

**“Bringing individual animal management and EID to the next level”
and
“Comparison of DNA, EID Methods & Current Pedigree Matching”**



Elders Victoria Sire Evaluation Group

June 2014

Executive Summary

This project aims to extend the use of sheep electronic identification (EID) to record performance information of individual animals. It will provide information to producers regarding the effective use of sheep electronic identification to capture and utilize performance and production information. It shows that even with large volumes of sheep in a commercial situation, electronic identification tags allow data capture on individual animals.



Field day at Wando Estate April 2014

A manager's ability to make proactive decisions based on objective continuous real-time information assists productivity, profitability and animal welfare outcomes. Although big differences in performance between individual sheep in a mob are known, without full pedigree and individual performance analysis it is often hard to identify the full range of performance and where each animal is placed. Electronic identification technology allows easy data capture and the ability to then manipulate this data to extract useful information and performance history.

This project captured information on over 1100 ewes and 960 lambs. It compared 3 different methods of collecting dam pedigree information (1 method EID is essential) and the costs and benefits of each method. It also demonstrated the ability to quickly and easily capture other information such as pregnancy status and litter size, breeding history, trait information and weight gain. Through the use of EID to link this information in a sheep management program the data was then able to be accessed to provide useful management reports and information.

New technology such as Pedigree Matchmaker to determine dam pedigree and Walk over Weighing (WOW) to capture real time body weight information remotely from the paddock is not possible without electronic identification for individual animals.

Through the use of electronic identification tags large volumes of data can be easily and quickly recorded and stored on individual animals. The ability to capture this information at a reasonable cost, store it and access it when required in a form that is meaningful is the key to improving livestock management, making genetic gain and improving profitability for sheep producers.

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Background

The Elders Sire Evaluation Trial has been in operation since 1998, with over 150 different sires evaluated through progeny analysis from using like dams, run together and evaluated over two years. The trial has moved location every two years to a new commercial host property. Ram entrants pay a fee, which covers the AI cost and all the associated testing costs. The Sire Evaluation Group is a Not for Profit

Organisation with its key goal being to assimilate genetic information to producers in a non-biased way. Information is communicated through quarterly newsletters, emails and field days that regularly have over 150 participants.

The trial has been utilising Electronic Animal Identification devices for over 10 years with an active level of producer interest in the technology. The committee, which is all voluntary, is keen to continue to assist industry in developing both new methods of management and extension of technological developments that help drive the industry to increase productivity gains, while also continuing the work on trialing different sires and communicating this to producers.

This project was run in conjunction with the 2013 Elders Victorian Sire Evaluation program at 'Wando Estate', 1550 Edenhope-Casterton Rd, Wando, Victoria.

Traditionally sire evaluation sites lamb sire groups separately to establish progeny sire pedigree before they are combined into one mob, and their performance evaluated in a commercial management situation.

With the development of improved DNA based parentage tests, and other technologies such as Pedigree Matchmaker (PMM), alternate systems are available to producers to capture pedigree information. This trial was established to compare three alternate methods – visual dam identification, DNA based parentage tests, and Pedigree Matchmaker. The traditional sire group lambing can be allied with the all methods to establish full sire and dam pedigree, however the DNA based testing can provide that without the need to separate sire groups at lambing.

Typically managers of sheep rely on their judgment and experience in evaluating how their sheep are performing. By the time even the most skilled managers identify a production problem, the impact could potentially have a detrimental outcome to productivity and profit. Strategic condition scoring and weighing of sheep are two of the current best practice



Collecting blood samples for DNA parentage tests from the ewes July 2013

management yardsticks, but this approach is reflective and leads to reactive management decisions. A manager's ability to make proactive decisions based on objective continuous real-time information would assist productivity, profitability and animal welfare outcomes.

Although big differences in performances between individual sheep in a mob are known, without full pedigree and individual performance analysis it is often hard to differentiate between environmental and genetic effects. Traditionally in commercial sheep flocks, establishing full pedigree has been considered too time consuming and expensive without a justifiable business model that demonstrates that better selection, and subsequent genetic gain, is feasible. For example a heavier ewe with a poor lamb is kept and a light ewe that had great twins finds herself culled.

With the development of improved DNA based parentage tests, and other technologies like pedigree matchmaker, systems are now available to more readily identify full pedigree. Producers are also seeking to more readily link progeny to their dams to discover and monitor the full implications of the ewes' body weight changes on progeny performance and survival.

