

APRIL 2023

Sheep reproduction RD&A alert

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

The annual call for MLA's Producer Demonstration Site (PDS) program is now open and will close on **16 May 2023**. The PDS program gives livestock producers an opportunity to discover and implement new management practices that could improve business profitability, productivity and sustainability. The PDS program underpins MLA's RD&A programs by supporting groups of producers to demonstrate, adapt and validate the triple bottom line benefits of integrating new management practices, research and development outputs, and associated skills within the context of their own commercial production systems. The [Terms of Reference for the 2023/24 PDS open call](#) is available now!

Program coordinator

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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.

MLA Sheep and Goat Productivity Project Manager

MLA is currently seeking applications for the Project Manager – Sheep and Goat Productivity. This role involves identifying Research, Development & Adoption (RD&A) needs and opportunities to improve the profitability of on-farm lamb, sheepmeat and addressing those needs through the establishment, management and execution of appropriate RD&A.

You will liaise with key industry stakeholders and provide key support and linkage of the R&D programs to peak industry councils, government and research organisations, to ensure transparency and accountability against agreed program outcomes.

More information on this role can be found on the [MLA Careers website](#), Seek or LinkedIn.

Applications close on **Wednesday 10 May 2023**.

Scientific papers

Reproductive performance of triplet-bearing ewes on commercial farms and research priorities identified by sheep producers to improve the survival of triplet-bearing ewes and their lambs

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Animals, Volume 13(7) April 2024 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13071258>

Simple Summary

The proportion of ewes conceiving triplets is increasing on farms across Australia as sheep producers adopt more fecund genetics and ewe management practices to increase lamb output per ewe mated. The aims of this research were to consult producers to quantify rates of ewe and lamb mortality in this cohort and identify priorities for future research to reduce these losses. Surveys of producers with experience in managing triplet-bearing ewes indicated the average mortality of triplet-bearing ewes was 6.4%, and the survival of triplet-born lambs was 59%. There was significant variation in the actual targets adopted by different producers for ewe condition score at lambing, mob size during lambing and feed-on-offer at lambing, and no differences in the average rate of mortality of triplet-bearing ewes or lamb survival between producers that prioritised adoption of certain management practices. The highest priorities for further research identified by producers from surveys, workshops and a webinar were ewe condition score, mob size, feed-on-offer at lambing and mineral supplementation.

Abstract

Consultation with sheep producers was used to quantify the mortality of triplet-bearing ewes and their lambs, identify management practices adopted by producers to reduce these losses and prioritise future research needs to improve the survival of triplet-bearing ewes and their lambs. Surveys were completed by 64 producers across Australia who identified and separated triplet-bearing ewes from twin-bearing ewes in 2017 and/or 2018. On average, 5.9% of all ewes mated were identified as carrying triplets (6.6% of non-Merino ewes and 2.9% of Merino ewes). The average mortality of triplet-bearing ewes was 6.4%, and ewe mortality did not differ significantly between ewe breeds. The average survival of triplet-born lambs was 59%, and survival was significantly higher for lambs from non-Merino compared to Merino ewes (60.1 vs. 52.9%, $p < 0.05$). The key strategies adopted to reduce the mortality of triplet-bearing ewes and their lambs included management of condition score, feed-on-offer, mob size at lambing and use of shelter. There were no differences ($p > 0.05$) in the average mortality of triplet-bearing ewes or their lambs between producers that prioritised the adoption of certain management practices. However, significant variation existed between producers in their targets at lambing for ewe condition score (2.8 to 3.5), mob size (10 to 150 ewes) and feed-on-offer (800 to 2500 kg dry matter/ha). Overwhelmingly, the highest priorities for further research identified by producers from surveys, workshops and a webinar were ewe condition score, mob size, feed-on-offer at lambing and mineral supplementation. This study informs benchmarks for mortality of triplet-bearing ewes and their lambs under extensive grazing conditions in Australia, and the priorities for future research to reduce these losses.

