

JUNE 2023

Sheep reproduction RD&A alert

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

The Sheep Sustainability Framework has recently released its [Annual Report for 2023](#). Data on sheep industry progress against key sustainability proprieties across the Australian sheep industries domestic value chain are presented.

[MLA's Productivity & Profitability series](#) presents new and topical information to help southern sheep, beef and goat producers to increase the success of their businesses. The series, coordinated and co-funded by Agrista, will deliver webinars and podcasts from a diverse range of expert speakers to aid on-farm decision making. Content will be based on topical and seasonally relevant information, emerging research findings and attendee feedback.

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.

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Feature project update

Investigating animal health and diseases in Australian lamb feedlots

Background

Specialist lamb finishing systems (feedlots) are increasingly being utilised by Australian lamb producers to combat the seasonal fluctuations of nutrient supply in extensive pasture-based systems to facilitate high lamb growth rates following weaning. This strategy will improve overall production efficiency by meeting market specifications are younger ages, decrease total nutrient intake and optimal prioritisation of feed resources. However, dietary changes, transport and mixing of lambs of different age groups and origins can exacerbate weaning related stress and potentially impact animal health.

Aim

To quantify the incidence of disease in Australian lamb feedlots.

Project objectives

- Conduct a literature review to determine the most significant health concerns in feedlots and establish gaps in the literature,
- Conduct prospective cohort monitoring to determine the incidence of health conditions within feedlots and to determine risk factors associated with these conditions, and
- Develop an appropriate resource to aid producers in managing health issues in Australian feedlot systems.

Key findings

Acidosis, urolithiasis, pulpy kidney, salmonella and pneumonia were the animal health issues with the highest incidence. Time of year and space allocation (m²/weaner) were identified as key risk factors. Antibiotic usage was not common practice; however, multidrug antibiotic resistance was found within one pneumonic lung sample which highlights the need for further research into more effective preventive measures for bacterial infections. Booster vaccinations on entry onto the property and 4-6 weeks later is recommended when producers have bought in lambs with unknown vaccination status.

For more information on the animal health and diseases in Australian feedlots project contact Dr Shawn McGrath (shmcgrath@csu.edu.au).

Scientific papers

Climatic seasons and time of the day influence thermoregulation and testicular hemodynamics in Santa Inês rams raised under humid tropical conditions

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Journal of Thermal Biology, Volume 114, May 2023

DOI <https://doi.org/10.1016/j.jtherbio.2023.103546>

Abstract

This study evaluated the possible association between the diurnal variations of climatic factors during the rainy (RS) or less rainy (LS) seasons on the testicular hemodynamics and thermoregulatory responses of hair sheep rams raised in a humid tropical climate. Santa Inês rams (n = 6) underwent evaluation of general and testicular physiological parameters (heart and respiratory rates, internal and scrotal temperatures, internal-scrotal temperature gradient, scrotal distention, and color Doppler ultrasound evaluation of the spermatic cords and spectral analyses of testicular arteries) over six consecutive weeks per season at three separate times daily (morning = 8:00 a.m., noon = 12:00 p.m., and afternoon = 5:00 p.m.) during the RS and LS. Climatic air temperature and relative humidity data were recorded, and the temperature and humidity index (THI) was calculated. Higher thermal challenge was observed in LS relative to RS (air temperature = 28.0 vs. 30.9 °C; relative humidity = 84.1 vs. 69.9%; THI = 80.0 vs. 82.5; P < 0.05). In both seasons, respiratory rate and internal temperature were normal, demonstrating the animals' adaptability. In RS, however, a higher scrotal temperature was recorded in relation to LS (35.0 vs. 34.7 °C; P < 0.05), with a gradual increase from morning to afternoon. Lower resistivity (0.40 vs. 0.64; P < 0.05) and pulsatility (0.55 vs. 1.14; P < 0.05) indices, and a higher rate of high-velocity blood flow of testicular arteries (71.1 vs. 60.6%; P < 0.05) were observed in RS compared to LS. The lowest correlations between testicular hemodynamic, physiological variables, and environmental parameters (P < 0.05) were observed in the morning. In conclusion, testicular thermoregulation and testicular hemodynamics were influenced by the climatic seasons and time of the day, being more efficient in the LS season and with less interference from environmental factors in the morning.

