Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA
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# Ovine Observer

## Contents



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## Causes of abortion and lamb mortality for maiden ewes in WA

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### Introduction

Lamb survival typically refers to the survival of foetuses between scanning in mid-pregnancy and lamb marking. Lower lamb survival has been reported for maiden ewes compared with mature and mixed age flocks, but the causes of this lower survival for lambs born to maiden ewes are not well studied. Australian studies using mostly mature or mixed age flocks have shown starvation-mismothering-exposure complex, stillbirths, and dystocia (difficult births) are the most common causes of lamb mortality during the perinatal period during or soon after lambing.

Infectious diseases may contribute to lamb mortality through abortion, stillbirths and birth of weak lambs that

are more like to die soon after birth. Maiden ewes can be more susceptible to infectious diseases resulting in abortion or birth of compromised lambs because these ewes are younger and less likely to have developed immunity to infection prior to pregnancy. Relatively few studies include lamb necropsies (post-mortem examination) in conjunction with laboratory testing for infectious diseases. Similarly, relatively few investigations for abortion and perinatal lamb death are submitted to veterinary diagnostic laboratories for exclusion of infectious diseases. It is possible that the contribution of infectious disease to poor lamb survival may be under-recognised.

Therefore, the aim of this study was to determine the causes of abortion and perinatal deaths for lambs born to primiparous ewes in Western Australia and identify if infectious diseases are implicated.

## Key findings

- Starvation-mismothering-exposure, dystocia and stillbirth were the most common causes of perinatal lamb death.
- There was no evidence of exotic diseases in aborted and stillborn lambs.
- *Chlamydia pecorum* was detected in 43% of aborted and stillborn lambs, including 64% of the aborted or stillborn lambs from ewe lamb flocks. Infections may contribute to foetal and lamb mortality for maiden ewes in Western Australia.

## Materials and methods

### Study location and sheep flock characteristics

This study was conducted at 10 farms in southern Western Australia using 11 maiden flocks each with approximately two-hundred Merino or non-Merino maiden ewes randomly selected at mating.

Maiden ewes were mated as either ewe lambs (7 flocks, 7-10 months old at mating) or maiden hogget ewes (4 flocks, 18-20 months old at mating) and monitored between mating and lamb marking. Two farms used an artificial insemination program on all or some of the ewes, followed by a period of natural back-up mating. All other flocks were mated naturally with an average mating period of 38 days (range 32-46 days).

### Reproductive data

Foetal count (number of foetuses) were determined using pregnancy ultrasounds at 62–87 days (scan 1).

Farmers checked the lambing mobs once or twice daily throughout the lambing period. On most farms, lambs were ear tagged at birth, and their birth type and dam were recorded. The number of lambs born was calculated using records of the number of lambs tagged plus the number of dead lambs collected. On farms where tagging at birth was not performed, number of lambs born was calculated based on number of lambs present at marking (approximately 6 weeks from start of lambing) plus the number of dead lambs collected. Number of lambs born may have been underestimated at these sites because it is unlikely that all lambs that died were recovered for necropsy. There was no evidence of widespread abortion or ewe illness noted in any of the flocks.

### Lamb necropsies and laboratory testing

Lambs that died in the first 3 days of life were collected for necropsy to determine cause of death. Dead lambs were either refrigerated (4ºC) or frozen (-20ºC) for up to 5 days.

One aborted foetus and one foetal membrane were also recovered prior to the start of lambing in flock 3a.

Lamb necropsies were performed using a previously described method to determine cause of death (Table 1)

*Table 1 - Cause of death classifications (modified from Everett-Hincks and Duncan, 2008)*

| Classification | Post-mortem observations |
|---|---|
| Dystocia | Evidence of oedema to the head or neck |
| Stillborn | Full-term appearance; not walked or breathed |
| Abortion/prematurity | Pre-term appearance (size, wool covering); not walked or breathed |
| Starvation-mismothering-exposure complex | Evidence that had walked and breathed<br>Empty stomach contents<br>Mobilisation of peri-renal (kidney) and peri-cardial (heart) fat |
| Other | Cause of death determined based on the gross appearance of affected organ systems |

Tissue samples from aborted or stillborn lambs from flocks with at least two lambs classified as abortion or stillbirth were submitted to the Department of Primary Industry and Regional Development Diagnostic Laboratory Service (South Perth, Western Australia). The testing methods included histology (examination of tissues with microscope), bacterial culture (growth of bacteria) and molecular diagnostics (for example, PCR and sequencing) and are outlined in more detail in the scientific paper (see further information).