The Elders Balmoral Sire Evaluation group offered an excellent conduit to both the commercial and seed stock sectors of the Australian sheep industry, to evaluate commercial pedigree identification systems, and relate them to enhanced flock performance through the use of real-time monitoring technologies.

Tom Silcock Chair of the Elders Victoria Sire Evaluation Group is the Project Leader for this project. Project Managers Steve and Debbie Milne from Richmond Hill Agribusiness were employed to project manage the project. The steering committee for the project was Tom Silcock, Steve and Debbie Milne, Michael Craig (Treasurer EVSEG), Rosey Leeming (Member EVSEG), Robert Wyld (Sapien Technology), Bill Murray (Exacta Livestock) and Peter Bailey (Vic DEPI).

Project Description

Aims

The project aims to extend the use of sheep electronic identification to record performance information of individual animals. It will provide information to over 150 producers regarding the effective use of sheep electronic identification for recording purposes.

The project also aims to identify the pros and cons of each pedigree identification method, identify issues and assess utilization of technology to achieve results.

Objectives

1. Use electronic identification to identify individual animals and capture their performance and production information.
2. Process this data to provide information on performance and production information.
3. Provide non biased performance information to over 150 producers regarding the effectiveness in using sheep electronic identification for recording purposes.
4. Assess the pros and cons and cost/benefits of 3 pedigree identification methods.

Methodology

A total of 1167 merino ewes were Artificially Inseminated to 19 sires in April 2013. The ewes were pregnancy scanned on June the 3rd 2014 with 564 being identified as carrying a single lamb and 234 ewes were scanned in lamb with twins. There were 4 ewes having triplets and 365 dry ewes. Dry ewes and ewes bearing triplets were removed from the trial. One sire only had 2 ewes in lamb and was removed from the trial leaving 18 sires in the trial. At lambing 936 lambs were recorded with a further 32 dead lambs not recorded (total lambs 968).

The three pedigree capture methods compared in the trial were visual matching of lambs with dams at birth (Visual ID/Tag at birth), DNA based parentage test, and Pedigree Matchmaker.



Trial ewes with single lambs returning to their paddock at Wando Estate October 2013

Visual ID/Tag at birth

On July 31st 2013 the pregnant ewes were weighed and allocated a visual ID number by tagging them with an individually numbered 'Flexible Size 3' cattle tag supplied by Leader Products®. This was linked to an already existing RFID (electronic)tag using an Allflex® stick reader and a Trutest® XR3000 indicator. The RFID tag also had a visual number on it which matched a coloured sire tag that was applied at AI.

On July the 23rd the twin bearing ewes were split into their joining sire groups, with the single bearing ewes being split on July the 26th. Wando Estate has a drought containment paddock setup which allowed each single/twin joining sire group to be allocated a small lambing paddock (36 individual lambing paddocks).

There were a few early lambs that were identified by Wando Estate staff however the bulk of lambing commenced on August the 31st. Visual matching of lambs with their dams continued until lambing ceased on September the 9th. The lambs were tagged with a Leader Products® Jumbo EID Sheep Tag and a numbered coloured sire tag that matched the colour of their dams tag. Pedigree and other lambing information were recorded using a Datamar® GES3S Universal Portable Tag Reader.

At the height of lambing, the task of identifying dams, tagging lambs and recording lambing information was full time during daylight hours. This visual matching required a team of between one and five people. Considerable difficulties were experienced reading the cattle tags in the ewes ears. The tags were too small and only numbered on one side. Some of the tags were inserted without enough thought to their readability. In addition some had the numbers

obscured with mud. A number on both sides and bigger tags would have overcome much of this issue. Results from the dam visual identification and tagging at birth were received from the contractor on the 10th September 2013.

DNA Parentage Test

All but 2 of the sires involved in the trial had previously had DNA samples submitted to the Sheep CRC for assessment through either the 50k SNP (Single Nucleotide Polymorphism) genomic test. The results of this test can also be used for the associated parentage test. DNA had to be extracted from semen for the two sires that had not previously been tested. This did cause some delay in the parentage results being available.

Blood samples were taken from the 798 ewes that were included in the trial on July the 31st 2013 using the Sheep CRC Sheep Genomic Test blood cards. These blood cards were matched to the visual ID allocated on that day for the Visual ID method described previously. The samples were taken with the ewes restrained in a 'VE machine' with pre-lambing vaccination and drench given at the same time. These 'blood cards' were submitted prior to lambing to allow the ewe flock DNA data base to be built prior to lambing.

