

SEPTEMBER 2022

Sheep reproduction RD&A alert

This sheep reproduction RD&A alert is an initiative of the Sheep Reproduction Strategic Partnership (SRSP).

Have you visited the [SRSP website](#) lately? We are adding new information and resources in line with our aim of developing it into a hub for sheep reproduction RD&A information. You can now find all the resources you will need to assess the fitness of ewes for joining that were developed as part of the recently completed [Fit to Join](#) project. You will find a Fit to Join factsheet, the Fit to Join Ute guide and four short instructional videos to assist you to complete the ewe, udder and lameness assessments.

The SRSP aims to help sheep producers to profitability and sustainably increase lamb production through increasing lamb survival and weaning rates and will coordinate a national approach to improving sheep reproductive performance.

Program coordinator

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Feature project update

Developing and piloting a real-time monitoring system for sheep

Background

Management decisions, animal husbandry practices along with monitoring health and welfare in the Australian sheep industry is largely undertaken on a flock or mob basis. Monitoring whole of flock health and welfare accounts for a large portion of labour use in sheep enterprises. Automation of health and welfare monitoring can improve labour use efficiency and improve welfare through early detection of potential issues. Recent developments in wearable sensors and analytical techniques, including machine learning, provide new opportunities for real-time quantitative assessment of animal behaviour related to production and welfare.

Project aims

To undertake a range of industry consultation, market analysis, and preliminary research and development to quantify the value of autonomous monitoring systems for sheep enterprises.

Project objectives

1. Develop and verify normal behaviour algorithms breeding ewes utilising different breeds of sheep under diverse nutritional conditions.
2. Utilise behavioural algorithms to predict key lambing behaviours for synchronised ewes.
3. Support remote monitoring using real time sensors to test the ability of algorithms and developed processes to autonomously monitor lambing ewes and provide remote alerts to the producer.
4. Conduct a detailed market analysis, analysing the required further development to enable the progress and deployment of a system across the wider sheep industry, including:
 - a. A detailed cost benefit analysis of the value of autonomous alerts at lambing supported by experimental data outputs.

- b. A review of the unit cost and proportion of the flock that would require sensors to derive the benefits of the technology
 - c. A review of:
 - i. Engagement with a commercial partner to investigate the development and release of a commercial version of the developments achieved
 - ii. A competitor analysis and value proposition-to a commercial partner-analysis.
5. Survey sheep producer perceptions of the value of autonomous monitoring systems.

Current progress

This project confirmed that producers were interested in the concept of autonomous livestock monitoring and are willing to invest time and energy into progressing the concept. A significant database of sheep behaviour linked to accelerometer output has been compiled which will contribute to future research towards automating aspects of livestock management. Autonomous monitoring of lambing ewes has proven problematic due to within flock variation in behaviour related to lambing events. Difficulties associated with defining an accelerometer pattern to identify soon-to-lamb or just-lambing ewes pivoted the project toward a vision-based approach which has proven to be a useful development.

For more information on the developing and piloting real time monitoring systems for sheep, contact Andrew Thompson (andrew.thompson@murdoch.edu.au).

Have your say on methane-reducing supplements

Reducing enteric methane emissions from red meat is a key challenge on the red meat industry's journey to becoming carbon neutral by 2030 (CN30).

With new methane reducing active ingredients becoming available, supplementation is shaping up to be one of key tools producers can use to address this challenge on-farm. However, as producers know, the best method of supplementing livestock will depend on the individual operation. Consequently, MLA wants to understand more about:

- how beef cattle and sheep producers currently supplement their livestock
- which delivery forms of methane reducing products producers are most likely to use.

To help gather this information, producers are encouraged to participate in the surveys below, which take approximately 15 to 20 minutes to complete. To complete the survey, you will need to have information about your stock numbers and the supplements you feed handy. The results will allow MLA and its partners to focus their research and development on the supplementation products best for producers, therefore helping our industry to achieve its CN30 goal.

There are two surveys, one for [beef producers](#) and the other for [sheep producers](#).

Survey responses are anonymous, and the results will be aggregated, summarised and reported according to practice groups and Natural Resource Management region. As a reward for participating in the survey, you'll go in the running to win one of 30 \$50 YETI gift cards to spend on their range of eskys, drinkware and more.

For more information on the survey please contact Rhys Pirie, MLA Program Manager – Business Development (rpirie@mla.com.au).

