Nutritional research to meet future challenges *

D. P. Poppi and S. R. McLennan

Abstract. Nutrition is a mature science with well established principles for energy, protein and mineral metabolism based on known metabolic pathways. The quantitative requirements are summarised within various international feeding standards and models. However, when these are applied to specific circumstances, especially in northern Australia, the response of the animal to nutrient supply does not always agree with that predicted from the feeding standards or the error of prediction is not sufficiently accurate for practical use. There is a need for the continual testing of these relationships within production systems. Molecular methods have the potential to discover new metabolic relationships within tissues and characterise the microbial ecology and its relationship to rumen function. Suitable problem models based on growth, meat quality, reproduction, milk and fibre production, and environmental consequences need to be identified. We suggest that production systems designed to meet market weight for age specifications, growth paths and compensatory growth, skeletal growth, parasites, fatty acid isomers, adaptation to low crude protein diets, rumen microbial ecology, epigenetics, remote data acquisition and animal management, greenhouse gas emission, and C balance of various production systems are important problem models, the research of which will benefit the future of the livestock industries in Australia.

From full paper which is published in *Animal Production Science,* 2010, **50**, 329-338.

Effects of Yerba Mate (*Ilex paraguariensis*) supplementation on the productive performance of dairy cows during mid-lactation *

Pietro Celi and Herman W. Raadsma

Abstract. Yerba Mate (*Ilex paraguariensis*), a tea known for its high antioxidant content, was fed (250 g/cow.day) to 8 of 16 Holstein cows for 6 weeks to assess its effect on their performance. Cows were weighed and blood samples were taken on Weeks 0, 3 and 6. Blood samples were centrifuged and plasma was analysed for reactive oxygen metabolites, biological antioxidant potential, advanced oxidation protein products and non-esterified fatty acids. Cows were milked two times daily and milk yields were recorded daily for individual cows. On Weeks 0 and 6, individual milk samples were collected from two consecutive milkings, composited, and analysed for somatic cell counts, fat and true protein concentrations. Plasma concentrations of reactive oxygen metabolites, biological antioxidant potential and non-esterified fatty acids were not affected by Yerba Mate supplementation. Similarly, no effect of Yerba Mate supplementation was noted on milk fat and protein content and on somatic cell counts. This study indicates that supplementation of dairy cows' diet with Yerba Mate during mid lactation seems to improve milk yield when cows are fed with maize silage; however, even if the effect on milk yield was significant it was quite small and needs to be validated with further studies. Cows' oxidative status was not affected by Yerba Mate supplementation indicating that the effect of Yerba Mate on their productive performances is not mediated by changes in redox status.

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Selection for fertility traits in Brahmans increases heifer pregnancy rates from yearling mating*

T. J. Schatz, G. A. Jayawardhana, R. Golding and M. N. Hearnden

Abstract. The performance of heifers from a Brahman herd that was selected for fertility was compared with Brahman heifers sourced from commercial properties using three year-groups of heifers. Each year, conception rates from yearling mating were significantly higher in heifers from the selected herd (SEL) than in heifers sourced from commercial properties (COM), despite the average joining weight of the SEL heifers being lower each year. The pregnancy rate in SEL heifers was 24% higher ($P = 0.008$) in the first year, 36% higher ($P = 0.005$) in the second year and 45% higher ($P < 0.001$) in the third year. Over the 3 years of the study, the conception rate was 35% higher ($P = 0.009$) in SEL heifers than in COM heifers. Joining weight also affected pregnancy rates. When heifers were split into weight ranges according to their pre-joining weight, pregnancy rates were significantly higher ($P = 0.018$) in the heavier weight range than the lighter one. The results indicate that selection for fertility has been successful in improving conception rates from yearling mating in SEL heifers.

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Growth, feed intake and maternal performance of Angus heifers selected for high or low growth and milk production*

S. T. Morris, D. J. Garrick, N. Lopez-Villalobos, P. R. Kenyon, J. L. Burke and H. T. Blair

Abstract. Weight of calf weaned per cow that incorporates both growth and maternal component traits is an important determinant of profitability for cow–calf production systems. In New Zealand, there is little objective information available on the performance of progeny from bulls selected for either growth or maternal ability when compared under similar pastoral farming conditions. The present experiment produced 84 Angus heifers sired by Angus bulls divergently selected for high (Hi-Gr) or low (Lo-Gr) estimated breeding value (EBV) 600-day weight or high (Hi-Milk) or low (Lo-Milk) 200-day maternal EBV. Each heifer had their liveweight gain from weaning to just before first calving, herbage intake from pasture using the n-alkane method, and maternal performance (calf production after first and second parity) assessed. Liveweights of heifers born to Hi-Gr bulls were generally greater than for all other lines, while there was no difference between Lo-Gr and either of the maternal lines. There was no difference ($P > 0.05$) in herbage intake between the different genetic lines when measured at Days 310 (days of age from birth) and 880. At Day 400, the Lo-Milk selection line had higher ($P < 0.05$) intakes than the Hi-Milk, Hi-Gr and Lo-Gr lines. Calves born to the Lo-Gr heifers at the first parity were lighter while the birth weights of calves born at the second parity calving were similar for all the selection lines. Calf weaning weight was lowest ($P < 0.05$) after both the first and second parity weaning for the Lo-Milk sired heifers. The Lo-Milk heifers produced the least milk at Day 50 during their first lactation while the Hi-Milk heifers produced the most. This experiment confirms that for beef cattle, producers who wish to select bulls to use in their herds based on either high growth rate or high milk EBV, the resultant progeny will outperform those that are average or below average for those particular traits.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 349-353.

Profitability of calving heifers at 2 compared with 3 years of age and the effect of incidence of assistance at parturition on profitability*

R. E. Hickson , N. Lopez-Villalobos, P. R. Kenyon, B. J. Ridler and S. T. Morris

Abstract. There is potential to increase the profitability of beef-breeding cows in New Zealand by calving heifers for the first time at 2 instead of 3 years of age; however, calving at this earlier age is often associated with an increase in assistance at calving. This study used a simulated farm system within the Grazing Systems Model to estimate the profitability of calving heifers at 2 years of age with various incidences of assistance at calving. Annual profit from the beef cattle herd was greater for primiparous 2-year-old heifers than for 3-year-old primiparous heifers when the incidence of assisted calving in 2-year-old heifers was less than 89%. Replacement rate increased with increased assistance at parturition. These results indicated that a considerable gain in profitability could be made by calving heifers for the first time at 2 instead of 3 years of age, and further gains could be made in herds already calving heifers at 2 years of age by reducing the incidence of assistance at calving.

* From full paper which is published in *Animal Production Science*, 2010, **50**, 354-358.

Temporal and spatial regional cattle farm turn-off patterns in eastern Australia*

G. E. Donald, D. J. Miron, T. Dyall and M. G. Garner

Abstract. The introduction of the National Livestock Identification System served to provide a record of cattle movements by using an effective, electronic animal tracking system across Australia. The availability of an algorithm to simulate real-time and accurate movements of cattle is critical in the event of a major exotic disease outbreak. Such an algorithm could also be used for forecasting and formulation of policies to manage emerging disease threats. The National Livestock Identification System database will provide the basis for testing and verifying real-time and forecast cattle livestock turn-off patterns as a precursor to developing a real-time cattle movement simulation algorithm. The study demonstrated the major drivers and that real-time pasture information clearly needed to be incorporated into a movement model.

* From full paper which is published in *Animal Production Science*, 2010, **50**, 359-362.

Evaluating development options for a rain-fed dairy farm in Gippsland*

D. P. Armstrong, K. A. Tarrant, C. K. M. Ho, L. R. Malcolm and W. J. Wales

Abstract. A case study and modelling approach was used to examine options for a dairy farm in the high rainfall area of Gippsland (southern Victoria) that would enable it to maintain or increase profit in the future (next 5–10 years) in the face of a continuing 'cost-price squeeze'. The economic performance of the business under a range of development options, identified by an 'expert panel', was analysed for a planning period of 10 years. The options analysed were: (i) increased herd size without purchasing more land, (ii) increased milking area and (iii) purchasing non-milking area for production of conserved fodder. Expanding the milking area by purchasing more land without significantly increasing herd size (reducing stocking rate from 2.5 to 2.1 cows/ha) increased annual operating profit without increasing variability in profit between years compared with the base farm. The increased profit resulted from a reduction in the amount of purchased feed. The purchase of an additional outblock for fodder production reduced risk compared with the base farm system, but did not improve the profitability of the farm system. Other options significantly reduced profit while increasing risk. The most appropriate changes to dairy farm businesses in response to changes in the operating environment will vary from farm to farm. The analysis suggested that there may be an alternate path to the historical trends of larger and more intensive operations. It has also highlighted the importance of home-grown feed and efficient supplement use to increase or maintain profitability in the medium term.

From full paper which is published in *Animal Production Science,* 2010, **50**, 363-370.

Effect of pelleting of concentrates on milk and blood selenium concentrations in lactating dairy cows when selenised yeast is included in the diet*

C. R. Stockdale and H. S. Gill

Abstract. An experiment using 12 multiparous Holstein–Friesian cows was undertaken for 3 weeks in September–October 2008 to determine milk and blood selenium (Se) concentrations (surrogates for bioavailability) when Se-yeast was incorporated into pellets relative to providing unprocessed Se-yeast. The Se in the Se-yeast is principally in the form of seleno-methionine. Since the bioavailability of protein can be reduced by heat processing, it was hypothesised that the temperature and/or pressure conditions associated with commercial pelleting of concentrates would adversely influence the Se concentrations in milk and blood by reducing the bioavailability of Se in the animal compared with Se-yeast that had not been subjected to pelleting. The results clearly showed that pelleting conditions had no effect on concentrations of either milk or blood Se, thereby indicating that pelleting did not have an impact on the bioavailability of the Se in the animal.

From full paper which is published in *Animal Production Science,* 2010, **50**, 371-375.

