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Economic impact of switching to once-a-day milking on a dairy farm in northern Victoria

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Abstract. During recent years, there has been interest in once-a-day (OAD) milking. A comparison was made of OAD with twice-a-day (TAD) milking on a case study farm in northern Victoria. The comparison suggests that operating profit and internal rate of return are similar to TAD milking if the decrease in milk protein plus fat production, as a result of OAD milking, is less than 12 percent. Although a decrease in milk protein plus fat production of this magnitude may be achievable on some farms in Australia, the decrease is likely to be greater than this in many instances, resulting in reduced profit when changing from TAD to OAD milking. To achieve comparable operating profit with OAD milking, a farm system would need to be well suited to OAD milking, and the implementation well planned and executed. The profitability of switching to OAD milking is sensitive to the amount of genuine savings in labour costs or the ability to make real earnings from off-farm employment.

For the case study farm analysed, increasing the stocking rate when switching to OAD milking was not an appropriate option when pasture consumption remained the same. On farms where stocking rates are lower or opportunities exist to increase pasture consumption or where cows are consuming less grain per cow and more pasture per cow, it may be profitable to increase stocking rate when switching to OAD milking.

Keywords: Dairy farming systems, once-a-day milking, economics.

Introduction

During recent years there has been interest in once-a-day (OAD) milking both as a strategic (long-term) option for full-lactations, or as a tactical (short-term) response to adverse seasonal conditions (low pasture availability and high supplementary feed prices) within a lactation. Before the 2006/07 drought, only a small number of Australian dairy farmers were milking OAD for most of a lactation. The number of farms with OAD milking increased during 2006/07, as a tactical response to the seasonal conditions. Some of these farms have since milked OAD for most of a lactation.

A review of literature on OAD milking (Armstrong and Ho 2008) indicated farms that are likely to be suited to OAD milking include those that:

- Have opportunities to obtain off-farm income or would have a cash saving if milk harvesting labour was reduced;
- Have a cow type that is suitable, i.e. produces milk with relatively high protein

and fat concentration – generally Jersey or Jersey cross-breds;

- Have herds with relatively low somatic cell count;
- Do not feed large amounts of concentrates;
- Are not aiming for exceptionally high production per cow.

Adoption of OAD milking in New Zealand has increased markedly during recent years. In 2003/04 there were 130 farms milking OAD before Christmas and this increased to 850 farms before Christmas in 2005/06 (Dalley and Clark 2006) (Christmas would be about the middle of lactation for most of these herds). Herd sizes on these New Zealand farms with OAD milking ranged from 100 to 5,000 cows. The motivations for strategic OAD milking are generally to save labour, allow more attractive and flexible working hours, avoid capital expenditure (e.g. for a new dairy) and herd management reasons (e.g. to reduce distances walked and improve cow condition).

There are a number of differences between Australian and NZ conditions that could have an impact on the attractiveness and adoption of OAD milking in Australia. Compared with NZ farms, Australian farms generally have:

- Higher milk production per cow (Holmes 2007);
- Longer lactation lengths;
- A greater prevalence of Holstein-Friesian herds;
- Higher supplementary feeding levels and lower prices for grain.

Also, there are differences in the financial performance of dairy farms, with the average Australian farm having a lower (2 vs 3 percent) return on assets from milk production and total return on assets (4 vs 10 percent) than the average New Zealand farm (Thorrold and Doyle 2007). Wealth generation from capital appreciation is clearly higher in New Zealand. There are also differences in labour availability and costs between the two countries. Hence, it was important to analyse the impact of milking OAD on profit in the Australian situation.

This paper compares the profitability of OAD and twice-a-day (TAD) milking for a case study farm in northern Victoria, where OAD milking is used as a strategic option.

Method

There were several key aspects to the study: the use of a case study farm; the use of an industry steering committee to test assumptions made in the analysis; and spreadsheet modelling to analyse biophysical and economic performance of the farm (further details on the approach can be found in Armstrong et al. 2005 and Ho et al. 2005).

Excel spreadsheets were used for both the economic and biophysical modelling. The methods used for farm management economic assessments are described in Malcolm et al. (2005). The main measures considered were operating profit (earnings before interest and tax) and internal rate of return (IRR). Both cash and profit analyses were conducted over 10 years where the production system (TAD or OAD milking) was assumed to be in steady state. The focus in this analysis was mainly on profit, but it was also necessary to consider the impact on cash flow. The Palisade @Risk program was used to model the effect of fluctuations in milk and grain prices. The approach to incorporating risk and the development of probability distributions for milk and grain prices are described by Ho et al. (2006).

Case study farm details

On the case study farm, cows obtained more than half their energy requirements from pasture, calved in spring and labour inputs were mainly owner/operator.