Predicting feed efficiency traits in growing lambs from their ruminal microbiota

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animal, Volume 17(6), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.animal.2023.100824>

Highlights

- The rumen microbiota was assessed to predict lamb feed efficiency and production.
- Accounting for the environment is essential to predict from the rumen microbiota.
- The rumen microbiota predicts feed intake better than feed efficiency.
- Selecting for feed efficiency did not shape the rumen microbiota.
- The rumen microbiota is not the best proxy of meat sheep feed efficiency.

Abstract

Selecting feed-efficient sheep could improve the sustainability of this livestock production. However, most sheep breeding companies cannot afford to record feed intake to select feed-efficient animals. Past studies underlined the potential of omics data, including microbiota metabarcoding data, as proxies for feed efficiency. The study involved 277 Romane lambs from two lines divergently selected for residual feed intake (RFI). There were two objectives: check the consequences of selecting for feed efficiency over the rumen microbiota, and assess the predictive ability of the rumen microbiota for host traits. The study assessed two contrasting diets (concentrate diet and mixed diet) and two microbial groups (prokaryotes and eukaryotes). Discriminant analyses did not highlight any significant effect of sheep selection for residual feed intake on the rumen microbiota composition. Indeed, prokaryotic and eukaryotic microbiota compositions poorly discriminated the RFI lines, with averaged balanced error rates ranging from 45% to 55%. Correlations between host traits (feed efficiency and production traits) and their predictions from microbiota data varied between -0.07 and 0.56 , depending on the trait, diet and sequencing. Feed intake was the most accurately predicted trait. However, predictions from fixed effects and BW were more accurate than or as accurate as predictions from the microbiota. Environmental effects can greatly affect the variability of microbiota compositions. Considering batch and environmental effects should be paramount when the predictive ability of the microbiota is assessed. This study argues why metabarcoding the rumen microbiota is not the best way to predict meat sheep production traits: fixed effects and BW were more cost-effective proxies and they led to similar or better predictive accuracies than microbiota metabarcoding (16S and 18S sequencing).

PhenoBR: a model to phenotype body condition dynamics in meat sheep

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animal, Volume 17(6), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1016/j.animal.2023.100845>

Highlights

- Body energy reserves are the main source of energy in ruminants facing negative energy balance.
- In situations of negative energy balances, the flexibility of ewes' body reserves is of major importance in the current context of breeding for resilience.
- PhenoBR is a model to quantify the body condition score flexibility at individual level.
- PhenoBR contributes to better adapting feeding systems to the individual characteristics of animal.
- PhenoBR helps geneticists to develop animal breeding programmes for more resilient animals by including body reserve dynamics.

Abstract

In situations of negative energy balance (NEB) due to feed scarcity or high physiological demands, body energy reserves (BRs), mainly stored in adipose tissues, become the main sources of energy for ruminants. The capacity to mobilise and restore such BRs in response to different challenges is of major concern in the current context of breeding for resilience. Body condition score (BCS) is a common, practical indicator of BR variations throughout successive productive cycles, and quantitative tools for characterising such dynamics at the individual level are still lacking. The main objective of this work was to characterise body condition

