Future farm systems: an alternative dairy milking system

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Summary

Full season, once a day (OAD) milking systems have increased in popularity. A high proportion of farmers in Northland (24%) use the system. This study investigated the reasons behind this level of adoption. Four OAD case study farmers were interviewed followed by a thematic data analysis.

Farmers reported an OAD system was more resilient to climatic and topographical challenges. This was reflected in higher herd reproductive rates overall, with a 6-week in-calf rate of 84% compared to the Northland average of 63%. Milk production overall was lower (7%) than the Northland average. However, time milking decreased, and flexibility in time management increased. OAD milking could be used to adapt dairy farming to challenging climatic conditions.

Keywords: dairy system, once a day milking, Northland, climate

Introduction

Dairy farming is facing a range of challenges from climatic conditions to social sustainability issues with regards to farmer and staff well-being. There is a need for dairy farming systems to evolve and adapt to these challenges. Altering milking frequency is one potential way that farmers can adapt their systems. While milking cows twice a day (TAD) is the accepted frequency, there is also milking OAD, three times in two days, three times per day and robotic milking. The proportion of New Zealand farmers adopting OAD has increased by 41% since 2007 (Edwards, 2019), with a high proportion (24%) of farmers in Northland adopting the system (DairyNZ.). The aim of this research is to investigate the specific reasons why farmers' in a region with a challenging environment adopted an alternate milking frequency (OAD) system.

Once a day milking - benefits and drawbacks

OAD systems evolved in the 1990's, and can be used for short periods such as two to three weeks, for the second half of the season or for the full lactation. Farmers are believed to adopt OAD mainly to achieve a more balanced lifestyle (Tipples & Verwoerd, 2007). Benefits such as a shorter working day, reduced staff turnover, reduced absenteeism and accidents have all been reported (Tipples et al., 2007). Unfortunately, the negative social stigma of being a 'lazy farmer', or that OAD is not the 'right' way to farm have also arisen (Bewsell et al., 2008). While social sustainability reasons are key to the adoption of OAD, Bewsell et al. (2008) reported herd expansion, time required to build capital, labour availability, feed shortfall, the need for labour flexibility and herd health as influencing different groups of farmers to adopt the system. OAD milking has also gained wider acceptance in the industry with DairyNZ running specialist discussion groups for farmers.

OAD systems however, are not suitable in some situations, due to cow breed, concerns around profitability, capital or infrastructure investments and farmer preferences. With regards to the breed of cow, Jersey, followed by Friesian–Jersey cross were the breeds most suited to OAD, with Holstein-Friesian cows experiencing the greatest production decrease when comparing cows milked OAD and TAD (Tong et al., 2002). Along with yield decreases, there can also be concerns around farm profitability. Anderle & Dalley (2007) found that milk production per cow decreased by 10% when examining farms that had switched from TAD to OAD. However, total milk solids produced only decreased by 5% as farmers had lifted their stocking rate when changing milking frequency. Farm expenses were on average 25% lower for farms milking OAD compared to those milking TAD (Anderle & Dalley, 2007), however it is the decrease in expenses in relation to the decrease in milk income that is important for farm profitability (Edwards, 2019). While milk yield can decrease by varying degrees, reproductive performance improves with an OAD system and thus can be a positive influence on farm profitability. The three and six week submission and herd in-calf rates improved with OAD compared to TAD milking systems (Clark et al. 2006).

Thus the main gains from moving from TAD to an OAD system are around time and a more balanced lifestyle. However, as noted, some breeds of cows are more suited to the system than others and the picture around the effect on farm profitability is not always clear. These factors may influence the adoption of the system in Northland, but the regions challenging environment and climatic conditions may also play a role.

Northlands environmental and climatic conditions

Rainfall levels, soil type and a subtropical climate in Northland lead to a challenging environment for dairy farming. Rainfall levels are high, 1100mm per annum, with considerable variation in the rain fall level across the region (Chappell, 2013). Approximately a third of the rainfall occurs in winter, which can lead to flooding in low lying areas. High rainfall and predominantly clay based soils, the predominant type in the region, can suffer sever soil damage by livestock. Northland also has a warm, subtropical environment, and without large scale irrigation systems, the region can experience summer droughts.

