# Dairy RESEARCH REVIEW™

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Issue 29 – 2022


## In this issue:



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# Welcome to the latest issue of Dairy Research Review.

Selections in this issue include research on a technique used to prove that milk has come from cows that are grass fed, improving growth rates in preweaning calves, and initiatives that might reduce greenhouse gas emissions from pasture-based livestock systems in NZ. In other selections, NZ dairy farmers are surveyed on their views on providing cow-calf contact and selective dry cow therapy and its effects on milk yield and quality are assessed.

We hope that you learn something new from reading this issue of **Dairy Research Review**. Please keep your suggestions and comments coming!

Kind regards

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


## Genetic analysis of milk urea concentration and its genetic relationship with selected traits of interest in dairy cows

**Authors:** Chen Y et al.


**Summary:** These researchers estimated genetic parameters of milk urea nitrogen (MUN) level and its genetic correlations with milk production traits, longevity, and functional traits during the first 3 parities in 560,739 dairy cows from 2,356 herds. The total data set consisted in 9,107,349 MUN test-day records. The most prominent findings were the average daily heritability of MUN during days in milk 5 to 365 in the first 3 parities being 0.19, 0.22, and 0.20 and the mean genetic correlation estimated among MUN in the first 3 parities ranging from 0.96 to 0.97.


**Comment:** As far as I am aware, is MUN now routinely reported by all the milk processors. I think we all tend to try and use it to get a handle on how much of the protein we feed our cows is being "captured" by the cow, or by the bugs in her rumen, and how much is being lost as ammonia and converted to urea nitrogen in the liver and lost to the cow in the milk, urine, or faeces. MUN might reflect the balance between crude protein and energy in the diet. The authors point out that although there is not complete consensus it seems that MUN is a reasonable predictor of urine urea nitrogen excretion, which can be lost to the water or lost to the atmosphere as $N_2O$ – a greenhouse gas (GHG). This paper found the heritability of MUN was around 0.2 and importantly there was a negative correlation with production traits, so selecting for milk production traits should lead to decreasing MUN and presumably urine urea nitrogen so less GHG produced. However, Lopez-Villalobos et al. (2018) and Ariyarathne et al. (2021) reported that MUN had a moderately positive genetic correlation with milk yield in dairy cows in NZ. There may be a genetic x environmental interaction going on, or do we just simply feed to much nitrogen relative to energy when we feed grass?


***Reference: J Dairy Sci. 2021;104(12):12741–12755***
Abstract


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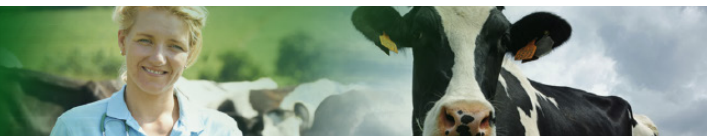

## Application of machine-learning methods to milk mid-infrared spectra for discrimination of cow milk from pasture or total mixed ration diets

**Authors:** Frizzarin M et al.

**Summary:** In this study, the robustness, specificity, and accuracy of 11 machine-learning statistical analysis methods were tested and compared for the discrimination of grass-fed versus non-grass-fed milks based on the mid-infrared spectroscopy (MIRS) spectra of 4,320 milk samples collected from cows on pasture- or indoor total mixed ration (TMR)–based feeding systems over a 3-year period. The system was able to discriminate between cow diets. Linear discriminant analysis and least squares discriminant analysis were found to offer the greatest level of accuracy for the prediction of cow diet from MIRS.

**Comment:** This paper from Ireland looks at a technique that could be used to validate or prove that milk has come from cows that are grass fed. We are used to the idea that something measurable in milk can tell us what the cow ate as Fonterra reports the fat evaluation index (FEI) grades as a way of trying to limit the amount of palm kernel extract used. What tests are used on the milk to generate the FEI is not public knowledge I don't think. Milk from cows fed either a TMR, a diet of Ryegrass, or ryegrass and 20% clover diet was analysed using MIRS. The MIRS data was then analysed using several statistical and machine learning techniques I did not even vaguely understand. It turns out that using the data from MIRS and subjecting it to a couple of techniques the data could accurately discriminate between milk from cows fed a TMR or a pasture or clover diet. It remains to be seen if this approach could be used on bulk tank milk and how it would handle early or late season milk when it is likely more purchased feeds make up the diet of cows managed at pasture. Whether this tool is used or required in the future I suppose will depend on what our customers demand or how compliant milk suppliers are with the recording of purchased feeds for auditing.