MLA Project L.LSM.0013 *Managing fecund flocks to improve survival of triplet dams and their lambs*

Thermoregulatory, metabolic and stress responses to spring shearing of aged ewes born to undernourished mothers

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Journal of Thermal Biology, Volume 113, April 2023

DOI <https://doi.org/10.1016/j.jtherbio.2023.103503>

Abstract

Maternal undernutrition during gestation affects the behaviour, metabolism, and sensitivity to stressors of the offspring. Shearing is a stressor that triggers physiological and behavioural changes and augments the thermoregulatory demands in sheep. The aim of this study was to compare the thermoregulatory, metabolic, and behavioural responses to spring shearing of aged ewes born to mothers who grazed different pasture allowances during gestation. Nineteen non-gestating six-year-old Corriedale ewes born to mothers who

grazed two pasture allowances from 23 days before conception until 122 days of gestation were used. The pasture allowance offered to the mothers was high [HPA group; n = 11; 10–12 kg of dry matter (DM)/100 kg of body weight (BW)/day] or low [LPA group: n = 8; 5–8 kg of DM/100 kg of BW/day]. The adult offspring of both experimental groups were sheared during spring (Day 0), and remained outdoors, grazing natural grassland, and the behaviour, the surface temperature and the rectal temperature were recorded. Blood concentrations of albumin, total protein, glucose, and insulin were also determined. Data were compared with a mixed model. The LPA ewes had lower ear and nose maximum and minimum surface temperatures before shearing ($P < 0.05$). On Day 15, the average surface temperature of the vulva was lower in LPA than in HPA ewes ($P < 0.05$). After shearing, rumination frequency was greater in HPA than in LPA ewes ($P = 0.01$), and LPA ewes were observed more time standing up than HPA ewes ($P < 0.0001$). Insulin concentration tended to be greater in LPA than HPA ewes ($P = 0.06$). Maternal undernutrition during gestation modified the thermoregulatory responses and the acute behavioural changes after shearing in aged female offspring, whilst the metabolism was affected to a lesser degree. The long-term effects noticed in this study highlight the importance of providing proper nutrition to pregnant ewes.

Comparison of three maternal composite sheep breeds managed under pasture lambing and purebred or terminal mating systems: ewe body weight, reproductive efficiency, and longevity

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Journal of Animal Science, Volume 101 April 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1093/jas/skac418>

Abstract

Extensive sheep systems have lower inputs (e.g., feed, labor, infrastructure) but, generally, lower outputs per ewe than intensively managed flocks. Average ewe prolificacy is low (< 1.1 lambs per ewe) across the United States and traditional expectation is that costs required to support larger litters will not be recovered due to greater lamb mortality. The Composite-IV (C-IV) is a 50% Romanov, 25% Katahdin, and 25% White Dorper hair sheep developed and selected for enhanced reproductive efficiency at the U.S. Meat Animal Research Center. Objectives of the current study were to compare productivity of C-IV ewes ($N = 404$) to Katahdin ($N = 342$) and Polypay ($N = 390$), two popular maternal composite breeds, in a lower-input system. Experimental ewes were exposed to either rams of their own breed or Texel rams for the first time at 7 mo of age and remained in the same mating system for up to 4 yr. Ewes lambled on pasture from May to June and were expected to rear their lambs in the absence of supplemental feed and with minimal intervention. The ewe age \times breed interaction effect impacted all annually recorded traits ($P < 0.01$) including number and total weight of lamb marketed at 25 wk per ewe exposed to mating (LS25 and LW25, respectively). Within all ages, LS25 of C-IV was greater (1.2 to 1.63 lambs; $P < 0.01$) than Katahdin (0.71 to 1.17 lambs) and Polypay (0.68 to 1.26 lambs) which were similar. At 1, 2, and 3-yr of age, C-IV ewes had, on average, 12 to 17 kg greater LW25 ($P \leq 0.01$) than other breeds. Polypay LW25 was similar to Katahdin at 1 yr of age, but 8 to 13 kg greater ($P < 0.01$) at older ages. At 4 yr of age, LW25 was similar for C-IV and Polypay (63 and 62 kg, respectively). Overall, Texel mating improved LW25 by 3 kg compared to purebred mating ($P < 0.01$). Twin litters were most common within mature ewes (> 1 yr) of all breeds (52% to 65%); however, the proportion of triplet litters was numerically greater for C-IV (13%) than Katahdin (1%) or Polypay (4%). The frequency of mature ewes that gave birth to and reared twins (75% to 82%) was high for all breeds. Most triplet-bearing mature C-IV ewes reared twins (43%) though many reared triplets (39%). Ewe reproductive efficiency can be enhanced in lower-input systems by utilizing additive breed effects and heterosis in a complimentary crossbreeding program. More research is needed to identify indicator traits associated with lamb survival and to derive appropriate levels of prolificacy to fit specific management constraints.

