Dairy RESEARCH REVIEW™

Making Education Easy

Issue 31 – 2022

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Welcome to the latest issue of Dairy Research Review.

The effects of dairy cow farming on the environment are addressed in two papers, one of which uses life cycle assessment methodology to estimate greenhouse gas emissions and acidifying pollutants in pasture-based systems and another paper that evaluates advanced machine learning algorithms for prediction of enteric methane emissions. In a second brace of papers, public attitudes toward dairy farming with respect to i) the management of surplus calves and ii) the management of heat stress in dairy cows are evaluated. Also included is a paper that describes the association between reproductive performance on NZ dairy farms and milk composition and specific animal factors.

We hope that you enjoy this issue of **Dairy Research Review**. We value your input so please keep sending us your comments and suggestions.

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.

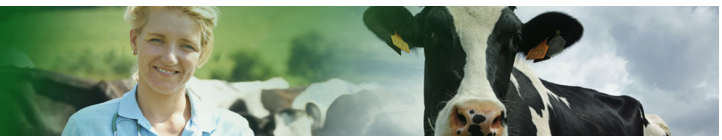
Integrating heterogeneous across-country data for proxy-based random forest prediction of enteric methane in dairy cattle

Authors: Negussie E et al.

Summary: The objectives of this study were to compare the performances of machine learning ensemble algorithm random forest (RF) and multiple linear regressions (MLR) models in predicting methane (CH_4) emissions from proxies in dairy cows and to assess the influence of imputing missing data points on prediction accuracy. Data on enteric CH_4 production and proxies for CH_4 that are routinely collected from dairy farms were provided by 13 research centres from 10 European countries. Three data sets were created and used to test scenarios (with or without dry matter intake [DMI], imputed versus non-imputed DMI, milk fat, and protein), and prediction models (RF vs MLR). In all scenarios, RF models out-performed MLR models. The results suggest that routinely measured variables from dairy farms can be used to develop robust prediction models for CH_4 if combined with state-of-the-art techniques for imputation and advanced machine learning algorithms for predictive modelling.

Comment: Agriculture is estimated to contribute 10–14% of global greenhouse gas emissions. Livestock production accounts for 40% of the CH_4 emissions (most coming from rumens). Globally, mitigation of CH_4 reduction will have a quick return due to its short "half-life" compared with CO_2. So it seems there is a need for a relatively easy, and or cheap, way of creating a CH_4 inventory that can be applied to different countries and production systems. Direct measurement of CH_4 in respiration chambers is not practical to roll out on a large scale. Instead, a combination of proxies for CH_4 (directly or indirectly related) are used. Some of the proxies used are expensive to generate or not widely available such as energy intake or DMI and diet composition. The traditional models used MLR but cannot approximate potentially nonlinear relationships between proxies. This paper examined whether the use of low-cost and routinely recorded traits (e.g., milk yield, milk composition, age, lactation stage) as predictor variables, could be a practical option using machine learning. This modelling technique helps overcome the difficulty of procuring predictor variables related to intake and diet composition on-farm and can manage missing data. I guess the take home message is that there are people out there trying to find a standardised way to predict or measure CH_4 production using readily available data (not DMI, or feed composition) that is applicable across wide range of management systems, and going forward, we are all going to have a greater understanding of what machine learning is or our kids will really think we are luddites.

Reference: J Dairy Sci. 2022;105(6):5124–5140
Abstract



Life cycle assessment of pasture-based dairy production systems: Current and future performance

Authors: Herron J et al.

Summary: Life cycle assessment (LCA) is an internationally-recognised methodology used to determine the environmental impact of all stages in the life of a product, service, or process. The objectives of this study were to update an existing dairy LCA model with country-specific emission factors, life cycle inventory data, and recommended methodologies; and to calculate the environmental performance of an average Irish spring-calving pasture-based dairy system and an ambitious target pasture-based dairy system. The environmental impact categories assessed were global warming potential, non-renewable energy depletion, acidification potential, and eutrophication potential (marine and freshwater). Two functional units were used: per kilogram of fat- and protein-corrected milk (FPCM), and per hectare. Overall, the results suggest that the adoption of management practices that improve system efficiency will reduce the environmental impact per kilogram of FPCM. However, improved system efficiency can be offset by the associated increase in productivity, which underlines the importance of reporting multiple environmental impact categories and functional units to prevent pollution swapping.

