

MARCH 2022

## Sheep reproduction RD&A alert

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

Pregnancy scanning is a key technology that enables sheep producers to make informed decisions regarding managing their breeding ewes and lambing. The next SRSP webinar, on **5 April 2022 at 7.30 pm (AEST)**, will highlight the role of pregnancy on farm profitability and discuss the key actions producers can take to set their scanner up for success. John Young (Farming Systems Analysis Services) will answer the question **Can you afford not to scan?** by presenting the results of a recent economic analysis of the benefits and costs of pregnancy scanning in sheep. Josh Cousins (Cousins Merino Services) will round out the webinar and will provide a scanners perspective on **How to get the best out of pregnancy scanning**. [Register for the webinar now!](#)

### Program coordinator

Dr Sue Hatcher

M: 0407 006 454

E: [sue@makinoutcomes.com.au](mailto:sue@makinoutcomes.com.au)

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.

### Feature project

#### More lambs from ewe lambs through developing and extending best practice

Mating ewes to lamb at 12-15 months is an effective avenue to build ewe numbers and increase lamb supply. However, the reproductive performance of ewe lambs is much lower than mature ewes and is highly variable. A lack of information on the financial ramifications of joining ewe lambs and the variable results has contributed to relatively low levels of adoption with about 30% of Maternal and 5% of Merino producers currently joining ewe lambs.

#### Project aim

To significantly increase both the number of ewe lambs being mated and their reproductive performance (Maternals, Merinos and Shedding ewes) by developing and validating best practices to deliver reproductive success.

#### Project objectives

1. Identify the range in current industry recommendations and suggest best practice for mating ewe lambs to lamb at 12 to 15 months and the key barriers to adoption.
2. Compile national baseline data from producers on current numbers of ewe lambs mated to lamb at 12 to 15 months; the reproductive rate achieved when mating ewe lambs; mortality rates of mated ewe lambs and their lambs; and resultant marking rate.
3. Identify the suite of management practices that impact the reproductive performance of ewe lambs on commercial farms and reduce mortality rates of ewe lambs and their progeny lambs.

4. Test the effectiveness of these practices at commercial scale on a network of commercial properties across Australia.
5. Quantify the carryover impacts of management of ewe lambs during their first pregnancy and lactation on their subsequent reproductive rate.
6. Undertake economic modelling and cost benefit analyses to quantify the value of various management practices and identify optimal economic pathways to improve ewe lamb reproductive success for Maternal and Merino enterprises.
7. Develop and pilot a supported learning program that coaches producers to improve reproductive performance of ewe lambs and at their first and second lambing.
8. Develop a best practice guide and decision tools for obtaining reproductive success from ewe lambs.

### Current progress

More than 40,000 ewe lambs have been joined across 30 commercial or seedstock enterprises located in Victoria, New South Wales, South Australian and Western Australia with individual sites implementing a range of joining, lambing and weaning treatments.

For more information on the ewe lambs project contact Jason Trompf ([jason@jtagrisource.com.au](mailto:jason@jtagrisource.com.au)).

## Scientific papers

### Out-of-season breeding and ewe-lamb bond from birth to weaning in Corriedale sheep

Ophélie Menant ([ophelie.menant@gmail.com](mailto:ophelie.menant@gmail.com)), Rodolfo Ungerfeld, Frédéric Lévy, Raquel Pérez-Clariget, Aline Freitas-de-Melo

Applied Animal Behaviour Science, Volume 247, February 2022

DOI <https://doi.org/10.1016/j.applanim.2021.105542>

### Highlights

- Season of lambing affects the ewe-lamb bond from birth to weaning.
- Autumn-born lambs requested more their mother than spring-born lambs.
- Autumn and spring-born lambs displayed different behaviours to cope with weaning.
- Lambs born in spring and their mother were heavier than those born in autumn.
- Ewes produced more milk and solid contents when lambing in spring than in autumn.

### Abstract

Out-of-season lambing is based in productive aims; however also modifies the basic physiology of the ewe. It might affect ewes and lambs' behaviours at birth, their bond, the process of lambs' independence from their mothers and their response to weaning. This study aimed to compare the ewe-lamb bond from birth to artificial weaning in out-of-season lambing (autumn) and spring lambing. A complementary aim was to determine if out-of-season breeding affects ewes' udder size, milk yield and composition, body condition score (BCS) and body weight of the ewes and lambs. The study was performed with 26 multiparous single-lambing Corriedale ewes that lambed in spring (natural season: group SPR), and 26 ewes that lambed in autumn (out-of-season: group AUT) and their lambs. The ewe-lamb behaviours were recorded during a separation-reunion test performed 24–36 h after birth. Lambs' behaviours were recorded before and after weaning (at 80 days of age). Ewes' BCS and body weight were recorded at mating, lambing and weaning. Lambs' body weight was recorded at lambing, before and after weaning. Ewes' milk yield and composition were determined before weaning. During the separation-reunion test, although AUT lambs vocalised more often than SPR lambs their mothers remained further away ( $P = 0.01$ ). Before weaning, AUT ewe-lamb dyads

