



Dairy Research Review™

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Issue 3 – 2015

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Welcome to the third issue of Dairy Research Review.

Selections in this issue follow two major themes: reproductive performance and outcomes and diagnostic and quality assessment tools, techniques, and systems. Other selections cover the effects of breed and heterosis on once versus twice daily milking farms, and the costs and control of paratuberculosis.

We hope that the selections in this issue of Dairy Research Review are informative and possibly even practice-changing, and we look forward to receiving your feedback and comments.

Kind regards

Hamish Newton

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Meta-analysis of progesterone supplementation during timed artificial insemination programs in dairy cows

Authors: Bisinotto RS et al.

Summary: This systematic literature review and meta-analysis evaluated the effects of progesterone supplementation using a single intravaginal insert during timed artificial insemination (AI) programmes on fertility in lactating dairy cows. Twenty-five randomised controlled studies involving 8,285 supplemented cows and 8,398 untreated controls were included in the meta-analysis. Information on the presence of corpus luteum (CL) at the initiation of the synchronization protocol was available for 6,883 supplemented cows and 6,879 untreated controls in 21 experiments. Random effects meta-analyses were conducted with the treatment effect summarised into a pooled risk ratio with the Knapp-Hartung modification (RRK+H). Progesterone supplementation increased the risk of pregnancy on day 32 [RRK+H=1.08; 95% CI=1.02-1.14] and day 60 after AI (RRK+H=1.10; 95% CI=1.03-1.17). The benefit of progesterone supplementation was noted mainly in cows lacking a CL at the initiation of the timed AI programme (day 60; RRK+H=1.18; 95% CI=1.07-1.30) versus those with a CL (day 60; RRK+H=1.06; 95% CI=0.99-1.12). Progesterone supplementation benefited pregnancy per AI in studies in which all cows were inseminated at timed AI (day 60; RRK+H=1.20; 95% CI=1.10-1.29) but not in studies in which cows could be inseminated in oestrus during the timed AI programme (day 60; RRK+H=1.04; 95% CI=0.92-1.16). In addition, progesterone supplementation tended to reduce the risk of pregnancy loss (RRK+H=0.84; 95% CI=0.67-1.00).

Comment: This review of 21 papers showed overall that the addition of progesterone (a CIDR or PRID) in a synchrony programme results in improved fertility. There is evidence that insufficient progesterone during the development of the ovulatory follicle is one of the reasons for reduced fertility in dairy cows in fixed-time AI programmes. Synchrony programmes that had progesterone in them resulted in more pregnancies per AI and less pregnancy loss. The reduced pregnancy loss could have been due to altered uterine gland morphology and uterine vascularisation. It is likely that we will come under pressure to remove progesterone from our synchrony programmes to try and cut costs; this study provides data and proposed mechanisms on why the addition of progesterone to a synchrony programme makes sense.

Reference: *J Dairy Sci.* 2015;98(4):2472–87

[Abstract](#)

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Evaluation of on-farm tools for colostrum quality measurement

Authors: Bartier AL et al.

Summary: For determination of immunoglobulin G (IgG) content of colostrum, this Canadian study evaluated which on-farm tool, the colostrometer or the Brix refractometer, was more highly correlated with IgG content as determined by radial immunodiffusion (RID). Colostrum samples (n=569) were collected from 13 commercial dairy farms with herds of 60 to 300 lactating cows. IgG content was determined directly by RID and indirectly by a colostrometer (specific gravity) and Brix refractometer (total solids). According to RID analysis, 29.1% of the colostrum samples contained <50 mg/mL of IgG and concentrations ranged from 8.3 to 128.6 mg/mL, with a median of 65.1 mg/mL. Higher colostrum IgG content was observed in third or greater parity cows (69.5±1.98 mg/mL) than in second parity (59.80±2.06 mg/mL) or first parity (62.2±1.73 mg/mL) cows. The colostrometer data were more highly correlated with the RID results (r=0.77) than were the Brix refractometer data (r=0.64). Specificity and sensitivity were determined for both tools and compared with a cut-point of 50 mg/mL IgG as determined by RID. The highest combined value for sensitivity and specificity occurred at 80 mg/mL for the colostrometer (84.1 and 77.0%, respectively) and at 23% Brix refractometer (65.7 and 82.8%).