Comment: In 2019, dairy cattle produced 11.9% of the global greenhouse gas (GHG) emissions from agriculture and forestry. This Irish paper looks at emissions from dairy cows using LCA. The Irish are in a similar situation to us in NZ with ruminant production contributing 35% of their total GHG emissions and almost all of their CH_4. I think in NZ about 50% of our emissions come from agriculture and half of that from dairy. Two production systems were simulated, one was the current average pasture-based dairy system and the second was a pasture-based system achieving high animal and farm performance that is being achieved by the most efficient dairy farms. There was a reduction in global warming potential (GWP) of 0.21kg of CO_2-eq/kg of FPCM if the high-performance farm system was compared the average farm system (0.97 vs 0.76 kg of CO_2-eq/kg FPCM). However, when the GWP was expressed per hectare (Ha), the high-performance system produced 11% more CO_2-eq (9,663 vs 10,689 CO_2-eq/Ha). This rise in emissions per Ha was due to a 42% increase in productivity per Ha. So, there was proportionately a greater increase in production per Ha than emissions per Ha. This is a good article to read to get your head around all the terminology and units used in the measurement or accounting of GHGs. It seems to me there will always be a bit of conflict between what a country wants (lower total GHG emissions – which for a ruminant seems to mean less dry matter intake) and what a seller of a ruminant product wants (lower emissions intensity per unit of product).

Reference: J Dairy Sci. 2022;105(7):5849–5869
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.

Public attitudes toward different management scenarios for "surplus" dairy calves

Authors: Ritter C et al.

Summary: A mixed-methods questionnaire was developed and distributed online in the US and Canada to evaluate attitudes of members of the public toward the management of surplus calves not needed for milk production on dairy farms, and to assess how specific calf management practices might influence these attitudes. Data representative of key census demographics from 998 respondents were analysed. The survey findings suggest that by failing to provide assurances that excess dairy calves have a reasonable length of life that is purposeful (i.e., contributes to the beef supply chain) the dairy industry has placed itself at variance with public values. As public awareness grows, the practice of early cow-calf separation will be increasingly questioned and failure to initiate discussions on this topic may mean that future decisions regarding the practice will be made in the absence of the farmer.

Comment: We all are aware of how important the public's perception of what happens on dairy farms is to the industry retaining its "social licence". I am often surprised by how little the public know or understand about what happens on farms, and I live in a provincial town, so found this article from Canada enlightening about how the rest of society (Canadian and US at least) feels about bobby calves. The authors state that "it is now established that a general negative attitude toward early cow-calf separation exists among the public when they are made aware of the practice". This study examined public perceptions to the management of "surplus calves" and cow-calf separation. Early slaughter was defined was slaughter within the first two weeks of life, late slaughter was after 12 months. Early calf separation was described as the calf being removed within a few hours of birth and fed milk from a bottle by the farmer. Not separated was described in the survey as "after being born, the calf remains with the cow and drinks milk from the cow". Between 33% and 39% of the participants in the survey had "no idea" if the scenarios presented to them about calf management represented what occurs on dairy farms in North America. Generally, study participants were "amenable" to use of surplus dairy calves for meat production but were not comfortable with slaughter at a young age. Early cow-calf separation further negatively influenced these attitudes. The dominant factors that influenced attitudes were age at slaughter (the older the better and >1 month old), and not having the calf separated early. Having access to pasture was perceived as the most important additional consideration by participants in this study. In this survey, participants did a "manipulation check", which involved reading a paragraph about research studies unrelated to the current study and instructions on which responses to select. Participants who did not follow the instructions were excluded from the analysis. Of the 2,753 participants, 1,454 failed this check. This may have introduced some unknown bias, but the aim was to remove the "less attentive" participants. The benefits and draw backs of manipulation checks in research surveys are still being debated. Despite being a survey, this paper highlights to me what I think are known reputational risks for the dairy industry and ranks what the public might see as most important.

