

Sheep reproduction RD&A alert

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

An exciting month for the SRSP as our first project from the 2020 Project call has now been contracted. *Investigating heat stress in ewes – reproductive performance* will quantify the effects of heat events on sheep reproduction, thermoregulatory capacity, behaviour, and wellbeing through long term data collection during a range of climatic conditions in diverse production settings. The University of Western Australia is the lead agency for this project with collaborators from Murdoch University, CSIRO, the University of Sydney and the NSW Department of Primary Industries.

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

Dr Sue Hatcher

M: 0407 006 454

E: sue@makinoutcomes.com.au

Scientific papers

Behavioural reactivity of two lines of South African Merino sheep divergently selected for reproductive potential

Maud Bonato (mbonato@sun.ac.za), Jasper Cloete, Anna Kruger and Schalk Cloete

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Highlights

- Behavioural reactivity of two lines of Merino sheep was investigated in docility and scale tests.
- No line differences were observed in the success of the docility test and the scoring in the scale test.
- Low-line sheep were contained for longer and bleated more in the docility test than High-line sheep.
- Rams were less stressed in both tests than ewes (lower number of bleats and urinations/defecations).

Abstract

The behavioural reactivity of two divergently selected lines of South African Merino sheep for an increased (HL: N = 1187) and reduced (LL: N = 285) number of lambs weaned per ewe mated was investigated using a docility test and a 'scale' test. The objective of this study was to determine whether these two lines, which differed significantly in terms of reproduction performance, would also react differently when exposed to

novel and challenging situations. In the first test, an individual animal was moved to the test pen by an experienced handler then an unfamiliar or familiar human entered the test pen and tried to encourage the animal to move into a marked area for 3 min. The test was terminated if the animal could not be moved within 3 min, came out of the marked area or if the animal could be contained in the marked area for 30 s (successful test). The latency of the animal to enter and time contained in the square area was recorded as well as whether the animal was bleating or urinating/defecating during the test. No difference was found between production lines and handler in terms of the success of the test and latency to enter ($P > 0.05$). LL sheep were however contained for longer and bleated more than HL sheep ($P < 0.05$). Sex differences were also observed, with ewes being more difficult to successfully contain and bleating more than rams, especially when exposed to an unfamiliar human ($P < 0.05$). They also tended to urinate/defecate more than rams ($P < 0.05$). In the second test, behaviour response of animals was recorded using a 5-points score system (1 = calm; 5 = wild) while spending 30 s on a scale. We also recorded whether animals were bleating during the test. While there was no difference in average scores between selection lines ($P > 0.05$), inter-observer variability was observed ($P < 0.05$). Ewes were also observed to bleat more than rams ($P < 0.05$). Further research is needed to determine whether these and other behavioural tests are related to traits of economic importance in sheep.

Consistent behavioural responses to heatwaves provide body condition benefits in rangeland sheep

Stephen Leu (stephen.leu@adelaide.edu.au), Katrin Quiring, Keith Leggett and Simon Griffith

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Highlights

- We provide insight into the behavioural strategies of an arid zone ungulate to cope with challenging ambient conditions.
- These ambient conditions are likely to become more prevalent with climate change.
- Individuals were consistent in their shade use behaviour between heatwaves.
- Shade use affected body condition, which has known flow-on effects on reproductive success.

Abstract

Species are increasingly confronted with extreme climatic conditions such as heatwaves. Behavioural changes are an important response to changed environmental conditions. We investigated how free-ranging sheep (*Ovis aries*) in large rangeland paddocks respond to heatwave conditions in the arid zone of Australia. We defined heatwaves as a three-day period with each day's maximum temperature exceeding 40 °C, and its minimum temperature remaining above 25 °C. Hence, the daily maximal temperature exceeded the upper limit of the thermal neutral zone in sheep. We equipped 48 sheep with GPS collars and combined the detailed locational data with georeferenced maps of water locations and tree areas, representing shade. We measured shade use as time spent within areas with trees. We show that individuals were consistent in their shade use behaviour between two separate heatwaves, while there was variation among individuals. Furthermore, shade use was positively related with body condition change between the start and the end of the study. In sheep body condition affects reproductive success, which suggests that shade use behaviour may have flow-on effects on reproductive benefits. We also compared shade use, water use and movement activity between the two heatwaves and two periods of typical ambient conditions. During heatwaves sheep

spent on average 14.7 times longer in the shade during the midday interval and 2.0 times longer before dusk than during typical periods. Time spent near the water was high during the midday interval but did not differ between conditions, although, it was greater after dawn and before dusk during heatwaves. Such behavioural changes would assist in avoiding hyperthermia and dehydration. Sheep moved half the distance (which would include grazing) during the midday interval, which they seemed to offset to some extent through increased movement activity before and after dawn and dusk. Our study indicates that shade, and water use behaviours during hot ambient conditions upscale from small yards to large paddocks. Furthermore, it provides deep insight into the behavioural strategies that will allow a free-ranging arid zone ungulate to cope with the challenging ambient conditions that will become more prevalent with a changing climate.

