# final report

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# Pedigree MatchMaker for Beef

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# Executive summary

The stud beef sector makes efficient use of both sire and dam pedigree and performance information to increase the rate of genetic gain. It is widely acknowledged, that most genetic improvement in commercial beef herds is achieved through sire selection alone. This highlights a missed opportunity in that there is little, or no performance-based selection applied to the dam.

To date, the main method of establishing maternal pedigree is to tag calves at birth or utilise DNA technologies. Tagging at birth is labour intensive and has associated occupational health and safety risks, whilst DNA testing is perceived as a costly option ($30/head) based on the Zoetis pricing for cattle products Appendix 1. The result is that few producers take up either strategy and the information is not collected.

The sheep industry is successfully using Pedigree MatchMaker (PMM) to associate lambs with their ewes. PMM provides an effective and accurate method for collecting maternal pedigree information, which when added to sire pedigree, offers substantially improved pedigree information and increased rates of genetic gain.

This Enhanced Producer Demonstrate Site (EPDS) demonstrated that it is possible to match cows and calves using PMM and that large numbers of cattle can run through a PMM setup. In addition to recording cow details, calves as young as 1 month of age and up to 6 months of age were successfully recorded through the PMM equipment.

Water was the most effective attractant tested for achieving animal flow through the PMM system. It does however rely on the seasonal conditions encouraging cattle to drink. Wet conditions, or situations where abundant green feed is available, resulted in poorer animal flow through the system. Other attractants such as hay and silage, or lick blocks may supplement water as an attractant, but are not as effective on their own.

Given that water was the most effective attractant in conjunction with dry pasture conditions, it is recommended that PMM is best suited to spring calving herds, with recording to take place in late spring or early summer. This also reduces the risks of paddock damage through pugging.

The time taken to capture enough data is wholly reliant upon animal flow through the system. With effective attractants, it was found that 56% and 94+ % of animals were matched after 15 and 30+ days respectively.

The use of PMM for beef cattle has been shown in this demonstration to provide an alternative to traditional means of recording cow calf associations, however there is the potential for variable accuracy based upon recording conditions. The greatest limitation to the success of implementing PMM for cattle is not the technology itself, but the ability to manipulate cattle behaviour. With the right set up and conditions, PMM offers an alternative option for recording large numbers of animals.

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# 1 Background

## 1.1 Basis for Conducting the Demonstration

The stud beef sector makes efficient use of both sire and dam pedigree and performance information to increase the rate of genetic gain. It is widely acknowledged, that most genetic improvement in commercial beef herds is achieved through sire selection alone. This highlights a missed opportunity in that there is little, or no performance-based selection applied to the dam.

The total weight of calves weaned is a key production output of a cow herd and is result of many factors. Up to 70% of the variation in weaning weight of calves is due to differences in milk production of the dam (Morris S. and Smeaton D. 2009). This highlights an opportunity for commercial producers to identify the high and low performing cows within their herd to enable greater weaning weights, and hence improved profitability and efficiency.

The problem addressed by this project is that most commercial beef operations have limited ability to identify high and low performing breeders. To do this requires the collection of maternal pedigree information, linking the performance of progeny to their dams.

Cow liveweight and maintenance energy requirements, calf liveweight gain from birth to weaning and reproductive efficiency are all indicators of cow efficiency. Simplistic measures of cow efficiency that can be applied if progeny can be linked back to the cow, is to identify the kilograms of calf weaned compared to kilograms of cow weight at weaning; or kilograms of calf weaned to kilograms of cow mating weight (Morris and Smeaton (2005). Adding feed intake values increases the accuracy of the cow efficiency measure but is manifestly more difficult and currently not feasible within a commercial context.

Through identifying high and low performing breeders and applying objective measurements (e.g. kilograms of beef turnoff per breeder), producers can apply increased selection pressure to their breeding herd. This concept is not a replacement for sire selection, but instead provides an opportunity to build on the existing genetic gain achieved through sire selection. In combination with the existing sire selection, the identification of high and low performing breeders and increased selection pressure on dams will allow producers to be more productive with the stock they currently have and increase their profitability by continually selecting their superior breeders.

To date, the main methods of establishing maternal pedigree has been to tag calves at birth or use DNA technologies. Tagging at birth is labour intensive and has associated occupational health and safety risks, whilst DNA testing is perceived as a costly option (>$30/head). For these reasons, few producers use either strategy and pedigree information is generally not collected. As a result, the commercial beef industry is largely unaware of the productivity and profitability benefits of genetic gain in the breeding herd.

In contrast, many in the sheep industry successfully use Pedigree MatchMaker (PMM) to associate lambs with their dams. PMM provides an effective and accurate method for collecting maternal pedigree information, which when added to sire pedigree, offers substantially improved pedigree information leading to increased rates of genetic gain. The PMM process involves the use of individual electronic animal identification to match ewes to lambs as they pass through a raceway in the paddock to an attractant such as water, feed or lick blocks. Using an automated scanning setup in the raceway, dam pedigrees have been determined to an accuracy of 95%.

*Figure 1 - A ewe and twin lambs passing through a PMM setup*

PPM equipment setup and design for sheep has been refined over several years and includes the following:

- Radio Frequency Identification (RFID) tags to be applied to all ewes and lambs within the flock
- Panel reader(s)
- Data logger/weigh scale indicator for tag recording
- Power source – 12v batteries (solar panels optional)
- Temporary fencing panels – single entrance 1200mm long by a maximum of 600mm wide
- Suitable attractant - water, loose licks, mineral blocks, feeder (grain). Water is the most effective attractant under dry conditions, however its appeal is significantly diminished when operating under winter/spring conditions. Grain has proven the most effective attractant during periods with significant green feed is on offer.

*Figure 2 - Grain is used as an effective attractant during spring when water consumption is low*

The aim of this project was to demonstrate the use of PMM with beef cattle to enable producers to identify superior breeders, leading to productivity and profitability gains. An example of how this could work is the selection of breeders that wean heavier calves, which could be achieved in a shorter time than under existing management systems and leads to a reduction in the cost of production.

The ageing demographic of the producer group and the challenge and risks involved in tagging calves at birth was a catalyst for investigating an alternative pedigree recording method.

# 2 Project objectives

The overall objective was to determine the critical success factors for the effective use of PMM in a commercial beef herd. More specifically, this included;

1. Data Collection Equipment: Identify specific data collection equipment options and setup designs that are sufficiently accurate, user friendly and cost effective.
2. Attractants: Identify a range of suitable attractants that enable reliable data collection.
3. Age of calf and recording period: Specify the most suitable age of calf and data recording period that optimises data collection.
4. Mob Size: Identify limitations to mob size for effective data collection.
5. Raceway design: Identify and demonstrate the raceway design that achieves effective data capture and minimises damage to pasture, gateways or laneways.
6. Economic analysis: undertake a basic cost benefit analysis of using PMM to link calves to dam.
7. Producer guidelines: Using the critical success factors identified in the demonstration, develop a set of practical guidelines, including an economic analysis, that will assist producers to design and set up their own PMM system as an alternative method for collecting female pedigree information, with confidence in its accuracy comparable to manual data collection.

# 3 Methodology

## 3.1 Site selection, timing and sequence of events

### 3.1.1 Site selection

Site selection was based on the following factors:

- Desire of producer to participate
- Availability of appropriate recording location (i.e. available waterpoints, paddock size etc.)
- Time of calving
- Age of calves at tagging
- Current pedigree recording practices (particularly for comparison with PMM results)
- Herd/mob size
- Seasonal conditions with emphasis on feed availability and risk of pugging.

### 3.1.2 Sequence of events and site utilisation

*Table 1 - Site information and sequence of events*

| Date | Site | Activity Focus | Identification verification method | System design | Data collection system | Number of breeders used | Duration of testing and age of calves |
|---|---|---|---|---|---|---|---|
| Spring 2015 | Site 1– Yeodene, Vic | Initial testing of equipment layout and ability to achieve cattle flow through the system | Visual matching when tagging post marking. No pedigree information was previously recorded at this site | Single raceway in laneway between paddocks. Cattle walked through between paddock rotations | Sapien PedigreeScan | 46 | 27 Days Recording<br><br>Calves 4 months old |
| Spring/ Summer 2015 | Site 2 – Irrewarra, Vic | Refinement of equipment layout and confirmation of recording accuracy | Visual matching when tagging at birth | Expanded sheep design – single raceway with water as attractant | Sapien PedigreeScan | 15 | 40 Days Recording<br><br>Calves 2-4 months old |
| Autumn 2016 | Site 2 – Irrewarra, Vic | Refinement of equipment layout and confirmation of recording accuracy over different lengths of time | Visual matching when tagging at birth | Expanded sheep design – single raceway with water as attractant | Sapien PedigreeScan<br>Tru-Test XR3000 with Alflex panel and flexible antenna | 16 | 60 Days Recording<br><br>Calves 0-2 months old |
| Summer/ Autumn 2016 | Site 3 – Birregurra, Vic | Refinement of equipment layout and testing of water as attractant under different seasonal conditions | Visual matching when tagging post marking. No pedigree information was previously recorded at this site | Expanded sheep design – single raceway with water as attractant | Tru-Test XR3000 with Tru-Test XRP2 (sheep) panel reader | 30 | 30 Days Recording<br><br>Calves 1-2 months old |
| Spring/ Summer 2016 | Site 4 – Beeac, Vic | Refinement of equipment layout, testing of system with large mob numbers and within a cell grazing system | No matching at this property | Multiple single race ways at water trough based on a wagon wheel design rotational grazing system | Tru-Test XR3000 with Tru-Test XRP2 (sheep) panel reader | 246 | 28 days recording over 3- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | No pedigree information was previously recorded at this site | | | | month period<br><br>Calves 3-6 months old |
| Autumn/ Winter 2017 | Site 5 – Irrewarra, Vic | Refinement of equipment layout and testing of various attractants | Visual matching when tagging post marking<br>No pedigree information was previously recorded at this site | Expanded sheep design – single raceway with silage/ hay and lick blocks as attractant<br><br>Testing two attractants in one season | Tru-Test XR3000 with Tru-Test XRP2 (sheep) panel reader and Alflex panel on second system | 30 | 17 Days of Attempted* Recording<br><br>Calves 3-5 months old |
| Summer/ Autumn 2018 | Site 5– Irrewarra, Vic | Refinement of equipment layout | Visual matching when tagging post marking<br>No pedigree information was previously recorded at this site | Expanded sheep design – single raceway with water as attractant | Tru-Test XR3000 with Tru-Test XRP2 (sheep) panel reader and Alflex panel | 30 | 20 Days of recording over 2-month period<br><br>Calves 2-3 months old |

*Demonstration site cancelled due to weather

## 3.2 Measurements & data analysis undertaken

The measurements to be undertaken during this demonstration were as follows –

- Physical/visual matching of cows to calves where practical and appropriate
- Recording of tags as read through the PMM setup
- Interpretation of results using Pedigree Matrix Software

Note: Statistical analysis of results was not undertaken given that this EPDS was simply investigating the adaptation of the concept for cattle, rather than proving its accuracy. Accuracy of the Pedigree Matrix software for sheep has been extensively researched, including, most recently, comparisons with DNA testing as undertaken by Kemmis et al (2016).

### 3.2.1 Data analysis using pedigree matrix software

Data analysis for the matching of progeny to dam was undertaken using "Pedigree Matrix" software, developed by the Sheep CRC. The software is designed to predict associations between ewes and lambs, and the reliability of those associations, using the sequence of tags recorded to identify each ewe and the first lamb to follow behind her. Based upon the number of times that each lamb follows a given ewe; a reliability score is calculated for the association. Figure 3 shows the flow of information through the Pedigree Matrix software, from the lists of ewes and lambs, the recorded data and the results. Table 2 describes the accuracy of each reliability score assigned by the software.

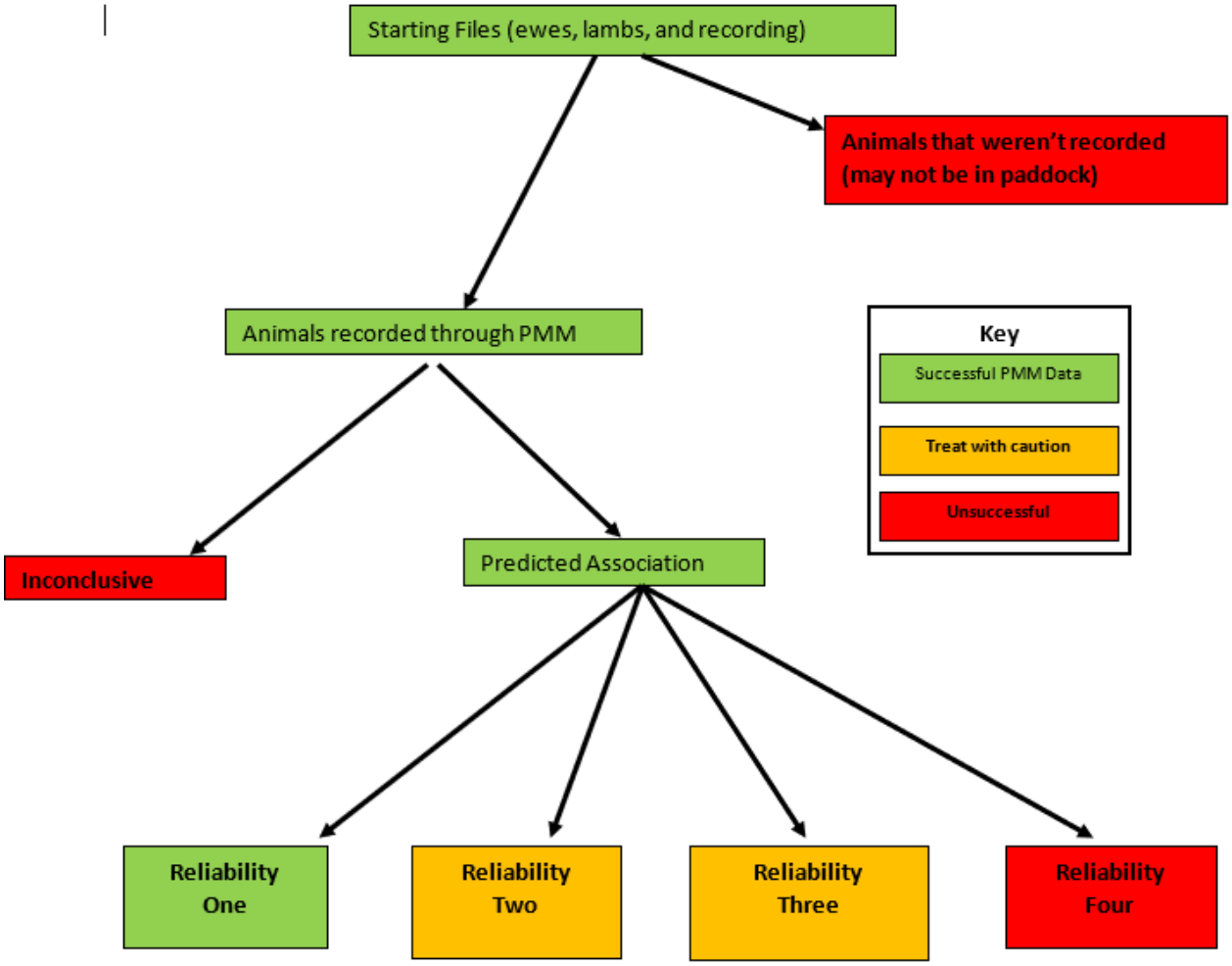



*Figure 3 - Information flow through Pedigree Matrix software*

*Table 2 – Reliability scores assigned by the software and its accuracy*

| Reliability Score | No. of Matches Required | Proportion of Matches between dam and progeny | Accuracy | Comments |
|---|---|---|---|---|
| 1 | >10 | 100% | **Highly accurate** | |
| 2 | >3 | 75% - 100% | **Require some investigation** | - Is the progeny possibly a twin? Hence the lower number of matches and reliability.<br>- Is it because the progeny followed more than 1 dam? |
| 3 | >1 | >50% | **Too uncertain** | |
| 4 | >1 | <50% | **Should not be considered** | These results are not reported |

## 3.3 Site specific methodology

### 3.3.1 Site 1, Yeodene, Victoria – Spring 2015

Site 1 was located at Yoedene, South East of Colac.