The DNA samples from the lambs were taken on the 14th of October 2013. This was combined with ear notching, scoring the lambs for breech cover and wrinkle and pigmentation scoring. The lambs were identified by their EID, with barcode labels being printed and attached to the blood cards. This was done using an Allflex® stick reader and a Zebra® barcode printer, with the lambs restrained in a rotating lamb marking cradle. The ewes that had been drafted from their lambs were simultaneously assessed as wet and dry, with the dry ewes removed from the mob.

The blood samples were dispatched to the Sheep CRC on the 25th November. After DNA samples and parentage test results were obtained from the two previously untested sires, the DNA based parentage results for the lambs were received on March the 18th 2014.

Pedigree Matchmaker

Following joining, training commenced to familiarise the trial ewe flock with the equipment used for Pedigree Matchmaker data capture. To facilitate the capture of dam and lamb IDs (using EID technology) the animals must pass through a short race equipped with an EID panel reader and a data collector. Initial training was done using a trailer with a mesh floor which was able to be lowered to ground level. A loose mineral lick was placed in the middle of the trailer to encourage the ewes to walk onto and through the trailer. This training continued until just prior to lambing.

Following lambing and the boxing of the single and twin bearing ewes and their lambs back into two mobs, two purpose built Proway® Walk Over Weighing (WOW) crates were introduced into the trial. Training of the ewes and lambs continued through mustering each mob into a holding laneway/paddock and then allowing them at will to return to their paddocks only through the crate. These crates are adjustable for width and initially were set on their widest setting and over the course of the next week were gradually narrowed until they were approximately 300mm wide at the base, allowing only single file access. The crates were then moved to

become the access point in a fence around the water troughs with a mineral lick as an added attractant placed inside the fence.

Each crate was equipped with a Sapien Pedigreescan® panel reader and data collector supplied by Sapien Technology. The panel reader captured the electronic tag number of each ewe and lamb as they passed through the crate. Data was downloaded and emailed to Sapien on October 16, 23, 29, November 4, 14, 24, and December 3, 10 and 24th. Data analysis and results were undertaken by Bill Murray from Exact Livestock and received on 9th January 2014.

Walk Over Weighing (WOW)

Lambs were weaned on 24/12/13. The weaners were boxed into one paddock that has 2 water troughs. Due to extremely hot weather after weaning access to the water troughs was left open. By 28/1/14 fences around the troughs were closed with access to water via the PMM/weigh crates at their widest setting (again due to extremely hot weather access was not restricted to the narrowest setting). By 11/2/14 weigh crates had been reduced to their narrowest settings and weaners were freely accessing the water troughs through the weigh crates.

On the 20/2/14 the telemetry (aerial and modem) and computer system was installed at the homestead. The WOW scale head, batteries, solar panel and aerial were also installed in the paddock on the weigh crate at the first water trough.

Once the WOW system was installed and operating, data (EID tag numbers and weights) were stored in the scale head. Some software difficulties with the scale head reader and the download function from that scale head were encountered, but have now been resolved. The telemetry system is now fully operational and Rob Wyld of Sapien Technology is able to download data from the paddock to the Sapien office in Melbourne.

Development of software to provide meaningful interpretation of downloaded weight results is continuing by Sapien Technology.

Results

Objective 1 (Use electronic identification to identify individual animals and capture their performance information.)

The ability to capture individual performance information has been clearly demonstrated in this project. This includes individual animal data that has been captured in the following processes,



Producers at the Wando Estate Field day in April 2014

1. At Artificial Insemination in April 2013 – the ewe EID tag was linked to the sire she was inseminated to and data was stored electronically.
2. Pregnancy scanning information was collected via the ewes EID tag. This data was used to determine the pregnancy status of the ewes and then draft them based on pregnancy status and litter size. This information was then easily transferred into a stock management program based on the electronic identification of the individual ewe.
3. At lambing, the lambs were tagged with an EID tag and information such as the dam, body weight and date of birth was recorded electronically.
4. Prior to lamb marking the lambs were individually assessed for visual traits and blood was taken for a DNA parentage test. The identity of the lamb was linked to the blood card via their EID tag. The blood cards were identified by a bar code label printed with the lambs EID number via a hand held EID reader. Individual trait assessments were stored electronically using the EID tag of the lamb for identification.
5. The Pedigree Matchmaker dam parentage identification system collects the EID of ewes and lambs each time they pass through a race in the paddock. This information is then downloaded and analysed to identify the dam of each lamb. All identification is by the EID tag of the ewe and lamb. Final analysis on dam parentage was received on the 9th January 2014.
6. Lambs were weaned on the 24th December 2013 and a weaning weight taken using the EID tags of the lambs to automatically match their weights. This information was stored and transferred electronically.
7. From February 2014 EID tag number of the weaners and their associated weights have been captured in the paddock and transmitted to the Sapien offices in Melbourne. Sapien is in the process of developing software to analyse this data and provide meaningful performance information on body weight changes of individual animals and the mob as a whole.
8. The DEPI “Maidens To Matrons” trial is also utilizing the 2013 lamb drop. Lambs are regularly weighed and weights captured via EID tags on the XR3000. These weights will then be compared to the “WOW” collection system to provide an audit.