Comment: Although not routinely measured on farm, colostrum quality is one of the most important factors influencing the amount of IgG that a calf receives, along with the quantity and timing of when the colostrum is given and to a lesser extent how it is given (tubed or suckled). This study examined the use of an electronic refractometer and a colostrometer against measured IgG content in individual cows' colostrum. The results from the colostrometer were more highly correlated with actual IgG levels than the refractometer and the authors suggest a cut-off point of 80 mg/mL is appropriate and that the colostrometer is a good tool to use on farm for measuring colostrum quality.

Reference: *J Dairy Sci.* 2015;98(3):1878–84

[Abstract](#)

Effect of injectable vitamin E on incidence of retained fetal membranes and reproductive performance of dairy cows

Authors: Pontes GCS et al.

Summary: These researchers evaluated the effects of injectable vitamin E during the last 3 week prepartum on the incidence of retained foetal membranes (RFM) and reproductive performance in 890 dairy cows, including 390 Holsteins (132 nulliparous and 258 parous) and 500 crossbred Holstein × Gyr (199 nulliparous and 301 parous), from 3 dairy farms in Brazil. In addition to their usual feed, the cows were fed 280 (farm 1), 390 (farm 2), and 480 IU (farm 3) of supplemental vitamin E per day during the prepartum period and 370 (farm 1), 500 (farm 2), and 600 IU per day (farm 3) throughout postpartum. The cows were randomly assigned to remain as untreated controls or to receive three IM injections of dl- α -tocopherol 1000 IU administered 19.2±4.3, 12.9±3.3, and 6.2±2.9 days before calving (VitE-treated). The serum concentration of α -tocopherol or α -tocopherol:cholesterol ratio did not differ between treatments and averaged 2.97±0.10 μ g/mL and 4.46±0.16 $\times 10^{-3}$, respectively. In total, 53.2% of the cows had an inadequate concentration of serum α -tocopherol based on the 3.0 μ g/mL cut-off for adequacy. In the VitE-treated cows, RFM decreased from 20.1 to 13.5%, stillbirth incidence decreased from 14.9 to 6.8%, and there was a tendency to reduced death by 200 days postpartum. VitE-treated cows tended to have improved pregnancy per insemination at first AI (36.7 vs 30.1%) because of reduced pregnancy loss (12.5 vs 20.5%) from 31 to 62 days of gestation. Despite a similar insemination rate, VitE-treated cows had 22% greater pregnancy rate than control cows.

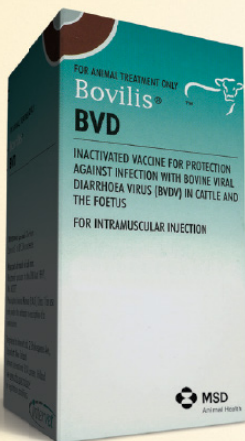
Comment: In cows with vitamin E levels below what is considered adequate (as measured by blood), weekly injection with vitamin E for the three weeks prior to calving reduced the incidence of RFMs and improved the pregnancy per AI and pregnancy rate. The levels of supplemental vitamin E in the diets of the cows in the trial ranged from 280 to 480 IU. The diet prepartum was a mixture of forages and concentrates. A typical New Zealand pasture-based prepartum diet based on forage might contain between 80 and 200 IU vitamin E/kg of DM. Silage will contain 20 to 80% less vitamin E. This makes it likely that traditional New Zealand prepartum diets contain more vitamin E than the diets described in this paper and the NRC recommendation of 1000 IU; however, with changes in winter feeding practices occurring on many farms, if an increase in the incidence of RFM is noted then vitamin E injections might be worth considering.

Reference: *J Dairy Sci.* 2015;98(4):2437–49

[Abstract](#)

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1. Patel, J.R. et al. Prevention of transplacental infection of bovine fetus by bovine viral diarrhoea virus through vaccination. *Arch. Virol.* (2002), 147:2453-2463.
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Evaluation of selective dry cow treatment following on-farm culture: Milk yield and somatic cell count in the subsequent lactation

Authors: Cameron M et al.