Group members planned the set-up of PMM equipment at Site 1, with cows and calves "trained" to walk through the single file entrance. To construct the systems, Achieve Ag Solutions purchased a set of heavy-duty portable cattle yard panels (used throughout the project) and in consultation with the producers involved, constructed a timber panel onto which the panel reader was mounted. The photos below show the group planning the set up at the Site 1, as well as the various stages of construction.

Equipment was set up in a laneway system, and cattle were moved through the system as part of the normal rotational grazing movements of the property

*Figure 4 - Colac BetterBeef Group members planning the set-up of PMM equipment at Site 1 Spring 2015*

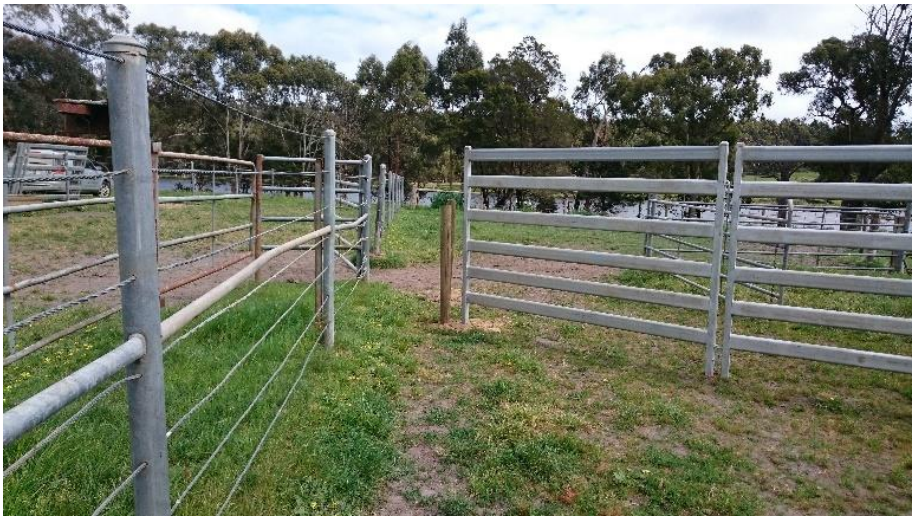


*Figure 5 - Using the existing yards in combination with portable panels to produce a narrow entrance at Site1*

*Figure 6 - The timber section of fence with Sapien Technology PedigreeScan panel reader in place at site 1*

No pedigree recording or management tags had been used at Site 1 prior to the demonstration. For this reason, it was necessary to tag all cows and calves with both visual and National Livestock Identification System (NLIS) Radio Frequency Identification (RFID) tags. Calves were then matched to cows during the tagging process by observing which cow each calf interacted with after it was released from the marking race. The matched cow and calf tag data was further cross-checked through visual examination of management tags when animals were at rest and grazing in the paddock.

*Figure 7 – Example of cow and calf used for visual matching*

Unfortunately, not all cows and calves were accurately matched through either physical matching in the yards, or through visual matching in the paddock. Only 23 (of the 46) were matched confidently. Those that were verified however, provided a high level of confidence as reference data for assessing the accuracy of PMM achieved on this site.

Cows at this site were not trained to the PMM infrastructure prior to the commencement of data collection.

Recording was undertaken at Site 1 using a Sapien Technology PedigreeScan panel reader. This reader was originally designed for use in sheep PMM and has been a popular panel in sheep enterprises in recent years. Success with cattle would allow properties who also run sheep to make further use of what is otherwise a single-use item. This reader is a battery powered unit and it successfully and consistently recorded data from day 1 until the conclusion of the trial.

### 3.3.2 Site 2, Irrewarra, Victoria - Spring 2015

Site 2 was located at Irrewarra, North East of Colac.

All calves on Site 2 were tagged at birth and matched to the 15 cows by visual conformation and were trained to walk through the system to water prior to the demonstration. The construction of the entrance at this site was different to Site 1, with the timber panel constructed from treated pine timber and designed to be used throughout the remainder of the project.

*Figure 8 - Laying out the timber ready to construct a timber panel to match the portable cattle panels at site 2*

Temporary electric fencing was used at this site to fence off the water point, with just the single file entrance allowing access. This was constructed as a staged process so that stock would become familiar with the setup. Initially the entrance was wide and was narrowed to allow single file once cattle were travelling through comfortably.

*Figure 9 – Site 2 starting set up with a wide entrance to allow cows and calves to investigate the equipment and become used to walking through before the entrance narrowed.*

*Figure 10 - Initial entrance set up in line with existing cattle track to water to encourage natural interaction with panels at Site 2*

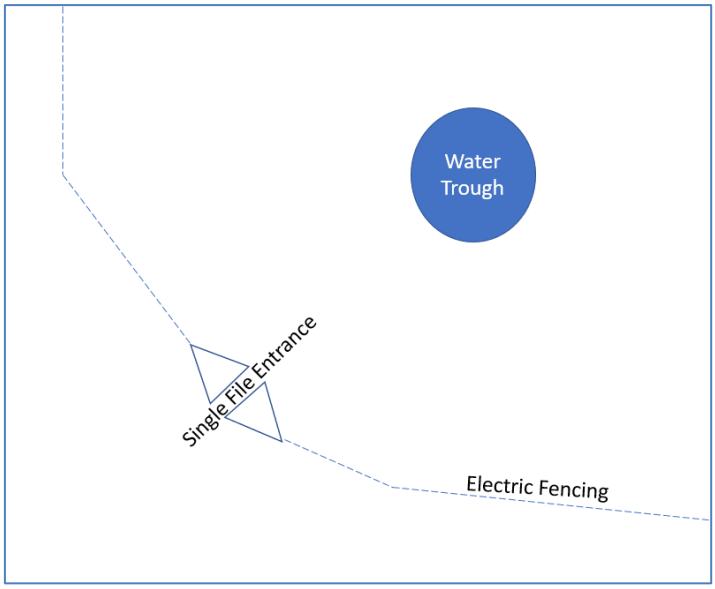



*Figure 11 - Diagram of entrance set up with electric fencing around water trough*

Once cows and calves were trained at Site 2, the reader and associated hardware was installed, consisting of an Allflex reader using Sapien Technology "flexible antenna" and a Trutest XR3000 indicator as a data logger. A solar panel and a 60-amp hour battery were used to power the unit. The setup required a cable linking to the two separate antenna panels (one on either side of the race) to run over the top of the entrance, which was attached a piece of timber to avoid damage.

### 3.3.3 Site 2, Irrewarra, Victoria – Autumn 2016

Fifteen cow and calf units were utilised at this site.

The equipment, including the timber and the steel entry panels and temporary electric fencing to enclose the area, remained in place from the previous spring recording period and was used for the autumn calving mob. Water was again used as the attractant. Prior to calving, the mob was moved onto the demonstration paddock, allowing time for stock to become familiar with the equipment.

Pedigree associations for the autumn 2016 drop calves commenced during the calving period, unlike the previous spring drop calves which were recorded after calving. Pedigree associations for the autumn cows and calves was recorded using with the Sapien Technology PedigreeScan panel reader.

### 3.3.4 Site 3, Birregurra, Victoria – Autumn 2016

Site 3 was located at Birregurra, Victoria and used 30 cows with calves at foot.

Traditionally, this producer recorded pedigree by matching cows to calves in the paddock and again at calf marking.

The equipment set up was similar to Site 2, with a single file entrance leading to a fenced off area around the only water trough in the paddock. All electronics were also the same as site 2. The Colac BetterBeef group visited Site 3 and all group members inspecting and provided suggestions to refinement the system.

*Figure 12 - Colac BetterBeef members at Site 3, witnessing cows travelling through the system*

### 3.3.5 Site 4, Beeac, Victoria – Spring/Summer 2016

Site 4 is located at Beeac, North East of Colac. The site consisted of 246 cows with claves at foot.

Calves ranged in age from 10 to 24 weeks of age at the start of recording. The herd followed a 5 -7 day rotational cell grazing system.

The recording period was originally scheduled to last 3-4 weeks; however, this required some flexibility due to the management strategies being implemented on the property. As such, data recording was undertaken intermittently over a three-month period.

PMM equipment was setup at waterpoints in a way that would allow multiple paddocks to be grazed using a single PMM setup. Equipment consisted of a Tru-Test XRP2 with a sheep panel powered by a solar panel. This set up was used at three different locations on Site 4. Figure 13 indicates the equipment setup used in a cell grazing wagon wheel set up.

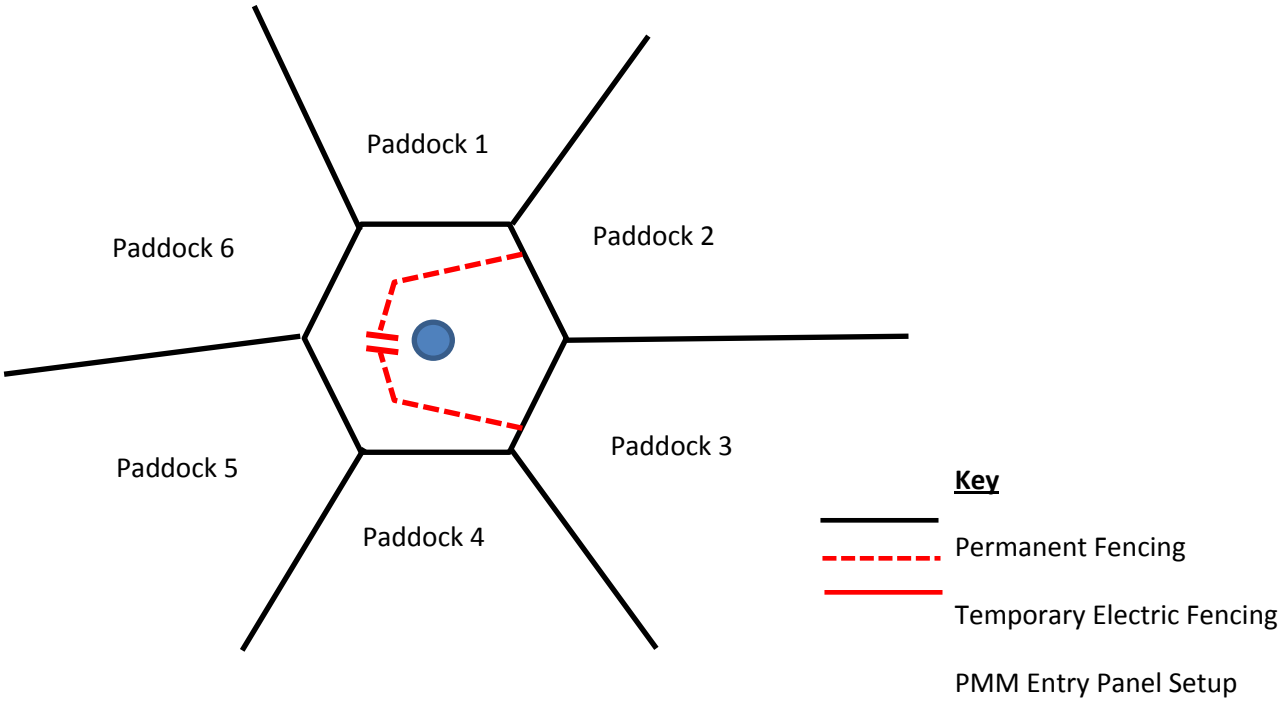



*Figure 13 - PMM setup design used at Site 4 to accommodate cell grazing rotations*

This design (Figure 13) allowed paddocks one, four, five and six to be grazed in rotation without requiring any movement of equipment. Paddocks two and three could be grazed by rearranging equipment and temporary electric fencing.

At one of the recording locations, a second single file entrance was erected to allow greater animal flows through in hot weather and to test the concept of multiple entrances. No reader was attached to the second entrance which did have an impact upon rates of tag reading.

### 3.3.6 Site 5, Irrewarra Victoria, Autumn/Winter 2017

Equipment setup used at Site 5 was the same as previously used at Site 2 and Site 3, utilising temporary electric fencing and portable cattle yard panels to create a single file entrance. At this site, however, water was not used as an attractant as it was deemed unlikely to entice cattle to the same extent in winter.

The alternative attractants were hay/silage in one area and salt/molasses blocks in a separate area. All cattle had been exposed to and were accustomed to both salt/molasses blocks and hay/silage, over a period of 3 months in the lead up to the recording period.

Hay and silage were fed using hay rings in a fenced off area, and a second area was fenced off for lick blocks. Single file entrances were created on the 22$^{nd}$ of August, with the attractants in place. Temporary electric fencing and reading equipment was installed 7 days later. This timing allowed the animals to investigate the panels that formed the single file entrances and locate the attractants.

*Figure 14 - The two entrances when first erected. The entrance in the foreground is where the lick blocks were located as the attractant. The entrance in the background is where hay was used as an attractant. Note the trough is located between the two PMM areas*

*Figure 15 - Lick blocks used as an alternative attractant*

### 3.3.7 Site 5, Irrewarra – Autumn 2017

The final setup utilised at Site 5 was designed to test water as the primary attractant once more, under green feed conditions.

The PMM equipment was the same as that used at sites 2 and 3, with temporary electric fencing enclosing an area, and a single file entrance created using portable cattle yard panels. The cattle used had not been exposed to the setup prior to the recording period but were given an opportunity to investigate the single file entrance for a week prior to the area being fenced off with temporary electric fencing.

An Allflex panel reader was used, with a Trutest XR3000 indicator employed as the data logger. A large solar panel was utilised to provide enough power to maintain the 60-amp hour battery.

## 3.4 Timing of events and project delivery

The project experienced consistent delays in relation to expected timeframes for the activities outlined in the project plan. However, where possible, sites were operated in quick succession to avoid conditions not conducive to demonstrating PMM. Timing changes were almost entirely determined by weather and seasonal conditions. Despite adjusting timelines, the project team ensured there was no impact on project outcomes.

## 3.5 Communication and Extension

Fourteen farm walks were conducted with members of the Colac BetterBeef group across the different sites throughout the project. The demonstration became a focus for the group, with at least one BetterBeef meetings conducted at sites 1, 2, 3 and 5. These meetings provided a chance for the wider members to assist with site setup and/or to discuss progress, issues and results. Results were also extended where ever possible, including Hamilton's "Sheepvention" field days. Additionally, there an open field day at Site 6 near the completion of the project.

## 3.6 Knowledge, Attitude, Skills, Aspirations and Adoption

**KASAA change**

The group members participated in a pre and post Knowledge, Attitude, Skills, Aspirations, Adoption (KASAA) surveys to assess KASAA changes as a result of participating in the demonstration.

**ADOPT workshop**

Upon completion of all site monitoring the group members were taken through the Adoption and Diffusion Outcome Prediction Tool (ADOPT) process to assess the likely uptake of PPM in commercial beef enterprises.

# 4 Results

## 4.1 Site 1, Yeodene, Vic – Spring 2015

The reliability score assigned by the software estimates the accuracy of the cow and calf matching (Figure 3, Table 2). All reliability scores (1-4) were included at Site 1 to assess cow calf associations, as this was the first trial of PMM equipment and the first analysis of data. However, this was the only site that reliability score 4s were included, as they were subsequently considered too inaccurate. Sixty-five percent of cows and calves were correctly matched with a reliability scores 2-4 and no matches received a reliability score of 1 (Table 3).

*Table 3 - Site 1 PMM recording results, including the number of cows and calves utilised, reliability scores, unmatched animals, number of correct matches and length of data collection.*

| Cows in mob | Calves in mob | PMM reliability scores allocated to matches recorded | | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | | | | |
| 23 | 23 | 0 | 4 | 8 | 5 | 6 | 2 | 15 | 3747 | 27 days |
| | | 0% | 17% | 35% | 22% | 26% | 9% | 65% | | |

In addition to the animals used in this analysis, there were another four cow-calf units matched using PMM, which could not be verified, due to insufficient visual identification.

## 4.2 Site 2, Irrewarra, Vic - Spring 2015

Data recording was successful cross checked at this site utilising accurate and comprehensive records kept routinely by the producers. All cattle on this property were identified with both EID and management tags and calves matched to dams at birth.

