



Making Education Easy

Issue 1 – 2015

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Abbreviations used in this issue

BCS = body condition score
 BHB = beta-hydroxybutyrate
 DM = dry matter
 ECM = energy-corrected milk
 MJME = megajoule of metabolisable energy
 MS = milk solids
 NEFA = non-esterified fatty acid
 SCC = somatic cell count
 SCK = subclinical ketosis

Welcome to the first edition of Dairy Research Review.

This Review is the first in a series of Animal Health Reviews and is a summary of what we think are some of the most significant recent papers in the field of dairy research. In addition we provide expert local commentary on why they are important and how they can potentially affect your practice.

The Review also provides website links to the abstract or fully published papers so you can make your own judgements. The selection and review of each study is independent.

If you have friends or colleagues within New Zealand who would like to receive our publication, please send us their contact email and we will include them for the next issue.

We hope you find this first edition stimulating reading and welcome your comments and feedback.

Kind regards

Hamish Newton

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A longitudinal study of production and survivability of carry-over cows in a commercial dairy herd

Authors: Pangborn MC & Woodford KB

Summary: These researchers previously demonstrated that two cohorts of carry-over cows in a New Zealand dairy herd produced 10% more MS in the first lactation (2008/09) subsequent to the carry-over (non-lactating) season. In this study, further production data for this cohort through to the fourth post-carry over lactation was generated and analysed, together with production data for two further cohorts through to their second and third post-carry over lactations, respectively. This data was also compared to production from non-carry over (annual calving) cows of similar breed and breeding worth in the same herd. Carry over cow cohorts produced more MS through to and including the third post-carry over lactation relative to non-carry over cows, additional production that was termed the 'holiday effect'. MS holiday effects were 57kg (13%) and 106kg (23%) in the first year; 36kg (8%), 48kg (10%) and 31kg (6%) in the second year; and 48kg (10%) and 41kg (8%) in the third year. Aggregate survivability through to the fourth post-carry-over lactations was 83%, 82% and 71%, respectively, which was broadly consistent with national survivability statistics.

Comment: This study followed carry over cows through three lactations and in one cohort for four lactations after being 'carried over'. The additional production compared to non-carried over cows was 81kg MS for the first lactation, 38kg MS for the second, 45kg MS for the third, and 10kg MS for the fourth lactation post being carried over (only one cohort). Survival from one lactation to the next was 83% from the first carry over season to the next, then 82%, and 71% for the third to fourth season post being carried over. These survival percentages are similar to those reported for New Zealand in the dairy statistics. This work suggests that carrying over young and genetically valuable animals for a year could well be more economic than we sometimes think especially if the carry overs can be managed to calve at an appropriate body condition score.

Reference: *Proceedings of the New Zealand Society of Animal Production. 2013;73:96-9*

[Abstract](#)

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

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Body condition score at calving affects systemic and hepatic transcriptome indicators of inflammation and nutrient metabolism in grazing dairy cows

Authors: Akbar H et al.

Summary: This study investigated the metabolic and molecular changes induced by the change in calving BCS in a group of cows of mixed age and breed that were managed from the second half of the previous lactation to achieve mean group BCS (10-point scale) that were high (HBCS, 5.5; n=20), medium (MBCS, 4.5; n=18), or low (LBCS, 3.5; n=19). Blood was sampled at weeks -4, -3, -2, 1, 3, 5, and 6 and liver biopsied on weeks 1, 3, and 5, relative to parturition. Ten cows per BCS group were used for transcript profiling via quantitative polymerase chain reaction. Cows in HBCS and MBCS produced more milk and had higher levels of non-esterified fatty acids and β -hydroxybutyrate postpartum than LBCS. Peak levels of NEFA and BHB and higher hepatic triacylglycerol levels were recorded in HBCS at week 3. Consistent with blood biomarkers, HBCS and MBCS had higher expression of genes associated with fatty acid oxidation (CPT1A, ACOX1), ketogenesis (HMGCS2), and hepatokines (FGF21, ANGPTL4), whereas HBCS had the lowest expression of APOB (lipoprotein transport). Higher expression during early lactation of BBOX1 in MBCS and LBCS suggested greater *de novo* carnitine synthesis. The higher BCS was associated with lower expression of growth hormone/insulin-like growth factor-1 signalling axis genes (GHR1A, IGF1, and IGFALS) and higher expression of gluconeogenic genes.

