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Lean meat yield and eating quality producer demonstration sites – South Australian sites facilitation

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Abstract

Three Producer Demonstration Sites (PDS) were undertaken in South Australia to demonstrate the value of research breeding values (RBVs) for lean meat yield intramuscular fat and tenderness (shear force) in prime lamb and Merino production systems. Ewes were artificially inseminated with semen from Poll Dorset, White Suffolk and Merino rams selected to have divergent RBVs for the key traits. Ewes were managed to lifetime ewe targets and achieved excellent lamb survival rates (at least 85% lambs marked to lambs scanned). Lambs were individually identified with electronic tags and weighed at monthly intervals. Lambs were finished according to normal on-farm practices and processed at three plants.

Data collected from these PDS will be aggregated with data from other sites and analysed under the national coordination project, B.SCC.0144, to determine the value of RBVs for LMY and eating quality traits to ram breeders, lamb producers and processors.

Executive summary

This project is providing data to the MLA project B.SCC.0144 - Proof of Concept of Lean Meat Yield and Eating Quality Producer Demonstration Sites. The overarching purpose of these projects is to deliver “proof of concept” for lean meat, eating quality and human health attributes within major lamb and sheep meat supply chains by facilitating, empowering and developing a common focus and normal trading mechanisms on these future key industry profit drivers right along the supply chain.

Twenty Producer Demonstration Sites were established to demonstrate the impact new research breeding values (RBVs) for lean meat yield (LMY) and eating quality, particularly intramuscular fat (IMF) and shear force (SF5), will have on lamb production along the supply chain. Three of these sites were in South Australia.

Ewes inseminated with semen from Poll Dorset, White Suffolk or Merino rams with extreme RBVs for LMY, IMF and SF5 were managed according to Lifetime Ewe Management recommendations on three PDS in South Australia. One of the sites had poor conception rate and only 72 lambs were produced from 300 ewes mated. The remaining two sites marked 268 crossbred lambs from 300 ewes mated and 311 male Merino lambs from 600 ewes mated. The lambs were weighed monthly until target slaughter specifications were achieved. The lambs were processed through three supply chains/processors. Sufficient lambs were produced from two sites to provide carcase and eating quality data to determine the value of RBVs along the supply chain. Data collected from these PDS will be analysed in B.SCC.0144 to determine the value of RBVs for LMY and eating quality traits to ram breeders, lamb producers and processors.

Understanding of the value of LMY and EQ along the lamb supply chain has been boosted by the involvement of the producers hosting the sites in the processing and measurement of their lambs carcases. In addition over 100 producers attended information sessions/workshops associated with the three SA PDS to increase their awareness of the value of LMY and EQ to the lamb supply chain.

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1 Background

The aim of this project is to deliver “proof of concept” for lean meat, eating quality and human health attributes within major lamb and sheep meat supply chains by facilitating, empowering and developing a common focus and normal trading mechanisms on these future key industry profit drivers right along the supply chain. From the Sheep Genomics Program and the Information Nucleus Flock of the Sheep CRC, Poll Dorset, White Suffolk and Merino sires have been identified that have significant differences in research breeding values (RBVs) for dressing percent, lean meat yield (LMY) and eating quality, particularly intramuscular fat (IMF) and shear force (SF5). Proof of concept Producer Demonstration Sites were established to demonstrate the impact these new RBVs will have on lamb production along the supply chain.

Twenty Producer Demonstration Sites (PDS) were established across Australia involving 8 sires (2 high and 2 Low by 2 traits) per site, with the target of producing 200 lambs for measurement & processing and allowing 80 lambs for eating quality determination. The data from each site will be aggregated for analysis, validation of the RBVs and used in major communications programs with Sheep Genetics, MLA and the Sheep CRC.

The data will contribute to the overall outcomes of the LMY & EQ Proof of Concept project (B.SCC.0144), which include:

1. Determining the value of 6 or more new research breeding values for ram breeders, lamb producers & processors at 20-30 sites.
2. Developing suitable measurement technology and feedback mechanism for these breeding values at processing.
3. Initiating a common focus and foster the development of normal trading mechanisms including potential Value Based Trading on these future key industry profit drivers right along the supply chain.

This project encompasses the three PDS located in South Australia.

