Economics of extended lactations in dairying

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Abstract. This paper deals with the economic analysis and management implications of extending lactations in specialised dairy cows. The main conclusion from this study is that in the two dairy farm cases that have been investigated in depth, the use of extended lactations to achieve efficient herd reproduction is highly likely to give greater profit than alternative systems that could be implemented. This conclusion holds even after allowing for less than total persistency of cows embarking on extended lactations.

The overall outcome of a change from having only 10-month lactations to having some cows in the herd milking for extended lactations is determined by the complex interactions of all of the major input, output, cost and income factors at work in a dairy system. The likely net effects of adopting the extended lactation innovation in a dairy system has to be estimated for each unique farm system, with particular attention paid to the skills and aspirations of the people who operate the system.

Keywords: extended lactation, dairy systems, benefit cost analysis, farm economics, farm business management

Introduction

There are around 11 000 dairy farms in Australia, and thus around similar number of dairy farming systems. In terms of timings of calving and lengths of lactations, there is a continuum of possibilities where at one extreme all cows in the herd could be calved on one day and around 10 months later all cows dried off, and at the other extreme of this continuum some of the herd could calve, and others be dried off, on every day, with lactations that continued for up to 18 months or more (Borman et al 2002, DRC 2000).

In practice the calving and lactation systems are determined mainly by annual cycles of farm feed supply and supplies of off-farm feeds, the need to have cows calve periodically to achieve lactation, seasonal variations in milk prices, managerial constraints and objectives, and non-economic objectives.

In Victoria calving and lactation systems tend towards some broad groupings:

- Seasonal calving and 300-day lactations with a single calving period aimed to occur over a reasonably short time. With these systems, achieving a tight calving period and subsequent synchronized lactations is a challenge because of the difficulties of getting the whole of the herd to conceive over a correspondingly tight time frame. Thus to achieve tight calving and lactation periods induction of late conceiving, and late calving, cows is commonly used. Alternatively, in practice, the constraint of tight calving period and herd synchronized lactation periods are modified, with the result that some of the herd calves later than the majority of the herd and are milked beyond the date when the rest of the herd is dried off. Consequently, milking is taking place for longer than 10 months for a proportion of the herd, and some cows are being milked at all times during the year (Morton 2000).
- Dual calving times and 300-day lactations where usually a portion of the herd is calved in Spring to maximize lactation potential by exploiting the peak Spring feed supply, with some of the herd calving in Autumn to milk through Winter and reap milk price premiums. Winter or Spring calving cows that do not conceive within the 8 weeks of calving that is necessary to maintain a 12-month calving interval and a 10-month lactation can be mated later with the aim of having them calve in the Autumn calving time.

Similarly, Autumn calving cows that do not conceive for a 12-month calving interval and 10-month lactation can be mated over a longer time and carried over to calve with the Spring calving cows.

- Some farmers use systems with three or more calvings in a year, and often do so with cows that do not conceive for a 12-month calving interval conceiving later and being milked for more than 10 months to calve at subsequent calving times.

Seasonal calving is widely practised because it matches feed demand well with pasture feed supply and may thus have less risk; it is a relatively simple system; and requires probably less skill than more elaborate cow feed supply and demand systems. Also, farmers can get a break in the year when they are not milking. On the other hand, seasonal production systems require high levels of cow reproductive performance, which can be hard to achieve.

In recent times, there has been an increase in Autumn calving in Victoria as herds have moved to split calving systems, in part to try and capture some 'out of season' milk premiums, and in part as a result of difficulties in getting cows in calf for the annual calf, and carrying them over to a later mating and an extended lactation. Feed management with split calving systems is more complicated than with single calving systems.

The focus of this research was on issues of farm management economic of extended lactations. For a comprehensive reviews of the technical pros and cons of extended lactations, see Borman, Fahey and MacMillan (2002), DRC (2000) and Van Amburgh (1997). In this study, the following question was investigated: 'what are the economic implications for two case study dairy farm businesses of having a proportion of cows in the total herds extend lactations beyond the traditional 10 month lactation time?'

Whole farm analysis of alternative lactation regimes

The farm management economic perspective brought to bear on innovations to farming systems is mostly about change at the margin - a bit more of this and a bit less of that; is the farm family likely to be sufficiently better off in terms of meeting their goals to warrant making this change, or some other change to their system? (Doyle *et al.* 2002) In this study, for two case study farms, the question asked is: how profitably does this farm operate using extended lactations, and what happens to profit when some aspect of the extended lactation regime is changed?

The criterion for forming a judgement about whether an innovation that has potential to increase productivity is likely to be an actual productivity increasing change, and is likely to significantly contribute to the constant battle against the cost-price squeeze, is called the with-without criterion.

