The economics of recycled cows and extended lactations

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Summary

- Recycling cows reduces empty culling rate in the short term but there hidden costs to this policy including lost milk yield, slippage in calving pattern and fewer replacement heifers produced
- A 443-day herd average calving interval reduces annual milk yield by 690 litres per cow compared to a 375 day CI for a herd with 7000-litre potential
- Slippage in calving pattern due to extended calving interval increases annual feed cost by €71 per cow
- A comprehensive herd fertility management plan is required to achieve progress encompassing herd genetics, BCS management, culling policy and submission rate targets.

Introduction

Achieving compact calving with low empty culling rates is a cornerstone of successful pasture-based milk production. The rigour of a limited breeding season can be costly in the short term, but it imposes a discipline on breeding decisions that tends to benefit herd reproductive efficiency in the longer term. Sub-fertile cows effectively cull themselves out of the herd early, while assessing herd fertility performance to identify problems is comparatively straightforward. Important fertility indices for compact calving are measured relative to a defined mating start date (***MSD***) and include:

- **3-week submission rate** (% of eligible cows served in the first 3 wks- typical target 90%),
- **6-week submission rate** (% of eligible cows served in the first 3 wks- typical target 95%), and
- **6-week in-calf rate** (% of eligible cows pregnant by day 42 of the breeding season- typical target 75%).

Management protocols aim to maximise the proportion of cows cycling on MSD, and to achieve acceptable **first service conception rate** (typical target 55-50%). **Final empty culling rate** is also critical (target less than 10%). Measures such as calving interval and % of carryover cows are less relevant because of the constraint of a limited breeding period.

But what of the split calving scenario that predominates for liquid/winter milk producers? Are seasonal fertility indices relevant when calving is divided between winter and spring? Examination of ICBF data for the sector shows an average 6-week autumn calving rate of 41% and a spring 6-week calving rate of 48%. Mean calving interval is 436 days, with cows calving 0.82 times per year on average. Final empty culling rate is difficult to quantify given the non-seasonal breeding structure, but taken as a whole these figures point to a significant fertility problem for liquid milk herds.

Recycling cows in split calving herds

There is of course nothing new in highlighting fertility as an issue for split-calving herds. However, examining the role and effect of recycled cows (i.e. empty cows that move from one breeding season to another) in the system is important. The option to

retain non-pregnant cows for re-breeding is often cited as an advantage for split-calving herds as it can reduce empty culling rate and facilitate higher-yielding cows. This moderates direct replacement costs (Table 1) particularly where cull cow values are low. It also reduces the negative impact on milk yield of a less mature herd (Table 2). On the other hand, there are numerous indirect costs associated with extended calving intervals that should be quantified, including milk production losses, change to calving pattern, youngstock numbers and veterinary/breeding costs.

Table 1. Direct cost of additional culling rate for a 100-cow herd

	Replacement/Cull Value Differential [1]		
Additional Empty Culling Rate	***€400***	***€600***	***€800***
4%	€1,600	€2,400	€3,200
6%	€2,400	€3,600	€4,800
8%	€3,200	€4,800	€6,400
10%	€4,000	€6,000	€8,000

[1]Differential between market value of cull cows and replacement heifer cost

Table 2. Culling rate and milk revenue loss due to reduced herd maturity for a 100-cow herd

	Herd base milk production level (litres) [1]		
Additional Empty Culling Rate	***6000***	***7000***	***8000***
4%	€1,293[2]	€1,510	€1,701
6%	€1,939	€2,266	€2,552
8%	€2,585	€3,021	€3,403
10%	€3,231	€3,776	€4,253

[1] Based on 305-d yield for a herd with 370 day calving interval
[2] Based on a 30cpl annualised milk price

Calving interval- effect on annual milk yield

Herd milk yield can be quoted on a 305-day, annual or lactation average basis. These figures align very closely for a herd with a 365-day calving interval because the lactation cycle (days in milk plus days dry) is completed within the calendar year. Cows afforded an extended calving interval may have increased lactation milk yield but annual average milk yield is reduced due to more days spent in late lactation and more days dry.