were observed more often far from each other ( $P < 0.001$ ); AUT lambs attempted to suckle more times ( $P < 0.001$ ) and grazed less frequently than SPR lambs ( $P = 0.004$ ). At weaning, AUT lambs walked more frequently, but were less often standing up than SPR lambs ( $P < 0.001$  for both behaviours). While SPR lambs decreased their grazing frequency on the day of weaning, AUT lambs increased it, grazing more frequently than SPR lambs ( $P < 0.001$ ). AUT ewes lambed with a greater BCS and body weight than SPR ewes ( $P = 0.01$  and  $P = 0.031$ , respectively), but this was reverted at weaning (BCS:  $P < 0.001$ ; body weight:  $P = 0.002$ ). SPR ewes had a greater milk yield, with more fat, lactose and protein amount than AUT ewes ( $P < 0.001$  for all variables). At weaning, SPR lambs were heavier than AUT lambs ( $P < 0.001$ ). In conclusion, although AUT ewes were in better body condition after birth, the ewe-lamb bond of the AUT group was weaker. This was associated with a lower expression of maternal attention when AUT lambs requested maternal care. The better environmental conditions of SPR dyads during lactation might positively impact their social and nutritional behaviours. The difference between groups remained until weaning, so AUT and SPR lambs displayed different behavioural strategies to cope with artificial weaning.

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## Comparison between pulse oximetry and venous blood gas analyses to assess lamb asphyxia at parturition

Mariel Regueiro ([marielregueiro@gmail.com](mailto:marielregueiro@gmail.com)), Ezequiel Jorge-Smeding, Anderson Saravia, Carlos López-Mazz and Georgget Banchemero

Small Ruminant Research, 4 March 2022, *In Press*

DOI <https://doi.org/10.1016/j.smallrumres.2022.106665>

### Highlights

- Practicality and accuracy of pulse oximetry to assess oxygenation status in newborn lambs was evaluated.
- Pulse oximetry was compared with lambs' vein blood gasometry, vitality and vigour.
- Lambs with blood gas values indicating severe acidosis registered the lowest oximetry % of O<sub>2</sub> saturation.
- Vitality and vigour of lambs with lowest O<sub>2</sub> saturation were poor.
- Pulse oximetry appears an accurate method to evaluate lamb birth asphyxia.

### Abstract

Early detection of fetal distress at lambing is essential to reduce mortality. Practicality and accuracy of pulse oximetry to assess oxygenation status in newborn lambs under field conditions was evaluated. Oximetry was compared with blood gas analyses and included assessment of vitality (Apgar test) and vigour (attempt to and successful standing and suckling) of 135 Finnish by Polwarth lambs. Sampling of data was obtained immediately after fetal expulsion; percentage of oxygen saturation (satO<sub>2</sub>) was measured using a pulse oximeter clamped to an ear, and was compared with gas analyses variables measured from a jugular vein sample (Gas Analyser: Siemens-Rapidlab 248®). Correlations between satO<sub>2</sub> measured by pulse oximetry and venous blood gas parameters either directly (partial pressure of carbon dioxide (pCO<sub>2</sub>), partial pressure of oxygen (pO<sub>2</sub>) and pH) or estimated (bicarbonate concentration, extracellular fluid base excess, and oxygen saturation) were studied. Considering pH as a good indicator of hypoxia at parturition, data was grouped as: G1 = pH < 7.1; G2 = 7.1 ≤ pH < 7.2; G3 = 7.2 ≤ pH < 7.3 and G4 = pH ≥ 7.3. Saturation of oxygen measured by pulse oximetry correlated significantly with pCO<sub>2</sub> ( $r = -0.50$ ;  $P < 0.001$ ), pH ( $r = 0.36$ ;  $P < 0.001$ ) and pO<sub>2</sub> ( $r = 0.2$ ,  $P = 0.04$ ) measured by blood gas analyses. Lambs with low pH values (G1= pH ≤ 7.1, acidosis) showed the lowest percentage to attempt and success to stand and suck, lowest Apgar score (G1 = 6.7, G2 = 8.6, G3 = 8.6, G4 = 8.5,  $P = 0.025$ ), lowest percentage of satO<sub>2</sub> measured by oximetry (G1 = 78.8%, G2 = 87.5%, G3 =

87.7%, G4 = 92.1%, P = 0.011) and highest pCO<sub>2</sub> (G1 = 78.5, G2 = 73.8, G3 = 65.8, G4 = 53.8 mmHg, P < 0.001). Pulse oximetry appears an accurate method to evaluate lamb birth asphyxia, helping to identify oxygenation constraints during labour, facilitating priority of perinatal handling, and thus improving lamb survival.