Summary: This study determined the effect of a Petrifilm (3M) on-farm culture-based selective dry cow therapy (DCT) programme on milk yield and somatic cell count (SCC) in the following lactation. A total of 729 low-SCC (<200,000 cells/mL) cows from 16 commercial dairy herds with a low bulk tank SCC (<250,000 cells/mL) were randomly assigned to receive either blanket DCT or Petrifilm-based selective DCT. Cows belonging to the blanket DCT group were infused with a commercial DCT product and an internal teat sealant (ITS) at drying off. Using composite milk samples collected on the day before drying off, cows in the selective DCT group were treated at drying off based on the results obtained by the Petrifilm on-farm culture system with DCT and ITS (Petrifilm culture positive) or ITS alone (Petrifilm culture negative). According to final multivariable models, when low-SCC cows were selectively treated with DCT at drying off based on results obtained using the Petrifilm on-farm culture system, no effect on milk production (least squares means for blanket DCT=39.3kg vs selective DCT=39.0kg) or natural logarithm of SCC (least squares means for blanket DCT=3.95 vs selective DCT=3.97) was noted in the subsequent lactation when compared with cows receiving blanket DCT.

Comment: It is likely that we as an industry will come under increased pressure to reduce the amount of antibiotics used especially for prophylaxis. This Canadian study examined the use of an on-farm culture system to make decisions about dry-off therapy. Cows in this trial were from herds with a BMCSS of <250,000 cells/mL and an ICSCC <200,000 cells/mL. The control group received what we would call "combo therapy" (an antibiotic and internal teat sealant). Cows in the selective DCT group received either "combo therapy" (Petrifilm positive) or an internal teat sealant alone (Petrifilm negative). Mastitis rates post calving were not reported but there were no significant differences in the post-calving milk yields or somatic cell counts between cows that received combo therapy or a treatment at dry off based on the on farm culture results. These results add to the growing list of tools we potentially have to be able to respond to the likely pressure to reduce prophylactic antibiotic usage.

Reference: *J Dairy Sci.* 2015;98(4):2427–36

[Abstract](#)

Rear shape in 3 dimensions summarized by principal component analysis is a good predictor of body condition score in Holstein dairy cows

Authors: Fischer A et al.

Summary: The objective of this study was to develop and validate a new method of assessing body condition score (BCS) with 3-dimensional (3D) surfaces of the cow's rear. A camera captured 3D shapes 2m from the floor in a weigh station at the milking parlour exit, with BCS being scored by three experts on the same day as 3D imaging. Four anatomical landmarks were identified manually on each 3D surface to define a space centred on the cow's rear. A set of 57 3D surfaces from 56 Holstein dairy cows was selected to cover a large BCS range (0.5 to 4.75 on a 0 to 5 scale) to calibrate 3D surfaces on BCS. Validation was performed on two external data sets: one with cows used for calibration, but at a different lactation stage, and one with cows not used for calibration. Additionally, 6 cows were scanned once and their surfaces processed 8 times each for repeatability and then these cows were scanned 8 times each the same day for reproducibility. The selected model showed perfect calibration and a good but weaker validation (root mean square error=0.31 for the data set with cows used for calibration; 0.32 for the data set with cows not used for calibration). Assessing BCS with 3D surfaces was 3-times more repeatable (SE=0.075 vs 0.210 for BCS) and 2.8-times more reproducible than manually scored BCS (SE=0.103 vs 0.280 for BCS). The method was not less efficient for cows not used for calibration as indicated by the prediction error being similar for both validation data sets.

Comment: This paper examines a method of automatically measuring BCS of cows using 3D images of a cow's rump. BCS assessment of cows is a now an important part of many dairy vets' work. At present, body condition scoring by visual assessment (\pm palpation) of recognised anatomical sites is routinely used, but potentially suffers from the following limitations:

- Subjectivity.
- Low reproducibility.
- Low sensitivity to detect rapid or small changes in individual cows.

