

JUNE 2024

Sheep reproduction RD&A alert

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

If you missed the SRSP's June webinar, the recording is now available to view from the [SRSP webpage](#). Just scroll down to the SRSP webinar series and click on the *Optimising ewe lamb joining outcomes & preg scanning in extensive sheep flocks* dropdown box.

- Sally Martin (SheepMetriX) discusses the decision making process and the learnings to date to achieve successful ewe lamb joining outcomes.
- Laura Broughton (Productive Livestock Systems) highlighted the benefits of pregnancy scanning in extensive sheep flocks.

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

Optimal supplementary feeding strategies for lamb survival

Background

Supplementary feeding is often required to meet the nutritional demands of ewes lambing in autumn and when feed-on-offer is limited when lambing in winter or even early spring. Anecdotal evidence has suggested that supplementary feeding ewes at lambing may cause them to abandon their lambs which could reduce lamb survival. However, there is conflicting opinion as to whether trail feeding or the use of self-feeders is more favourable for lamb survival.

Aim

To evaluate the effects of various methods for trail feeding and self-feeders at lambing on ewe behaviour and lamb survival.

Project Objectives

- Quantify the effects of supplementary feeding ewes during lambing using self-feeders or trail feeding on ewe behaviour and lamb survival to marking and include a detailed benefit cost analysis of each feeding strategy.
- Develop guidelines for supplementary feeding ewes during lambing for extension to producers via existing networks.

Current progress

This project has three stages. The first experiment will compare the impacts of supplementary feeding single- or twin-bearing ewes via trail feeding or self-feeders on lamb survival to marking and is underway at research sites in WA, SA, Vic and NSW. Remote technology will be used at up to one third of these sites to examine the impacts on ewe behaviour during lambing for the second experiment. The third experiment will

investigate the effects of the proximity of trail feeding or self-feeders to water and the number of feed trails or self-feeders in the paddock on ewe behaviour during lambing.

For more information on the supplementary feeding and lamb survival project contact Serina Hancock (s.hancock@murdoch.edu.au) or Susan Robertson (surobertson@csu.edu.au).

Review papers

Systematic review of hormonal strategies to improve fertility in rams

Estela Garza-Brenner, Fernando Sánchez-Dávila (fernando_sd3@hotmail.com), Keyla Mauleón-Tolentino, Cecilia Carmela Zapata-Campos, Carlos Luna-Palomera, Javier Hernandez-Melendez, Marisol Gonzalez-Delgado and José Fernando Vázquez-Armijo

Animal Reproduction Volume 21 Number 2 June 2024 **OPEN ACCESS**

DOI <http://dx.doi.org/10.1590/1984-3143-AR2024-0007>

Abstract

Reviewing the current state of knowledge on reproductive performance and productive traits in rams has many advantages. First, the compilation of this information will serve as a literature resource for scientists conducting research around the world and will contribute to the understanding of the data collected and interpreted by researchers on the different hormonal strategies used to improve reproductive performance in rams. Second, it will allow scientists to identify current knowledge gaps and set future research priorities in ram reproduction. Rams play an important role in the global flock economy, but their reproductive analysis has been limited in the use of hormonal technologies to increase the productivity of sheep flocks. In this review, we cite the most important works on six hormones that, in one way or another, modify the hypothalamus-pituitary-gonadal axis, at different doses, in and out of the reproductive season, breeds, application methods, among other factors. The overall aim is to increase the reproductive efficiency of rams in different scenarios and, in some cases, of other species due to the lack of limited information on rams.

Use of assisted reproductive technologies (ARTs) to shorten the generational interval in ruminants: current status and perspectives

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Theriogenology, Volume 225, 1 September 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.theriogenology.2024.05.026>

Highlights

- ARTs are providing new strategies that could be used to reduce generation time in domestic ruminants.
- Large number of oocytes can be collected from prepubertal donors. But their developmental potential is still low.
- Advancements in 3D platforms are allowing to recreate spermatogenesis in vitro in livestock animals.
- ROSI is still an unsuccessful technique mostly because of round spermatids inadequate isolation and selection procedures.