The case study was based on an actual dairy farm, but was modified to represent an average farm of this type in the region (Ho et al. 2005 and Armstrong et al. 2005). The key farm details are outlined below.

The farm was situated on the Goulburn Irrigation System with 55 ha of irrigated perennial pasture and a 220 ML water right (4 ML/ha). The herd of 180 cows had an average milk production of 234 kg fat and 180 kg protein/cow. The herd consisted of cross-bred cows (Jersey x Holstein-Friesian) with an average liveweight of about 475 kg for mature cows. Pasture consumption was 10 tonnes DM/ha and the amount of concentrate fed was normally 1.5 t DM/cow/year.

No increase in stocking rate

The assumptions used to compare TAD and OAD milking with a stocking rate of 3.3 cows/ha were as follows:

- When milking TAD it was assumed that the total labour costs (operators allowance and paid labour) was \$60,000 each year. When switching to OAD milking, it was assumed there was a labour saving of \$18,000 per year (3 hours/day at \$20/hour = \$60/milking X 300 milkings/year). The \$18,000 in saved labour could result from either a reduction in paid labour, or off-farm income;
- It was assumed the farm had no initial debt;
- Decreases in milk protein plus fat production of 10 percent, 20 percent and 30 percent per cow (as a result of switching to OAD milking) were analysed. This reflects the range of decreases reported in the literature (Holmes et al. 1992; O'Brien et al. 2005; Clark et al. 2006). Decreases in milk protein plus fat production of 10-20 percent are likely if stocking rate is not increased. It was assumed there was no change in the protein:fat ratio, although in reality this cannot be ruled out;
- A milk price of \$7.00/kg butterfat equivalent or \$4.00/kg milk protein plus

fat was assumed for both TAD and OAD milking in the initial analysis;

- Shed costs decreased by 30 percent (Dalley and Clark 2006) (from \$45/cow/year) with OAD milking;
- Herd costs decreased by \$8/cow/year due to reduced animal health costs with OAD milking (Dalley and Clark 2006);
- Grain price was assumed to be \$180/t, and hay price \$120/t in the initial analysis;
- The irrigation water allocation was assumed to be 100 percent of water right and 330 ML of temporary irrigation water was purchased. The temporary irrigation water price was assumed to be \$60/ML;
- It was assumed the income from stock trading was the same for TAD and OAD milking;
- The reproductive performance of the herd was assumed to be unchanged, although there is evidence of some improvement with OAD milking (Dalley and Clark 2006);
- The cost of repairs and maintenance was assumed to be the same;
- Estimated metabolisable energy and dry matter intakes decreased with OAD milking because of reduced milk production. Reductions in energy used in walking were ignored, although this could be significant on some farms, particularly in other regions on large, steep farms. It was assumed concentrate intake declined (see Table 1) as feeding 1.5 t DM of concentrate per cow per year would be difficult to manage if it was fed only once a day in the dairy. Pasture consumption remained about 3 t DM/cow (all reductions in intake were assumed to be concentrates). The assumptions of a 10, 20 or 30 percent decline in milk production are in some ways reflecting differences in farmer skills and knowledge in pasture management and cow nutrition.

To analyse the impact of varying milk and grain prices on operating profit, probability distributions describing the range and variation of each variable were created. A triangular distribution was used for milk price, with minimum \$5.20, median \$7.00 and maximum \$9.20/kg butterfat equivalent. A normal distribution was used to represent grain price with mean \$180/t, standard

deviation \$50/t, minimum of \$80/t and no absolute maximum.

Increase in stocking rate of 20 percent with no change in pasture consumption

An option of increasing stocking rate to compensate for reduced milk production per cow was also considered. Most of the assumptions were the same as when herd size was not increased, however, there were several differences:

- 36 extra cows were purchased in year 1 at \$750/cow to give a herd size of 216 (it was assumed that the extra cows were salvaged at 100 percent of the purchase price at the end of year 10);
- There was a labour saving of \$9,600 per year when milking 216 cows OAD (assuming that the total labour costs were \$60,000 when milking 180 cows TAD);
- Shed costs, herd costs and stock trading profit were all assumed to be 20 percent greater than when 180 cows were milked OAD;
- It was assumed that the dairy, yards and other infrastructure did not need upgrading when the herd size was increased by 20 percent;
- It was assumed that pasture consumption per ha did not change with the increase in stocking rate. The pasture consumption per cow was 2.5 t DM per year. There was 1.1 t DM of concentrate and 0.8 t DM of brought in hay fed per cow per year.

