



Dairy Research Review™

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Issue 10 – 2017

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Animal Health publications are intended for those with a professional interest in the animal health sector.

Welcome to the tenth issue of Dairy Research Review.

Apart from a study of fodder beet crop yields, all of the papers in this issue deal specifically with dairy farming and dairy cows. The selections include analyses of the microbiome of bulk milk, absorption of colostrum IgG, and the association between the colostrum microbiome and clinical mastitis. Other dairy cow-focussed papers include investigations of mastitis treatment and bacterial culture results, whether feeding waste milk to calves contributes to the development of antimicrobial resistance, and how the timing of artificial insemination influences reproductive performance.

We hope that this issue of Dairy Research Review is educational and thought-provoking. We look forward to receiving your feedback and comments.

Kind regards

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

The microbiome of bulk tank milk: Characterization and associations with somatic cell count and bacterial count

Authors: Rodrigues MX et al.

Summary: This US study investigated associations between the microbiome and the quality of bulk tank milk. Bulk milk samples (n=472) from 19 different dairy farms were analysed using next-generation sequencing and quantitative PCR of the 16S rRNA gene to assess the milk microbiome and measure total bacterial load, respectively. Flow cytometry was used to determine bacterial and somatic cell counts (SCC). *Corynebacterium*, *Streptococcus*, *Lactobacillus*, *Coxiella*, *Arthrobacter*, and *Lactococcus* were encountered in significantly higher relative abundances in the high SCC milk than in low SCC milk. *Acinetobacter*, *Enterobacteriaceae*, *Corynebacterium*, and *Streptococcus* were found in significantly higher relative abundances in high standard plate count (SPC) versus low SPC milk. Bacterial diversity was negatively correlated with bacterial load.

Comment: Many of us will be aware of the Antibigram now being offered that isolates any *Staphylococcus aureus* or *Streptococcus uberis* and reports the MICs for these species. This paper examined the microbiome in bulk milk samples from dairy farms in New York state. Samples with a higher bacterial count had a smaller number of species isolated suggesting in these samples there was one species that dominated. The relative abundances of both *Streptococcus* and *Corynebacterium* increased as the SCC increased, which is consistent with their role as causative agents of mastitis. *Streptococcus* species were the second most abundant genus found in bulk milk samples that had a SCC >200,000 cells per ml. This seems to make sense as we know *Streptococcus* is associated with mastitis. Of interest, *Staphylococcus* species were relatively more abundant in low bacterial count samples than in samples with a high bacterial count. This paper is of interest if you want to try and understand a bit more about the bacteria in bulk milk, especially with the roll out of the Dairyantibiogram.

Reference: *J Dairy Sci.* 2017;100(4):2536–2552

[Abstract](#)



Measurement techniques and yield estimates of fodder beet in Canterbury and Southland

Authors: Judson HG et al.

Summary: These researchers conducted a survey of commercial fodder beet crops across Canterbury and Southland to determine average yields and to provide some basic information on commercial crops. Fodder beet yield (t DM/ha) was measured in 132 paddocks. Commercial yields were approximately 19 t DM/ha but higher yields (34 t DM/ha) were achievable. Dry matter content (DM%) of bulbs was higher for lighter than for heavier bulbs. The variation in DM% between bulbs exceeded the variation between inner and outer fractions of the bulb suggesting that a rapid method of sampling multiple bulbs may result in increases in the accuracy of DM% assessment.

Comment: Fodder beet is now a very common feed in the South Island and the ability to accurately estimate crop yields is important for feed budgeting, correct allocation of crop during transition, for comparing against other crops or feeds, and for selling the crop in the paddock. The average crop yield reported here was 19 tDM/ha (range 8 to 34). And the leaf on average made up 17% (3.5 t) of the total DM% (range 5 to 40). The DM% of the bulbs varied from 8 to 28% and heavier bulbs had lower DM% regardless of variety. As a rule of thumb, each kilogram increase in bulb weight resulted in 1% lower DM%. Hence, it is important to select bulbs for DM analysis that represent the average bulb in the crop. There was variation in DM% between different parts of the bulb but this variation was not as large as the variation between bulbs in the same paddock, so increasing the number of bulbs sampled is likely to give a better estimate of crop yield. Perhaps of most practical interest was the finding that using a coring device to get samples for DM analysis correlated very well with the results obtained by quartering and slicing bulbs. As a final note, the authors caution about the confidence of yield estimates due to the variability of the crop in paddocks and the gaps left in rows by seeds that failed to establish. They suggest the confidence you have around an estimate could be plus or minus 4 t.