Cow-level effect of calving interval on milk production

To examine this effect on a per-cow basis, milk production and calving interval data were collated for 120 mature cows (>4 lactations complete) across 6 Teagasc client liquid milk herds. The ratio of annual milk yield to lactation milk yield was calculated for each cow, and the association between this ratio and calving interval was determined (Figure 1). The data clearly show that as calving interval increases, ratio of lactation to annual milk yield decreases considerably, and the association between these factors is very robust. This can have a considerable effect on milk sold per cow when aggregated over a herd level, and explains why we often see a large discrepancy between herd 305-day milk yield and annual milk delivered per cow. It is also represents a considerable indirect cost of recycling cows and extended calving intervals

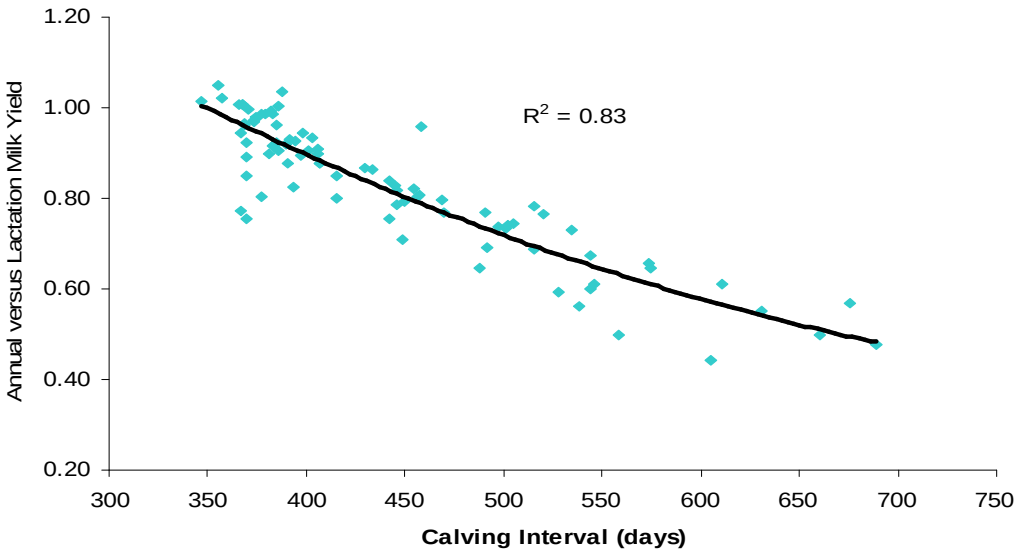

Figure 1. Association between calving interval and ratio of annual to lactation milk yield per cow in liquid milk herds

Herd-level effect of calving interval on milk production

Herd average calving interval gives a good estimate of herd reproductive efficiency but it can be unduly biased by the worst 10-15% of cows, especially where restricted breeding seasons are imposed. It is thus also important to account for the pattern or range of calving intervals within the herd when assessing effects on milk yield. To this end, a simple model was constructed calculate the change in annual milk yield for different herd calving interval structures (Table 3).

Table 3. Cows per category for a range of herd-average calving intervals

	Herd Avg Calving Interval					
Category	**375**	**401**	**422**	**443**	**464**	**485**
365	47	25	14	8	8	2
380	34	32	22	14	3	3
400	11	11	18	18	11	4
430	5	14	14	14	14	11
450	3	6	6	9	13	13
470	0	8	8	3	8	9
490	0	4	14	17	17	21
530	0	0	4	16	16	19
550	0	0	0	1	10	18
Total Cows	*100*	*100*	*100*	*100*	*100*	*100*

A Wilmink function was used to plot lactation curves for this range of structures, across a 3 scenarios of 6000, 7000 and 8000 litre herd-average base milk yields (305-d yield with 365-d calving interval). It was assumed that drying off of individual cows occurred at the earlier of a 12 litre daily milk yield or 60 days pre-calving.