The perspective brought to bear is 'how will this farm system perform in the changed future it faces with this change that is being evaluated compared with how will this farm system perform in the changed future it faces without this change and with some other change instead?' The comparison is between alternative future #1 versus alternative future # 2. So, whatever the *status quo*, the future will be a different world and the *status quo* is not an option because the farming world constantly changes.

In this analysis of the impacts of extended lactations of cows on dairying systems, the whole farm approach is used. The idea is that the farm can be run in various different ways, each of which comprises a whole system, with each 'system' having different whole farm income, costs and mixes of lactation lengths, etc. Using whole farm budgets, the effect on whole-farm profit of changing the mix of lactation lengths, income and costs can be investigated.

The economic analysis is based on calculations about a number of main elements of the activity. First, herd dynamics. The calving, mating and lactating experience of each cow in the herd is defined, deriving from the proportion of cows that get in calf at each mating, over a 56-month period. This time encompasses a 48-month time period in which all elements of each lactation are fully represented. The profit performance over the 48-month period is then the criterion for judgement about merit of the particular mix of lactations involved. Cows that are assumed to fail to conceive are carried over to the next scheduled joining time. With the particular split calving regimes of the two case study farms, the lactation lengths then become either 10 month or 15 month or 18 months long (calving intervals of 12,17 and 20 months). Not-in-calf cows are culled at the end of their lactation and are assumed to be replaced with bought-in replacements at point of calving.

Next, month-by-month herd lactation figures are used to estimate milk produced per cow per month. The lactation curves used come from the performance of cows in the respective farm systems analysed. For the extended components of the lactations (i.e. milk produced beyond 10 months of lactation), an average number of litres per cow per month is used. In judging the relative performances of the alternative systems with and without extended lactations, the average litres/month of extended lactation and the persistence of cows on average through the extended lactation period are the critical figures. Note that the estimates of whole farm performance with extended lactation cows in the herd includes adjustment for the reality that not all cows going into extended lactations will persist for the whole of the planned extended lactation period. As a further test of the extended lactation notion, the average litres per month of extended lactation required to be produced for the extended lactation system to breakeven with the profitability of the 10-month lactation systems is calculated. The minimum degree of persistence needed for the extended lactation system to breakeven with the traditional system is extremely useful information – and a future research question of high priority. At this stage, on the basis of what is known about cow performance in the systems under study, a judgement can then be formed about the likelihood of this breakeven level of milk production being produced during the extended phase of the lactation in the system under study.

Herd feed demand is estimated based on daily requirements per cow for maintenance, body score, stage of lactation, and litres of milk produced.

Finally, profit calculations are done. This involves estimating milk income per month and in total over 48 months, and trading profit or loss is estimated using the livestock-trading schedule. Not-in-calf cows are assumed to be culled and replaced at the end of their lactation, while about 10 per cent of cows are culled for other reasons, regardless of the system involved. Gross income comprises milk income plus trading profit (loss), and variable costs are herd, shed and feed costs. Milk is valued according to the monthly price regime that is applicable. Feed costs are derived from total quantity of dry matter required, and valued using information from the case study farms and depending on the source of the feed (home grown or brought-in) and when it is required (Autumn feed is more expensive than during the rest of the year). Total gross margin over 48 months of operation is estimated (gross income minus variable costs). Overhead costs include labour, operators labour and management, repair and maintenance, depreciation, and other fixed costs. Operating profit for the 48-month period is estimated as total gross margin minus overhead costs. Annual operating rate of profit is estimated, and also expressed as an annual percentage return on total capital. Annual operating rate of profit of alternative farm systems becomes the main criterion by which alternative whole farm systems are compared and judged.

The aim has been to do all of the above whole farm profit analysis with only the essential information. That is, enough information to get the directions and magnitude of changes right (thus enabling the right conclusion to be drawn), but without detail that does not much improves the quality of the conclusion drawn from the results. Thus, for instance, the feed supply and demand are handled in a relatively simple way, at the level of kilograms of dry matter required per day for the various different animal needs. Replacement animals are assumed to be bought in at point of calving.

Case study farm number one

Liquid milk contract, 600 cows, 400 Spring calving and joining (65 per cent in calf), 100 Summer calving and joining (60 per cent in calf), 100 Autumn calving and joining (65 per cent in calf), 6 week mating periods, not-in-calf cows carried over to next joining period, 50 per cent pasture feed, 50 per cent brought-in feed.