Effects of Yerba Mate (*Ilex paraguariensis*) supplementation on the performance of dairy calves*

Pietro Celi and Adam Robinson

Abstract. Yerba Mate (*Ilex paraguariensis*), a tea known for its high antioxidant content, was supplemented to 24 of 48 Holstein calves to assess its effect on the calves' performance. Calves were weighed and blood samples were taken each week. Serum was assayed for metabolic parameters (total protein, albumin, urea, non-esterified fatty acids, triglycerides and β-hydroxybutyric acid) and markers of oxidative status [advanced oxidation protein products, 8-isoprostane and total antioxidant capacity (TAC) concentration]. Supplemented calves had higher triglyceride levels ($P < 0.05$) suggesting that Yerba Mate induced fat mobilisation and usage. A significant effect of the interaction time of sampling × diet ($P < 0.05$) was noted for plasma TAC concentration with the Yerba mate calves presenting significantly lower levels of TAC on the last week of the trial. Yerba Mate supplemented calves had significantly lower levels of total protein ($P < 0.05$) and albumin ($P < 0.05$) compared with the non-supplemented calves. The net result was reduced liveweight in Yerba Mate supplemented calves ($P < 0.001$) and thus the hypothesis that Yerba Mate supplementation would increase dairy calves' growth rates was rejected. This study demonstrated that supplementation of Yerba Mate to dairy calves had significant effects on their metabolic and oxidative status, which resulted in lower liveweight at the end of the trial.

From full paper which is published in *Animal Production Science,* 2010, **50**, 376-381.

Measuring the shear force of lamb meat cooked from frozen samples: comparison of two laboratories*

D. L. Hopkins, E. S. Toohey, R. D. Warner, M. J. Kerr and R. van de Ven

Abstract. The tenderness of 160 samples of *m. longissimus thoracis et lumborum* (LL) from 40 sheep carcasses was measured at two laboratories, 80 samples per laboratory, with two ageing times (0 and 5 days). The samples were all cooked from frozen and then measured on the same type of machine, a Lloyd Texture analyser with a Warner–Bratzler-type shearing blade attached to give a shear force value for each sample. Shear force results were natural log-transformed and the analysis showed that there was a significant ($P < 0.001$) effect of ageing on shear force and a significant ($P = 0.01$) difference between the laboratories. Thus, on equivalent samples, Laboratory B produced shear force results 0.78 times those for Laboratory A. There was no significant ($P > 0.05$) effect of ageing on cooking loss, but there was a significant ($P < 0.05$) difference between the laboratories. On equivalent samples, Laboratory B produced lower cooking loss results (expressed as a percentage), on average by 3.1%, than did Laboratory A. When cooking loss was included in the model for shear force, it was significant ($P < 0.001$), and its inclusion reduced the significance ($P = 0.04$) of the difference between laboratories. Thus, part of the differences between the two laboratories for shear force could be explained by the difference in the cooking loss at the two laboratories. As cooking loss increased, shear force increased.

From full paper which is published in *Animal Production Science,* 2010, **50**, 382-385.

Eastern grey kangaroo (*Macropus giganteus*) myofibres. 1. A simplified classification method using two commercially available antibodies*

N. B. Spiegel, W. H. Johns, S. D. Sinclair, P. C. Wynn, J. M. Thompson and P. L. Greenwood

Abstract. Skeletal muscles from eastern grey kangaroos (*Macropus giganteus*) were assessed for myofibre contractile and metabolic characteristics using immunocytochemical and histological staining of serial sections. Myofibre classification using monoclonal antibodies that typically bind to mammalian slow (clone WB-MHC), fast (clone MY-32) and Types 1, 2X and 2B (clone S5 8H2) myosin heavy chains was validated using acid- and alkali-preincubated myofibrillar ATPase, NADH and α-glycerophosphate dehydrogenase stains. Myofibres were classified as Type 1 (slow oxidative), Type 2A (fast oxidative-glycolytic), Type 2X/2B (fast glycolytic) or intermediate or transitional myofibre Types 2C (Type 1–Type 2A intermediate) and 2AX/B (Type 2A–Type 2X/2B intermediate). The Type 2 (fast) antibody (clone MY-32) used in the present study did not bind to a subset of fast myofibres in any of the eight kangaroo muscles investigated. These myofibres were identified as Type 2A using clone S5 8H2 and on the basis of the histochemical staining profile. Hence, a simplified immunostaining system using only clones WB-MHC (anti-Type 1) and MY-32 (anti-Type 2X/2B) allowed five myofibre types to be identified based on the staining pattern and intensity of staining for the two antibodies. It is concluded that the myofibres of muscles from kangaroos can be quickly classified into five types using two commercially available antibodies. This method is directly applicable for routine investigations into the myofibre properties of commercially important muscles from the kangaroo musculature and, when combined with enzymatic assays for oxidative and glycolytic activity, will allow for a better understanding of factors influencing the quality of meat from kangaroos.

From full paper which is published in *Animal Production Science,* 2010, **50**, 386-392.

Eastern grey kangaroo (*Macropus giganteus*) myofibres. 2. Characteristics of eight skeletal muscles*

N. B. Spiegel, P. C. Wynn, J. M. Thompson and P. L. Greenwood

Abstract. The myofibre characteristics of eight skeletal muscles of economic importance, comprising six muscles from the upper hindlimb, one from the lumbar and one from the sacral region, from five eastern grey kangaroos (*Macropus giganteus*) were determined. Differential staining of myosin heavy chains allowed myofibres to be classified as Types 1 (slow oxidative), 2A (fast oxidative-glycolytic) and 2X/2B (fast glycolytic), as well as the intermediate or transitional Types 2C (Type 1–Type 2A intermediate) and 2AX/B (Type 2A–Type 2X/2B intermediate). The *m. psoas minor* had a higher area comprising Type 1 myofibres (41.4%) relative to total myofibre area than did any of the other muscles studied (each <5%). This was due to the *m. psoas minor* having a higher percentage (31.9%) and larger average cross-sectional area (CSA; 4211 μm^2) of Type 1 myofibres. Type 2X/2B myofibres comprised over 70% of the relative area in the *mm. semimembranosus*, *semitendinosus* and *gluteus medius*, compared with 34.2% in the *m. psoas minor*, with the other muscles intermediate. The proportion of Type 2A myofibres ranged from 19.1% (*m. gluteus medius*) to 34.6% (*m. caudal dorsolateral sacrocaudalis*) of the relative myofibre area. The *m. caudal dorsolateral sacrocaudalis* had the largest average myofibre CSA and the *m. adductor* the smallest (5539 and 2455 μm^2, respectively). Among the intermediate myofibre types, Type 2AX/B myofibres were more prevalent (range 4.3%–13.0% of myofibres) than Type 2C myofibres (≤0.5%). Overall, the correlations between carcass weight and the percentage and relative areas of myofibres were positive for Type 2A and negative for Type 2X/2B myofibres. The results provide a detailed characterisation of myofibres in kangaroo skeletal muscles of economic importance. Furthermore, they enhance our understanding of factors influencing kangaroo muscle structure and post-mortem metabolism and provide potential indicators of eating quality of kangaroo meat.

From full paper which is published in *Animal Production Science,* 2010, **50**, 393-399.

Wastage of conserved fodder when feeding livestock *

C. R. Stockdale

Abstract. The objective of the present review was to establish levels of conserved fodder wastage when feeding livestock (sheep, beef cattle, dairy cattle) under various conditions and using various feed-out systems, and to determine the factors affecting wastage. The mean wastage of hay recorded in the literature reviewed was 17% of the DM offered, but the range was from 4 to 77%. The main factors affecting the degree of wastage were storage method, packaging method, method of feeding out, amount of fodder on offer and its palatability and/or quality and the impact of wet weather. Although the emphasis was on hay, the principles should also apply to silage. If wastage was 40% rather than 5%, the cost of feeding conserved fodder to livestock would be a third greater than producers might expect or budget on.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 400-404.

Effect of the concentration of Spirulina (*Spirulina platensis*) algae in the drinking water on water intake by cattle and the proportion of algae bypassing the rumen*

T. Panjaitan, S. P. Quigley, S. R. McLennan and D. P. Poppi

Abstract. Spirulina, a freshwater microalgae, has previously been shown to increase the efficiency of microbial protein production in cattle fed hay with a low crude protein content. The present study was carried out to determine the effect of increasing the concentration of Spirulina in the drinking water on the intake of water and the amount of water containing Spirulina bypassing the rumen of cattle. Five rumen-cannulated steers were given a fixed amount of pangola grass hay (14 g DM/kg W.day^{-1}) and water containing 0, 1, 2, 2.7 and 3.5% (w/w) Spirulina in an incomplete Latin square design. Water intake by the control steers (0% Spirulina) was 29.7 and 49.3 g/kg W for the first drinking event after it was made available and over 24 h, respectively. For steers receiving the algae, intake of water plus Spirulina increased linearly ($P < 0.01$) from 42.7 to 60.2 g/kg W during the first drinking event, as the concentration of Spirulina in the drinking water increased, but over 24 h was not affected by Spirulina concentration and averaged 74.4 g/kg W. The bypass of water through the rumen, as determined using chromium-EDTA as a marker, averaged 20.5 ± 1.2% and was not affected by the concentration of Spirulina in the drinking water. Increasing inclusion of Spirulina was associated with a decrease in rumen pH, an increase in urea concentration in blood serum, and an increase in ammonia-N concentration, propionate and branched-chain fatty acids, and a decrease in butyrate proportions in rumen fluid. Spirulina inclusion in the drinking water increased water intake and may provide a potential safe and inexpensive alternative to urea for extensively grazed ruminants.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 405-409.