Abstract

The challenges posed by climate change and increasing world population are stimulating renewed efforts for improving the sustainability of animal production. To meet such challenges, the contribution of genomic selection approaches, in combination with assisted reproductive technologies (ARTs), to spreading and preserving animal genetics is essential. The largest increase in genetic gain can be achieved by shortening the

generation interval. This review provides an overview of the current status and progress of advanced ARTs that could be applied to reduce the generation time in both female and male of domestic ruminants. In females, the use of juvenile in vitro embryo transfer (JIVET) enables to generate offspring after the transfer of in vitro produced embryos derived from oocytes of prepubertal genetically superior donors reducing the generational interval and acceleration genetic gain. The current challenge is increasing in vitro embryo production (IVEP) from prepubertal derived oocytes which is still low and variable. The two main factors limiting IVEP success are the intrinsic quality of prepubertal oocytes and the culture systems for in vitro maturation (IVM). In males, advancements in ARTs are providing new strategies to in vitro propagate spermatogonia and differentiate them into mature sperm or even to recapitulate the whole process of spermatogenesis from embryonic stem cells. Moreover, the successful use of immature cells, such as round spermatids, for intracytoplasmic injection (ROSI) and IVEP could allow to complete the entire process in few months. However, these approaches have been successfully applied to human and mouse whereas only a few studies have been published in ruminants and results are still controversial. This is also dependent on the efficiency of ROSI that is limited by the current isolation and selection protocols of round spermatids. In conclusion, the current efforts for improving these reproductive methodologies could lead toward a significant reduction of the generational interval in livestock animals that could have a considerable impact on agriculture sustainability.

Scientific papers

Lipidomic profiling of cervical mucus reveals the potential role of pro-inflammatory derived metabolites on sperm transport across the ovine cervix

Laura Abril-Parreño, Anette Krogenæs and Sean Fair (sean.fair@ul.ie)

Animal, Volume 18, Issue 5, May 2024 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.animal.2024.101136>

Highlights

- Mucus composition related to differences in cervical sperm transport between breeds.
- First study to assess the lipids in cervical mucus from ewes with varying fertility.
- Reduced levels of arachidonic and linoleic acid metabolites in the low fertility breeds.
- The low fertility breed, Suffolk, had an up-regulation in the COX pathway.
- Pro-inflammatory environment could have negative effects on cervical sperm transport.

Abstract

Internationally, cervical artificial insemination (AI) in sheep yields low pregnancy rates when frozen-thawed semen is used. An exception to this is in Norway where vaginal AI of frozen-thawed semen to a natural oestrus yields non-return rates in excess of 60%, which has been attributed to the ewe breed used in Norway. This study used both metabolomics and an RNA-sequencing approach to assess the lipid production and composition from cervical mucus and tissue of four European ewe breeds (n = 28–30 ewes per breed) with previously reported differences in pregnancy rates following cervical AI with frozen-thawed semen. These breeds included Suffolk (exhibiting low fertility), Belclare (medium fertility) as well as Norwegian White Sheep and Fur (both with high fertility and pregnancy rates > 60%) at both a synchronised and natural oestrous cycle. The aim was to explore the differences between ewe breeds in the lipidomic profile and to identify candidate biomarkers associated with an optimal environment for cervical sperm transport. The results revealed the identification of 255 lipids, of which 170, 102 and 83 were different between ewe breeds, types of cycle and affected by their interaction, respectively (P < 0.05). Reduced levels of lipids involved in the resolution of inflammation (i.e. 14-HDoHE, 17-HDoHE, 15-HETE) were identified in the low-fertility Suffolk

breed compared to high-fertility ewe breeds. However, there was an up-regulation of the COX pathway accompanied by increased levels of prostaglandins in the Suffolk breed. These findings indicated a sub-optimal and pro-inflammatory environment that could have a negative effect on cervical sperm transport.

Effects of prepartum shearing on metabolic and placental parameters of ewes: Impact on productive parameters of their lambs

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Livestock Science, Volume 284, June 284

DOI <https://doi.org/10.1016/j.livsci.2024.105489>

Highlights

- Prepartum shearing has been associated with increased lamb survival.
- Effects of ewe prepartum shearing on metabolism and placenta traits were evaluated.
- Live weight, morphometric measurements and body composition were determined in lambs.
- Prepartum shearing caused changes in the metabolic and placental profile of ewes.
- It also resulted in an increase in weight and development of the lambs at birth.