Description of farming system one

Case study farm number one is located in the Goulburn Valley region of central Victoria. As a result of the close proximity to an urban centre the property is landlocked by industrial and commercial precincts eliminating the possibility of acquiring adjacent land for business expansion. The family has owned and operated the property for the past 22 years. This business has grown rapidly over the past two decades from a low equity base and average herd size. The owner/operators managed to achieve this growth by taking financial risks early in the development phase of the business and adjusting their management practices. The ability to gather accurate knowledge in relatively new areas of dairy production and incorporate this into their current management practices has been the key to the success of their business.

The property has 100 ha. available to milk production – 10 ha. of annual irrigated pasture with the remaining 90 ha. irrigated perennial pastures. An additional 87 ha. 'out block' is owned eight kilometres north of the home property. The dairy is a ten-year old, 44-unit rotary.

The combined water right (for both properties) is 700 ML per annum. An extra 250 ML are added to this by a spear-point bore on the property; and an additional 200 ML were purchased bringing the total water used last year to 1150 ML or 6.1 ML per effective hectare. A fully automated centre-pivot irrigation system has been installed to irrigate 32 ha. as the traditional flood irrigation method was not suitable due to the undulating topography of the land.

The current stocking rate for the home property is 5.5 cows per perennial pasture equivalent hectare or 3025 liveweight kilograms per perennial pasture equivalent hectare. All dry stock are agisted on nearby properties while the heifers are raised on the heifer-link program.

Approximately half the total energy required is derived from grazing pasture. The remaining energy is made up of a total mixed ration issued onto a recently constructed 600 head feedpad. The system operates on a fixed paddock rotation. As pasture growth slows, rations are increased on the feedpad to maintain energy necessary for target milk production. Maize is sown in November under irrigation on 32 hectares of the out block, harvested in February and carted to silage stacks on the property. Immediately following, the ground is prepared for lucerne. The remaining area on the out farm is sown to barley (or alternative) undersown with lucerne. Typically the lucerne is harvested three times during the year for silage. All sowing and harvesting is contracted.

The Total Mixed Ration (TMR) typically consists of pasture hay, silage (maize, ryegrass and clover, lucerne), straw, citrus pulp, brewers grain (by-product), ME 14 (high-energy liquid by-product). Pellets are fed in the bail, providing for approximately 18 per cent of the dry matter in the diet. Cows are individually identified for feeding in bail.

Grain supplements are typically 1.2 ton. DM/cow/year and bought-in fodder supplement from 0.8 tonnes DM/cow/year. Current pasture consumption per hectare is 12 tonnes/DM/effective hectare.

The current peak herd size is 600 cows split into August, January and April calving, with matings around 8 weeks after calving. Four hundred cows are calved in August, 100 in January and 100 in April. The herd is self-replacing. All cows are artificially inseminated using six-week joining periods.

The staff required to operate the business includes three full-time labour units employed on overlapping 10-day fortnights. In addition, a casual employee milks ten times a week and an independent Sunday milking team allows the owners and full-time employees a day off milking each week.

Production per cow is around 7000 litres/cow, 280 kg/butterfat, and a total of 490 kg milk solids. The owners have negotiated a supply contract with National Foods who supply the domestic market. The processor requires a relatively flat annual production curve and consistently low cell-counts. The demand for off-season milk is a major factor why the owners have 3 calvings - to achieve a more consistent production curve.

In 2000/2001 this farm business, milking 550 cows, earned an operating profit of $210,000, a return on total capital of 7 per cent per annum.

The success of this system is sensitive to milk price received and feed costs. This system is better suited to supplying a fresh milk processor than relying on a volatile export market. The relatively controlled environment of this system enables constancy of quantity and quality, and thereby attracts a milk price premium.

The performance of the split calving system currently practised using a proportion of extended lactations, with and without a persistency adjustment to the total amount of extended lactation milk produced, is compared with the performance of the same split calving system but having 10-month lactations for all cows.

Whole-farm results of farming system one

There are 400 Spring, 100 Summer and 100 Autumn calvers with 6-week joining periods resulting in 65 per cent 10-month lactations, 21 per cent 15-month lactations and 14 per cent 18-month lactations over a 48-month period of analysis in which all components of the system occur. The scenarios based solely on 10-month lactations are assumed to achieve the typical result of 80 per cent conception rate for cows over 9 weeks of mating.

Number of cows calving in each calving time vary as the split calving cycle evolves over the 48-month period being analysed. Not-in-calf cows are milked for the extended lactation period that is appropriate and then culled for $400/head. They are replaced by cows on point of calving at a cost of $800/head.

Annual average milk price is $0.32/litre (this is a hypothetical but realistic figure as the actual contract price is confidential). Cow lactation curve is provided by the farm business, based on recent years' production, with production in the extended component of the lactation an average daily milk production per cow per month of extended lactation. In practice, depending on the timing, a second spring often results in a secondary 'peak'. This effect is included in the average production figures for the extended lactation.

