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LMY and EQ Producer Demonstration Sites – Victoria sites facilitation

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Abstract

Seven Producer Demonstration Sites (PDS) were undertaken in Victoria to demonstrate the value of research breeding values (RBVs) for lean meat yield, intramuscular fat and 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 Management targets and achieved reasonable lamb survival rates (ranging from 72% to 107% 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 four 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 (PDS) 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. Seven of these sites were in Victoria.

Depending on the ewe breed, ewes inseminated with semen from terminal sires (Poll Dorset or White Suffolk) or Merino rams with divergent RBVs for LMY, IMF and SF5 were managed according to Lifetime Ewe Management recommendations on seven PDS in Victoria including 2 pilot demonstration sites in 2012 and 5 sites in 2013.

All demonstration sites had good pregnancy rates (66% to 81%), each site marking in excess of the 200 lambs required to obtain sufficient data for each of the 8 sires assessed per site.

The lambs were weighed monthly until target slaughter specifications were achieved. The lambs were processed through four supply chains/processors. Sufficient lambs were produced from all 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 lamb’s carcases. In addition, over 300 producers attended information sessions/workshops associated with the seven Victorian 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 yield, 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 to have loin samples collected 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 seven PDS located in Victoria.

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

Seven producers in Victoria agreed to host producer demonstrations sites (PDS) over 2 consecutive years commencing in 2012 and 2013. In 2012 two sites (PD01 and PD02) commenced in SW Victoria as Phase 1 pilot PDS aiming to assess the methodology and concept of producer demonstration sites for LMY & EQ. Successful completion of these two PDS lead to Phase 2 and in 2013 a further 5 sites were established in Victoria, with two sites located in SW Victoria and three sites in NE Victoria (PD07, PD08, PD09, PD10 and PD20), along with an additional 13 sites established in SA, Tasmania, Western Australia and NSW.

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. Approximately 50 ewes were condition scored at pregnancy scanning and marking to monitor ewe condition.

Artificial Insemination:

Rams used at artificial insemination (AI) were selected for divergent RBVs for LMY, IMF and SF5. Sheep Genetics sourced all of the semen and arranged delivery to the AI operators.

Additional ewes were programmed at all sites to enable spares in the event a ewe was rejected by the AI technician. At all sites the artificial breeding services commented that the ewes were well prepared and cycling well. The AI program was professionally conducted with the ewes being carefully handled and immediately returned to pasture.

Two DEPI staff assisted with the AI program for each farm and were responsible for recording ewe and sire information as well as assisting producers to lift and remove ewes from cradles. AI was conducted on a single day for sites inseminating 300 ewes (PD07, PD08 and PD09, PD10) and over two days for PD01, PD02 and PD20 which inseminated 600 ewes. The same sires were used on both days of the AI program for these 3 sites. Back up rams were put with the ewes two weeks post AI for approximately five weeks (apart from PD08 who chose not to use back up rams). Condition score (CS) and feed on offer (FOO's) were measured and recorded around the AI date. Site and AI details for 2013 and 2014 are shown in Table 1.

Table 1. Phase 1 producer and AI details for LMY and EQ Producer Demonstration Sites

Site	***Sire Breed***	***Ewe Breed***	***No. ewes AI***	***Date AI***	***AI Contractor***
PD01	Terminal	Maternal composite	581	29-30/3/12	Genstock
PD02	Terminal	Maternal Composite	600	22-23/3/12	Brecon Breeders
PD07	Terminal	Maternal composite	299	6/02/2013	LBS
PD08	Terminal	Maternal composite	317	27/02/2013	LBS
PD09	Terminal	Coopworth	297	25/02/2013	Genstock
PD10	Terminal	Maternal composite	294	4/03/2013	Genstock
PD20	Merino	Merino	600	13-14/03/13	LBS

Ewes were individually identified with RFID tags and randomly allocated to eight different mating groups (75 ewes per sire). The ewe groups were inseminated with frozen semen from the 8 allocated White Suffolk or Poll Dorset terminal sires. These were the same sires as used in PD02 with the intention of using the wether progeny at both PD01 and PD02 sites.

PD01: There were 600, 4 and 5-year old composite ewes inseminated on 29th and 30th March 2012 which had been selected as those with the best condition score (average 3.2). The ewes have been supplemented with 100g/head/day of a bean and lentil mix prior to AI. As the green pasture increased the amount of beans and lentils fed was reduced.

PD02: A total of 600 3 year old composite ewes were presented for AI on 22nd and 23rd March 2012 to achieve 75 ewes per sire.

In addition, at both sites 2 rams per site from different studs belonging to the host producers were used to naturally mate 200 ewes. These ewes were used as a comparison to the project AI ewes and their lambs measured for lean meat yield (LMY) and eating quality (EQ) traits. These ewes were mated at the same time as the project ewes were inseminated and were run together up until lambing. The results from these additional lambs are not included in this report.

Fig. 1 Artificial insemination at PD01 (Left) and PD07 (Right)

In 2013 the methodology changed to 300 ewes for sites joining terminal sires, aiming for 38-40 ewes per sire group with both male and female progeny used for the project. There were 600 Merino ewes (75 per sire) inseminated to Merino sires at PD20, aiming to utilise the wether portion for the project.

Details of AI for 2013 producer sites are shown in Table 1 and as follows:

- 300 maternal composite ewes were programmed at PD10
- 320 Coopworth (PD09) and maternal composite (PD08) ewes were programmed (including some spares to buffer for any CIDR loss)
- 620 merino ewes were programmed at PD20
- 600 maternal composite (Texel x East Friesian x White Suffolk x Merino) ewes were synchronised for AI at PD07 but only 299 were inseminated. This occurred because of a change to the protocol after CIDR's had been pulled and PMSG administered to all 600 ewes. The remaining 301 ewes were then joined naturally.
- In addition, one of the owners (PD09) used his own Lamb Supreme ram which was naturally mated to an additional 50 ewes. These were lambed

down with the project ewes and lambs were slaughtered with the project lambs so lean meat yield and eating quality traits can be measured.

