Dairy systems – farming today with tomorrow in mind

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Summary

- Increased economic value in tandem with improved environmental sustainability have been achieved within the Irish dairy sector by focusing on core grazing principles to maintain low production costs and high levels of pasture utilisation.
- Against the backdrop of two consecutive years of agricultural input cost inflation coupled with declining milk prices during the last 6 months, dairy farmers must urgently revisit farm financial budgets to secure an adequate household income for 2023.
- Our grazing systems can be further improved by reducing reliance on supplementary feed and chemical fertilisers, maintaining appropriate grazing stocking rates and further refining day-to-day operations to reduce workloads, simplify systems and improve work-life balance on family run dairy farms.

Introduction

Ireland's dairy exports are the largest single element of total food and drink exports, with over 1.7 million tonnes of product shipped to over 130 markets worldwide (Bord Bia, 2023). By any measure, the performance of the sector during 2022 has been extraordinary. With a total estimated value of €6.8 billion in 2022, the year-on-year increase in value alone was worth €1.7 billion to the Irish economy (equivalent to approximately 30% of the total national budget surplus at year-end; CSO, 2023). The sustained recent performance of the sector has been achieved through a 33% increase in product value, together with a 20% increase in total milk output since 2017. Although herd expansion has been one feature of this change (average herd size increased from 75 to 93 cows per farm during the same period), the success of the dairy sector has come primarily from increased productivity via improved animal breeding, grassland management and animal husbandry. Remarkably, the increase in total sector value has been achieved while reducing reliance on both chemical nitrogen (N) fertiliser and chemical herbicide usage on Irish farms. Average N fertiliser usage on Irish farms reduced by 14% in 2022; in part, this was due to a marked increase in fertiliser prices, but also reflects the accelerated adoption of climate-smart farming practices to achieve the target 25% reduction in carbon emissions by 2030. The stellar performance of the sector has been achieved against the backdrop of tumultuous international economic circumstances, most notably in terms of the impact of the war in Ukraine, hyperinflationary cost pressures, tightening financial markets and the ongoing legacy of trade disruptions from the Covid-19 pandemic. Indeed, the sustained recent performance of the sector is in stark contrast to global trends with flat or weakening milk production in all key exporting regions during 2022 and further modest reductions predicted for 2023; as rising input costs, reduced availability of skilled labour and increased environmental regulation have diminished confidence in key exporting nations.

Farming today with tomorrow in mind – first principles of grazing

The next decade is likely to see further pressure on all forms of global food production systems. Increasing population and greater per capita consumption will continue to increase demand. At the same time, greater competition for inputs and land use, the impacts of climate change and the requirement for climate change mitigation are expected

to restrict supply. The good news for Irish dairy farms is that despite recent turmoil, profitable and sustainable dairy systems will continue to be based on executing a relatively small number of key management practices accurately. The key performance indicators for Irish grazing systems of milk production are summarised in Table 1. As evidenced by the data below, significant further progress can be achieved within Irish grazing systems. Indeed, a continued focus on improved grazing practices, supported by further genetic improvement, can yield additional pasture utilisation and increased farm profitability on Irish dairy farms. This can be achieved while delivering world-leading dairy products with improved environmental sustainability, increased animal welfare and superior product quality to international consumers.

Table 1. *Target performance indicators for Irish pasture-based dairy systems compared to average and top performing farms*

	Average[1]	Top 10%[2]	Target
Dairy Economic Breeding Index (€)[3]	164	200	>225
Herd maturity (No. calvings/cow)[3]	3.6	4.1	> 4.5
Optimum soil fertility (% farm area)	20	75	100
Fertiliser N (kg chemical N/ha)	180	200	<150
Calving rate (% calved in six weeks)[3]	67	85	90
Grazed pasture in the diet (%)	57	65	>70
Pasture utilised (t DM/ha)[2]	8.0	9.6	13.0

[1]*National Farm Survey (NFS, 2021)*, [2]*Ramsbottom et al. (2020)*, [3]*ICBF (2023)*

So what are the key management practices that Irish dairy farmers need to revisit to future-proof Irish dairy systems for the next decade? In the next section, we focus on three key components: (1) refocusing on prudent financial management; (2) achieving appropriate stocking rates (SR); and (3) simplifying workloads to achieve a sustainable work-life balance on-farm.