All replacement rearing costs and costs of agistment for young stock are ignored and replacements assumed to be bought in at market prices (this is the same in effect as combined rearing and agistment costs).

Feed demand is determined by an animal's physiological state – 6kg DM/day for maintenance, 2 kg/DM/day for last 3 months of pregnancy, 2 kg DM/day for body score in last 4 months of pregnancy, 1 kg DM/day for first 3 months of lactation for body score, and 0.8 kg DM/litre produced (derived as a balancing item to give a total feed requirement that is compatible with the total litres produced plus maintenance, etc. and calibrated to the detailed total DM requirements for this herd as estimated in the Future Farming Systems project modelling (DRDC 2002; Doyle *et. al.* 2002).

Feed costs are based on actual on-farm feed costs of the business in 2001-2002, and medium-term brought-in feed costs of $220/t. The same feed costs/kg DM are used for each scenario, so whatever price is used has the same effects on each of the alternatives.

Herd costs/cow are the same for each type of lactation, with higher breeding costs of Summer matings. With the preponderance of herd health costs being associated with reproduction, possible lower lifetime veterinary costs of extended lactation cows seem logically possible but are not included. Shed costs, and all other costs, are as provided by the farm business. Labour requirements are as defined by the farmers. The farmers argued strongly that in their situation, labour costs would be the same for each of the realistic alternative ways of operating their systems.

The average milk yield per day per month of the extended lactation component of the total lactation was 18 litres. The milk produced from the extended lactation component of lactations was adjusted downwards by allowing for a proportion of the extended lactation cows (25 per cent) not completing a full extended 15 or 18-month lactation (30 per cent less production than the production resulting from the complete extended lactation). This adjustment is called a 'persistency adjustment'.

In this case study, for the system with extended lactations, 39 per cent of total milk produced came from the extended lactation component. Extended lactations comprised 35 per cent of total lactations over the 48-month period studied. Only 4.5 per cent of cows were not-in-calf over the 48-month period. The comparable figure is 20 per cent not-in-calf for the 10-month calving system that achieves the state-wide average of 80 per cent conception over a 9-week mating.

The expected annual profit for the 400 Spring, 100 Summer, 100 Autumn calving system with extended lactations was estimated to be $220,000; with a 7.5 per cent p.a. return on capital. With the alternative 10-month lactation system, this was estimated to be $175,000; a 5.8 per cent p.a. return on capital.

The number of litres/day of the extended component of the extended lactation with a persistency adjustment that enables this system to just breakeven with the annual profit from the alternative system, which has no extended lactation component, is 10 litres/day. That is, as long as the cows doing extended lactations average at least 10 litres per day during the extended lactation component of their lactation, the system using extended lactations is expected to be more profitable than the system using solely 10-month lactations.

The question of persistency of cows performance during the extended lactation (EL) phases is of critical importance. For example, a persistency adjustment which allowed for 25 per cent of the 15-month EL cows persisting for only 65 per cent of the 'planned' extended lactation (i.e. completing only 10 months of a 15-month EL) and for 35 per cent of the 18-month EL cows persisting for only 65 per cent of a planned 18-month lactation (i.e.12 months of an 18-month EL), at the average of 18 litres/month of extended lactation, reduced the expected annual profit to the break-even figure of $175,000.

Roughly, if more than one-third of the 15 and 18-month EL cows fail to deliver the extended lactation milk production of 18 litres/month for at least 10 months (65 per cent of 15 months) and 12 months (65 per cent of 18 months) respectively, then for this farm the EL system with these levels of persistency of extended lactation is no more profitable than the alternative 10-month lactation system (Note: non-monetary benefits not included in the breakeven profit analysis).

Annual livestock trading loss (which has already been accounted for, having been deducted in the calculation of annual operating profit) ranged from $-14,000 for the extended lactation systems to $-77,000 for the 10-month lactation systems.

The main differences between the extended lactation and 10-month lactation systems are in the total quantities of milk produced and the timing of the milk supplied (Autumn milk is worth more than Spring milk); the timing of feed demand (Spring feed is cheaper than Autumn feed); and the trading losses associated with the herd depreciation which is directly a function of the rate at which cows get in calf. In this case there are no seasonal feed cost or milk price differences that could cause the profitability of the systems to change if seasonal patterns of feed demand

and of milk supply change between systems. As shown in the figures above, there are no seasonal feed cost or milk price differences that could cause the profitability of the systems to change if seasonal patterns of feed demand and of milk supply change between systems. The major source of the added profit in the extended lactation system comes from the lower annual herd depreciation cost that results from lower cull rates and replacement costs, encapsulated in lower annual trading losses, than the 10 month-lactation systems. In the 10-month lactation system the 80 per cent conception rate achieved over the whole herd significantly determines the size of the trading losses. In effect, this result bears out the farmers reason for using extended lactations, viz. 'to get efficient reproduction'. The performance of the alternative systems within case study one are summarised in Table 1 (Appendix).