Increase in stocking rate of 20 percent with an increase in pasture consumption

An option of increasing stocking rate with an increase in pasture consumption was also analysed. Most of the assumptions were the same as for the scenario of increasing stocking rate by 20 percent with no change in pasture consumption. However, there were several differences:

- It was assumed that pasture consumption per ha increased from 10 to 12 t DM/ha when stocking rate increased by 20 percent. Pasture consumption per cow was about 3 t DM per year;
- It was assumed that there was a \$10,000 increase in labour costs (for pasture management, assessment and allocation) required to achieve the increase in pasture consumption. The

total labour costs assumed were \$60,400, which was slightly higher than when milking 180 cows TAD. The labour savings of milking OAD were therefore outweighed by the increased labour required to improve pasture management.

Pasture production costs, such as fertiliser and pasture renovation, were assumed to remain the same when pasture consumption was increased.

Results and discussion

No increase in stocking rate

The profitability of switching to OAD milking for full lactations was sensitive to the reduction in milk protein plus fat production (Table 2). A 10 percent reduction might maintain, or slightly improve, annual operating profit but, larger reductions substantially reduced profit and IRR. A similar operating profit and IRR to TAD milking occurred when the decrease in milk protein plus fat production was 12 percent. This farm, which has a crossbred herd, is suited to OAD milking and the decline in production would be expected to be at the lower end of those reported by Holmes et al. (1992), O'Brien et al. (2005) and Clark et al. (2006).

At a 10 percent decrease in milk production, the decrease in costs was greater than the decrease in income (milk income decreased by about \$30,000, while feed, herd, shed and labour costs decreased by \$9,000, \$1,500, \$2,500 and \$18,000 respectively). The savings in feed costs may be more substantial if there is a significant reduction in the energy required for walking.

Sensitivity to labour savings

The profitability of switching to OAD milking depends largely on genuine, cash labour savings or real earnings from off-farm employment. Many dairy farm families take drawings from the business and do not pay themselves a wage. In such businesses, genuine labour savings are only likely where employed labour can be reduced. Without reduced labour costs, OAD milking was less profitable than TAD milking, even if the milk protein plus fat production decrease was 10 percent (Table 3).

Sensitivity to milk and grain prices

The profitability of milking OAD compared with TAD on this farm was not overly sensitive to changes in milk price, particularly if the decrease in milk production was 10 percent or less (Table 4). If milk price increased from \$7.00/kg butterfat (BF) to

\$7.50/kg BF equivalent, a milk production decrease of 10-11 percent when milking OAD generated similar profitability to milking TAD. If milk price decreased to \$6.50/kg BF equivalent, a 13 percent decrease in milk production resulted in similar profitability to when TAD milking was used. This indicates that OAD milking may be more attractive (compared with TAD milking) if the outlook for milk prices is poor.

The combined impact of variations in milk and grain prices is shown in Figure 1. The analysis suggests in about 75 years out of 100 the OAD option would result in a similar, or slightly greater operating profit than TAD milking, if the milk fat plus protein production decrease was 10 percent. If the milk fat plus protein production decrease was 20 percent, there would only be about five years in 100 when OAD milking would be more profitable than TAD milking.

It appears that OAD milking has some impact on reducing the exposure to risk from variations in milk and grain prices on this case study farm (steeper shaped curve for OAD milking compared with TAD milking in Figure 1). But it is also likely that when milking OAD, opportunities to increase profit will be foregone if the milk price is high and the grain price is low. On the other hand, the curve for the TAD milking option is flatter, indicating it would be able to take advantage of favourable conditions, but it would also be more responsive to decreases in the milk price and increases in the grain price.

Increase in stocking rate of 20 percent with no change in pasture consumption

Increasing the stocking rate to compensate for lower milk production per cow when switching to OAD milking may have potential to help maintain profitability (Table 5). But confining the decrease in milk production per cow to less than 20 percent would be much less likely if the stocking rate was increased, compared with the scenario where stocking rate was not increased. For this case study farm to maintain profitability when milking OAD, it is probably more important to concentrate on minimising the production decrease per cow rather than increasing cow numbers.

Increase in stocking rate of 20 percent with an increase in pasture consumption

If pasture consumption could be increased from 10 to 12 t DM/ha when stocking rate was increased in conjunction with OAD milking, a similar operating profit to TAD milking could be achieved when milk production decreased by 20 percent per cow

(Table 6). If the decrease in milk production per cow was 10 percent when milking OAD, a substantially higher operating profit than TAD milking could be achieved. However, it would be extremely challenging to restrict the decrease in milk production per cow to 10 percent when increasing the stocking rate by 20 percent and milking OAD. It may also be challenging to achieve the increase in pasture consumption from 10 to 12 t DM/ha with no expenditure other than a \$10,000 increase in labour costs (for pasture management, assessment and allocation). In situations where the stocking rate is lower, where there are opportunities to increase pasture consumption, and where cows are consuming less grain and more pasture per cow, it may be appropriate to increase stocking rate when switching to OAD milking.