2 Project objectives

1. To professionally and efficiently co-ordinate and oversight Producer Demonstration Sites to ensure the approved key activities are achieved, activities are aligned and integrated and all measurement, monitoring and evaluation is carried out according to the project plan.
2. To ensure that rigorous timely measurement occurs on all animals and that they reach target slaughter specifications.
3. To ensure the ewes are run in accordance with Lifetime Ewe Management (LTEM) targets.
4. To ensure 20-50 producers are actively engaged per site.
5. To coordinate up to 3 field days / workshops per site.

3 Methodology

Three producers in South Australia agreed to host producer demonstrations sites. All producers managed the ewes to LTEM targets at mating and through pregnancy. Ewes were condition scored prior to AI and light ewes were removed from the flock. Subsamples of ewes (30-50) were condition scored at scanning and marking to monitor ewe condition.

Each of the three sites prepared ewes for a two day artificial insemination (AI) program - PD05 in November 2012, PD06 in January and PD19 in February, 2013. Commercial AI operators were engaged to undertake the process. White Suffolk x Merino ewes at PD05 (N=300) and composite ewes at PD06 (N=300) were inseminated with semen from terminal sires (Poll Dorset and White Suffolk). Merino ewes (N=600) at PD19 were inseminated with semen from Merino rams. Rams were selected for divergent RBVs for LMY, IMF and SF5. Sheep Genetics sourced all of the semen and arranged delivery to the AI operators. Where possible, sires were used on both days of the AI program, however, due to delays in obtaining semen, this was not possible for two sires at PD05 and one sire at PD06. Sires were given equal opportunity with ewes randomised for weight and CS.

Pregnancy scanning was undertaken by commercial scanning operators approximately 60-70 days after the AI program at each site, to identify ewes carrying single, twins or triplets to AI rams. Ewes were split into single bearing and multiple bearing mobs at all sites at scanning. The ewes remained in these mobs through lambing in order to ascertain the birth type of the lambs. Lambs were tagged with electronic tags and visual identification tags prior to combining lambing mobs two weeks after the completion of lambing (PD05) or at marking (PD06 & PD19). A small blood samples was collected from the ear of each lamb at marking and sent to a commercial provider for parentage testing (sire only). Lambs were weighed at monthly intervals from marking until slaughter. A final liveweight was recorded after a curfew period, prior to loading onto trucks for slaughter.

Animal use in the project was approved by the PIRSA Animal Ethics Committee (PIRSA AEC 04/12).

4 Results and discussion

4.1 Ewe performance

As per LTEM guidelines, average ewe condition scores (CS) were recorded at mating, scanning, and marking (Table 1). The successful management of ewes to achieve LTEM targets is reflected in the survival rates of the lambs (Table 2).

Table 1: Ewe breed and ewe condition scores at mating, scanning and marking.

Site	*Ewe breed*	*Mating*	*Scanning*	*Marking*
PD05	First cross (WSxMo)	4.3	3.9	3.4
PD06	Composite	3.4	2.9	2.4
PD19	Merino	3.5	3.4	2.9

Condition scores were recorded for approximately 50 ewes as a representation of the entire mob.

Pregnancy and conception rates were variable across the three sites (Table 2). There appeared to be a high level of anoestrus occurring in PD05 (White Suffolk x

Merino ewes), resulting in only 25% lambs born to ewes mated. Ewes were inseminated in mid-November at PD05 however no obvious anoestrus was reported by the AI operator. Nevertheless, it is recommended that seasonal ewes involved in research programs utilising AI procedures are not inseminated until after day-length begins to decrease.

The pregnancy rate of 66% ewes pregnant to ewes inseminated at PD06 is similar to that reported in the Sheep CRC IN (Geenty *et al.* 2014). Conception at the Merino site (PD19) was excellent (Table 2) and exceeded that reported elsewhere. Lamb survival was excellent across all three SA sites from conception to marking and from marking to weaning (Table 2).

Table 2. Number of ewes inseminated (AI) and scanned pregnant, number of foetus scanned and number of lambs marked and weaned.