Over the 40 day recording period, 10 of the 15 cows with calves were successfully matched with very good reliability (Table 4). Two calves achieved a high level of reliability matched to the same cow, which was not believed to be the mother of either calf. The same cow was not matched to her own calf. This result possibly indicates some fostering or "babysitting" taking place, with calves regularly following other cows.

*Table 4 - Site 2 Spring 2015 PMM recording results*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 15 | 15 | 6 | 4 | 2 | 3 | 2 | 10 | 5741 | 40 days |
| | | 40% | 27% | 13% | 20% | 13% | 67% | | |

Two different readers were utilised at this site, with the PedigreeScan reader once again being utilised, as well as an Allflex reader matched to a Sapien Technology flexible antenna. Both readers were tested with a "dummy tag" to measure read range within the single file entrance. Both readers can read the full width of the single file entrance, and from a height of 200mm through to 1500mm. There was no discernible change to the average daily read rate of approximately 140 reads per day recorded, despite the change of readers.

## 4.3 Site 2, Irrewarra, Victoria – Autumn 2016

The PMM results based on either 15, 30 or 60 days of data recording for Site 2 are included below (Table 5).

*Table 5 -Site 2 2016 PMM vs visual recording- comparison over time*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 16 | 16 | 3<br>19% | 1<br>6% | 5<br>31% | 7<br>44% | 1<br>6% | 9<br>56% | 1356 | 15 days |
| 16 | 16 | 8<br>50% | 5<br>31% | 2<br>13% | 1<br>6% | 2*<br>13% | 15<br>94% | 3445 | 30 Days |
| 16 | 16 | 13<br>81% | 2<br>13% | 1<br>6% | 0<br>0% | 2*<br>13% | 16<br>100% | 7167 | 60 Days |

It is believed that the cows listed as being incorrectly matched to calves (*) have either swapped calves, or they were recorded incorrectly at birth. Both visual IDs are very similar with a high chance of incorrect recording. After further investigation undertaken by the producer hosts, the calf which remained unmatched after 30 days, was one which had been assisted during a difficult birth. It was noticeably impaired after birth and spent a considerable amount of time alone away from the main herd. It is evident that it did not present at all through the scanner until day 35, despite its mother travelling through at regular intervals. After day 35 the calf was recorded regularly, eventually becoming one of the most reliable matches in the data set. Without DNA testing it is impossible to know for sure whether the two calves recorded against the incorrect cows, were in fact an error in the visual recording system, or within the PMM system.

## 4.4 Site 3, Birregurra, Vic – Summer/Autumn 2016

Data collection at Site 3 was marred with issues. While cows were willing to walk through the system, the site proved more challenging when it came to calves. The calves were 1-3 months of age, similar to other sites, however there was a much higher incidence of “babysitting” with large groups of calves remaining with a single cow at a given point in the paddock. When calves did travel through the system, they were often travelling in groups and not following closely behind their mothers. While these types of behaviours were something that was raised as a potential issue prior to commencing the project, this was the first time it was experienced to this degree. While data collection was still possible, the usefulness of the data was negligible.

*Table 6 - Site 3 PMM recording results*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 30 | 30 | 0 | 0 | 0 | 30 | 0 | 0 | 1734* | 30 days |
| | | 0% | 0% | 0% | 100% | 0% | 0% | | |

*Total number of records includes 1163 records which were lost due to equipment failure

## 4.5 Site 4, Beeac, Vic – Spring 2016

Of the 246 cows and 246 calves grazing within the system, all cows were recorded using PMM, however only 209 calves where recorded through the system. This indicated either a reluctance to travel through the system, or the ineffectiveness of attractant (water) for calves.

*Table 7 - Site 4 PMM recording Results*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Matches recorded using PMM* | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 246 | 246 | 12 | 54 | 91 | 89 | N/A | 157 | 15,321 | 28 days |
| | | 41% | 27% | 11% | 36% | | 64% | | |

*Note that with no cross-reference data available for the matches at this site, results are reported as matches only, as opposed to “correct matches” at all other sites.

Thirty-seven (or 15%) of the calves didn’t pass a reader and of the remaining 89 calves that were not considered successfully matched, 52 reached a reliability score 4 (Table 7).

There were several periods when high numbers of cows and calves were moving past the PMM equipment. However, there were also times, such as between 19/2 and 18/3 (Figure 16), when very few animals were being detected by the EID scanner and no records were collected.

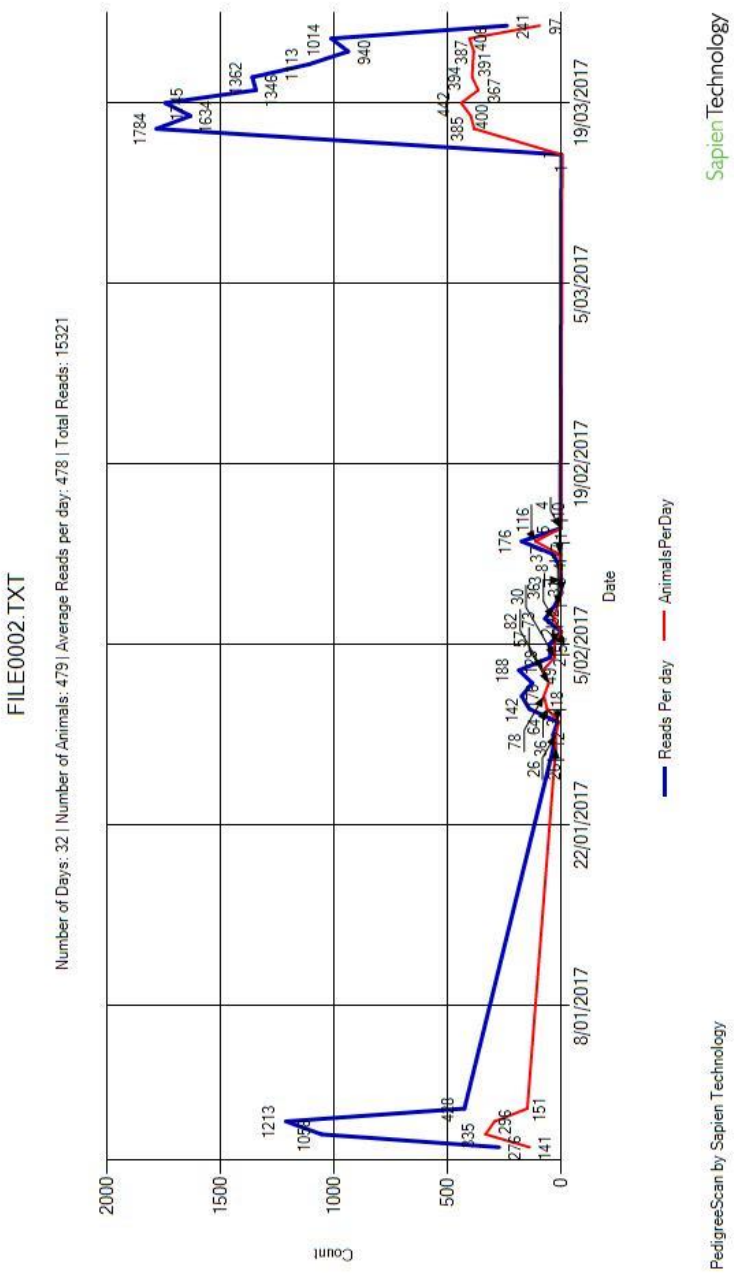



*Figure 16 – Number of EID reads at Site 4, spring 2016. (Graph produced by the Sapien PedigreeScan RFID Reader)*

## 4.6 Site 5, Irrewarra, Vic – Autumn/Winter 2017

Unfortunately, Site 5 autumn/winter 2017 produced no useful pedigree data (Table 8), as calves did not enter any of the PMM systems enough to produce any pedigree matches at all.

*Table 8 - Site 5 PMM Recording Results*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 30 | 30 | 0 | 0 | 0 | 30 | 0 | 0 | 1247 | 17 days |
| | | 0% | 0% | 0% | 100% | 0% | 0% | | |

## 4.7 Site 5– Summer/Autumn – 2018

Only 129 records were achieved in total across the 3-week recording period at Site 5-summer/autumn 2018, with no successful, reliable matches achieved.

*Table 9 - Site 6 PMM Recording Results*

| Cows in mob | Calves in mob | PMM Reliability Scores allocated to matches recorded | | | Number of animals not matched through PMM | Number of incorrect matches recorded through PMM (if known) | Correct matches recorded using PMM | Total number of records captured through PMM | Duration of PMM recording |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | | | | | |
| 30 | 30 | 0 | 0 | 0 | 30 | 0 | 0 | 129 | 20 days |
| | | 0% | 0% | 0% | 100% | 0% | 0% | | |

## 4.8 Communication and Extension

Fourteen farm walks were undertaken with the members of the Colac BetterBeef group and an open field day (with a fact sheet provided - **Error! Reference source not found.**was conducted towards the end of the project, presenting final results. A PPM display was also included in the Agriculture Victoria marquee at Sheepvention field days.

*Table 10 – Communication and extension activities*

| Type of communication and extension | Number | Audience |
|---|---|---|
| Field walks | 14 (approx. 2 per site) | Colac BetterBeef group |
| Interim fact sheet | 1 | Producers in attendance at Sheepvention 2016, Hamilton Vic (Appendix 3) |
| Open field day | 1 | Open invitation to all of industry with a focus on producers |
| Fact sheet | 1 | Open invitation to all of industry with a focus on producers (Appendix 2) |

As the demonstration concludes, the project team is keen to further communicate results through Agriculture Victoria channels, including the Beef and Sheep Networks Newsflash, social media and by promoting the project factsheet on the Farming Systems Demonstration webpage. Additional options to present at conferences and forums will be sort where applicable.

## 4.9 ADOPT model results

The Adoption and Diffusion Outcome Prediction Tool (ADOPT) (Kuehne et al, 2017), was used at the final project workshop to predict the likely extent and time for adoption of PMM in commercial beef enterprises in Victoria with a herd size of at least 100 breeders. The model predicted a peak adoption level of 94% could be reached in 16 years. It identified 26% adoption in 5 years, 76% adoption in 10 years and 50% of peak adoption in 6.8 years. The ADOPT model also identified that if the technology were more easily trialable, peak adoption could be reached at 14.3 years. These were optimistic results and may reflect the groups enthusiasm towards the innovation.

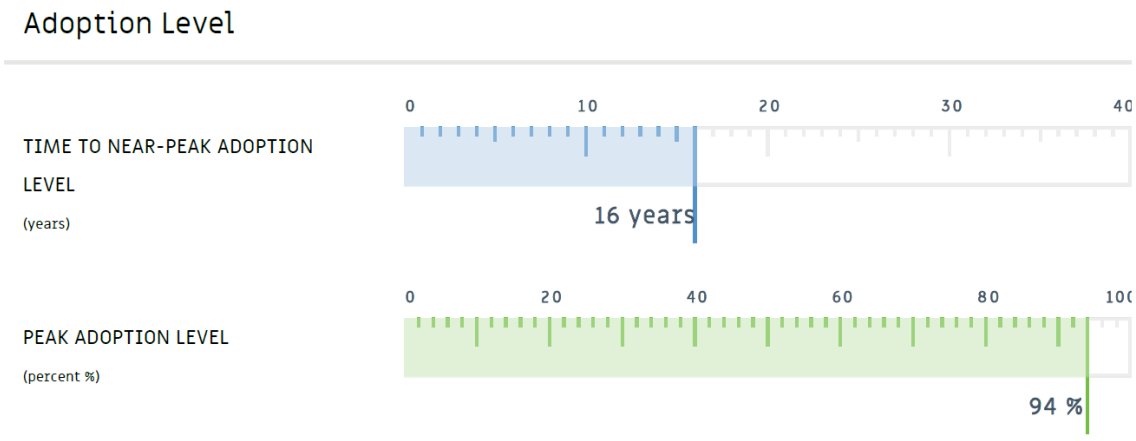



*Figure 17 – adoption of Pedigree Mach maker in beef according the ADOPT modelling*

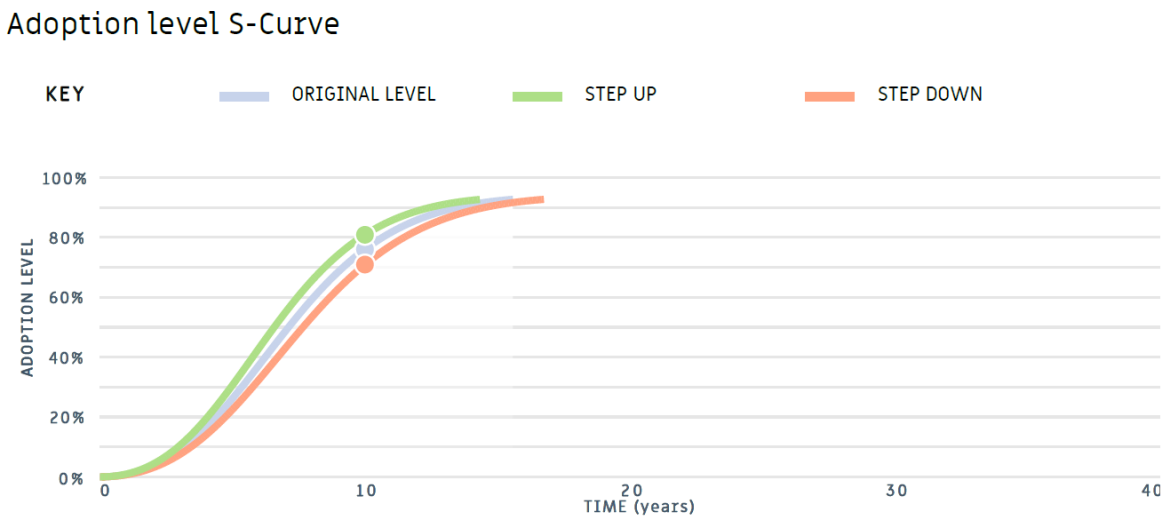



*Figure 18 – s curve showing the step up in in peak adoption if the technology is easily trialable.*

## 4.10 Knowledge, Attitude, Skills, Aspirations and Adoption

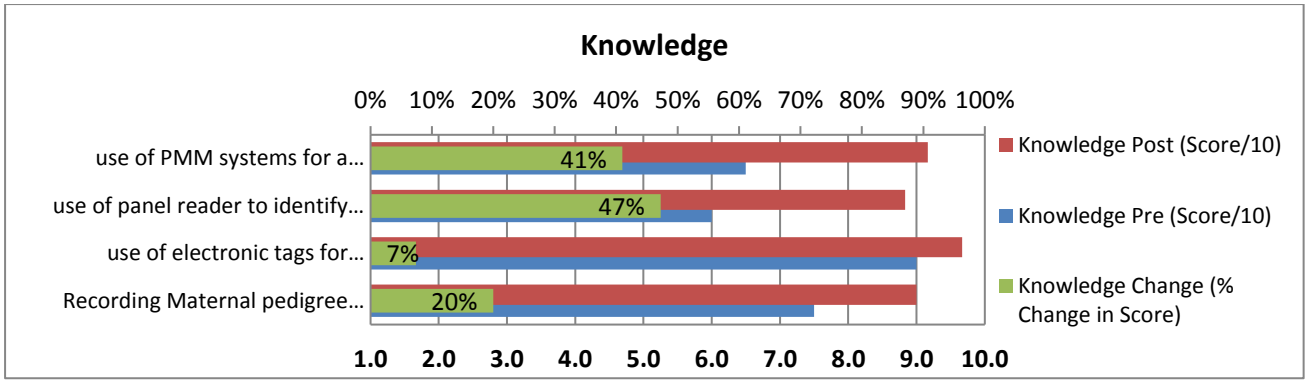
A pre and post evaluation survey was completed by members of the Colac BetterBeef Group. The evaluation measured changes in knowledge, attitude, skills, aspirations and adoption (KASA) for four parameters;