dynamics in terms of BR mobilisation and accretion capacities of meat sheep during their productive lifespan through a modelling approach, using BCS measurements. The animal model used in this work was the reproductive meat ewe ($n = 1\,478$) reared in extensive rangeland. Regular measurements of BCS for each productive cycle were used as the indicator of BR variations. A hybrid mathematical model and a web interface, called PhenoBR, were developed to characterise ewes' BCS variations through four synthetic and biologically meaningful parameters for each productive cycle i : BR accretion rate (k'_b), BR mobilisation rate (k'_p), plus the time of onset and the duration of the BR mobilisation t'_b , and ΔT^i , respectively. The model PhenoBR converged for all the ewes included in the analysis. Estimation of the parameters indicated the inter-individual variability for BR accretion and mobilisation rates, and the length of the mobilisation period. The present study is a proof of concept that the combination of data-driven and concept-driven models is required for the estimation of biologically meaningful parameters that describe body reserve dynamics through consecutive productive cycles. Individual characterisation of animals by these parameters makes it possible to rank them for their efficiency in the use of body reserves when facing NEB challenges. Such parameters could contribute to better management and decision-making by farmers and advisors, e.g. by adapting feeding systems to the individual characteristics of BR dynamics, or by geneticists as criteria to develop future animal breeding programmes including BR dynamics for more robust and resilient animals.

Reproduction of sheep through nuclear transfer of somatic cells: A bibliometric approach

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Animals, Volume 13(11), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13111839>

Simple Summary

Different reproductive biotechnologies have been applied to sheep, such as cloning, which has been successfully applied in this species. In this context, the aim of the present study was to carry out a bibliometric analysis of the scientific literature on cloning applied to sheep reproduction, since the first report was published, to identify the most cited articles, main authors and collaboration among them, published journals, institutions with more published papers, most prolific countries and the network collaboration among them, and research topics. This study collected bibliographic data from 124 papers relating to cloning of sheep. The articles that were cited more often addressed topics related to the generation of transgenic animals, recovery of wild species, and xenotransplants. So far, no bibliometric studies have been conducted about cloning of sheep.

Abstract

Somatic cell nuclear transfer (SCNT) is a reproductive biotechnology with great potential in the reproduction of different species of zootechnical interest, including sheep. This study aimed to carry out a bibliometric analysis of scientific papers published on the application of SCNT in sheep reproduction during the period 1997–2023. The search involved the Science Citation Index Expanded and Social Sciences Citation Index databases of the main collection of the Web of Sciences with different descriptors. A total of 124 scientific papers were analyzed for different bibliometric indicators using the VOSviewer software. Since 2001, the number of SCNT-related papers that have been published concerning sheep reproduction has increased and it has fluctuated in ensuing years. The main authors, research groups, institutions, countries, papers, and journals with the highest number of papers related to the application of SCNT in sheep reproduction were identified, as well as the topics that address the research papers according to the terms: somatic cell, embryo, oocyte, gene expression, SCNT, and sheep.

Decreasing mob size at lambing increases the survival of triplet lambs born on farms across southern Australia

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animals, Volume 13(12), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13121936>

Simple Summary

Consultation with sheep producers in Australia revealed that understanding the impact of the number of triplet-bearing ewes in a paddock at lambing, known as the mob size, on the survival of their lambs was an important research priority. Previous research has demonstrated that smaller mob sizes at lambing improve the survival of single- and especially twin-born lambs. Therefore, we expected that lambing triplet-bearing ewes in smaller mobs would increase the survival of their lambs. Research was conducted on 12 commercial sheep farms across southern Australia between 2019 and 2021, with three farms used in two years of the experiment. Adult, triplet-bearing ewes were randomly allocated into one of two treatments, 'High' or 'Low' mob size, at about 15 days before the start of lambing. We found that lamb survival was significantly greater for lambs born in the Low compared with the High mob size treatments. Analysis of the effect of the actual mob sizes showed that reducing mob size at lambing by 10 triplet-bearing ewes increased the survival of their lambs by 1.5%. Lambing triplet-bearing ewes in smaller mobs will therefore be included in management guidelines for producers as a strategy to improve the survival of triplet-born lambs.