Site	*PD05*		*PD06*		*PD19*	
	N	%	N	%	N	%
N ewes AI	300		300		600	
N ewes pregnant	153[a]	-	199	66%	478	80%
N foetus @ scanning	254[a]	-	308	102%	689	115%
Lambs marked	72	24%	268	87%	311 [#]	89%
Lambs weaned	72	100%	264	99%	299 [#]	96%

[a]Includes back-up ram progeny, misidentified as AI lambs; [#]Males only

At PD05, all ewes were maintained on dry pasture until 14th February, 2013 (scanning) when the multiple bearing ewes were introduced into a lucerne paddock. Single bearing ewes remained on dry pasture until 4th April after which they went onto lucerne pasture prior to lambing. Lambing occurred between 16th and 25th April, 2013, with all ewes lambing on lucerne and clover (1100kgDM/ha) in separate mobs according to litter size. Unfortunately, many of the ewes that were scanned in lamb to the AI rams failed to lamb within this time frame, with a distinct break of approximately a week between the end of AI lambing and the start of back-up lambing. After back-up lambs were removed from the mob, there were only 73 lambs to AI rams (44 twins and 29 singles). The parentage tests revealed an even spread of lambs across sires, indicating that semen quality is unlikely to have been the cause of the low conception rates.

At PD06, the ewes were split into singles and multiples at scanning and the dry paddock feed was supplemented with barley and silage. Lambing occurred between 14th and 24th June, 2013. Weather was relatively mild during the lambing period and there were few lamb or ewe losses. Single-bearing ewes lambed in a paddock containing 900kgDM/ha and the twin lambing paddock contained 1300kgDM/ha. Lambs were marked and weighed on the 17th July with 87% lamb survival (Table 2). At marking, ewes and lambs remained in the twin and single mobs and were grazing 60 – 70% clover and annual grasses. Lambs were weaned on 10th October 2013.

Singles and multiples at PD19 were split at scanning, with multiples getting fed more than the single bearing ewes. Lambing occurred between 7th and 15th July, 2013. While there was some inclement weather during lambing, the lambing paddocks had sufficient shelter such that there were minimal ewe and lamb losses (Figure 1). Indeed, lamb numbers at marking on 27th August showed exceptional survival of single (98%) and twin (83%) mobs. Data (weights, parentage tests) was only recorded for males, as females were not followed through to slaughter. Lambs were vaccinated and drenched at weaning and were shorn in early January.

Figure 1. Twin lambing paddock at PD19.

4.2 Lamb growth

Lambs at PD05 were marked in mid-May and weighed on 14th June 2013 and again on 18th July and 15th August (Appendix 1). These lambs were not weaned and were sold as suckers (Figure 2).

Figure 2. August lamb weighing at PD05

From weaning, PD06 lambs went onto bean stubbles as one mob until the 26th November, 2013 when the first draft of lambs (>43kg empty liveweight) were sent to slaughter. The remaining lambs were finished on irrigated lucerne pasture until slaughter on the 21st January, 2014.

The Merino lambs (PD19) were grown on lucerne from weaning until 1st April, when all lambs over 38kg (n=165) entered the feedlot and began a diet of ad lib sheep pellets and hay. The remaining lambs (<38kg; n=129) returned to lucerne pasture until 28th April when they also entered the feedlot and received the same diet.

The first draft of PD05 lambs had an average growth rate of 360g/d from 92d of age until 134 days of age when they were slaughtered (Table 3; Fig. 3a). Lambs from PD06 grew at 306g/d from marking to weaning (Figure 4) and 236g/d from weaning until slaughter at 159d of age (Table 3; Fig. 3b). Merino lambs from PD19 grew at slower rates, which includes the loss of wool weight at shearing (approximately Day 180). In the feedlot, the Merino lambs grew at an average rate of 160g/d. Not surprisingly, the second draft of lambs across all sites grew at much slower rates (red points in Fig 3a, b & c).