Comment: This study followed cows that were classified as high BCS, medium BCS or low BCS, which had mean calving BCS's of 5.5, 4.5 and 3.5 respectively. Milk production was similar for the high and medium BCS cows, which were greater than the low BCS cows at least until 6 weeks post calving (when the data collection stopped). Blood NEFA and BHB increased with the BCS as did the hepatic gene expression suggesting that fatter cows have increased capacity for fatty acid metabolism. These measurable differences occur over a relatively small range of BCS and support the recommendation that cows should calve at a BCS of 5.

Reference: *J Dairy Sci.* 2015;98(2):1019-32

[Abstract](#)

Temporary alterations to postpartum milking frequency affect whole-lactation milk production and the energy status of pasture-grazed dairy cows

Authors: Phyn CVC et al.

Summary: These researchers investigated the immediate and long-term effects of temporary alterations to postpartum milking frequency (MF) on milk production, body condition score (BCS), and indicators of energy status in 150 pasture-grazed multiparous Holstein-Friesian cows randomly assigned to 1 of 5 groups at calving: milked twice daily (2x) throughout lactation (control), or milked either once daily (1x) or 3-times daily (3x) for 3 or 6 weeks immediately postpartum, and then 2x for the remainder of lactation. During weeks 1-3 postpartum, cows milked 1x produced 15% less milk and 17% less energy-corrected milk (ECM) than cows milked 2x. This immediate production loss increased to 20% less milk and 22% less ECM during weeks 4-6 postpartum for cows that remained on 1x milking; these animals also produced less than 1x cows switched to 2x milking after 3 weeks. During weeks 8-32, when all cows were milked 2x, those previously milked 1x had sustained reductions in milk (-6%) and ECM (-8%) yields. In contrast, cows milked 3x postpartum had 7% greater milk yields during weeks 1-6 compared with 2x controls. Although milk yields also remained numerically greater (+5%) during weeks 8-32 in cows previously milked 3x, yields of ECM were not increased by 3x milking. Cows milked 1x postpartum had higher plasma glucose and lower plasma non-esterified fatty acid levels during the reduced MF, and plasma glucose remained lower for 2 weeks after cows had switched to 2x milking. In contrast, cows milked 3x had lower plasma glucose levels, higher plasma non-esterified fatty acid levels, and greater BCS loss during weeks 1-3. Greater body fat mobilisation, however, was not sustained.

Comment: The season-long effects of once a day milking at the start of lactation on milk solid production are significant. The cows milked once a day did have improved measures of energy balance but in this study did not flow on to improved reproductive outcomes. Cows milked once a day did not have a shorter anoestrus period or improved submission or conception rates. This is surprising as improved energy status is associated with improved reproductive performance but may reflect insufficient power in this study or the length of time milked once a day was not sufficient for positive reproductive effects to be expressed. What was found though was cows milked once a day had a better final pregnancy rate compared to cows milked 3 times a day. This study suggests that putting cows on once a day milking for a short period (3 or 6 weeks) post calving will have a detrimental effect on the amount of MS produced and is unlikely to improve reproductive performance, at least in cows that calve down at a BCS >5.

Reference: *J Dairy Sci.* 2014;97(11):6850-68

[Abstract](#)



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Effect of heifer live weight on calving pattern and milk production

Authors: McNaughton LR & Lopdell T

Summary: Using data from the Livestock Improvement Corporation database, these researchers investigated the effects of breed and region on heifer live weight and the effects of pre-calving heifer live weight (18–21 months) on milk production in New Zealand dairy animals. Fewer Friesian heifers reached their target live weight than Jerseys or Crossbreds (85.3 vs 89.3 vs 88.1%; $p < 0.001$). Heifers born in Otago (91.9%) and Taranaki (91.8%) were the closest to achieving their target live weight. In contrast, those born on the West Coast (85.6%) and Northland (86.0%) had the greatest number of heifers not reaching their target. Heifers that had only one calving were a significantly lower percentage of target live weight than those heifers that had two calvings (83.5% vs 87.1%; $p < 0.001$). In heifers with a live weight record between 18 and 21 months of age, every 1% increase in the percentage of target live weight attained was associated with an increase in milk volume of 23 ± 0.6 L in the first lactation and 24 ± 0.9 L in the second lactation.