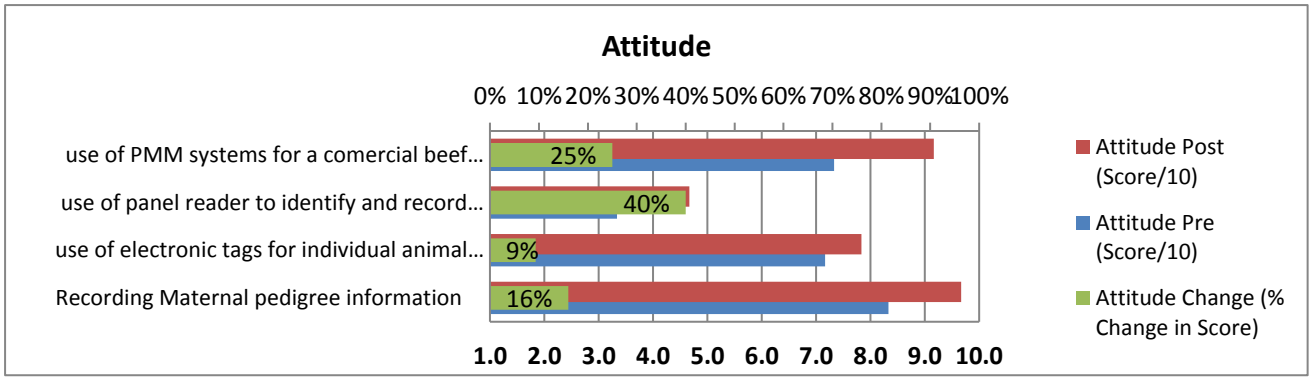
- Use of PMM systems for a commercial beef herd,
- Use of a panel reader to identify and record individual cattle identification,
- Use of electronic tags for individual animal identification and management, and
- Recording maternal pedigree information

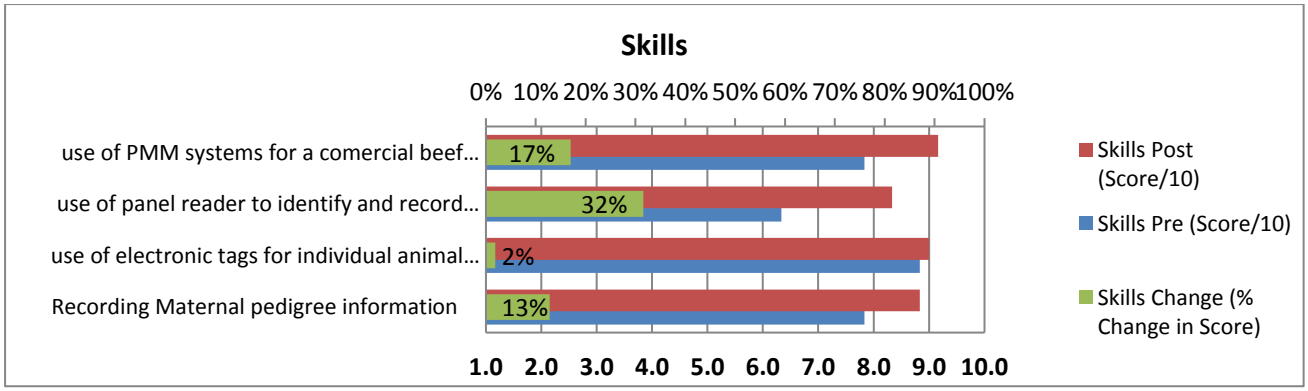
Figure 19 shows that producers' knowledge relating to recording maternal pedigree information increased by 20%. This is likely to have led to the 11% increase in the group's aspirations to record pedigree information. The use of a panel reader to identify and record individual cattle ID had the biggest percentage increase in all areas of the KASAA (47%).

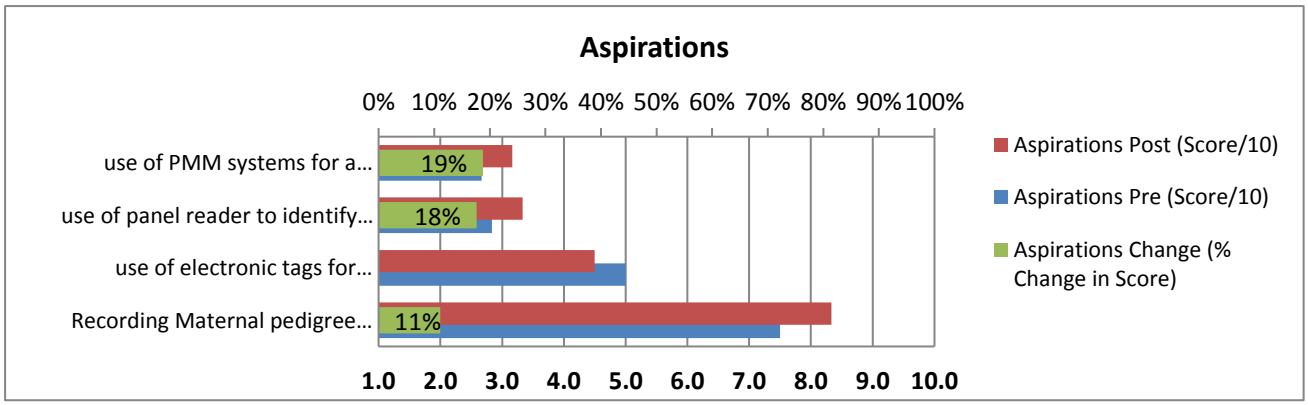
The use of electronic tags for individual identification and management had the lowest change across all KASAA areas. This can be attributed to the mandatory use of EID electronic tags for cattle in Victoria since 2002, and producers were already using electronic tags for animal management benefits.

Ultimately an increase in KASAA for PMM systems for a commercial beef herd was the desired outcome of the demonstration. There was a small increase in the skills and aspirations amongst the group, however the PMM technology collects specific pedigree data and without a clear pathway for using the data, producers are unlikely to invest in the technology. The increased knowledge across all parameters was a positive outcome of the demonstration.


Knowledge
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
use of PMM systems for a...
use of panel reader to identify...
use of electronic tags for...
Recording Maternal pedigree...
41%
47%
7%
20%
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
Knowledge Post (Score/10)
Knowledge Pre (Score/10)
Knowledge Change (% Change in Score)


Attitude
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
use of PMM systems for a comercial beef...
use of panel reader to identify and record...
use of electronic tags for individual animal...
Recording Maternal pedigree information
25%
40%
9%
16%
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
Attitude Post (Score/10)
Attitude Pre (Score/10)
Attitude Change (% Change in Score)


Skills
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
use of PMM systems for a comercial beef...
use of panel reader to identify and record...
use of electronic tags for individual animal...
Recording Maternal pedigree information
17%
32%
2%
13%
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
Skills Post (Score/10)
Skills Pre (Score/10)
Skills Change (% Change in Score)


Aspirations
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
use of PMM systems for a...
use of panel reader to identify...
use of electronic tags for...
Recording Maternal pedigree...
19%
18%
11%
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
Aspirations Post (Score/10)
Aspirations Pre (Score/10)
Aspirations Change (% Change in Score)

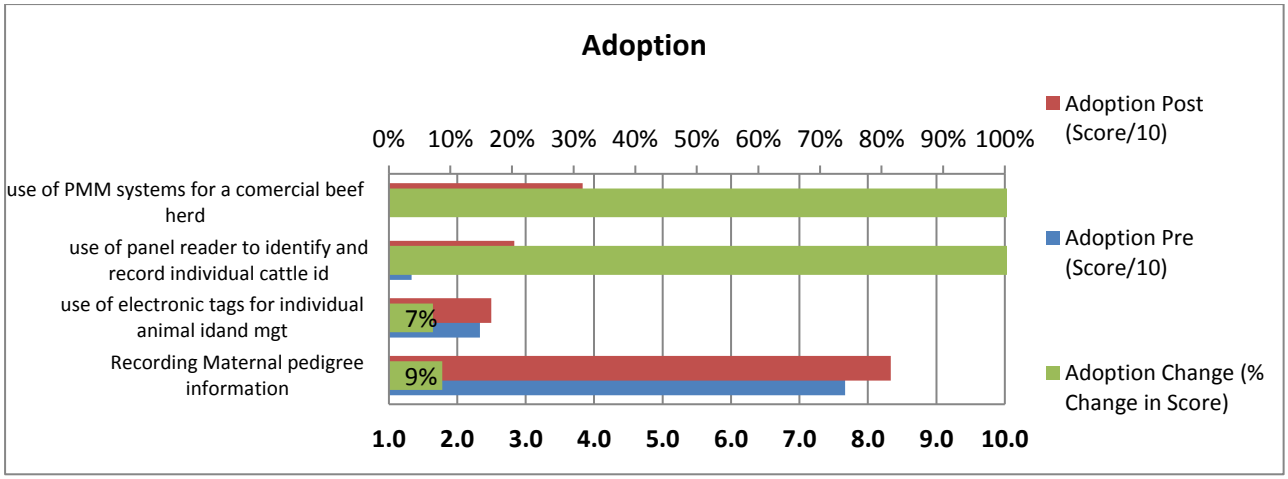



*Figure 19 – knowledge, attitude, skill, aspirations and adoption percentage change graphs*

Table 11 details a sample of responses to surveys after events held throughout the EPDS and Table 12 provides additional comments from the KASSA survey. Some members indicated a benefit of using PMM whilst others suggested some form pedigree recording and better record keeping in general would lead to herd improvements.

*Table 11 – Examples of responses to evaluation surveys*

| Question | Response |
|---|---|
| Respondent 1 | |
| Do you plan to make changes on-farm as a result of attending today? | • Yes |
| If "YES", briefly describe the planned changes: | • "How to setup part of the farm to be able to do the program (PPM)" |
| What benefits do you expect from the changes? | • "I.D. what breeders to keep and improve the herd"<br>• "Increase beef production" |
| Respondent 2 | |
| Do you plan to make changes on-farm as a result of attending today? | • Yes |
| If "YES", briefly describe the planned changes: | • "Invest in a panel reader" |
| What benefits do you expect from the changes? | • "Better record keeping" |

*Table 12 – Samples of KASAA survey responses*

| Question | Response |
|---|---|
| Objective 1 recording maternal pedigree<br>What specific benefits can you see for your beef enterprise arising from recording maternal pedigree? | "What are the cattle to keep for improved productivity gains" |
| Objective 4 use of PMM system for a commercial beef herd | "In respect to safety, saving time in matching and calf performance" |

| | |
|---|---|
| What specific benefits can you see for your beef enterprise arising from the use of PMM system? | |

# 5 Discussion

## 5.1 Producer Sites

### 5.1.1 Site 1, Yeodene, Victoria – Spring 2015

As the first site for this demonstration, the main discoveries centred around approaches to move stock through the system. While this is a similar requirement to sheep applications of PMM, the aim was to position the setup in a location that would capture cattle movements between paddocks.

It was planned that cows were trained to walk through the single file PMM system prior to calving to help achieve high rates of data collection. However, there was much to learn about effective set up and methods of training cows, which resulted in a delayed start to recording. Instead, cows were trained to walk through the set-up after calving, with calves at foot.

Due to this initial setback, it was not surprising that the PMM equipment did not provide the volume of records required to achieve a high level of accuracy for this site, and 26% of calves remaining unmatched. However, it did prove that the concept *could* work, with 52% cows and calves matched successfully.

The Sapien PedigreeScan panel reader had not previously been used for cattle, yet successfully recorded both cow and calf tags, despite physical height differences. Sufficient data was captured to produce pedigree matches across subsequent sites and locations. Its low power usage made it user friendly and reliable.

The lack of historical pedigree recording on this property presented another challenge, requiring this to be undertaken for the first time. Unfortunately, the visual conformation of cow/calf matches was not 100% accurate for this trial site and limited the ability to confirm matches made by the PMM system.

As an initial learning platform, the site played a significant role for establishing the basic requirements for PMM that would be implement throughout the project.

The hosts developed a greater appreciation for the use of pedigree information, regardless of the method of recording. They recognised the benefits of recording performance information against individual animals using RFID tags, rather than simply applying tags immediately prior to sale as they had the past. This was a positive outcome from their involvement in the demonstration.

### 5.1.2 Site 2, Irrewarra, Victoria – Spring 2015

Site 2 demonstrated that it was possible to train cows and calves to walk through the single file entrance using an effective attractant. It also demonstrated that data recording can successfully match cows to their calves. While the numbers in the mob at Site 2 were relatively small (15 cows with calves at foot), it was important to ground truth the PMM concept, where reliable visual cow/calf associations had been collected and provided confidence in the system.

*Figure 20 –site 2 - cattle entering the single file entrance*

Water was an effective attractant under the dry pasture conditions of Site 2, and all animals in the mob were recorded through the system. This was the first time that temporary electric fencing was used to enclose the area around the trough, creating the single file entrance.

The construction of temporary fence panels from treated pine timber on this site and was one of the more significant developments for the practical and cost-effective implementation of the concept. These panels were lighter to handle and easier to work with due to the flexibility they offer in layout. Furthermore, they cost approximately one third the price of the metal panels used previously in the project. Construction details can be found in the recommendations section of this report.

Unfortunately, cattle rubbing on the fence panels caused the entrance to widen and damaged the link cable. A more rigid attachment of the overhead piece of timber and better anchored fence panels prevented this from occurring at subsequent sites. A PedigreeScan panel reader was used at Site 1 for the remainder of the recording period.

The Sapien Technology PedigreeScan panel proved again to be user-friendly, with very low power usage and simple Plug and Play design. A single 80-amp hour battery was used throughout the

recording period, with only one charge required in the final days. It was also found by the hosts to be easy to monitor with the simple display screen indicating the number of reads recorded.

*Figure 21 - Site2 2015 - calf travelling past the Sapien Technology PedigreeScan panel reader demonstrating the height of recording for calves*

*Figure 22 - Site 2 2015 - cow travelling pass the Sapien Technology PedigreeScan panel reader demonstrating the height of recording for cows*

The change of reader midway through the recording provided an opportunity to compare the Allflex and the PedigreeScan readers. The read range of the Allflex panel data capture matched the Sapien flexible antenna and was equivalent to the PedigreeScan panel with similar read range and average

daily read rates. The power usage however, was considerably higher and the 80-amp hour battery used previously and the PedigreeScan reader relied heavily on solar panels to keep up with the power demands of the Allflex reader. While effective, the solar panels add an extra level of complexity and cost to the setup plus more potential issues. These issues can be as simple as having wiring indivertibly accessible to calves leading to chewed cables, a disconnected solar panel and dead batteries.

*Figure 23 - Site 2 2015 - Chris Blore (Agriculture Victoria) applying the finishing touches to equipment installation, including solar panel to maintain charge during use of Allflex reader.*

With regular stock movement through the setup, this site demonstrated that it was possible to record the pedigree of most calves through the use of PMM to a reliability level of 1, 2 or 3. However, it showed that some animals present themselves to the system infrequently, in a disorderly fashion, or not at all, as 26% of calves were unmatched. The site also demonstrated that calves can be matched incorrectly, as in one instance, two calves were matched to the same cow, despite neither calf belonging to her. This was always a concern to the group, given the propensity of cattle to "babysit" other calves. Often referred to as the "Aunty Cows", the group felt this was a potential limitation of the system, with calves following another cow.

Generally, the results from this site were encouraging because they demonstrated that it was possible to match cows and calves using PMM. The group felt that with further refinement the percentage of animas matched accurately should increase.

### 5.1.3 Site 2, Irrewarra, Victoria - Autumn 2016

Site 2 Summer/Autumn 2016 provided evidence that it was possible to: (1) get cows and calves accustomed to walking through the single file entrance of PMM, and (2) record all animals within a 60-day period, and most within 30 days, which is more commercially realistic.

To establish the length of time required to accurately match cows and calves, the system was run for 60 days. In this case, the extended period of monitoring led to 100% cow/calf pairing. One calf took 35 days before it walked through the system. Upon investigation, it was revealed that this calf had been assisted at birth and the host observed that it was often not travelling the paddock with the rest of the animals. Its traumatic birth had presumably taken a toll on the calf and its behaviour was affected for a prolonged period. It is worth noting, that there were visually no indications that this calf was any different to others in the paddock.

The second issue drawing attention from the group, was that two cows appeared to swap calves at some point during the testing of the PMM system. Both cow/calf units were accurately matched according to PMM, yet their recording was the reverse in the property's herd book. There are two distinct possibilities for this scenario. The first, is that the cows swapped calves at some point, which is quite possible as fostering of calves is known to happen. The second possibility is that the calf details were recorded incorrectly in the herd book at calving.