Reference: J Dairy Sci. 2022;105(7):5909–5925
Abstract

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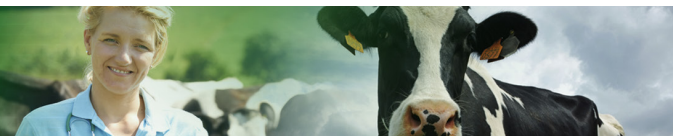


Estimating the effect of different work practices and technologies on labor efficiency within pasture-based dairy systems

Authors: Hogan C et al.

Summary: Using data from an existing labour time-use study (150 days) on 76 Irish dairy farms in conjunction with a survey on work practice and technology implementation, these researchers identified work practices and technologies associated with labour efficiency of particular tasks and estimated the time savings that could be made via their implementation during the period of peak labour input on spring-calving dairy farms. The study results emphasise the wide range of labour-efficient work practices and technologies available to dairy farmers and that when accumulated they can result in significant influences on farm labour efficiency. Although there is room for improvement in the adoption of these work practices and technologies, the benefits of their implementation are already evident.

Comment: NZ studies have indicated high levels of satisfaction on farms that have adopted automation technologies including automatic cluster removers, automatic milk plant wash systems, in-shed meal feeding, and automatic drafting, while also showing that these farms were more labour-efficient than peers without technology (Dela Rue et al, 2020). But these results could be subject to recall bias and confirmation bias (we tend to recall stuff that supports our prior beliefs). Labour efficiency in this study was defined as hours per cow. Irish farmers kept a diary on an app and were surveyed about the use of 110 technologies and work practices. Some of the techniques identified in this study don't seem relevant to NZ to be honest. For example, not leaving the milking pit to feed calves during milking and using a quad to get the cows to and from the "parlour" were two of the five practices that were included in the final model to improve milking efficiency. Similarly in the section on improving labour efficiency associated with calf rearing, training calves onto group feeder was unsurprisingly more efficient than individually feeding calves. Perhaps the most useful tip from this paper is that "large variations in labour efficiency from farm to farm indicate that the impact of work practices and technologies may affect individual farms differently (Deming et al, 2018)". Ask to see your Fonterra supplier's Farm Insights Report and have look at the milking efficiency section. The milking efficiency visits done by Fonterra that I am aware of have had better recommendations made than those described in this paper to improve milking efficiency – although the measures used are not hours per cow.

Reference: J Dairy Sci. 2022;105(6):5109–5123
Abstract

Public perceptions of potential adaptations for mitigating heat stress on Australian dairy farms

Authors: Hendricks J et al.

Summary: These investigators determined how proposed changes to mitigate heat stress in dairy cattle influence public perceptions toward Australian dairy farm systems. A representative sample of resident Australians were presented with one of four treatments representing a potential solution to mitigate heat stress in dairy cattle: (1) indoor system; (2) choice system (agency to choose to be indoors or outdoors); (3) gene edition plus pasture (cows are genetically modified to become more resilient to heat stress); and (4) pasture (current outdoor system used in Australia, but the farmer plants more trees). They were then asked to respond to questions (7-point Likert scale). Overall, the feedback from the participants suggested that the Australian public may be reluctant to accept heat stress mitigation strategies that either do not allow cows to have access to pasture or those that include gene-editing technologies.