Alternative fibre sources for steers and calves fed high-grain feedlot diets *

V. Beretta, A. Simeone, J. C. Elizalde, J. Franco, O. Bentancur , A. Ferrés, S. Ayçaguer, J. Iriñiz and V. Martínez

Abstract. An experiment was conducted to evaluate the effect of fibre source (FS) in high-grain feedlot diets on liveweight gain (LWG) of steers and calves and carcass traits of steers at slaughter. Eighteen steers (330 ± 27.3 kg) and 18 calves (153 ± 11.9 kg) were randomly allotted within animal category to one of three high-grain diets varying in the FS, including either grass hay (H, 66% neutral detergent fibre (NDF)), rice hulls (RH, 85% NDF) or wood chips (W, 90% NDF), and a total mixed ration formulated for equal levels of digestible DM, crude protein and NDF, within category. Animals were individually fed (3 kg DM/100 kg LW, distributed in four meals) during 56 days. The LW increased linearly with time in all treatments ($P < 0.01$). FS did not affect calves' LWG ($P > 0.05$), but it resulted in differences in steers LWG (H: 1.77b; RH: 1.51c; W: 2.02a kg/day, $P < 0.05$). However, no differences were observed in hot carcass weight ($P > 0.05$), which resulted in higher carcass yield ($P < 0.05$) for steers fed RH (55.0%) compared with H (53.5%) and W (53.3%). There was a significant interaction ($P < 0.05$) for feed : gain ratio, with an improvement of this value observed only for steers fed the W diet. Although varying the FS affected rumination of calves and steers ($P < 0.01$) and the time spent eating of steers ($P < 0.05$), it did not represent any constraint for animal production. This study suggests by-products high in fibre content, such as RH and W, could be used in substitution to H in high-grain feedlot diets when fed at equal NDF concentration in the ration, both for calves and steers. Because calves are sometimes grown on a high-concentrate diet during winter before spring grazing, further research is needed to quantify potential residual effects on LWG after they return to pasture.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 410-413.

Modes of transmission of rumen protozoa between mature sheep *

Simon H. Bird, R. S. Hegarty and R. Woodgate

Abstract. Three experiments were conducted to evaluate routes by which viable rumen ciliate-protozoa may be transferred between mature sheep. Feed, water and faecal material were tested as possible vectors for protozoal transfer in addition to direct animal to animal contact. In Experiment 1, protozoa-free sheep were either offered or orally dosed with protozoa-contaminated material or allowed contact with faunated animals. The treated sheep were then monitored over a 4-week period for the appearance of protozoa in the rumen. Protozoa were successfully transferred to protozoa-free animals via contaminated water but no transfer occurred via feed or faeces or by direct animal to animal contact. In Experiment 2, the drinking water of penned faunated sheep was found to become contaminated with protozoa within 4–6 h of being placed in the pen. In Experiment 3, nine protozoa-free sheep were grazed in a paddock with a flock of 75 faunated ewes for periods of 1–3 weeks, and protozoa became established in one protozoa-free sheep. The results of these studies suggest that the most likely mode of transfer of protozoal cells from one sheep to another is via water, rather than by rumen fluid contaminating feed, or from faeces of faunated sheep. Further tests are required to demonstrate protozoal transmission via water occur under a range of conditions and inoculum levels.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 414-417.

Achieving adoption and innovation in Australia's beef industry *

H. M. Burrow

Abstract . Beef CRC uses industry value-add and impact as the guiding principle to identify the most appropriate 'Path to Adoption' for each one of the practices, tools and technologies it develops. This approach recognises that, regardless of the product type or the method of commercialisation, all Beef CRC's decisions aimed at achieving commercialisation, utilisation, and/or adoption are designed to achieve and demonstrate maximum value for Australian beef businesses. This is achieved by customising commercialisation approaches to ensure that (1) all Beef CRC technologies are specifically designed to maximise industry adoption and utilisation and (2) all Beef CRC processes aiming to achieve industry adoption and innovation are specifically designed and implemented for that purpose. This paper presents case studies outlining the different approaches used by Beef CRC to maximise adoption, innovation and impact of different product types and different processes (or 'delivery vehicles') to achieve demonstrable adoption and impact of complex knowledge-based technologies among the tens of thousands of small-to-medium beef enterprises located throughout Australia.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 418-423

Cooperative Research Centres as effective institutions for contemporary models for achieving innovation in primary industry *

P. Thomas

Abstract. The creation of a formal organisational structure that brings together the specific needs of particular industries, with the expertise and research capacity available through recognised research providers, has an underlying and undeniable logic. Cooperative Research Centres (CRCs) provide this formal structure and are generally strongly focussed on carrying out applied outcome-driven research to improve productivity through innovation. Despite this strong commercial focus and record of scientific-output CRCs, there is general recognition that adoption of research from CRCs can be improved. The present paper focuses on primary industry CRCs and discusses the applicability of contemporary innovation concepts, which have evolved through the process of industrialisation and socialisation of science, and their application for improving innovation within primary industry CRCs. Specifically considered are 4th and 5th generation innovation concepts that promote ideas within 'Open Innovation' and 'Knowledge Creation' as a means of improving innovation within the primary industry CRCs organisational structure.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 424-428

Aligning farm decision making and genetic information systems to improve animal production: methodology and findings from the Australian dairy industry *

Ruth Nettle, Mark Paine and John Penry

Abstract . To date there has been little research into the way genetic improvement decisions are made in practice on Australian farms. This type of knowledge is important for guiding the design of programs to increase the use of genetic information and thereby the rate of genetic gain in animal production systems. This paper describes an approach to understanding farm decision making in order to improve the design of services to increase the use of genetic information in the Australian dairy industry. A mixed-method approach involving a national survey and regional focus groups was used to determine farmers' perceptions of the genetic information system overall and the key features of bull selection decisions and information sources. The current genetic information system was found to have a strong reputation for ease of access, use and fit with the way farmers evaluated bulls. In the focus groups the farmers described their decision process as having an 'ideal cow' in mind that fitted their farming system (e.g. balancing survival, milk volume, milk components, mammary features, fertility, milking speed, etc.). Bull proofs were then screened to identify a batch of eligible bulls that were further screened for their specific situation. Focus groups of advisers generally concurred with the process described by farmers. Further, farmers tended to rely on one or two main information sources in making decisions. To address the issue of greater alignment between farmer decision making and use of genetic information through industry organisations requires a coordinated strategy and a comprehensive development program. Suggestions for activities to this end are outlined.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 429-434

Issues and advances in the integrated control of sheep lice *

Peter J. James

Abstract . Ongoing pressure to minimise costs of production, growing markets for low residue and organic wool and meat, resistance to chemicals in louse populations, and the deregistration of diazinon for dipping and jetting have contributed to a move away from routine annual application of lousicides to more integrated approaches to controlling lice. Advances including improved methods for monitoring and detection of lice, an expanded range of louse control products and the availability of a web-accessible suite of decision support tools for wool growers (LiceBoss™) will aid this transition. Possibilities for the future include an on-farm detection test and non-chemical control methods. The design and extension of well-constructed resistance management programs to preserve the effectiveness of recently available new product groups should be a priority.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 435-439

Sustainable use of anthelmintics in an Integrated Parasite Management Program for sheep nematodes *

R. G. Woodgate and R. B. Besier

Abstract . Anthelmintic resistance is a major problem affecting sheep nematode control; however, chemical treatments will always be a likely routine part of any parasite control program. The present paper, with the aim of minimising the selection pressure for worsening anthelmintic resistance, outlines important practical and strategic aspects of planning the anthelmintic component of an integrated approach to sheep worm management.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 440-443.

Intake, retention time in the rumen and microbial protein production of *Bos indicus* steers consuming grasses varying in crude protein content *

T. Panjaitan, S. P. Quigley, S. R. McLennan, T. Swain and D. P. Poppi

Abstract . Feed intake, rumen function, microbial protein (MCP) production and the efficiency of MCP production were determined in steers fed four different forage hays varying markedly in crude protein content. Low quality tropical forage (speargrass and Mitchell grass) hays had lower crude protein content, higher neutral detergent fibre content and lower digestibility than a medium quality tropical forage (pangola grass) hay and a temperate forage (ryegrass) hay. Steers fed speargrass and Mitchell grass hays had lower MCP production (80 and 170 g MCP/day, respectively) and efficiency of MCP production [78 and 79 g MCP/kg digestible organic matter (DOM), respectively] than steers fed pangola grass (328 g MCP/day; 102 g MCP/kg DOM) and ryegrass (627 g MCP/day; 135 g MCP/kg DOM) hays, which was directly related to the supply of DOM and rumen degradable protein. Intake was greatest for ryegrass hay, followed by pangola grass, Mitchell grass and speargrass hays [17.6, 15.6, 10.1 and 5.5 g DM/kg W.day, respectively]. The retention time of DM in the rumen was 72.1, 47.7, 28.6 and 19.1 h for speargrass, Mitchell grass, pangola grass and ryegrass hays, respectively, with a similar trend apparent for the retention time of neutral detergent fibre, lignin, chromium-EDTA and ytterbium labelled digesta. The difference in the protein : energy ratio of absorbed substrates (measured as efficiency of MCP production) did not appear to account for all the differences in intake, nor did a purely physical mechanism.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 444-448.