Pregnancy scanning was undertaken by commercial scanning operators approximately 80-100 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 at marking. In 2013 a small blood sample was collected from the ear of each lamb either at or close to marking and sent to a commercial provider for DNA parentage testing (sire only), apart from PD09 who tagged lambs at birth. Lambs were weighed at monthly intervals from marking until slaughter. A final live-weight off feed was recorded on the day of transporting and also after a curfew period, prior to loading onto trucks for slaughter.

Animal use in the project was approved by the DEPI Animal Ethics Committee (DEPI 2012-06 and DEPI 2012-29).

4 Results and discussion

4.1 Ewe performance

All producer demonstration site farms successfully completed their laparoscopic insemination (AI) programs in March 2012 or February and March, 2013. Additional ewes were programmed at all sites to enable spares in the event a ewe was rejected by the AI technician. As per LTEM guidelines, average ewe condition scores (CS) were recorded at mating, scanning, and weaning. Ewes were all in good condition score at AI and site CS averages ranged from 2.6 to 3.6, as shown in Table 2. The successful management of ewes to achieve LTEM targets is reflected in the survival rates of the lambs (Tables 3 and 4).

Table 2: Ewe breed and ewe condition scores at mating, pregnancy scanning and weaning

Site	***Ewe breed***	***Mating***	***Pregnancy Scanning***	***Weaning***
PD01	Maternal Composite	3.2	3.6	3.0
PD02	Maternal Composite	3.2	3.0	3.2
PD07	Maternal composite	3.1	3.3	-
PD08	Maternal composite	2.6	2.7	2.8 S 2.6 Tw
PD09	Coopworth	3.5	2.7	3.0
PD10	Maternal composite	3.6	2.7 S 2.8 Tw	2.8
PD20	Merino	2.9	2.9 S 2.8 Tw 2.5 Trip	-

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

PD01: There were 600 ewes with CS average 3.2, presented for AI on 29th and 30th March, of which 591 were suitable and inseminated. After AI, the ewes were divided into 2 equal mobs based on ewe condition and to match FOO. They were allocated to these respective paddocks from post AI through until pregnancy scanning. After scanning they were rotationally grazed. Supplementary feeding continued for 2

weeks following AI after which there has been adequate green pasture. Initially the mobs were set stocked and later they were rotationally grazed to maintain FOO at approximately 1,200 kg DM/ha. On the 17 May the FOO was estimated to be 1,300 kg DM/ha and of high digestibility

Prior to pregnancy scanning ewes were in excellent condition, assessed at CS 3.5 and estimated to have improved by up to 0.3 of a score since AI. At pregnancy scanning on the 4 July the CS was estimated to be 3.6. Ewes were in good condition throughout the spring time until weaning. They were regularly monitored and averaged CS 3.0, (range 2.7 to 3.5)

PD02: Ewes were in good health and condition at AI with an average CS of 3.2. A visit was made to the farm prior to pregnancy scanning to inspect the ewes. They were in good condition (CS 3.0) but were estimated to have lost 0.2 of a CS. The owner took appropriate action by drafting off the lower CS ewes and providing them with a higher level of nutrition through grain supplementation which continued into early winter until 15 days prior to lambing. The higher CS group was also fed wheat and the lower CS group received wheat and vetch hay. Pasture in the lambing paddocks was estimated on average to be 1,200 kg DM/ha. Ewes were in good condition throughout the spring time until weaning. They were regularly monitored and averaged CS 3.2 (range 2.7-4.0).

Pregnancy Scanning

Ewes were scanned for dry, single and multiples and AI and natural mated pregnancies. Ewes identified as dry and natural mated pregnancies were removed from the mob at scanning or at the pre-lambing draft.

A summary of reproduction results for PD01 and PD02 are shown in Table 3. Pregnancy scanning occurred at PD01 on the 4th of July with an excellent pregnancy rate of 81% ewes in lamb to AI sires and a reproduction rate of 142% for AI sires. At scanning for PD02 on the 7th July 2012, 69% were scanned in lamb to the AI sires, with an average reproduction rate for AI ewes of 106%.

Table 3. 2012: number of ewes inseminated (AI) and scanned pregnant, pregnancy %, number of foetus scanned, number and percentage of lambs marked and weaned to total ewes scanned and ewes scanned pregnant to AI

Site	***PD01***		***PD02***	
	N	**%**	**N**	**%**
N ewes AI	591		600	
N ewes pregnant to AI	443		413	
Pregnancy % to AI		81%		69%
N AI foetus @ scanning	843	142%	644	106%
Lambs marked	583	99%	446	74%
Lambs weaned	279*		203*	
% AI foetus to ewes pregnant		190%		156%
% Lamb marked to AI ewes pregnant		139%		108%
% Lamb weaned to AI ewes pregnant		135%*		101%*

* Males only

Fig. 2 Pregnancy scanning at PD07 8th May, 2013

Pregnancy scanning was completed during April and May for the 2014 sites. DEPI staff assisted with scanning and collection of reproduction data for each farm.

Ewe pregnancy rates to AI for individual 2014 sites ranged from 66% to 81% which are within industry standards, with PD10 achieving an exceptional pregnancy rate of 81%. Lambing percentages to AI ewes pregnant were predicted based on scanning results to range between 126% and 168% for the sites. Condition scores at pregnancy scanning were good showing a range of CS 2.8 to 3.5 averages for the five sites. Table 4 shows the reproduction summary for each site. Most sites had some ewes missing from AI which were assumed to have either lost tags, died or been drafted incorrectly.

Fig. 3 Triplet bearing ewes pre-lambing grazing oats at PD10, 16th July, 2013

Pregnancy rates for individual sires were good with ewes AI'd achieving 50% to 92% per sire, apart from one sire in PD09 that achieved only 24%.