Clustering climate and management practices to define environmental challenges affecting gastrointestinal parasitism in Katahdin sheep

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Journal of Animal Science Volume 101 April 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1093/jas/skad002>

Abstract

Gastrointestinal nematodes (GIN) negatively affect the performance and well-being of sheep. Due to anthelmintic resistance, GIN are difficult to control leading producers to choose breeds that can exhibit resistance to parasitism. An example is Katahdin sheep. Katahdins are raised in various climates and management systems in the United States. These environmental factors can be combined to form eco-management groupings or clusters. We hypothesized that GIN challenge varies predictably based on the characteristics of these environmental clusters. Forty Katahdin producers from across the United States were surveyed for management information, with body weights (BW), fecal egg counts (FEC), and FAMACHA scores (FAM) available from 17 of the 40 flocks. The performance data included 3,426 lambs evaluated around 90 d of age. Management and climate data were combined into clusters using multiple correspondence and principal component (PC) analysis. Performance data were aligned with their corresponding cluster. Depending on the trait, eco-management cluster, birth-rearing type, sex, and, as a covariate, dam age, were fitted as systematic effects with ANOVA. Clusters also were formed based on climate or management data alone. When compared with fitting the eco-management clusters, they defined less variation in each of the traits based on Akaike and Bayesian information criterion, and adjusted r^2 values. To further examine variation defined by eco-management clusters, residuals from an ANOVA model excluding eco-management cluster were retained, and their correlation with PC loadings calculated. All PC loadings were included as potential independent variables and tested for significance using backward stepwise regression. The PC loadings with a correlation $|\geq 0.49|$ explained significant variation in each trait and were included in the final models chosen; adjusted r^2 values for BW, FEC, and FAM were 0.90, 0.81, and 0.97, respectively. When analyzing GIN challenge, eco-management clusters corresponding with hotter temperatures and greater rainfall, and with pasture-born lambs, suffered greater parasitism. Conversely, the eco-management clusters with lambs turned out to pasture at older ages benefited from reduced parasitism. Through the formation of eco-management clusters, an environmental variable can be defined to study interactions of genotypes to their environment, providing a potentially useful tool for identifying parasite-resistant sheep.

Genetic and phenotypic relationships between ewe reproductive performance and wool and growth traits in Uruguayan Ultrafine Merino sheep

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Journal of Animal Science Volume 101 April 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1093/jas/skad071>