Investigating *Eremophila glabra* as a bioactive agent for preventing lactic acidosis in sheep *

P. G. Hutton , Z. Durmic and P. E. Vercoe

Abstract. The Australian native plant *Eremophila glabra* was tested as a potential agent for preventing lactic acidosis in sheep after it was observed to be effective against acidosis *in vitro*. Ruminally fistulated wethers were infused via rumen cannula with single doses of kibbled wheat (14 g/kg bodyweight) and either virginiamycin (Eskalin500; AB, 80 mg/kg of wheat plus 100 g milled oaten hay/kg of wheat, $n = 6$), *E. glabra* (EG, 100 g freeze-dried and milled leaf material per kg of wheat, $n = 10$) or milled oaten hay (Control, 100 g milled oaten hay/kg of wheat, $n = 16$). Rumen samples were collected immediately before infusion and then 2, 4, 6, 8, 12, 16 and 24 h after the infusion. The samples were analysed for pH, D-lactate, volatile fatty acids (VFA) and osmolality. Rumen pH and D-lactate values indicative of acidosis were detected in the Control and EG groups. The pH nadir of the rumen was 12 h after the wheat infusion, at which time the values in the EG (pH = 4.87) and Control (pH = 5.09) groups were lower ($P < 0.05$) than in the AB group (pH = 5.63) and the D-lactate concentrations were higher ($P < 0.05$) in the EG and Control groups (24 mmol/L and 15 mmol/L, respectively) than in the AB group (0.9 mmol/L). At the same time, total VFA concentration was higher ($P < 0.05$) in the AB group (102 mmol/L) than in the Control (65 mmol/L) and the EG (14 mmol/L) groups. Rumen osmolality did not differ between groups. Virginiamycin was effective at preventing lactic acidosis. However, the inclusion of dried leaves from *E. glabra* at a similar level that was effective *in vitro* did not prevent lactic acidosis *in vivo*, and the reasons behind this remain unclear. The study demonstrates the difficulty in converting *in vitro* results to *in vivo* and highlights the need to test the plant at higher doses *in vivo*.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 449-453

Proportion of rams and the condition of ewe lambs at joining influences their breeding performance *

P. R. Kenyon, S. T. Morris and D. M. West

Abstract . The aim of the present study was to examine the effects of ram : ewe lamb ratio and condition score on the reproductive performance of ewe lambs. In the 2007 study, ewe lambs were bred with rams, at ram : ewe lamb ratios of 1 : 30, 1 : 50, 1 : 75 or 1 : 100. In the 2008 study, ewe lambs were bred at ratios of 1 : 31, 1 : 50, 1 : 75 or 1 : 100. Ewe lambs were bred over two 17-day periods. In both studies, ewe lambs bred in the first 17 days of breeding only were heavier ($P < 0.05$) than those bred in the second 17-day period only, and those ewe lambs diagnosed as twin-bearing were heavier ($P < 0.05$) than their single-bearing counterparts. Ewe lambs with a condition score of 2.5 or greater were more likely ($P < 0.05$) to be bred, and be pregnant, in the first 17 days of breeding than those of condition score 1.5 or 2.0. Over the entire 34-day breeding period, ewe lambs with a condition score of 2.5 or greater had higher ($P < 0.05$) pregnancy rates than those with a condition score of 2.0, which in turn had higher rates than those of 1.5. In the 2007 study, after 34 days of breeding, there were no differences ($P > 0.05$) in pregnancy rates among the different ram : ewe lamb ratios. While in the 2008 study, pregnancy rates after 34 days were greater ($P < 0.05$) in the 1 : 50 compared with both the 1 : 75 and 1 : 100 treatments. Pregnancy rates of 1 : 31 ewe lambs were greater ($P < 0.05$) than those of 1 : 75 ewe lambs. In the 2007 study, pregnancy rates of ewe lambs to the first 17 days of breeding were greater ($P < 0.05$) for those bred at a ratio of 1 : 75 than for those bred at 1 : 50, and tended to be greater ($P = 0.08$) than for those bred at 1 : 100. In addition, those bred at a ratio of 1 : 30 tended to have higher pregnancy rates (farmers $P = 0.07$) than those bred at 1 : 50. While in the 2008 study, pregnancy rates to the first 17 days of breeding were greatest ($P < 0.05$) in the 1 : 31 and 1 : 50 treatments groups. In conclusion, the results of the present study indicate that achieving greater liveweights and higher condition scores of ewe lambs at breeding will increase the proportion pregnant, especially early in the breeding period. The data also suggest, in combination with the results of previous research, that should consider utilising ram : ewe lamb ratios lower than 1 : 100, although further studies are warranted.

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Effect of birthweight and birth rank on the survival of single and twin lambs born to ewe lambs

N. M. Schreurs , P. R. Kenyon , F. J. Mulvaney , P. C. H. Morel , D. M. West and S. T. Morris

Abstract. Benefits of ewe lamb mating include improved lifetime production, increased rates of genetic gain and higher net profits. These benefits are only achieved if the ewe lamb successfully rears its offspring to weaning. A meta-analytic approach was used to assess the effects of birthweight and the interacting effect of birth rank on the survival to weaning of lambs born to ewe lambs. The data were from eight studies where birthweight and weight at weaning had been recorded for lambs born from ewe lambs. Data were for single- (n = 1392) or twin-born lambs (n = 456). The twin lambs were further classified as the 'heavier' or 'lighter' of the pair to give three birth rank categories. To compare the probability of dying before weaning between birth ranks, but with lambs compared at a similar birthweight, lambs were categorised by their birthweight as heavy (>3.8 kg) or light (<3.8 kg) and also categorised within their birth rank on their placement around the mean birthweight (birthweight deviation). A mid-range birthweight deviation fell between one standard deviation above or below the mean for each birth rank, whereas a low- and high-range birthweight fell below and above the mid-range, respectively. Logistic regression was used to assess the effect of birth rank (single, heavier twin and lighter twin) and birthweight on lamb mortality up to weaning. To compare the probability of surviving up to weaning between the different birth ranks, relative risk ratios were calculated. Birth ranks were compared for lambs within the same birthweight group (heavy or light) and same birthweight deviation (low-, mid-, high-range). Decreasing birthweight increased mortality before weaning in twins and the change in mortality was greater for the lighter twin. Birthweight did not alter mortality before weaning in singles. Comparison of the birth ranks showed that there were differences (P < 0.05) in the probability of dying for lambs of different birth ranks but similar birthweight. The results suggest that management options for ewe lambs that increase the birthweight of the lighter twin could increase the weaning percentage.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 460-464.

High Merino weaner survival rates are a function of weaning weight and positive post-weaning growth rates *

S. Hatcher , J. Eppleston , K. J. Thornberry and B. Watt

Abstract. Survival and subsequent productivity of Merino ewe weaners (weaned in 2006 and 2007, respectively) on commercial properties in the New South Wales Central Tablelands were monitored through routine liveweight measurement until weaning of their own progeny from their maiden joining. Growth rates were calculated from the regular liveweight measurements with survival determined by the continuing presence of an individual animal at subsequent measurements. This study demonstrates that high weaner survival rates are a function of both weaning weight and post-weaning growth rates. Importantly, it indicates that low post-weaning growth rates can negate the survival benefit conferred by a high weaning weight such that weaners who were unable to sustain positive post-weaning growth rates were at high risk of death. Furthermore, classification of weaners into liveweight profile groups based on their weaning weight and post-weaning growth rates identified another group of weaners that are also at high risk of death. These weaners (14% of the mob) had above average weaning weights but low post-weaning growth rates and a mortality rate nearly 1.5 times that of the lightest cohort of weaners. High weaner survival rates about the 95% industry benchmark are possible if weaners show positive growth rates post weaning. Weaning weight continues to have a residual influence on the subsequent productivity of ewe weaners until they wean their first lambs. Maiden ewes that were heavier at weaning tend to have higher scanning percentages and are more likely to successfully rear their progeny to marking than their lighter weight counterparts. This finding should be taken into account when economic analyses of the benefits of alternative management strategies to promote weaner survival are undertaken.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 465-472

Effects of dam parity and rearing rank on the glucose and fat metabolism, and adrenal function of post-pubertal single and twin-ewe progeny *

S. J. Pain , P. R. Kenyon , S. T. Morris and H. T. Blair

Abstract. In an effort to increase the number of lambs produced per ewe's productive lifetime in New Zealand, an increasing number of ewe lambs (8–9 months old) are being bred. This, in turn, results in an increased proportion of second-parity 2-year-old ewes in New Zealand's breeding flock, rather than the more usual first-parity 2-year olds. The longer-term effects of dam parity on resulting ewe progeny are of interest and few studies have examined this. The present study was designed to determine whether parity (first or second) of Romney 2-year-old dams had any effect on the metabolic function of their single- and twin-born and reared ewe lamb progeny at 10 months of age. Ten-month-old, single and twin ewe lamb progeny born to first- or second-parity dams (n = 8 per group) were catheterised and given intravenous glucose (0.17 g/kg liveweight) (GTT), insulin (0.15 IU/kg liveweight) (ITT) and epinephrine (1 μg/kg liveweight) (ETT) tolerance tests to assess their glucose and fat metabolism and adrenal function. Rearing rank reduced ($P < 0.05$) the insulin response of twins to a glucose challenge, but increased ($P < 0.05$) their glucose response to an insulin challenge. Offspring from first-parity dams had higher ($P < 0.05$) basal plasma concentrations of cortisol and cortisone, whereas their cortisol/cortisone responses to an insulin challenge were unaffected by either dam parity or rearing rank. Neither dam parity nor rearing rank appeared to influence responses to an epinephrine challenge. The present study suggests that both dam parity and rearing rank alter the glucose and insulin metabolism of the offspring, which may have longer-term impacts on the growth and reproductive efficiency of the animal.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 473-478

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Fat depth, muscle depth, fat score and wool growth in Merino dams selected for high or low clean fleece weight and bodyweight *

G. Refshauge, S. Hatcher, G. N. Hinch, D. L. Hopkins and S. Nielsen

Abstract. Concerns exist that selection for increased clean fleece weight (CFW) is expected to reduce body fatness. Such an effect is likely to impact on reproduction; however, all previous studies have examined non-reproductive yearlings or hoggets. The present study, using adult reproductive dams examined the impact of phenotype [based on high or low phenotypic CFW and bodyweight (BWT) performance], stocking rate (high or low) and litter size on body composition and wool traits. High CFW dams were heavier ($P < 0.01$) with lower fat depth ($P < 0.01$) and muscle depth ($P < 0.05$). The high CFW twin-weaning dams had a lower fat score from lamb marking to pre-joining ($P < 0.05$), but tended to replete fat reserves faster ($P < 0.1$) between weaning and pre-joining. At these times of repletion these animals grew longer wool staples ($P < 0.05$). High BWT ewes had reduced staple length ($P < 0.01$), and when adjusted for maternal liveweight also reduced fat depth ($P < 0.001$) and muscle depth ($P < 0.05$). We conclude that the CFW phenotype impacts on fat reserves but that management of dams in groups according to their CFW performance is not warranted.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 479-484

Effect of offering concentrate supplement in late pregnancy, under conditions of unrestricted herbage, on the performance of multiple-bearing ewes and their lambs to weaning *

. R. Kenyon , A. J. Wall, D. L. Burnham, K. J. Stafford , D. M. West and S. T. Morris