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## Melatonin or L-arginine in semen extender mitigate reductions in quality of frozen-thawed sperm from heat-stressed rams

Abdallah M. Shahat, Jacob C. Thundathil and John P. Kastelic ([jpkastel@ucalgary.ca](mailto:jpkastel@ucalgary.ca))

Animal Reproduction Science, Volume 238, March 2022

DOI <https://doi.org/10.1016/j.anireprosci.2022.106934>

### Highlights

- Scrotal neck insulation and whole-body heating models reduced ram sperm quality.
- Melatonin and L-arginine ameliorated effects of heat stress on frozen-thawed sperm.
- For melatonin or L-arginine, 1 mM was generally superior to 0.5 mM.

### Abstract

Our objective was to determine effects of melatonin or L-arginine on quality of frozen-thawed sperm from heat-stressed (HS) rams. Ten Dorset rams were randomly allocated to either scrotal neck insulation for 3.5 d or whole-body heating (28 °C and 30–34% RH for 8 h/d for 4 consecutive days). Semen was collected before HS then once weekly for 1–5 wk, extended (Steridyl CSS One Step<sup>®</sup>), and divided into 5 aliquots: control (no additive) or 0.5- or 1-mM of melatonin or L-arginine. For total and progressive motility (CASA), there were effects of group (P = 0.023 and P = 0.008, respectively); for morphological abnormalities (eosin-nigrosin), effects of group (P = 0.01) and a group\*week interaction (P = 0.03); and for acrosome integrity (FITC-PSA), effects of group (P = 0.046) and week (P = 0.001). All 4 treatments improved motility (~5–10% points), whereas 1 mM of either compound optimized abnormalities and acrosomal integrity (~7% and 12% points, respectively). For superoxide dismutase and catalase, there were effects of week (P = 0.01 and P = 0.045, respectively), with 1 mM of either additive yielding best results. For DNA fragmentation index (DFI%), there was an effect of week (P = 0.01), and a group\*week interaction (P = 0.05), with all 4 treatments reducing DFI%. For total ROS%, there was an effect of week (P = 0.044) and a group\*week interaction (P = 0.037), with 1 mM melatonin or L-arginine being best. The hypothesis that melatonin or L-arginine improve quality of frozen-thawed sperm from HS rams was supported; 1 mM of either gave best results, except 0.5 mM minimized DFI%.

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## Progestogen supplementation during superovulation leads to higher embryo viability and TGFB1 gene expression in sheep

Augusto Ryonosuke Taira ([augusto.vete@gmail.com](mailto:augusto.vete@gmail.com)), Ribrio Ivan Tavares Pereira Batista, Juliana Dantas Rodrigues Santos, Pedro Henrique Nicolau Pinto, Mario Felipe Alvarez Balara, Caroline Gomes do Espírito Santo, Viviane Lopes Brair, Joanna Maria Gonçalves Souza-Fabjan, Rodolfo Ungerfeld, Jeferson Ferreira da Fonseca and Felipe Zandonadi Brandão.

Animal Reproduction Science, Volume 238, March 2022

DOI <https://doi.org/10.1016/j.anireprosci.2022.106938>

### Highlights

- Progestogens during superovulation (SOV) did not influence follicular growth.
- Exogenous progesterone during superovulation increased the viability rate embryos.

- Progestogens during SOV increased the expression of TGFB1 gene in embryos.