Comment: This study showed that the closer a heifer is to her target live weight the better her fertility and milk production. The herd the heifers were from was the most important factor in determining the percentage of the live weight target achieved, herd is a proxy for management. On average heifers that were closer to their target weights were more likely to calve for the first time and if they did calve were more likely to calve a second time. The 305 day milk yield was increased in both the first and second lactations. Each percentage point increase in live weight attained at 18 to 21 months resulted in 23L more milk in both lactations. This roughly equates to 2kg MS for each 1% increase in live weight (5kg), which will cost somewhere in the region of 300 MJME or 30kg DM.

Reference: *Proceedings of the New Zealand Society of Animal Production*. 2013;73:103-7

[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.



Growth rates of dairy heifers fed alternative feeds

Authors: de Clifford RP et al.

Summary: This study measured the effects of grazing New Zealand dairy heifers on alternative feeds over the summer period. Sixty 6-month-old Friesian-Jersey crossbred heifers were assigned to one of three treatments for a 6-week period: pasture (P), conserved forages (C), or lucerne (L). All treatments included supplementary meal. Heifers were weighed at 0, 3, and 6 weeks. L heifers had a greater ($p < 0.05$) average daily gain (1.22 ± 0.03 kg/day) than P heifers (0.57 ± 0.03 kg/day) at the end of the 6 weeks, with C heifers being intermediate (0.78 ± 0.03 kg/day). L and C heifers had a greater ($p < 0.01$) increase in wither height (0.15 ± 0.01 cm/day and 0.14 ± 0.01 cm/day, respectively) than P heifers (0.11 ± 0.01 cm/day). L heifers had the greatest ($p < 0.05$) increase in girth circumference (0.30 ± 0.02 cm/day vs 0.22 ± 0.02 cm/day with P heifers and 0.16 ± 0.02 cm/day with C heifers).

Comment: Calves fed on lucerne had a significantly greater rate of live weight gain than either of the groups fed pasture or conserved feed. This in itself is not surprising once the feed quality was analysed but the measures of growth used, apart from actual weights, are interesting to look at to see if they are sensitive enough to allow monitoring of growth:

- Calves fed on lucerne had a significantly greater change in girth circumference. (5cm greater over 67 days)
- There were no differences in crown-to-rump length between the groups.
- There was a difference in the change in wither height between the pasture fed calves and the lucerne fed calves, but the calves fed conserved feeds were not significantly different from either the lucerne or conserved feed calves.

The actual difference in wither heights was 2.5cm (10cm change compared with 7.5cm change) over 67 days. At the end of the 42 day feeding trial (the first 25 days were to transition calves to their new diets) the average amount of weight gained was 51kg for the lucerne fed calves compared with 24 kg for the pasture fed calves. From this data I do not believe that you can accurately monitor calf growth by eye due to the small changes in wither height, no changes in crown-to-rump length, and difficulty in assessing girth circumference by eye. Calves need to be weighed.

Reference: *Proceedings of the New Zealand Society of Animal Production*. 2014;74:29-34

[Abstract](#)

Diseases, reproductive performance, and changes in milk production associated with subclinical ketosis in dairy cows: a meta-analysis and review

Authors: Raboisson D et al.

Summary: This meta-analysis of the literature, including 131 different models from 23 papers, or a review paper when the literature was scarce, was conducted to investigate the relationship between SCK and an increased risk of developing various diseases and reproductive disorders in dairy cows, as well as changes in milk production. The relative risk or OR (95% confidence interval) related to abomasal displacement, clinical ketosis, early culling and death, metritis, placental retention, clinical mastitis, lameness, and a doubling of the somatic cell score in cases with SCK were 3.33 (2.60-4.25), 5.38 (3.27-8.83), 1.92 (1.60-2.30), 1.75 (1.54-2.01), 1.52 (1.20-1.93), 1.61 (1.24-2.09), 2.01 (1.64-2.44), and 1.42 (1.26-1.60), respectively. The direct mean \pm standard deviation of the 305-day milk losses associated with SCK were 251 ± 73 kg after adjusting for abomasal displacement, clinical ketosis, metritis, and placental retention. The OR (95% confidence interval) for first service calving risk in cases of SCK was 0.67 (0.53-0.83). The calving-to-first-service interval was 8 days longer and the calving-to-conception interval was 16 to 22 days longer in cows with SCK.