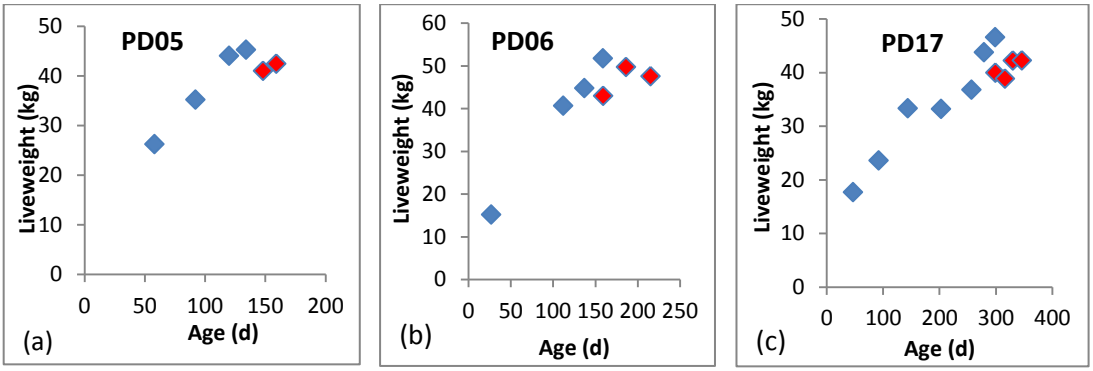

Figure 3. Growth of lambs at (a) PD05, (b) PD06 and (c) PD19.

A proportion of lambs from each site (Table 4) did not meet target pre-slaughter weights in time to be slaughtered with their contemporaries (too light lambs; Table 3). In addition, as only 200 lambs were required for carcase measurement, some heavier lambs from sire groups in PD06 that had sufficient progeny for LMY & EQ measurement were not measured, hence the average liveweight of the too light lambs from PD06 is heavier than at the other two sites.

Table 3: Weaning weight, post weaning weight and pre-slaughter weights (PSWT1 first draft; PSWT2 second draft) at each of the three Producer Demonstration Sites in South Australia.

Site	*PD05*		*PD06*		*PD19*	
	Age	Wt	Age	kg	Age	kg
Weaning	92d*	35.2kg	112d	40.6kg	92d	22.3kg
Growth mark to wean		264g/d		306g/d		125g/d
Final common wt	120d*	44.0kg	137d	44.8kg	299d	37.9kg
Growth from wean		315g/d		167g/d		75g/d
PSWT 1	134d*	45.3kg	159d	51.7kg	299d	46.6kg
Growth from wean		360g/d		236g/d		98g/d
PSWT 2	159d*	42.5kg	215d	47.6kg	346d	42.3kg
Growth from wean		110g/d		68g/d		54g/d
Too light	-	24.4kg	-	43.9kg	-	31.3kg

*Lambs not weaned, sold as suckers, therefore PD05 growth rates are from marking.

Figure 3. Weaned lambs at PD06.

4.3 Lamb slaughter

At PD05, lambs were yarded and drafted off their mothers on 28th August, 2013 (132 days of age). The first draft of lambs contained 72% of the mob (Table 4). Lambs were weighed 19h after yarding and transported to Thomas Foods International (TFI), Murray Bridge. Lambs were killed at approximately 9pm on the 30th August, 55h after initial yarding. The remaining lambs (n=19) were drafted off ewes, weighed after 16h curfew on 12 September 2013, and transported to Thomas Foods International (TFI), Murray Bridge, for slaughter.

Table 4: Number and percentage of lambs killed in the first and second draft, light lambs and lambs lost at each of the three Producer Demonstration Sites in South Australia.

Site	*PD05*		*PD06*		*PD19*	
	N	%	N	%	N	%
First draft lambs	52	72%	126	47%	117	39%
Second draft lambs	18	25%	79	30%	165 *	37%/18% *
Light lambs	1	1%	55	21%	8	3%
Lambs lost	1	1%	5	2%	9	3%

*110 Domestic / 55 light export

All PD06 lambs were yarded at 4pm 26th November, 2013 and curfewed over night for 17h prior to weighing. Lambs were drafted into two groups, with those ready for slaughter (PSWT>43kg; 43% of the mob; Table 4) remaining in the yards until 1pm when they were transported to JBS Swift Bordertown, where they arrived at 3:30pm and were killed the following morning (42h curfew). The second draft of lambs was yarded at 8am 20th January, 2014. Lambs were weighed the following morning at 7am and then immediately transported to the abattoir for slaughter on the 22nd January (50h curfew).