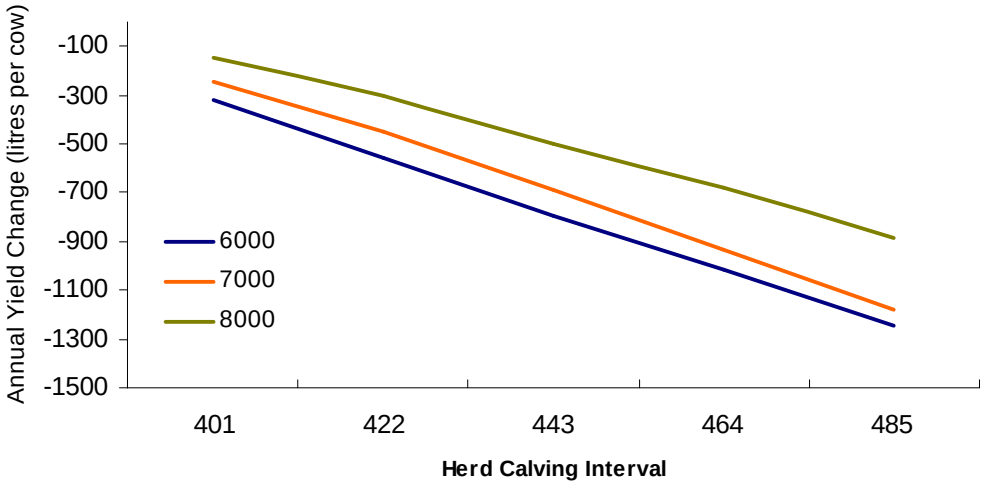

Figure 2. Change in annual milk yield per cow across a range in herd calving intervals, relative to a 375-day herd average

Results are outlined in Figure 2. Increasing the herd-average calving interval as per structures outlined significantly reduces annual milk production. The effect is greatest in the 6000-litre herd category, where a herd calving interval of 443 days reduces annual milk yield by 792 litres per cow (the effect at this calving interval is 690 litres and 499 litres per cow for 7000 and 8000 litre herd respectively). This occurs due to a greater proportion of recycled cows being dried off before 60 days pre-calving. The effect is likely to be herd-specific however, as a higher minimum daily yield threshold or any imposition a date-based dry-off policy that shortens the lactation period would result in proportionally greater yield changes.

The revenue value of such milk yield effects for a 100-cow herd is shown in Table 4, based on a 30cpl annualised milk price. Annual milk sales losses are considerable across all categories, and amount to approximately €150 - €200 per cow at current average calving interval for liquid milk herds.

Table 4: Effect of calving interval on milk revenue losses[1] for 100 cow herd

	Herd Base[2] Production Level (litres)		
Calving Interval	***6000***	***7000***	***8000***
401	€9,660[3]	€7,320	€4,380
422	€16,770	€13,620	€9,060
443	€23,760	€20,700	€14,970
464	€30,570	€28,020	€20,490
485	€37,290	€35,370	€26,520

[1]Relative to a 375 day calving interval
[2] Based on 305-d yield for a herd with 370 day calving interval
[3] Based on a 30cpl annualised milk price

Effect of calving interval on structure of calving pattern

Failure to achieve good reproductive efficiency results in slippage from optimum calving pattern over time. There is some trade-off between retaining a limited calving season and controlling calving interval, (in that spring or autumn breeding seasons

become extended to avoid excessively long recycling periods), but in general it is difficult to control calving pattern when herd calving interval exceeds 430 days. Slippage from an optimum to an unstructured calving pattern causes increased feed costs and less persistent lactations. The scale of this effect was estimated for a 100-cow herd with 50% liquid contract across 3 yield levels using the Teagasc calving pattern model and current feed prices (Table 5). At the herd level, moving to an unstructured calving pattern with more Apr-Sept calving increased annual feed costs by €6000-€8000 compared to a compact split calving scenario. This represents a significant hidden cost of suboptimal fertility and extended calving intervals.