Comment: This meta-analysis of papers looking at SCK (increased BHB or NEFA levels) found increased risk of abomasal displacement, clinical ketosis, early culling, metritis and retained placenta. There was also an increased risk of high SCC, mastitis and lameness but with less precision as there are fewer papers that examined these outcomes. There were only one or two studies that examined reproductive performance so the reported results will have less precision; even so, the risk of getting pregnant to the first service was lower, and the calving to first service interval and the calving to conception interval were longer for cows that had SCK. Monitoring for SCK in the early pre-partum period has the potential to reduce disease if it results in a change of management of the springer mob and the colostrum mob.

Reference: *J Dairy Sci*. 2014;97(12):7547-63

[Abstract](#)

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Analysis of milking characteristics in New Zealand dairy cows

Authors: Edwards JP et al.

Summary: This study evaluated the variation in milking characteristics, and factors associated with these traits, in grazing dairy cows milked without pre-milking stimulation. Milk yield, duration, and average and maximum milk flow rate data were collected from 38 farms in New Zealand at two time points (spring and autumn) during the 2010-11 season and subsequently from two farms during the 2011-12 season. Corresponding animal data were extracted from the New Zealand Dairy Industry Good Animal Database. The average milk yield was 10 kg/milking and the average milking duration was 360 seconds. The average milk flow rate was 1.8 kg/min and maximum milk flow 3.3 kg/min, with 44% of milk flow curves being classified as bimodal. Primiparous animals exhibited a lower maximum milk flow than multiparous animals. Residual milking duration was shortest (-10 seconds) in mid-lactation (121-180 days) and was 13 seconds longer for Jersey versus Friesian cows; however, it was 19 seconds shorter when adjusted for energy content. Residual milking duration had a negligible genetic correlation (-0.07) with milk yield.

Comment: This study described and measured the variation in milking characteristics of New Zealand cows. It was found that Jersey animals were more efficient to milk based on the amount of solids extracted per milking. This study provides data supporting the T_{max} approach to cluster removal to make milking more time efficient. It shows that waiting for all cows in a herringbone to be milked would result in row times of 12 minutes for a herd producing 10L per milking but if the slowest 20% of the cows had their milking truncated the row time would reduce to 7 minutes. It was also found that the residual milking characteristics are heritable so perhaps could be used to select cows for faster milking times.

Reference: *J Dairy Sci.* 2014;97(1):259-69

[Abstract](#)

Rate of transmission: a major determinant of the cost of clinical mastitis

Authors: Down PM et al.

Summary: These researchers used probabilistic sensitivity analysis to evaluate the relative importance of different inputs for a model designed to estimate the cost of clinical mastitis (CM) in a susceptible population of 99 dairy cows. A stochastic Monte Carlo model was developed to simulate a case of CM at the cow level and to calculate the associated costs for five defined treatment protocols: 3 days of antibiotic intra-mammary treatment, 5 days of antibiotic intra-mammary treatment, 3 days of intra-mammary and systemic antibiotic treatment, 3 days of intra-mammary and systemic antibiotic treatment plus 1 day of non-steroidal anti-inflammatory drug treatment, and 5 days of intra-mammary and systemic antibiotic treatment. Risk of transmission was found to have the strongest association with the cost of CM, followed by bacteriological cure rate, cost of culling, and yield loss. In comparison, milk price, cost of labour, and cost of medicines were of minimal influence. The cost of CM was similar for all five treatment protocols.

Comment: This study modelled the cost of a case of clinical mastitis, which is not new but the authors included in the model the chance of a cow passing on her infection to other cows. The rate of transmission of infection accounted the majority of the variance in the cost of clinical mastitis, followed by the bacteriological cure rate. If the rate of transmission of infection increased from 0.13 to 0.25 new cases per 14 days the predicted cost of mastitis increases by 60%. Systemic illness increased the cost of mastitis by 40% by decreasing the probability of a cure. Doubling the cost of a cull only increased the cost of mastitis by 15 to 20%. The cost of drugs had negligible effect on the overall cost of a case of mastitis. This study highlights that to manage the costs of mastitis, preventing clinically cured, but not bacteriologically cured, cows from passing infection to herd mates is critical. To identify the non-cured cows is problematic, perhaps then all treated cows could be run in a second herd or a high SCC and suspect cow mob?

