Sheep reproduction RD&A alert

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

Managing triplet bearing ewes for success will be discussed during the SRSP's October webinar. The key results and practical outcomes from the recently completed *Managing fecund flocks to improve survival of triplet dams and their lambs* project will be presented. The webinar is scheduled for **Friday 27th October 2023 at 12.30 pm (AEDT)** and will feature:

- Andrew Thompson (Murdoch University) – project overview and R&D priorities for triplet bearing ewes
- Amy Lockwood (Murdoch University) – the importance of mob size
- John Young (Farming Systems Analysis Services) Managing ewe condition score
- Jason Trompf (JT Agri-Source) On-farm application of best-practice guidelines for triplet ewes.

Register now!

If you missed the SRSP September **Let's talk rams** webinar, a recording will soon be available to view from the SRSP website.

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

Making maidens' weight

Background

Sheep producers in Central West Queensland face a challenge with low rearing rates from maiden Merino ewes. Maiden ewes tend to have good conception rates in this environment. However, the challenge lies in keeping the foetuses alive to lamb marking.

Aim

The project is seeking ways to improve lamb marking rates from pregnancy maiden ewes.

Current progress

The Making maiden's weight Producer Demonstration Sites (PDS) project is monitoring demonstration sites at Dunblane and Beaconsfield in the Central West of Queensland as well as collating the conception, scanning rates and lamb marking rates of single and twin bearing maiden Merino and Dorper ewes from members of a discussion group located in both the Longreach and Barcaldine shires. This data has allowed the impact of mismothering, condition score, pasture availability, weather, genetics, predation and disease on lamb marking rates.

The PDS team would welcome more producers to be involved as a demonstration flock or to contribute via the discussion group. For more information on the Makin Maiden's weight PDS project contact David Counsell (davidjcounsell@bigpond.com).

Sheep Genetics Maternal Index Survey

Sheep Genetics is currently collecting information on flock structure and output information of commercial operations who:

- join Merino ewes to a Maternal sire (e.g., Border Leicester) to produce first cross sheep,
- breed from first cross ewes,
- purchase Maternal rams for a self-replacing flock.

This data will help inform the development of future Maternal indexes.

Maternal indexes will be re-developed in 2024 using feedback from these surveys. As indexes are developed for industry please consider commercial production system data as opposed to data from ram breeding flocks when completing.

If you are a commercial producer who has more than one production system, please click on the QR code and fill out *all* relevant surveys.

The surveys are quite comprehensive so please allow between 30 minutes and 1 hour to complete.

Scientific papers

An investigation of pathways for rebuilding Australia's sheep flock

F.D. Brien (forbes.brien@adelaide.edu.au), R.L. Pitchford, S.P. Vogt and D.J. Koopman

Abstract

Context: A significant opportunity remains to further increase the supply of premium sheepmeat products to Australia's customers, which requires a more rapid rebuilding of the national sheep flock. To help meet this challenge, developing relevant information for sheep producers to assist them to achieve a profitable flock-rebuilding outcome is viewed as highly desirable.

Aims: (1) Develop flock-rebuild scenarios that track inventory, cashflow, profit and loss, and the overall balance sheet over a 5-year projection. (2) Model the impact on flock-rebuilding pathways of exposure to variation in supplementary-feed costs, purchase of stock and price received for sale animals and flock structure. (3) Model variation in benefits and costs for a range of production zones, enterprise types and flock-age profiles.

Methods: Fourteen flock-rebuilding pathways were assessed for up to nine flock types, using a spreadsheet model that tracked inventory, cashflow, profit and loss, and the overall balance sheet over 5 years.

Key results: The top four pathways for profitability and capacity to rapidly rebuild flock numbers include retention of more older ewes, purchasing young ewes, purchasing older ewes (mostly 5–6-year olds) in Merino and Merino-cross flock types only and joining ewe lambs in Maternal and Cleanskin flock types only. These pathways were not sensitive to variation in the cost of supplementary feed, stock prices or flock structure, although joining Merino ewe lambs became one of the top four pathways when feed costs were lower.

