Dairy RESEARCH REVIEW™

Making Education Easy

Issue 27 – 2021

In this issue:

NEW ZEALAND VETERINARY NURSING ASSOCIATION

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Welcome to the latest issue of Dairy Research Review.

Research into the financial aspects of dairy farming commences this issue. First up is a study of the economics of implementing selective dry cow therapy. This is followed by companion cost analyses that estimate the cost of mastitis and then the cost of lameness on production and economic indicators in dairy cows. Also featured are an investigation of how fodder beet supplementation affects digestion and grazing behaviour in early-lactation dairy cows and a "must read" review of how immune activation influences transition-cow health and performance. Concluding this issue are the findings of two surveys, one reporting leptospiral vaccination practices on NZ dairy farms relative to best-practice guidelines and the other reporting the practices and opinions of NZ veterinarians regarding control of bovine viral diarrhoea.

We hope that the research presented in this issue of **Dairy Research Review** helps to inform your daily practice. We value your input so please keep sending us your comments and feedback.

Kind regards

Hamish Newton

hamishnewton@animalhealthreview.co.nz

Research Review thanks AgriHealth for their sponsorship of this publication, and their support for ongoing education for animal health professionals.

Antibiotic use and potential economic impact of implementing selective dry cow therapy in large US dairies

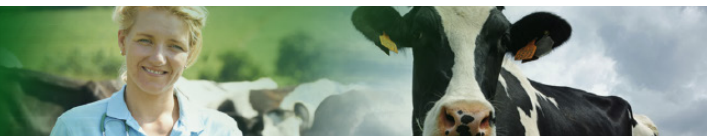
Authors: Hommels NMC et al.

Summary: These researchers evaluated the economic feasibility of implementing selective dry cow therapy (SDCT) in large herds in the US and estimated the potential reduction in antibiotic use around the dry period if SDCT management was adopted. The results indicate that it is economically feasible to implement SDCT in large herds and it may be possible to reduce the use of antibiotics around the dry period by 29% in a conservative scenario. The largest reduction in the use of antibiotics when applying SDCT is likely to be in primiparous cows.

Comment: I suspect we are all very comfortable talking about the use of SDCT but it seems the Americans are not so keen on the concept. This study modelled the economics effects of implementing SDCT on large US dairy herds and its impact of total antibiotic use in cows. The modelling done here showed that using SDCT had minimal economic benefit but would result in less usage of antibiotics with no negative economic consequences. The modelling technique used allowed the model to choose what cows got antibiotics to minimise the costs of mastitis (clinical and subclinical) in the following lactation, and the cost of antibiotic used at drying off. Because the cost of mastitis changes with milk price (74% of the cost of clinical mastitis was milk loss), the optimal proportion of cows to receive antibiotics at dry off will increase as milk price increases with this approach. Likewise, if the cost of dry cow therapy antibiotics increased (or teat sealants got cheaper) the model would suggest less antibiotic use would be optimal. The models showed that as the percentage of cows getting antibiotics at dry off reduced the incidence of mastitis increased. The modelling done here suggests, for what they consider a representative large dairy herd in the US with >500 cows, antibiotic use at dry off could be reduced by around 29% with no economic cost.

Reference: J Dairy Sci. 2021;104(8):8931–8946

Abstract



The hidden cost of disease: I. Impact of the first incidence of mastitis on production and economic indicators of primiparous dairy cows

Authors: Puerto MA et al.

Summary: The objectives of this cost analysis were: (i) to quantify the impact of the first instance of mastitis, at different stages of lactation, on production and economic performance; and (ii) to quantify the impact of the first instance of mastitis when only cows that remain in the herd for at least 100 days in milk (DIM) and those that remain for 305 DIM are included in the analysis. The key findings were that failure to include losses incurred by cows culled before finishing their lactation can lead to an underestimation of the true cost of the disease and that failure to account for level of production before the first instance of mastitis for cows in later stages of lactation can mask the losses that result from the disease.