Abstract

Industry consultation in Australia revealed that the potential impact of the mob size of ewes during lambing on the survival of triplet-born lambs was an important research priority. Previous research has demonstrated that smaller mob sizes at lambing improve the survival of single- and especially twin-born lambs, regardless of ewe stocking rate. Therefore, we hypothesised that lambing triplet-bearing ewes in smaller mobs, regardless of stocking rate, will increase the survival of their lambs. Research sites were established on 12 commercial sheep farms across southern Australia between 2019 and 2021. One farm used Merinos whilst the remainder of the farms used non-Merino breeds, consisting of composite ewes joined to composite or terminal sires. Three of the farms were used in two years of the experiment. Adult, triplet-bearing ewes were randomly allocated into one of two treatments, 'High' or 'Low' mob size, at an average of 135 days from the start of joining. Ewe and lamb survival were assessed between allocation to treatments and lamb marking. Lamb survival was significantly greater for lambs born in the Low (65.6%) compared with the High (56.6%) mob size treatments ($p < 0.001$). There was no effect of mob size at lambing on the mortality of triplet-bearing ewes. Analysis of the effect of the actual mob sizes showed that reducing the mob size at lambing by 10 triplet-bearing ewes increased the survival of their lambs to marking by 1.5% ($p < 0.001$). This study has shown that the survival of triplet-born lambs can be improved by lambing triplet-bearing ewes in smaller mobs regardless of stocking rate when ranging from 0.7–13 ewes/ha.

Determining the effects of pelleted cranberry vine grains on the ewe and offspring during pregnancy and lactation

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animals, Volume 13(12), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13121989>

Simple Summary

Parasitic infections are a significant problem in the sheep and goat industries worldwide. This issue is compounded by parasites becoming resistant to commercially available dewormers. Currently, the efficacy of tannins and other plant secondary compounds is being evaluated as natural dewormers in sheep and goats. The main objective of this study was to determine if cranberry vine was safe to feed pregnant and lactating ewes. The results of this study indicate that there were minimal effects on the growth and health of the ewe and her offspring from the consumption of a 50% cranberry vine pellet during late gestation and lactation.

Abstract

When creating any new anti-parasitic interventions, it is important to evaluate their effects across all life stages. This study had three objectives, which were to evaluate the effect of feeding cranberry vine pellet (CVP) on (1) ewes' body weights and BCS during late gestation and lactation; (2) ewes' milk quality during lactation; and (3) lambs' body weight and growth parameters from birth to 65 days of age. Across two years, 41 Dorset ewes were fed either a 50% CVP or a matching control pellet (CON) from 104 ± 1.60 days of gestation for 62.8 ± 0.68 days of lactation. Measurements were collected from ewes (BW, BCS, and milk) and lambs (BW and body size). Milk from CVP ewes exhibited reduced milk fat and solids ($p < 0.01$) and increased concentrations of milk urea nitrogen ($p = 0.02$) when evaluated for the treatment–time. There was no significant difference in the BCS, protein, lamb BW, or growth measurements for treatment–time ($p \geq 0.05$). Additional research that targets blood biochemistry and metabolic assessments is needed to fully determine the impact of this pellet on ewes and lambs.

Ensiling sorghum with urea, aerobic exposure and effects on intake, digestibility, ingestive behaviour and blood parameters of feedlot lambs

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animals, Volume 13(12), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.3390/ani13122005>

Simple Summary

Urea, due to its fungicidal effect, when used as a chemical additive in sorghum ensilage improves the aerobic stability of the silage, minimising material losses after opening and exposure to oxygen. Thus, sorghum silage, as a source of roughage, when treated with up to 2% urea based on natural matter, can be used in the feeding of beef sheep in the growth phase, without harming the productive performance of the animals. We also hypothesised that sorghum silages treated with urea, given the potential of this additive, present greater aerobic stability compared to sorghum silages that were not subjected to chemical treatment during ensiling. In this way, it is possible to maintain them for a longer period exposed to oxygen, so that there is little impairment of ingestion, performance and nutritional value of this silage until consumption.