### Statistical analyses

Lamb mortality (%) between birth and marking for single-born lambs and multiple-born lambs (twins and triplets) were compared using two-tailed two-sample z-test. Only farms where lambs were tagged at birth were included in calculation of mortality for single- and multiple-born lambs. The proportion of cases with *C. pecorum* detected for each ewe age category (ewe lambs and yearling ewes) were compared using two-tailed two-sample z-test.

## Results

### Lamb mortality in maiden ewe flocks

Lamb mortality for study flocks are outlined in Table 2. Overall, lamb mortality from birth to marking ranged 13-27% for Merino hogget flocks and 9-41% for non-Merino ewe lamb flocks.

*Table 2 - Lamb mortality for 11 flocks of maiden ewes in Western Australia*

| | | Mortality between birth and marking (%) | | |
|---|---|---|---|---|
| Ewe age category | Lambs born (*n*) | All birth types | Singles | Multiple |
| Hogget | 249 | 19.7 | 9.8 | 29.4 |
| Hogget | 210 | 27.1 | 17.2 | 42.7 |
| Hogget | 277 | 23.5 | 16.0 | 29.1 |
| Hogget | 151 [A] | 12.6 [A] | Unknown | Unknown |
| Ewe lamb | 89 | 18.0 | 7.0 | 25.0 |
| Ewe lamb | 169 [A] | 29.0 [A] | Unknown | Unknown |
| Ewe lamb | 150 [A] | 40.7 [A] | Unknown | Unknown |
| Ewe lamb | 197 | 16.8 | 15.4 | 17.2 |
| Ewe lamb | 196 [B] | 10.7 [B] | 15.8 [B] | 14.5 [B] |
| Ewe lamb | 145 | 20.0 | 15.7 | 24.2 |
| Ewe lamb | 130 | 24.6 | 13.0 | 29.2 |
| TOTAL | 1963 | 22.0 | 14.0 | 26.4 |

[A] Lambs not tagged at birth (number lambs born may be underestimated)
[B] Not all lambs tagged and assigned to birth type and/or dam

## Necropsies and cause of death

A total of 298 lamb necropsies were performed. These represented 69% of lambs that died between birth and marking. Remaining cases without necropsy either were not recovered by the farmers or died after 72 hours of age.

The cause of death assigned at necropsy are shown in Table 3. The starvation-mismothering-exposure complex, dystocia, and stillbirths accounted for 96% (218/227) of cases where cause of death was identified.

*Table 3 - Cause of death identified at lamb necropsy*

| | Count (n) | % necropsies | % necropsies with diagnosis |
|---|---|---|---|
| **Necropsies performed** | | | |
| Total | 298 | - | - |
| | | | |
| **Cause of death** | | | |
| Abortion or premature birth | 4 | 1 | 1.8 |
| Stillbirth | 44 | 15 | 19.4 |
| Dystocia | 73 | 24 | 32.1 |
| Starvation-mismothering | 101 | 34 | 44.5 |
| Infection/inflammation | 5 | 2 | 2.2 |
| Undetermined | 71 | 24 | - |

**Infectious diseases detected in aborted and stillborn lambs**

Infections detected for 35 cases classified as abortion or stillbirth from six farms are shown in Table 4.

*Chlamydia pecorum* DNA was detected by qPCR in 39% (13/33) of stillborn or premature cases and 100% (2/2) of abortion cases. *C. pecorum* DNA was detected at five of the six farms, and was more commonly detected in cases from ewe lambs (64%, 14/22) compared with hoggets ewes (8%, 1/13; $P = 0.001$).

Genetic characterisation identified the *C. pecorum* from aborted and stillborn lambs strain sequence types (STs) as ST23. This genotype was identical to *C. pecorum* strains associated with sheep abortions in NSW, arthritis in sheep, conjunctivitis (pink eye) in sheep, and sporadic bovine encephalomyelitis (in cattle from WA, NSW and USA). This sequence type ST23 is distinct from sheep and cattle rectal strains, and strains from pigs and goats.

The only other bacteria detected that was likely to be associated with abortion or birth of compromised lambs was *Trueperella pyogenes*. This was detected in two lambs, including one lamb where *C. pecorum* was concurrently detected.

Other infections that are endemic in WA and may cause abortion (such as *Toxoplasma gondii, Listeria* spp., *Campylobacter fetus*, *Campylobacter jejuni*) were not detected. Exotic diseases including *Chlamydia abortus, Brucella melitensis, Salmonella enterica* serovar Abortusovis were not detected.