Scientific papers

Using pen-side measurable blood parameters to predict or identify dystocic lambing events

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Biology, Volume11(2) January 2022 **OPEN ACCESS**

DOI <https://doi.org/10.3390/biology11020206>

Simple Summary

Prolonged or non-progressive labour is the greatest risk factor for loss of newborn lambs in Australia and poses significant welfare and economic concerns worldwide. In this study, we set out to investigate whether pen-side technology could be used to predict which ewes would be at risk of prolonged labour. In our pilot trial, we found potentially useful markers. We next developed a sampling protocol by looking at changes in candidate markers over time in normal lambing events. Finally, we searched for blood markers that could distinguish between normal and difficult lambing events, sampling pre-birth (estimated one week before birth), at birth (within 3 h) and post-birth (16–26 h). Possible predictors of lambing difficulty were chloride, haematocrit and haemoglobin, sampled one week before birth; creatinine, sampled at birth; and acid–base related parameters after birth. In conclusion, we found that pen-side analysis of blood markers showed promise in identifying dystocic lambing events. More information is required to decide whether pen-side diagnostics could be useful to identify and predict dystocic lambing in the future.

Abstract

Dystocia is the greatest contributor to neonatal lamb mortality in Australia and poses significant welfare and economic concerns worldwide. In this study, we set out to investigate whether pen-side analysis technology could be employed to detect blood parameters predictive of dystocic labour events in sheep. In a pilot trial, we collected and analysed blood samples in pen-side assays for glucose, lactate, pH, pCO₂, pO₂, base excess, HCO₃⁻, TCO₂, sO₂, lactate, sodium, potassium, chloride, calcium, urea nitrogen, creatinine, haematocrit, haemoglobin and anion gap. From the pilot data, we identified creatinine, TCO₂, chloride and calcium as potentially useful markers. To develop a time course and to establish variability of the selected blood parameters, a time series of samples was collected from 12 ewes, from mid-gestation to 48 h after birth. For the main trial, blood samples were collected at mid- and late gestation for glucose determination and for the full set of blood parameters at three time points before, at and after birth. Possible predictors of lambing difficulty were chloride, haematocrit and haemoglobin, sampled one week before birth; creatinine, sampled at birth; and blood pH and base excess after birth. In conclusion, we found that pen-side analysis of blood markers showed promise in identifying dystocic lambing events.

MLA Project PSH.0808 *New approaches to the understanding of underlying causes for neonatal lamb mortality*

Response to heat stress for small ruminants: Physiological and genetic aspects

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Livestock Science, Volume 263, September 2022

DOI <https://doi.org/10.1016/j.livsci.2022.105028>

Highlights

- Small ruminant's response to heat stress is complex.
- Traits involved include physical, physiological and metabolic.
- Several gene pathways are up and down regulated in this response.
- Genes and traits identified may be candidates for biomarkers in selection programs.

Abstract

As the expectation of the influence of climate change scenarios increases, the effect of heat stress on small ruminants is significant due to their importance for smallholders in stressful environments. This article reviews the physical, physiological, metabolic, genes (N=126) and genetic pathways that affect heat stress response in sheep and goats. Molecular functions (N=304) linked to cytokine, growth factor, hormone and ATPase activity, as well as binding proteins, ATP, DNA, metal ions were prevalent in these analyses. As for biological processes (N=1803), gene expression and regulation, cell differentiation, apoptotic processes, cytokine pathways and inflammatory responses are important. Biological processes were centred on regulation, positive/negative, cell, signals, processes, proteins and pathways, while molecular functions included binding, DNA/RNA, protein, factors and activity. This review will contribute to have a better understanding of the complex animal's response to heat stress and it should support scientific groups to delineate new studies as well to stimulate the generation of more data towards the development of strategies and methods to reach more sustainable animal production systems.

Mating weight and condition score are both good predictors of lambing potential for young Merino and Border Leicester Merino ewes across different environments and years in Australia

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Animal Production Science, Volume 62(15), September 2022 **OPEN ACCESS**

DOI <https://doi.org/10.1071/AN20143>

Abstract

Context: Increasing mating weight or condition score increases the lambing potential of ewes (fetuses scanned per 100 ewes joined).

Aim: We hypothesised that in some years, condition score would contribute an additional effect to mating weight on lambing potential.