The visual numbering system used on the property involves the cow and calf carrying the same tag number, with the year-colour of the tag providing the differentiation. The two numbers in question, in this instance were 3101 and 310. There is a potential for human error to have occurred in the recording of these animals, although the hosts believed this is unlikely, given that the number is written on the tag as it is applied to the calf.

A DNA test is the only method to determine the correct match in this case. The case also raised the question of the most important traits for the enterprise and how detrimental a result like this could be. If it were a stud or commercial operation wanting to apply selection pressure on specific traits, the impact could be considerable. If, however it was applying selection pressure on the cows based upon a composite trait (such as kilograms of calf weaned), the impact is lessened. A trait such as kilograms of calf weaned considers more than just the genetic growth of the calf, including the cows milking ability as well. Based on this, the cow that milks well throughout lactation will still provide a gain, even if it wasn't her calf that she rears.

At this site, 94% of cows were matched to the calves they were rearing after 30 days of recording. The calf that was not matched initially, was subsequently matched in the next 30-day period, once it had recovered from its traumatic birth.

This site demonstrated that it was possible to record all animals within a 60-day period, but more practically, 30 days was enough for most animals.

The site highlighted that fostering calves is a potential issue for the PMM system, given that the focus is on the animal being reared and not the animal born to a particular cow.

Water was a particularly good attractant under dry summer/autumn conditions and resulted in excellent animal flow through the system. Given the abundance dry feed, there was also little incentive for stock to be moved to a different paddock, allowing a prolonged recording period.

### 5.1.4 Site 3 Birregurra, Victoria - Summer/Autumn 2016

Site 3 presented some challenges and frustrations in comparison to previous sites. The difference in seasonal conditions meant that cattle were now grazing lush, green grass, with a noticeable reduction in the attractiveness of water available in a trough. This was identified as a significant challenge for PMM in beef herds, particularly for autumn calving herds, which would encounter these circumstances in most years.

Data analysis supported the group's visual observations, that random cattle flowed through the system without the desired cow/calf associations. No confirmed matches were recorded. Some cows travelled through the system to the trough, however calves were observed comfortably remaining in other areas of the paddock with other cows. This "babysitting" affect was always a concern in the planning of this demonstration, however it had not developed as an issue at previous sites.

The group determined that the trough height was a likely deterrent for calves. The height of the trough and soft, pugged ground around it made it difficult for calves to drink (Figure 24) however,

this had not been identified by the host or anyone else involved in the set up. All other sites had recorded calves moving to the water point, indicating that despite the consumption of milk from their mothers, they were still travelling to water. Whether trough height, or pasture conditions had the greatest influence, could not be determined, as the observations around trough height occurred towards the end of the recording period.

*Figure 24 - Photo showing trough height at site 3*

Other group members recognised that trough heights on their properties had been determined to prevent cows accessing and standing in them and not to allow calf access for drinking. The progressive eroding of soil around troughs exacerbates this problem. Most group members identified that many troughs across their properties presented the same potential issue.

The implications of this finding may be more wide-ranging than in the context of this project. It has been clearly demonstrated at previous sites that calves will follow their mother to water even in winter/spring and our previous host property owners have witnessed them drinking from the troughs. The fact that the calves on this property did not appear to have been accessing water could impact upon their performance through subclinical dehydration. The impact may only be minor due to the age of the calves and the fact that most of their needs are being met by milk from the cow, however, it is still worthy of consideration. It is of greater risk for spring calving herds, whose calves experience a higher water requirement earlier in life due to changing pasture and climatic conditions.

Other complications on this site include the failure of a panel reader which was a prototype of the now commercially available PedigreeScan reader from Sapien Technology. The reader had been used extensively without incident in both this project and 10 sheep PMM projects/activities over the previous two years. On one occasion, the Bluetooth module failed to connect to allow download. It was later found that the reader had stopped reading entirely and that moisture had entered the internal components of the reader, compromising all functionality and destroying the data captured during the first two weeks of recording. This was not a problem that has been experienced with this type of reader before and is believed to be an isolated incidence.

In summary, the vastly different seasonal conditions to the previous recording period, with abundant water and green feed throughout the paddock, made encouraging cows and calves through the system challenging. There were also problems with equipment, highlighting the need for regular data downloading.

### 5.1.5 Site 4, Beeac, Victoria – Spring/Summer 2016

Site 4 presented an opportunity to test PMM with larger numbers of cattle - 246 cows with calves at foot. The ability to achieve adequate flow through a PMM system with large animal numbers had been well established in sheep, however, there it was unproven with cattle.

A cell grazing system with 15 paddocks was used. Figure 15 shows the peaks and troughs in recording. This included extended periods when cattle were moved to other paddocks and the use of PMM was not possible. The large peak towards the end of the recording period was achieved when all equipment was relocated and cattle flow to water could be isolated to a single entrance.

Set up of equipment and recording at Site 4 was delayed for various reasons including:

- Very wet paddock conditions restricting access, until late October. It was determined that setting up would cause significant damage through pugging. It was also likely that accuracy would have been affected by reduced movement of cattle to and from water troughs during the wet conditions.
- Extremely high pasture growth rates influencing paddock selection in the spring. The paddocks requiring grazing were unsuitable for testing PMM due to multiple water points, or waterpoints in unfavourable location. The more appropriate paddock was not ready to be grazed until later in the season.
- Pink eye developed in calves, causing cattle to be moved for treatment and delaying rotation to the selected paddock.

Site 4 required additional timber panels to create a second entrance, and more extensive electric fencing to direct stock through the entrances. The complexity of rotational grazing and both wet and hot conditions required a more complex setup. These new developments would be used in future designs, particularly the temporary electric fencing systems.

There was also a two-month delay in receiving the tag number files from the farm manager, who did not normally download or use the information. The manager requested assistance to access the file, which led to an unexpected outcome for the demonstration- NLIS database training. A training session was provided to the group by Achieve Ag Solutions staff after finding the NLIS database access was a common issue.

The wet conditions and rotational grazing proved challenging and three different locations trialed to ensure effective data capture. With time (to allow paddocks to dry out) and planning, the issues were overcome.

*Figure 25 - Site 4 PMM setup Site 2017 - evidence of cattle traffic through the single file entrance and up to the trough located within the fenced off area*

*Figure 26 - Site 4 2017 - cattle used*

*Figure 27 - Site 4 2017 - small amount of pugging in the entrance following rain*

*Figure 28 Site 4 2017 - cattle congregating within the fenced off water point*

With recording taking place in warm spring/summer conditions, the greatest concern was dehydration if cattle were not readily accessing water. As a precaution, a spare trough was located outside the fenced area to allow the host producer to increase access to water at any point. An additional entry point into the fenced area was also constructed but did not contain a second reader due to issues with interference caused when two readers are within proximity. This limitation can be overcome by synchronising the readers to ensure they operate a fraction of a second apart and don't compete. Only some readers in their standard form are capable of this function, and generally not on-farm readers. Saleyards and abattoirs rely on this functionality using more expensive commercial readers to operate effectively.

There were four days when the hosts decided to offer the additional water source to cattle and the remainder of the time cows and calves relied on one trough within the fenced area.

The cattle adapted quickly to the set up and once again, temporary electric fencing was used to fence off a large area including the water source. Given that the property utilises a cell grazing system, with large mobs and fast rotations, it was necessary to design the system around these factors. As outlined in the methodology, placing the setup within the centre of the wagon wheel paddock design allowed the PMM system to be used for multiple paddocks. While the recording period wasn't continuous, it was achieved easily over the course of multiple rotations through paddocks in the area.

The property had not previously recorded pedigree information owing to the scale of the operation and the labour it would require. The result of 64% of calves matched to cows through the PMM system provided evidence to the host that it was possible to apply some level of selection pressure, which had not previously been available. With further refinement of the system, the result could be improved considerably given that 75% of calves that travelling through the system were matched with a reliability of 1,2 or 3.

In summary, this site reinforces that the first challenge to PMM is to get animals travelling through the system, and the second is to achieve enough records of cow/calf units to provide confidence in the result. The number of animals recorded at least once through the system was 442 of a possible 492 (89.8%) (Figure 16). While not all cows and calves were matched successfully, the site

demonstrated that large numbers of animals can be recorded if there is an appropriate attractant to provide the incentive required.

### 5.1.6 Site 5, Irrewarra Victoria, Autumn/Winter 2017

Site 5 in Autumn/Winter of 2017 provided the greatest challenges of the whole project. The aim was to test hay/silage and lick blocks as alternative attractants to water, and enable better animal flow through the system under green feed conditions. The hay and silage provided great incentive for cows to enter the system initially, but there was little interest from calves, particularly as conditions worsened across the site with wet weather and pugging. The lick blocks provided no incentive whatsoever, despite consumption of the blocks being observed in the lead up to fencing off the area.

Recording was delayed by a month due to the timing of calving, very wet site conditions and delayed application of RFID tags to calves. The calves were 10 – 16 weeks old at the start of recording.

Notable at this site, was how quickly paddock conditions deteriorated through the winter recording period, following double the average rainfall for April (Table 13). Cattle tended to mill around the gateway and fenced off area waiting for more hay or silage, which exacerbated the situation. The wet conditions led to severe pugging within a two-week period, to the point that cattle had to be moved to another paddock. This ended PMM recording.

*Table 13 - Rainfall data for Colac 2017, Bureau of Meteorology (BOM) site 90022*

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly Total 2017 | 43.4 | 22.6 | 23.2 | 105.2 | 47.4 | 13.4 | 66.2 | 64.6 | 90.4 | 35.6 | 83.4 | 22.6 |
| Mean | 36.9 | 30.9 | 29.6 | 44.4 | 48.9 | 56.3 | 67.5 | 71.6 | 59.4 | 58.3 | 47.9 | 36.3 |
| Median | 26.8 | 23 | 24.1 | 31.6 | 48.3 | 55.5 | 71.2 | 64.7 | 57.6 | 44.6 | 49.6 | 31.2 |

(BOM, 2019)

The result of no confirmed cow/calf matches was disappointing, however, there were considerable learning opportunities.

The lick blocks were not successful in attracting cattle to walk past the PMM equipment, despite activity around the blocks immediately prior to fencing off the area, and cattle didn't enter the fenced off area at all. As feed on offer reduced across the paddock, it could be noted that the area inside the lick block location was ungrazed (Figure 29).

*Figure 29 - Obvious lack of traffic and grazing within the area containing lick blocks*

Hay and silage on the other hand, proved very effective as an attractant and led to some unexpected issues with traffic across the paddock. The cows became quickly accustomed to waiting in the corner of the paddock for the next bale of hay or silage to arrive. This resulted in excessive grazing and trampling of the corner of the paddock nearest the gate.

*Figure 30 - Traffic was concentrated around the gate, anticipating the arrival of hay.*

*Figure 31 - It is possible to see the amount of stock movement around the entrance prior to fully closing off the fenced areas.*

As the weather and paddock conditions deteriorated considerably, it became obvious that concentrating cattle movements around the hay rings was causing pugging. The paddock became so wet that calves were reluctant to travel through the heavily pugged areas.

*Figure 32 - Severe pugging around the hay feeders. Even getting hay into position proved difficult.*

The host producer was keen to persist and make the system work, however, the conditions deteriorated to the point that was no choice but to move the cattle and abandon recording.

*Figure 33 - A large section of the paddock underwater, illustrating the extent of the waterlogging.*

*Figure 34 - Pugging*

While the efforts of host producer to persist with the recording are commended, there was significant damage to pasture sustained as a result and it was a concern he may need to take remedial action to rectify the issues.

*Figure 35 - Damage caused by concentrated cattle traffic in wet conditions at the site*

Figure 36 shows the comparison in conditions at setup and three weeks later after conditions had quickly deteriorated.

*Figure 36 - Comparison of conditions at the start of set up period and when recording efforts were abandoned*

Fortunately, the action to remove the cattle after just a week of very bad pugging, was implemented early enough to mitigate significant long-term damage, and pasture recovered over the following months (Figure 37).

*Figure 37 - Site 5 June 2018, the area of pasture damaged by pugging the previous year.*

While the lack of data captured was disappointing, the site provided considerable learning opportunities that shaped the final recommendations of the project. The most important observations were:

- Recording during winter/spring is difficult due to wet conditions and should only be undertaken where the season permits. For this reason, the PMM concept is considered better suited to spring born calves, where recording will happen in the summer months, with drier conditions.

- While alternative attractants may be useful, water was the best attractant tested. Hay and silage were great additions to help attract more flow through the system, however, the logistics are difficult, and it should only be used under dry conditions where pugging will not be an issue. The suitability of hay as an attractant for calves is questionable.

- During planning for the project, it was proposed that crushed rock, or soil stabilising products could reduce plugging. However, in this trial period, no amount of effort could have overcome the pugging problems due to the vast area (2ha) that was affected by cattle traffic.

- While the conditions experienced were certainly wet, they were not unusual for the location at that time of year. When the conditions of paddocks surrounding the one in question were compared, there was a marked difference in the impact that cattle had upon pastures and the incidence of pugging. The use of PMM in these conditions had a negative impact upon cattle grazing habits and resulted in severe pugging and pasture damage, while all other paddocks were seemingly unaffected under similar stocking rates.

### 5.1.7 Site 5, Irrewarra – Summer/Autumn 2018

Site 5 in summer/autumn 2018 offered a final opportunity to test the system under green feed conditions. A different paddock, and different cattle were used, compared to the 2017 site on the same property. While the season was drier and offered much less risk of pugging, the lack of moisture restricted pasture growth and the time available for grazing the paddock with PMM setup.

Despite dryer conditions, water provided little or no attraction, evidenced by very low numbers of cows and calves detected by the system (Table 9). A small amount of hay was thrown into the area on regular occasions to coax animals past the reader, however, this was observed to create disorderly entry through the system, and very few calves followed their own mothers. These observations were confirmed by PMM with only 191 animals recorded across the whole period, and no cow/calf matches created.

Issues with the reader itself also contributed to low levels of animal detection. When testing the range of a reader, it is critical that it be set up precisely. In this instance, clipping one more device (XR3000 indicator charger) onto the same battery, halved the read range and resulted in poor read rates.

Some animals were observed baulking at the entrance due to the beep produced by the panel reader. While the volume is adjustable, the beep is still audible on low volume. The decision was made to disconnect the beeper, resulting in an immediate reduction in baulking. Recording rates subsequently increased, however it is not possible to differentiate between the beep influence and the natural desensitisation to the whole setup over time.

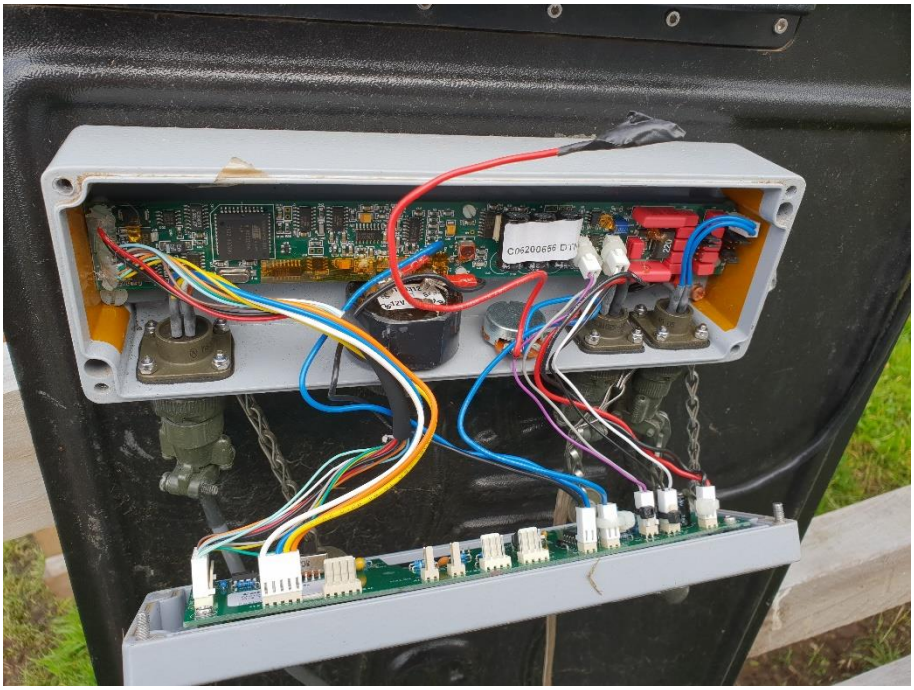


*Figure 38 - Disconnecting the beeper on Allflex panel reader*

It was also observed, that not all ear tags were being read when cattle travelled through the entrance, unlike other sites. It was discovered that the read range had shortened considerably, and testing showed that charging the XR3000 indicator from the same deep cycle battery and the panel reader was creating interference and reducing the read range by half. This was not discovered during set up as the charging cable was the final item attached to the battery, which came after the read range had been checked. Providing a second battery for the XR3000, supplemented by a small solar panel, solved the issue and returned the system to a fully functioning read range.