Comment: The animal wellbeing plans we now create for our Fonterra-supplying clients as minimum requirement under the "environment" plan to address heat stress mitigation. The aims of this study were to determine the Australian publics' perceptions of different farm system adaptations that, if implemented, could mitigate the negative effects of heat stress in grazing dairy cattle. One of four scenarios to manage the increasing number of days that cows will experience heat stress (I will assume global warming is accepted by most of you) was described to survey participants. One scenario was cows had access to a barn with fans and access to pasture with trees (cows could decide where to be). The second scenario was cows were housed all year, the third scenario was the farmer used gene editing to add in genes from other breeds to make the resulting calves more heat tolerant and were managed at pasture with access to trees. And the final scenario was having cows outdoors with access to shade trees. As in NZ, in Australia heat mitigation has mainly been limited to management changes, such as changing milking times and installing sprinklers, and the authors state there are trees being planted and shade structures being built. However just a few sentences later acknowledge that "farmers in some regions of Australia removing trees from their pasture to allow for the installation of large, automated irrigation systems, driven by the need for increased water-use efficiency (Finger, 2005)", which is what I see happening. This paper provides no practical answers to mitigating heat stress but, like the article on "surplus dairy calves", reminded me how I see the industry we work in might not be how it is perceived by the "public". For example, the "Public acceptance of gene edition strategies in dairy farming is generally low, even when the use of gene edition aims to address potential animal welfare issues such as heat stress or dehorning (Yunes et al, 2021)" but in this study, participants' perceptions of cow welfare were higher for the gene edition plus pasture scenario, compared with the indoor scenario. In this study, participants' purchasing intention was associated with the scenario with which they were presented. However, the authors "caution the reader when interpreting the findings from the willingness to pay question in this study, as the link between questions around willingness to pay and actual purchasing behaviour is not direct, thus limiting our ability to draw strong conclusions". Finally, for those of us who identify as male, are older, and reside rurally, we need to remember that in this study younger, urban-residing participants, and those who identified as female, had lower perceptions of cow welfare.

Reference: J Dairy Sci. 2022;105(7):5893–5908
Abstract

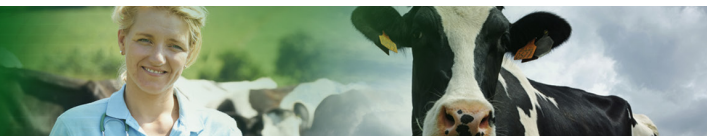
Predictors of diarrhea, mortality, and weight gain in male dairy calves

Authors: Schinwald M et al.

Summary: This prospective cohort study determined the effect of an abnormal faecal consistency score on weight gain and mortality in male Holstein calves (n=2,616) and identified risk factors associated with the occurrence of an abnormal faecal consistency score. The results suggest that the presence of abnormal faecal consistency has a substantial influence on short-term weight gain and mortality and morbidity risk, and that diarrhoea occurrence can be predicted using body weight at arrival and calf source.

Comment: This Canadian study examined the effect of having an abnormal faecal score on weight gain and mortality in male Holstein calves. A total of 2,616 calves were followed for 77 days after arriving at a grain-fed veal facility. Calves arrived at the facility at between three and ten days of age. Calves were sourced directly from dairy farms, livestock markets, or from drovers (people who collect calves from multiple farms and transport them to a veal facility). For the first 49 days, calves were housed individually on a slatted rubber floor separated from their neighbour by open partitions that allowed physical contact. Each calf had 1m^2 of space. After 49 days partitions were removed to allow five calves to live together. One-third (36%) of calves on arrival at the facility had a serum total protein (STP) of <5.2 g/dL indicating failure of passive transfer of colostral immunity, a remarkably similar proportion to what has been reported in NZ. In terms of predictors of the proportion of days a calf had diarrhoea (loose or watery stool), only the weight of the calf at arrival and where/how the calf was sourced from were significant in the final model. Smaller calves and calves sourced from drovers had a more days with diarrhoea. During the course of the study, 65% of calves received antibiotics for diarrhoea. A model to evaluate factors contributing to receiving antibiotics for diarrhoea was created with STP, weight at arrival, calf source, season of arrival, and the proportion of days with an abnormal faecal score offered to this model. Only STP and days with abnormal faeces remained in the final model. The STP was not significant in the model, but it was included due to its confounding effect. For every g/dL increase in STP, the hazard for antibiotic treatment for diarrhoea decreased (HR 0.991; 95% CI: 0.916–1.073; p=0.83). During the study, 71% of calves received antibiotics for respiratory disease and STP and days with an abnormal faecal score were retained in the model (STP was significant this time). During the study period, 8.9% of calves died (59% and 33% of deaths were attributed to respiratory disease and diarrhoea, respectively). It was found that for each additional g/dL in STP, there was a decreased hazard of mortality (HR 0.74; 95% CI: 0.59–0.93; p=0.009). This study did not find an association with STP and diarrhoea, which is also a finding reported in other studies cited in this paper. However, a meta-analysis cited in this paper found that calves with failed transfer of passive immunity were 1.5-times more likely to be treated for diarrhoea. It is also possible that STP may not in this situation be a reliable measure of passive transfer as transported calves are often dehydrated when entering a veal facility. Additionally, the exact age of the calves was not known and the composition of immunoglobulins in STP changes as a calf ages. The amount of disease treated in this facility with antibiotics makes me hope we don't get forced into a housed veal system to allow our "surplus" calves to live longer, which from the previous paper in this review suggests the public may want.