A cheap and rapid automated BCS measurement would overcome these potential issues.

Reference: *J Dairy Sci.* 2015;98(7):4465–76

[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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Estimation of breed and heterosis effects for milk traits and somatic cell scores in cows milked once and twice daily in New Zealand

Authors: Lembeye F et al.

Summary: These investigators estimated breed and heterosis effects for lactation length (LL), total yield of milk (MY), fat (FY) and protein (PY), and average somatic cell score (SCS) in cows milked once a day (OAD) or twice a day (TAD). Records from 36,276 Friesian (F), 31,560 Jersey (J) and 90,081 crossbred (F×J) cows that spring calved were used. Compared to J cows, F cows had a higher MY (657kg in OAD and 1034kg in TAD cows), FY (2.9kg and 7.8kg), PY (13.6kg and 22.4kg), and SCS (0.28 and 0.05). LL in OAD cows was five days shorter than in TAD cows ($p<0.05$). These results demonstrated a significant interaction between breed and milking frequency for production traits ($p<0.001$). Expressed as a percentage of the average of parental breeds, first-cross heterosis effects ranged from 4.92 to 6.84% for production traits, and were similar across milking frequencies.

Comment: This study looked at the effect of breed and cross breeding on OAD farms. Heterosis has been shown to increase farm profitability in herds milked TAD and this is the first New Zealand study to quantify breed and heterosis effects on pasture-based New Zealand cows milked OAD. The relative reductions in milk yield for cows milked OAD compared with TAD were 24%, 24%, and 21% for Fr, FxJ and J, respectively. The relative reductions on milk solids were compared to TAD were 20%, 19%, and 15% for Fr, FxJ, and J, respectively. However Friesians still performed better than Jerseys. As the difference between Friesian and Jersey performance was less when milked OAD compared with TAD it is possible that the heterosis effect when milking OAD compared to TAD is greater. It has been previously found that the best cows in a TAD system were also likely to be the best cows in a OAD system.

Reference: *Proceedings of the New Zealand Society of Animal Production*. 2015;75:60–63
[Abstract](#)

Risk factors for and reproductive outcomes of phantom cows on New Zealand dairy farms

Authors: Cuttance EL et al.

Summary: Over a 2-year period, in dairy herds from the Waikato ($n=10$) and Canterbury ($n=4$) regions, pregnancy diagnosis was carried out 35–42 days after artificial (AI) on cows that had been inseminated in the first 3 weeks after the start of mating (PSM) but had not been seen returning to oestrus. Risk factors for phantom cows were analysed using a generalised linear mixed effect model. In year 1, all phantom cows were left untreated. In year 2, phantom cows were categorised as having a corpus luteum (CL+; $n=120$) or having ovarian follicles ≥ 10 mm ($n=101$) or <10 mm ($n=40$) in diameter. Cows with a CL were treated with cloprostenol or untreated and placed with bulls. Cows with no CL received intravaginal progesterone (P4) for 7 days, with injection of gonadotrophin-releasing hormone (GnRH) on Days 0 and 9, and cloprostenol on day 7 followed by AI. Pregnancy diagnosis of all cows took place 100–120 days after PSM and the interval to conception and final pregnancy rate determined. Of cows inseminated in the first 3 weeks after PSM that did not return to oestrus, 610/6,734 (9.1%) were phantom cows. Treatment for anoestrus, BCS ≤ 4.0 at mating, being 2 or >6 years of age, being pure-bred, and decreasing interval between calving and mating, until 98 days post calving, were associated with increased odds of being a phantom cow. Compared with all other groups of cows, phantom cows had a longer interval to conception ($p<0.001$) and a lower final pregnancy rate ($p<0.001$). Treatment of CL+ cows or cows with follicles ≥ 10 mm did not affect reproductive outcomes. For cows with follicles <10 mm, treatment reduced the final percentage not pregnant (3/27; 11%; $p=0.01$) and interval to conception (21 days; $p=0.02$) compared with controls (7/13; 54% and 37 days, respectively).