Refocusing on financials – protecting the margin for 2023

The high rate of general inflation in Ireland over the last 18 months has eroded the real value of incomes on all farms and in the wider economy at large. The greatest immediate challenge for Irish dairy farms is to secure an adequate household income for farm families against the backdrop of two consecutive years of agricultural input price hyperinflation (9% and 32% in 2021 and 2022, respectively). Figure 1 illustrates the fluctuations in average gross margin, production costs and net profit margin (excluding family labour) during the last decade on Irish farms. Teagasc estimated that net margins on Irish dairy farms increased by 70% to €3.20 per kg fat plus protein (23.9 cent per litre) in 2022, and resulted in an average family farm income of €151,000 per farm (Teagasc, 2023). However, the strong performance of the sector in 2022 will not be repeated this year as milk prices have already reduced to 2021 levels.

Feed costs in particular, have remained at stubbornly high levels during 2023 (+75% of 2020 levels) and, together with rising interest rates, will likely contribute to a continuation of inflationary pressures and tightening cash flows on dairy farms for much of 2023. On that basis, the average net margin per litre of milk is expected to fall to €1.50 per kg fat plus protein (12-14 cent per litre) in 2023. Hence, 2023 will be more typical of medium term norms, but it is essential for farmers to now create a financial budget to reappraise capital expenditure plans and maintain family farm income in this high cost environment.

To maintain profit margins, Irish dairy farmers must refocus on cost control during 2023. At a general level, multiple prices should be sought when sourcing farm materials during the remaining months of 2023 to take advantage of any market price reductions. More specifically, reduces feed costs as well as costs related to pasture and forage are an essential objective to constrain total production costs in 2023 as fertiliser prices reduce and increased use of clover in swards reduces total N fertiliser requirements.

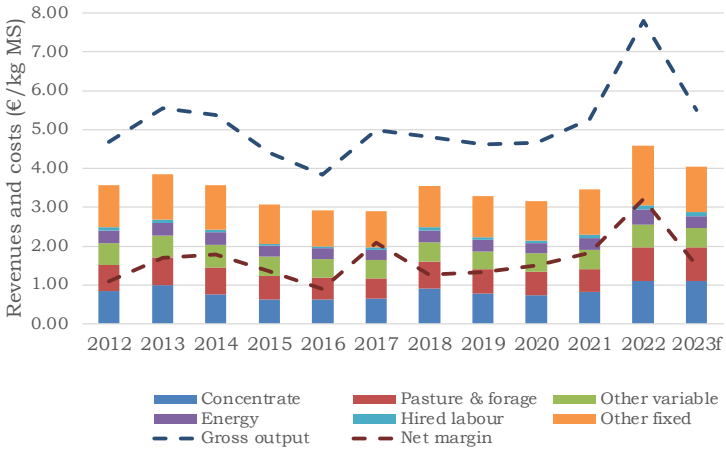

Figure 1. *Trends in gross output, costs and net profit margins on Irish dairy farms during the last decade (National Farm Survey) and forecasts for 2023*

As purchased feed costs have markedly increased during the last decade through a combination of increased land costs, rising fertiliser prices and increased energy costs; the relative cost competitiveness of grazed pasture has been enhanced. Figure 2 outlines how absolute and relative feed costs have increased during the last decade. Grazed pasture and grass white clover have increased in cost by €30/t DM between 2013 and 2023, pit and bale silage have increased by €55 and €75/t DM during the same period and purchased concentrates have increased by €213/t DM. On a relative energy corrected basis, pit and bale silage are currently 2.5 times the cost of grazed pasture and purchased concentrate is five times the relative cost of grazed pasture.

