.

Growth in this procedure allows us to see if the EBVs for growth were having an effect on weaning weight, while the interaction term Growth*X*Muscle allowed us to look how

the EBVs for muscle were having an effect either directly or in some combination with growth .
Generally statistical significance was claimed when the numbers showed the chance of that particular outcome was less than 5%.

Composition of the Ram teams used

Heywood

		EBVs		
Group	Ram ID	Pwwt	Pfat	PEMD
High Growth High Muscle	90/05	12.7	-0.4	2.1
	111/05	12.2	-0.02	1.9
	151/05	12.5	-1	1.7
Average HGHM		*12.5*	*-0.5*	*1.9*
High Growth Low Muscle	35/05	12.6	-0.8	0.2
	38/05	12.7	-1	0.4
	79/05	12.2	-0.8	0.5
Average HGLM		*12.5*	*-0.9*	*0.4*
Low Growth High Muscle	39/05	7.8	0	2.1
	40/05	7.3	0	1.6
	52/05	6.2	-0.2	1.8
	27/05	8.3	-0.2	1.9
Average LGHM		*7.4*	*-0.1*	*1.9*
Low Growth Low muscle	17/05	4.5	-1.1	-0.9
	80/05	7.1	-0.5	0.5
	129/05	7.4	-0.5	0.3
	11/05	6.3	-0.8	0.6
Average LGLM		*6.3*	*-0.7*	*0.1*

Condah

Group	Ram ID	Pwwt	Pfat	PEMD
High Growth High Muscle	54/05	9.9	-1.04	2.49
	133/05	11.2	-0.21	1.45
	148/05	10.9	-0.65	1.69
Average HGHM		*10.7*	*-0.6*	*1.9*
High Growth Low Muscle	122/05	11.4	-0.92	-0.49
	235/05	12.5	-0.93	-0.39
	255/05	14.6	-1.65	-0.81
Average HGLM		*12.8*	*-1.2*	*-0.6*
Low Growth High Muscle	360/04	4.9	-0.1	1.76
	407/04	4.1	0.27	1.87
Average LGHM		*4.5*	*0.1*	*1.8*
Low Growth Low Muscle	266/04	4.1	-0.42	-0.12
	420/04	5.3	-0.38	-0.34
Average LGLM		*4.7*	*-0.4*	*-0.2*

Hamilton

Group	Ram ID	Pwwt	Pfat	PEMD
High Growth High Muscle	73/05	11.2	-0.7	1.24
	378/05	11.4	0.2	1.24
	87/05	12.9	0	1.24
	385/05	15.2	-0.5	1.23
	84/05	10.4	-0.5	1.86
Average HGHM		*12.2*	*-0.3*	*1.4*
High Growth Low Muscle	352/05	12.2	-0.3	0.6
	71/05	13.1	-0.2	0.6
	351/05	13.6	-0.7	0.6
	68/05	14.8	-0.6	0.7
	68/05	14.8	-0.6	0.7
	395/05	12	0	0.6
Average HGLM		*13.1*	*-0.4*	*0.6*
Low Growth High Muscle	119/05	4.9	0.7	2.2
	374/05	8.8	0.1	2.3
	373/05	9.2	0	2.1
	399/05	8.1	0	1.4
	358/05	0	1.4	
Average LGHM		*7.8*	*0.2*	*1.9*
Low Growth Low muscle	105/05	5.4	0.3	0.6
	107/05	6.2	0.1	0.5
	346/05	7.4	0	0.6
	392/05	8.9	-0.5	0.4
Average LGLM		*7.0*	*-0.03*	*0.5*

Using teams of young rams with similar breeding values should tend to compensate for the reduced breeding value accuracy which would be available from older rams with progeny information as well. This assumes that all members of the team contribute to the progeny

Lambplan Information and Definitions

An EBV (Estimated Breeding Value) is the best estimate of an animal’s genetic merit. To calculate an EBV consideration is given to the animals own performance for the particular trait, also for its performance in genetically related traits and the performance of an animals relatives for those traits and adjustments are made for known environmental differences affecting those traits.

Lambplan provides a large number of EBVs with specific ages and definitions. Lambplan also puts together a range of Indexes where the EBVs are combined to produce a single overall measure of genetic merit. When looking EBVs and Indexes it is important to understand exactly what has been included and make sure that these are appropriate for your production system.

Half the genes in any lamb come from the sire and half come from the dam. This means that if we mate a random group of ewes to a sire with a Post weaning weight EBV of +10 Kg compared with another sire of +2 Kg we would expect the progeny of the first sire to be 4 Kg heavier than those of the second sire.

Weaning Wt EBV estimates the genetic differences between animals in Liveweight at 100 days of age
Post Weaning weight EBV estimates the genetic differences between animals in Liveweight at 225 days of age
Post weaning fat estimates the genetic differences in GR fat depth at 45 KG liveweight
Post weaning EMD estimates the genetic difference in EMD at the C site at 45 Kg liveweight.

Sheep Genetics Australia has a series of pamphlets and guides giving further explanations.

Problems encountered during the course of the trial.
Data from one farm has been excluded from this report. There were several problems on this farm which were not the fault of the owners or their staff. Firstly, one team of rams failed to get any lambs, Secondly as project co-coordinator , I allowed them not to collect litter size data, in retrospect not a good decision with such small groups of lambs, Thirdly for part of the postweaning phase these lambs seemed to grow quite poorly due to the prevailing drought conditions and perhaps a failure to adapt to grain self feeding and Finally and most importantly there seemed to be a severe discrepancy between weights recorded for the trial and weights recorded soon afterwards when some of these lambs went to market suggesting a technical problem with the weighing itself.
On another farm lambs were sent to Castricums for viascan results but due to our inexperience at the works this data was not obtained.

Report prepared by Leo Cummins 28/8/07