Reference: *Journal of New Zealand Grasslands*. 2016;78:177–180
[Abstract](#)

The bovine colostrum microbiome and its association with clinical mastitis

Authors: Lima SF et al.

Summary: In this prospective observational study, US researchers attempted to characterize colostrum microbial diversity and its potential associations with early-lactation clinical mastitis. Colostrum samples were collected from all four mammary gland quarters of 70 Holstein cows and high-throughput sequencing of the 16S rRNA gene was used to investigate the bovine colostrum microbiome. Colostrum samples were categorised according to whether the quarter was diagnosed or not diagnosed with clinical mastitis during the first 30 days postpartum. The results showed that the colostrum microbiome of primiparous cows differs from that of multiparous cows, and that it harbours some diversity and taxonomic markers of mammary gland health specific to primiparous cows.

Comment: This study followed 70 cows for the first 30 days of lactation and categorised the cow by whether she had a case of clinical mastitis or not and looked for associations with the microbiota in the quarter colostrum samples from those cows. The study was conducted on a commercial dairy farm in upstate New York (3,450 cows milked 3 times a day). The incidence of mastitis for the primiparous cows was 46% and 23% for the multiparous cows. Two different indexes to measure the diversity of bacteria found in the samples were used (Chao1 and Shannon indexes). The Chao 1 index was higher in primiparous cows than multiparous cows and tended to be higher in primiparous heifers that did not get mastitis compared to primiparous heifers that did get mastitis. The Shannon index was not different between primiparous and multiparous cows but the primiparous heifers that did not get mastitis had a higher value than those that did not. The reason for the multiparous cows having less microbial diversity may be due to the use of dry cow therapy. Colostrum samples from primiparous cows were more likely to have Staphylococcus genus found. Regardless of parity or whether or not mastitis occurred the Staphylococcus genus was the most prevalent. The authors discuss this and feel that it is a true representation of the microbiome as they also identified strict anaerobes indicating that the complex microbiota found was not merely due to contamination from the teat skin. This study highlights the diversity of bacteria present in colostrum and, at least for heifers, diversity seems to have a protective effect against developing mastitis.

Reference: *J Dairy Sci*. 2017;100(4):3031–3042
[Abstract](#)

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Short communication: Apparent efficiency of colostral immunoglobulin G absorption in Holstein heifers

Authors: Halleran J et al.

Summary: The objective of this US study was to investigate how contributing factors (volume of feeding, birth weight, and time of feeding) can alter the apparent efficiency of absorption (AEA) of immunoglobulin (IgG) and to establish a reference range for AEA in healthy calves. Study subjects were 100 Holstein heifer calves from five different dairy farms. The results of the study indicated that serum IgG concentration may be increased either by feeding increased volumes of colostrum or by genetic selection, given that the AEA varied widely between calves.

Comment: In this study, the amount of colostral antibodies in a calf was measured as the concentration of IgG serum multiplied by the estimated amount of serum that each calf had (based on body weight). This was then expressed as a percentage of the amount of IgG given to the calf (concentration of IgG in the colostrum x volume fed) within four hours of birth. This percentage was termed the AEA. In this study, there was no apparent relationship between the AEA and the amount of IgG fed suggesting that the ability to absorb IgG was not "saturable", which is in contrast to some other papers. The AEA varied widely between calves ranging from 7.7% to 59.9%, with a mean value of 28.1%. Calves received either 4 or 5.6 litres of colostrum within 4 hours of birth. The calves that received 5.6 litres received colostrum with significantly higher IgG concentrations and consequently had higher serum IgG levels but also had higher AEA. There were only two calves out of 100 that were diagnosed with failure of passive transfer (FPT serum IgG <10g/L). What does need to be noted is that the average time to feeding was only 70 minutes so with our relatively delayed giving of colostrum the AEA might be quite different. The message I take from this paper is that the mantra of "an adequate quantity of quality colostrum needs to be given quickly" still rings true.

Reference: *J Dairy Sci.* 2017;100(4):3282–3286

[Abstract](#)

Short communication: An observational study investigating inter-observer agreement for variation over time of body condition score in dairy cows

Authors: Morin PA et al.