Abstract

This study reports genetic parameters for yearling and adult wool and growth traits, and ewe reproductive performance. Data were sourced from an Uruguayan Merino flock involved in a long-term selection program focused on reduced fiber diameter (FD), and increased clean fleece weight (CFW) and live weight (LW). Pedigree and performance data from approximately 5,700 mixed-sex yearling lambs and 2,000 mixed-age ewes born between 1999 and 2019 were analyzed. The number of records ranged from 1,267 to 5,738 for yearling traits, and from 1,931 to 7,079 for ewe productive and reproductive performance. Data on yearling

and adult wool traits, LW and body condition score (BCS), yearling eye muscle area (Y_EMA), and fat thickness (Y_FAT), and several reproduction traits were analyzed. The genetic relationships between FD and reproduction traits were not different from zero. Moderate unfavorable genetic correlations were found between adult CFW and ewe lifetime reproduction traits (-0.34 ± 0.08 and -0.33 ± 0.09 for the total number of lambs weaned and total lamb LW at weaning, respectively). There were moderate to strong positive genetic correlations between yearling LW and all reproduction traits other than ewe-rearing ability (-0.08 ± 0.11) and pregnancy rate (0.18 ± 0.08). The genetic correlations between Y_EMA and reproduction traits were positive and ranged from 0.15 to 0.49. Moderate unfavorable genetic correlations were observed between yearling FD and Y_FAT and between adult FD and BCS at mating (0.31 ± 0.12 and 0.23 ± 0.07 , respectively). The genetic correlations between adult fleece weight and ewe BCS at different stages of the cycle were negative, but generally not different from zero. This study shows that selection for reduced FD is unlikely to have any effect on reproduction traits. Selection for increased yearling LW and Y_EMA will improve ewe reproductive performance. On the other hand, selection for increased adult CFW will reduce ewe reproductive performance, whereas selection for reduced FD will negatively impact body fat levels. Although unfavorable genetic relationships between wool traits and both FAT and ewe reproductive performance existed, simultaneous improvements in the traits would occur using appropriately designed indexes.

How well does Australian animal welfare policy reflect scientific evidence: A case study approach based on lamb marking

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Animals, Volume 13, Issue 8, April 2023 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13081358>

Simple summary

Animal welfare policy regarding husbandry practices in sheep in Australia differs between states and territories. This dis-uniformity of the legislature can be confusing and limit the application of the law, particularly with growing pressure from the local and global community to improve animal welfare. The influence of scientific evidence contributing to the development of these policies is unclear. This article explores the Australian animal welfare legislature and the scientific evidence informing husbandry practices commonly performed at lamb marking.

Abstract

The development and substance of animal welfare policy is subject to a range of social, cultural, economic, and scientific influences that commonly vary within and between countries. Discrepancies in policy can create confusion and mistrust among stakeholders and consumers and limit the ability to create a uniform minimum level of requirements to safeguard animal welfare, as well as create a level 'playing field' for farmers when trading with other jurisdictions. The livestock sector is receiving growing scrutiny globally for real and perceived violations of animal welfare, for example, the practice of mulesing in Australia. This article explores animal welfare legislation within Australia and how it reflects the scientific evidence surrounding routine husbandry practices in sheep, including tail docking, castration, and mulesing. While there is some variation between state and territory legislation, the most notable concern is the lack of enforceable recommendations surrounding the evidence-based use of analgesia and anaesthesia for painful husbandry procedures. The age at which these procedures are recommended to be performed is relatively consistent across Australian jurisdictions, but there is a marked difference compared to international legislation. The global context of animal welfare legislation, public perception, and producer perception of these procedures

are also discussed, highlighting the difficulty of creating robust animal welfare legislation that promotes a good standard of welfare that is respected worldwide whilst being practical in an Australian setting given our unique geography and climatic conditions.

Effect of birth rank, and placentome subtype on expression of genes involved in placental nutrient transport in sheep

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Theriogenology, Volume 203, June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.theriogenology.2023.03.009>

Highlights

- Placental gene expression differs in response to birth rank, and placentome morphologic subtype in sheep.
- Maternal and fetal factors may influence placental function.
- Placental adaptations in response to birth rank may lead to improved placental efficiency to support fetal growth.