Either at scanning or prior to lambing ewes from four sites was split into single and multiple mobs and nutritionally managed according to their mob pregnancy status. The other site (PD09) grazed ewes in one mob due to unavailability of paddocks to manage specific feeding and lambs were tagged at birth to record birth type.

Table 4. 2014: number of ewes inseminated (AI) and scanned pregnant, conception %, number of foetus scanned, number and percentage of lambs marked and weaned to total ewes scanned and ewes scanned pregnant to AI

Site	***PD07***		***PD08***		***PD09***		***PD10***		***PD20***	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
N ewes AI	299		317		297		294		600	
N ewes @ scanning*	297		311		297		288		589	
N ewes pregnant to AI	196		217		198		233		412 M&F 206 M	
Pregnancy % to AI		66%		70%		67%		81%		70%
N AI foetus @ scanning	304	102%	273	88%	333	112%	386	134%	615	104%
Lambs marked	257	86%	259	83%	254	86%	311	107%	212[#]	72%
Lambs weaned	242	81%	254	82%	248[†]	84%	284	99%	206[#]	70%
% AI foetus to ewes pregnant		155%		125%		168%		165%		149%
% Lamb marked to AI ewes pregnant		131%		119%		128%		133%		103%[#]
% Lamb weaned to AI ewes pregnant		123%		117%		125%		122%		100%[#]

[*] Conception calculated on number of ewes at scanning; [#]Males only; [†]Unweaned

Lambing, Marking and Weaning

DEPI staff visited sites pre lambing to determine condition scores and check AI ewe identification. Dates for lambing, marking and weaning shown in Table 5.

Table 5. Lambing, marking and weaning dates

Site	*Lambing dates*	*Marking date*	*Weaning dates*	*Weaning Day*
PD01	25/8–31/8/12	10-12/10/12	3-6/12/12	98d
PD02	13/8-22/8/12	1/10/12	19/11/12	93d
PD07	1/7–9/7/13	8/8/13*	7/10/13	94d
PD08	20/7-29/7/13	27/8/13*	1/11/13	100d
PD09	18/7-1/8/13	30/8/13	Lambs not weaned	0
PD10	25/7-8/8/13	S & Tw 28/08/13	S-18/11/13	S-109d
			Tw-12/11/13	Tw-103d
		Tr-9/09/13	Tr-21/11/13	Tr-112d
PD20	7/8-14/8	27/8/13*	29/12/13	134d

* DNA blood samples taken 27/8/13 PD07, 25/9/13 PD08, and 2/10/13 PD20.

All ewes were on adequate (2000+ kgDM/ha) good quantity green pasture prior to and throughout lambing. Multiple birth ewe mobs were given preference to higher quantity pasture and the triplet mob at PD10 provided with additional barley supplementation.

Ewes from PD01 commenced lambing 25th August and lambed in 8 separate paddocks to identify sire groups. There was a storm event early lambing which impacted on lamb survival with the number of lambs weaned to AI ewes pregnant being 135% from a potential 190% at pregnancy scanning. Lambs were tagged to identify their sires at marking after which all ewes and lambs were run together as one mob. Pasture in the lambing paddocks was estimated to be, on average, 1,400 kg DM/ha. Lambs were weaned on the 3rd, 4th and 6th of December onto 1200 kg DM/ha of rapidly deteriorating pasture and imprint fed 6 times by trail feeding prior to weaning.

Ewes started lambing at PD02 on the 13th August in 8 sire group paddocks. There was a severe weather event on the 17th and 18th August with over 50 mm of rain and a severe wind chill which resulted in dramatically reduced lamb survival from a potential 156% foetuses scanned to AI pregnant ewes to 101% lambs weaned for ewes pregnant to AI (Table 3). Lambs were tagged to identify their individual sire groups a week after completion of lambing and ewes and lambs were then run in one mob. There was abundant green feed from lambing through the spring, and feed on offer (FOO) between the range of 2000-2500kg DM/ha was recorded at marking on the 1st October. Lambs were weaned on the 19th of November onto adequate green pasture (>1500 kgDM/ha).

Lambing in 2014 commenced in winter with the first site commencing on July 1st and the last site completed lambing in mid-August. Four sites (PD07, PD08, PD10 and PD20) lambed ewes in single or multiple pregnancy mobs enabling birth type to be determined at marking. PD09 ewes lambed in one mob however lambs were tagged at birth and identified to their dam to enable identification of lamb birth status.

All 2014 sites reported a good lambing with PD07 and PD08 reporting milder weather than usual during lambing. PD20 experienced higher rainfall and colder weather than the other NE Victorian sites with some twin losses on the first day of lambing due to storms. PD09 and PD10 both reported good weather conditions over lambing. However, PD10 noted poor lamb survival in the triplet bearing mob.

Lamb survival from conception to weaning was variable but generally good across all 5 sites, with excellent results for PD08 which showed good lamb survival from conception to weaning (Table 4). Although PD20 lambed later in mid-August when better seasonal conditions are expected, the site experienced poorer seasonal conditions than those sites lambing in mid-winter, which is reflected in PD20 lower lamb survival from conception to marking.

DEPI staff assisted producers at lamb marking to identify lambs with EID tags and collect data. Lambs in 2014 were blood sampled at 4 sites using blood cards for DNA at marking or within 4 weeks post marking (PD07 lambs were sampled and weighed two weeks post marking as DNA cards were not available at marking time). After initial results were received, a follow up was required for 3 of the sites which each had several lambs identified as unknown sires. After the follow up results were obtained the majority of lambs were allocated a sire and those that were still unknown were removed from the project. DNA for parentage testing was not taken for PD09 as lambs were tagged at birth and identified to their dam.

Lambs were weaned from October to December at four sites, with PD09 processing their lambs as sucker lambs (Table 5).