***Reference: J Dairy Sci. 2021;104(12):12394–12402***
Abstract

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## Pain in the weeks following surgical and rubber ring castration in dairy calves

**Authors:** Nogues E et al.

**Summary:** These investigators compared two methods of castration in 21 dairy calves: surgical (n=10) and rubber ring (n=11). The calves were castrated at 28 days of age using multimodal pain control and assessed during the 8 weeks that followed. Surgical wounds were fully healed on average 4 weeks after the procedure. In contrast, only one calf in the rubber ring treatment group was fully healed within the 8-week study period. Compared with surgically-castrated calves, those castrated by rubber ring gained less weight over the study period (mean 11.9 kg less), which was partially attributed to lower intake of calf starter (on average 1.8 kg less). In addition, calves in the rubber ring treatment group spent less time lying down (mean 4.2% fewer scans per day) and licked their lesions more often (mean 16.0 more licks per day).

**Comment:** This study looked at dairy calves that were castrated with a rubber ring (n=11) or surgically (n=10) at 28 days of age. Calves were observed and measured for the next 8 weeks. All calves were sedated with xylazine and received local anaesthesia prior to castration and meloxicam after the procedure. I do not know what percentage of male dairy origin calves in NZ get castrated or when the ones that do get castrated get done apart from the ones we do at calf debudding, which are almost all younger than the calves in this study. The calves that got a rubber ring grew slower over the 8-week observation period not because they consumed less milk but they did consume more meal. Time to healing was less in the surgically castrated calves, all were completely healed in 28 days, and only one of the rubber ring castrated calves had a fully healed wound at the end of the study. It would seem from this small study surgical castration with the use of analgesia is preferable to castration with rubber rings if post operative infection can be effectively prevented.

***Reference: J Dairy Sci. 2021;104(12):12881–12886***
Abstract

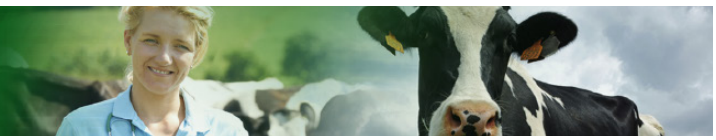
## Investigating anogenital distance and antral follicle count as novel markers of fertility within a herd of cows with positive or negative genetic merit for fertility traits

**Authors:** Grala TM et al.

**Summary:** These researchers investigated two phenotypes, antral follicle count (AFC) and anogenital distance (AGD), which can be measured early in life and are moderately heritable, to determine their association with traditional measures of reproductive success and genetic variation under a seasonal-calving, pasture-based system. They found that AGD may be a promising early marker of fertility in seasonal grazing systems. Primiparous cows with a short versus long AGD had a higher likelihood of becoming pregnant within the first 6 weeks of mating, and the duration from calving to conception was 20 days earlier in short- versus long-AGD cows. Genomic regions of interest for AGD and AFC did not overlap, i.e. the two phenotypes were independent.

**Comment:** This study looked at associations between AFC (measured 3 to 6 days after a heifer's first visible oestrus) and the AGD (measured at an early pregnancy test after mating in her first lactation) and key reproductive measures. There was no relationship between AGD and AFC and the genomic region of interest for these traits did not overlap. This suggests these phenotypes are independent of each other. Unexpectedly, heifers with greater AFC did not have improved reproduction over the three years of this study. AGD did though. A short AGD was defined as less than 102mm. First calvers with a short AGD had a 20-day shorter calving to conception interval (103 vs 123 days). The planed start of mating to conception interval was also shorter (25 days vs 47 days). The calving to submission time was similar between AGD groups though. Every 5mm increase in AGD reduced the likelihood of recalving in the first 6 weeks of a cow's second lactation by 9%. First lactation cows with a AGD <102mm were 42% more likely to get pregnant in the first 6 weeks of mating. It seems AGD predicts the processes that control conception rather than expression of oestrus. The genetic work done identified a single nucleotide polymorphism that was involved with AGD. This seems good, but the authors point out that it is possible epigenetics and the uterine environment alter AGD. While this all seems promising it would be great to know if measuring the AGD prior to any matings occurring is predictive of reproductive performance. In this study AGD was not measured until after at least one successful pregnancy and after mating had commenced for the second pregnancy.

***Reference: J Dairy Sci. 2021;104(12):12939–12952***
Abstract



## Invited review: Use of assisted reproduction techniques to accelerate genetic gain and increase value of beef production in dairy herds

**Authors:** Crowe AD et al.

**Summary:** This comprehensive review article discusses how assisted reproduction technologies can be used to select for genetic improvement in both dairy breed and beef breed bulls suitable to use in the dairy herd.