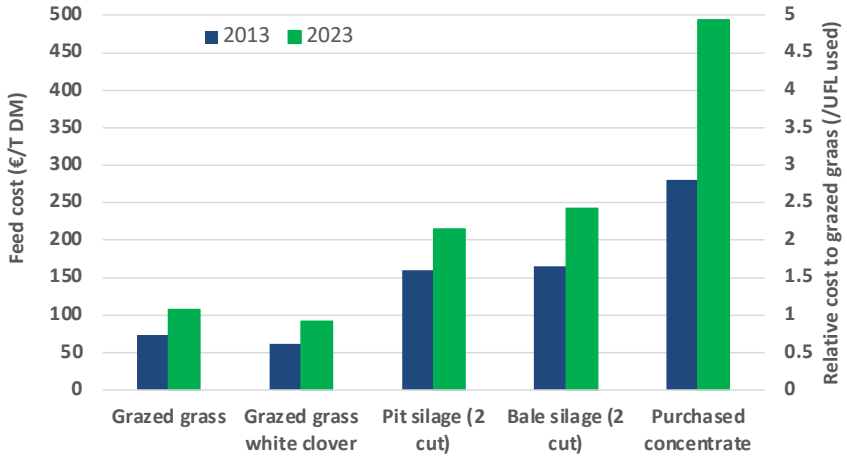

Figure 2. *Actual feed costs (€/tonne) during 2013 and 2023. [Adapted from Finneran et al., 2011, Doyle et al., 2023]*

The central importance of increased pasture utilisation (t DM/ha) to increase economic performance in grazing systems is well recognised. Efficient pasture-based systems must therefore maintain a high proportion of grazed pasture in the animal diet to achieve a low production cost-base, and to insulate the dairy farm business from both climate and imported feed price shocks. An overall target of 70% grazed pasture in the dairy herd diet is appropriate in Irish grazing systems to achieve high levels of performance within a low cost grazing system. This equates to approximately 265 days of grazing and 0.5 tonnes of concentrate fed per lactating cow per annum.

Stocking rate – the happy medium and the 'TMR' cow

Whether the objective is minimising external feed and capital costs, reducing workload or minimising environmental impacts, having the correct stocking rate (SR) has always been a cornerstone of efficient and profitable grazing systems. Recent trends for SR on Irish dairy farms reveals that overall SR has increased only modestly during the last decade from 1.9 to 2.1 livestock units per hectare (LU/ha; NFS, various years), but there has been a significant increase in SR on the milking platform area (i.e. lands adjacent to the milking parlour). Based on available national statistics (National Farm Survey), milking platform SR has increased from 2.0 to 2.7 LU/ha during the last decade; farms have become increasingly specialised in dairy cows and other stock have been moved to outside land parcels or in some cases to contract rearing. Similar to the NFS, Figure 3 illustrates the change in both overall and milking platform SR for a matched sample of dairy farms that completed Teagasc eProfit monitor during the period from 2013 to 2017 and recorded overall pasture utilisation (tonnes DM/ha) during the same period. Similar to the national picture, only a very modest change in overall SR (2.2 to 2.3 LU/ha) occurred during the period, whereas milking platform SR increased substantially (from 2.4 to 2.8 LU/ha). At the same time, and despite a consistent increase in milking platform SR, there was no significant increase in pasture utilisation on these farms between 2015 and 2017. This analysis reveals that, on many farms, milking platform SR has increased to levels beyond that required to maximise pasture utilisation. Consequently, there are additional cows on these platforms that are effectively increasing total purchased feed requirements, labour and capital costs and reducing the duration of the grazing season for the entire dairy herd. In addition, where SR on the available area exceeds the pasture production capability of that area, this results in an increase in total costs that correspond to approximately 1.6 times the increase in feed costs alone.