Abstract. The aim of the present study was to determine if offering ewes a commercial concentrate supplement under conditions of unrestricted perennial ryegrass–white clover herbage availability would increase newborn lamb heat production, colostrum intake and subsequent liveweight. Forty seven twin- and 43 triplet-bearing Romney composite ewes (1/2 Romney, 1/4 Finn, 1/4 Texel) were randomly allocated to either non-concentrate or concentrate treatment groups (twin non-concentrate, $n = 24$; twin concentrate, $n = 23$; triplet non-concentrate, $n = 22$; triplet concentrate, $n = 21$) from Day 79 of pregnancy. Concentrate-fed ewes were offered an increasing amount of concentrate sheep pellets from Day 79 until Day 90 of pregnancy, at which stage ewes were offered 400 g/day per ewe until they lambed. Pre- and post-grazing herbage masses did not differ ($P > 0.05$) between non-concentrate (2162 ± 54 and 1704 ± 47 kg DM/ha) and concentrate (2135 ± 49 and 1771 ± 42 kg DM/ha) ewes. Ewe nutritional treatment had no effect ($P > 0.05$) on ewe liveweight, body condition score, β-hydroxybutyate or non-esterified fatty acid concentrations in late pregnancy. Offering concentrates increased ($P < 0.05$) the birthweight of triplet-born lambs (4.4 ± 0.1 *v*. 3.9 ± 0.1 kg for those born to concentrate and non-concentrate ewes, respectively) but had the opposite effect on twins (4.8 ± 0.1 *v*. 5.2 ± 0.1 kg, respectively). There was no difference ($P > 0.05$) in maximal heat production, total heat production, rate to reach maximal heat production, and IgG concentrations at 24–36 h of age or liveweight and survival of lambs born to ewes offered concentrates or not. Twin-born lambs had greater ($P < 0.05$) liveweight and total heat production and had higher ($P < 0.05$) survival rates than triplet-born lambs. In conclusion, the results of the present study indicate that there are only minor beneficial effects from offering concentrate supplements to ewes in late pregnancy under conditions of unrestricted herbage availability and it is not a viable option for farmers to utilise.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 485-492.

Factors affecting the response of Bali cattle (*Bos sondaicus*) calves to supplementation prior to weaning *

I. G. N. Jelantik, M. L. Mullik, C. Leo-Penu, and R. Copland

Abstract. Some factors that contribute to variation in the responses of Bali cattle calves to dry season supplementation before weaning were examined on-farm in 10 villages located in three districts in East Nusa Tenggara Province, Indonesia from June to December 2008. The altitudes of the three districts were 0–100, 400 and 800 m above sea level. A total of 199 Bali (Banteng, *Bos sondaicus*) calves were offered a concentrate supplement from 1 month after birth (or June for calves born before May) at a level of 2% liveweight. The supplement consisted of grass hay and concentrate (rice bran, corn meal, leucaena leaf and fish meal) containing 18.6% crude protein. The supplement was offered to calves in the morning while confined to calf pens when the dams were released for grazing. Calves were reunited with the cows during the night. The effects of districts, herd size and month of birth on mortality rate, liveweight gain (LWG) and growth in supplemented calves were examined. Mortality rate averaged 1.0% and was not affected by month of birth, herd size or districts. The month of calving varied from March to September, but was mostly concentrated during June and July (55%). Month of birth did not significantly affect ($P > 0.05$) LWG of the calves, but the heart girth of calves born early (May) did increase at a slower rate ($P < 0.05$) than calves born late (August) (10 mm/day *versus* 27 mm/day). LWG of supplemented calves was faster ($P < 0.05$) in herds of 10 or less cow-calf pairs (220 g/day) than in herds of more than 10 cow-calf pairs (160 g/day). Altitude affected LWG ($P < 0.05$) of supplemented calves; gains were 170, 210 and 280 g/day for the three districts with altitudes of 1–100, 400 and 800 m, respectively. Implications of the factors affecting response to supplementation are discussed.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 493-496

Survey of beef cattle producers to better understand factors influencing cattle movements from an exotic disease modelling perspective *

T. Dyall , D. J. Miron , G. E. Donald and M. G. Garner

Abstract. In late 2008 a survey of beef cattle producers was undertaken to gain a clearer picture of how, why and when producers buy, sell, and move cattle, provide an insight into what influences on-farm decision making and to assist in the development of a simulation model for (modelling) cattle movements. The survey was targeted at beef producers in central and southern inland Queensland and north-western New South Wales.

The survey was part of a project funded by the Federal Department of Agriculture, Fisheries and Forestry. The project focussed on utilising animal movement data from the National Livestock Identification System for 2006 and 2007 in the development of a national-scale spatial simulation model that would be used by national and state animal health agencies as a decision-support tool to assess and manage emerging animal disease threats.

Major highlights arising from the study were that over half of the respondents were beef-only enterprises, with the remainder mixed enterprises (sheep and or cropping), and were predominantly in the breeding and growing production sector. The number of cattle movements, for farms having greater than 50 head, was not related to herd size. The most common movements other than buying or selling cattle were to a property owned by the producer close by (32%) or between properties for agistment (20%). Most types of cattle (cows, bulls, steers, etc) were sold within a few hundred kilometres of the property. The two main factors influencing when to sell cattle were reaching a target weight or matching a buyer/processor's specification. Pasture availability, current prices and availability of suitable stock were also important factors.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 497-502

Mastitis in beef cows and the effects of supplemental β-carotene on milk parameters *

D. H. Whiteman , N. W. Tomkins , R. J. Young , I. Immig , G. Weber and R. Elliott

Abstract. Belmont red and Brahman cows (n = 50) were allocated to one of two groups to determine if β-carotene supplementation could reduce the incidence of mastitis and consequently improve calf productivity from birth to weaning. Both groups received a molasses-based supplement *ad libitum*; the treatment group supplement was fortified with ROVIMIX® β-carotene and ROVIMIX® E50 whereas the control group were provided access to the molasses supplement only. Blood samples were collected from cows pre and post calving and from calves when 84 ± 0.4 days old to measure plasma β-carotene concentration (PCC). Milk samples were collected 7 and 84 days post calving and at weaning and analysed for somatic cell count (SCC) and composition. Supplementation had no significant (P > 0.05) effect on SCC, calf PCC, calf LW gain and LW at weaning. Supplemented cows had significantly (P < 0.05) higher PCC compared with unsupplemented cows (4.9 ± 0.36 *v.* 3.9 ± 0.24 mg/L, respectively) at weaning. Cows commenced the study in an above-average condition, and combined with unseasonal green forage it is concluded that β-carotene supplementation has no effect on mastitis or calf weaning weight.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 503-507.

Influence of end-grazing forage residual and grazing management on lamb growth performance and crop yield from irrigated dual-purpose winter wheat *

D. R. Miller, G. J. Dean and P. D. Ball

Abstract. The effects of end-grazing forage residual and continuous *v*. rotational grazing systems on prime lamb performance, grain yield and quality were examined in an irrigated dual-purpose winter wheat (cv. Mackellar) crop in Tasmania. The design was a two end-grazing residual (400 and 800 kg/ha of dry matter (DM) at Zadoks Growth Stage 30, Low and High respectively, 0.2 ha plots) × two grazing system (continuously, or rotationally grazed in four subplots) factorial, replicated three times. Mixed-sex, second-cross lambs [37 kg liveweight (LW), 2.5 body condition score, 45 kg DM/head initial feed allowance] grazed for a total of 46 days before removal. Initial feed availability was 1875 kg DM/ha, with final residuals of 520 ± 57 and 940 ± 70 kg DM/ha for the Low and High treatments respectively. Particularly for the Low residual, *in vitro* DM digestibility and crude protein at stem elongation were reduced ($P < 0.05$) by rotational compared with continuous grazing. The weekly lamb growth rate (g/day) during the first 5 weeks of grazing was linearly related to average weekly available DM in kg/ha (GR = 0.35 ± 0.041 × DM – 194 ± 49.0, $P < 0.01$, $R^2 = 0.56$). Total LW produced (336 ± 11.7 kg/ha), and grain yield (6.9 ± 0.21 t/ha), protein (11.4%), screenings <2.2 mm (10.9%) and 100 grain weights (3.82 g DM) were not different between treatments. There were no advantages of rotational grazing compared with continuous grazing. Irrigated dual-purpose winter wheat can be continuously grazed by lambs up to a 500 kg DM/ha residual at stem elongation without compromising total LW produced, grain yields or grain quality.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 508-512.

Can a herb and white clover mix improve the performance of multiple-bearing ewes and their lambs to weaning? *

P. R. Kenyon , P. D. Kemp , K. J. Stafford , D. M. West and S. T. Morris

Abstract. The productive performance of highly fecund ewes and their progeny on ryegrass-based swards is limited in late pregnancy and lactation. Alternative herbages, such as chicory, plantain and red and white clover, have the potential to improve performance levels. In the present study, 49 twin- and 42 triplet-bearing Romney composite ewes bred to either Suffolk or Romney rams were allocated to one of three nutritional treatments from Day 131 of pregnancy [19 twin ewes on a ryegrass–white clover sward mix (Rye/WC); 16 twin ewes on a plantain–ryegrass sward mix (Plant/Rye); 14 twin ewes on a chicory–plantain–red and white clover sward mix (Herb); 13 triplet ewes on Rye/WC; 16 triplet ewes on Plant/Rye; and 13 triplet ewes on Herb] and remained on these sward treatments with their lambs until 75 days after the midpoint of the lambing period (L75). Nutritional treatment had no effect ($P > 0.05$) on ewe liveweight, body condition score (BCS) or non-esterified fatty acid and β-hydroxybutyrate concentrations on Day 145 of pregnancy. At L75, ewes on the Herb treatment sward were heavier than ewes on Plant/Rye (70.75 ± 1.31 *v.* 61.43 ± 1.28 kg, respectively) and had a higher BCS than ewes on either Plant/Rye or Rye/WC (2.7 ± 0.1, 2.2 greater ($P <$ ± 0.1 and 2.3 ± 0.1, respectively). Sire type and nutritional treatment had no affect ($P > 0.05$) on lamb birthweight or weight at L75. At L20, lambs born to ewes on the Herb sward treatment were heavier than those on the Rye/WC and Plant/Rye treatments (8.74 ± 0.23 *v.* 7.98 ± 0.23 and 7.79 ± 0.22 kg, respectively; $P < 0.05$). Neither birth rank, sire type nor ewe treatment had any effect ($P > 0.05$) on maximum heat production on a per kg liveweight basis or total heat production. Romney-sired lambs on the Herb sward treatment had higher ($P < 0.05$) survival rates than those on the Rye/WC sward treatment (97.8% *v.* 61.7%, respectively). However, no such relationship was observed in lambs born to Suffolk sires (79.8% *v.* 84.8%, respectively). The survival response resulted in 0.05) total liveweight of Romney-sired lambs at L75 per ewe on the Herb nutritional treatment than on the Rye/WC treatment (61.6 ± 5.0 *v.* 36.7 ± 4.6 kg, respectively) a relationship not observed ($P > 0.05$) in Suffolk-sired lambs. In conclusion, the present study indicates that there is the potential to improve the productive performance of multiple-bearing ewes and their lambs by grazing on a Herb sward mix.*