### Abstract

This study aimed to compare the effect of the administration of either medroxyprogesterone acetate (MPA) or progesterone (P4) in superovulation (SOV) treatments applied during the first follicular wave on follicular development, embryo yield, and the expression of genes related to pluripotency maintenance, differentiation of the trophectoderm, cell growth and differentiation, apoptosis and energy metabolism in sheep embryos. The estrous cycle of 36 multiparous ewes was synchronized with a short protocol, and the animals were randomly allocated to three groups. At the beginning of SOV, 12 ewes per treatment received an intravaginal sponge impregnated with 60 mg of MPA (TMPA), or an intravaginal device containing 0.33 g of P4 (TP4), or received no progestogen treatment (CON). The device was kept until the fifth dose of FSH. Ewes were mated with five fertile rams. Gene expression was performed by RT-qPCR using grade I and II blastocysts. The numbers of corpora lutea, total structures and viable embryos recovered per ewe were similar ( $P > 0.05$ ) among groups. However, the viability rate was higher in TP4 ( $71.9 \pm 16.3\%$ ) compared to CON ( $24.4 \pm 16.8\%$ ;  $P = 0.01$ ) and similar to TMPA ( $49.9 \pm 16.3\%$ ;  $P = 0.2$ ). Similarly, when compared with CON, treatment with P4 or MPA positively regulated the TGFB1 transcript involved in cell proliferation and differentiation ( $P = 0.01$  and  $P = 0.03$ , respectively). In conclusion, supplementation with P4 during the first follicular wave of the estrous cycle improves embryo viability and alters the expression of the TGFB1 gene.

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### Effect of hydrated C<sub>60</sub> fullerene on lipid, vitamin and amino acid composition in frozen-thawed ram semen

Gaffari Türk, Recep H. Koca ([rhkoca@bingol.edu.au](mailto:rhkoca@bingol.edu.au)), İbrahim H. Güngöra, Serap Dayan Cinkara, Tutku C. Acısu, Figen Erdem Erişir, Gözde Arkalı, Şeyma Özer Kaya, Meltem Kızıl, Mustafa Sönmez, Seyfettin Gür, Ökkeş Yılmaz, Abdurrauf Yüce, Mustafa Karatepe

Animal Reproduction Science, Volume 238, March 2022

DOI <https://doi.org/10.1016/j.anireprosci.2022.106939>

### Highlights

- C60HyFn increased total and progressive motility in post-thaw ram semen.
- C60HyFn increased HOS and antioxidant activities in post-thaw ram semen.
- C60HyFn decreased abnormal and dead spermatozoon rates in post-thaw ram semen.
- C60HyFn decreased MDA levels in post-thaw ram semen.
- C60HyFn increased vitamins A, K and amino acid levels in post-thaw ram semen.

### Abstract

This study was conducted to investigate the effect of different doses of hydrated C<sub>60</sub> fullerene (C60HyFn) on freeze-thawing process-induced changes in lipid, vitamin and amino acid composition and also in motility, kinematic, sperm quality and oxidative stress parameters in ram semen. Semen was collected from seven rams twice a week for 3 weeks, so six repetitions were performed. The semen collected in each repetition was pooled. Each pooled sample was diluted with tris + egg yolk extender with (200 nM, 400 nM, 800 nM, 1 µM and 5 µM) and without (control) C60HyFn and they were frozen in mini straws. The doses of 800 nM, 1 µM and 5 µM had higher total, progressive motility, sperm membrane functionality rates, glutathione-peroxidase and catalase activities. All doses of C60HyFn significantly reduced dead and total abnormal sperm rates and malondialdehyde levels. Significant increases in vitamin A (400 and 800 nM doses), vitamin K1 (400 nM, 800 nM and 1 µM doses), total amino acid (all doses) levels, but significant decreases in vitamin D2 (800 nM, 1 and 5 µM doses), vitamin D3 (1 and 5 µM doses) and vitamin E (200 nM, 1 and 5 µM) levels were observed compared to control. In conclusion, the addition of C60HyFn to ram semen at 200 nM - 5 µM range,

especially at a dose of 800 nM, provides a positive contribution to the protection of motility, vitamins A, K and total amino acid levels, and oxidant/antioxidant balance after freeze-thawing.

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### **Effects of age at first joining and ewe genotype on the performance of two-tooth ewes and that of their progeny to slaughter**

Timothy W. J. Keady ([tim.keady@teagasc.ie](mailto:tim.keady@teagasc.ie)) and James P. Hanrahan

Animals, Volume 12(5), March-1 2022 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani12050653>

#### **Simple Summary**

Ewe replacements are a major cost in prime-lamb production. Many producers do not join replacements at 7 months as they believe that it has a negative effect on two-tooth performance. The effect of age at first joining on the reproductive performance of two-tooth ewes, representing three genotypes, was evaluated as well as the performance of their progeny. Whilst joining at 7 months reduced ewe body weight when joined at 19 months and immediately post joining, body weight at the subsequent lambing was increased, and ewe productivity and progeny performance were unaffected. Ewe genotype significantly influenced litter size and the number of lambs reared per ewe joined but had no effect on progeny performance. The probability of rearing at least one lamb (PR1L) is an indicator of overall efficiency. In the current study, whilst there was no relationship between ewe body weight when joined at 19 months and PR1L, there was a positive relationship between body weight at 7 months and PR1L at 2 years. It is concluded that joining replacements at 7 months does not have a negative impact on the performance of two-tooth ewes.