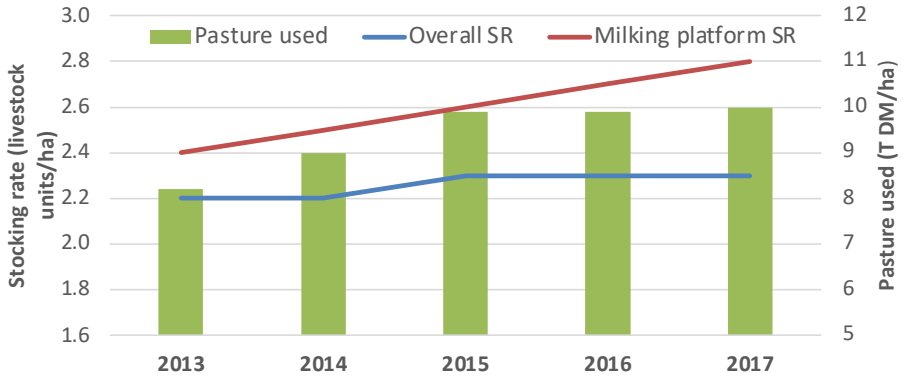

Figure 3. *Trends in overall and milking platform stocking rate and pasture utilisation (t DM/ha, green bars) on Irish dairy farms (2013-2017; Ramsbottom et al., 2020)*

So what should be the optimum overall and milking platform SR for efficient dairy farms in 2023? In defining the optimum SR, it must first be acknowledged that farms differ in terms of land quality and usability, cow type/size, milking platform area, availability of outside land blocks, etc. Nonetheless, pasture production, pasture utilisation and concentrate supplementation levels are the primary considerations that define the optimum SR to allow both high animal performance and high pasture utilisation to be achieved. In Table 2, the optimum whole farm SR for farms that produce different amounts of grass and feed different amounts of supplement are defined within self-sufficient forage systems.

Table 2. *Optimum overall stocking rate* for grazing dairy farms growing different amounts of pasture and feeding various levels of supplement/cow*

	Grass grown, t DM/ha			
Tonnes supplement DM/cow	10	12	14	16
0.00	1.5	2.0	2.3	2.6
0.50	1.8	2.2	2.5	3.0
1.00	2.0	2.4	2.9	3.1

**All of these stocking rates equate to 80 kg live weight/t feed DM available*

For the milking platform, the specific SR can be increased to improve grazed pasture utilisation, while the additional winter feed requirements can be provided on an area away from the platform. In this situation, the additional cows on the milking platform are considered 'marginal cows' as the system is no longer forage self-sufficient and part of the diet is supplied by feeds (both concentrate and silages) from outside the milking platform. The marginal cow milking platform SR to maximise pasture utilisation for farms growing various levels of pasture is outlined in Figure 4.

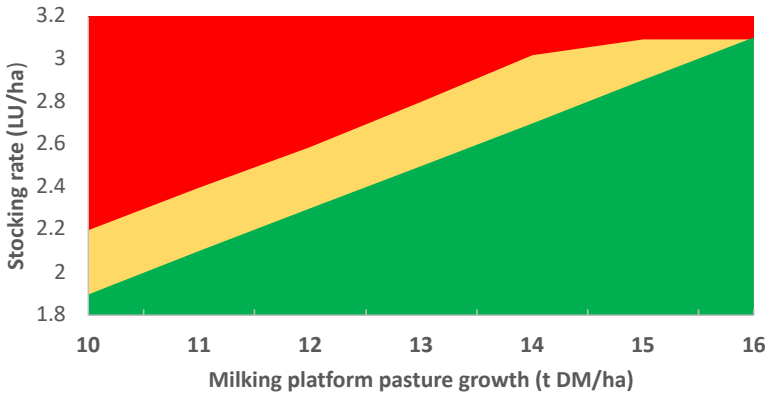

Figure 4. *Overall (green area) and milking platform (yellow area) stocking rate (SR) for farms growing various levels of pasture on the milking platform (t DM/ha). The red area reflects SR in excess of marginal levels where no additional pasture is utilised and the entire requirements of the additional animals are supplied from outside the system*

So what are the milking platform SR guidelines? As evidenced by Figure 4, milking platform SR can be higher than the overall SR to yield a finite additional pasture utilisation on the milking platform, but should never exceed the shaded yellow area as this corresponds to a complete supplementary feed (equivalent to a total mixed ration (TMR)) diet for these additional animals. Farmers should exercise caution with marginal SR increases as additional pasture utilisation is not guaranteed (depending on growing conditions) and the overall economic benefit is heavily dependent on favourable economic conditions (milk price and input costs, capital and labour requirements). For these reasons, previous studies in pasture-based systems in Ireland and New Zealand have reported a linear decline in profitability with increasing feed importation. In addition, many studies also indicate that where increased SR is associated with increased chemical fertiliser and supplementary feed importation, nutrient-use efficiency is reduced, resulting in increased nutrient losses to the general environment.

