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BRIEF COMMUNICATION: Reproductive performance of herds milked once a day all season compared with herds milked twice a day all season

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Abstract

The objective of this study was to compare the reproductive performance of herds milked once a day (OAD) for the whole season with that of herds milked twice a day (TAD) for the whole season. Herds were classified as OAD or TAD if they herd tested \geq three times a season and $>90\%$ of animals had the same milking regime (OAD or TAD) at each test. Once the OAD herds were identified, the closest geographical TAD herd was identified and included in the dataset for the 2014 to 2016 seasons. Only herds with a Detailed InCalf Fertility Focus report were analysed (OAD $n=75$, TAD $n=76$). The means of five key reproduction measures were analysed and the means were significantly different for all measures ($P<0.001$). The OAD herds had a 7.7% higher mean herd 3-week submission rate (OAD=84.6%, TAD=76.9%), 7.9% higher mean conception rate (OAD=60.1%, TAD=52.2%), 10.4% higher mean 6-week in-calf rate (OAD=74.8%, TAD=64.4%), 4.8% lower mean not-in-calf rate (OAD=12.8%, TAD=17.6%), and 4.3% more of the herd calved by week six of calving (OAD=88.2%, TAD=83.9%) than TAD herds. These results indicate that herds milking OAD for the whole season have, on average, better reproductive performance than those milked TAD the whole season.

Keywords: reproduction; herd reproductive performance; once-a-day milking; six-week in-calf rate

Introduction

The New Zealand dairy industry has targets for the all of the key reproduction measures (Burke *et al.* 2007). The aim of these targets is to maximise herd productivity and profitability. However, current national average herd reproductive performance is well below target. The average 3-week submission rate is 78%, 12% below the 90% industry target, and the average 6-week in-calf rate is 66%, 12% below the 78% industry target (Anonymous 2017). This means that methods to improve herd reproductive performance need to be investigated.

Various methods have been trialled by farmers to improve their herd's reproductive performance. Some farmers have anecdotally reported that milking their herd OAD for the whole season has had beneficial impacts on their herd's reproductive performance. Energy balance in early lactation is an important factor in cow reproductive performance (Beam & Butler 1999). The improved energy balance in early lactation of cows milked OAD compared with cows milked TAD in early lactation (Holmes *et al.* 1992; Phyn *et al.* 2014) supports the hypothesis that milking OAD for the whole season may have a beneficial impact on herd reproductive performance.

There are no recent studies that investigate the impact of OAD milking for the whole season on herd reproductive performance in commercial farms. Edwards (2018) compared key performance indicators in matched OAD and twice a day (TAD) herds, but the only reproductive measure reported was calving rate. As calving pattern can be influenced by more factors than just milking regime, e.g. culling practices, more reproduction measures need to be explored to get a clearer picture of OAD vs TAD performance. Therefore, this study investigates the hypothesis that herds milked OAD for the whole season

have better reproductive performance, using five key herd reproduction measures, than herds that are milked TAD for the whole season.

Materials and methods

Data were sourced from the Livestock Improvement Corporation's (LIC) database. Three seasons of reproduction data were analysed, 2014 to 2016. Herds were classified as OAD or TAD for the whole season herd if they had herd tested \geq three times a season and $>90\%$ of cows had the same milking regime (OAD or TAD) at each test. After the OAD herds had been identified, the closest geographical TAD herd was then identified and included in the dataset. There were some areas where more than one OAD herd matched to a single TAD herd. A total of 156 OAD herds and 143 TAD herds were identified with either a Detailed or Intermediate InCalf Fertility Focus report (FFR). Detailed FFRs have an actual 6-week in-calf rate calculated from early aged pregnancy-testing data, making them more reliable than those with an Intermediate report. The analysis was restricted to herds with a Detailed FFR, leaving 75 OAD and 76 TAD herds.

Five measures of herd reproductive performance were analysed and are defined as follows, herd 3-week submission rate was the percent of the herd that had a recorded mating, by artificial insemination (AI) or natural, within the first 21 days of the mating period. Mating start date is defined as the first of two consecutive days, both with at least one mating recorded, where 3 of the next 6 days also have matings recorded, based on cows that calved that season, e.g. spring 2016, and were still on the herd records at mating start date. Conception rate is the percentage of AI inseminations that resulted in a pregnancy as confirmed by early aged pregnancy testing (tested between 35-122

days of pregnancy). 6-week in-calf rate is the percent of the herd that got in calf within the first 6 weeks of the mating, as confirmed by early aged pregnancy testing. Not-in-calf rate is the percent the herd that was not pregnant at the end of mating. This includes cows recorded as Empty, Doubtful/Re-check, and those without a pregnancy result. Herd 6-week calving rate is the percent of the herd that calves within the first six weeks of the herds calving period (planned start of calving = mating start date – 83 days). The measures of reproductive performance are calculated and stored on LIC's database according to the rules described in the InCalf Fertility Focus User Guide (DairyNZ, 2015).