PD07 lambs were marked 8/8/13 and the 1st weight taken 27/8/13 prior to weaning. Lambs were weighed and weaned 7/10/13 (94d) onto good quality pasture and achieved an excellent growth rate for all lambs in the mob from birth to weaning of 389 g/day. The first weight was taken at weaning for PD08 on 1/11/13 (100d) with an estimated 329 g/day from birth to weaning. PD10 lambs were run in 3 separate birth status mobs until weaning as they were boxed into larger mobs of singles, twins and triplets on the property. Lambs were weaned and weighed on 18/11/13 (singles 109d), 12/11/13 (twins 103d) and 21/11/13 (triplets 112d). PD20 Merino Lambs were weaned late on 29/12/13 (134d) when they were approximately 20 weeks of age with an estimated growth rate of 163 g/day.

Fig. 4 PD20 Merino lambs at DNA sampling, 2nd October, 2013

4.2 Lamb growth

Lamb liveweights and growth rates at each site are shown in Tables 6, 7 and 8.

Table 6: Weight and growth rate (g/day) from weaning to 1st weight post weaning at the two sites in Victoria, 2012

Site	***PD01***		***PD02***	
	Age	**Wt**	**Age**	**kg**
Weight at wean time	98d	38.4 kg	93d	32.0
Growth rate wean to 1st weight post wean		140 g/d		160 g/d

Table 7: Weaning weight or slaughter weight, post weaning weight and pre-slaughter weights (first draft) and growth rates (g/day) at each of the two 2013 sites in Victoria processing 1 draft only

Site	***PD09***		***PD10***	
	Age	**Wt**	**Age**	**Kg**
Weight at wean time	105d*	33.2 kg	109d	38.8
Growth rate birth to approx. wean time		269 g/d		
Growth wean to draft 1				96 g/d
Final common wt	133d	44.2 kg	132d	41.6
Growth birth to draft 1		295 g/d		
PSWT 1#	133d	46.0 kg	132d	43.9kg
Growth from birth		309 g/d		
Growth from wean				102 g/d

*Approx wean day as lambs not weaned and sold as suckers
Includes only data for lambs processed at PSWT 1, actual kill day for PD09 was 146d however only curfew weight was recorded

Table 8: Weaning weight, post weaning weight and pre-slaughter weights (PSWT1 first draft and PSWT2 second draft) and growth rates (g/day) at each of the three 2013 sites in Victoria processing 2 drafts

Site	***PD07***		***PD08***		***PD20***	
	Age	**Wt**	**Age**	**kg**	**Age**	**Kg**
Weaning	94d	40.3 kg	100d	38 kg	134d	26.7 kg
Growth birth* to wean		389 g/d		329 g/d		163 g/d
Final common wt	115d	46.9 kg	126d	40.1 kg	374d	45.3 kg
Growth from birth*		362 g/d		278 g/d		109 g/d
PSWT 1#	115d	51.5 kg	126d	44.1 kg	374d	47.0 kg
Growth from birth*		410 g/d		308 g/d		113 g/d
PSWT 2†	145d	50.6 kg	259d	47.2 kg	416d	45.1 kg
Growth from birth*		314 g/d		156 g/d		95 g/d

*Calculated on estimated birth weight
Includes only data for lambs processed at PSWT 1
† Includes only data for lambs processed at PSWT 2

PD01 lambs were weighed and weaned 3rd December and the next weight obtained 11th January, 2013, achieving a growth rate of 140 g/day. Due to poor seasonal

conditions and a turnover in on-farm labour lamb live-weights were not recorded as frequently as required.

PD02 lambs grazed pasture from weaning and averaged a growth rate of 160 g/day from weaning until entering the feedlot on 18th December. At feedlot entry they averaged 35.8 kg and in the first three weeks averaged -0.05 kg/day which was partly due to low quality barley (8-9 MJ/kg DM, 6% protein) and an adjustment period from pasture onto grain.

Once in the feedlot lambs were fed twice a day (approx 3.5% live-weight) in bunkers and monitored closely. Lambs were fed an introductory diet for their first 3 weeks in the feedlot. The ration was comprised of 1.2 tonnes vetch hay, 2.5 tonnes oats, 0.8 tonnes lupins, 1 tonne barley, 0.4 tonne syrup and vitamins A, D&E, which worked out at 23% protein and 11% ME.

Lambs were then moved onto a higher energy diet once they had had adequate time for rumen adjustment and the risk of acidosis had been reduced significantly. Oats was replaced with barley and vetch hay with lucerne hay. This mix consisted of 1 tonne of lucerne hay, 0.5 tonne lupins, 4 tonne barley, 0.6 tonne syrup, 0.12 tonne salt and lime, and vitamins A, D&E.

Lambs were weighed at feedlot entry on the 18th of December and then 10th January, and 25th of January when the first draft for slaughter (63 lambs over 45kg) were processed. An interim weight was taken on the 2nd of February and the second draft of lambs weighed and drafted for slaughter on the 13th of February.

PD07: Lambs at PDS7 were weaned onto high quality green pasture. Growth rates were exceptional from birth to weaning (389g/day) and the first draft of lambs were processed 3 weeks post weaning (115d). The remaining lambs were drenched and placed back onto good quality pasture until the second draft of lambs were processed four weeks later on 28/11/13 (day 145).

PD08: Lambs were weaned onto ryegrass and clover pasture. The first weight was taken at weaning on 1/11/13 (100d) and then 3 weeks post weaning (21/11/13) and 1 week later (27/11/13), which included the final weight for the first draft. Following the first draft of lambs (n=101) being sent for processing the remaining lambs were shorn and placed into a feedlot on farm and remained in the feedlot until the second draft of lambs were processed in April. A weight taken on remaining 125 lambs four weeks later (20/12/13) showed lambs had not gained weight in the previous month which can be accounted for by weaning, shearing and low food quality and quantity, and due to development of dry seasonal conditions post-weaning. Lambs were placed into a feedlot following the 3rd weight on 20/12/13 and weighed at 4 weekly intervals. The following weight, taken 4 weeks later on 28/1/14, showed lambs had lost weight (0.8kg average). Fortunately, the subsequent monthly weights from February to April showed lamb growth improved with lambs reaching target slaughter weights in April 2014.