Becoming the 50 hour farmer - reducing workload on dairy farms

In addition to farm financial and biological performance, dairy farmers are now placing greater emphasis on quality of life, time off and time with family away from the farm as critical measures of family farm business success. While long working hours increase the

risk of ill-health and injury in agriculture and the wider economy, it is also a deterrent to young people entering careers in dairy farming. With this in mind, a recent large-scale study was conducted across 76 spring calving Irish dairy herds from February 1st to June 30th 2019. The aim of this study was to examine workload, time-use and labour efficiency, and the effect of labour saving strategies on labour demand. The studied farmers worked on average 60.0 hr/week during the 150-day study period and 63.5 hr/week during February and March. Although the top and bottom 25% of studied farms had a similar herd size (112 cows), the more labour efficient group worked 51.2 hr/wk compared with 70 hr/wk for the least efficient 25%. The working day had a similar start time (06:47 vs 07:00) but the more labour efficient group finished the working day earlier (18:25 vs. 19:58). Maintaining the 16:8 milking interval is a fundamental component of the shorter working day on efficient farms with no negative impact on milk production. Within this system, we believe an 18:00 hr finish time should be an achievable KPI on farms from February to June.

Table 3. *Work organisation effectiveness indices for top 25% and bottom 25% of farms from 1st February to 30th June*

	Top 25%	Bottom 25%
Average herd size (No. cows)	112	113
Labour input (hr/cow, February – June)	17.4	20.9
Farmer work (hr/week)	51.2	70.0
Farmer workday length (hr)	11.4	13.2
Start time (hr:min)	06:47	07:00
Finish time (hr:min)	18.25	19:58

Unsurprisingly, milking was identified as the most time-consuming task on dairy farms, accounting for 31% of time input. Five practices were identified to improve milking labour efficiency that should be relatively easy to implement on most dairy farms:

- one person milking during mid-lactation
- the milker not leaving the pit to feed calves during milking
- using a quad/jeep to herd cows to and from milking
- being able to operate cow exit/entry gates from anywhere in milking pit
- automatic cluster removers

Calf care accounted for 20% of time in the peak months of February and March. Contract rearing calves pre-weaning and selling male calves were two activities that can significantly reduce time input. Contractors have more efficient equipment than farmers to complete tasks such as slurry and fertiliser spreading, and can reduce or replace the need for additional farm staff and farm machinery. Although there is an economic cost to the farmer for contract rearing, additional use of contractors and investments in calf rearing equipment, studies have indicated that these additional costs do not significantly reduce farm profitability.

As part of the study, farm profitability was assessed for those farmers that had data available (n=34). The top 25% of farms for work organisation effectiveness had greater profit (€/ha), which agrees with previous studies. The greater profitability achieved on the most labour efficient farms indicates that the extra workload on less efficient farms does not contribute to farm profitability. More generally, improved labour efficiency can also enhance many other key aspects of dairy farming, including improved health and safety for farm operators and creating more attractive workplaces. In many cases, the work practices required may not need large investments on-farm and should be relatively easy to implement. For others, larger financial investments may be required (e.g. automatic cluster removers and automatic calf feeders); grant funding is currently available under DAFM schemes and should be investigated on a farm by farm basis in terms of cost/benefit.

Conclusions

The financial landscape for dairy production has been substantially altered during the last 24 months with unprecedented fluctuations in dairy product prices and hyperinflation of costs at farm level. In addition to the ongoing requirement to improve efficiency to meet climate action commitments, dairy farmers must also refocus on prudent financial budgeting to reduce costs and maintain financial margins during 2023. To that end, the core components of pasture-based milk production systems will continue to be high productivity pasture management, appropriate overall stocking rates, and highly efficient dairy cattle managed in a seasonal compact-calving system. Such systems can be further improved by reducing reliance on increasingly uncompetitive supplementary feed imports, incorporation of clovers within diverse grazing swards to reduce dependence on chemical N inputs and the further refinement of day-to-day operations to reduce workload, simplify systems and improve work-life balance for family run dairy farms.