Comment: This study only looked at the first case of mastitis in a lactation and when it occurred in a lactation, the transition (1–21 days DIM), early (22–100 DIM), mid (101–200 DIM), or late lactation (201+ DIM) periods, and its effect on production. This study unsurprisingly found mastitis is a costly disease but differs from other studies as it compares the production from a first case of mastitis with a similar level of production in the period preceding mastitis diagnosis. It also took into consideration that cows get culled. A greater proportion of cows that had mastitis were culled before 100 DIM and 305 DIM compared with healthy cows. The authors point out that cows that are high performing that get mastitis are more likely to be retained in the herd until the end of the lactation than lower-producing herd mates and this has in other papers probably resulted in the production loss caused by mastitis being masked. Studies have found that the higher-producing cows in a herd are more likely to experience mastitis. To overcome this issue, mastitis cases that occurred in the mid and late stages of lactation were stratified by the cow's production at the start of the period and looked at the cumulative lactation yields, which were 6% and 10% reduced compared to a heathy (at the start of the period) cow with similar production. The stratification by production level was not done for mastitis cases that occurred early in lactation as there was insufficient production data available to stratify cows by production. While this paper does not rock the world by telling us that mastitis costs money, it does make us think twice about those later season mastitis cases – it seems likely their contribution to the vat at the end of the season could well have been much bigger if they stayed mastitis free as she is likely to be have been a high producer, and in the past we compared her to the average cow (not her peers) to assess her performance.

Reference: J Dairy Sci. 2021;104(7):7932–7943
Abstract

The hidden cost of disease: II. Impact of the first incidence of lameness on production and economic indicators of primiparous dairy cows

Authors: Puerto MA et al.

Summary: The objectives of this cost analysis were: (i) to quantify the impact of the first instance of lameness, at different stages of lactation, on production and economic performance; and (ii) to quantify the impacts of the first instance of lameness when only cows that remain in the herd for at least 100 days in milk (DIM) and those that remain for 305 DIM were included in the analysis. The key findings were that gross profit, which included additional costs associated with lameness, encapsulated more losses than margin over feed cost in all analyses. The higher rates of early culling in lame cows indicated that all cows should be included in any complete cost analysis of lameness, not only cows that complete their entire lactation.

Comment: Lameness, in Canada where this study was conducted, is the fourth most common reason for culling cows (6.4%) after reproductive problems (15.9%), mastitis (9.5%), and low production (7.5%). Lameness, at least in housed environments, is a disease associated with high-production cows, but few studies account for this pre-existing production difference when analysing production changes post lameness. In this data set, cows that went lame for the first time in mid lactation (100–200 DIM) were producing more milk at 100 DIM and the same for the lameness cases diagnosed in late lactation. As in the above cost of mastitis study, this production bias was accounted for by stratifying cows based on their production at the start of the mid (100 DIM) and late lactation (200 DIM) periods. Like the cost of mastitis study, despite lameness that occurred mid or late lactation having less time to accumulate or accrue losses, the production losses reported here are still significant and it is the higher producing cows that are more likely to go lame. The largest economic losses were in the cows that got lame early in lactation as they had yet to get pregnant so were subject to extra breeding costs and associated costs with reduced fertility.

Reference: J Dairy Sci. 2021;104(7):7944–7955
Abstract

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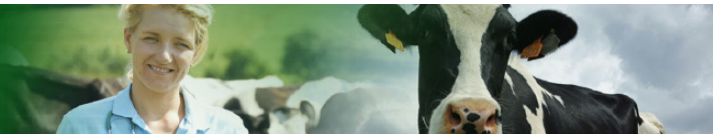
Independent Commentary by Hamish Newton

Hamish Newton graduated from Massey University with a BVSc in 1998 and started working in mixed practice at the Veterinary Centre – Oamaru. He then worked in mixed practice in the UK before starting a PhD at Bristol University examining factors that influence the cure of intramammary infections in the involuting mammary gland. Upon completing his PhD in 2007 he returned to the Veterinary Centre – Oamaru and became a partner in 2008. He now spends most of his working time dealing with dairy cows.



Rumen function and grazing behavior of early-lactation dairy cows supplemented with fodder beet

Authors: Fleming AE et al.

Summary: In this crossover study, eight Holstein Friesian × Jersey early-lactation dairy cows were used to test the effects of supplementing 16 kg of dry matter (DM) of a grazed perennial ryegrass herbage with 6 kg of DM/day of fodder beet bulb versus herbage only on rumen function and grazing behaviour. The data collected suggest that grazing dairy cows supplemented with fodder beet (40% of daily intake) increase rumination and mastication intensity to offset reduced ruminal degradation of ryegrass herbage due to low ruminal fluid pH.