#### **Abstract**

The effects of first-joining age (7 or 19 months) and genotype on ewe performance when joined to lamb at 2 years, and the performance of their progeny, were evaluated using 424 ewes, representing 3 genotypes: Belclare (Bel), Suffolk × Belclare (Suf × Bel) and Suffolk-type (≥75% Suffolk ancestry (Suf75)). Ewes were managed in a grass-based system. Ewes first joined at 7 months were lighter ( $p < 0.01$ ) at 19 months and immediately post lambing; otherwise, age at first joining had no effects ( $p > 0.05$ ) on ewes or their progeny and there were no important interactions with genotype. Bel and Suf × Bel had larger litters ( $p < 0.001$ ) and reared more lambs per ewe joined ( $p < 0.01$ ) than Suf75. Ewe genotype had no effect ( $p > 0.05$ ) on proportion failing to lamb, incidence of lambing assistance, lamb mortality, ewe survival to 31 months, or progeny performance. Increasing the body weight of ewes at 7 months of age increased the probability ( $p < 0.02$ ) of rearing 1 or more lambs at 2 years and there was no interaction with genotype. It is concluded that age at first joining had no negative impact on the performance of ewes or their progeny.

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### **Toxoplasma gondii is not an important contributor to poor reproductive performance of primiparous ewes from southern Australia: a prospective cohort study**

Thomas Clune, Amy Lockwood, Serina Hancock, Andrew N. Thompson, Mieghan Bruce, Sue Beetson, Angus J. Campbell, Elsa Glanville, Daniel Brookes, Colin Trengove, Ryan O'Handley and Caroline Jacobson ([c.jacobson@murdoch.edu.au](mailto:c.jacobson@murdoch.edu.au))

BMC Veterinary Research, Volume 18 Article Number 109 (2022) 19 March 2022 **OPEN ACCESS**

DOI <https://doi.org/10.1186/s12917-022-03211-w>

#### **Abstract**

**Background.** *Toxoplasma gondii* causes reproductive losses in sheep worldwide, including Australia. The reproductive performance of primiparous ewes is typically lower than for mature, multiparous ewes, and younger ewes are more likely to be immunologically naïve and therefore more susceptible to reproductive disease if *T. gondii* infection occurs during pregnancy. The aim of this study was to assess the impact of infection with *T. gondii* on the reproductive performance of primiparous ewes in southern Australia using a prospective cohort study. This will inform the need for targeted control strategies for *T. gondii* in Australian sheep.

**Results.** *Toxoplasma gondii* seropositivity using indirect ELISA was detected at 16/28 farms located across southern Australia. Apparent seropositivity to *T. gondii* was lower in primiparous ewes (1.1, 95% confidence interval (CI) 0.6, 1.8) compared to mature, multiparous ewes (8.1, 95% CI 6.0, 10.5;  $P < 0.001$ ). *Toxoplasma gondii* seroconversion during the gestation and lambing period was confirmed for 11/1097 (1.0, 95% CI 0.5, 1.7) of pregnant primiparous ewes that failed to raise a lamb, and 1/161 (0.6, 95% CI 0.1, 2.9) primiparous ewes with confirmed mid-pregnancy abortion.

**Conclusions.** Low frequency of detection of *T. gondii* seroconversion during gestation and low frequency of seropositivity to *T. gondii* suggests that toxoplasmosis was not an important contributor to reproductive losses in primiparous ewes on farms located over a wide geographical area in southern Australia.

## Upcoming events

Date	Event	Location
4 April 2022	<a href="#">Optimising reproductive rates in pastoral sheep flocks</a> Western Local Lands Services	Oxley, NSW
5 April 2022	<a href="#">How to profit from pregnancy scanning</a> SRSP	Webinar
7 April 2022	<a href="#">Winning With Weaners</a> Sheep Connect NSW	Yass, NSW
8 April 2022	<a href="#">Optimising reproductive rates in pastoral sheep flocks</a> Western Local Lands Services	Brewarrina, NSW
8 April 2022	<a href="#">Winning With Weaners</a> Sheep Connect NSW	Forbes, NSW
27 April 2022	<a href="#">The importance of trace minerals for lamb growth</a> MLA Productivity & Profitability	Webinar
28 April 2022	<a href="#">Lamb Marking Expo</a> Western Local Lands Services	Balranald, NSW

## Funding calls

Program	Open	Close
<a href="#">Producer Demonstration Sites</a> Meat & Livestock Australia	1 April 2022	13 May 2022