Reference: *J Dairy Sci.* 2013;96(10):6301-14

[Abstract](#)

Application of liquid semen technology improves conception rate of sex-sorted semen in lactating dairy cows

Author: Xu ZZ

Summary: This study compared the reproductive performance of liquid sex-sorted (SS) semen with that of conventional (CON) semen in lactating dairy cows. Between 2011 and 2013, commercial dairy herds (n=101, 203, and 253 for 2011, 2012, and 2013, respectively) with predominantly Holstein-Friesian cows were enrolled in a contract mating programme to produce surplus heifers for export using liquid SS semen. During spring mating, each herd was allocated with liquid SS semen at 50% of its daily requirement and the remaining daily requirement allocated with CON liquid semen. Artificial insemination (AI) with liquid SS semen was performed 43 to 46 hours after collection. The estimated difference in non-return rate between AI with SS and CON semen over the three seasons was -3.8 percentage points (SS=70.2% vs CON=74.0%; SS/CON=94.9%). The estimated maximum difference in calving rate per AI between SS and CON semen was -3.1 percentage points for 2011 (SS=51.2% vs CON=54.3%; SS/CON=94.3%) and -3.0 percentage points for 2012 (SS=49.7% vs CON=52.6%; SS/CON=94.5%). 2013 data were not available at time of publication. The percentage of heifer calves born to AI with SS semen was 87.0% for 2011 and 85.8% for 2012. Both rates were lower than the expected 90%, mainly due to misidentification of calf dams in seasonal dairy herds calving on pasture.

Comment: Liquid sexed semen is now available throughout most of New Zealand. It has been shown to result in slightly less than 90% heifer calves and it is slightly less likely to result in a conception than conventional semen (94%). At present Kiwi Cross bulls and Friesian bulls are available. This technology offers the farmer the ability to reduce the number of inseminations required to produce the required number of herd replacements or to produce more potential replacements to market. If all the replacements can be born early in the calving period then they have longer to reach live weight targets which if heifer growth is limiting reproductive performance will give more days to reach targets.

Reference: *J Dairy Sci.* 2014;97(11):7298-304

[Abstract](#)

Quantifying veterinarians' beliefs on disease control and exploring the effect of new evidence: a Bayesian approach

Authors: Higgins HM et al.

Summary: In this UK study, the clinical beliefs of 94 randomly selected veterinarians regarding herd-level strategies to control mastitis, lameness, and Johne's disease were quantified in a numerical format. During interviews, a statistical technique called probabilistic elicitation was used to capture the veterinarians' clinical expectations as probability distributions. This analysis revealed that markedly different clinical expectations existed for all three diseases, and many pairs of veterinarians had expectations with non-overlapping 95% Bayesian credible intervals. For example, for a 3-year lameness intervention, the most pessimistic veterinarian was centred at an 11% population mean reduction in lameness prevalence (95% credible interval: 0-21%) while the most enthusiastic veterinarian was centred at a 58% reduction (95% credible interval: 38-78%). These data suggest that a major change in beliefs would be required to achieve clinical agreement. To assess the influence of new evidence on current clinical opinion, veterinarians' clinical expectations were used as priors in Bayesian models where they were combined with synthetic data (from randomised clinical trials). Predictions of the mathematic models were based on assumption that veterinarians would update their beliefs logically. For example, for the lameness intervention, a 200-farm clinical trial that estimated a 30% mean reduction in lameness prevalence was predicted to be reasonably convincing to the most pessimistic of veterinarians, i.e. they were predicted to believe there would be a 0.92 probability of exceeding the median clinical demand of this sample of veterinarians, which was a 20% mean reduction in lameness.

Comment: With disease control programmes for diseases that are not under statutory control the advice from vets to farmers becomes critical. The authors state that it may not be desirable for vets to have unified clinical beliefs, it is however desirable that we have a unified approach to disease control. The authors support the use of national programmes to control non-statutory diseases but acknowledge that more research is needed to understand how veterinarians logically update their clinical beliefs from published trials, and that other factors such as how information is communicated and help interpreting new information are also important.

Reference: *J Dairy Sci.* 2014;97(6):3394-408

[Abstract](#)