*Table 4 - Detection of infectious agents from aborted or stillborn lambs in Western Australia*

| | Ewe lamb flocks | Hogget flocks | TOTAL |
|---|---|---|---|
| **Cases submitted** (*n*) | | | |
| Total | 22 | 13 | 35 |
| Aborted foetus & membranes | 1 | 0 | 1 |
| Aborted membranes only | 1 | 0 | 1 |
| Stillborn lamb | 18 | 13 | 33 |
| ***Chlamydia* spp.** | | | |
| *C. pecorum* (qPCR) | 14 | 1 | 15 |
| **Other** | | | |
| *Listeria* (culture) | 0 | 0 | 0 |
| *Salmonella* (culture) | 0 | 0 | 0 |
| *Trueperella pyogenes* (culture) | 2 | - | 2 |
| *Campylobacter* (culture) | 0 | 0 | 0 |
| *Campylobacter* (PCR) [A] | 2 [A] | 0 | 2 |
| *Leptospira* (PCR) | 0 | 0 | 0 |
| *Toxoplasma* (qPCR) | 0 | 0 | 0 |
| *Coxiella* (qPCR) | 0 | 0 | 0 |
| *Brucella ovis* (PCR + sequencing) | 0 | 0 | 0 |
| Pan-pestivirus (qPCR) | 0 | 0 | 0 |

[A] *C. sputorum* and *C. mucosalis* by sequencing (suspected contaminant)

## Discussion

*Chlamydia pecorum* was detected in aborted and stillborn lambs from maiden ewes on multiple farms in WA. The same sequence type identified in aborted and stillborn lambs can be associated with arthritis and pink eye in sheep. Other *C. pecorum* sequence types have been detected in the gut of sheep without evidence of disease. *C. pecorum* should be considered as a differential diagnosis for abortion and perinatal mortality in Australian sheep, particularly ewe lambs.

*C. pecorum* was detected in aborted and stillborn lambs from five out of six farms, and was more commonly detected in offspring from younger ewes (ewe lambs). However, the degree to which *C. pecorum* ST23 contributed overall lamb mortalities could not be determined. Infectious disease screening was not conducted for lambs that died from causes other than abortion or stillbirth, including those classified as starvation-mismothering. Inflammation of the placenta caused by *C. pecorum* infection may result in a spectrum of outcomes. This could include abortion of the foetus, stillbirth, birth of live but compromised lambs (weak and with low birth weights) with poor survival, or normal offspring. The outcome is likely to depend on the severity of disease in the placenta and the lamb's organs. More research is needed to determine whether infection contributes to reduced lamb viability (presenting as starvation-mismothering), as well as abortion or stillbirth, and the factors that impact the outcome for the lamb.

Overall lamb mortality for flocks in this study was comparable with other Australian studies. Stillbirths accounted for 19% of necropsies where cause of death was determined. This was not markedly different to stillbirths as proportion of total losses reported in other Australian studies despite detection of *C. pecorum* in most flocks. Notably, stillbirths and abortion associated with *C. pecorum* ST23 were detected in flocks without obvious signs of abortion storm (*i.e.* farmers detecting abortions when inspecting ewes) or illness in ewes that would have triggered alarm. This suggests *C. pecorum* may be associated with losses that go undetected on Australian farms, and explains why *C. pecorum* abortion has not been more widely reported in the past.

The starvation-mismothering-exposure complex and dystocia accounted for most lamb mortalities that occurred in the perinatal period and mortality was higher for multiple-born lambs compared to single-born lambs. Strategies to reduce dystocia and starvation-mismothering-exposure, including provision of adequate shelter for lambing ewes and managing ewe nutrition during pregnancy to optimise lamb birthweights may help optimise survival for progeny of maiden ewes.

## Conclusion

Starvation-mismothering-exposure complex, dystocia and stillbirths accounted for most lamb mortalities for lambs born to maiden ewes*. Chlamydia pecorum* was detected in aborted and stillborn lambs born to maiden ewes in WA. The *C. pecorum* strains detected from abortions and stillborn lambs belong to the ST23 sequence type that has also been associated with abortions in sheep and cattle, and other diseases including arthritis, pink eye and sporadic bovine encephalitis. Further investigation to quantify impact of *C. pecorum* as a cause of abortion, stillbirth or poor lamb viability in sheep, and determine factors that impact outcomes for pregnant ewes.