Methods: Border Leicester Merino and Merino ewes were mated naturally to Merino or Terminal rams between 2008 and 2013 at eight linked sites across Australia. Border Leicester Merino ewes were mated in their first year while Merino ewes were not mated until their second year. All ewes were mated for a second time as 2 year olds (Border Leicester Merinos) or 3 year olds (Merino). A total of 4270 Border Leicester Merino and 5788 Merino ewes were weighed and condition scored at mating and scanned for pregnancy.

Key results: Lambing potential increased by 3.1% per 1 kg increase in mating weight, compared to 1.3% for 1 and 2 year old Border Leicester Merinos respectively, and by 2.1% compared to 1.4% for 2 and 3 year old Merinos respectively ($P < 0.05$). Lambing potential increased by 27% compared to 13% per increase in condition score for 1 and 2 year old Border Leicester Merinos respectively, and by 29% compared to 25% for for 2 and 3 year old Merinos respectively ($P < 0.05$). All relationships were linear. When both mating weight and condition score were fitted together, mating condition score explained additional variation to weight in one instance of all the 160 possible breed ($n = 2$) \times age ($n = 2$) \times site ($n = 8$) \times mating year ($n = 5$) combinations.

Conclusions: Mating weight and condition score increased the lambing potential of ewes linearly with differences due to ewe age, year and possibly ewe breed. Mating condition score rarely explained additional variation in lambing potential to weight in young Merino or Border Leicester Merino ewes.

Implications: If ewes are weighed at mating then condition scoring is of minimal extra benefit to predict lambing potential. Achieving the heaviest possible mating weights or highest condition score maximises the lambing potential of ewes in their first two mating years.

Exposure of rams in sexual rest to sexually activated males in spring increases plasma LH and testosterone concentrations

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Theriogenology, Volume 192, 15 October 2022 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.theriogenology.2022.08.035>

Highlights

- Rams are rendered sexually active in sexual rest by exposure to long days followed by short days.
- These rams stimulate another rams' LH and testosterone secretion during sexual rest.
- We call this phenomenon the “ram-to-ram effect”.

Abstract

Eight stimulating rams, and twelve stimulated rams, were used to determine whether a similar endocrine response to the introduction of sexually active males in spring in a flock of ewes is observed in a flock of rams. The stimulating rams (n = 4) were induced into a sexually active state by exposure to 2 months of long days (16 h light/d) (15 December-15 February). At the end of the long-day period, rams were returned to the natural photoperiod. Control-stimulating rams (n = 4) were kept under the natural photoperiod. On April 20, stimulated rams were divided into 2 groups, and joined with activated (ACT; n = 6) or control stimulating rams (C; n = 6). On the day of ram introduction, stimulated rams were blood sampled for 8 h at 20-min intervals, from 4 h before to 4 h after ram introduction, and next day from 24 to 28 h after ram introduction, and analyzed for plasma LH concentrations, and 10, 20 and 30 days after ram introduction to measure plasma testosterone levels. Mean (\pm SEM) plasma LH concentrations (ng/ml) of stimulated rams were similar during the 4 h before stimulating-ram introduction (ACT: 0.59 ± 0.03 ; C: 0.53 ± 0.04 ; $P > 0.05$). The introduction of the photoperiod-treated stimulating rams increased LH concentrations of stimulated rams during the 4 h after their introduction (1.14 ± 0.37) compared with the C group (0.51 ± 0.03 ; $P < 0.05$), especially during the first hour (ACT: 0.93 ± 0.16 ; C: 0.49 ± 0.03 ; $P < 0.05$), and during the blood sampling period 24–28 h after ram introduction (0.75 ± 0.07 vs. 0.58 ± 0.04 ; $P < 0.05$). Before the introduction of stimulating rams, the LH pulse frequencies and amplitudes did not differ between groups; however, LH pulsatility was higher at 4 h (0.58 ± 0.11 pulses/h; $P < 0.05$), and had trend to be higher 24 h (0.50 ± 0.06) ($P = 0.10$) after the introduction of the photoperiod-treated stimulating rams compared with the control-stimulating rams (0.29 ± 0.08 and 0.29 ± 0.10 , respectively). As for LH pulses, there was an effect of group ($P < 0.05$) on LH amplitude, which presented a trend to be higher in ACT rams 4 h after ram introduction (1.68 ± 0.30 ; $P < 0.10$) and higher 24 h (1.07 ± 0.08 ; $P < 0.05$) after ram introduction, compared with LH amplitudes of C rams (0.71 ± 0.06 and 0.82 ± 0.07 , respectively). Plasma testosterone concentrations of rams exposed to photoperiod-treated activated rams were higher than those of rams exposed to control-stimulating rams, at 4 h, 20 and 30 days after ram introduction ($P < 0.05$). In conclusion, sexually active rams in spring are able to stimulate LH and testosterone secretion of other rams in sexual rest, a phenomenon we called “ram-to-ram effect”.