* From full paper which is published in *Animal Production Science,* 2010, **50**, 513-521

Does the physiological status of lambs within a twin- and triplet-born litter differ during the first 12 hours of life? *

J. I. Kerslake , P. R. Kenyon , K. J. Stafford , S. T. Morris and P. C. H. Morel

Abstract. This study examined the physical and physiological differences from birth until 12 h of age within twin- and triplet-born litters. In 2005 and 2006, the parturition of 75 twin- and 62 triplet-bearing Romney ewes were observed. After parturition lamb blood samples were taken within 5 min of birth and rectal temperature was measured within 5 min of birth and at 1, 3, 6 and 12 h post-birth. Lamb birth weight, crown–rump length and thoracic-girth circumference were measured at 3 h of age. Lamb birth weight, plasma glucose, fructose, lactate, thyroxine and tri-iodothyronine did not differ ($P > 0.05$) between the heaviest-twin-born, lightest-twin-born and heaviest-triplet-born lamb. The lightest-triplet-born lambs, however, had lighter ($P < 0.001$) birthweights, greater ($P < 0.001$) surface-area-to-birth weight ratio, lower ($P < 0.05$) rectal temperatures, greater ($P < 0.1$) lactate concentrations and lower ($P < 0.1$) plasma thyroid hormone concentrations. These characteristics are known to have a negative impact on the ability of the lamb to maintain its body temperature after birth and may therefore provide some evidence as to why triplet-born lambs display a greater mortality rate than twin-born lambs, and why the lightest-triplet-born lambs have the greatest mortality rate within a litter.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 522-527.

Response of additional ewe lamb liveweight during gestation on birth and weaning weight of offspring and liveweight of the ewe lamb at weaning *

N. M. Schreurs , P. R. Kenyon , F. J. Mulvaney , P. C. H. Morel , D. M. West and S. T. Morris

Abstract. Increasing the liveweight of ewe lambs during gestation may have positive effects on lamb birthweight and weaning weight and also on ewe lamb liveweight at weaning. Specific times during the gestation period of the ewe lamb may be more responsive to improved nutrition and increases in liveweight. The objective of this work was to use a meta-analytic approach to investigate the effects of ewe lamb liveweight at mating and during pregnancy on lamb birth and weaning weights, and the ewe lamb's liveweight at weaning. Increasing ewe lamb liveweight in early gestation and in particular before mating gave the greatest increases in the birth and weaning weight of the lambs, and also of the ewe lamb's liveweight at weaning compared with increasing liveweight in the second and third trimester of gestation. This indicates that management practices for ewe lambs that generate higher liveweight at mating are likely to result in increased lamb survival, higher weaning percentages, greater lamb weaning weights and create rising 2-year-old ewes with better liveweight for mating in the subsequent season. Compared with ewe lambs that gave birth and reared singletons to weaning, those ewe lambs that gave birth to twins and reared twins had greater increases in lamb birthweights, lamb weaning weights and ewe lamb weights at weaning for each extra kilogram of ewe lamb liveweight during gestation. For ewe lambs, especially those that birth and rear twins, management options that increase the pre-mating weights will have the greatest response in lamb birthweight, weaning weight and liveweight of the ewe lamb itself at weaning.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 528-532

Management of young goats during prolonged fasting affects carcass characteristics but not pre-slaughter liveweight or cortisol *

P. L. Greenwood , J. A. Finn , T. J. May and P. J. Nicholls

Abstract. Effects of pre-slaughter management (72 h continual fasting; 24 h feeding within 72 h fasting; 24 h feeding plus 6 h additional transport within 72 h fasting) and of water availability, gender, weaning 3 weeks before slaughter, initial liveweight (LW) and body condition score (CS) on LW, plasma cortisol and carcass characteristics were studied in young goats. The goats (n = 229) were ~16 weeks of age, with a mean ± s.d. LW of 13.7 ± 2.4 kg. Pre-slaughter treatment did not significantly affect LW or carcass weight at slaughter, but goats fed within the fasting period had lighter-coloured meat compared with the continually fasted goats and the goats fed and transported during the fasting period. Interactions between fasting treatment and gender were evident for hot carcass weight (HCW), retail yield (kg) and dress (% pre-fasting LW). Fasting treatment also interacted with water availability for HCW and with weaning status for GR (12th rib, 110 mm from mid-line) tissue depth. Interactions were evident between gender and water availability for LW at slaughter, and between gender and weaning status for retail yield (% HCW). Weaning status interacted with pre-fasting LW to influence LW at slaughter, and fasting treatment interacted with pre-fasting body CS to influence dress (% pre-slaughter LW). The effects of gender, weaning status, water availability, initial LW and CS on the pre-slaughter LW and carcass characteristics were generally consistent with our previous findings on time off feed. The results show benefits of providing high-quality feed and water and of minimising transport of goat kids during prolonged pre-slaughter fasting. They provide additional information for estimation of carcass characteristics of young goats to be marketed for meat and to aid in the further development of welfare standards for goats. Further research on interactions between gender and pre-slaughter management factors that influence goat carcass characteristics and meat quality is warranted.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 533-540

Training Merino sheep to respond to visual and auditory cues *

Donnalee B. Taylor , Wendy Y. Brown , Ian R. Price and Geoff N. Hinch

Abstract. The feasibility of training sheep to approach a stimulus was investigated in three experimental groups and a control group of fine wool Merino sheep (n = 11 in each group). The experimental groups (n = 11) were trained to approach either a visual (V), auditory (A), or visual + auditory (V+A) stimulus over eight training sessions and were subsequently tested in a T-maze for memory retention on six occasions over a 4-month period. Four testing occasions were spaced at greater than 30 days apart while two were less than 3 days apart. Sheep learned to approach the cues during the training period and the tests indicated that the sheep retained memory of the cues for over 130 days without reinforcement. The controls received no contingency exposure and made no choice in the T-maze test. The proportion of correct stimulus choices (±s.e.m.) in the T-maze averaged over the four longer-spaced testing occasions were V 0.61 (0.06), A 0.50 (0.11), V+A 0.77 (0.04). These differences approached significance (P = 0.058). Sheep trained to the V+A stimulus performed significantly (P < 0.05) better in the T-maze than sheep trained to the A stimulus alone. Comparisons over the shorter-spaced testing durations indicated that the sheep quickly learnt not to approach the stimulus (temporary extinction) when no food reward was available. Individual temperament of the animals was not related to their learning. This study highlights the potential for the use of V and A cues in manipulating the movement of sheep which may be useful for farm management purposes.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 541-545.

Odour emissions from tunnel-ventilated broiler sheds: case study of nine Queensland farms*

Mark Dunlop, Erin Gallagher and Jae Ho Sohn

Abstract. Odour emission rates were measured from nine tunnel-ventilated broiler farms in south-eastern Queensland, Australia. At one farm, odour emission rates were measured over two sequential batches approximately weekly, while at the remaining farms, odour emission rates were measured just before the first pickup (around Day 35 of the batch) when bird liveweight was greatest and peak odour emission rates were expected. Odour samples were analysed using dynamic olfactometry (to AS/NZS 4323.3:2001), and an artificial olfaction system was used to continuously monitor odour emission rates at one farm. Odour emission rates ranged from 330 to 2960 ou/s per 1000 birds and from 0.19 to 2.12 ou/s.kg, with a significant amount of variability observed throughout the batch and throughout each sampling day. While the wide range in odour emission rates was primarily due to changes in bird liveweight and ventilation requirements, other factors were also involved. The artificial olfaction system proved useful for quantifying the range and variability of odour emission rates, especially when olfactometry analysis was impractical.

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Dust emissions from a tunnel-ventilated broiler poultry shed with fresh and partially reused litter *

Robin L. Modini , Victoria Agranovski , N. K. Meyer , Erin Gallagher, Mark Dunlop and Zoran D. Ristovski

Abstract. Dust emissions from large-scale, tunnel-ventilated poultry sheds could have negative health and environmental impacts. Despite this fact, the literature concerning dust emissions from tunnel-ventilated poultry sheds in Australia and overseas is relatively scarce. Dust measurements were conducted during two consecutive production cycles at a single broiler shed on a poultry farm near Ipswich, Queensland. Fresh litter was employed during the first cycle and partially reused litter was employed during the second cycle. This provided an opportunity to study the effect that partial litter reuse has on dust emissions. Dust levels were characterised by the number concentration of suspended particles having a diameter between 0.5 and 20 μm and by the mass concentration of dust particles of less than 10 μm diameter (PM_{10}) and 2.5 μm diameter ($PM_{2.5}$). In addition, we measured the number size distributions of dust particles. The average concentration and emission rate of dust was higher when partially reused litter was used in the shed than when fresh litter was used. In addition, we found that dust particles emitted from the shed with partially reused litter were finer than the particles emitted with fresh litter. Although the change in litter properties is certainly contributing to this observed variability, other factors such as ventilation rate and litter moisture content are also likely to be involved.