These environmental conditions combined with high sunlight levels provide an ideal environment for subtropical pasture species such as kikuyu (*Pennisetum clandestinum*). The characteristics of the species, a C4 photosynthetic pathway, robust strongly nodded stolons and rhizomes with a deep rooting system (Garcia et al. 2014), lead to high levels of dry matter and drought tolerance. However, the growth pattern of kikuyu does not match the typical feed demand profile for a spring calving dairy herd (Betteridge & Haynes, 1986) and its growth characteristics allow it to outcompete and supress other more desired pasture species such as legumes and temperate grasses. The growth and plant characteristics combine to make kikuyu a poor quality feed leading to lower milk production (Henning et al., 1995).

The challenging environmental conditions in Northland are demonstrated by the lower stocking rate and production levels in the region compared to average data for New Zealand, as shown in table 1. In addition, farms in Northland are smaller than the average in New Zealand.

Table 1: Comparison of farm characteristics for the Northland region compared to data for the New Zealand average (DairyNZ, 2017)

Farm characteristics	Northland	New Zealand
Farm size (ha)	134	148
Herd size (cows)	304	418
Stocking rate (cows/ha)	2.3	2.8
Production per cow (kgMS/cow)	331	384
Production per hectare (kgMS/ha)	751	1082

The aim of this research was to investigate why a range of farmers, in a region with a challenging environment, adopted an alternate or OAD milking system.

Methods

A multiple case study method was utilised as it allows the identification of patterns and trends in data and allows triangulation of results (Lees & Nuthall, 2015). This approach allowed the incorporation of both qualitative and quantitative data in order to investigate farmer decision making in a real life context, and allowed for an understanding within the specific context of the challenging environment in Northland, New Zealand.

Four dairy farmers from Northland were interviewed. All four had transitioned from TAD to OAD, and were planning to continue OAD milking. Interviewees were selected though local farm consultants with the aim of interviewing a range of farmers from different farm sizes, farming systems and career stages. Semi-structured interviews were conducted during the farm visit. Interviews were recorded and transcribed and research notes were also taken by the researcher.

Interviewees were asked to talk about their farming background, characteristics of their farm and farming system, staff employed, their experience of milking frequency. The information from the interviews was analysed systematically to identify common and contrasting themes amongst the farmers interviewed. These themes were used to understand farmers' reasons for using an OAD milking system in Northland.

Results

All of the case study farmers had been milking OAD for three or more seasons and had established OAD systems. Three of the farmers (A, C and D) were owner operators, one of whom, farmer D, employed a contract milker. The fourth case study (B) was a contract milker employed on a family farm. Three of the farms involved staff with farmer C preferring to manage their farm without staff.

Farms A, B and C had similar farm sizes of 160, 150 and 153 hectares respectively, with Farm D smaller at 88 hectares. Farm A had the largest herd size and highest stocking rate at 395 cows stocked at 2.5 cows/ha. The herd sizes and stocking rates reflect the different proportion of flat, rolling and steep country in each farm, as shown in table 1. Milk production varied little between farms on a per cow basis, with a range of 300 to 325kgMS/cow. However, there was a wider range in the milk production per hectare (table 1). The case study farms were low input, with production systems ranging from 1 to 3 on the DairyNZ production system scale (DairyNZ, 2017).

Table 2: Physical characteristics of the case study farms.

Farm characteristics	Case study farm			
	A	B	C	D
Farm size (ha)	160	150	153	88
Herd size (cows)	395	310	305	180
Stocking rate (cows/ha)	2.5	2.1	2.0	2.0
Production system	2	3	2	1
Farm dairy[1]	32 H	20 H	26 R	26 H
Milk production (kgMS/cow)	304	300	325	303
Milk production (kgMS/ha)	751	620	648	620
Labour (FTE[2])	3.5	2.5	2	1
Farm topography (%)				
Flat	70	20	20	15
Rolling	30	60	50	85
Steep	0	20	30	0

[1] H, herringbone farm dairy, R, rotary farm dairy, [2] Full time equivalent

Environmental characteristics

All interviewees reported that OAD was suited to the Northland region. This suitability was due to climatic and topographical factors that influenced each of the case study farms to different degrees. In addition, two farmers reported there was less of a social stigma OAD milking in Northland, providing a more accepting atmosphere for the farming system.