Fig. 5 PD07 ewes and lambs at marking 8th August, 2014

Fig. 6 PD08 lambs pre slaughter draft 2, 21st November, 2014

PD09: Following marking PD09 ewes and lambs continued grazing high quality green pasture (+2500 kg DM/ha, 30% clover and ryegrass). Pasture quality declined (going to seed) in December but was still green at processing in December.

PD10: Following weaning, PD10 lambs were boxed in with large mobs of the same birth status on the property and followed 7 day rotations on green pasture. The

quality of the pasture was gradually declining (going to seed) by the time the lambs were processed as one draft in December.

PD20: Merino lambs were weaned at 20 weeks of age, which is later than the other sites who weaned around 14 weeks of age. Due to unforeseen circumstances the farm manager went on extended leave for several months around the time the ewes lambed. This placed considerable pressure on the remaining staff member and due to limited human resources the management of the lambs was less than optimum resulting in late weaning and poor growth rates (-16 g/day between Wt. 1 December weaning to Wt 2 late February and 23 g/day between Wt. 2 and April Wt. 3) until Wt. 4 in May 2014. In January lambs were boxed into a larger mob post-weaning for ease of supplementary grain feeding on dry pasture. Although the intention was to obtain 4 weekly weights, the lack of resources meant weights were only available bi-monthly in late February and late April. The farm manager returned intermittently in May and after discussion, the nutritional and husbandry management of the lambs was given high priority. Lambs were drenched and shorn and provided access to high quality green pasture without the necessity of supplementary feeding due to an excellent autumn season. Feed quality on the rye grass and clover pasture in May was obtained which showed good quality (11.2 ME and CP 23.1) and quantity 1,500 kgDM/ha. Nevertheless, due to earlier slow growth the two drafts of lambs were not processed until August or October 2014, respectively. Fortunately, although the lambs were over 12 months of age, they had not cut their teeth and were therefore still classed as lambs.

Fig. 7 PD20 Merino lambs, 14th July, 2014

Fig. 8 PD20 Merino lambs post shearing, 13th August, 2014

Producer demonstration site 2013 lamb live-weight averages at each weigh interval, including average for all available lambs and lambs processed in drafts 1 or 2 are shown in Fig 9. Both full and curfew weights were obtained for Northern Victoria (PD07, PD09 and PD20) sites and curfew weights only for SW Vic (PD09 and PD10) sites.