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Behavioural and physiological responses of laying hens to humans *

L. E. Edwards, N. A. Botheras, G. J. Coleman and P. H. Hemsworth

Abstract. Human interactions, particularly negative ones, affect the behaviour and physiology of laying hens, with possible implications for bird productivity and welfare. The present experiment investigated the effects of handling on the behaviour and plasma corticosterone concentrations of laying hens. A 2 × 2 × 3 factorial design was used to study the following three main effects: human contact during rearing [an additional 12 min of human contact per day (AC) or no additional contact (MC) during rearing]; handling quality in adulthood [brief daily exposure to positive (+ve) or negative (–ve) visual contact with a human]; and handling proximity in adulthood [handling-quality treatment (+ve or –ve) imposed at the following three distances from the birds: Near, 0–45 cm; Middle, 45–75 cm, or Far, 75–105 cm]. AC during rearing resulted in reduced avoidance behaviour of humans during adulthood, whereas handling imposed at the Far level resulted in greater avoidance behaviour than did handling at the Near or Middle level. The quality of the handling (+ve or –ve) had little effect on avoidance behaviour; however, there was a trend ($P = 0.07$) for hens receiving +ve handling to have a lower corticosterone response to human contact than those receiving –ve handling. These results demonstrate that visual human contact can influence the avoidance behaviour of laying hens.

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Effects of sowing rate and grazing management of forage rape (*Brassica napus*) on grazing behaviour and utilisation by dairy cattle *

E. P. Stefanski , S. C. Garcia , S. R. Farina , D. K. Y. Tan and D. Tanner

Abstract .The increase in total factor productivity in the Australian dairy industry over the last 10 years has been low (1.5%). To help address this issue, 'FutureDairy' is aiming to increase the production of home-grown feed currently achieved from pastures using a complementary forage-rotation (CFR) system. Forage rape (*Brassica napus*) is a key component of the CFR; however, it is a complex crop to manage and feed, and the interactions between the behaviour and grazing habits of dairy cattle are unknown. The present experiment investigated the effect of the sowing rate and grazing management of forage rape on the grazing behaviour and forage utilisation of lactating dairy cattle. A field experiment was established, with a forage rape crop planted at three different sowing rates of 2, 3.5 and 5 kg/ha. The crop was grazed using either a 'multiple grazing' system, where the forage rape was strip-grazed in a manner to promote regrowth to allow for regrazing, or a 'take-all grazing' system, where the forage rape was grazed once only after reaching maximum biomass. The grazing preferences of cows for the sowing rates during the grazing sessions were visually observed and recorded, and forage utilisation was determined from pre-grazing and post-grazing forage availability. Nitrogen (N) deposition from excreta was estimated using stocking density and time spent. Cattle preferred grazing the forage rape sown at 2 kg/ha, but this preference did not result in higher forage utilisation. Grazing method had no effect on forage utilisation or N deposition. Cows should be removed after ~80 min of grazing in a multiple grazing system to ensure future regrowth. Further work is necessary to fully investigate the effects of grazing method on forage utilisation and N deposition, and more accurate external devices and internal markers should be used in the future to provide better estimates of forage utilisation.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 560-567

Fibre production by beef cows *

B. A. McGregor and J. F. Graham

Abstract. Cattle grow and shed fibre which assists them adapt to seasonal changes in the environment. In the absence of cattle fibre production data for southern Australia, Angus, Hereford, Simmental and Limousin cows and crosses between these breeds grazing perennial pastures at Hamilton, Victoria were sampled in late winter. The fibre-growing area on the sides of cattle was measured, fibre sampled at the mid-side site and the sampling area determined. Fibre was tested for fibre diameter distribution, clean washing yield and fibre length measured. Cows were 3–7 years of age, liveweights were 412–712 kg and the mean fibre-growing area was 2.2 m^2. This produced an average 682 g of total fibre (range 346–1175 g). The mean fibre diameter of all fibres was 51.7 μm (range 43–62 μm) and 18% of fibres were <36 μm (range 6–39%). The clean washing yield was 92.4% (range 87.4–95.8%). Fibre length averaged 21 mm. Increasing the age, liveweight and condition score of cows and increasing weight of clean fibre were associated with significant increases in mean fibre diameter. Breed of cattle did not affect fibre production ($P > 0.1$) but did affect mean fibre diameter ($P < 0.05$). The quantity of fibre production indicates potential for low value textile production. The high level of total fibre production, twice that of an earlier report, and fibre shedding from cattle suggests that white fibre-producing animals such as Merino sheep, Angora and cashmere goats and alpaca should avoid using cattle-handling facilities, particularly in the month before shearing.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 568-572

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Gross margins in Australian mohair enterprises and relationships with farm inputs, productivity and mohair quality *

B. A. McGregor and W. D. English

Abstract. In the absence of financial information on Australian mohair enterprises we aimed to determine the gross margins (per dry sheep equivalent, DSE) and their relationships with farm inputs, productivity and mohair quality in Australian mohair enterprises. Using established Victorian Farm and Sheep Monitor Project protocols we collected data for the financial years 2004–05, 2005–06 and 2006–07 from farmers in south-eastern Australia and made comparisons with data from wool enterprises of similar farm area. Over 3 years the financial returns from mohair exceeded that from wool in terms of $/DSE ($23.0 *v*. 11.3) and $/ha ($132 *v*. $116). This result was achieved despite the mohair enterprises grazing their goats far less intensively compared with the grazing intensity of sheep (5.9 *v*. 10.3–11.1 DSE/ha) and by using far less phosphate fertiliser than used in the wool enterprises (2.2 *v*. 4.6–6.1 kg P/ha). These differences were counterbalanced by higher prices for mohair compared with fine wool ($13.15/kg *v*. $8.35/kg clean fibre). Gross margin for the mohair enterprise did not increase as stocking rate increased. Income from mohair sales declined as the proportion of does in the flock increased. Increasing the proportion of does in the flock was associated with a decline in the average price of mohair ($16/kg greasy at 42% does to $8/kg greasy at 83% does in the flock). This decline was closely associated with the increasing proportion of the total amount of mohair coarser than 34.0 μm (either fine hair or hair) plus stained mohair. The variation in profitability between farms indicates significant scope for many mohair enterprises to increase profit. A focus on producing finer quality mohair will increase mohair profitability.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 573-580

Relationship of weaning weight to the mature liveweight of cashmere does on Australian farms*

B. A. McGregor and K. L. Butler

Abstract. Median weaning weight and its relationship with the median mature liveweight of does was quantified for four commercial Australian cashmere farms in various parts of Australia. Individual liveweights, of does of all ages at the time of weaning in December, ranged from 9 to 61 kg. Individual farm means of adult does (>1 year old) ranged from 24.6 to 38.8 kg. The model for the logarithm of liveweight was: $\log_{10}(\text{liveweight}) = a + br^{(\text{Age} + 0.6)}$; where a, b and r are parameters that are different for each farm. The result that the r parameter differs with farm was statistically significant ($P = 9.4 \times 10^{-6}$). The percentage variance accounted for was 84.4% and the residual standard deviation was 0.042. Farms differed greatly in the median mature liveweight with some farms reaching ~44 kg and others only 31 kg. Median weaning weight was 14.1 kg (range 11.4–16.8 kg). Median weaning weight as a percentage of median mature doe liveweight on a particular farm varied from 32 to 42%. These weaning weights appear low in absolute and relative terms and thus are likely to incur production penalties.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 581-584

Measurement of light penetration through a simulated Merino fleece *

A. L. King and K. R. Millington

Abstract. The degree of light penetration along the length of the fibre of a simulated Merino fleece was measured using a fibre optic probe to investigate the relationship between light exposure and photodamage to the wool fibre. The percentage of the total direct sunlight that reached the base of the 100-mm long, simulated, closed Merino fleece was ~1% and the section of the fibre from the root to 60 mm from the root was protected from exposure. The light intensity at the base of the fibre was increased to 2% when the density of the simulated fleece was halved. Wool was scoured and the yellowness and intensity of methylene blue staining was measured to estimate the extent of damage to wool staples.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 585-588

Measuring colour and photostability of small fleece wool samples *

K. R. Millington and A. L. King

Abstract. A convenient method for measuring the clean colour (Y and Y-Z) and photostability Δ(Y-Z) of small samples of fleece wool (0.5 g) is described. Scoured wool samples are compressed to a constant density in disposable polymethyl methacrylate spectrophotometer cells and the wool colour is measured using a standard textile laboratory reflectance spectrophotometer. Packing scoured wool into cells ensures that the irradiated fibre surface is robust and individual fibres are unable to move relative to one another during irradiation and measurement. A UVB (280–320 nm) source was used to ensure all samples regardless of initial yellowness were yellowed following exposure and photobleaching was avoided. An apparatus capable of irradiating up to 48 scoured wool samples in one batch is described. The precision of photostability measurements was assessed and the relative error in Δ(Y-Z) was 5.7%. An initial study on 75 fleece wool samples with a high range of initial yellowness showed a moderate linear correlation ($R^2 = 0.68$) between initial yellowness and Δ(Y-Z).