Case study farm number two

> Manufacturing milk supplier, 400 cows, 200 Spring calving and joining, 200 Autumn calving and joining, 9 week mating periods, 80 per cent in calf, not-in-calf cows carried over to next joining period, 70 per cent pasture feed, 30 per cent brought-in feed.

This dairy farm is in south-west Victoria, close to a major town. The farm comprises 180 hectares of well-established, highly productive pastures, which includes 58 hectares of irrigated pastures. The farm holds 475-ML water licence and a Van Den Bosch irrigation system is used. Four hundred cows are milked, split equally between Spring and Autumn calving, using a 20-unit double-up herringbone dairy. All cows are mated using artificial insemination over a 10-week period. (May/June and December/January).

Replacement heifers leave the farm (120 ha run-off block) at 6 months of age and return 2-3 weeks prior to calving. There are 100 head of dry cattle and 150 replacement heifers 3-6 months carried on other farm land owned nearby. There are three full-time staff, plus one permanent casual who works four days per month, with a casual milker on an 'as needs' basis.

Fertilizers are applied to the irrigation and dryland areas according to the milk solids removed throughout the previous year. Generally there are four applications per annum on the irrigation area and two annual applications for the dryland. Urea is applied when there is a predicted feed deficit to gain a quick increase in dry matter grown.

Milkers are fed silage at night and graze irrigated pasture during the day. Maize silage is used to balance the ration during the day or night. In the spring of 2001, 85 ha. of pasture silage were conserved with a yield of 1400 tonne, plus 400 small square bales of grass/lucerne hay were made, and 90 rolls of silage were made for the calves. As well, 500 tonnes (wet weight) of maize silage were purchased. Further, opportunistically, maize silage is contracted to be grown. In 2001/2002, around 600 kg of pellets per head were fed to milkers, including lead feeding. Cows are not individually identified for bail feeding.

Over the past three years the operating profit of this farm has been around $180,000-$200,000, a return on total capital of around 5 per cent per annum.

Description of farming system two

There are 200 Spring and 200 Autumn calvers with 80 per cent pregnancy rate per joining over a 9 week period. This resulted in 80 per cent 10-month lactations, 11 per cent 15-month lactations and 9 per cent 18-month lactations over a 48-month period of analysis. Not in calf cows are milked for the extended lactation period that is appropriate and then culled for $400/hd. They are replaced by cows on point of calving at a cost of $800/hd.

Milk prices used are the expected prices provided by the milk processor for the 2003-2004 year. Annual average milk price is $0.23/litre. Cow lactation curve based on data from previous years performance, as shown below.

Feed cost used is derived from 3 years of actual feed cost/kg of milk solids for the business. Spring, summer and winter feed costs $0.15/kg DM and Autumn feed costs $0.20/kg DM. Different Spring and Autumn feed costs are used, based on actual farm data from past three years.

Herd, shed and all other costs are as provided by the farm business. Labour costs are as defined by the farmers and are the same for all scenarios

A persistency adjustment was applied, being 25 per cent of extended lactation cows producing 30 per cent less milk than the complete extended lactation cows.

Whole-farm results of farming system two

The performance of the farming system case study two is summarised in Table 2 (Appendix).

Annual profit for 200 Spring -200 Autumn calving EL system with no persistency adjustment was estimated to be $180,000. Annual return on total capital was expected to be 4.5 per cent per annum.

Annual profit for 200 Spring -200 Autumn calving EL system with persistency adjustment was estimated to be $170,000. Annual return on total capital was expected to be 4.3 per cent per annum.

Annual profit for a 200-200 system using only 10-month lactations was estimated to be $150,000. Annual return on total capital was expected to be 3.8 per cent per annum.

Annual profit for 400 Autumn calving cows with 10-month lactations was estimated to be $150,000. Annual return on total capital was expected to be 3.8 per cent per annum.

Annual profit for 400 Spring calving cows with 10-month lactations was estimated to be $140,000. Annual return on total capital was expected to be 3.4 per cent per annum.

The number of litres/day of the extended component of the EL system with persistency adjustment that enables the EL system to just breakeven with the annual profit from the alternative system that has no extended lactation component is 13 litres/day. That is, as long as the cows doing extended lactations average at least 13 litres per day during the extended lactation component of their lactation, the system using extended lactations is more profitable than the alternative systems using solely 10-month lactations.