Factors influencing seminal plasma composition and its relevance to succeed sperm technology in sheep: An updated review

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Small Ruminant Research, Volume 215, October 2022

DOI <https://doi.org/10.1016/j.smallrumres.2022.106759>

Highlights

- Ram seminal plasma composition and its function in reproduction in sheep.
- Analyze different factors that can affect the seminal plasma composition.
- Effect of seminal plasma in ram sperm processing.

Abstract

Seminal plasma (SP) is a complex biological fluid including multiple secretions of male reproductive glands and a smaller amount of epididymal secretions. Advances in reproductive technologies have revealed that SP can both inhibit and stimulate sperm function through multifunctional actions of organic and inorganic constituents. In this review, we focus on the current understanding of ram seminal plasma composition and involved factors that could influence its characteristics, such as breeds, age, individual effects, frequency and technique of collection, vasectomy procedure, nutrition, season, and heat stress. Seminal plasma's effect on sperm liquid storage, cryopreservation, and sorting is also highlighted.

Can genetic propensity for lambing difficulty be predicted by pelvic and body shape dimensions measured by X-ray computed tomography (CT) scanning of ram lambs?

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Small Ruminant Research, Volume 216, November 2022 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.smallrumres.2022.106790>

Highlights

- As potential lambing ease predictors, body/ pelvic measurements were taken by CT.
- CT lambing ease predictors measured in ram lambs are heritable.
- Preliminary genetic correlations suggest narrow hips and shoulders ease lamb birth.
- Also, wider, more vertical pelvises may result in easier lambing of ewes.
- Possible future potential to select for lambing ease via routine ram lamb CT scans.

Abstract

The ability of sheep to lamb unaided is important for both financial and welfare reasons. Current recording of lambing ease is subjective and unreliable for breeding purposes. The aim of this study was to investigate genetic control of measurements that could be taken from routine x-ray computed tomography (CT) scanning of ram lambs, within UK breeding programmes, to predict lambing difficulty of their progeny, or their daughters' progeny. Measurements of 6 CT-derived lambing ease predictor traits (hip width, shoulder width, pelvic area, pelvic height, pelvic width, pelvic angle) were taken from archived CT images from 437 Texel ram lambs from 58 flocks (average age ~20 weeks) scanned over 15 years, as part of the UK national terminal sire breeding programme. Heritabilities, after adjusting for live weight, ranged from 0.16 to 0.65, with the highest estimates for the pelvic traits. Lambing difficulty scores (17705 records over 16 years), recorded on a six-point scale of increasing severity, were available from lambs born within the same flocks. Lambing difficulty was lowly heritable when expressed either as a trait of the lamb ($h^2 = 0.05$) or the ewe ($h^2 = 0.02$) with large common litter effects, low maternal effects and low repeatability in the ewe. Genetic correlations gave some indication that wide hips and shoulders, at a fixed live weight, may be associated with increased lambing difficulty of the lamb ($rg = 0.28$ and 0.47) and that lower pelvic width and angle (more horizontal) may be associated with increased lambing difficulty of the ewe ($rg = -0.22$ and -0.39), although standard errors were high. Moderate genetic correlations between body width and pelvic measurements suggest scope to select for optimal combinations of these measurements. Further research in this area could lead to incorporation of robust breeding values for lambing ease into sheep breeding programmes to improve animal welfare.

Birth, colostrum, and vigour traits of lambs born from Corriedale ewes grazing native pastures supplemented during the peripartum period

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Small Ruminant Research, Volume 216, November 2022

DOI <https://doi.org/10.1016/j.smallrumres.2022.106795>

Highlights

- Short-term peripartum supplementation improved colostrum traits of ewes.
- Short-term peripartum supplementation improved blood glucose at lamb birth.
- Supplementation reduced dystocia/stillbirth/birth injury as cause of death in lambs.
- Supplementation did not affect duration or type of parturition in ewes or lamb vigour.