Abstract

This study was carried out to evaluate the effect of ensiling sorghum silage with urea and amending the aerobic exposure nutrients intake and apparent digestibility, ingestive behaviour and blood serum metabolites of feedlot lambs. Forty uncastrated crossbred Dorper \times Santa Inês lambs, aged 150 ± 15 days and with an initial body weight of 21.73 ± 2.40 kg, were used. Animals were assigned in a 2×3 factorial arrangement. Thus, six silage diets were produced with various urea addition levels (UA: 0 and 5 g/kg on a natural matter basis) and periods of aerobic exposure of silages (PAE: 0, 24 and 48 h). An effect was observed for nutrient intakes of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fibre

corrected for ash and protein (NDFap) and total digestive nutrients TDN (g/day) and for the total apparent digestibility of DM, OM and CP. There was an interaction effect between urea levels and aerobic exposure for ether extract (EE) and NDFap intakes (g/kg) and nonfibrous carbohydrate (NFC) digestibility (g/kg) ($p = 0.012$). The addition of 5 g/kg of urea to sorghum ensilage improved the digestibility parameters without changing dry matter intake and ingestive behaviour. The addition or not of urea does not change the blood parameters of the animals.

Longitudinal assessment of the impact of aging on wastage, productivity and welfare of ewes

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Australian Veterinary Journal, Volume 101(6), June 2023 **OPEN ACCESS**

DOI <https://doi.org/10.1111/avj.13240>

Abstract

Retention of aging ewes is a strategy producers may use to maintain or increase flock size. Older ewes can have a higher risk of mortality and health issues, but these may be minimised with early intervention and culling. This retrospective study examined the incidence and causes of mortality and culling in a flock of Merino ewes as they aged from 4.5 to 5.5 until 9.5 to 10.5 years. The annual rate of ewe mortality ranged from 6.2% to 9.9%, with lambing complications being the major source of reported loss. Annual culling rates ranged from 1.6% to 42.8%, the larger rates reflecting opportunistic replacement with younger ewes rather than essential culling to maintain welfare and productivity. The major reasons for culling were low condition score, worn or missing teeth or faulty udders. The incidence of other faults was low. Only 18.3% of ewes remained when aged 9.5–10.5 years and these were fertile (89% pregnant) with a high proportion of multiple fetuses (52%) in their final year, although fleece weight had declined. Younger ewes born in 2004/2005 tended to have lower annual mortality rates than the aged ewes, but 8%–12% were still culled annually. It is concluded that an annual inspection pre-joining of all ewes and preventative culling for health issues is necessary to minimise any increase in mortality and risk to ewe welfare from retaining aging ewes. More frequent inspection will be required as potential health issues develop during the year, as these may not be evident pre-joining.

Pulse wave Doppler ultrasound of umbilical cord in experimentally induced pregnancy toxemia in sheep

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Research in Veterinary Science, Volume 160, July 2023

DOI <https://doi.org/10.1016/j.rvsc.2023.05.004>

Abstract

Contrary to its widespread use in human cases, the use of Doppler ultrasonography is only recently becoming prevalent in farm animals. This study aimed to determine the effects of maternal metabolic and clinical changes on fetal hemodynamics during pregnancy toxemia with the doppler examination of umbilical cord. In the study twenty ewes with a single healthy fetus were included in the study. At the end of the 120th day of pregnancy, 20 single-bearing pregnant ewes were randomly categorized into two groups. Ewes in the control group were fed to meet all nutritional requirements. On the other contrary, the experimental ewes were fed to meet equivalent to 50 % of the daily needs and then fasted for 96 h. Doppler ultrasonographic examinations of umbilical cord were performed once every two days and once a day during fasting. Beta hydroxybutyric acid (BHBA) concentration was measured by taking blood from sheep on examination days.