The breakeven persistency adjustment – the level of persistency of EL cows that makes the EL system just breakeven with the alternative 10-month lactation system is for 65 per cent of the 15-month EL cows to achieve only 75 per cent persistency (and the remainder complete the full extended lactation) and 65 per cent of the 18-month EL cows to achieve only 65 per cent of the complete extended lactation (with the remainder completing the full extended lactation).

If more than one-third of the EL cows perform for the expected EL time, and the rest fall short as specified above, then the EL system is more profitable than the alternatives.

In the systems with a proportion of extended lactations, 37 per cent of total milk produced came from the extended lactation component of total lactations. Extended lactations comprised 25 per cent of total lactations over the 48-month period studied. Only 5 per cent of cows were not-in-calf . The comparable figure is 20 per cent not-in-calf for the 10-month calving systems achieving 80 per cent conception at mating.

Annual livestock trading loss (which is already accounted for, having been deducted in the calculation of annual operating profit) ranged from $-24,000 for the extended lactation systems to $-43,000 for the 10-month lactation systems.

The main differences between the extended lactation and 10-month lactation systems are in the total quantities of milk produced and the timing of the milk supplied (Autumn milk is worth more than Spring milk); the timing of feed demand (Spring feed is cheaper than Autumn feed); and the trading losses associated with the herd depreciation which is directly a function of the rate at which cows get in calf. The difference in trading loss accounts for a good deal of the difference in profit between the two systems.

The patterns of milk supply associated with each of the systems is shown below. In this comparison the pattern of milk supply is the same for the alternative split-calving scenarios. The only difference between the EL split-calving scenarios is the persistency adjustment. The split-calving, 10-month lactation scenario differs from the base case (EL split-calving) in milk supply pattern and in feed demand and supply – but not markedly because even in the base case the majority of the herd is doing 10-month lactations. The split between autumn and spring milkers remains similar. Not-in-calf cows are assumed to be milked for an extended lactation and then replaced at the end of lactation. The 200-200 split for each calving is maintained. The difference in seasonal feed and milk price effects is encapsulated in the two scenarios where all cows are calved either in the Spring or the Autumn, and all do 10-month lactations. Despite this, neither of these two systems promise to be more profitable than the base case – split-calving system with extended 15 and 18-month lactations for those cows that do not get in calf at earlier joinings. Summary of these results may be found in Table 2 (Appendix).

General discussion of results

The Benefit Cost Analysis method has been applied to the question of the potential economic effect of extended lactation dairying systems. A whole farm spreadsheet budget was constructed that comprises a set of herd dynamics over a number of years, with the implications for profit of 1, 2 and 3 calving times and 3 lactation lengths 10, 15, and 18 months being investigated.

In all farm management economics investigations, the answer to the question ‘Is this a good idea?' is ‘It depends’. It depends on the unique detail of each farm system and the unique characteristics and goals of each farm family. In essence, in farming, and within reason, what you do is less critical to achieving goals than is the way you do it. Under the right conditions and with good management, many different systems can be profitable and enable farmers to achieve their goals.

All the results that derive from this analysis, and the judgements about the merits of the innovation that ensue, are unique to the farm systems investigated, and are the consequence of a complex compound of interactions between the following phenomena:

- Juxtaposition of timings of events and subsequent lactations and milk prices
- The proportion of cows in the whole herd that milk for extended lactations, thus causing different total cow dry time over the whole time analysed
- Cow lactation performance for various lactation lengths
- Feed requirements and feed costs at different times of year as result of particular systems
- Different herd depreciation costs resulting from different cull and replacement rates and costs associated with different lactation lengths and the various proportions of lactation lengths making up total lactations
- Labour requirements and labour supply and quality
- Overhead costs of each system
- Total capital invested in each system
- Cash flows
- The risk profile of the business

There are dairy farm businesses in a range of different situations that have implemented variations of extended lactation systems, and have continued to operate these systems over a number of years under a range of climatic and economic circumstances. This is good evidence that dairy systems using extended lactations can earn as good a return on capital as the seasonal calving systems that now predominate, and that these systems, with the right gearing of the business, are financially viable. The case study farms with extended lactation systems have earned competitive rates of return on capital in the recent past.

In the cases studied, a major motivation for the choice of system adopted was to achieve simple, effective herd reproduction – extended lactations were seen as a practical way to achieve this aim. Given this, the majority of cows in both herds completed 10-month lactations, with extended lactation cows making up 20-30 per cent of the herd. That is, the innovation is a marginal change to the whole herd lactation system, not a total change to extended lactations.