In terms of climate, interviewees reported the challenge of managing wet and dry conditions on their farms. This was a major challenge for farmer C as their farm was at higher altitude with rainfall of 2600mm per annum, double the regional average. Farmer C reported that milking OAD allowed their farming system to be more resilient in these conditions. Not milking in the afternoon during Northlands hot and humid summer conditions reduced the stress on both cows and milkers. Farmer D reported that there is little to be gained milking TAD in summer. The case study farms pasture composition was also influenced by Northlands climate. The pasture on all farms contained kikuyu. Two interviewees reported lower levels, farmer C as they farmed at higher altitude and farmer A as they mulched kikuyu pastures and then over sowed with ryegrass.

The case study farms had a variety of topography on their farms (table 1). Topography was a particular challenge for farmers B and C as they ran milking cows on steeper parts of their farm. Farmer D, who farmed low quality dairy land, commented on the low level of pasture production and the influence on the farms milk production *"it is very hard to harvest more than 8 tonne of dry matter per hectare on this land. This makes it harder to maximise profit though maximising milk production off pasture. To increase milk production feed input has to increase, which can only be done through increasing the use of supplement and therefore cost. I'm not interested in farming like that…"*

Farm performance
Interviewees were focused on profitable, efficient systems based on low input, pasture based farming systems. All interviewees reported an improvement in cow reproductive performance with an OAD system. As an example, farmer B reported a decrease in empty cows from 10% to between 4 and 6%, and a 6 week in calf rate of 90%, well above the industry benchmark of 78%. This allowed a higher proportion of their herd to be selectively culled, replacement stock selected from earlier born animals and later calving cows to be mated to a beef breed, increasing the value of their progeny.

In terms of milk production, farmers emphasised profit and efficiency as goals. Farmer B is now producing approximately 1000kgMS more than the farms highest production TAD and farmer B reported that they were producing *"at the Northland average OAD, so why go back to TAD?"*

Farmer goals and objects
All farmers reported the importance of reducing the time spent milking to allow them, or their staff, to undertake other activities. Farmer A's objective was to farm in a way that was sustainable in the long term. For them, sustainability was a lifestyle that allowed farmer A to spend time with family and participate in off farm activities. As farmer A reported *"no one ever wishes they had worked another day in their life, but they do wish they had spent more time with their kids."*

Spending time with their young family was also a key objective of farmer B. In addition, one partner preferred not to milk, and OAD meant that all of the milking could be carried out by the other partner and employee. OAD milking also freed up time for both partners to undertake income generating, off farm activities. The aim of farmer C was to reduce the time they spent milking to enable them to focus on other, for them more enjoyable, areas of their farm business. Farmer C reported *"we can spend time looking at individual cow records, working on our spreadsheets, mating plan and grazing plan. We can do everything much more effectively and you actually have time to notice a lot more things, this means we can make better and informed decisions."*

Farmers B, C and D reported the importance of a dairy shed that could be efficiently operated by one person. For farmer C this was in the summer, and farmer D was aiming for a system where one person, with help during busy periods, could run the farm on a day to day basis. He believed this was the most efficient farm system for his situation as it reduced the labour cost which was identified as a key objective to maintaining farm profitability.

Farm staff
The interviewees who employed staff, farmers A, B and D, all reported very little to no staff turnover. Farmer A reported that staff were working 8 to 10 hours per day which was comparable to non-farm work. In addition, farm staff were also able to have more flexibility in their work, to spend time with their families. Farmer B argued that staff were more productive as they were able to complete farm tasks, rather than having to leave them half-finished to do the afternoon milking. Interviewees reported providing staff with greater job variety which led to increased

job satisfaction. As farmer A reported they had *"happier, productive staff who want to be here."*

Discussion

The aim of this study was to investigate farmers' adoption of an alternative milking frequency (OAD) in a region with challenging environmental and climatic conditions. Interviewees adopted an OAD system as they believed the system was more suited and resilient in their environment and was more sustainable in the long term with regards to the labour required. The adoption of the system was facilitated by lower levels of social stigma associated with the practice in Northland.