Duration of phase II of labour negatively effects maternal behaviour and lamb viability in wool-type primiparous ewes under extensive rearing

Mariel Regueiro (marielregueiro@gmail.com), Carlos Lopez-Mazz, Ezequiel Jorge-Smeding, Fernando Baldi and Georget Banchemo

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Highlights

- Lamb mortality around parturition is a constrained event yet to be decreased.
- Extended labour phase II negatively influences maternal behaviour in primiparous ewes.
- Maternal poor behaviour avoid lambs suckling and increase desertion and mortality.
- Birth control of primiparous ewes becomes highly relevant to prevent lamb mortality.

Abstract

This study determined to what extent the duration of labour phase II under extensive rearing would affect lamb viability and maternal behaviour in primiparous (P) single-bearing Corriedale ewes ($n = 63$). Multiparous (M) ewes ($n = 116$) were used as control category, reared under the same conditions. Duration of labour was divided in 4 time-groups, G1: ≤ 30 min; G2: 31–60 min; G3: 61–90 min and G4: ≥ 90 min for each ewe category. Body condition score (BCS, scale 0–5), duration of labour, delivery assistance, maternal behaviour score (MBS, 1–5) and presence of grooming after parturition were recorded and length of gestation calculated. Lambs were Apgar tested (score 1–10) at birth; time elapsed to stand and successful suckling during the first two hours of birth was recorded as well as birthweight (BW) and mortality during their first 72 h. Prepartum BCS was similar between categories, while P ewes showed shorter gestation (147.2 ± 0.3 vs. 148.0 ± 0.2 days, $P = 0.0474$), longer expulsion phase (50.5 ± 4.2 vs. 32.2 ± 2.6 min, $P < 0.0001$) and required more delivery assistance (22.2 % vs. 11.2 %, $P = 0.0496$) than M ewes, with the highest percentage of assisted labours registered in G4 for both categories. Lambs born from P ewes were lighter than M-born lambs (5.3 ± 0.1 vs. 5.8 ± 0.1 kg, $P < 0.0001$) and BW and duration of labour had a significant correlation within each category. Apgar was similar between categories but among P ewes was lower when duration of labour was longer. Extended labour in P ewes had a negative influence on the percentage of lambs that sucked within 2 h of birth (G1 = 95.5 %, G2 = 91.3 %, G3 = 75 % and G4 = 30 %), but not in lambs born to M ewes. Between categories MBS was different (3.6 ± 0.2 vs. 4.7 ± 0.1 for P and M respectively) being lower in P ewes of G3 (2.9 ± 0.3) and G4 (1.3 ± 0.2). Grooming was observed in 100 % of M ewes but not in 20.6 % of P ewes. Lamb mortality was greater in P than in M ewes (12.7 % vs 1.7 %) with 75 % of the deaths registered within lambs born to primiparous when duration of labour was longer. It is concluded that in conditions of extensive

breeding extended labour has a negative influence on lamb survival as well as on maternal behaviour in primiparous ewes. Birth control and perhaps a higher degree of assistance during phase II of parturition in primiparous becomes relevant to prevent ewe desertion and lamb mortality.

The role of reproductive loss on flock performance: a comparison of nine industry flocks

Paul Shorten (paul.shorten@agresearch.co.nz), Sara Edwards and Jenny Juengel

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Abstract

The reproductive performance of a sheep flock is dependent on a multitude of complex interacting factors. Attaining optimal flock performance requires information about how the reproductive steps are linked and relate to readily available measurements of the state of the flock. The goal was to use data from nine commercial flocks (greater than 300,000 records) to investigate and model the key reproductive steps affecting flock reproductive performance. We also developed a maximum-likelihood based methodology to predict flock ovulation rate based on measurements of the number of fetuses at mid-pregnancy (detected by ultrasound-scanning). The model was used to determine how changes in pre-mating liveweight, age, predicted ovulation rate, number of fetuses at mid-pregnancy, lamb survival and lamb growth rate affect the total lamb liveweight at weaning per ewe exposed to the ram in each flock. The data from the commercial flocks were also used to investigate the role of ewe age and pre-mating liveweight on each reproductive step. Sensitivity analyses were conducted to identify the key reproductive steps affecting flock reproductive performance with a focus on understanding how these steps vary between flocks. The elasticity for embryo survival was 60% of that for lamb survival for these flocks and the elasticities for ovulation rate were highly variable between flocks (0.16 to 0.50 for mature ewes). This indicated that ovulation rate was near-optimal for some flocks, whereas there was potential to significantly improve flock reproductive performance in suboptimal flocks. The elasticity for ewe pre-mating liveweight was highly variable between flocks (-0.03 to 0.84 for mature ewes and -0.18 to 1.39 for ewe lambs) indicating that pre-mating liveweight ranged from optimal to suboptimal between flocks. For these suboptimal farms, the opportunity exists to increase flock performance through improved management of ewe pre-mating liveweight. Reproductive loss was significantly greater in ewe lambs than mature ewes, although the difference is dependent on the stage of reproduction and the flock. Predicted ovulation rate was 25% lower for ewe lambs and there was a 30% relative decrease in the predicted embryo survival probability from ovulation to scanning for ewe lambs. There was a 10% relative decrease in lamb survival probability from birth to weaning for ewe lambs and lamb growth rate was 25% lower for ewe lambs.