Conclusions and implications: The well established practices of retaining ewes for longer and purchasing ewes, especially young ewes, have the most potential to both rapidly and profitably rebuild flock numbers. However, joining ewe lambs, particularly in Maternal and Cleanskin flocks, can also profitably contribute to rapid flock rebuilding. While reducing reproductive wastage or increasing reproductive potential were mostly profitable, they could not rapidly rebuild flock numbers. In contrast, accelerated lambing systems can rapidly rebuild flock numbers, but are only marginally profitable.

MLA Project L.LSM.0032 *Investigating flock rebuilding strategies*

Body temperature, heart rate, and locomotor activity measured by bio-loggers before and after a progestogen+eCG treatment for artificial insemination in sheep: effect of pregnancy

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Abstract

Context: The introduction of bio-sensors for monitoring real-time changes in physiological variables has helped understand how external factors affect an animal's resiliency to stressors.

Aims: To quantify changes in temperature, heart rate, and locomotor activity in ewes during hormonal treatments for artificial insemination (AI) for up to 15 days after insemination.

Method: Twelve ewes received a surgically implanted subcutaneous bio-logger to record data every 5 min. One week later, ewes received an intravaginal sponge for 12 days and AI was performed 54 ± 1 h after sponge withdrawal. The data were divided into the following four periods: 'sponge in' (Days −14 to −2), 'day before AI' (Day −1), 'day AI' (Day 0), and 'post-AI' (Days 1–5, Days 6–10, and Days 11–15).

Key results: Ewes presented significantly (P < 0.001) higher mean temperature and activity, and a lower heart rate when the sponges were in place than they did in the days following AI. Mean body temperature in the 'sponge in' period and the 'day before AI', but not in 'post-AI period', differed significantly (P < 0.001) between pregnant and non-pregnant ewes. Non-pregnant ewes had a significantly (P < 0.001) higher heart rate than did pregnant ewes when sponges were in and in the 'post-AI' period. Non-pregnant ewes were significantly (P < 0.001) less active than were pregnant ewes in the 'sponge in' period and on Days 1–5 after AI; however, the former were significantly (P < 0.001) more active than were pregnant ewes on Days 11–15 after AI.

Conclusions: The subcutaneous bio-logger system documented 24-h variations in body temperature, heart rate, and locomotor activity before and after AI in ewes that had received an estrus-synchronising hormonal treatment. Pregnancy status affected those variables and their circadian fluctuations at the time of the hormonal treatment and in the 'post-AI' period.

Implications: Any device designed for use in the study of Precision Livestock Farming that allows a simple, non-invasive measurement of these variables might provide the basis for the development of a system that could identify females that are in an optimal state for insemination, and provide an early pregnancy prediction system.

Investigating how genetic merit and country of origin impact the profitability of grass-based sheep production systems

Nicola Fetherstone, Fiona M. McGovern (fiona.mcgovern@teagasc.ie), Noirin McHugh, Tommy M. Boland and Alan Bohan

Simple Summary

An animal's genetic merit can govern its production potential and performance. This study used a bio-economic model informed by a large dataset of records from a commercial sheep-production-flock study to investigate the effects of selecting breeding females based on their maternal genetic merit for productivity, feed demand and gross margin. The results showed that selecting and using breeding females of high genetic merit will increase the gross margin of the flock, thus improving the profitability of the production system for the farmer. Our results provide insight for sheep-meat-production industries into the cumulative economic returns of using animals of high genetic merit. Our results also indicate potential outcomes from improving flock genetic merit, an important key performance indicator for the industry, and inform decision-making around production priorities of producers.