Some battery issues associated with using a standard panel reader (in this case Allflex), were experienced over the initial 10 days of testing and the 80-amp hour deep cycle battery drained completely. This was problematic, as it is not possible to recharge a deep cycle battery, once completely flat, using a standard battery charger. For this reason, a battery monitoring device ($80) was added to the setup to ensure that the battery was not reduced below 11.5 volts, which protected the life and capacity of the battery. During periods of the demonstration when solar panels were operating effectively, this had not been an issue.

Ultimately, the recording period for this final site was limited by low feed on offer. Cattle came into the demonstration paddock for a 10-day period, however they were removed when feed became limiting, half way through the recording period, to allow two weeks of growth. While this did allow some pasture growth, the slow start to the season placed significant limitations on the time stock could be held in a single paddock.

The experience at this final site reiterated the main constraints to the use of PMM in cattle. These were feed conditions, including the grazing time available in a single paddock; general stock flow through the system maintaining sufficient power to run the reader and data-capture equipment.

The most significant constraint, also observed at other sites, was a lack of stock movement through the system and calves following cows. With each feed of hay, around 10 cows and 3 calves regularly entered the fenced area and cows tended to rush through, without any regard for calves.

*Figure 39 - A small amount of hay was used to encourage cows through the entrance*

The remaining cattle congregated outside the fenced area, with little interest in travelling through the entrance.

*Figure 40 – Majority of cattle congregating outside the fenced area*

It was obvious at this site that water was of no interest whatsoever, and cows opted to rub on the trough rather than drink from it. The green feed alone across the paddock was likely to be providing animals with a significant daily water intake.

## 5.2 Economic analysis

There was a large variation across the group in estimated costs for recording pedigree by traditional methods. Group members who were recording pedigree generally tagged calves at birth. While this takes time, most felt it was a small impost as they were checking calving cows anyway.

Economic analysis was calculated using the cost of recording pedigree using PMM, allowing producers to make their own comparison with their existing methods of recording.

Three alternative costings were calculated. Each amortises the cost of purchased equipment over 10 years and provides a breakdown of the cost per animal recorded based on various herd sizes. The first costing is based on the equipment recommended for ease of use. This comes at a greater cost; however, it does provide a greater opportunity for success.

The second costing is based upon the producer already owning a panel reader, weigh scale indicator to capture data and temporary electric fencing equipment. This scenario offers a considerably lower equipment cost; however, given solar panels are used, additional time has been allocated to checking equipment.

The third costing is based on hiring the PedigreeScan panel reader, which currently costs $110 per week, and using existing electric fencing equipment.

All scenarios use timber fence panels for the entrance, which can be constructed for $50 each, compared to steel panels which cost $180 each.

*Table 14 - Costs of recording using PMM based on combinations of purchased and already owned equipment*

| Item | **Option 1** Specific Purchased Equipment | **Option 2** Standard panel reader & electric fencing equipment already owned | **Option 3** Hired panel reader & electric fencing equipment already owned |
|---|---|---|---|
| Temporary timber fence panels required - 6 @ $50 | $300 | $300 | $300 |
| Electric fencing equipment* | $50 | | |
| Sapien Technology Panel Reader | $3,500 | | |
| Deep Cycle Battery | $170 | $170 | $170 |
| Solar Panel | | $300 | |
| Total equipment cost | $4,020 | $770 | $470 |
| | | | |
| Lifespan of equipment (years) | 10 | 10 | 10 |
| **Purchased Equipment cost per year** | **$402** | **$77** | **$47** |
| | | | |
| Equipment hire cost per year | | | $440 |
| Set up time (hrs) | 3 | 3 | 3 |
| Set up cost at $35/hr | $105 | $105 | $105 |
| Amount of monitoring required (hrs) | 3 | 5 | 3 |
| Monitoring cost at $35/hr | $105 | $175 | $105 |
| **Total labour cost per year** | **$210** | **$280** | **$210** |
| | | | |
| **Total combined labour & equipment cost** | **$612** | **$357** | **$697** |
| | | | |
| **Cost per animal based on the number of animals recorded** | | | |
| 50 | $12.24 | $7.14 | $13.94 |
| 100 | $6.12 | $3.57 | $6.97 |
| 200 | $3.06 | $1.79 | $3.49 |
| 300 | $2.04 | $1.19 | $2.32 |

* assumes there is an existing electric fence system to attach to

A 3:1 return on investment (ROI) in labour and equipment was assumed to justify the investment.

Table 15 shows the increase in carcass weight produced per cow per year required to deliver this 3:1 ROI.

*Table 15 - Increase in carcase weight required to deliver a 3:1 return on investment in the cost of implementing PMM*

| Measure | **Option 1** Specific Purchased Equipment | **Option 2** Standard panel reader & electric fencing equipment already owned | **Option 3** Hired panel reader & electric fencing equipment already owned |
|---|---|---|---|
| Cost per animal based on 100 animals recorded | $6.12 | $3.57 | $6.97 |
| Return required to produce a 3:1 return on investment | $18.36 | $10.71 | $20.91 |
| Increase in carcass weight produced per cow (kg) required to produce a 3:1 return on investment in equipment and labour based on $5/kg carcass weight | 3.67 | 2.14 | 4.18 |

Increases in carcass weight of less than 5kg per cow per year were required under all options presented above. The increase in growth rate required between calving and weaning was less than 3% (assuming weaning at 8 months, weaning weight of 230kg and birthweight of 30kg).

Achieving this improvement in a single year, and then maintaining it each year, will continue to cover the annual cost of using PMM. Any further cumulative improvements in performance are additional ROI.

The two components to improving herd performance based upon cow selection are genetic improvement, and generational improvement. Genetic improvement relates to the ongoing and cumulative improvement achieved through selecting and breeding from animals with higher genetic merit. Generational improvement refers to moving the average performance of a generation of animals, simply by removing the poorer performing animals. To maintain stocking rate, while applying generational selection, it is important that the animals removed are replaced with better animals.

Knowing the pedigree of calves is valuable only if it is associated with good genetic or generational decision making. The true value of recording pedigree using PMM is clearly influenced the actions generated by knowledge of pedigree.

## 5.3 Overall findings & recommendations

The demonstration showed that there is huge variation in the ability of PMM for beef to accurately match calves to their dams. Whilst it was possible to match cows and calves using PMM to achieve reliability scores of 1,2 or 3 – there were also scenarios where no reliable data could be collected. It also demonstrated that a mob as large as 246 cows with calves at foot can progress through a PMM setup, provided that the design of the area and seasonal conditions are conducive. Recommendations for the successful use of PMM with cattle include the following;

### 5.3.1 Recording equipment, batteries & solar panels

Any EID panel reader can be used to record cattle in a PMM system, however, power usage proved to be a problem with standard panels during this demonstration. If using a standard panel reader, solar panels are a must to keep sufficient charge in the deep cycle batteries powering the reader.

Attaching a separate data logging unit, such as a weigh scale indicator (Trutest XR3000 or similar) can be effective, however it became evident within this demonstration that charging with the same battery can interfere with the read range of the panel reader, and hinder recording.

The Sapien Technology PedigreeScan panel reader provides the most user-friendly option for reading tags in a PMM system. It used less than 5% of the power of a traditional panel reader and has a built-in data logger. All of this means that the only reading equipment required is a deep cycle battery of around 60-amp hours or more and the PedigreeScan panel reader. At the time of writing this report PedigreeScan panel was available for hire.

### 5.3.2 Fencing & temporary fence panels

Temporary cattle yard panels are required to fence off an area and create a single file entrance for mounting the reader. While some heavy-duty panels were used during the demonstration, treated pine panels were the most cost effective and user-friendly option. The panel reader should be mounted onto timber rather than metal to ensure effective performance, so at least one panels should be timber.

Timber panels can be constructed cheaply using treated pine sleepers and fence rail timber. The materials cost around $50 for a 1.8m x 1.8m timber panel, compared favourably to the heavy-duty steel panels at $180 each.

*Figure 41 - Treated pine timber panel constructed for use in PMM*

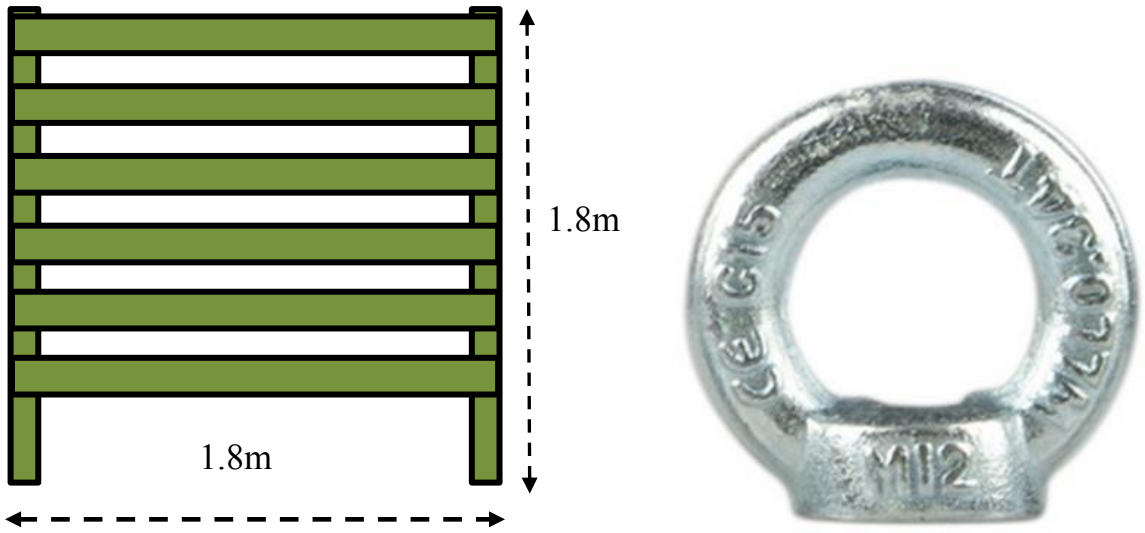



*Figure 42 - Timber panel dimensions & metal eyelets used for pinning panels together (using metal pins similar to traditional temporary fence panels.*

Temporary electric fencing provided a simple way to exclude animals from the attractant. This was done using tread-in posts and poly wire or poly tape. In most instances, it was possible to simply hook onto existing electric fencing to provide power. In one instance a solar electric fence unit was used.

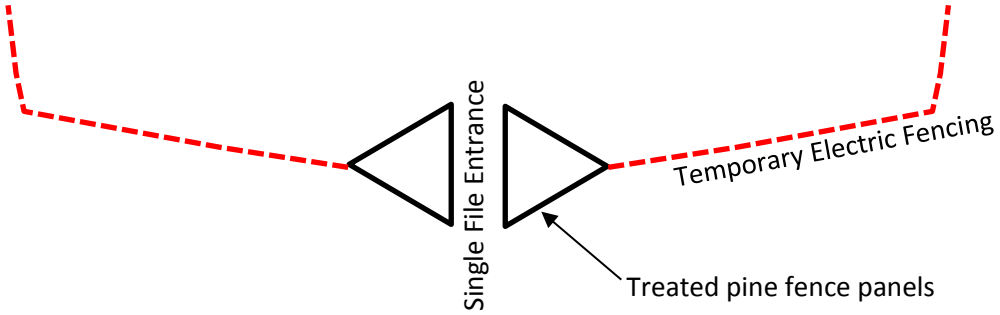



*Figure 43- Recommended layout using temporary electric fencing and treated pine fence panels*

### 5.3.3 Attractants

Water was the most effective attractant for achieving enough animal flow through the PMM system. It does however rely on the seasonal conditions encouraging cattle to drink. Wet conditions, or situations where abundant green feed is available, will result in poorer animal flow through the system. Other attractants such as hay and silage, or lick blocks may supplement water but were not as effective on their own, particularly in attracting calves through the system. Other cattle operations may achieve more success using alternative attractants if their stock have a higher requirement for supplementation.

### 5.3.4 Training stock

Generally, cattle adapted quickly to the PMM setup, wherever an effective attractant such as water (under dry conditions) was used. However, participants concluded that the best opportunities for cow/calf matching are achieved when cattle are carefully introduced to the system.

While it wasn't possible at all sites to train stock prior to calving, additional training or opportunity to familiarise cows with the system is beneficial. It is recommended, that a single file entrance is erected in line with a cattle track to the water point, as this encourages animals to continue through the entrance. It is also recommended that the entrance is erected first and left for cattle to investigate for some time. Ideally access restricted to the entrance once cattle have investigated it.

### 5.3.5 Timing and duration of recording period

Given that water was the most effective attractant in conjunction with dry pasture conditions, it is recommended that PMM used for spring calving herds, with recording to take place in late spring or early summer.

The time to capture enough data is wholly reliant on animal flow through the system. With effective attractants, it is expected that at least 75% of animals will be recorded accurately within the first 30 days. Only the calf recovering from a traumatic birth wasn't matched within 30 days at Site 2. Matching of more than 60% of cows & calves was achieved across all sites where conditions were favourable, including the mob of 246 cows with calves at foot at Site 4. It is expected that both accuracy and length of time required for recording can be improved through additional conditioning of cattle to the system, and more operator experience.

Grazing the residual feed left following the spring flush provides a greater opportunity to "park" cattle in a single paddock for longer and allow a decent recording period. This again highlights why the spring/summer period provides the best fit for recording using PMM.

### 5.3.6 Avoiding paddock damage

Winter conditions made all the tested attractants less effective, but also greatly increased the risks of paddock damage due to pugging. There is a risk of cattle congregating around the area and causing significant damage to areas of the paddock and not just the immediate PMM entry point as first thought. In this demonstration, an area of approximately three hectares was severely affected by pugging. It is not recommended that PMM be implemented under wet winter conditions.

### 5.3.7 Mob size

Almost 250 cows with calves at foot travelled through the system at Site 4, with a 65% match rate. Using PMM with larger numbers provides a more efficient use of equipment, however, it does make providing access to water more challenging can increase compaction or pugging in the area surrounding equipment.

Water and feed availability are the two most limiting factors to mob size. There is a risk of dehydration when water is the attractant and cattle are either reluctant, or physically limited due to the number of head able to access at any given time. It is recommended that contingencies are in place to reduce the risks of dehydration in hot conditions. This may be the use of an additional water source, or simply a willingness to open up the fence surrounding PMM equipment to allow free access to the water point during hot conditions.

Having enough feed available for the length of the recording period must also be considered. It is recommended that the operator prepare a feed budget to estimate the time of grazing available and tailor the mob size to suit the paddock size and feed on offer.

### 5.3.8 Calf Age

Across the various sites of this demonstration, calves successfully recorded and matched to their dam from as young as 1 month old and through to 6 months. The group noticed that older calves were more likely to seek water, however they were less likely to follow closely behind their mother. In contrast, younger calves were observed to follow closely behind their mother and consume water under the right conditions, but were subject to "babysitting" by cows other than their mother.

Without any conclusive evidence provided by the demonstration, the best recommendation is that recording is undertaken as soon as calves have RFID tags applied. This is based on the fact that it is possible to extend the recording period, if initial data is insufficient.

## 5.4 Overall project delivery

The timing of events within this project was severely hampered by weather and at times, difficulty in obtaining host properties suitable at required times. While the producer group was interested in investigating alternative methods of pedigree recording, as the demonstration progressed, many identified that their current method was meeting their needs. With that in mind, enthusiasm did dampen at times throughout the project, particularly when the results were disappointing and more challenges than successes were being observed.