The genetics of perinatal behaviour of Merinos in relation to lamb survival and lambs weaned per ewe mated

Schalk Cloete (schalkc2@sun.ac.za), Marelee Burger, Anna Scholtz, Jasper Cloete, Cornelius Nel, Arthur Gilmour and Japie van Wyk

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Highlights

- Data for ewes and lambs in a resource population divergently selected for reproduction (H and L lines) were analysed.
- H line lambs had an improved survival compared to their L line contemporaries, while H line ewes weaned more lambs per mating.
- Behavioural traits were more heritable at the direct and maternal levels in lambs and the direct level in ewes.
- Lamb survival and weaning rate were favourably genetically correlated to behaviour, an observation backed by genetic trends.
- Selection for weaning rate improved ewe and lamb behaviour based on genetic trends and correlations, thus benefitting welfare.

Abstract

Data for birth weight (BW), lamb survival (LS) and neonatal behaviour, including records of between 1494 (latency of birth to first suckling or LBS) and 2705 (BW and LS) lambs were used. Additionally to the lamb data, ewe data comprising of between 1003 ewe-year records for the latency of stay on the birth site (SBS) and 2024 ewe-year records for number of lambs weaned per ewe mated (NLW) were analysed. These records were from selection lines that had been divergently selected from the same base population since 1986, either for NLW (termed the High or H line) or against NLW (termed the Low or L line). Overall, H line lambs had an improved LS compared to their L line contemporaries, while H line ewes were superior to L line ewes for NLW. Latency of parturition of H line progeny was shorter than in L line progeny while ewe lambs had shorter births than ram lambs. Lamb sex and selection line had no effect on the latency from birth to suckling, which decreased as dam age increased. The second of multiples took longest to progress to suckling from birth, with singles being the quickest. H line ewes had shorter parturitions and cooperated better with the first suckling attempts of their offspring. Single-trait direct heritability estimates (h^2) in lambs were 0.15 for BW, 0.07 for LS, 0.06 for latency of parturition (LP) and 0.14 for LBS. The inclusion of the maternal genetic variance ratio (m^2) resulted in an improvement in the log likelihood ratio for BW, LP and LBS, yielding estimates of respectively 0.37, 0.18 and 0.12. The maternal permanent environment variance ratio for LS amounted to 0.07. The genetic correlation of LS with LP was favourable at -0.69. Estimates of h^2 , as ewe traits, were 0.04 for NLW, 0.17 for LP, 0.07 for ewe cooperation score (ECS) and 0.20 for SBS. Genetic correlations indicated that ewes with a high NLW had shorter parturitions while ECS was genetically correlated to SBS. Genetic trends suggested divergence between the lines for breeding values for LP, suggesting that parturitions became shorter in the H line and longer in the L line. Selection for NLW would yield desirable outcomes for ewe and lamb behavioural traits based on genetic trends and correlations. Such selection would putatively benefit animal welfare by reducing birth stress in ewes and lambs and by promoting maternal cooperation with their offspring's first suckling attempts in ewes.

Conception during the lactation and rearing period affects the ewe-lamb bond at birth

Rodolfo Ungerfeld (rungerfeld@gmail.com), Raquel Perez-Clariget, Ophelie Menant and Aline Freitas-de-Melo

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Highlights

- Lambs born from ewes that conceived while nursing were lighter.
- Those lambs were less vital at birth.

- Their maternal bond at birth was weaker as compared to lambs born to non-nursing ewes.
- Even 24 – 36h after birth, their bond remained weaker.