Comment: This study done at Lincoln looked at the effects of feeding harvested fodder beet to make up 40% of the early lactation diet. The control group was cows offered pasture only. Pasture allocation to both treatment groups was 30 kg of DM per cow per day (aboveground). Fodder beet bulbs were offered individually to cows immediately after the morning milking in plastic bins. The cows getting fodder beet remained off pasture for up to two hours or until they had finished their fodder beet allocation. The cows that were offered forage only went to their allocated pasture immediately after morning milking. The amount of energy consumed by the cows offered fodder beet was not significantly different from those that were only offered pasture (182 vs 186 MJ of ME/day). The estimated DM intakes were also similar (15.6 and 16.2 kg of DM/day). Fodder beet made up 38% of the daily DM intake for the cows fed fodder beet. DM intake of pasture was calculated from the energy the cow expended (maintenance, walking, body condition score change, milk, etc.) less the energy from the fodder beet she ate. The milk yields, protein, and fat percentages were not different between treatment groups. Rumen pH declined after the morning allocation of feed. The pasture-only rumen pH values fell from 6.5 to about 6 at about mid-day then stabilised. In cows that were offered fodder beet the pH dropped to 5.7. The authors suggest that the drop in pH could explain the lack of milk response found in the fodder beet-supplemented cows by causing impaired ruminal digestion of pasture. Fodder beet-fed cows spent less time gazing and more time ruminating than pasture only cows. The reduced grazing time if fed fodder beet was greater than the time they were away from pasture. The increased rumination time for the fodder beet-fed cows is likely a response to the decreased rumen pH. With increased use of technology available to measure rumination time we should consider that rumination times could well increase as a response to decreased rumen pH and we should also look at grazing times as well.

Reference: J Dairy Sci. 2021;104(7):7696–7710
Abstract

Using Dairy Research Review for CPD points

Reading relevant veterinary articles such as those in Dairy Research Review is a valuable way to keep current and can become part of your CPD record. Simply record the activity on your activity record and create a reflective record by writing a few sentences about what you learnt and how this impacts your practice as a veterinarian.

See the VCNZ website for templates to download activity records and reflective records http://www.vetcouncil.org.nz/contProfDevel.php

Invited review: a 2020 perspective on pasture-based dairy systems and products

Authors: Moscovici Joubran A, et al.

Summary: In this review article, the authors discuss the multiple effects of pasture-based production systems on dairy product composition, nutritional profile, and sustainability. In addition, potential future methods for authentication are highlighted.

Comment: This Irish paper looks at milk produced by feeding pasture and what differences and benefits it has (real or perceived) over milk from cows fed total or partial mixed rations. Nutritional benefits of milk from pasture-fed cows that have been described include a greater concentration of protein and fat in the liquid milk and the fats are described as having a "more nutritionally beneficial profile". There are also welfare benefits with cows being grazed that have been recognised by the European Food Safety Authority in a report in 2009. These benefits include less lameness, ability to express normal behaviours, and that more social interactions can take place. The authors stop short of saying welfare is better on pasture though and state "there are numerous challenges to correctly assess cow welfare in a holistic way and in real time", which to me sums up measuring welfare. The other big area examined in this paper was sustainability, another difficult thing to measure and rank between systems. It was stated though that the Irish milk (pasture-based) has the lowest Greenhouse gas footprint per unit of protein and fat corrected milk in the EU. Fonterra states on its website that their cows "consume on average 85 percent of their diet as grass". Furthermore, cows spend at least 90% of their time outside grazing as a minimum requirement of the standard. Synlait also pays a premium for milk that is produced from pasture with no imported feeds. It seems very likely that in the future there will be ways to authenticate claims about pasture-fed dairy products. This can be done by fat analysis at present but it seems that in the future there will be low-cost, high-throughput screening techniques, and what the authors describe as "simple technology", such as near-infrared spectroscopy, which will be able to be used to verify claims about dairy products being pasture based.

Reference: J Dairy Sci. 2021;104(7):7364–7382
Abstract

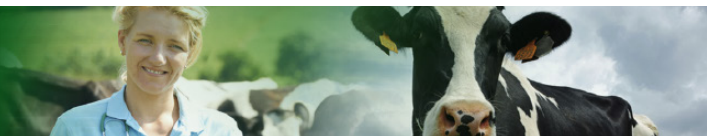
Invited review: the influence of immune activation on transition cow health and performance – a critical evaluation of traditional dogmas

Authors: Horst EA et al.

Summary: The authors of this review article propose that changes in circulating non-esterified fatty acids (NEFAs), ketones, and calcium are reflective of either normal homeorhetic adjustments that healthy high-producing cows use to maximise milk synthesis or the result of immune activation and its sequelae.