Abstract

The objective of this study was to simulate and assess the profitability of sheep production systems that varied in maternal genetic merit (high or low) and country of origin (New Zealand (NZ) or Ireland), using the Teagasc Lamb Production Model (TLPM). A production system study performed at Teagasc Athenry, Co. Galway, Ireland, from 2016 to 2019, inclusive, provided key animal performance input parameters, which were compared across three scenarios: high maternal genetic merit NZ (NZ), high maternal genetic merit Irish (High Irish) and low maternal genetic merit Irish (Low Irish). Prior to the beginning of the study ewes and rams were imported from New Zealand to Ireland in order to compare animals within the same management system. Ewes were selected based on the respective national maternal genetic indexes; i.e., either the New Zealand Maternal Worth (NZ group) or the €uro-star Replacement index (Irish groups). The TLPM was designed to simulate the impact of changes in physical and technical outputs (such as number of lambs, drafting rates and replacement rates) on a range of economic parameters including variable costs, fixed costs, gross margin and net profit. Results showed that total farm costs (variable and fixed) were similar across the three scenarios, driven by the similar number of ewes in each scenario. The number of lambs produced and the cost of production per lamb was 14.05 lambs per hectare for the NZ scenario at a cost of EUR 82.35 per lamb, 11.40 lambs per hectare for the High Irish scenario at a cost of EUR 101.42 per lamb and 11.00 lambs per hectare for the Low Irish scenario at a cost of EUR 105.72 per lamb. The net profit of the three scenarios was EUR 514, EUR 299, and EUR 258 per hectare, for the NZ, High Irish and Low Irish scenarios, respectively. Overall, the NZ scenario had a lower cost of production in comparison to either Irish group, while the High Irish scenario had a 14% greater net profit than the Low Irish scenario, equating to an additional EUR 41 per hectare net profit. Output from this simulation model reiterates the importance, for overall farm profitability, of maximising the number of lambs weaned per hectare, particularly through maximising income and diluting the total farm costs. To conclude, the use of high-maternal-genetic-merit animals, regardless of their country of origin impacts farm profitability.

Use of a visual scoring system to assess external udder conformation and its relationship to colostrum quality and lamb growth rates

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Simple Summary

Because udder shape and milkability are strongly correlated, particular structural traits might be chosen in the future to increase milking effectiveness in sheep. Among udder conformation traits, udder depth and length are most strongly associated with milk output. An efficient selection approach to examine external udder conformation in relation to lamb growth rates and colostrum quality might be produced by a practical

method of visual assessments of udder conformation and structure. However, there has not been much research on how the external udder conformation of meat-breed sheep relates to the quality of colostrum and lamb growth rates. The goal of this study was to investigate the relationship among external udder conformation and colostrum quality and lamb growth rates in Suffolk ewes using visual evaluations of the external udder. The study showed that ewes with a 'normal' udder conformation had greater mean total protein and Brix values in colostrum compared with ewes with an 'abnormal' conformation. Udder conformation based on the parameters of udder floor, udder depth, teat placement, teat lesions, and presence of wool did not appear to have a significant effect on lamb body weight or growth rates. Although udder conformation appears to affect colostrum quality, more research is needed to determine how it affects lamb growth, morbidity, and mortality during the first week of life.

Abstract

In sheep raised for meat production, the relationship between external udder conformation, colostrum quality, and lamb growth rates has not received much attention. We hypothesized that ewes with a more desirable udder conformation at lambing would have greater colostrum quality and greater growth rates in lambs. Fifty Suffolk ewes were used in this study. Within 6–8 h of parturition, colostrum samples from both halves of the udder were collected and visual scoring of the udder was conducted. Colostrum quality was measured for total proteins using both optical and Brix refractometers. On day 2, day 45, and day 60 after parturition, lamb weights were recorded, and udder conformation measurements were repeated. A visual scoring system evaluating udder floor (scale 1–4), udder depth (scale 1–9), teat placement (scale 1–9), teat/mammary lesions (present or absent), and the presence of wool (present or absent) was used to assess the external udder conformation. Normal udder parameters included udder depth scores of 5 or 6; udder floor scores of 1 or 2; teat placement scores of 4, 5, or 6; and the absence of teat/mammary lesions and wool. All ewes not meeting normal parameters were considered to have an abnormal udder. The data were analyzed using the GLM procedure. Mean total colostrum protein was greater ($p = 0.03$) in ewes displaying a 'normal' udder conformation compared with those with an 'abnormal' conformation (14.82 ± 0.5 and 13.31 ± 0.3 mg/dL, respectively). Mean Brix values were also greater ($p = 0.03$) for ewes with a 'normal' udder compared to an abnormal udder confirmation (21.70 ± 0.8 and 19.54 ± 0.5, respectively). On day 2 after parturition, the mean lamb body weight was not different between ewes with 'normal' and abnormal udders (5.38 ± 0.26 vs. 5.46 ± 0.15). No differences ($p > 0.05$) in lamb weights were detected between ewes with normal and abnormal udder conformations on day 45 and 60 after parturition. These data provide evidence of greater colostrum total protein values and greater Brix values present in ewes with a 'normal' udder conformation. There were no differences in the weights of lambs born to ewes with normal or abnormal udder conformations.