In hindsight, the demonstration topic could have been more closely aligned with the production drivers of the businesses involved. This not a reflection of the technology itself, but of its relevance to this specific group of cattle producers. Producer aspirations to adopt PMM technology (Figure 19) were relatively low, reflecting this result.

Nevertheless, the demonstration focussed the group on recording pedigree and using EID within their own herds. While the uptake within the group of PMM may be limited, the wider uptake of EID as a management tool is likely to be much greater.

## 5.5 Ability of demonstration to address the objectives outlined

The overall objective of this demonstration was to determine the critical success factors for the effective use of PMM in a commercial beef herd. This has clearly been achieved within this project, with each of the specific objectives addressed below.

### 5.5.1 Identify specific data collection equipment options and setup designs that are sufficiently accurate, user friendly and cost effective

As discussed, there are options for using standard panel readers and weigh scale indicators as a data logger, however, in terms of battery life the specifically designed Sapien Technology PedigreeScan reader was the clear stand out. All other readers required either large solar panels, or regular changing and charging of batteries to continue operating. The Sapien panel could record an entire 30-day period without a solar panel, and without changing of battery.

### 5.5.2 Identify a range of suitable attractants that enable reliable data collection

This was a major focus within the demonstration and proved a limiting factor in the application of PMM. Spring/summer recording is very feasible with water as the main attractant.

### 5.5.3 Specify the most suitable age of calf and data recording period that optimises data collection

This was found to be a less significant issue than others identified throughout the demonstrations. We recommend recording from the youngest possible calf age to ensure enough time to capture accurate data.

### 5.5.4 Limitations to mob size for effective data collection

The ability to record almost 250 cows with calves at foot within one mob demonstrated the effectiveness of recording large numbers of cattle. The size of the group does not change this accuracy, it simply increased the total number of records required for the mob. The practicalities of achieving a high volume of records was a key component of this demonstration. As discussed, there are complexities, such as availability and access to water, and pugging, that can be problematic when managing large stock numbers.

### 5.5.5 Identify and demonstrate the raceway design that achieves effective data capture and minimises damage to pasture, gateways or laneways

The construction of timber panels and the use of temporary electric fencing were the most significant findings of the demonstration in terms of raceway design and animal control. Seasonal conditions ultimately determine the risks of damage to pastures, gateways and laneways, and for this reason, PMM is considered best suited to spring calving herds.

### 5.5.6 Determining the above critical success factors will allow development of a set of practical guidelines including an economic analysis that will assist producers to design and set up their own PMM system as an alternative method for collecting female pedigree information, with confidence in its accuracy compared to manual data collection.

The project demonstrated that equipment designed specifically for PMM greatly improved ease-of-use. The economic analysis however, illustrated the value of utilising equipment that is already owned. The purchase of equipment specifically for the task, increases the cost of recording pedigree and therefore the importance of good decision making utilising the pedigree information to generate a return. As has been demonstrated in the use of PMM with sheep, animal behaviour is a critical factor in achieving data accuracy. The demonstration showed that accurate pedigree records can be achieved where cows and calves both travel through the system – and key to achieving this is a suitable period of training where animals are familiarised with the reader and approach race.

The factsheet (Appendix 3) provides a summary of all recommendations developed within this demonstration.

# 6 Conclusions/recommendations

The use of PMM for beef cattle provided an alternative to traditional means of recording cow/calf associations. It is recommended that the practice is used in spring calving herds due to the

favourable seasonal conditions offered and the effectiveness of water as an attractant to entice both cows and calves through the system.
The demonstration showed that it is possible to record pedigree information with reliability scores of 1,2 or 3 against 15 animals in a mob of 16 cows with calves at foot (96%), and 64% of animals in a mob of 246 cows with calves at foot under appropriate paddock and feed conditions. Further refinement of the process to meet site constraints is likely to improve the results with larger mobs of cattle. While specific PMM readers are user friendly, their cost may be prohibitive. The economics of using equipment already on a property is much easier to justify.

The greatest limitation to the use PMM for cattle is not the technology itself, but the ability to manipulate cattle behaviour. Without regular movement of cattle through the system, the technology will not capture any data and is of little use.

For producers looking for an opportunity to apply greater selection pressure based on knowledge of pedigree, PMM offers a viable and cost-effective option for recording large numbers of animals. To achieve an ROI of 3:1 on equipment and labour costs, it would require less than 3% increase in calf growth rate from birth to weaning to be achieved. This could be achieved through greater or more informed genetic or generational selection pressure.

Additional research is being undertaken by the University of Central Queensland into the use of PMM for within extensive pastoral zones. It is expected that the outcomes of this research will complement the demonstration findings.

For many producers, the recording of pedigree has been considered either too difficult, too costly, or too dangerous. The concept of PMM could be used as a catalyst for more discussion around the recording of pedigree generally. Within the Colac BetterBeef, there has been a significant shift in the consideration of pedigree recording and the use of EID as a management tool. While PMM may not be the solution for everyone, the discussion and thought that it evokes can be a significant catalyst for change.

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# 8 Appendices

## 8.1 Appendix 1: Example pricing for genetic testing

# PRICING FOR CATTLE PRODUCTS

Zoetis Genetics
PO Box 75, Banyo QLD 4014
Customer Service 1300 768 400
Fax 1300 768 555
Email genetics.au@zoetis.com

EFFECTIVE 1ST AUGUST 2015 – THE SERVICES SPECIFIED IN THIS FORM ARE SUPPLIED UNDER THE ATTACHED ZOETIS GENETICS TESTING SERVICES TERMS

If you are a member of a Breed Society please contact your society for up to date pricing and submission information. To take advantage of Breed Society contract rates, samples must be submitted through the society.

| Group Test Code | Genetic Traits and Conditions | Volume of Samples | Price Per Sample EX GST |
|---|---|---|---|
| HP | **HornPOLL: A DNA Test for Poll Status in Beef Cattle**<br>Multiple beef breeds – refer to detailer for breeds and accuracies | Any volume | $25.00 |
| GAB | **Coat Colour Test**<br>Red or Black coat colour – multiple breeds | Any volume | $22.00 |
| MVPs | **Tenderness MVPs**<br>Marker panel to determine Molecular Value Predictions for Tenderness | Any volume | $20.00 |
| CA | **CA Test: Contractural Arachnodactyly (Fawn Calf)**<br>Affects Angus and Angus influenced cattle | Any volume | $32.00 |
| AM | **AM Test: Arthrogryposis Multiplex (Curly Calf)**<br>Affects Angus and Angus influenced cattle | Any volume | $32.00 |
| NH | **NH Test: Neuropathic Hydrocephalus**<br>Affects Angus and Angus influenced cattle | Any volume | $32.00 |
| DD | **DD Test: Developmental Duplication**<br>Affects Angus and Angus influenced cattle | Any volume | $21.00 |
| 2 TESTS | **2 Genetic Conditions – Choose 2 from AM, NH, CA or DD** | Any volume | $45.00 |
| 3 TESTS | **3 Genetic Conditions – Choose 3 from AM, NH, CA or DD** | Any volume | $55.00 |
| 4 TESTS | **4 Genetic Conditions – AM + NH + CA + DD** | Any volume | $60.00 |
| OS | **OS Test: Osteopetrosis**<br>Affects Red Angus and Red Angus Influenced cattle | Any volume | $20.00 |
| MA | **α – Mannosidosis**<br>Affects Angus, Murray Grey and Galloway Cattle | Any volume | $60.00 |
| TH | **Tibial Hemimelia**<br>Affects Shorthorn and Shorthorn influenced cattle | Any volume | $30.00 |
| PHA | **Pulmonary Hypoplasia with Anasarca**<br>Affects Shorthorn and Shorthorn influenced cattle | Any volume | $30.00 |
| IE | **Idiopathic Epilepsy**<br>Affects Hereford and Hereford influenced cattle | Any volume | $30.00 |

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# PRICING FOR CATTLE PRODUCTS

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If you are a member of a Breed Society please contact your society for up to date pricing and submission information. To take advantage of Breed Society contract rates, samples must be submitted through the society.

| Group Test Code | HD 50K or 150K for Black Angus | Volume of Samples | Price Per Sample EX GST |
|---|---|---|---|
| HD 50K | **HD 50K for Angus**<br>Molecular Value Predictions based on a high-density marker panel for 22 Calving, Growth, Feedlot, Fertility & Carcase traits.<br>Includes SNP Parentage Markers. | Any volume | $74.00 |
| 150K | **150K for Angus**<br>Molecular Value Predictions based on a low-density marker panel for 22 Calving, Growth, Feedlot, Fertility & Carcase traits.<br>Includes SNP Parentage Markers. | Any volume | $59.00 |
| | **HD 50K or 150K for Angus including SNP Profile and Genetic Conditions AM+ NH+ CA+ DD** | Any volume | Additional $51.00 |

| Group Test Code | CLARIFIDE for Dairy – Includes Sire Assignment – Holstein and Jersey Only | | Volume of Samples | Price Per Sample EX GST |
|---|---|---|---|---|
| CLAR | **CLARIFIDE for Dairy – Heifer Test**<br>Genomic Australian Breeding Values (ABVg) for 36 Production, Type and Management traits. Includes Breeding Indexes. | | 1-59 samples | $60.00 |
| | | | 60+ samples | $50.00 |
| | **CLARIFIDE for Dairy – Male Test (Paddock Bulls and Bull Calves)**<br>Genomic Australian Breeding Values (ABVg) for 36 Production, Type and Management traits. Includes Breeding Indexes. | | Any volume | $120.00 |
| | **CLARIFIDE for Dairy plus Selected Genetic Conditions**<br>Each CLARIFIDE test screens for 11 genetic conditions including DUMPS, BLAD, Factor XI and Chondrodysplasia free of charge. For a full list of conditions, please refer to the product detailer. Testing for CVM, Brachyspina and Beta Casein A2 can be requested with CLARIFIDE testing at an additional cost. | CVM | Any volume | Additional $45.00 |
| | | Brachyspina | Any volume | Additional $35.00 |
| | | Dairy HornPoll Test | Any volume | Additional $20.00 |

| Group Test Code | SireTRACE DNA Profiling and Parentage Products – All Breeds | Volume of Samples | Price Per Sample EX GST |
|---|---|---|---|
| DNA | **SireTRACE DNA Profile** | Any volume | $30.00 |
| | **SireTRACE DNA Profile and Parentage Verification** | Any volume | $33.00 |
| PV | **SireTRACE Reanalysis Against Additional Parents**<br>Reanalysis of tested animals against additional parents on file will be charged on a job basis. Jobs containing a total of up to 10 animals (including progeny, sires and dams) will be charged at $20+GST. Jobs with 11-50 animals will be charged at $50+GST and jobs with 51 or more animals will be charged at $100+GST. | | |
| SNP | **SNP Profile (96 Markers)** | Any volume | $20.00 |

FOR ANIMALS. FOR HEALTH. FOR YOU.

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# ZOETIS GENETIC TESTING SERVICES TERMS

Zoetis Genetics
PO Box 75, Banyo QLD 4014
Customer Service 1300 768 400
Fax 1300 768 555
Email genetics.au@zoetis.com

The following are Zoetis Australia Pty Ltd's (**Zoetis**) terms for testing services relating to genetics. These terms, any other terms agreed on in writing between Zoetis and the client specified in the Test Request Form (**Client**) and the Test Request Form (together, **Agreement**) apply to all supply of services by Zoetis to that Client to the exclusion of all other terms.

**1. Definitions and Interpretation**

1.1. Unless the context otherwise required:

Fee means the relevant prices for the Services in the pricing forms made available by Zoetis from time to time.

**Intellectual Property** includes design patents, registered designs, copyrights, trade dress, trade marks, trade and business names and trade secrets, and applications for any of the foregoing as well as rights in and to inventions, discoveries, improvements, look and feel, works and names.

**Pre-Existing IP** means any Intellectual Property owned, licensed or held by a party and made available to the other party for the purpose of the Agreement and, in the case of Zoetis, includes all testing methodology, testing processes, raw data (which includes genotype data, laboratory results files, marker information and phenotype data) and the Trade Mark.

**Samples** means any samples submitted by the Client to Zoetis for the purposes of the tests described in the Test Request Form.

**Services** means the services requested by the Client in the Test Request Form.

**Trade Mark** means the registered and unregistered trade mark(s) used or owned by Zoetis.

1.2. All monetary amounts are in Australia dollars, unless otherwise stated.

1.3. The term **person** includes an individual, partnership, firm, company, body corporate, corporation, association, organisation, trust, estate, state or government or any agency thereof, municipal or local authority, and any other entity, whether incorporated or not (in each case whether or not having a separate legal personality).

**2. Order, Acceptance and Performance of Services**

2.1. The Client must order the Services by submitting:

(a) a Test Request Form identifying the type and quantity of the Services it wishes Zoetis to supply;

(b) the Samples in accordance with Zoetis' instructions; and

(c) such other information as Zoetis may request.

2.2. Zoetis may reject any Test Request Form without liability to the Client.

2.3. In relation to Test Request Forms that have not been rejected, the Client engages Zoetis to provide the Services and Zoetis will carry out the Services on the terms of the Agreement.

2.4. The Client acknowledges that, while Zoetis will use reasonable efforts to ensure that the Services are provided within the time (if any) specified in the Test Request Form or otherwise notified to the Client, all dates specified for completion or delivery of the Services are estimates only.

**3. Remuneration**

3.1. The Client must pay to Zoetis the Fee and any other charges specified in the Agreement.

3.2. Payments are due within 30 days from the date of invoice. Unless otherwise stated, all monetary amounts are, and all payments must be made, in Australian dollars and must be made in cleared funds. Zoetis reserves the right to provide the Services on a cash sale basis or on other terms as it, in its sole discretion, determines appropriate.

3.3. All prices are exclusive of freight, insurance, customs duty, and any other costs.

3.4. If GST applies to any supply made to the Client in accordance with these terms, the Client must pay Zoetis an additional amount equal to the GST payable on the supply. The additional amount is payable at the same time as the Fee or other consideration for the supply. Zoetis must issue a tax invoice to the Client. Terms used in this clause 3.4 that have a defined meaning in the A New Tax System (Goods and Services Tax) Act 1999 (GST Act) have the same meaning in this clause. Unless otherwise expressly stated, all amounts payable under these terms are expressed exclusive of GST.

3.5. The Client must not withhold payment or make any set off or deduction from the Fee or from any other payment due by the Client.

3.6. If the Client fails to pay any sum due under the Agreement on the due date, the Client must pay interest on that sum from the due date until the date of payment at 2% above the Westpac Bank base lending rate, calculated on a daily basis and capitalised monthly. That interest shall be payable on demand by Zoetis. If no time is provided, payment shall be made within 7 days of payment being demanded by Zoetis.

**4. Risk**

Notwithstanding delivery to Zoetis, the risk of any loss, damage or deterioration of or to the Samples will remain with the Client.

**5. Liability**

5.1. To the fullest extent permissible at law, all representations, terms, warranties, guarantees, or conditions whether implied or imposed by statute, common law or custom of the trade or otherwise that might apply to the provision of the Services are excluded.

5.2. In relation to any terms, warranties, guarantees or conditions that cannot lawfully be excluded, Zoetis's liability for them is limited, at the option of Zoetis, to:

(a) the re-supply of the Services; or

(b) the payment of the cost of having the Services re-supplied.

5.3. To the fullest extent permissible at law:

(a) the liability of Zoetis, whether in contract, tort (including negligence) or otherwise, to Client will not in aggregate exceed the invoice price of the Fee for the Services in respect of which the liability arises;

(b) Zoetis will not be liable for any loss of profits or any consequential, indirect or special damage or loss of any kind suffered by Client or any of the Client's representatives; and

(c) Zoetis does not accept any liability arising from: (i) any data, materials or protocols provided by the Client; (ii) any errors in any third party data; (iii) the Client's failure to correctly collect, identify, store or deliver the Samples; and (iv) any other act or omission by or on behalf of the Client.

5.4. A claim by the Client against Zoetis in connection with this Agreement must be notified to Zoetis within 12 months of the completion or delivery of the relevant Services.