Abstract

Placental function is a key determinant of fetal growth and development that can be influenced by maternal and fetal environmental factors. The molecular mechanisms by which the placenta senses and responds to environmental cues are poorly understood. This exploratory study aimed to characterize the effect of birth rank (single vs. twin) and placentome morphologic subtype on expression of genes involved in nutrient transport, angiogenesis, immunity and stress response. Cotyledonary tissue was collected from type A, B and C placentomes from five single and six twin fetuses at 140 days of gestation. GLUT1 and GLUT3 were the most highly expressed genes consistent with the high demand for glucose to support fetal growth. Expression of BCKDH β and IGF-2 was 1.3- and 1.5-fold higher, respectively, and PCYT1A was 3-fold lower in singles compared to twins ($P < 0.05$) while no other differences in gene expression were observed between birth ranks. Expression of EAAT2 and LAT2 was higher while PCYT1A was lower in A compared to B type cotyledons. Expression of GUCY1B1/3 and IGF-1 was higher while CD98 and LAT2 were lower in type B compared to C cotyledons ($P < 0.05$). Compared to type C cotyledons, expression of EAAT2, IGF-1, IGF-2, LAT1 was higher, while TEK was lower in type A cotyledons. The effects of birth rank on placental gene expression in this study indicated that placental nutrient transport and/or function differs between single and twin pregnancies in sheep. Differences in gene expression between the placentome subtypes suggests that changes in placentome morphology are associated with shifts in amino acid transport and metabolism, oxidative stress and angiogenesis and/or blood flow. This study highlights that placental gene expression differs in response to birth rank and placentome morphologic subtype which suggests that both maternal and fetal factors may influence placental function in sheep. These associations provide insights into gene pathways for more targeted future investigations as well as potential adaptations to improve placental efficiency to support fetal growth in twin pregnancies.

Ram sperm cryopreservation disrupts metabolism of unsaturated fatty acids

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Theriogenology, Volume 204, July 2023

DOI <https://doi.org/10.1016/j.theriogenology.2023.03.023>

Abstract

In ram sperm, metabolites are important components of the plasma membrane, energy metabolism cycle, and precursors for other membrane lipids, and they may have important roles in maintaining plasma membrane integrity, energy metabolism, and regulation of cryotolerance. In this study, the ejaculates from 6 Dorper rams were pooled and sperm were systematically investigated by metabolomics at various steps of cryopreservation (37 °C, fresh [F]; from 37 to 4 °C, cooling [C]; and from 4 to -196 to 37 °C, frozen-thawed [FT]) to identify differential metabolites (DM). There were 310 metabolites identified, of which 86 were considered DMs. Regarding the DMs, there were 23 (0 up and 23 down), 25 (12 up and 13 down), and 38 (7 up and 31 down) identified during cooling (C vs F), freezing (FT vs C), and cryopreservation (FT vs F), respectively. Furthermore, some key polyunsaturated fatty acids (FAs), particularly, linoleic acid (LA), docosahexaenoic acid (DHA), and arachidonic acid (AA) were down-regulated during cooling and cryopreservation. Significant DMs were enriched in several metabolic pathways including biosynthesis of unsaturated FAs, LA metabolism, mammalian target of rapamycin (mTOR), forkhead box transcription factors (FoxO), adenosine monophosphate-activated protein kinase (AMPK), phosphatidylinositol 3-kinase/protein kinase B (PI3K-Akt) signaling pathways, regulation of lipolysis in adipocytes, and FA biosynthesis. This was apparently the first report to compare metabolomics profiles of ram sperm during cryopreservation and provided new knowledge to improve this process.

Upcoming events

Date	Event	Location
18 May 2023	Ewe management and feed planning workshop Agriculture Victoria	Navarre, Vic
1 June 2023	MerinoLink Conference 2023 MerinoLink	Bathurst, NSW
19 June 2023	BestWool/Best Lamb industry dinner and conference Agriculture Victoria	Bendigo, Vic

Funding calls

Program	Open	Close
2023/24 PDS Annual Call Meat & Livestock Australia	03 April 2023	16 May 2023