Objective 2 (Process this data to provide information on performance and production information)

Data that was captured electronically was used in this project to provide performance and production information. This was demonstrated by,

1. At artificial insemination of the ewes the data that was captured (ewe EID and AI sire) was later used to verify the DNA parentage tests.
2. Pregnancy scanning data was used to determine pregnancy status and litter size. This allowed the manager to easily make project and management decisions based on data analysis. It also allowed the captured data to be quickly and easily transferred to a stock management program.
3. Lambing information was captured electronically based on the EID of individual animals. This data was then easily transferred to the stock management program for analysis.
4. The DNA parentage tests were identified by the EID tag number of each animal. Results were reported using the EID number of the sire, dam and lamb. This information was then used to assess the parentage of individual animals and compare results of the three parentage identification methods.
5. The Pedigree Matchmaker dam identification system relies on the use of EID tags in individual animals. Without EID tags and the tag reader to remotely capture information, this system would not be possible.
6. Weaning weight information was quickly and easily captured via a panel reader in the weigh crate that automatically read the EID tag in the lamb and scale head recorded the weight against the EID number. This data was then easily transferred electronically to the sheep management program for analysis.
7. Walk over weighing data would not be possible without EID tags and equipment. The ability to monitor weight changes of individual animals in the paddock within a mob and the mob performance as a whole will allow proactive management decisions. This project has so far demonstrated the ability to capture and transmit EID and body weights. At present software is being developed to interpret this information to allow proactive management decisions.
8. Regular manual weights taken for comparison in the “Maidens to Matrons” project are quickly and easily collected using EID and easily transferred to a software program for comparison with the “WOW” trial.

Objective 3 (Provide non biased performance information to over 150 producers regarding the effectiveness in using sheep electronic identification for recording purposes)

Project information and results were communicated to producers in a number of ways,

1. Via the Elders Victoria Sire Evaluation Group newsletter in November 2013 and March 2014. This has a circulation of around 250 producers. Results of the “WOW” trial will continue to be reported in future newsletters.
2. Display stand at the Balmoral Show in March 2014
3. Field day at Wando Estate in April 2014 attended by around 100 producers. This included a presentation by the Project Managers and display stand with photographs and information sheets.

Future communications that are planned include,

1. Presentation at the Trangie Field day on 19th June 2014
2. Display at the Bendigo Sheep Show
3. Display at Hamilton Sheepvention

Objective 4 (Pros and Cons and Costs/Benefits)

Pedigree identification methods

	Visual ID/Tag at birth	DNA parentage test	Pedigree Matchmaker
Sire identified %	99.5%	98.6%	N/A
Dam identified %	99.7%	98.1%	92.6%
Accuracy of Sire %	87.8%	99.6%	N/A
Accuracy of dam %	85.0%	97.8%	85.1%
Trial Capital costs	\$1176	\$15312	\$3350
Trial Annual costs	\$9683	\$15566	\$3610
Annual cost per lambs weaned	\$12.50	\$20.00	\$4.65
Annual labour hours	268	27	18