**6. Client's Acknowledgements**

6.1. Client acknowledges that:

(a) it has not relied, and will not rely, on any representation or statement made by or on behalf of Zoetis or its employees or agents other than the express provisions of the Agreement and any qualifications the Test Request Form and in any reports provided by Zoetis to the Client;

(b) there may be an inherent margin of error for each type of genetic testing conducted by Zoetis;

(c) genetic testing can provide only limited information about a condition or an animal, and does not guarantee or rule out the existence of a condition or a characteristic of an animal; and

(d) the accuracy and interpretation of the test results and the information contained in any Reports (as defined in clause 8.2(a)) depends on a variety of factors, including environmental factors, breed of animal being tested, quality of the Sample and any other specific factors specified on the Test Request Form.

**7. Release and Indemnity**

7.1. To the extent permitted by law, the Client releases and indemnifies Zoetis and its officers, employees, sub-contractors and agents from and against:

(a) all actions, claims, proceedings or demands by any person, in respect of any loss, damage, cost, expense or injury, which may be brought against Zoetis, whether on their own or jointly with the Client and whether at common law, in equity or pursuant to statute or otherwise, arising out of reliance on, and use or dissemination of, the test results and the information contained in any Reports;

(b) all damages, costs and expenses incurred in defending or settling any such claim, proceeding or demand; and

(c) any liability, damages, cost and expenses incurred by the Service Provider as a result of any breach by the Client of any provision of this Agreement.

7.2. Clauses 5 and 7 shall survive expiration or termination of the Agreement.

**8. Intellectual Property**

8.1. The Pre-Existing IP will remain the property of the party that provides it and is not altered, transferred or assigned by virtue of its use by the other party under the Agreement.

8.2. Unless the parties agree otherwise:

(a) the Client will own all rights, including Intellectual Property rights, in any material created by Zoetis (which includes gene test result reports, genetic conditions reports, client reports, profile reports, parentage verification reports, reinterpreted client data reports, sample confirmation reports, sample status reports and SIL reports) for the Client in providing the Services to the Client pursuant to the Agreement (**Reports**), provided, however, that Reports excludes any Zoetis Pre-Existing IP; and

(b) the Client grants to Zoetis a perpetual, irrevocable, non-exclusive, royalty-free licence to use all Intellectual Property in:

(i) the Reports for all such purposes as Zoetis sees fit; and

(ii) the Client's Pre-Existing IP to the extent required for Zoetis to comply with its obligations under the Agreement.

**9. Ownership and Use of Samples**

9.1. The parties acknowledge and agree that all Samples remain the property of the Client.

9.2. Subject to clause 9.3, Samples will be used only in delivery of the requested Services.

9.3. Zoetis may store Samples for future testing that may be requested by the Client, but makes no commitment that they will be available for further testing. Unless the Client has requested for the Samples to be returned to it (at its cost), the Samples may be destroyed within 30 days of testing.

9.4. The Client is responsible for all costs associated with the freight of DNA test kits and the Reports.

9.5. Zoetis will attempt to confirm with the Client the number of Samples received and any Samples that Zoetis cannot process (for example, due to duplicates or missing information). Any re-sampling and re-testing required to correct poorly taken, contaminated or incorrectly identified samples is at the Client's expense.

**10. Confidentiality**

10.1. In this clause 10, unless the context otherwise requires:

(a) **Approved Purposes** means the purpose of the Agreement;

(b) **Confidential Information** means information of every kind: (I) concerning, or in any way connected with: (A) either party or a Related Entity of either party; or (B) the business, property or affairs of either party or of any officers or employees of either party; or (II) which is the property of either party or a Related Entity of either party, and which: (III) is disclosed in writing, orally or by any other means by either party or by any person on either party's behalf to the other or an employee, officer or agent of the other; or (IV) comes to the knowledge of either party or an employee, officer or agent of either party by any means, and includes the Intellectual Property and any other intellectual property of either party; and

(c) **Notes** means notes which relate to, summaries and copies of, and extracts from any Confidential Information whether in documentary, visual, machine readable or other form.

10.2. Each party must:

(a) maintain and take all steps necessary to maintain all Confidential Information and all Notes in strictest confidence;

(b) use Confidential Information and Notes solely for the Approved Purposes;

(c) not make Notes or allow Notes to be made except as necessary in connection with the Approved Purposes; and

(d) not disclose any of the Confidential Information or Notes to any person other than those employees, officers and agents who are required to receive and consider the Confidential Information in the course of (and solely for) the Approved Purposes.

10.3. Clause 10.2 does not impose obligations on:

(a) either party concerning Confidential Information which is publicly available; and

(b) Zoetis in respect of DNA profiles resulting from SireTRACE® DNA profiling requested by the Client, which Zoetis may share with other customers requesting parentage verification, unless the Client has withdrawn consent in respect of specific Samples by signing the relevant notice on the Test Request Form where indicated.

10.4. It is not a breach of clause 10.2 for either party to disclose Confidential Information which it is obliged by law to disclose to the person to whom it is disclosed.

**11. Data Protection and Privacy**

11.1. The Client acknowledges that Zoetis may need to collect information and conduct security checks on the Client, its employees and consultant(s) for the purposes of administering the Agreement and complying with the special responsibilities Zoetis has to drug regulatory agencies and to the public in view of the nature of its products. The Client will promptly provide copies of all such information relating to the Client, its employees and consultant(s) as Zoetis may request from time to time and the Client must ensure that its employees and consultant(s) will cooperate with the provision of such references and information to Zoetis.

11.2. Zoetis must comply with all relevant privacy laws or regulations with respect to the references and other personal information provided by the Client.

11.3. The Client:

(a) acknowledges and agrees that Zoetis will collect, store, use and disclose any personal information provided by the Client in accordance with Zoetis' privacy policy; and

(b) warrants that, before providing any personal information to Zoetis, it has:
(I) notified all individuals to whom the personal information relates that it will be disclosing their personal information to Zoetis for the purposes of the Agreement and obtained any required consent to such disclosure; and
(II) provided the individuals with the location of where Zoetis' privacy policy can be found.

**12. Additional Terms for Specific Tests**

12.1. To the extent the Services relate to the HP, SireTRACE®, AM, NH, CA or DD group tests, the following additional terms apply:

(a) the Client acknowledges that testing of Samples according to standard procedures can result in false-positive test results and agrees that, where Zoetis' has followed the standard procedures, Zoetis will not be liable for any false-positive test results;

(b) the Client acknowledges and agrees that Zoetis' third party service providers will retain the DNA type on their database, provided that Zoetis will require its third party service providers to:
(I) keep DNA information confidential and not disclose or use it for any reason without the Client's prior written consent; and
(II) delete or destroy that information promptly after a request from the Client's to do so; and

(c) the Client must, within 7 days of receipt of a test result or Report identify any part of them as confidential, in which case, Zoetis will, and will ensure that its third party service providers will, keep that part of the test result or Report secret and confidential for 1 year following the completion of the Service.

12.2. To the extent the Services relate to Shepherd Multiplex, LoinMAX, MyoMAX, Mannosidosis or Sheep Progeny Test, the Client acknowledges and agrees that all genotypes derived from the Samples will be incorporated into the database of Zoetis' third party service providers, provided that Zoetis will require its third party service providers to:

(a) maintain confidentiality of that information at all times (save for disclosures consented to by the Client or required by law); and

(b) not use or disclose that information for any purpose other than the provision of the Services without the prior written consent of the Client.

**13. Default**

13.1. Zoetis may suspend or terminate the Agreement immediately by notice if:

(a) the Client breaches a term of the Agreement or any other agreement with Zoetis and fails to remedy the breach (if capable of remedy) within 7 days after notice to do so;

(b) being a corporation, the Client goes into liquidation, has a receiver or receiver and manager appointed to it or any part of its assets, enters into a scheme of arrangement with creditors or suffers any other form of external administration;

(c) being an individual, the Client has a meeting of creditors called or held or has a step take to make the party bankrupt;

(d) the Client no longer carries on business or threatens to cease carrying on business;

(e) there is a change of ownership or effective control of the Client or the nature of the Client's business is materially altered; or

(f) a Force Majeure Event (as defined below) continues for more than 60 days.

13.2. Without prejudice to any rights Zoetis may otherwise have under the Agreement or at law, on expiry or termination of the Agreement all moneys outstanding will become immediately due and payable. Payments by the Client will be applied in reduction of amounts owing by the Client in such order as Zoetis determines. The Client will pay all costs incurred by Zoetis, (including costs on a solicitor/client basis and debt collectors' costs) incurred in the recovery or attempted recovery of outstanding moneys and the enforcement of the Agreement.

13.3. Termination of the Agreement will not affect any obligations or rights of either party which will have accrued on or before termination.

**14. No Assignment**

Neither party may assign or otherwise deal with the whole or any part of it except with the prior written consent of the other party which consent may not be unreasonably withheld; provided, however, either party may, without such consent, assign the Agreement, in whole or in part, to any of its respective related entities (as defined in section 9 of the Corporations Act 2001) or successors-in-interest. Any permitted assignee shall assume all obligations of its assignor under the Agreement.

**15. Anti-Bribery Warranties**

15.1. The Client warrants that it has not offered, promised or paid, either directly or indirectly, any money or anything of value to a government official (including, but not limited to, a healthcare professional) or other person to induce such government official or other person to act in any way in connection with his/her official duties or to otherwise obtain an improper advantage for the Client or for Zoetis and will not offer, promise, pay or authorise such an offer, promise or payment in the future.

15.2. The Client will at all times comply with Zoetis' Anti-Bribery and Anti-Corruption Principles available at www.zoetis.com.au.

**16. Publications**

Subject to clause 10.3(b), in any publication (including advertising and promotional material) relating to the Agreement or the Reports, Zoetis must not publish individual results from testing without first obtaining the Client's prior written consent.

**17. General**

17.1. Each party must promptly, at its own cost, do all things (including executing all documents) necessary or desirable to give full effect to the Agreement.

17.2. If anything in the Agreement is unenforceable, illegal or void, then it is severed and the rest of the Agreement remains in force.

17.3. The Agreement contains the entire agreement and understanding between the parties on everything connected with the subject matter of the Agreement.

17.4. To the extent there is an inconsistency between the provisions of the Agreement, the order of precedence will be these terms and then the Test Request Form.

17.5. An amendment or variation to this Agreement is not effective unless it is in writing and signed by the parties.

17.6. Notices or other communications connected with the Agreement must be in writing.

17.7. Neither party shall be liable for any failure or delay in complying with any obligation imposed on that party under the Agreement if:

(a) the failure or delay arises directly or indirectly from a cause reasonably beyond that party's control and not due to the default or insolvency, or an intentional act or omission, of that party (**Force Majeure Event**);

(b) that party, on becoming aware of the Force Majeure Event, promptly notifies the other party in writing of the nature and expected duration of, and the obligation affected by the cause; and

(c) that party uses its reasonable endeavours to mitigate the effect of the cause on that party's obligations and to perform that party's obligations on time despite the Force Majeure Event,

but nothing in this clause shall excuse a party from any obligation to make a payment when due under the Agreement.

17.8. The laws of New South Wales, Australia govern the Agreement. The parties submit to the jurisdiction of the courts of New South Wales.

## 8.2 Appendix 2: Pedigree Matchmaker EPDS Factsheet

AGRICULTURE VICTORIA

mla
MEAT & LIVESTOCK AUSTRALIA

# Fact sheet

### Matching cows and their calves using Pedigree MatchMaker – Enhanced Producer Demonstration Site

Pedigree MatchMaker uses electronic ear tag data to match cows to their calves. Monitoring calf performance (through to weaning and beyond) provides a means to identify best-performing breeding stock.

#### Background

Pedigree MatchMaker (PMM) was developed for sheep enterprises. The system collects data from the ear tags of ewes and lambs in the paddock and, via association of ear tags that are repeatedly recorded together, matches the lambs to their dams. This enables producers to identify the best-performing breeders by tracking the performance of their progeny.

Pedigree MatchMaker technology was adapted for cattle and demonstrated over three years in an on-farm project with Colac BetterBeef group.

The recommendations in this fact sheet were developed through the demonstration, which was co-funded by Agriculture Victoria and Meat and Livestock Australia (MLA).

#### Equipment required

While systems will vary, the following is a guide to the equipment required:

- panel reader and data logger (if not built into the panel reader)
- deep-cycle battery and optional solar panel
- electronic NLIS ear tags on cows and calves
- temporary cattle yard panels (construction details below)
- electric fencing e.g. poly wire and tread-ins
- solar energiser (if not located near existing electric fencing).

#### When to record

The best time to start recording is when calves are young, ideally soon after electronic NLIS tags have been applied.

Recording is easiest in late spring/early summer or autumn, when conditions are drier and animals are seeking water. The use of water as a successful attractant over summer fits in well with spring-calving herds. Wet conditions should be avoided, when there is a risk of pugging.

#### Tips for success

- PMM relies on animals being drawn to an attractant, which becomes their motivation to walk through the single-file entrance past the panel reader. In drier months, water is a great attractant. Hay and silage may also work, although the demonstration had mixed success using these attractants.
- If using water as an attractant, ensure the trough is not too high for calves, as they will be unlikely to follow the cow if they cannot access water themselves.
- Set up a single-file entrance on an existing stock track to water. Cattle are creatures of habit and more likely to find their way through the entrance if following an existing track.

1

## 8.3 Appendix 3- SheepVention information flyer

# "Pedigree MatchMaker in Beef" On-Farm Demonstration

**Site locations:** Colac

**Producer Group:** Colac Better Beef group

### What is the issue?

To date the main method of establishing maternal pedigree is to tag calves at birth or utilise DNA technologies. Tagging at birth is labour intensive and has associated occupational health and safety risks, whilst DNA testing is perceived as a costly option (>$30). The result is that few producers take up either strategy, and the information is not collected. As a result, the beef industry is largely denied access to the productivity and profitability benefits of genetic gain related to maternal pedigree in the breeding herd.

### Why is this important?

Being able to identify high and low performing breeders through the use of objective performance measures (e.g. kilograms of beef turnoff per breeder), producers will be able to apply increased selection pressure to their breeding herd. This concept is not a replacement for sire selection, but instead provides an opportunity to build on the existing genetic gain achieved through sire selection. In combination with the existing sire selection, the identification of high and low performing breeders and increased selection pressure on dams will allow producers to be more productive with the stock they currently, enabling greater profit by continually selecting the more superior breeders.

### What are we doing?

The sheep industry is successfully using Pedigree MatchMaker (PMM) to associate lambs with their ewes. This project is demonstrating whether the same techniques will work for cattle. The PMM process involves the use of individual electronic animal identification to match cows to calves as they pass through a raceway in the paddock to an attractant such as water, feed or lick blocks.

Using an automated scanning setup in the raceway, dam pedigrees have been determined to an accuracy of 95 per cent in sheep. We want to know if we can replicate this success with cattle.

## What have we found so far?

Initial results indicate that it is possible to match cows and calves using a PMM system.

The following is a summary of results achieved on one of the demonstration sites. The accuracy of matching cows & calves has been demonstrated for various lengths of recording time for the 16 cows with calves at foot.

*Table 16- Interim results - Matches achieved on one of the demonstration properties*

| | Cows & calves matched correctly | Incorrect Matches | Unmatched calves |
|---|---|---|---|
| After 15 days recording | 8 | 1 | 7 |
| After 30 days recording | 13 | 2 | 1* |
| After 60 days recording | 14 | 2 | 0 |

It is believed that the cows indicated here have either swapped calves, or their tag numbers were recorded incorrectly at birth (manually).

The calf which remained unmatched after 30 days (*) was assisted during a difficult birth. It was noticeably impaired after birth and spent a considerable amount of time alone away from the main herd. It did not present at all through the scanner until day 35, despite its mother travelling through at regular intervals. After day 35 the calf was recorded regularly, eventually becoming one of the most reliable matches in the data set.

If the two calves that have been deemed to be matched incorrectly are in fact incorrect, then the level of accuracy achieved is 87.5% (note the small data set). If the two calves have actually been matched to their birth mothers, then the accuracy achieved is 100%.

It should be noted that these are only interim results, with further investigation, and confirmation of accuracy to be undertaken under varying conditions.

## Want to know more?

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