Suitability and resilience in the Northland environment

Farmers believed that OAD was both resilient and suitable in the Northland environment as it assisted them to adapt to a low and highly variable pasture supply and also improved animal welfare. Improving herd management, specifically improving cow condition and reduced cows' walking distances, and times, has been identified as a driver of OAD adoption (Bewsell et al., 2008). However, all interviewees in this study specifically referred to not having to walk the cows (and humans) to the dairy in hot, humid conditions in summer as an animal welfare benefit. Given the recent increased focus on dairy cow welfare (Webster et al., 2015), this could be promoted as a positive example of farmers proactively altering their system to improve animal welfare. An alternative option could be to build a barn, or similar, to provide cows with cooler conditions in summer (Frazzi et al., 2000). While this may be suitable in some farming situations, it would not provide the time and flexibility benefits valued by farmers in this study, and would require considerable capital outlay.

The case-study farmers were interested in profit and efficiency rather than production *per se*, however it is worth considering production as it is a main component of income and hence part of the profit equation. Assessing changes in milk production between OAD and TAD systems is challenging, mainly due to the lack of an appropriate counterfactual, or comparison for commercial OAD farms. Researchers have used a number of different methods to address this issue, from farmlet studies (Tong et al., 2002), surveys of OAD farm businesses (Anderle & Dalley, 2007) to pairing OAD and TAD milked farms (Edwards, 2019). In this study, average regional production data from Northland (DairyNZ, 2017), although not ideal, has been used as the TAD comparison.

In agreement with Edwards (2019), the OAD case study farmers had regained, or exceeded, production levels pre switch to OAD. There was a similar difference in per cow production between the case study farmers (OAD) and the Northland regional average (TAD) of 7% (table 3) to that reported by Anderle and Dalley (2007) of 10%. However, there was a greater difference in the per hectare production, with a 12% difference between the case study farms and the Northland regional average compared to 5% reported by Anderle and Dalley (2007). In the latter study the OAD farmers had increased their stocking rate to compensate for the lower production per cows, whereas the case study farmers had a lower stocking rate than the regional average. Interviewees may not have been able to increase cow numbers due to the size of the farm dairy or other constraints, or simply not needed or wanted to.

Table 3: Comparison of farm characteristics of the average of the case study farms and the Northland regional average. Source DairyNZ (2017)

Farm characteristics	Case study farms	Northland average
Farm size (ha)	138	134
Herd size (cows)	298	304
Stocking rate (cows/ha)	2.1	2.3
Production system	2	50% 1,2 30% 3
Production per cow (kgMS/cow)	308	331
Production per hectare (kgMS/ha)	660	751

Farmers in this study however, emphasised efficiency and were looking for the 'sweet spot' in terms of labour efficiency, rather than focusing on individual expenses. They were seeking a system where the key tasks, including cow feeding, farm maintenance and development that could be run efficiently by one person. Hence future economic modelling needs to take account of the infrastructure and labour available and model the whole farm system.

Long term people sustainability

Another key factor for interviewees to adopt an OAD system was reducing time spent milking and increasing the flexibility around when the cows were milked. These two drivers are not exclusive to Northland, with the drivers identified in a study by Bewsell et al. (2008). Stress and burnout are major issues in the dairy industry for owners (Botha & White, 2013) and also effect staff recruitment and retention. The increase in non-milking time and flexibility allowed farmers and staff to engage in a range of activities from farm management to family time, with all farmers reporting positive benefits for well-being. In addition, farmer employers had pride that a job on a farm was comparable to one 'in town'. An OAD system is an option to increase farmer and staff well-being and the long term social sustainability of dairy farming.

Areas for further research

Capturing the holistic benefits of an OAD milking system can be challenging. As well as finding suitable comparative data, there is also the challenge of capturing the economic benefits from improved cow reproductive performance and also the owner and staff well-being. In addition, the whole farm business rather than an individual farm needs to be the unit of analysis. Further research could be conducted on the marginal, rather than average economic gains for an OAD system for those farming with different levels of climatic and environmental challenge.

Conclusion

Milking OAD can provide a resilient farm system to cope and adapt to challenging environmental conditions, such as more variable climatic conditions, that could become more prevalent in New Zealand in the future, while also providing benefits in terms of social sustainability.

Further research need to develop a whole farm systems model, over a medium to long time frame to integrate financial, social and resilience aspects, with the aim of describing when the system in viable in terms of farm scale, infrastructure or capital invested and debt levels. This could assist farmer to identify under what conditions the system could be suitable for their farm.

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