Summary: This Canadian observational study compared inter-observer agreement of body condition score (BCS) and change in BCS in dairy cows when multiple observers performed data collection. Three observers independently assessed the BCS of 73 Holstein cows from a single commercial dairy herd. BCS assessments of the animals were performed between 1 and 20 days in milk and again between 41 and 60 days in milk. Based on the results, the authors concluded that studies investigating single BCS measures could use many observers with a high degree of accuracy in the results. However, when measuring change in BCS more reliable results would be obtained if one observer performs all of the assessments.

Comment: This short communication looks at the repeatability of BCS change between observers. It was shown that the agreement between observers at a single BCS observation is very good but that the agreement between observers of the change in BCS between two scorings (one at calving and one at peak milk) was "moderate". For this reason, it is suggested that if possible when monitoring change in BCS the same observer would ideally be used. With mob scoring this may be less of an issue but with individual cow scoring it would seem that it will be best to use one scorer.

Reference: *J Dairy Sci.* 2017;100(4):3086–3090

[Abstract](#)

Clinical outcome comparison of immediate blanket treatment versus a delayed pathogen-based treatment protocol for clinical mastitis in a New York dairy herd

Authors: Vasquez AK et al.

Summary: These US researchers compared immediate intramammary antimicrobial treatment of all cases of clinical mastitis with a selective treatment protocol based on 24-hour culture results on a 3,500-cow commercial farm. Mild to moderate clinical mastitis cases were randomly assigned to either blanket therapy or pathogen-based therapy. The study findings indicated that the use of a strategic treatment protocol based on 24-hour post-mastitis pathogen results has the potential to reduce antimicrobial use.

Comment: With the drive to reduce the amount of antibiotics used in the dairy industry, and an international trend to need a diagnosis at the cow level to use some classes of antibiotics, the use of bacteriology to make treatment decisions for treating mastitis is gaining traction. There are practices and individuals in NZ doing this already. This is a study from New York so the relative prevalences of different bacteria are not what we are familiar with and neither are the antibiotics used for the group that got treated without bacterial culture [ceftiofur hydrochloride for 5 days (1st gen cephalosporin)]. The cows that got mastitis were assigned to get either ceftiofur immediately or else get a treatment based on the culture results 24 hours later. If a culture was positive for either *Staphylococcus* or *Streptococcus* spp., the quarter was treated with two tubes of cephapirin (3rd gen cephalosporin) at 12 hour intervals. Samples that were no growth, or had another organism grown, received no antibiotics. Only 4% of cultures were positive for *Staphylococcus aureus* and these were excluded from the trial as the farm's policy was cows that were culture-positive for *S. aureus* were culled as soon as the meat WHP had elapsed. Sixty percent of the mild or moderate cases of mastitis were either no growth, no significant growth, or a gram-negative bacillus. In this study, the cows that were treated or not based on culture results had three extra days in the vat (less milk WHP). It is unclear whether this will hold true in our systems with a lower prevalence of gram-negative mastitis (and possibly lower prevalence of no growths). In the farm used for this study, 65% of cases would have not received antibiotics. This will have economic benefits and perhaps reduce the antimicrobial resistance risk.

Reference: *J Dairy Sci.* 2017;100(4):2992–3003

[Abstract](#)

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Feeding of waste milk to Holstein calves affects antimicrobial resistance of *Escherichia coli* and *Pasteurella multocida* isolated from fecal and nasal swabs

Authors: Maynou G et al.

Summary: The objective of this US study was to determine the antimicrobial resistance (AMR) patterns of faecal *Escherichia coli* and nasal *Pasteurella multocida* isolates from calves fed either milk replacer or waste milk on eight commercial dairy farms (four farms per feeding programme). Faecal and nasal swabs were collected from 20±5 dairy calves at 42±3.2 days of age, and from ten of these at approximately 1 year of age on each study farm to isolate the targeted bacteria. The resistance of *E. coli* isolates from the calves' farm environment and from five calves at birth and their dams was also evaluated on each study farm. The authors concluded that the results indicate that feeding calves waste milk fosters the presence of resistant bacteria in the lower gastrointestinal and respiratory tracts of dairy calves.

Comment: This study looked at the effect of feeding waste milk to calves on the resistance patterns of faecal *E. coli* and nasal *P. multocida*. Calves were fed either milk replacer or waste milk (dumped milk from cows treated with antibiotics). It was found that calves fed waste milk had a higher prevalence of faecal *E. coli* resistant to enrofloxacin, streptomycin, and florfenicol. Enrofloxacin and streptomycin were commonly used on the study farms. The beta-lactams (including cephalosporins) were also widely used compounds for the treatment and prevention of mastitis and treatment of diarrhoea and respiratory infections in calves in the study farms. It was surprising then that there were low levels of resistance to these antimicrobials found in both the calves fed waste milk and milk replacer. This paper does not support or damn the feeding of waste milk as a practice that promotes the development of resistant bacteria in calves as there were resistant bacteria found from calves not exposed to waste milk. It does, however, add some data to the debate about whether this is a practice that should be encouraged.