	PRO's	CON's	ANNUAL COSTS
Visual ID/Tag at birth	<ul style="list-style-type: none"> • Opportunity to collect birth traits • Only method to capture date of birth • Least technology required 	<ul style="list-style-type: none"> • Ewes disturbed during lambing • Highest time and labour costs • Unidentified pedigree errors and does not pick up mismothering • Highest opportunity for human error 	Cash costs (tags) \$1223 Labour (268 hours) \$8460 Total annual costs \$9683 Cost per lambs weaned (778) \$12.50
DNA Parentage Test	<ul style="list-style-type: none"> • High accuracy • Low time and labour 	<ul style="list-style-type: none"> • High annual costs 	Cash costs (DNA tests & tags) \$14546 Labour (27 hours) \$1020 Total annual costs \$15566 Cost per lambs weaned (778) \$20.00
Pedigree Matchmaker	<ul style="list-style-type: none"> • Low cost • Low time and labour • Least opportunity for human error • Accuracy improves over time 	<ul style="list-style-type: none"> • Ewe training a necessity • Need suitable attractant • Does not pick up mismothering • Highest rate of unidentified dams 	Cash costs (tags, attractant, data analysis) \$2200 Equipment hire \$660 Labour (18 hours) \$750 Total annual costs \$3610 Cost per lambs weaned (778) \$4.65
Notes	<ul style="list-style-type: none"> • <i>The DNA test results were compared to the ewe AI records. As the DNA test was the most accurate, Visual ID and PMM were compared to the DNA test where an accurate DNA test record was available.</i> 		

Discussion/Conclusion

This project has clearly demonstrated the benefits of using EID tags to quickly and accurately capture pedigree and performance data. With large volumes of sheep in a commercial situation the accuracy, speed and ability to collect, transfer and recall data has allowed individual performance management to become a reality.

The three methods of capturing pedigree information were compared in a 'commercial' situation. No method was 100% perfect in either the ability to identify all sires and dams or the accuracy of the identification. All three methods demonstrated an ability to capture that information, but with varying degrees of success (the percentage of lambs that had a sire or dam or both attributed to them) and accuracy (the percentage of those attributed sires and dams that proved to be correct when compared with joining or DNA records). Pedigree Matchmaker does not collect sire information so if that method is used to collect dam information it must be used in conjunction with other records to identify the sire.

It is clear from this trial that the DNA based method provided the most accurate pedigree information but it is also the most expensive to set up and on an annual basis. It is however the least time consuming and in fact the blood sample collection could be done concurrently with other activities such as lamb marking. Visual ID/tagging at birth and Pedigree Matchmaker were very similar in dam identification accuracy but at a much lower cost for Pedigree Matchmaker mainly due to the lower labour input required.

Appendix

Factsheet

Bringing individual animal management and EID to the next level and Comparison of pedigree identification methods

Through the use of electronic identification tags large volumes of data can quickly and accurately be recorded and stored electronically on individual animals. The ability to identify an animal electronically is critical to handling large volumes of animals without having to read their tags manually and reduces the human error in reading tags. This can include pedigree, breeding history and performance data.

The type of information that can be captured and stored electronically includes,

1. Individual animal performance history,
 - a. AI records, pregnancy status and litter size
 - b. Lambing and birth traits
 - c. Body weights and weight gain history
 - d. Other trait/history collection such as wool traits or treatments
2. Pedigree capture,

	PRO's	CON's	ANNUAL COSTS	
Visual ID/Tag at birth (EID not essential but it can reduce data entry costs and transcription errors)	<ul style="list-style-type: none"> Opportunity to collect birth traits Only method to capture date of birth Least technology required 	<ul style="list-style-type: none"> Ewes disturbed during lambing Highest time and labour costs Unidentified pedigree errors and does not pick up mismothering Highest opportunity for human error 	Cash costs (tags)	\$1223
			Labour (268 hours)	\$8460
			Total annual costs	\$9683
			Cost per lambs weaned (778)	\$12.50
DNA Parentage Test (EID not essential)	<ul style="list-style-type: none"> High accuracy Low time and labour 	<ul style="list-style-type: none"> High annual costs 	Cash costs (DNA tests & tags)	\$14546
			Labour (27 hours)	\$1020
			Total annual costs	\$15566
			Cost per lambs weaned (778)	\$20.00
Pedigree Matchmaker (EID is essential)	<ul style="list-style-type: none"> Low cost Low time and labour Least opportunity for human error Accuracy improves over time 	<ul style="list-style-type: none"> Ewe training a necessity Need suitable attractant Does not pick up mismothering Highest rate of unidentified dams 	Cash costs (tags, attractant, data analysis)	
				\$2200
			Equipment hire	\$660
			Labour (18 hours)	\$750
			Total annual costs	\$3610
			Cost per lambs weaned (778)	\$4.65

The ability to capture information at a reasonable cost, store it and access it when required in a form that is meaningful is the key to improving livestock management, making genetic gain and improving profitability for sheep producers.