Comment: Phantom cows (those cows not observed in oestrus 35 to 42 days after an unsuccessful artificial insemination) were looked at in this New Zealand study to try and understand the risk factors for becoming a phantom cow and to determine the reproductive outcome for these cows. Cows with a BCS <4 , 2-year-olds, and cows aged >6 years were at increased risk of being diagnosed as phantoms. Days in milk at mating was also a risk factor but this was not linear. Phantom cows had increased time from PSM to conception and an increased empty rate. Treatment of phantom cows did not alter the days to conception or empty rate if there was a CL present that was treated with cloprostenol, or if there was a follicle >10 mm. If the follicle was <10 mm, the time to conception was reduced by 15 days and the empty rate was 43% lower.

Reference: *N Z Vet J*. 2015;63(5):276–83.
[Abstract](#)

Invited review: The economic impact and control of paratuberculosis in cattle

Authors: Garcia AB & Shaloo L

Summary: Paratuberculosis (alternatively known as Johne's disease) is a chronic disease caused by *Mycobacterium avium* ssp. *paratuberculosis* (MAP) that occurs in ruminants and other animals. This review article discusses important aspects of the economic impact and control of paratuberculosis, including challenges associated with disease detection, estimations of the burden of the disease, and the implementation of control programmes.

Comment: Johne's disease is now a manageable disease in New Zealand with whole herd testing being readily available during herd testing. The DairyNZ resources and the VetScholar course on Johne's disease management are specific to New Zealand's management systems but this review article gives an international perspective. Most of the control programmes described in this paper include farm level risk assessments, testing (and culling), and biosecurity measures. This paper also summarises the economic costs associated with Johne's disease as far as they were able.

Reference: *J Dairy Sci*. 2015;98(8):5019–39
[Abstract](#)

Subclinical ketosis in post-partum dairy cows fed a predominantly pasture-based diet: defining cut-points for diagnosis using concentrations of beta-hydroxybutyrate in blood and determining prevalence

Authors: Compton CWR et al.

Summary: This main objective of this observational field study was to define, in dairy cows fed a predominantly pasture-based diet, cut points of levels of beta-hydroxybutyrate (BHBA) in blood, above which there were associations with purulent vaginal discharge (PVD), reduced pregnancy rates (PR), and decreased milk production, in order to better define subclinical ketosis (SCK) in such cattle. The prevalence, incidence, and risk factors for SCK were also determined. The study was conducted during dairy season in 565 cows from 15 spring-calving dairy herds in two regions of New Zealand. Cohorts of randomly selected cows (approximately 40 per herd) had blood sampled to determine BHBA levels on six occasions at weekly intervals starting within 5 days of calving. Two cut-points for defining SCK were identified. The first was a BHBA level ≥ 1.2 mmol/L within 5 days post-calving, which was associated with an increased diagnosis of PVD (24 vs 8%). The second was a BHBA level ≥ 1.2 mmol/L at any stage within 5 weeks post-calving, which was associated with reduced 6-week PR (78 vs 85%). The mean herd-level incidence of SCK within 5 weeks post-calving was 68% (12–100%) and large variations existed between herds in peak prevalence of SCK and the interval post-calving at which such peaks occurred. Cows aged >8 years and cows losing body condition were at increased risk of SCK within 5 weeks of calving.

Comment: This study defined some cut points for BHBA for predominately pasture fed dairy cows in New Zealand. A cut point of >1.2 mmol/L was used. Cows that had a BHBA greater than the cut point in the first five days of lactation were at increased risk of being diagnosed with a PVD (14.6 vs 5.4%). A maximum BHBA of >1.2 mmol/L any time during the first 5 weeks post calving resulted in a lower 6 week in calf rate (88.5 vs 81.4%). Note that the cows enrolled in this study were early calvers hence the high 6 week in calf rates. There was wide variation in the timing of peak prevalence and the incidence of sub-clinical ketosis between herds so herd level monitoring is likely to be needed to make herd recommendations.

Reference: *N Z Vet J* 2015;63(5):241–8
[Abstract](#)