Comment: This review looks at the evidence that increased ketones and hypocalcaemia lead to immune suppression and onto mastitis, retained membranes, and poorer fertility. This paper argues that the increased NEFAs, ketones, and decreased calcium levels are either a normal response to allow the prioritisation of milk production or else are the consequence of immune activation. I will struggle to summarise a 30-page review article here, but hopefully will interest you enough to get a copy of this paper and challenge your thinking about what is known. To set the scene, there is a section in this paper called "correlation does not equal causation", which points out that there are numerous studies showing an association between metabolites and transition-cow problems but there are also others that show no association or even improved milk yields with increased NEFAs. "During the last 50 years, dairy scientists have increasingly viewed elevated circulating NEFA and ketones, and hypocalcaemia as pathological and causal toward negative outcomes". These authors "believe that the post-calving changes to energetic and calcium metabolism reflect normal biological processes that healthy cows use to maximise milk synthesis or severe dysregulation of these processes arising from inflammation-induced changes enlisted to prioritise health". It is now accepted that an inflammatory response is a normal part of transition-cow biology. This inflammation could well arise from the udder, the uterus, or a "leaky gut". It is inflammation, this paper proposes, that leads to poorer reproduction (by altered follicular steroid concentrations and impaired oocyte maturation for example), hypocalcaemia (calcium concentrations decrease in sub-acute ruminal acidosis and infection for example), and reduced dry matter intake (leads to reduced milk yields, increased NEFAs and on to ketosis, etc.). If this is true, the changes we measure (ketones, beta-hydroxybutyrate, etc) are the result of inflammation and not a direct cause of poor reproduction and cow health. If you only read one paper this year, give this one a go. It will bring back nightmares of immunology, nutrition, and physiology and roll them into one and make you question everything you "know".

Reference: J Dairy Sci. 2021;104(8):8380–8410
Abstract



Determination of relationships between rumination and milk fat concentration and fatty acid profile using data from commercial rumination sensing systems

Authors: Andreen DM et al.

Summary: The objectives of this study were to quantify variation in rumination time between and within dairy herds and test for relationships between rumination time and milk fat production and fatty acid profile as a proxy of rumen fermentation. Measured using commercial rumination sensing systems, rumination time was not found to be directly associated with milk fat concentration but was weakly related to fatty acid indicators of altered rumen fermentation. Lower rumination cows did not have a higher incidence of biohydrogenation-induced milk fat depression (MFD) and longer daily rumination time was associated with a fatty acid profile indicative of MFD and subacute ruminal acidosis (SARA).

Comment: This paper looked at rumination data from either commercially available collars or ear tags from 1,700 cows on five commercial farms in the US to see if the data was related to milk fat concentration. Changes in rumination are good indicators or predictors of oestrus, calving, and illness. It seems plausible that there could be a relationship between rumination and fat percentage of milk and the milk fatty acid profile. It turned out that there was no strong relationship between rumination time and milk fat percentage. What I did find interesting, especially after reading the rumen function and grazing behaviour of early-lactation dairy cows supplemented with fodder beet article, was that rumination times increased when the fatty acids associated with SARA increased (C15:0) or decreased (iso C14:0). So, the fatty acids associated with a low rumen pH (SARA) were associated with more rumination.

Reference: J Dairy Sci. 2021;104(8):8901–8917
Abstract

Route of administration influences the concentration of ivermectin reaching nematode parasites in the gastrointestinal tract of cattle

Authors: Leathwick DM et al.

Summary: These investigators determined the concentrations of ivermectin reaching different tissues and target worm species, *Ostertagia ostertagi* and *Cooperia oncophera*, in cattle that had been treated either orally, topically, or by subcutaneous (SC) injection. Administration by SC injection resulted in the highest levels of ivermectin in plasma and the abomasal and intestinal mucosa. Oral administration resulted in the highest concentrations in abomasal and intestinal contents. However, pour-on administration also produced high ivermectin concentrations in the gastrointestinal contents, which was most likely due to oral ingestion of product by at least some animals. Ivermectin concentrations in *C. oncophera* were most closely associated with drug levels in the intestinal content while drug concentrations in *O. ostertagi* were highly correlated with concentrations in the abomasal mucosa.