The main conclusion from this study is that in the two cases investigated in depth, the use of extended lactations to achieve efficient herd reproduction, after allowing for less than total persistency of cows embarking on extended lactations, is highly likely to give greater productivity and profitability than alternative systems that could be implemented in these businesses but which do not have any cows doing extended lactations.

Note that the measureable net benefits (operating profit of system) is not the full measure of net benefits from the systems investigated. Unmeasureable benefits and costs also exist, and play an important role in the motivations for the systems adopted. It is noteworthy that the all case study farmers believed they received significant non-pecuniary benefits from having extended lactations as part of their dairying systems. As long as the profitability of the system compared well with alternative ways of operating, then non-pecuniary benefits were significantly valued.

Benefits not easily measured include the improved capacity to exploit the advantages of AI in the breeding program; benefits from smoothing of labour demands; and benefits from not having to induce cows and from calving and mating times being, as all case study farmers claimed, ‘much less stressful’. Whilst elements of extended lactation systems, such as feed matching feed supply and demand, appear more complex than traditional systems, other elements, such as reproduction, may be markedly simplified.

Labour considerations are usually critical to efficient dairy farming systems – all the cases studied were located close to major population centres and obtaining adequate labour supply of good quality was not the significant issue it can be in other areas. Further, the managers were all skilled and well-regarded managers of employed labour. This feature of these businesses is of paramount importance to their successfully earning competitive rates of return on capital and satisfactory growth in equity.

In some systems, using split calving to spread labour demand through the year has potential advantages. In other cases, doubling or tripling the number of joining and calving times could be a potential advantage. The labour effects would be determined by the unique details of each case – influenced greatly by the size of herd involved, and thus the quantity and quality of labour required. Perhaps most important of all, the labour implications of extended lactation systems may be determined mainly by the labour management skills and styles of the owner-operator or farm manager. As in all Australian businesses, labour management skills and styles vary greatly over a large range.

The success of extended lactation as an innovation in dairying comes from a complex combination of the attributes of the whole system and timings of events. There seems no 'in-principle' reasons why extended lactations are inherently more suited to systems based on particular milk markets, feed systems or particular climatic or geographic situations. The net result depends on the detail of the interactions between the many factors that combine to create business profit. Done well, in the right hands, as a modification to systems already well-suited to particular markets and environments, but which still have to cope with the costs associated with reproductive inefficiency, and/or which aim to profit from modifying herd lactation curves from the strictly seasonal patterns, extended lactation systems are highly likely to be a successful innovation in a wide range of dairying systems.

What ought be made of the result that in these two case study analyses, the differences in profit between the EL and non-EL systems is mostly attributable to differences in trading losses, resulting from different in-calf rates and different not-in-calf cull rates? First, the budgeting reflects the reality that a significant proportion of total costs of milk production relate directly to milk output, regardless of the system. There are many ways of combining these direct inputs to make milk output for similar net margins. This means that one of the means of increasing profit is to spread the fixed or overhead costs of the business over more litres of milk output. The main fixed costs are the opportunity cost of land capital, managers labour and plant and livestock depreciation. An operation that can maintain production and reduce herd annual depreciation by $30,000 adds $30,000 directly to operating profit.

In the case study analyses, essentially the comparison boils down to comparing systems culling 4.5 per cent of cows for being not-in calf with systems culling 20 per cent of cows for being not-in-calf. Does this mean that if systems based on 10-month lactations could simply achieve higher in-calf rates then the profit advantage of extended lactations would disappear? It is not quite so simple. The comparisons between the profitability of dairy farm systems involves many factors.

Still, an argument could be run that there are many ways to produce milk at similar direct costs per litre, and so the overhead costs per litre matter a lot, and if the overhead cost of annual herd depreciation were to be similar between extended and traditional lactation systems, then the profitability of both systems would be similar.

The key to answering this argument is careful consideration of the costs of alternative ways of achieving high in-calf rates. Extended lactation systems achieve high in-calf rates by having a particular system of production with particular associated costs and benefits. Alternative ways of achieving high in-calf rates and lower herd depreciation also involve different systems with different costs and benefits, e.g. joining over 21 weeks to achieve 91 per cent in-calf rate defines system that could be seasonal and uses induction to synchronize calving, or a system that has calving over a lengthy period and either milks some cows at all times through the year or has a significant number of cows drying off after having lactated for somewhat less than 300 days.

Any of these permutations of the main parts of dairy systems will have particular sets of costs and benefits that define the overall annual operating profit of each system. The appropriate dairy system to run in any particular situation – the system that gives the greatest net benefits (profit plus other net benefits) – cannot be defined by minimizing any single cost element but by the combined effects of all costs and all benefits.