## Further information

Project final report: https://www.mla.com.au/research-and-development/reports/2022/reducing-foetal-and-lamb-losses-in-young-ewes2/

Scientific paper (free access): https://doi.org/10.1186/s13567-021-00950-w

DPIRD Sheep Abortion Surveillance Scheme: https://www.agric.wa.gov.au/livestock-biosecurity/ewe-abortion-and-newborn-lamb-deaths-surveillance-program

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# Ultrawide band microwave scanning precisely and accurately predicts sheepmeat hot carcase GR tissue depth

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## Abstract

This study assessed the ability of a portable ultrawide band microwave system (MiS) to meet the AUS-MEAT accreditation standards as technology to measure girth rib (GR) tissue depth. Three microwave devices scanned hot lamb carcases (n=312) at the GR site on a stationary rail, immediately prior to entering the chiller. The microwave could predict grader GR knife measured tissue depth with 96.2-98.4% accuracy.

## Introduction

Precisely and accurately measuring carcases on the traits they are traded on is essential to maximise sheepmeat profitability. In Australia, sheepmeat carcases are largely traded on carcase weight and fat score, along with dentition, sex and breed. Fat scores run from 1 to 5, starting at Fat score 1 which equates to 5 mm or less of tissue depth at the GR site (AUS-MEAT, 2020). Scores increase in 5 mm depth increments at the GR site until fat score 5 which is classified as all depths greater than 20 mm (AUS-MEAT, 2020). Fat score can be determined objectively by measuring GR tissue depth (total tissue depth over the 12th rib, 110 mm from spine midline), or subjectively by palpating the transverse processes of the lumbar vertebrae (AUS-MEAT, 2020). Objective measurements are preferred to eliminate the human error of subjective palpation, however currently the only commercially available objective tool in Australia is the GR knife, a cut knife and ruler which makes an incision for insertion at the GR site (AUS-MEAT, 2020). Using the GR knife is slow, with a single operator unable to keep up with industry chain speeds (15 animals per minute) (Fowler et al. 2020). GR cut knife readings can be affected by pressure placed on the ruler, particularly prior to fat setting on the hot carcase (Pearce, 2016). As such, Australian processors are currently determining carcase fatness based on subjective fingertip palpation over the GR site.

Carcase fatness is negatively correlated with lean meat yield (Gardner et al. 2018) with fatter carcases having less saleable meat yield. Consumers preference is for a lean sheepmeat product (Thatcher and Couchman, 1983, Hopkins and Congram 1985a as cited in Hopkins and Fowler, 2018; Hopkins and Congram 1985b as cited in Hopkins et al. 1995) so increased fatness must be trimmed adding extra labour to process the cuts. Meat Standards Australia state the minimum carcase fatness must be 6 mm (fat score 2). Abattoirs set price grids around weight and fat scores, penalising those at the extremes.

An ultra-wide band microwave system (MiS) designed and fabricated at Murdoch University (Perth, Western Australia), has demonstrated the ability to scan both live lambs and carcases to predict GR tissue depth, C-site fat depth and eye muscle area (Marimuthu et al. 2021, Marimuthu et al. 2022). MiS is completely different to a traditional microwave oven, using low power, non-ionising electromagnetic waves which are completely safe to biological tissues thus no shielding is required. The MiS transmits and receives signal via an antenna. The device is handheld, battery operated and weighs approximately 1.5 kg. No specialised training is required to use the device apart from correctly identifying the anatomical site to

be measured. The antenna contacts the site to be measured, and via the click of a button, the fat depth is measured, taking approximately 1 second.

For a technology to be integrated into Australian processing plants as a measurement device, it must adhere to AUS-MEAT Limited (Murarrie, QLD, Australia) national accreditation standards (AUS-MEAT, 2020). For GR tissue depth, the correct fat score must be allocated with a tolerance of ± 2mm of the score boundary. The measurement must be repeatable within the same device as well as across three different devices. This experiment details the AUS-MEAT accreditation of the microwave device.

## Methods

### Experimental design and slaughter details

This study utilised commercial slaughter lambs (n=312) from three slaughter days at one commercial abattoir. Lambs were mixed sex and mixed breed (cross bred/Merino). Lambs were processed under standard operating systems, with medium voltage electrical stimulation (Pearce et al. 2010). Hot standard carcase weight was recorded by abattoir workers within 60 min of slaughter.

Carcases were selected based on fat score (AUS-MEAT, 2020), ensuring there were a minimum of 20 lambs per fat score from 1-5. Slaughter day 1 captured fat scores 1, 2, 3, and 4, however there were insufficient fat score 1 carcases. Slaughter day 2 captured additional fat score 1 carcases. Slaughter day 3 targeted fat score 5 carcases.