Future directions

It is possible that OAD milking could allow relatively cheap/less productive land to be used for dairying by enabling a greater distance to be walked between milkings. This issue could be analysed using the approach described in this paper and could increase in importance as competition increases for the land and water currently used for dairying in Australia.

Conclusions

A similar operating profit and IRR to TAD milking appears possible if the decrease in milk fat plus protein production associated with OAD milking was 12 percent or less. This decrease may be achievable when switching to OAD milking on some farms in Australia, however, the decrease is likely to be greater than this in many cases.

To achieve comparable profitability when milking OAD, the farm system would need to be suitable and the implementation well planned and executed. There also needs to be genuine labour savings or the capacity to obtain off-farm income.

The risk analysis indicated OAD milking is less responsive to variations in milk and grain prices than TAD milking.

For the case study farm, increasing the stocking rate to compensate for lower milk production per cow when switching to OAD milking had little impact on profitability, unless pasture consumption increased. In situations where cows are consuming less grain per cow and more pasture per cow, it may be appropriate to increase stocking rate when switching to OAD milking.

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Appendix

Table 1. Comparison of feed requirements when milking twice-a-day (TAD) and once-a-day (OAD) with various decreases in milk protein plus fat (P+F) production.

Milking frequency	TAD	OAD	OAD	OAD
Milk P + F production decrease	N/A	10%	20%	30%
Concentrates fed (t DM/cow)	1.5	1.2	1.1	0.9
Brought in hay fed (t DM/cow)	0.4	0.5	0.3	0.2
Total consumed (all feeds) (t DM/cow)	4.9	4.7	4.4	4.2

Table 2. Comparison of operating profit and internal rate of return when milking twice-a-day (TAD) and once-a-day (OAD) with different declines in milk protein plus fat (P + F) production.

Milking frequency	TAD	OAD		
Milk P + F production decrease	N/A	10%	20%	30%
Annual operating profit (\$'000) (Year 5)	52	55	35	16
Internal Rate of Return %	2.8	3.5	1.1	-1.1

Table 3. Operating profit and internal rate of return with various values for labour savings when switching from twice-a-day (TAD) to once-a-day (OAD) with different declines in milk protein plus fat (P + F) production.

Milking frequency	TAD	OAD			
Milk P + F production decrease	N/A	10%	10%	20%	20%
Annual labour savings (\$'000)	N/A	18	0	18	0
Operating profit (\$'000) (Year 5)	52	55	36	35	16
Internal Rate of Return %	2.8	3.5	0.8	1.1	-1.5

Table 4. Comparison of operating profit and internal rate of return when milking twice-a-day (TAD) and once-a-day (OAD) with different milk prices and different declines in milk protein plus fat (P + F) production.

Milk price (\$/kg butterfat equivalent)	6.50			7.50		
Milking frequency	TAD	OAD		TAD	OAD	
Milk P + F production decrease (%)	N/A	10	20	N/A	10	20
Operating profit (\$'000) (Year 5)	31	36	18	73	74	52
Internal Rate of Return %	0.5	1.5	-0.6	5.0	5.5	2.8

Table 5. Comparison of operating profit and internal rate of return when milking twice-a-day (TAD) and once-a-day (OAD) for full lactations with different stocking rates and different declines in milk protein plus fat (P + F) production.

Milking frequency	TAD	OAD			
		3.3	3.9	3.9	3.9
Stocking rate (cows/ha)	3.3	3.3	3.9	3.9	3.9
Milk P + F production decrease	N/A	20%	10%	20%	30%
Operating profit (\$'000) (Year 5)	52	35	64	40	18
Internal Rate of Return %	2.8	1.1	4.5	1.7	-0.9

Table 6. Comparison of operating profit and internal rate of return when milking twice-a-day (TAD) and once-a-day (OAD) for full lactations with different stocking rates, pasture consumption and different declines in milk protein plus fat (P + F) production.

Milking frequency	TAD	OAD			
		3.3	3.9	3.9	3.9
Stocking rate (cows/ha)	3.3	3.3	3.9	3.9	3.9
Pasture consumption (t DM/ha)	10	10	12	12	12
Milk P + F production decrease	N/A	20%	10%	20%	30%
Operating profit (\$'000) (Year 5)	52	35	77	54	31
Internal Rate of Return %	2.8	1.1	5.6	2.8	0.1

Figure 1. Comparison of the distribution of annual operating profit for twice-a-day (TAD) milking and once-a-day (OAD) milking (with decreases in milk protein plus fat production of 10, 20% and 30%) with fluctuations in milk and grain prices.