Effects of different dietary energy levels on development, quality of carcass and meat, and fatty acid profile in male lambs

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Simple Summary

Alpine Merino sheep are a new breed of sheep adapted to the cold and arid ecological zone 2400–4070 m above sea level; the breed has important economic significance for high-altitude areas. This study evaluated the effects of different dietary energy levels (9.7 MJ/kg, 10.1 MJ/kg, 10.5 MJ/kg) on the growth and meat quality of weaned Alpine Merino lambs. The results showed that compared with the low-energy diet (9.7 MJ/kg), the high-energy (10.5 MJ/kg) diet promoted the growth and development of lambs, increased the

live weight and carcass weight of lambs before slaughter, significantly reduced the yellowness and redness scores of lamb muscles, and increased the meat's content of monounsaturated fatty acids.

Abstract

This experiment was conducted to study the effects of dietary energy level on the growth performance and meat quality of weaned Alpine Merino lambs. The study ran for a total of 104 days (20-day pretrial, 84-day trial). From three groups of test lambs, we randomly selected ten lambs per group to determine slaughter performance, meat quality characteristics, and organ indexes. The slaughter performances of the lambs improved as the dietary energy level increased. The live weight before the slaughter of the lambs was significantly higher in the high group than in the low and medium groups. The carcass weight was significantly higher in the high group than in the low group. Dietary energy level had little effect on the organ weight of lambs. Meat quality differed among the three dietary energy levels. The muscle yellowness and redness scores decreased significantly as the energy levels increased. The C18:0, C21:0, C20:1, C18:2n6c, and C20:2 contents in the muscle were significantly higher in the high group than in the medium and low groups. The C18:3n6 content in the muscle was significantly higher in the low group than in the medium group. The C20:5n3 content in the longissimus dorsi was significantly higher in the high group than in the medium and low groups. The monounsaturated and unsaturated fatty acid contents in the muscle were significantly higher in the high group than in the low group. A dietary energy level of 10.5 MJ/kg is suitable for fattening weaned male Alpine Merino lambs.

Correlation between fatty acids levels in chicken, duck, goose, pigeon, quail and turkey egg yolks and post-thawed quality of ram semen