**Comment:** This Irish paper has identified that in many countries the size of the national herd has peaked. This is likely true for NZ. The authors also identified that the production of calves of dairy origin (50% dairy genetics or greater) that are not retained as replacements have low genetic merit as beef animals and "this results in animals of low economic value, in turn leading to welfare and environmental concerns". This paper looks at what tools are available to increase the rate of genetic gain to improve the value of the dairy replacements and the value of the calves produced that are not going to enter the herd as replacements. The use of sexed semen and genomic selection are well used and accepted. What is newer or at least less widely used are technologies such as Juvenile In Vitro Embryo Production and Transfer (JIVEPT) and it is now possible "for a heifer calf to be the mother of a bull destined to become an AI sire before she herself has reached puberty or ever lactated". So if very high genetic replacements can be produced then the balance of the herd (greater than 60%?) can be used to produce higher value calves destined for beef production. Being a review article, it is lengthy and goes into far more detail than I have the space to summarise but adoption of some or all of the technologies reviewed here will all come down to economics and it is summed up nicely by the authors saying: "For a dairy farmer to switch from using beef artificial insemination (AI) to beef embryo transfer (ET), the resulting calf would need to attract a greater economic value at 2 weeks of age. For the beef farmer to spend more money on an ET calf versus an AI calf, either the slaughter value needs to be greater (larger carcass, better conformation, premium price) or the cost of getting to slaughter needs to be less (e.g., finished at an earlier age, better growth rates, better feed efficiency)."

***Reference: J Dairy Sci. 2021;104(12):12189–12206***
Abstract

## Mitigating greenhouse gas emissions from New Zealand pasture-based livestock farm systems

**Authors:** Leahy S et al.

**Summary:** The premise of this viewpoint article is that a reduction of the agricultural greenhouse gases (GHGs), methane ($CH_4$) and nitrous oxide ($N_2O$), is likely to play an important role in NZ's transition to a low-emissions economy. Although few options currently exist to reduce emissions from pasture-based livestock farming systems, several technologies, e.g. inhibitors and vaccines, are under development that have the potential to considerably reduce on-farm emissions. Also, while on-farm forestry can be used to offset emissions via carbon sequestration in trees, a more robust and consistent scientific evidence base is required if soil carbon sequestration is to be used to offset NZ's GHG emissions.

**Comment:** It seems NZ agriculture will have to pay for its GHG emissions. How this will happen or is implemented is up for discussion in February when He Waka Eke Noa partners ask farmers and growers about policy options (https://hewakaekenoa.nz/pricing-options-february). This paper gives a summary of what drives $CH_4$ and $N_2O$ emissions. Options presented to reduce GHG emissions right now include increasing animal performance while reducing stocking rate, perhaps by reducing beef cow numbers by rearing more calves from the dairy industry? Using "low emission feeds" such as fodder beet or grains could improve animal performance with less total feed needed to reach a level of production, e.g., kg milk solids or live weight gain. Conversely, farms could move to less intensive systems but not increase stock numbers to compensate for reduced outputs (but still pay the mortgage). Another option is increased use of precision application and timing of fertiliser inputs. Urease inhibitors could also be more widely used but will have limited effect as most $N_2O$ emissions come from urine patches. In the future, there may be rumen methane inhibitors, vaccination against rumen methanogens, low-emission animals bred, and nitrification inhibitors that inhibit the formation of nitrates in the soil and thus $N_2O$ production. The section on whether NZ soils sequester carbon does not offer much hope that soil can be used to sequester or offset carbon emissions, unfortunately. It seems soil carbon is variable, tricky to measure and quite dynamic.

***Reference: Journal of New Zealand Grasslands. 2019;81:101–110***
Abstract

## Improving growth rates in preweaning calves on dairy farms: A randomized controlled trial

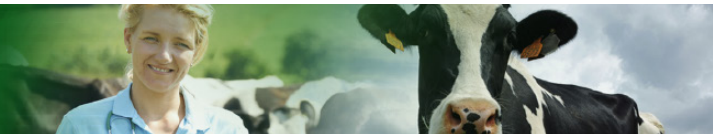
**Authors:** Hyde RM et al.