Reference: J Dairy Sci. 2022;105(6):5296–5309
Abstract



Using a target trial approach to evaluate the role of hyperketonemia in sole ulcer and white line hoof lesion development

Authors: Wynands EM et al.

Summary: This observational cohort study enrolled cows from seven free stall dairy herds across two states in the US to estimate the causal role of hyperketonaemia, an imperfect indicator of negative energy balance and fat mobilisation, on new sole ulcer and white line hoof lesions (SUWL). Multiparous cows (n=2,037) were enrolled at the time of their precalving hoof trim, at the end of their previous lactation. The results of the study suggest that hyperketonaemia is likely to have a limited role in the development of SUWL in cows with or without a hoof lesion precalving.

Comment: Although in our systems we don't see many sole ulcers, both sole ulcers and white line disease are thought to be caused by trauma within the hoof and damage to the internal structures of the hoof from both internal and external concussive forces, so the authors grouped these two lesions together. Whether this is true for our systems I will leave for you to decide. There have been studies done that found a relationship between hyperketonaemia and farmer-recorded lameness. However, these studies did not examine specific lesions, nor take into account previous lesions. Considering previous lesions is likely to be important, as after a lameness event the anatomy of the pedal bone changes with exostoses. Cows were trimmed at drying off (so 1st calvers were not enrolled in this study) and excluded from the study if at that point were diagnosed with SUWL (1.9% of cows). Cows were then β-hydroxybutyrate (BHB)-tested twice between 3 and 16 days in milk after calving (21.1% had BHB ≥1.2 mmol/L) and were trimmed between 21- and 150-days post calving (25.8% had a lesion, 3.6% had SUWL). The odds of a hyperketonaemia cow being diagnosed with SUWL was 0.66 (95% CI: 0.29–1.49). This study did not find a causal link between hyperketonaemia and SUWL. This may be due to the mobilisation of fat being trickier to measure than looking at BHB levels alone, and/or the digital cushion is only 30% fat. It seems more likely that changes that occur in the foot during the transition period caused by inflammation and endocrine changes are more important than fat mobilisation.

Reference: J Dairy Sci. 2022;105(7):6164–6174
Abstract

Effect of selective dry cow treatment on udder health and antimicrobial usage on Dutch dairy farms

Authors: Tijs SHW et al.

Summary: The aim of this study was to gain insight into the method and level of implementation of selective dry cow therapy (SDCT) on Dutch dairy farms several years after its implementation. Incidence rates of clinical mastitis (IRCM) and subclinical mastitis (IRSCM) as well as antimicrobial usage (AMU) were assessed. Differences between dairy farms with a conventional milking system or an automatic milking system in terms of SDCT, udder health, and AMU were also described. The findings showed that, several years after its implementation, the changed antimicrobial policy in the Netherlands resulted in a reduction in AMU with no worsening of udder health being apparent.

Comment: As a country we are voluntarily moving steadily towards more of our herd using SDCT. The Dutch are almost all using SDCT. So this paper can give us some idea of what we might expect going forward. By 2013, when blanket dry cow therapy (DCT) use was banned, 75% of Dutch dairy farmers applied SDCT. In this study, 98.8% of farms used SDCT. There was also a reduction in the proportion of cows within herds that use SCDT receiving antibiotic DCT, from 63% in 2013 to 46.7% in this study. In 2013, the main selection criteria used to apply antibiotic DCT was a cow's whole lactation somatic cell count (SCC) data compared to this study where the most common selection criteria was the cow's most recent SCC only. Clinical mastitis history was used as criterion to use antibiotic DCT for 12.4% of cows. The incidence rate of clinical mastitis was 27.3 cases/100 cows per year, which was less than the data from 2013. The bulk tank SCC was also lower. This paper seems to suggest going down the track of using less and less antibiotic DCT won't result in worse udder health. I suspect we are all susceptible to seeing a deterioration in udder health between seasons on a farm but not look at a longer-term trend or we forget the farms where udder health has not deteriorated or improved between seasons. Having said that, from December 2016 onward, the Dutch government required dairy farmers to decrease herd size because of excess manure. This resulted in more cattle being slaughtered between December 2016 until the end of 2017 than in other years. "If, as is likely, repeated clinical mastitis or (chronic) subclinical mastitis was a selection criterion for culling, this may be a reason for finding lower IRCM, IRSCM, and bulk tank SCC compared with earlier studies."