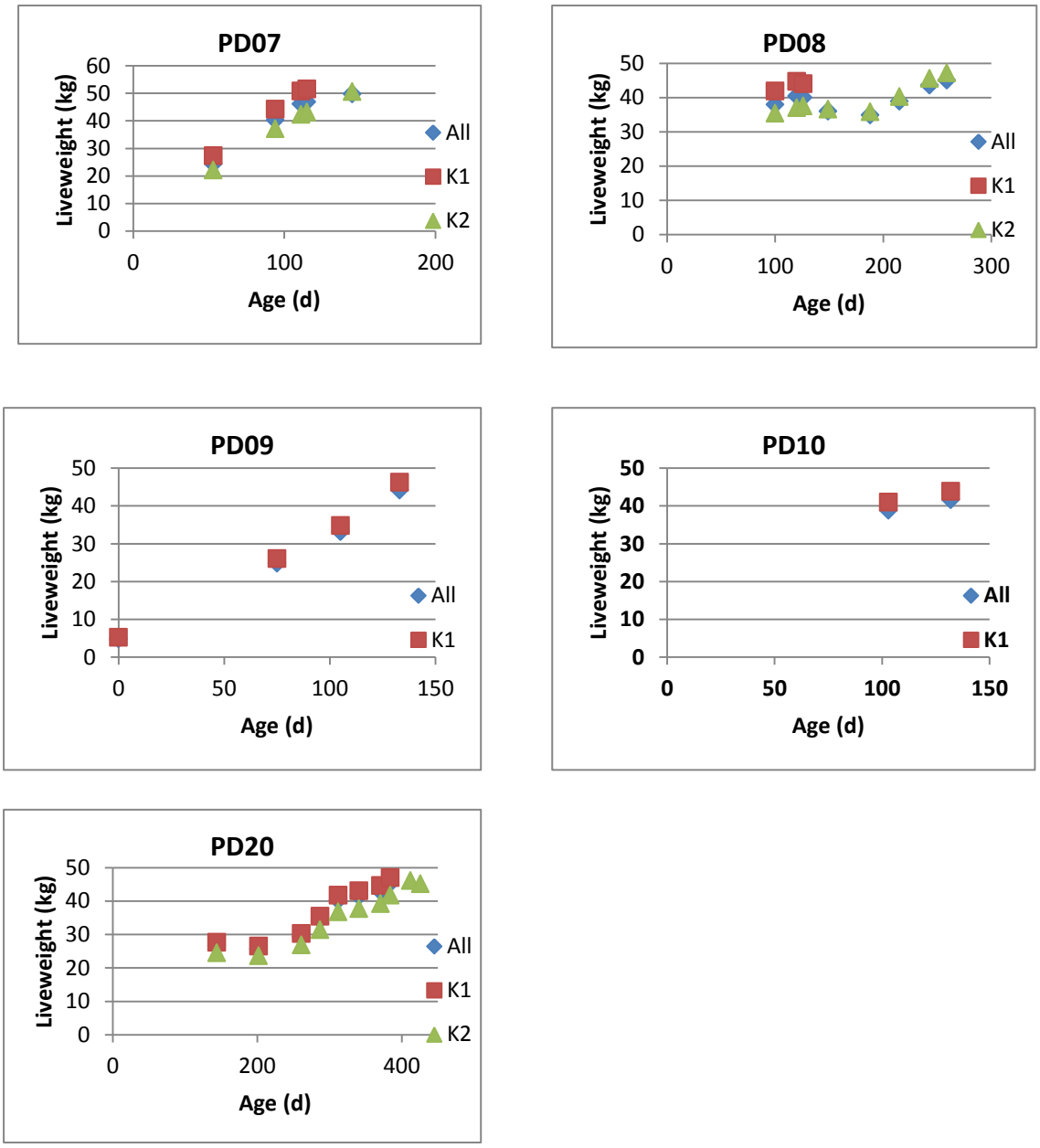

Fig. 9 Live-weight average of lambs at weigh intervals for all 2013 sites, showing weight for all lambs available and lambs processed in kill 1 or 2

4.3 Lamb slaughter

Lambs were selected for processing aiming for 25 lambs per sire and were selected so that sires were represented by both single and multiple births, when known, and male and female lambs, where both sexes were available (PD07, PD08, PD09, PD10) and a range of live-weights. Of the 25 lambs, samples for eating quality were obtained from 10 lambs and all lambs were measured for lean meat yield. The remaining lambs, which were generally too light, remained with the producer to process when they reached target weights. In some instances the producers transported and processed the excess heavier lambs at the same time as the LMY&EQ project lambs were sent (PD07). Details where lambs were processed and number of lambs processed at each draft for each site are shown in Table 9.

Table 9. Processor details, kill dates and number of lambs processed at each draft at individual PD sites

Site	*Date of slaughter*	*Processor*	*No. Lambs*	*LMY & EQ*	*LMY only*
PD01	K1 30/1/13 K2 9/4/13	Coles, JBS Brooklyn	132 56 **188**	81	111
PD02	K1 30/1/13 K2 14/2/13 K3 5/3/13 K4 9/4/13	Coles at JBS Brooklyn	62 83 40 14 **199**	91	105
PD07	K1 30/10/13 K2 28/11/13	JBS Cobram	121 71 **191**	80	41 71
PD08	K1 28/11/13 K2 10/4/14	JBS Cobram	101 98 **199**	80	21 98
PD09	K1 19/12/13	ALC Colac	**208**	80	128 (incl. 8 own)
PD10	K1 17/12	Frewstal, Stawell	**193**	80	113
PD20	K1 28/8/14 K2 8/10/14	JBS Brooklyn JBS Cobram	111 57 **167**	98	13 57

At PD01 mainly wethers were allocated for slaughter as there were sufficient in each sire group (min=20) without requiring any of the ewe lamb portion. Lambs were weighed on the morning of the 29th January and 132 lambs over 43kg were allocated for slaughter. Lambs were transported in the afternoon with lambs from PD02 to JBS Brooklyn and killed on the 30th of January. The remainder of the lambs grew slower than expected and were processed on 9th April, 2004.

Lambs from PD02 were weighed on the 25th January 2013 and a total of 62 ewes (n=23) and wethers (n=40) over 45kg were drafted for slaughter. Lambs were yarded the morning of transport for an 8 hour curfew and trucked to JBS, Brooklyn on the same load as the PD01 lambs on the afternoon of the 29th January. The second draft of lambs was weighed on the 13th February when 83 mixed sex lambs over 45 kg were allocated for slaughter. Lambs were trucked that afternoon for slaughter at JBS, Brooklyn on the 14th of February. The third draft of PD02 lambs (n=40) were processed 5th March and 14 remaining lambs processed with PD1 lambs on 9th April, 2013. Additional to the LMY&EQ project there were 125 excess

ewe lambs from PD02 which were utilised in a separate experiment in collaboration with CSIRO. Pre-slaughter full or curfew weights were not obtained for both PD01 and PD02 sites.

All four 2013 sites with crossbred lambs (PD07, PD08, PD09, PD10) produced in excess of 200 lambs.

Two 2013 sites processed their lambs on the same day (PD09 and PD10) and 3 2013 sites (PD07, PD08, PD20) processed their lambs over 2 kills, some weeks apart. Where lambs were processed over two kills, all samples for eating quality (10 per sire) were obtained at the first kill which also meant some lambs were required to be processed at a lower carcase weight to obtain the quota required per sire.

Lambs were processed at live-weights that met with the standard marketing specifications for each producer's lamb enterprise. Where possible processors were selected according to where the producer normally processed their lambs, providing electrical stimulation was available at the abattoir. At all sites lambs were taken off feed on the morning of transporting and curfewed off feed and water for 6-8 hours depending on the site. Live-weights directly off feed were also obtained from PD07, PD08, PD20.

PD07: The lambs were selected at a live-weight cut off of 45kg according to the producer's normal practice aiming for specifications for heavier lamb carcase weights. The first draft of lambs (n=121) was processed at JBS, Cobram, approximately 3 weeks post-weaning and grew at 410g/day birth to slaughter. The remaining 71 lambs were processed with lambs from PD08 at JBS, Cobram, four weeks later with a growth rate of 314g/day.

PD08 aimed for 42kg live-weight and above when processing lambs but included some lighter weight lambs to enable collection of eating quality samples from 10 lambs per sire. The first draft of PD08 lambs (n=101) were processed at JBS, Cobram, on 28th November, 2013. This draft was organised to coincide with the 2nd draft of lambs from PD07 for ease data and sample collection. As a result of observation and feedback on the first draft being under-finished, this site aimed for heavier carcase weights for the second lamb draft which was processed some months later at JBS on 10th April, 2014.

Lambs (n=200) from PD09 were processed at the Australian Lamb Company, Colac, on 19th December 2014. Lambs were not weaned and sold as suckers direct from their dams.