**Summary:** This study assessed the effect of an evidence-based calf health plan Web app on both productivity and health outcomes for calves reared on British dairy farms. Sixty dairy farms were randomised by location to either receive the plan at the beginning or after the end of the trial and birth and weaning weights by weigh tape, and cases of morbidity and mortality were recorded. Calf records were returned for 3,593 calves from 45 farms. The results indicated that implementation of a calf health plan is likely to improve mean farm average daily gain (ADG) for preweaning calves on dairy farms, particularly male beef calves, with each additional intervention undertaken being associated with improvements in rates of ADG, diarrhoea, and mortality.

**Comment:** As the title suggests this study looked at whether implementing a web-based animal health plan resulted in better growth rates in dairy heifers and male beef calves. There were 20 potential interventions covering the calving pen, colostrum management, feeding, and housing. The farmer and researchers entered farm data into a programme, which then produced 10 recommendations that the software deemed most likely to improve weight gain. The control farms did not receive a plan based on the data entered into the software until 6 months after the survey while the intervention farms got a plan from the software from which they could implement as many recommendations as deemed practical and were also contacted monthly to encourage compliance and implementation of any agreed interventions. For reasons I am unsure of, the intervention farms at the start of the trial were doing more interventions (mean 7.4) than the control farms (mean 6.6). The intervention farms were implementing a mean of 9.9 interventions at the end of the trial and the control farms had implemented a mean of 7.6 at the end of the trial period despite not having received any advice. This paper showed that with an increasing number of interventions the growth rates improved. Even in the control farms it seems that the act of going through a survey (with bench marking) resulted in more interventions being implemented. Perhaps the take home messages for us in NZ is if we don't measure "it" (weights in and out of the calf shed perhaps, or mortality or morbidity rates) we won't be able to "see" a result to any changes made or have relevant benchmarking data, but on a more positive note sitting down and going through a check list of "best practice" might well result in incremental gains.

***Reference: J Dairy Sci. 2022;105(1):782–792***
Abstract





## Characterization and comparison of the microbiomes and resistomes of colostrum from selectively treated dry cows

**Authors:** Vasquez A et al.

**Summary:** These investigators characterised and compared the microbiomes and resistomes in the colostrum of cows with low somatic cell count (SCC) that were treated or not treated with intramammary cephapirin benzathine at dry-off. Cows (n=307; from single farm) eligible for dry-off and with histories of SCC ≤200,000 cells/mL were randomly assigned to receive cephapirin and external teat sealant (ABXTS) or sealant only (TS) at dry-off. Composite colostrum samples taken within 4 hours of calving, and quarter milk samples taken at 1 to 7 days in milk were subjected to aerobic culture. DNA extraction was performed on colostrum and the resistome was captured using a custom RNA bait library for target-enriched sequencing. The four dominant phyla making up the microbiome were *Firmicutes*, *Proteobacteria*, *Actinobacteria*, and *Bacteroidetes*. There was a low prevalence of antimicrobial resistance (AMR) accessions, with aminoglycosides, tetracyclines and β-lactams being the most frequent classes. Overall differences in the microbiome and resistome between treated and untreated cows were not evident.

**Comment:** This study looked at the microbiomes and resistomes of colostrum (pooled sample taken at calving) from cows treated at dry off with either cephapirin benzathine 300mg and a teat sealant, or a teat sealant alone. To be enrolled in this study a cow had to have a SCC less than 200,000 cells/mL at the last herd test and the three-monthly SCCs prior had to average <200,000 cells/mL, no mastitis in the 14 days prior to dry off, and no more than one case of mastitis in the current lactation. After calving a composite colostrum sample and all four quarters sampled 1 to 7 days in milk had to be negative on aerobic culture for the cow's pooled colostrum sample to remain in the trial. If all these criteria were met the pooled colostrum samples had their microbiome described as well as the resistome. The microbiome was described using 16S rRNA metagenomic sequencing. What was surprising to me was that the microbiome composition at the phylum, class, and order levels were similar between treatment groups. The resistome composition was also similar between treatment groups at the class level, and the mechanisms of potential resistance (just because the genes were present does not mean they were being expressed). The most common type of resistance detected was to aminoglycosides despite all dry cow intramammary products in the US being beta lactams. That there was not a difference detected in the microbiomes seems amazing despite one group getting a dose of dry cow therapy. Is the microbiome in the colostrum established after the dry cow therapy (DCT) has finished working? Please don't take this paper as a reason to stop reducing antibiotic usage, as the subset of colostrum samples analysed were "sterile" and came from cows we would likely deem to not require antibiotics at dry off time. I think the message is that the microbiome will return to "normal" after DCT (if it did change?) and there is always a background level of resistance about (bacteria have been battling each other and fungi etc for ages), so let's not add another selection pressure to increase the frequency of AMR genes by using antibiotics unnecessarily by overusing antibiotics.