Table 5. Estimated total feed budget cost of optimum versus unstructured calving pattern

	Herd Average Base Milk Yield		
Calving Pattern	***6000***	***7000***	***8000***
Optimum[1]	€46,715	€60,643	€74,928
Unstructured[2]	€53,024	€67,761	€82,533
Difference	€6,309	€7,118	€7,605

[1] Optimum pattern of 65% calving Feb-Apr and 35% calving in Oct-Dec

[2] Unstructured pattern extends season to include 15% calving Apr-Jun and 16% August-September

Effect of calving interval on calves produced per year

While reduced milk yield and slippage in calving pattern account for most of the economic cost of extended calving intervals, fewer calves born per cow per year is a further source of lost revenue. Assuming a 7% mortality rate and 42% of the calf crop as breeding heifers, a slip in herd calving interval from 375 days to 443 days, results in revenue losses of approximately €33 per cow (Table 6).

Table 6. Effect of calving interval on annual calf values for a 100-cow herd

Herd Calving Interval	Calves born per Yr	Breeding Heifers[1]	Beef calves[2]	Revenue Difference[3]
375	0.97	39	54	-
401	0.91	36	50	€1,411
422	0.86	35	48	€2,424
443	0.82	33	45	€3,341
464	0.79	31	43	€4,175
485	0.75	30	41	€4,937

[1]Valued at €450 net of rearing cost [2] Valued at €80 net of rearing cost

[3] Relative to 375-d calving interval

Where to from here?

Retaining empty cows for recycling into subsequent breeding seasons is standard practice for most split-calving liquid milk herds as it helps reduce culling rate in the short term. However, the hidden costs of this policy are considerable. Based on data presented, annual profit for a 7000-litre herd of 100 cows is reduced by approximately €31,000 for a herd average calving interval of 443 days compared to 375 days. This takes no account of increased breeding and veterinary costs, or indeed extra heifer rearing costs, which could further erode margins. Nonetheless the conundrum remains that it may be necessary to recycle cows for herds with poor fertility even though this is likely to impede long-term progress.

Increasing empty culling rate to reduce calving interval is costly, may not be sustainable, and in any case will not in isolation solve a herd fertility problem. Rather, management should focus on implementing a balanced set of measures to lessen reliance on the highly expensive practice of recycling cows:

- Use seasonal fertility indices to set targets within each breeding season. Aim to submit 90% of all cows eligible for breeding in the first 21 days - 100% of recycled cows should be submitted for service during day 1-5 of breeding. This reduces the percentage of late calvers and cows at risk of recycling.
- Review heat detection efficiency. It is difficult to sustain over a long period of time, but attention to detail in the early weeks is necessary to reach submission rate targets
- Increase bull power to compact the spread of late calvers, particularly in the summer breeding season. One bull per 20 non-pregnant cows is suggested.
- Genetics for fertility is crucial. Only use herd sires with an EBI fertility sub-index of €120 or greater. This applies to stock bulls too. Use similar criteria if purchasing replacement heifer stock.
- Institute a policy of culling cows with consistently poor fertility/ repeatedly long calving intervals. Removing the worst 5-10% of the herd each year will significantly improve the herd profile.
- Manage replacements to calve at 2 years old. These should be front-loaded to calve at the start of each season (>80% in 6 weeks). Use synchrony if needed
- Correct body condition score (BCS) at calving (3.25) and breeding (2.75) improves conception rates. Use extra days dry, high energy/low protein diets, once daily milking etc to improve BCS. Restrict feed intake to avoid over-conditioning of recycled cows at calving.