* From full paper which is published in *Animal Production Science,* 2010, **50**, 589-592

Influence of grain supplements during winter on liveweight, mohair growth and mohair quality of weaner Angora goats *

B. A. McGregor , R. Harris and G. Denney

Abstract. To identify methods to improve growth and mohair production of weaned Angora goats (mean liveweight 18–20 kg) during their first winter, two supplementary feeding experiments using whole-grain barley and lupins were conducted on a farm in southern New South Wales, in a region where weaner illthrift had been reported. Experiment 1 was a 2 × 2 + 1 factorial with 16 replicate goats; two feeding levels (115 or 230 g/day of whole-barley grain) × two periods of feeding (4 or 8 weeks) + Control (grazing only). Experiment 2 had five treatments × 13 replicate goats; three treatments fed 230 g/day of whole-barley grain for periods of 2 or 3 months and two treatments fed a 50 : 50 mixture of lupin and barley grain at 350 g/day for 2 or 4 months. Goats were individually fed and then all returned together for grazing. There were no effects of feeding in Experiment 1 and variations of feeding 230 g/day of barley in Experiment 2 provided no benefit. Feeding lupin/barley for 4 months increased liveweight (gain 59 g/day), mohair production, mohair fibre diameter and the incidence of medullated fibre. About 25% of this ration was not eaten by eight goats, reducing treatment average intake to 295 g/day. By the end of spring, there was no difference in treatment liveweights. Regression constants indicated that for each 1 μm increase in mean fibre diameter, greasy fleece weight increased 35 g and for each 1 kg increase in pre-shearing liveweight, greasy fleece weight increased 26 g. The results show that Angora weaner goats can grow during winter, provided their energy and protein needs for growth are met. Improved pasture management and higher levels of supplementary feeding to weaned Angoras are indicated compared with current practices on farms in Australia.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 593-598

Breech bareness reduces flystrike in New Zealand crossbred sheep*

D. R. Scobie and D. O'Connell

Abstract. Two experiments on the effect of breech bareness on flystrike are reported here. Sires from commercial sources (n = 2) and from a mixed breed flock selected for breech bareness (n = 5) were mated to ewes from the same flock and Romney ewes. Lambs (n = 211) were run as one mob from docking to weaning. Within 2 days before weaning, flystrike affected several lambs. At weaning the lambs were inspected for breech bareness score and dag score. Flystruck lambs were recorded, treated and removed at weaning. The remaining lambs (n = 185) were regularly inspected and treated for flystrike, and the incidence of flystrike was recorded again 1 month later. There were no significant differences between sire groups, but the progeny of Romney dams were more likely to be flystruck (18.7 vs 3.4% and 24 vs 3.7%) on both occasions ($P < 0.05$). Flystrike increased with increasing dag score ($P < 0.001$) but dag score decreased with increasing breech bareness ($P < 0.001$).

The ewe progeny (n = 800) of 17 Romney sires were run as one flock following weaning on a commercial farm in the North Island of New Zealand. The lambs were inspected for breech bareness, dag score and the incidence of flystrike following a brief period of fly challenge. As breech bareness score increased, dag score declined ($P < 0.001$) with a significant effect of sire on dag score ($P < 0.001$). Breech bareness had a significant influence on the proportion of lambs with flystrike ($P = 0.028$), most likely through dag score which explained a greater proportion of variation in flystrike in multiple linear regression ($P < 0.001$). Selection against dags in New Zealand crossbred sheep could lower flystrike risk, but selection for increasing breech bareness will reduce both dagginess and flystrike risk.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 599-602

Shearing Merino ewes at different stages of pregnancy: effects on fleece characteristics of progeny *

E. H. van Reenen , P. R. Kenyon , R. G. Sherlock , R. E. Hickson and S. T. Morris

Abstract. Shearing strong-wool ewes at different stages of pregnancy has been shown to influence the follicle population of the offspring which may result in a finer, heavier fleece. The aim of this study was to investigate the effect of shearing time of Merino ewes on the liveweight, fleece characteristics and follicle population of their progeny.

Pregnant Merino ewes were allocated to one of three shearing times; mid-pregnancy (d106; 106 days from the introduction of the ram), late-pregnancy (d141) and post-lambing (d191). A skin biopsy was taken from the mid-side of 128 lambs at d359 (~7 months of age) and analysed for primary and secondary follicle density. Mid-side wool samples were collected at d359, d499 and d716. Samples from d359 and d716 were analysed for washing yield, colour and fibre diameter. Greasy fleece weight was measured on d499 and a mid-side sample was taken to measure staple length and staple strength.

Shearing time of Merino ewes had no effect on lamb liveweight at any stage of the experiment. Lambs born to ewes shorn during pregnancy had a lesser ($P < 0.05$) follicle density, secondary follicle density, follicle number index (FNI) and secondary FNI than those born to ewes shorn post-lambing. However, there was no effect ($P > 0.05$) of dam shearing treatment on fleece characteristics of progeny. The results indicate that, under the conditions of this study shearing Merino ewes in mid-to-late pregnancy did not alter the fleece characteristics of their progeny.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 603-607

Influence of dag score and breech wrinkle score on the time taken to crutch unmulesed Merino sheep *

J. E. Smith , R. G. Woodgate , C. A. Curnow and D. L. Michael

Abstract. This study used 393 ewe and 377 wether unmulesed Merino sheep to investigate the relationship between breech wrinkle score, dag score and the time required to crutch Merino sheep. Dag score and breech wrinkle score both significantly affected the time taken to crutch individual sheep ($P < 0.001$ for both). The mean crutching time of the ewe mob was significantly greater than that of the wether mob ($P < 0.001$), with factors other than breech wrinkle score and dag score accounting for approximately half of this difference. The potential of anthelmintic treatments to reduce overall dag formation was also highlighted.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 608-610.

Using MODIS imagery, climate and soil data to estimate pasture growth rates on farms in the south-west of Western Australia*

G. E. Donald, S. G. Gherardi , A.Edirisinghe , S. P. Gittins , D. A. Henry and G. Mata

Abstract. Remote sensing of vegetation and its monitoring using the normalised difference vegetation index (NDVI) offers the opportunity to provide a coverage of agricultural land at a large scale. The availability of MODIS NDVI at a resolution of 250 m provided the opportunity to evaluate the hypothesis that pasture growth rate (PGR) of individual paddocks can be accurately predicted using a model based on MODIS NDVI in combination with climate and soil data and a light-use efficiency model. Model estimates of PGR were compared with field measurements of PGR recorded in grazing enclosure cages collected over 3 years from six farms located across the south-west region of Western Australia. The estimates attained from the model explained 70% of the variation in PGR for individual paddocks on farms over the 3 years of the study, with an average error at the paddock scale of 10.4 kg DM/ha.day over all growing seasons and years. Across all farms studied, there was generally good agreement between satellite-derived PGR and ground-based measurements, although estimates of PGR varied between years and farms. The model explained 47% of the variation in pasture growth early in the season (from break of season to end of July), compared with 62% late in the season (from August to pasture senescence). The present study demonstrated that PGR for individual paddocks can be predicted at weekly intervals from MODIS imagery, climate and soil data and a light-use efficiency model at an accuracy sufficient to facilitate on-farm pasture and livestock management.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 611-615

Global navigation satellite system livestock tracking: system development and data interpretation*

M. G. Trotter , D. W. Lamb , G. N. Hinch and C. N. Guppy

Abstract. The use of global satellite navigation system tracking as a research tool for monitoring livestock activity is increasing. Commercial systems are being developed for the livestock industry. This paper reports on the development of a low-cost, store-on-board Global Positioning System collar suitable for large-scale deployment in livestock herds. A robust collar design that avoids the necessity of external cables has been designed and was tested on beef cattle in western New South Wales. Configured for alternating wake and sleep modes to conserve battery life, the collars obtained a positional fix on 99.9% of attempts. Numerous alternatives for presenting extracted data, based on average diurnal activity, mean daily velocity, Livestock Residence Index and dry sheep equivalent maps are introduced and discussed.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 616-623

Urine distribution and grazing behaviour of female sheep and cattle grazing a steep New Zealand hill pasture *

Keith Betteridge , Des Costall , Sophie Balladur , Martin Upsdell and Kazuhiro Umemura

Abstract. Much of the nitrogen (N) excreted by grazing animals is within highly concentrated urine patches. The N that is not used by plants is likely to be lost through leaching, emitted as N gases or added to the soil organic N pool. The present study used custom-made global positioning system (GPS) and urine sensors on 20 non-lactating ewes and 20 non-lactating beef heifers grazing steep hill country to determine potential critical source areas for N loss to the environment. Bite counters on four sheep and five heifers showed when and where animals were eating. Animals were monitored simultaneously on 0.5 ha adjacent paddocks over 8 days. Sheep and cows urinated a mean (±s.d.) of 21.2 ± 6.1 and 9.0 ± 3.0 times/day, respectively. Eating started soon after sunrise and increased during the day to reach a maximum in the hour before sunset, after which the eating activity of both species was near zero for most of the night, except for a short feeding period at around 0300 hours. The urination frequency of sheep increased as eating activity increased during the day, but this relationship was not seen in heifers. Land classified as easy hill country (≤12°) comprised 31% of the sheep paddock and contained 23% of the urination events. In contrast, although the easy hill country comprised 33% of the cattle paddock, 46% of the urine patches were in this area. Although aerial application of N mitigation products to whole paddocks or farms is uneconomic, the results of the present study suggest that mitigation products could possibly be cost-effectively targeted to easy contoured, cattle-grazed hill country areas accessible by farm vehicle.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 624-629.

Can rumen methane production be predicted from volatile fatty acid concentrations?*

D. L. Robinson , J. Goopy and R. S. Hegarty

Abstract. Rumen cannulated sheep (n = 12) were tested at each of three feeding levels: 0.8, 1.24 and 1.6 times maintenance. The ration (lucerne chaff) was provided in eight equal portions to emulate morning and afternoon grazing. After at least 10 days adaptation to each feeding level, methane production was measured in an open circuit calorimeter for 22 h using the same feeding regime. During measurement, 10 rumen samples were taken for volatile fatty acid (VFA) analysis by an indwelling rumen probe with a sampling tube that passed outside the calorimeter. Feed intake was strongly correlated with daily methane production (DMP, r = 0.87). Both methane production and VFA concentrations showed bimodal patterns related to the feeding cycle, but feed intake had a much smaller effect on VFA concentrations than on methane production rate. Average VFA concentration was a poor predictor of DMP. The best predictor, propionate concentration, explained 26% of the variance in DMP. The weakness of the association between VFA concentrations and methane production could be a consequence of differences in rumen volume and differences in VFA absorption associated with feeding level, although the possibility of accumulation of alternate fermentation end products or re-fermentation of VFA cannot be excluded. It is concluded that none of the suite of VFA parameters assessed offers a useful tool to predict daily methane production in grazing sheep.

* From full paper which is published in *Animal Production Science,* 2010, **50**, 630-636.