Reference: *J Dairy Sci.* 2017;100(4):2682–2694

[Abstract](#)

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.



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Systemic granulomatous and haemorrhagic syndrome in New Zealand dairy cattle

Authors: Rawdon TG et al.

Summary: In this paper, NZ researchers describe 16 cases of ill or dead cows that had evidence of frank haemorrhage, petechial haemorrhages on mucous membranes, wasting, or dermatitis of unknown cause reported over a 5-year period. The affected cows were from nine seasonally calving dairy farms. They were aged ≥3 years, and predominantly in their mid-to-late non-lactating period. In 15/16 cases, a brassica crop was identified as part of the current or recent ration. Eight cows were found dead or died ≤2 days of first signs. In the eight other cases, death or euthanasia occurred ≤3 weeks after signs were first observed. Idiopathic multisystemic granulomatous and haemorrhagic disease was diagnosed.

Comment: This series of cases described a sporadically occurring disease characterised by petechiation of the mucosal and serosal surfaces at post mortem and alopecia and thickening of the skin. Prior to death, the cows were likely to be inappetent, lethargic, or recumbent, and some showed signs of anaemia or jaundice. Possible differentials for systemic bleeding disorders included anthrax, *Pasteurella BVD* type 2, and bracken fern toxicity. Histologically there were granulomatous infiltrates and this allowed differentiation of these cases. Similar presentations have been reported in cattle fed citrus pulp, Vetch, and di-ureido iso-butane (DUIB) in concentrate rations in the Netherlands and a silage additive used in England and Wales. It was hypothesised that these feeds caused a type-IV hypersensitivity reaction. The authors speculate that what they are seeing is also a type-IV hypersensitivity reaction to a breakdown product of brassica glycosinolates. This article describes another differential to consider, and reminds us to not forget the exotic diseases when presented with a haemorrhagic cow.

Reference: *N Z Vet J.* 2017;65(3):156–162

[Abstract](#)

Effect of time of artificial insemination after oestrus detection on non-return rate of lactating dairy cows on pasture

Authors: Xu ZZ

Summary: The objective of this NZ study was to determine the difference in reproductive performance between cows detected in oestrus during morning (AM) or afternoon (PM) milking when artificial insemination (AI) was carried out once daily, either after the AM or PM milking. The study used 20,816 records for cows in 30 spring calving dairy herds for which a camera-based system was used for oestrus detection during milkings. Reproductive performance was determined using non-return to oestrus (NRR) 2–24 days after AI. The results suggested that the difference in NRR between cows first detected in oestrus during AM milking and those first detected in oestrus during PM milking is likely small when AI is carried out once daily after either AM or PM milking, irrespective of whether the semen used for AI is liquid or frozen.

Comment: This study examined the records of cows that had their heats detected by a camera on 30 farms (EZ heat system LIC) and examined the NRR to oestrus between 2 and 24 days after AI. The heat was categorised as either AM or PM and the AI event as either AM or PM. Fifty-nine percent of the almost 21,000 oestrus alerts occurred in the morning and 89% of inseminations occurred in the morning. None of the farms had technicians arriving twice a day. The average time between recorded oestrus and insemination was 17 hours for the PM oestrus cows and 3 hours for the AM detected cows when AI occurred in the morning. The values were 2 hours and 11 hours if AI occurred in the evening. There were no differences in the NRR between the AM and PM oestrus groups regardless of the timing of AI. Over both oestrus groups AM AI had a higher NRR. The reason for this is not obvious but perhaps was due to some farm factor not examined. The NRR and conception rate did not differ with timing of AI if either liquid or frozen semen was used. This study suggests that if a farmer is having difficulty with heat detection then advising him to concentrate his efforts solely on one milking is likely to be a better use of his resources than spreading them over two milkings. Unless the farmer has continuous cow monitoring (e.g. pedometers), twice daily AI is unlikely to make a great deal of difference to conception rate despite many matings occurring outside what is reported as the ideal time for conception (4–14 hours after the onset of oestrus).

Reference: *N Z Vet J.* 2017;65(3):119–123

[Abstract](#)