Comment: When reading this you will be more concerned about rotavirus infections than worms, but soon enough we will be discussing drenches for calves. This paper looks at different ways of administering drench and the amount of active agent that ends up in the worms. This is relevant as if a worm is partially resistant to an active (a heterozygote genotype) and it gets a lower amount of active than it would have if the active was administered to the calf via a different route we may well speed up the development of resistant genotypes in a population. Calves were infected with *O. ostertagi* and *C. oncophera* that had been shown to be resistant to ivermectin. The calves, once they had a patent infection, either received ivermectin orally, via injection, or as a pour on. All calves were egg positive post treatment confirming ivermectin resistance. Calves in each group were slaughtered daily after treatment for 8 days (none were slaughtered on day 7) and samples of abomasa and cranial jejunum contents and mucosa were collected, as well as the worms from these sites. The concentration of ivermectin in the *Ostertagia* recovered were best correlated with the levels of ivermectin in the abomasal mucosa whereas the concentration of ivermectin in *Cooperia* was best correlated with the concentration of ivermectin in the intestinal contents. Thus, it appears that the two parasites are acquiring ivermectin via different mechanisms or routes. The area under the curve (AUC) was greatest for the abomasal mucosa if ivermectin was administered as an injection followed by pour on application but the authors acknowledge that licking seems to have occurred in the pour-on calves. The lowest AUC for ivermectin in the abomasal mucosa was when ivermectin was given orally. It seems that if you want to get the most ivermectin into *Ostertagia,* use an injectable formulation. This was not the case for getting ivermectin into *Cooperia* whose ivermectin concentration was best correlated with the amount of ivermectin in the intestinal contents. The highest peak concentrations and AUCs for ivermectin in the intestinal contents occurred when it was administered orally or topically (but remember it seems very likely some of the pour on calves licked). It seems that if we want to maximise the exposure of *Ostertagia* spp. to ivermectin the injectable application is best.

Reference: Int J Parasitol Drugs Drug Resist. 2020;14:152–158
Abstract

Vaccination practices for Leptospira spp. on New Zealand dairy farms

Authors: Yupiana Y et al.

Summary: A cross-sectional survey of 200 randomly selected dairy farms stratified by herd size and region throughout NZ was conducted to investigate leptospiral vaccination practices in dairy herds. The results of the questionnaire, which was administered during a face-to-face interview with farmers, suggest that there is almost universal adoption of leptospiral vaccination for dairy cattle in NZ. However, the survey results also suggest some non-conformity with best-practice guidelines, possibly indicating lack of familiarity among the veterinary profession and farmers. There was also need for refinement of vaccination programmes, particularly the timing of vaccination in calves.

Comment: This paper reports on a survey completed by farmers on how they are vaccinating their herds against leptospirosis. In effect, as we (vets) prescribe the vaccine, it should give us an idea of whether what we are prescribing is being used according to how we expect it to be used. It seems that trivalent vaccines are used more in the North Island and North Island farmers were more likely to report observing rats so perhaps that drives greater usage of trivalent vaccine in the North Island. The most interesting finding to me was that the best practice guidelines (the NZVA ones) were more likely to followed for calves and heifers if the vaccine was administered by farm staff. Presumably due to the logistics of getting vets to varying mobs of calves or heifers away at grazing on time.

Reference: N Z Vet J. 2021;69(5):299–307
Abstract

Practices and opinions of New Zealand veterinarians regarding control of bovine viral diarrhoea

Authors: Gates MC et al.

Summary: This cross-sectional survey of registered veterinarians in NZ, which was conducted in 2019, asked respondents about the approaches they would use to manage bovine viral diarrhoea (BVD) under different clinical scenarios as well as their opinions on national BVD control. The survey respondents appeared to be highly supportive of BVD control but there were perceived financial and logistical barriers that could be impeding farmer engagement, including poor farmer awareness of the impacts of BVD and an inability to justify the costs of implementing control measures. The survey also revealed wide variations in the recommendations that veterinarians make about BVD, which suggests the need for increased efforts to determine whether veterinarians fully understand the different BVD management options so that the profession is presenting clear and consistent messages to farmers.

Comment: Here is the paper that reports on a survey that 101 of you completed two years ago about how you would manage BVD in situations that were presented to you. The authors point out that as only 101 of an estimated 807 cattle vets responded we need to be careful about any inferences drawn from this survey as respondents were self-selecting so possibly "more motivated or had stronger opinions on BVD than the average practitioner". We seem to be motivated to screen dairy herds for BVD due to its impacts on calf health and reproductive performance rather than milk yield or mastitis. The survey also gives a bit of an insight into what we think about a national eradication programme for BVD. However, this survey was conducted when we were in the thick of the *Mycoplasma bovis* outbreak, so you motivated and opinionated vets out there may have been influenced somewhat by the concurrent (and ongoing) national eradication programme for *M. bovis*. If a national eradication scheme was implemented, the following measures were almost universally supported: a) requiring farmers to declare the BVD status of animals prior to sale; and b) requiring slaughter of persistently infected animals within a set time period. The free text responses suggested that the best way to achieve this would be an animal BVD status to be linked to its unique NAIT number.

Reference: N Z Vet J. 2021;69(5):274–284
Abstract