Reference: J Dairy Sci. 2022;105(6):5381–5392
Abstract

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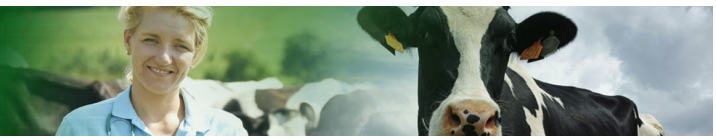

Impact of winter fodder beet or kale allocation on body condition score gain and early lactation performance of dairy cows

Authors: Dalley DE et al.

Summary: The aim of this study was to compare body condition score (BCS) gain, nutrient intake, and early lactation milk production of groups of cows offered two feeding levels of winter diets differing in crop type: fodder beet and kale. The investigators hypothesised that there would be a crop x allocation interaction where cows fed *ad libitum* fodder beet would become over conditioned and this would lead to poorer animal performance in early lactation. Based on the results, the investigators rejected their hypothesis. Cows fed *ad libitum* fodder beet were not over conditioned and fodder beet cows had greater milk production and improved reproductive performance compared with kale cows.

Comment: For those of us who work in areas with fodder beet it is common, that for any problem a farmer has, to be asked if fodder beet is part of, or the sole, reason for the issue. It is always hard to answer objectively especially when you look around and struggle to find cows spending their winter on anything else. This study from Southland had four treatment groups with 82 cows in each group. Cows were fed either fodder beet or kale at two allocation rates ("target" or "high"). The target allocations were to gain 0.7 of a BCS unit so were offered 140MJ metabolisable energy (ME)/day with no more than 70% of the diet on a dry matter (DM) basis coming from the crop, the balance was from baleage. For the high allocation groups, the crops provided ≥80% of the total diet and were offered *ad libitum*, with the balance being baleage. For these groups, the predicted intakes were 160MJ ME/day and BCS gain was predicted to be 1.25 BCS units. This in terms we think about more commonly means the kale fed cows got 10.5kg or 14kg DM after transitioning for the "target" and "high" groups, respectively. For the fodder beet groups, it was 9.1 and 11.9kg DM of fodder beet for the "target" and "high" groups, respectively. After taking allocation and utilisation into account, the ME intakes were 176 and 153MJ ME/day for the high and target fodder beet groups and 157 and 147MJ ME/day for the high and target kale groups. Surprisingly, the average BCS gain over the dry period was very similar for cows on fodder beet and kale but cows in either of the high allocation groups had slightly greater gains. Colostrum quality as measured by Brix was not different between treatment groups. Average daily milk yields for the first 12 weeks was significantly higher for cows wintered on fodder beet than for cows wintered on kale (1.93kg milk solids [MS]/day vs 1.86kg MS/day, respectively; p=0.002). Cows wintered on fodder beet had a 3-week pregnancy rate (3WICR) of 73% versus 59% for the kale fed cows. Unsurprisingly, given the 3WICR, the 6-week pregnancy rates (6WICRs) were not significantly different. Conception rate to first artificial insemination was also greater for the fodder beet cows (70% vs 54%). For the final pregnancy rate within the fodder beet fed cows, those fed to "target" tended to have a better final pregnancy rate than those in the "high" or *ad libitum* group (99 vs 93.6%). The trend was reversed for the cows wintered on kale with those fed to "target" tending to have a lower final pregnancy rate than those in the "high" group (93.6 vs 97%). The time from start of mating to conception was less for cows wintered on fodder beet than kale (13.5 vs 17.5 days). The dry period length in this trial is shorter than we might consider "normal" in Southland as the cows had a planned start of calving of 20 July with cows transitioning onto their crops on 31 May (transition times ranged from 12 days for the kale target group to 30 days for the fodder beet "high" group) and coming off crop 10 days prior to expected calving. This might explain the lack of difference in BCS at calving and values lower than those predicted (no treatments achieved the targeted or predicted BCS at calving). There was also a change in the planned start of mating to result in a planned start of calving shift from 20 July to 5 August so the cows had an extra 16 days to resume cycling, which might well explain the reproductive performance reported. In conclusion, crop type had a greater effect on performance than allocation, whether this holds true for cows with a longer dry period we can't say but to me it seems likely allocation would become more important. This paper gives me more confidence in trying to answer a farmer's concerns about fodder beet. What effects fodder beet, if any, has over a lifetime of winters is not answered but at least this paper should allay some concerns. Perhaps the take-home message is ME intake over the dry period is more important than where it comes from.