Hot carcase GR tissue depth was measured within 60 minutes post slaughter with carcases hanging on a static rail just prior to entering the chiller. GR tissue depth was measured first via GR cut knife and ruler (AUS-MEAT, 2020) by an AUS-MEAT accredited technician employed by the processing plant. Immediately after the GR knife measurement, MiS scanning commenced. The Vivaldi patch antenna (VPA) was positioned such that the centre was over the GR site, ensuring that the antenna was in full contact with the surface of the carcase with no air gap (Figure 1). Three microwave devices were used to scan each carcase. Device 1 took three consecutive readings of GR tissue depth on the same carcase, lifting the device off the measurement site and then repositioning prior to acquiring the next measurement. Device 2 and 3 took one GR tissue depth measurement.

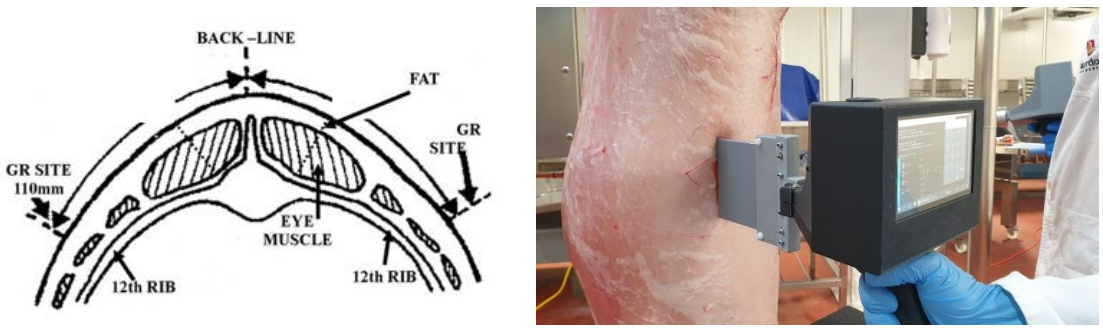


*Figure 1 - Image of the commercial microwave device in the abattoir measuring hot carcase GR tissue depth. The GR site is located 110 mm from the midline of the carcase over the 12th rib as depicted in the drawing.*

### Description of microwave hardware and signal analysis

The microwave system was designed and fabricated at Murdoch University, with details described in full in (Marimuthu et al. 2022). In brief, the MiS is a signal analysing computer system connected to a single broadband Vivaldi patch antenna (VPA). The VPA is a planar structure, 95mm height, 110mm length, 1.27mm thick. The electromagnetic waves are emitted from the VPA in an arc, approximately 120mm long and 80mm wide. The system

and antenna are encased in Teflon with a battery pack. It has wifi and Bluetooth connectivity through which to communicate with existing plant database systems.

Device calibration is conducted prior to measurements at ambient temperature using a three stage “Open, Short and Load” technique (Marimuthu 2016). Open calibration is performed by pointing the antenna into free space ensuring no objects are within 2 metres. Short and load calibration is performed via a calibration block, where the antenna slots into a Teflon and metal block.

### Statistical analysis

The MiS prediction equations were constructed using a machine learning algorithm in WEKA®3.9.4 (The University of Waikato, Hamilton, New Zealand) and detailed in full in (Marimuthu et al. 2022).

To evaluate MiS prediction of GR tissue depth in relationship to AUS-MEAT accreditation standards, the MiS predictions were transformed to AUS-MEAT fat scores from 1 to 5 (Anonymous, 2005; AUS-MEAT, 2020). Accuracy has been reported against the AUS-MEAT auditing and accreditation standards for GR fat score prediction, requiring that the correct fat score must be assigned with a tolerance of ±2mm from the score boundary, as measured by a GR Knife on a stationary carcase, with 90% accuracy. Using these same accuracy standards, the accreditation data was also analysed for repeatability of the measurement of GR tissue depth. Repeatability was assessed within device number 1, across three consecutive measurements, and also between three separate devices. Lastly, precision was reported for all of the comparisons described above reporting R2 and RMSEP.

## Results

### Comparison with AUS-MEAT accredited grader

All three microwave devices predicted AUS-MEAT grader measured GR tissue depth well within the 90% accuracy tolerance limit (Table 1). Devices predicted grader measured tissue depth with 96.2 – 98.4% accuracy (Table 1).