The Analysis was conducted in R (R Core Development team, version 3.4.3) and the data were checked for approximate normal distribution. The distribution was shifted to the right for all of the reproduction measures analysed, except for not-in-calf rate. The five reproductive measures, and one qualifying parameter, were analysed using Students T-Test to determine the significance of any differences between the means.

Results and discussion

Five key herd reproductive performance measures were analysed to investigate the difference in herd reproductive performance between herds milked OAD or TAD for the whole season. For all five measures the means were all significantly different ($P < 0.001$) between the OAD and TAD herds, see Table 1.

6-week in-calf rate and not-in-calf rate are the two main indicators of herd reproductive performance (Burke et al. 2007). The OAD herds had a 10.4% higher mean 6-week in-calf rate and a 4.8% lower mean not-in-calf rate (despite a shorter total mating length) than the TAD herds (both $P < 0.001$). The key drivers of 6-week in-calf rate are herd 3-week submission rate and conception rate (Burke et al. 2007); the OAD herds had better performance in both of these measures. These results support the anecdotal farmer reports, and are in line with results reported by Patton et al. (2006) and Clark et al. (2006) who investigated the impact of OAD on reproductive performance under experimental conditions. Together, the results support the hypothesis that herds milked OAD for the whole season have better herd reproductive performance than herds that are milked TAD for the whole season.

The results of the current study do not mean that TAD herds cannot achieve high reproductive performance.

Nationally (spring 2016 season), 13% of all herds with a Detailed FFR (OAD, TAD & milking system unknown) had a 6-week in-calf rate the same or higher than the OAD average of 75% (LIC National Statistics dataset). It does indicate, however, that for some farms, milking OAD for the whole season may be beneficial to their herd's reproductive performance.

The OAD herds had 4.3% more of the herd calved by week six of calving than TAD herds ($P < 0.001$). This is in line with results reported by Edwards (2018), who reported an increase in herd 6-week calving rate in the second season of OAD milking, relative to the same herds' performance on TAD. However, as the milking regime of the herds analysed is unknown prior to 2014 season, it is not possible to separate out the impact of milking regime on calving pattern based on the available data.

There were differences in the herd sizes and breed compositions of the OAD and TAD herds in this study. The OAD herd size ranged from 96 to 918 cows (mean = 400 cows), TAD herd size ranged from 112 to 983 cows (mean = 445 cows). The breed composition of the OAD herds was more Jersey and cross-bred than the TAD herds (22% and 14%, respectively). While the mean herd size was different, Brownlie (2012) found that herd size does not explain the variation in herd reproductive performance. Additionally, Xu and Burton (2003) found that in general cross-bred cows only have slightly better performance (+2% 6-week in-calf rate) than their parent breeds, and Friesian and Jerseys had the same final in-calf rate. Therefore, the difference in herd size and breed between the OAD and TAD herds is unlikely to explain all of the difference in reproductive performance seen in this study.

The results of the current study indicate that herds milked OAD for the whole season, on average, have better reproductive performance than herds that were milked TAD for the whole season. The reasons for the better performance of the OAD herds cannot be determined from this study, and require further investigation. Possible factors to investigate are cow body condition score around mating and the impact of OAD milking on hours worked on farm. Farm management has a large influence on reproductive performance (Brownlie 2012). It could be postulated that lower working hours may provide more time to devote to farm management, leading to improvements in reproductive performance.

Table 1 Means and statistical significance of the parameters analysed for herds milked once a day for the whole season and herds milked twice a day for the whole season with a Detailed Fertility Focus report, plus or minus the standard error (SEM).

	Parameter	OAD mean	TAD mean	Difference	P-value
Herd 3-week Submission rate (%)	Key measure	84.6 ± 0.65	76.9 ± 1.05	7.7	<0.001
Conception rate (%)	Key measure	60.1 ± 0.57	52.2 ± 0.67	7.9	<0.001
6-week in-calf rate (%)	Key measure	74.8 ± 0.55	64.4 ± 0.74	10.4	<0.001
Not-in-calf rate (%)	Key measure	12.8 ± 0.33	17.6 ± 0.52	-4.8	<0.001
Herd 6-week calving rate (%)	Key measure	88.2 ± 0.57	83.9 ± 0.60	4.3	<0.001
Mating length (days)	Qualifier	71.8 ± 1.00	76.1 ± 0.83	-4.3	<0.001

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