Lambs (n=193) from PD10 were processed in one draft at Frewstal, Stawell, on 17th December 2014. A draft of the very light lambs were sold following weaning and therefore only have one weight obtained.

Although PD20 marked 212 wether lambs there was a sizeable decrease in the number of lambs at each weighing from December to April (through deaths and mis-drafting into other mobs). This resulted in only 167 merino wether lambs available for processing and the low number of available lambs meant all lambs for this site were required for measurements. This further delayed processing as this site did not have the same opportunity as other sites where the heavier weight lambs were selected for processing and light lambs remained with the producer. Due to the lower number of available lambs, the number of lambs per sire ranged from 13 lambs to 26.

The first draft of lambs (n=111) were processed at JBS, Brooklyn, on August 28th, 2014. These lambs were processed in Brooklyn as 98 of the 111 lambs were used

in collaboration with CSIRO for a meat packaging experimental project (A.MQT.0068) as the sire parentage and Research Breeding Values of the lambs were available which could be utilised when interpreting experimental results. The remaining 57 lambs were processed at JBS, Cobram, on October 8th, 2014.

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

4.4 Field days

Every opportunity has been taken to promote the project to farming groups, networks and field days with the following activities undertaken.

Ararat BestWool/BestLamb Group: On July 2, 2012 an overview of the project was presented to 10 group members.

SheepVention, Hamilton, Victoria: SheepVention is a major sheep industry show conducted over two days at Hamilton, Victoria, which attracts in excess of 20,000 visitors annually. The LMY EQ project was presented as a display at the DEPI site at the 2012 SheepVention 6th and 7th August.

Southwest Prime Lamb BestWool/BestLamb Group: A presentation was made to 15 group members at their AGM on 24 July,2012 with two producers indicating interest in hosting demonstration sites.

Other BestWool/BestLamb group and EID field day presentations: The project has been discussed at 9 BestWool/BestLamb and EID groups throughout Victoria. These include the Chatsworth and Hamilton EID field days where a total of 50 farmers attended and the Goulburn, Birchip, Streatham, Fiery Creek, Barwon, Apsley and Balmoral BestWool/BestLamb groups.

A major combined field day was held on the 20th May, 2013, at the property of 2012 pilot host Tony Fleetwood at Byaduk near Hamilton. The field day presented results from both SW Victorian sites for the 2012 pilot participants Tony Fleetwood and Georgina Gubbins. The field day was well attended by 30 farmers from the surrounding area and some travelling from further afield (Sudholz, Kotupna 2013 site host). There were 25 industry representatives present from a number of local businesses, stock agencies, DEPI, MLA and ten Sheep CRC Professional Development students.

The agenda included a broad overview of the project and available results from Project Leader Janelle Hocking-Edwards from SARDI, an update on the progress from the PDS sites by site leader Peter Bailey, reasons for participating by site hosts Tony Fleetwood and Georgina Gubbins, and a practical demonstration of the value of lean meat yield by Mark Inglis from JBS.

Feedback on the day was generally positive and most people thought the inclusion of the practical demonstration by the JBS mobile butcher was worthwhile to demonstrate the LMY and EQ traits in a lamb carcase. Other feedback included that some people were disappointed that the eating quality results were not available yet and expressed interest in attending another such day when more data was available from the 2013 LMYEQ trial, particularly on the eating quality results.

Fig. 10 Peter Bailey, DEPI presenting LMY&EQ project management and results (left) and Mark Inglis, JBS, demonstrating carcase breakdown using mobile butcher display (right) at the field day at Tony Fleetwood's property, 20th May, 2013

Two field days were held at Graham & Polly Sudholz's, Kotupna, in N Victoria on October 27th, 2014 and at the Corowa RSL, (co-sponsored by Rivalea) on October 28th, 2014. The days focused on "Exploring options for finishing lambs" and included presentations by Janelle Hocking-Edwards who provided information about the LMY&EQ project objectives, methodology and newly analysed results, as well as results from sites PD07 and PD08 and take home messages for producers. Mark Inglis, JBS farm assurance and supply chain manager, and Steve Chapman, JBS Southern livestock manager, followed on from Janelle's talk at Kotupna and Corowa respectively. Mark Inglis supported the LMY&EQ program by utilising the JBS mobile butcher display and breaking down two lambs to demonstrate the differences between high and low yielding lambs. Steve Chapman presented to the group in a question and answer format and emphasised the importance of lean meat yield and eating quality, utilising new technology and producers taking the opportunity to learn from processor feedback.

The days were attended by 60 (Kotupna) and 70 (Corowa) producers and industry service providers. Feedback from the days was excellent with a satisfaction rating of 8/10 for both evaluation questions regarding relevance and satisfaction of the information presented to enable better management decisions for their business. Comments included "Great breadth of information across the entire supply chain from the producer to the consumer", "Understand final market and work backwards", "Great to have a combination of practical and research on the day".

Additionally the host producer of site PD07 is a member of a BWBL group who has been following the project with interest. A final presentation to the group on the results and outcomes is scheduled for the near future. A field day is planned for South West Victoria (date TBC) to present results relevant to sites PD09 and PD10.

Fig. 11 Field day "Exploring Options for Finishing Lambs" at Kotupna, including producer Graham Sudholz (bottom) discussing his experience with the project, October 27th, 2014

Fig. 12 Tim Hollier, DEPI presenting at "Exploring Options for Finishing Lambs" field day Corowa, October 28th, 2014

4.5 Relationships with supply chain/processor

Relationships were developed with four supply chains – JBS (Cobram and Brooklyn), Coles (Brooklyn), Australian Lamb Company (Colac) and Frewstal (Stawell). All processors/supply chains were extremely cooperative with the organisational logistics and accommodating DEPI work teams that coordinated in-plant data measurement and sample collection. They expressed interest in being involved in any further work due to the process running smoothly and an interest in project outcomes.