*Table 1 - Ability of Microwave devices to predict grader fat score based on AUS-MEAT GR tissue depth error tolerance limits*

| Measurements | Fat score 1 | Fat score 2 | Fat score 3 | Fat score 4 | Fat score 5 | Total carcases measured (n) |
|---|---|---|---|---|---|---|
| MiS Device 1 | | | | | | |
| Correct (n) | 24 | 34 | 102 | 92 | 55 | 307 |
| Error (n) | 0 | 0 | 1 | 4 | 0 | 5 |
| **Accuracy** | | | | | | **98.4%** |
| MiS Device 2 | | | | | | |
| Correct (n) | 22 | 55 | 104 | 66 | 53 | 300 |
| Error (n) | 0 | 0 | 11 | 1 | 0 | 12 |
| **Accuracy** | | | | | | **96.2%** |
| MiS Device 3 | | | | | | |
| Correct (n) | 22 | 51 | 108 | 70 | 52 | 303 |
| Error (n) | 0 | 1 | 7 | 1 | 0 | 9 |
| **Accuracy** | | | | | | **97.1%** |

MiS device 1 predicted the AUS-MEAT grader measured GR tissue depth with an RMSEP of 1.93, with the $R^2$ of 0.9 which equates to explaining 90% of the variation. The relationship between MiS predicted and grader measured hot carcase GR tissue depth is depicted in Figure 2.

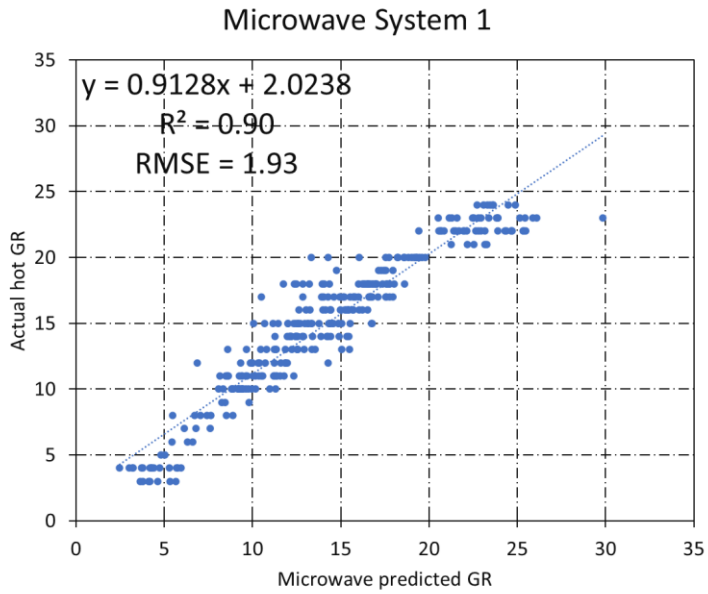


*Figure 2 - The association between actual and MiS measured GR tissue depth (mm). The solid line represents the relationship between the actual and the predicted measurements.*

**Comparison of GR prediction between the microwave systems**

The predictions of GR tissue depth across the 3 microwave devices had extremely high accuracy, ranging from 99.4% and 100%.

MiS device 2 predicted MiS device 1 measured GR tissue depth with an RMSEP of 1.05 mm and $R^2$ of 0.97. MiS device 3 predicted MiS device 1 with an RMSEP of 1.13 and $R^2$ of 0.96. The relationship between MiS devices is depicted in Figure 3.

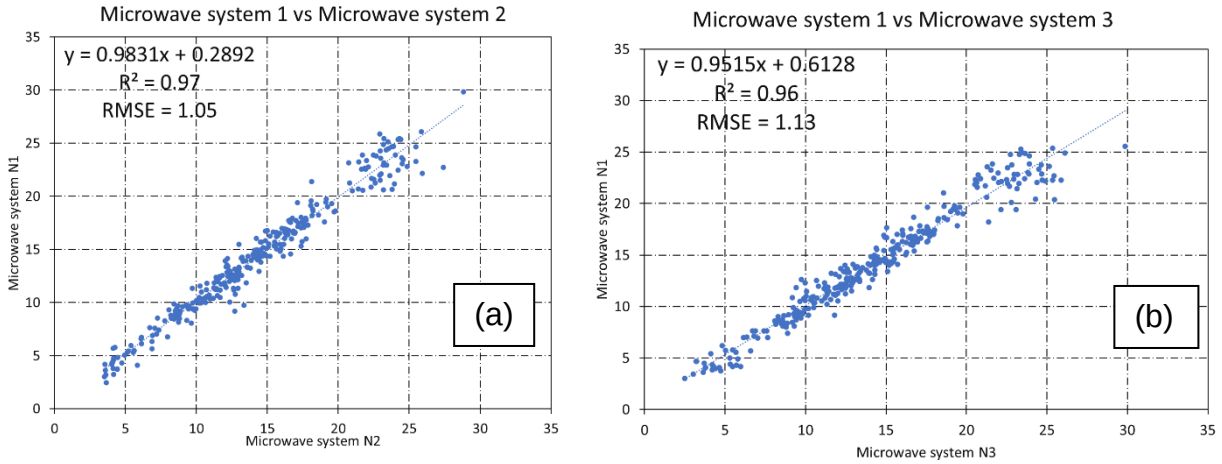


*Figure 3 - The association between MiS device 1 and (a) MiS device 2 or (b) MiS device 3. The solid line represents the relationship between the actual and the predicted measurements.*

**Within device comparison of GR prediction**

All three Device 1 measurements had extremely high accuracy, predicting GR tissue depth with 99.7 – 100% accuracy.