Abstract

To evaluate the effect of a short-term energy-protein supplementation during the peripartum on birth, colostrum, and vigour traits of lambs, 214 multiparous Corriedale pregnant ewes grazing native pastures were used. Ewes, according to body conditions score and body weight, were assigned to a 2 × 2 factorial design: type of birth (single or twin), and supplementation (yes or no). Single (n = 67) and twin bearing (n = 39) non-supplemented, and single (n = 67) and twin bearing supplemented ewes (n = 41) were observed during lambing in two similar sub-paddocks. There was no detected interaction between supplementation and type of birth for any of the experimental variables (P > 0.05), except in the time the lambs took to stand after birth. Length of gestation and type of parturition (normal vs. dystocia) were not affected by supplementation or type of birth (P > 0.05). The duration of parturition (phase II) was longer in supplemented than non-supplemented and in single than in twin bearing ewes (P < 0.05). Colostrum production was greater, heavier, and less viscous in supplemented than non-supplemented ewes, and in single than twin bearing ewes (P < 0.05). Colostrum nutritional values were greater in supplemented than non-supplemented ewes; there was more total lactose in single than twin bearing ewes (P < 0.05). Birth weight of lambs was not affected by supplementation (P > 0.05), but it was higher in single than twin lambs (P < 0.05). There were more lambs with blood glucose concentration greater than 20 mg/dl at birth from supplemented than non-supplemented, and from single than twin bearing ewes (P < 0.05). There was no effect of supplementation in the time taken by lambs to stand and suck their mothers (P > 0.05), however in non-supplemented ewes, single lambs stood and sucked faster than twin lambs (P < 0.05). No differences in lamb mortality to 72 h were observed due to supplementation or type of birth (P > 0.05) but lesions of dystocia/stillbirth/birth injury as cause of death was less frequent in supplemented than non-supplemented ewes (P < 0.05), without differences by type of birth (P > 0.05). In conclusion, a short-term energy-protein supplementation in ewes during peripartum period influenced positively the volume, viscosity and composition of colostrum and blood glucose of lambs at birth, reducing lesions of dystocia/stillbirth/birth injury as cause of death of lambs, but did not affect the length of gestation, duration, or type of parturition in ewes, birth weight, lamb vigour, or lamb mortality to 72 h.

Fetal programming in sheep: Effects on pre- and postnatal organs and glands development in lambs

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Research in Veterinary Science, Volume 151, 10 December 2022

DOI <https://doi.org/10.1016/j.rvsc.2022.07.014>

Highlights

- Organs are more likely to undergo weight changes than glands.
- The progeny's liver is the organ most affected by maternal nutrition.
- The extent of the effect is influenced by the duration and level of the intervention.

Abstract

The present systematic review and meta-analysis aim to summarize the effects of maternal undernutrition or overnutrition during pregnancy on the absolute weight and relative weight of the organs (liver, kidneys,

heart, spleen, and lung) and glands (adrenal, pancreas, and thyroid) measured during gestation, birth and the postnatal period in lambs. After completing the search, selection, and data extraction steps, the measure of effect was generated by the individual comparison of each variable response compared with the average of the control and treated group (undernutrition or overnutrition) using the DerSimonian and Laird method for random effects. The liver was the organ most affected by maternal undernutrition, as the absolute weight of the liver was reduced during pregnancy, birth, and the postnatal period. The extent of this effect is related to the duration of the intervention. Reductions in the absolute fetal weight of the lungs and spleen have also been observed. No change in organs weight were observed when the results were expressed as relative weight. For overnutrition, the fetal weight of the liver was reduced to both absolute and relative values. In contrast, the relative weight of the kidneys has been increased. For the glands analyzed, no changes in weight were observed in either scenario (absolute or relative weight). Thus, the organs are more likely to suffer weight changes, especially during pregnancy, as a result of maternal nutrition. However, this change in organ weight seems to be closely related to the reduction in body weight of the progeny as a whole.

Upcoming events

Date	Event	Location
11 October 2022	Shade, Shelter & Shrubs show-and-tell WALRC. MLA. UWA, Murdoch University, NSW DPI & CSIRO	Cranbrook, WA
14 October 2022	MerinoLink (FINAL) MLP Field Day AMSEA, MerinoLINK & AWI	Temora, NSW
21 October 2022	Pingelly MLP Final Field Day AMSEA, AWI, Murdoch University & UWA	Pingelly, WA
26 October 2022	Best practice predator control at lambing Goulburn Murray BESTWOOL/BESTLAMB	Picola, Vic