Abstract

Conceiving during the early postpartum period, when ewes are investing energy resources nursing an offspring is energetically demanding. Moreover, it requires artificial weaning during ewe gestation, which induces a strong stress response. All this together can impact fetal growth and lambs' mortality rate. The aim of the study was to determine if conceiving during the lactation and rearing period affects lambs' weight and body temperature, and ewe and lamb behaviors after birth. Ewes were induced to ovulate during October (spring) and lambed in autumn. When they conceived, they either remained lactating while nursing their current offspring (LAC, n = 10) or had their last parturition the previous year (CON, n = 49). Lambs born from LAC ewes were lighter than those born from CON ewes (4.13 ± 0.35 kg vs 4.77 ± 0.26 ; $P = 0.02$, respectively). More LAC ewes lambed lying down than CON ewes (100 % vs 42.9 %; $P = 0.03$). At birth, lambs born from LAC ewes made more attempts to stand up (11.4 ± 2.2 vs 6.1 ± 1.1 , $P = 0.043$), and had a longer latency before first suckling (79.4 ± 11.2 s vs 45.6 ± 5.9 s; $P = 0.012$) than lambs born from CON ewes. At the end of a separation-reunion test performed 24–36 h after birth, LAC ewes were further away from their lambs than CON ewes (5.1 ± 1.0 m vs 2.95 ± 0.54 m; $P = 0.045$). Lambs born from LAC took longer than those born from CON ewes to meet their mother (24.9 s vs 8.5 ± 3.5 s ± 7.7 ; $P = 0.059$), and suckle (142.5 ± 22.8 s vs 86.3 ± 10.3 s; $P = 0.029$). Overall, conceiving during the lactation and rearing period affected the establishment of the ewe-lamb bond. More LAC ewes lambed lying down, their lambs were lighter and less vigorous after birth. LAC ewes were less interested in their lamb, both at parturition and during the separation-reunion test. LAC ewes were less disposed to invest in their lamb, both at parturition as well as during a separation-reunion test performed the day after birth. On the other hand, although lambs from LAC ewes were less vigorous, they tended to require more attention during the short separation test. These results highlight the need of research to develop strategies aiming to improve the welfare of ewes and lambs in accelerated lambing systems.

Ovulation and ovulation rate in ewes under grazing conditions: factors affecting the response to short-term supplementation

Georgget Banchemo (gbanchemo@inia.org.uy), Katia Stefanova, David Lindsay, Graciela Quintans, Fernando Baldi, John Milton and Graeme Martin

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Abstract

The relationships between ovulation rate and nutrition remain confused, probably because of uncontrolled variation in experimental conditions. To help resolve the problem, we analyzed data from 20 experiments conducted between 2002 and 2016, in Uruguay with grazing ewes. All experiments were carried out by a single laboratory under comparable conditions of experimental design and measured variables. The studies used a total of 3,720 ewes, of purebred Corriedale, Polwarth, or East Friesian x Polwarth genotypes. In all experiments, a control group grazed native pastures and extra nutrition was provided to the treatment groups using either improved pastures or supplements. Ovulation rate was measured by counting corpora lutea using laparoscopy or rectal ultrasound or by counting fetuses at ultrasound on day 45 of gestation. For statistical analysis, data were grouped according to nutritional treatment (control or supplemented) and, within these groups, type of supplement to provide energy or protein (protected or not from rumen

degradation). Across all experiments, 92–99% of the ewes ovulated and the effects of diet, length of supplementation, and initial live weight and genotype are reported. Within diets, ovulation was most affected by overall energy intake during supplementation ($P < 0.01$). Ewes that grazed native pastures supplemented with protein supplements had higher ovulation rates ($P < 0.05$) than control ewes grazing only native pastures. The addition of tannins to the protein supplement, to protect it from degradation in the rumen, did not further increase the ovulation rate. In unsupplemented ewes that had access to legume pastures, ovulation rates did not increase when the legume pasture was rich in tannins although only ewes that grazed tanniferous legumes had marginally higher ovulation rates than the control ewes ($P < 0.05$). When ewes grazing native pastures were supplemented with energy, their ovulation rate did not increase above those of nonsupplemented ewes. Live weight at the start of supplementation also affected ovulation rate. We conclude that ovulation was most affected by overall energy intake, whereas the factors that affected ovulation rate during short-term nutritional supplementation were intake of protein from highly digested supplements or dietary protein protected from ruminal degradation.

Upcoming events

| Date | Event | Location |
|------------------|--|--------------------------|
| 5 May 2021 | Livestock Production in the Rangelands Riverina Local Lands Services | Hay, NSW |
| 5 May 2021 | Oestrogenic clovers – identification and remediation Meat & Livestock Australia | Webinar |
| 11 - 12 May 2021 | Breeding Focus 2021 Improving Reproduction Animal Genetics and Breeding Unit & CSIRO Agriculture and Food | Armidale, NSW |
| 13 May 2021 | MLP Project, Macquarie Site Sheep Connect NSW | Webinar |
| 9 - 11 June 2021 | Recent Advances in Animal Nutrition RAAN Committee | Gold Coast. QLD & online |

Funding calls

| Program | Open | Close |
|--|--------------|-------------|
| Producer Demonstration Sites Meat & Livestock Australia | 1 April 2021 | 12 May 2021 |