Measurement 2 predicted measurement 1 with an RMSEP of 0.44 and $R^2$ of 0.99. Measurement 3 predicted measurement 1 with an RMSEP of 0.49 and $R^2$ of 0.99. The relationship between MiS device measurements (reading) is depicted in Figure 4.

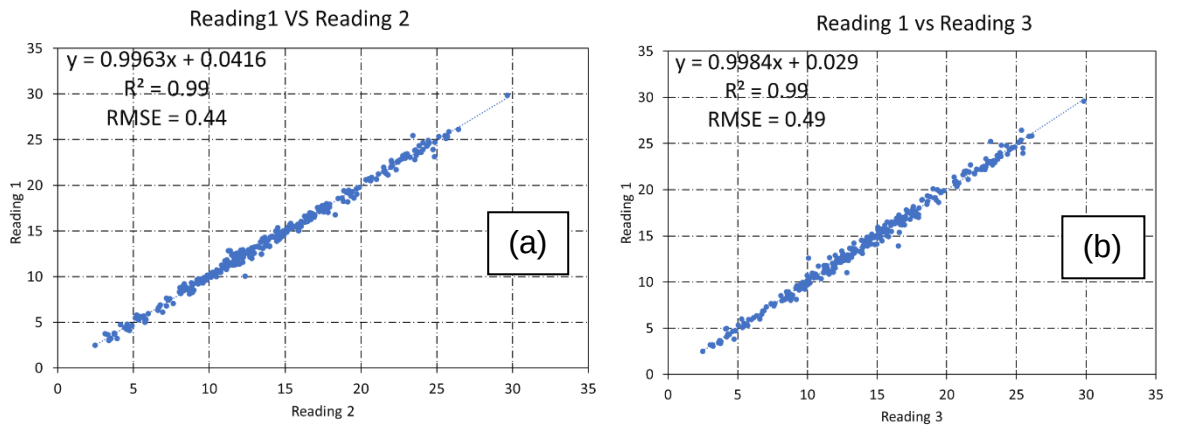


*Figure 4 - The association between MiS device 1 measurement (reading) 1 and (a) measurement 2 or (b) measurement 3. The solid line represents the relationship between the actual and the predicted measurements.*

## Discussion

The microwave system has met the accuracy standards required for measuring GR tissue depth. It has been assessed relative to the accredited plant graders, easily meeting the accuracy requirements. The repeatability of measurements both within and between devices has met the same accuracy standards.

The device developed at Murdoch University is the first in the world to use ultrawide band microwave technology as a carcase precision tool in the commercial setting. This technology provides Australian processers with the ability to measure GR tissue depth objectively and non-invasively while operating at chain speeds. A commercial partnership is in place to install the device in a Western Australian processing plant. The installation stage will test the robustness of the device in the commercial setting.

## Conclusion

The microwave system has met the AUS-MEAT accuracy standards required for measuring GR tissue depth. AUS-MEAT has granted accreditation of the MiS device meaning it can be installed as an objective measurement technology in abattoirs to measure GR tissue depth.

## Acknowledgements

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# Improving farm productivity with better carcase feedback

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Carcase lean meat yield (LMY) and eating quality create value across the supply chain. However, current methods of measuring lean meat yield and eating quality in lamb are inaccurate or non-existent, resulting in poor feedback to producers and therefore slow improvements in these traits. The development of technologies that objectively measure carcase quality traits, including the installation of DEXA at WAMMCO, now can provide accurate carcase feedback to producers.

This project facilitates producers through the Meat the Market Profitable Grazing Systems (PGS) program. The first producer group includes 7 farm businesses that have completed the 3 workshop sessions. These sessions create a producer-processor relationship with open communication around carcase feedback, pricing signals, and market specifications. The producers learn the basics of manipulating lean meat yield and eating quality on farm and applying those techniques based on carcase feedback. Lambs from 4 farm businesses have been processed at WAMMCO with producers receiving DEXA LMY and SOMA intramuscular fat information. This feedback will be used in future coaching sessions to assist implementing changes on-farm.