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Abstract

The comparison between adding egg yolks (EY) of chicken, duck, goose, pigeon, Japanese quail or turkey to the Tris glycerol extender on the quality of ram semen before freezing and post-thawing was evaluated. The correlation between fatty acids levels in egg yolks of different avian species and the post-thawed quality of ram semen was studied. The pooled ejaculates collected from five rams were extended with Tris EY glycerol extenders containing the EY of chicken, duck, goose, pigeon, quail or turkey and cryopreserved at −196°C. The straws were evaluated before freezing and post-thawing for sperm motility using a sperm cell analyser, vitality using a FluoVit kit and abnormality using a SpermBlue stain besides plasma-membrane and DNA integrities using a hypo-osmotic swelling test and a Halomax kit, respectively. The moisture, ash, protein and fatty acid (FA) contents of EY of chicken, duck, goose, pigeon, quail and turkey were analysed using a gas chromatograph. The chicken and quail EY extenders significantly improved the total progressive motility (32.05 ± 1.41 and 31.68 ± 1.43, respectively), vitality, plasma membrane and DNA integrities and abnormalities of post-thawing ram semen in comparison with other EY extenders. Pigeon EY had the lowest saturated fatty acids (SFAs) in comparison with the other types of EYs. The chicken and turkey EYs had the lowest percentage of (monounsaturated fatty acids) MUFAs in comparison with the other types of EYs. The highest percentage of polyunsaturated fatty acids (PUFAs) was observed in the turkey, pigeon and chicken EYs which were considered double or triple their percentage in duck and goose EYs, respectively. Significant positive correlations existed between SFAs levels and total motility, vitality, plasma membrane functionality and DNA integrity (0.77, 0.80, 0.67, 0.52, respectively). Significant negative correlations existed between gondoic EY levels and total motility, vitality, plasma membrane functionality and DNA integrity. In conclusion,

the EYs of duck, goose, pigeon or turkey cannot substitute the chicken EY in ram semen extenders as they gave lower post-thawing quality. The quail EY can be used as a good replacer for chicken EY in the extender used for cryopreservation of ram semen. The EY composition of FAs can significantly affect the quality of ram semen post-thawing.

Behavior of lambs and ewes of the Polish Merino and Wrzosówka breeds simulating different conditions of loss during extensive grazing

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Abstract

Extensive sheep grazing carries both benefits and risks. Whereas the benefits include reduced labor input and optimal (close to natural) welfare conditions for sheep, the risks involve a danger of lambs getting lost on the pasture. The objective of this study was to compare the behavior of lambs and their mothers belonging to two breeds (Polish Merino and Wrzosówka) in three experiment systems simulating the conditions in which lambs tend to get lost on the pasture during extensive grazing: 1) with visual and auditory contact, 2) with auditory contact, and 3) without visual-auditory contact with the flock. Two main questions were analyzed about the first three months of the lambs' life: 1) the time of finding the flock by the lambs and 2) the behavior patterns of the lambs and ewes, such as the lambs' movements, the lambs' and mothers' vocalization, the reaction to the curtain, the reaction to the observer, and the lambs' behavior in the field. The study found that the flock finding time in the first and third month of the lambs' life (experiments 1 and 2, respectively) was shorter in the Wrzosówka breed than in the Merino breed (p ≤ 0.05). Regardless of the scenario, the most frequently observed reactions in the lamb flock were flock calling and navigating to the flock by the shortest route. In the absence of visual and auditory contact, the most frequent response of the Polish Merino and Wrzosówka lambs was to run to the top of the hill and search for the flock. In the third month of life, the lambs of both breeds began to show a higher degree of independence, and the observed patterns of their behavior were similar. The results of the study show that in the first two months of life, the Wrzosówka lambs found the flock faster and were better oriented in the field than the Merino lambs. In the third month of life, the differences in the behavior patterns of the two breeds became very small. This finding could indicate that during extensive grazing, lambs of some breeds, especially those subjected to intensive artificial selection such as the Merino breed, may require more care of the breeder in the first two months of their life.

Progress on the roles of zinc in sperm cryopreservation

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Abstract

One of the effective methods for the long-term preservation of mammalian genetic resources is the cryopreservation of semen. However, a number of parameters, including diluents, the rate of freezing and thawing, cryoprotectants, etc., can easily alter the survival of frozen-thawed sperm. Numerous studies have documented the addition of a variety of zinc compounds, to the diluents used to cryopreserve sperm. The primary objective of this review is to briefly describe that adding zinc to diluents as an antioxidant significantly enhances frozen-thawed sperm quality. Second, a summary of the present understanding of zinc's molecular

mechanism on semen cryopreservation is provided. Thirdly, this study addresses that nanoparticles of zinc can offer suggestions for raising cryopreservation effectiveness.