Pulse systolic velocity (PSV), end diastolic velocity (EDV), PSV/EDV, pulsatility index (PI), resistance index (RI), and fetal heart rate (FHR) as well as BHBA values and how those parameters has changed over time (time by treatment effect) due to energy deprivation during pregnancy were evaluated using repeated measure analysis of variance. No clinical signs were observed in both toxemia and control groups during restricted feeding. BHBA concentration increased and there was a significant time, time by treatment and main effect of treatment effect between groups. No significant main effect of treatment and time by treatment interaction was observed in the changes of PI, RI, FHR, and systolic/diastolic velocity values over time in both groups. FHR was reduced over time, and there was a significant time effect in FHR in both groups. Although doppler indices didn't increase, both PSV and EDV values increased significantly in the pregnancy toxemia group compared with the controls (Time $P = 0.03$, time by treatment interaction $P < 0.05$) and the main effect of treatment $P < 0.05$). The marked increase in blood velocities (PSV and EDV) in the umbilical cord is probably due to the compensatory functioning for excessive energy deprivation of the fetus. Therefore, PSV and EDV might be a valuable indicator for evaluating the fetus's health status during the management of the PT.

Intravaginal progesterone device reinsertion during the early luteal phase affects luteal function and embryo yield in superovulated ewes

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Animal Reproduction Science, Volume 254, July 2023

DOI <https://doi.org/10.1016/j.anireprosci.2023.107273>

Abstract

This study checked the efficacy of progesterone (P4) device reinsertion during the early luteal phase on luteal function and embryo yield in superovulated crossbred ewes. Twenty multiparous ewes received an intravaginal P4 device for nine days (D0 to D9) followed by six decreasing doses (25, 25, 15, 15, 10, 10%) of 133 mg pFSH i.m. at 12 h intervals, starting 60 h before P4 device removal. Ewes were naturally mated at 12 h intervals while in estrus. On D13, ewes with viable corpora lutea (CL; $n = 19$) were equally allocated for receiving their P4 device reinsertion (G-P4; $n = 10$) or not (G-Control; $n = 9$). On D17, the P4 device was removed, and all females received the cervical relaxation protocol 16 h to 20 min before non-surgical embryo recovery. CL count and their functionality classification were performed on D13 and D17 by transrectal B-mode and color Doppler ultrasonography (US). Plasma P4 concentrations (ng/mL) of G-P4 ewes increased ($P < 0.05$) over the days, being greater on D17 (9.2 ± 2.8) than on D9 (1.9 ± 0.7) and D13 (1.6 ± 0.4). The overall CL count per ewe tended to be greater ($P = 0.09$) in G-P4 compared with G-Control. The occurrence of premature regression of corpora lutea did not differ ($P > 0.05$) between G-P4 (30.0%) and G-Control (44.4%). The number of ova/embryos recovered was greater ($P < 0.05$) in G-P4 (11.6 ± 2.9) compared with G-Control (3.7 ± 2.0), respectively. Altogether, the reinsertion of the P4 device for four days after superovulation in ewes promotes greater P4 concentrations, resulting in greater ova/embryos recovered.

Upcoming events

Date	Event	Location
4 July 2023	RAMing Up Repro Sheep Connect SA	Tintinara, SA
17 July 2023	Gippsland Farm Fit Ewes workshop Agriculture Victoria & neXtgen Agri	Toongabbie, Vic

18 July 2023	Gippsland Farm Fit Ewes workshop Agriculture Victoria & neXtgen Agri	Walpa, Vic
26 July 2023	Animal Breeding at the Crossroads Association for the Advancement of Animal Breeding and Genetics (AAABG)	Crawley, WA
6 August 2023	Sheepvention Rural Expo Hamilton Pastoral & Agricultural Society Inc.	Hamilton, Vic
10 August 2023	Meat Up Forum Meat & Livestock Australia	Cowra, NSW