Prior to the project, most producers did not assess carcase compliance over time or use feedback to improve carcase performance. Most producers did not know how to best manipulate lean meat yield and eating quality via genetics, and how lamb growth alters these carcase traits. Producers were least confident in identifying the “sweet spot” on the price grid, increasing lean meat yield in lambs, and assessing pasture quantity. After the workshops, producers’ knowledge gaps and confidence improved by 20%, with the highest confidence scores seen in activities targeted by the workshops including understanding ASBVs and percentile reports, matching feed requirements with pasture assessment, and pre-slaughter fat score assessment.

Producers rated the sessions very highly and all expressed a strong intent to change as a result of attending the workshops. We will continue to coach the producers with on-farm management decisions and monitor their progress with carcase compliance, lamb turn off productivity, and farm profitability.

More information about this SheepLinks project can be found on the Objective Carcase Measurement Feedback webpage.

# Saltland Genie Web App - Practical information on productive grazing of salt affected land

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Famers now have an online tool at their fingertips to rehabilitate salt affected land.

Dryland salinity affects about 1.75 million hectares of public and private land in the South-West of Western Australia, resulting in lost agricultural productivity. An estimated 340,000 hectares of cleared agricultural land is classed as moderately salt affected, to which there are proven productive solutions available.

The Department of Primary Industries and Regional Development in partnership with Great Southern-based natural resource management group Gillamii Centre have developed and tested eight decision support tools to help landholders implement solutions on their salt affected land.

Farmers and landholders can enter their water and soil salinity measurements to help find practical solutions, access information about on-site implementation and estimate the return on investment from planned rehabilitation.

There are details on selecting solutions best suited to a particular environment, detail on suitable plant species, 'how-to' prescriptive YouTube videos, farmer case studies, a soil salinity calculator, and a water salinity calculator to determine safe drinking water requirements for sheep and cattle.

The Saltland Genie project has been supported with funding from the Western Australian Government's State NRM Program and is available at https://www.saltlandgenie.com/

# Lambing Planner app updated

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The Lambing Planner is a simple tool that allows you to change the joining date of your mob to see the impacts of that on other key times and tasks in the reproductive year.

It sets out key management operations that make up the breeding cycle, providing information on:

- ewe and ram nutrition
- condition score targets at different stages
- reproductive management
- lambing guidelines.

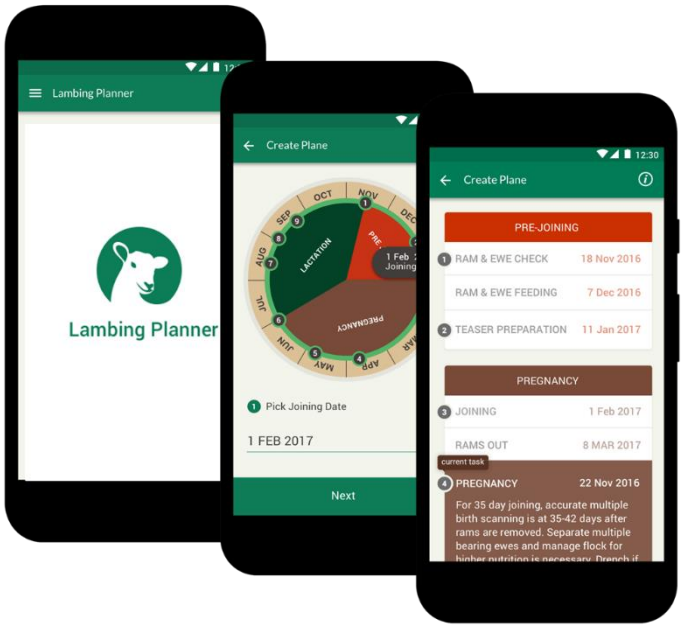
The app has recently been updated to solve a glitch in the joining date selection and some users may need to manually update their app via their app store.

For Apple users: note down your old plan names and joining dates so you can manually add these to the new version once update is complete. Visit the App Store, search for Lambing Planner and select update. Depending on your phone settings, this may have already updated automatically.

For Android users: note down your old plan names and joining dates so you can manually add these to the new version once update is complete. Delete the Lambing Planner app you have on your phone, then visit the Google Play Store, search for Lambing Planner and download.

The next phase of updates includes implementing features suggested by Lambing Planner app users recently surveyed.

For more information, please visit the Lambing Planner app webpage https://www.agric.wa.gov.au/management-reproduction/lambing-planner



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