Identification and functional analysis of differentially expressed proteins in high and low freezing tolerance sheep sperm

Xiaofei Ma, Aiju Liu, Ruoyan Liu, Limeng Zhang, Zhong Zheng, Yuexin Li and Shujun Tian (dktsj@hebau.edu.cn)

Abstract

The purpose of this study was to identify proteins associated with differences in the freezing tolerance of sheep sperm and to analyze their functions. Qualified fresh semen from four breeds of rams, the Australian White, white-head Dorper, Black-head Dorper, and Hu sheep breeds, were selected for cryopreservation. The sperm freezing tolerance was investigated by evaluation of the overall vitality, progressive vitality, and rapidly advance vitality of the sperm. A differential model of sperm freezing tolerance was constructed for sheep breeds showing significant differences. Differentially expressed proteins associated with sperm freezing tolerance were identified using iTRAQ and the protein functions were analyzed. It was found that sperm freezing tolerance was best in Hu sheep and worst in white-head Dorper sheep. These two breeds were used for the construction of a model based on differences in freezing tolerance and the identification of sperm proteins expressed differentially before freezing and after thawing. A total of 128 differentially expressed proteins (88 up-regulated and 40 down-regulated) were identified before freezing and after thawing in Hu sheep sperm (fresh/frozen Hu sheep sperm referred to as HL vs. HF), while 219 differentially expressed proteins (106 up-regulated and 113 down-regulated) were identified in white-head Dorper sheep (fresh/frozen white-head Dorper sheep sperm referred to as WL vs. WF). A comparison of these differentially expressed proteins showed that 57 proteins overlapped between the two breeds while 71 were only expressed in Hu sheep and 162 were only expressed in white-head Dorper sheep. Functional annotation and enrichment analyses of differentially expressed proteins down-regulated in Hu sheep involved in phosphorylation of phosphatidylinositol phosphate kinases, regulation of GTPase activity and glycolysis/gluconeogenesis signaling pathway. Up-regulated proteins of Hu sheep participated in oxidoreductase activity and oxidative phosphorylation process of sperm freezing. Furthermore, down-regulated in white-head Dorper sheep involved in the metabolic regulation of carbohydrate and nuclear sugar metabolism. Up-regulated proteins of white-head Dorper sheep involved in the ferroptosis and oxidative phosphorylation pathways. Collectively, These proteins were found to participate mainly in oxidative phosphorylation as well as phosphorylation and metabolic processes in the mitochondria to affect the freezing tolerance of sheep sperm.

Upcoming events

Date	Event	Location
5 October 2023	Fleece and feed: A field day for sheep producers Northern Tablelands Local Lands Services	Glen Innes, NSW
9 October 2023	Mixed species annual fodder crops MLA, NSW DPI & Moses & Son	Quandialla, NSW
9 October 2023	Stock management in containment Agriculture Victoria	Loddon Vale, Vic

10 October 2023	Feed gap workshop North West Local Land Services	Collarenebri, NSW
11 October 2023	Feed gap workshop North West Local Land Services	Croppa Creek, NSW
11 October 2023	Managing seasonal variability – siting and design of a stock containment area Agriculture Victoria	Webinar
13 October 2023	BredWell FedWell sheep workshop Meat & Livestock Australia	Collingullie, NSW
17 October 2023	Feed gap workshop North West Local Land Services	Loomberah, NSW
18 October 2023	Feed gap workshop North West Local Land Services	Bingara, NSW
18 October 2023	Managing seasonal variability – animal nutrition and feeding during dry times Agriculture Victoria	Webinar
24 October 2023	Sheep handler & practical eID use demonstration Leading Sheep QLD & AWI	Tambo, Qld
25 October 2023	Stock containment are demo field day Riverine Plains & Riverina Local Lands Services	Lockhart, NSW
25 October 2023	Managing seasonal variability – is your water supply up to scratch Agriculture Victoria	Webinar
27 October 2023	BredWell FedWell sheep workshop Meat & Livestock Australia	Boree Creek, NSW
27 October 2023	Managing triplet bearing ewes for success Sheep Reproduction Strategic Partnership (SRSP)	Webinar