***Reference: J Dairy Sci. 2022;105(1):637–653***
Abstract

## Dairy farmers' perspectives on providing cow-calf contact in the pasture-based systems of New Zealand

**Authors:** Naeve HW et al.

**Summary:** The aims of this study were to examine the perspectives of NZ dairy farmers toward providing cow-calf contact, and to describe the cow-calf contact systems and perspectives of farmers that are already rearing calves with cows. Telephone-interviews were conducted using a semi-structured interview format. Interviewees were randomly selected from a national dairy farmer database. Conventional and cow-calf contact dairy farmers were found to have diverse views on the practice of providing extended cow-calf contact in NZ, especially around animal welfare, labour, and system-level practices. There was, however, common ground regarding concerns about animal welfare from both groups of farmers.

**Comment:** This paper is in response to what happens on most dairy farms regarding the timing of picking calves up and the "emerging concerns about this practice among citizens and other stakeholders". The early separation of the calf from the cow is according to papers cited in the introduction not supported by the public due to its unnatural-ness and "the public typically consider farming systems to have good animal welfare if they are perceived to be natural". Also mentioned in the introduction is that when there are concerns about management practices such as dehorning, or limited or no access to pasture, and that "providing reasons for why these practices occur on farms does not appear to resolve these concerns". Sixty-seven surveys were conducted of which only four participants practiced extended cow-calf contact whose herds ranged in size from 14 to 140 cows. There were three themes identified:

1. Welfare, including colostrum intake, mastitis of the cow, ability to provide shelter, and stress of separation.
2. Labour and staff wellbeing, which covered the perceived need for more labour or increased workload and potentially having to deal with less tame calves.
3. Required system changes, concerns around how to manage calves in the yards and milking shed and requirement for better (calf proof) fencing.

Why conventional farmers reported what they do is not surprising, but animal welfare was also a theme that the extended cow-calf contact farmers used to explain why they did things as well. The most interesting part of this paper was the introduction, where to oversimplify, it seems the public associates naturalness with good welfare, and perhaps worrying is that explaining the reason for doing certain practices, which cause concern, does not resolve concerns.

***Reference: J Dairy Sci. 2022;105(1):453–467***
Abstract



## Selective dry cow therapy effect on milk yield and somatic cell count: A retrospective cohort study

**Authors:** Niemi RE et al.

**Summary:** This retrospective cohort study compared milk yield and somatic cell count (SCC) in antibiotic dry cow therapy (aDCT)-treated and untreated cows in herds that used selective aDCT, taking into account risk factors for reduced yield and high SCC. Data on test-day milk yield (kg/d) and naturally log-transformed composite SCC (× 1,000 cells/mL) during the first 154 days in milk (DIM) from 4,720 multiparous cows from 172 Finnish dairy farms were analysed. Based on the results, it was concluded that a missed aDCT treatment for a high-SCC cow has an undesirable effect on subsequent lactation milk yield and SCC, which emphasises the importance of carefully selecting cows to be treated.

**Comment:** Soon enough we will be prescribing aDCT and there will likely be the odd comment along the lines of "are things going to gradually get worse now we are not using blanket dry cow therapy?". This paper goes some way to answering that question. Although it looks at data from Finnish farms, I think it could well be relevant. Seventy percent of the surveyed farms administered aDCT to a maximum of one quarter of their cows (according to electronic data) or 82% of farms based on a questionnaire. Either way, the majority of farms were using selective DCT and most cows were not getting aDCT. The cows that got aDCT had higher late lactation SCC, more mastitis prior to dry off, and a slightly higher milk production than non-aDCT cows, as expected. What was fortuitous was there were cows with a last SCC >200,000 cells/mL that did not receive aDCT. The difference in subsequent milk yield between aDCT-treated cows and non-aDCT treated cows increased as the pre-dry off SCC increased. "Missing an aDCT treatment for a high-SCC cow at dry-off has a minor undesirable yield effect during the subsequent lactation." Similarly, a cow at drying off with a SCC of 200,000 cells/mL and received aDCT had a SCC at 45 days in milk 20,000 cell/mL less than those that got non-aDCT. In summary, I feel the effect of not using blanket DCT is minor but try not to miss cows that should get aDCT as there is a small undesirable effect on subsequent milk yield and SCC for those individuals. If a farm's SCC or mastitis rates are trending in the wrong direction the use of selective DCT might be having a minor effect but it will likely be due to other factors.

***Reference: J Dairy Sci. 2022;105(2):1387–1401***
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.