Reference: J NZ Grasslands. 2020;82:73–81
Abstract

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Dairy Research Review

A statistical evaluation of associations between reproductive performance and milk composition and animal factors on grazing dairy cows in two New Zealand dairy farms

Authors: Rodriguez-Cutzal LX et al.

Summary: These investigators determined if milk composition and an array of animal factors were associated with reproductive performance in dairy cows from two NZ dairy farms. The results demonstrated that breed, heterosis, energy-corrected milk yield, protein and lactose percentages, live weight change, and calving date are associated with the reproductive performance of grazing cows. Milk urea nitrogen was not associated with reproductive performance traits, except with submission rate at 21 days.

Comment: This study grabbed a heap of data from two seasons from the Massey #1 (once-a-day milking herd, low stocking rate) and #4 (twice-a-day milking herd, with "high amounts of supplements") dairy farms and looked at reproductive outcomes. Various milk components have been associated with reproductive outcomes overseas, and these relationships have not always been found under our systems, e.g., milk urea nitrogen (MUN), and for some relationships a biological relationship has not been established, e.g., between milk protein percentage and reproductive performance, which may be a proxy for better energy intake. The outcomes examined were start of breeding to first service and to conception in days and the 21 days submission rate (SR21) and three- and six-week pregnancy rates (PR21 and PR42, respectively). The number of days a cow calved relative to the mean calving date was associated with her PR42. The average PR42 changed by 0.15% for each day either side of the herd mean calving date. Contrary to what I expected, the proportion of F (Friesian) genetics in a cow was positively associated with the PR21. It was modelled that a pure F cow had a PR21 that was 17.8% higher (not 17.8 percentage points higher!) than a J (Jersey) cow. The F x J cows were higher still, showing the importance of heterosis. The proportion of F was not significantly associated with PR42 indicating that purebred F and J cows will have similar performance for PR42. The effect of heterosis was still significant though. The reason the F cows perform better than J cows at least for the PR21 was discussed and may be because for the last 20 years 13% of the breeding worth has been towards fertility and the rate of genetic gain for fertility may be higher in F × J cows than the rate of genetic gain in J cows due to the population size of F × J being larger than the J population (more selection pressure applied). Also in his study, a change to what we might be tempted to believe, the reproductive performance increased with energy-corrected milk yield, i.e., reproductive performance increased with production. The authors also discuss this finding and mention the changes that have occurred in selection indexes over the last 25 years "evolving from a single trait selection index for milk production to multi-trait selection indices, incorporating many fertility, health and fitness traits with high relative economic emphasis on fertility". The authors also advise or counsel that "genetic improvement for milk production and reproductive performance must be supported with improvement in feeding and management". In this case, the herds that contributed data were once-a-day milking or using "high amounts of supplements" so may have allowed both production and reproduction to traits to be expressed. PR42 increased by 9.6% when the protein percentage increased from 3.5 to 4.5% (p=0.034). Once again, the authors suggest that this may be due to concurrent selection for both high fertility and milk protein production. Now to add some confusion, cows that were gaining weight from the start of the breeding period had a lower SR21 but the PR21 increased with weight gain. The reason for this finding "is unknown and deserves further investigation". Finally, PR21 and PR42 were not associated with MUN and MUN varied more between farms, rather than between breeds and production seasons.

Reference: N Z Vet J. 2022;70(3):138–148
Abstract