Producers from all sites were invited and producers from PD07, PD08, PD09 and PD10 attended at least one draft of their lambs being processed. The producers appreciated the opportunity to view their lambs on the hook and participate in the collection of data and talk to the processers who provided informative feedback on their lambs as well as providing them with a tour of the processing plant.

Fig. 13 Mark Inglis, JBS demonstrating the importance of LMY through a carcase breakdown using mobile butcher display (right) at field day at Graham Sudholz's, Kotupna site, 27th October, 2014

Acknowledgements

Sincere thanks to the seven Victorian site hosts; Georgina Gubbins (Maneroo Partnership, Heywood), Tony Fleetwood (Wexford Pastrol Co, Hamilton), Graham and Polly Sudholz (Sudholz Farm, Kotupna), Tom Marriott (Yarallah Lamb, Benalla), Lachie Ranken (Boonerah, Hexam), Andrew and Diana Sutherland (Berachah, Hamilton), and Frank O'Connor (Melbourne University – Dookie Campus, Dookie) for their time commitment, cooperation and diligence in following protocol and running field days to ensure project outcomes were successful.

Many thanks to the processors JBS (Cobram and Brooklyn), Coles (Brooklyn), Australian Lamb Company (Colac) and Frewstal (Stawell) for their excellent co-operation with the logistics of processing and collection of samples and data.

Thanks are also extended to DEPI personnel Peter Bailey who initially led the development and management of the project and Garry Hallam and Ruth Corrigan for their assistance by managing individual sites, and Wayne Brown, Matthew Kerr, Nick Linden and Greg Seymour for their assistance with collecting data and processing samples.

5 Appendix 1

Summary of key dates and raw live-weight data from seven Victorian PDS.

Site	*Date*	*Age (d)*	*Count*	*Min (kg)*	*Max (kg)*	*Ave (kg)*
PD01						
AI	29-30/3/12		591			
Scanning	7/7/12	99				
DOB	28/8/12	0	520			
WWT	6/12/12	100	467	20.6	51.0	37.6
EPWT1	14/1/13	140	520	26.2	56.0	43.4
EPWT2	8/4/13	223	21	44.4	56.0	49.0
	Pre-slaughter full or curfew weights were not obtained					
PD02						
AI	22-23/3/12		600			
Scanning	4/7/12	103				
DOB	18/8/12	0	365			
WWT	3/12/12	93	233	17.5	47.5	32.7
EPWT1	18/12/12	122	244	23.0	50.5	36.3
EPWT2	11/1/13	146	354	21.5	56.0	37.0
EPWT3	6/2/13	172	141	26.0	55.0	41.6
EPWT4	13/2/13	179	158	25.5	58.5	44.4
PWWT1	28/2/13	194	159	24.0	55.0	42.8
	Pre-slaughter full or curfew weights were not obtained					
PD07						
AI	6/02/2013		299			
Scanning	29/04/2013	82	297			
DOB	5/07/2013	0	241			
MWT	27/08/2013	53	241	13	35	24.4
WWT	7/10/2013	94	235	23.5	54	40.3
EPWT1	28/10/2013	115	241	29	62.5	46.9
EPWT2	27/11/2013	145	117	37	61.5	49.8
PSWT1	29/10/2013	116	121	42.5	61	50.6
PSWT2	27/11/2014	145	71	59.5	50.6	50.3

Site	*Date*	*Age (d)*	*Count*	*Min (kg)*	*Max (kg)*	*Ave. (kg)*
PD08						
AI	27/02/2013		317			
Scanning	20/05/2013	82	311			
DOB	24/07/2013	0	224			
WWT	1/11/2013	100	221	23	30.5	38
EPWT1	21/11/2013	120	208	24	55	40.4
EPWT2	27/11/2013	126	213	24.5	53	40.1
EPWT3	20/12/2013	149	118	25	43.5	36
EPWT4	28/01/2014	188	118	23.5	48	34.9
EPWT5	24/02/2014	215	121	26.5	56	38.9
EPWT6	24/03/2014	243	123	30.5	59.5	43.6
EPWT7	9/04/2014	259	118	31.5	59.5	45.1
PSWT1	27/11/2013	126	101	36	52	42.9
PSWT2	9/04/2014	259	98	35	59.5	46.4
PD09						
AI	25/02/2013		297			
Scanning	27/05/2013	91	297			
DOB	25/07/2013	0	259			
PreWWT1	8/01/2013	75	256	14.4	36.5	24.8
PreWWT2	7/11/2013	105	254	20.4	46.3	33.2
PreWWT3	5/12/2013	133	257	20.6	60.4	44.2
PSWT1	18/12/2014	146	208	35.7	61.0	46.0
PD10						
AI	25/02/2013		294			
Scanning	22/05/2013	86	288			
DOB	1/08/2013	0	311			
WWT	18/11/2013	109	292	20.5	51.5	38.8
EPWT1	11/12/2013	132	268	25.5	54	41.6
PSWT1	15/12/2014	136	193	38	55	44.4
PD20						
AI	13-14/3/13		600			
Scanning	31/05/2013	79	589			
DOB	17/08/2013	0	210			
WWT	29/12/2013	134	193	15.9	40.9	26.5
EPWT1	25/02/2014	192	194	16	39	25.5
EPWT2	25/04/2014	251	172	17.2	42	29.1
PWWT1	21/05/2014	277	154	22.5	47	34.1
PWWT2	15/06/2014	302	165	28.5	54.5	40
PWWT3	14/07/2014	331	166	30.5	53	41.2
PWWT4	13/08/2014	361	168	33.5	57.5	42.8
PWWT5	26/08/2014	374	169	37	57.5	45.1
PWWT6	23/09/2014	402	52	39	59	45.8
PWWT7	7/10/2014	416	60	37	59	44.8
PSWT1	26/08/2014	374	111	37	58.5	46.1
PSWT2	7/10/2014	416	57	37	59	44.5