Abstract

Prepartum shearing has been associated with increased lamb survival under pastoral conditions. This research aimed to evaluate the effects of early and late prepartum shearing in gestating Corriedale ewes on the metabolic profile and placental parameters of the ewes and how these changes affect the productive parameters of their lambs. On day 70 of gestation, 37 ewes carrying a single foetus were randomly divided into three groups: ewes sheared at day 70 of gestation (early, PS70, n = 12), sheared at day 110 of gestation (late, PS110, n = 12), and ewes unsheared at prepartum (US, n = 13, control group). Energy metabolism (glycaemia, insulin, NEFA, and BHB) and placental parameters (placental weight, number, and characteristics of cotyledons, and placental efficiency) were evaluated in the ewes. Live weight, morphometric measurements, and body composition were determined in the lambs. Prepartum shearing performed on different days (early and late) caused changes in energy metabolism, leading to a decrease in serum insulin and an increase in NEFA and BHB blood values. Early prepartum shearing increased placental weight and the number and weight of the 2–3 cm-cotyledons, while late prepartum shearing increased placental weight and placental efficiency and only changed the weight of the 2–3 cm-cotyledons. Prepartum shearing on both days caused an increase in lamb birth weight. Therefore, prepartum shearing caused changes in the metabolic profile and placenta of the ewes, which resulted in increased weight and development of lambs at birth.

Use of coenzyme Q-10 to improve the pregnancy rate in sheep

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Animal Reproduction Science, Volume 266, July 2024

DOI <https://doi.org/10.1016/j.anireprosci.2024.107498>

Highlights

- Coenzyme Q10 is an option for cryopreservation of sheep semen.
- Coenzyme Q10 improves the pregnancy rate of sheep.
- Membrane integrity is increased with Coenzyme Q10 supplementation.

Abstract

One of the factors responsible for less pregnancy rates is the use of frozen semen in sheep due to the oxidative stress created by the process. The aim of this experiment was to test the effects of adding coenzyme Q-10 (CoQ10) to the seminal extender on sperm quality and the pregnancy rate of sheep. In this study, ejaculates from eight Dorper rams of reproductive age were used and tested in four treatments: Control (pure BotuBov®), C1 (175 µM of CoQ10), C3 (350 µM of CoQ10), and C7 (700 µM of CoQ10). Samples were collected in triplicate from each animal, and sperm analysis was performed by CASA after thawing at 0 h and 2 h. The samples were also analyzed by flow cytometry for plasma and acrosomal membrane integrity, stability, lipid peroxidation, mitochondrial potential, and superoxide anion production. In total, 198 ewes were inseminated by laparoscopy and divided into two groups: control (n=98) and C7 (n=100). Pregnancy diagnosis was performed at 30 days. Coenzyme Q10 proved to be safe for semen cryopreservation, not altering sperm kinetic values between the groups post-thawing. In flow cytometry, the C1 and C7 groups achieved a better index of plasma membrane integrity and membrane stability (P<0.05). A increased pregnancy rate was observed in C7 (52 %) compared to the control (38 %). In conclusion, coenzyme Q10 assists in the cryopreservation process, protecting the sperm cell and improving pregnancy rates in ewes.

Upcoming events

Date	Event	Location
8 July 2024	Excel for EID – using your data effectively NSW LLS & SheepMetrix	Webinar
18 July 2024	Weaner sheep nutrition online AWI Extension NSW	Webinar
22 July 2024	Excel for EID – Building four data over time NSW LLS & SheepMetrix	Webinar
25 July 2024	Getting the most out of grazing crops NSW LLS	Braidwood, NSW
26 July 2024	BredWell FedWell MLA	Marthaguy, NSW
26 July 2024	Getting the most out of grazing crops NSW LLS	Goulburn, NSW
29 July 2024	Getting the most out of grazing crops NSW LLS	Boorowa, NSW
31 July 2024	BredWell FedWell MLA	Forbes, NSW
1 August 2024	BredWell FedWell MLA	Cobar, NSW
7-9 August 2024	LambEx	Adelaide, SA
21-22 August 2024	Livestock 2024 Conference SALRC	Albury, NSW