The first draft of Merino lambs (n=117; 39%) from PD19 were yarded 11am 5th May, weighed after a 21hr curfew on 6th May 2014 prior to being transported for processing at TFI Murray Bridge on the 7th May. The second draft of lambs were yarded on 21st June 2014, weighed after 19hr on 22nd June 2014 prior to being transported for processing to Frewstalls on the 23rd June (42h curfew). The majority of the remaining lambs were sent for slaughter as light export lambs (14-18kg cwt) or for the domestic trade. Therefore the second draft of lambs contained lambs as light as 34kg empty weight. The light export lambs consisted of 18% of the total lamb draft and 37% of the lambs achieved domestic trade weights (Table 4).

All data has been collected and submitted to the National Coordinator for analysis in B.SCC.0144.

4.4 Field Days

Two field days formally showcased the SA LMY & EQ PDS project. Information about the project was presented at the South East Prime Livestock Achievers Sticky Beak Day on 26th September 2013 and at the McKillop Sheep Producers Forum on 30th July 2014. A third field day was planned to be held on PD19, however due to the failure to collect slaughter measurements from the first draft of lambs, this was combined with the McKillop Sheep Producers Forum. The Sticky Beak Day was attended by 30-40 producers, along with 6-10 livestock agents and a similar number of service providers. Over 70 people attended the McKillop Sheep Producers Forum held at Naracoorte Town Hall. Approximately 50 of the attendees were producers, approximately 5-8 attendees were secondary school students and the balance were service producers (Elders, Landmark, private consultants and Biosecurity SA).

The producers hosting the LMY & EQ PDS have been advocates for the project. For example updates about the project were provided by the host of PD05 to the LTEM group he is a participant with. The LMY & EQ PDS ewes were assessed as part of the LTEM activities.

4.5 Relationships with Supply chain / processor

Relationships were developed with four supply chains – JBS (Bordertown), Thomas Foods International (Murray Bridge), Woolworths and Frewstalls (Stawell).

Work teams were coordinated for in-plant sample collection. Producers from PD06 and PD19 participated in carcase measurement and sample collection from their lambs. The producers spent time with key personnel at the plants and were provided with an in-depth understanding of the processing logistics.

5 Acknowledgements

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6 Bibliography

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7 Appendices

Summary of key dates and raw liveweight data from three SA producer demonstration sites – PD05, PD06 & PD19

PD05	**Date**	**Age (d)**	**Count**	**Min (kg)**	**Max (kg)**	**Ave. (kg)**
AI	19/20 Nov 2012		300			
Scanning	14/02/2013		300			
DOB	17/04/2013		73			
MWT	14/06/2013	58	72	16.5	36.0	26.2
WWT	18/07/2013	92	72	18.1	50.8	35.2
EPWT1	15/08/2013	120	72	19.7	60.0	44.0
EPWT2	12/09/2013	148	18	24.4	47.0	41.1
PSWT1	29/08/2013	134	52	39.5	56.2	45.3
PSWT2	23/09/2013	159	18	35.0	47.2	42.5
PD06						
AI	21/22 Jan 2013		300			
Scanning	21/04/2013					
DOB	20/06/2013	0	268			
MWT	17/07/2013	27	267	7.2	22.2	15.2
WWT	10/10/2013	112	264	22.6	59.8	40.6
EPWT1	4/11/2013	137	263	27.0	61.0	44.8
EPWT2	26/11/2013	159	139	32.3	49.6	43.0
PWWT1	23/12/2013	186	137	38.8	57.8	49.8
PSWT1	26/11/2013	159	124	43.0	64.4	51.8
PSWT2	21/01/2014	215	79	41.7	55.0	47.6
PD19						
AI	11/12 Feb 2013		600			
Scanning	26/04/2013		600			
DOB	11/07/2013	0	311			
MWT	27/08/2013	47	308	10.2	26.1	17.7
WWT	11/10/2013	92	299	12.7	35.1	23.6
EPWT1	2/12/2013	144	295	20.6	47.2	33.3
EPWT2	30/01/2014	203	280	14.3	48.5	33.2
PWWT1	25/03/2014	257	282	22.7	49.6	36.8
PWWT2	16/04/2014	279	159	34.7	60.8	43.8
PWWT3	6/05/2014	299	289	25.5	61.2	40.0
PWWT4	23/05/2014	316	170	22.3	51.2	38.9
PWWT6	6/06/2014	330	172	28.4	53.8	42.3
PSWT1	6/05/2014	299	117	38.9	61.2	46.6
PSWT2	22/06/2014	346	165	28.3	52.2	42.3