Thus the answer to the response ‘If I could get in-calf rates nearly as high as extended lactations without using extended lactations then extended lactations would not add to the profits of my system’ is ‘The answer to such questions have to be decided not by assertion but by analysis, taking into account all the costs and benefits of the alternative systems’. That’s the farm management economics way.

Conclusions

Both case study dairy farm systems use a mix of 10-month lactations and 15-month and 18-month extended lactations. On both farms, the extended lactations are seen primarily as the means of achieving the aim of efficient herd reproduction.

Both farms have achieved returns on capital in recent years comparable to alternative investments in dairy farming, and in other agricultural or non-agricultural investments, i.e. from 4-8 per cent per annum. In 2001-2002 it is estimated that Case Study One earned a return on total capital of 7 per cent while in 1998,1999 and 2000 Case Study Two earned between 4 and 6 per cent return on total capital.

It may be that the key to understanding the potential role of extended lactations is to see it as a modification at the margin to well-run systems that currently fit markets and environments reasonably well (i.e. do not have a fundamental structural problem), where some additional net benefits can be attained (e.g. reproduction efficiency, reduced dry time over lifetime, labour use gains, reduced net herd depreciation) without compromising the inherent strengths of the current system whose relative advantage currently is in matching environmental and market demands and combating cost-price pressures sufficiently well to be profitable and meet owners goals.

In other words, the advantages of extended lactations are not necessarily such as to 'over-throw established systems' and replace much of what happens in dairying and which has evolved this way for very good reasons, but extended lactations are a potentially significant productivity increasing modification that could improve the performance of some aspects of some of these established systems and thus improve overall profits.

One of the keys to success of extended lactation systems seem to be feed supply management. Extended lactation, multiple calving systems are likely to pose complex challenges to management and managers who are already struggling to get good results in single-calving, traditional-lactation systems. Such managers would be likely to struggle even more to manage more complex systems. However, extended lactations could fit particular managers supplying particular markets in some environments.

For this reason, and on the basis of the encouraging evidence there is about the potential economic merit and other benefits of extended lactations, there is enough reason to conclude that a thorough and detailed investigation of the science, management and economics of extended lactations in dairying under Australian environmental and market conditions is well warranted. There are questions about feed to milk quantity conversions, and milk quality, during the extended lactation phase; as well as the question of the persistency of cows in the extended lactations.

Finally, on the evidence of the case studies analysed, modifying dairying systems based on 10-month lactations by having a portion of the total herd lactating for longer than 10 months is likely to be a way to increase profitability and non-pecuniary benefits on some dairy farming systems.

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Appendix

Table 1. Summary of performance of alternative dairy farm systems for case study one

	400-100-100 With EL	400-100-100-Without EL
Number of lactations over 48 months	2200	2400
Percentage of total lactations as extended lactations	35	N/a
Total litres/48 months with no persistency adjustment	18433734	17421600
Total litres/48 months with persistency adjustment (25%-30%)	17810831	N/a
Total litres from extended lactations over 48 months	7034527	N/a
Percentage of total litres from EL over 48 months	39	N/a
Number of dry cow months over 48 months	2004	4800
Number of cows not in calf over 48 months	109	480
Percentage of herd not in calf over 48months	4.52	20
Herd trading loss over 48 months	-55737	-307200
Annual herd trading loss	-13934	-76800
Total operating profit over 48 months	890371	698650
Annual operating profit	222593	174663
Annual percentage return on total capital	7.42	5.82

Table 2. Summary of performance of alternative dairy farm systems for case study two

Dairy System	**200-200 (No P adj.)**	**200-200 (Padj)**	**200-200 (12)**	**400-Aut.**	**400-Spr**
Number of lactations over 48 months	1481	1481	1600	1600	1600
Percentage of total lactations as extended lactations	26	26	n/a	n/a	n/a
Total litres/48 months with no persistency adjustment	12417888		12336000	12336000	1233600
Total litres/48 months with persistency adjustment (25%-30%)	n/a	12288536	n/a	n/a	n/a
Total litres from extended lactations over 48 months	4617019	4270743	n/a	n/a	n/a
Percentage of total litres from EL over 48 months	37	35	n/a	n/a	n/a
Number of dry cow months over 48 months	982	982	3200	3200	3200
Number of cows not in calf over 48 months	83	83	320	320	320
Percentage of herd not in calf over 48months	5.20	5.20	20	20	20
Herd trading loss over 48 months	-98858	-98858	-172000	-172000	-172000
Annual herd trading loss	-24714	-24714	-43000	-43000	-43000
Total operating profit over 48 months	716221	686471	594847	608019	518382
Annual operating profit	179055	171618	148712	152005	129595
Annual percentage return on total capital	4.5	4.3	3.7	3.8	3.2