National DAIRY CONFERENCE 2025

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‘PATHWAYS TO PROGRESS’

Teagasc

Agriculture and Food Development Authority

Conference Programme

9.45am	**Welcome** *Teagasc Chairman, Liam Herlihy*
9.50am	**Opening Address** *Minister for Agriculture, Food and the Marine, Martin Heydon (Clonmel)*
10.10am	**Session 1: Milk markets and key farm performance priorities for 2026**
	What's happening in international milk markets – prospects for 2026 *Chris Walkland, Dairy Market Analyst*
	Key Performance Indicators – what lessons can we learn from real-farm data? *Joe Patton, Teagasc Grange*
	Using benchmarking to help drive my farm performance *Tony & Stephen Kenny (Clonmel)| Oisin Gallen (Cavan)*
11.20am	**Tea/Coffee break**
11.40am	**Session 2: Models for succession and progression in dairy farming**
	Partnerships, profit sharing, leasing farming – which option is right for me? *Ruth Fennell, Teagasc Collaborative Farming Specialist & Conor Hogan, Teagasc Researcher*
	Farmers experience of collaborative dairy farming – making it work for both parties *Michael Dunphy & John Gilvarry (Clonmel) | Conor Wynn & Tony McCormack (Cavan)*
1.00pm	**Lunch**
2.00pm	**Session 3: Driving further progress in Irish dairy breeding**
	Reviewing EBI after 25 years – a lot done and more to do? *Donagh Berry, Teagasc Moorepark Researcher specializing in animal genetics*
	Interactive audience discussion on future breeding priorities
2.50pm	**Session 4: Bite-size research updates**
	Practical steps to protect water quality on dairy farms *Cathal Somers, Teagasc ASSAP Programme*
	Controlling dairy production costs in 2026 *Michael Freaney (Clonmel) & Owen McPartland (Cavan), Teagasc Dairy Advisors*
	Update on the Pasture Profit and Clover Index *Sarah Walsh, Teagasc Moorepark*
	Using the MOST grass prediction model for precision grazing management *Elodie Ruelle, Teagasc Moorepark*

National Dairy Conference 2025

Pathways to Progress

Talbot Hotel, Clonmel
Wednesday 26th November 2025

&

Hotel Kilmore, Cavan
Thursday 27th November 2025

Agriculture and Food Development Authority

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Welcome from Teagasc Tipperary Advisory Region

Donal Mullane
Regional Manager, Teagasc Tipperary Advisory Region

On behalf of the Teagasc Tipperary Region, I am delighted to welcome all attendees to the 2025 National Dairy Conference, *"Pathways to Progress."*

This year has been good for dairy farming in terms of milk and livestock prices, supported by weather conditions. However, significant challenges lie ahead, and a sharp focus on technical performance will be essential.

Tipperary is a diverse farming county with a particularly strong dairy sector. Since the removal of quotas, our milk output has doubled. Farmers here have adapted exceptionally well to increasing scale while maintaining efficiency and embracing new technologies. Situated at the crossroads of the Irish dairy industry, Tipperary is served by six dairy co-ops that collect milk from almost 200,000 dairy cows within the region. Our joint programmes with these processors allow us to transfer world-class research directly onto farms.

Today's conference offers an important opportunity to prepare for both the challenges and opportunities ahead. Change is constant, and success requires an ongoing ability to adapt to an ever-evolving internal and external environment. As we explore generational renewal, new ways of involving young people in farming, and emerging technologies, the conference also provides a moment to take stock, reconnect with colleagues and friends, and plan for the year ahead.

Finally, I would like to welcome you to Clonmel, Co. Tipperary. We are pleased to host this year's conference alongside our colleagues in Cavan and hope you enjoy an informative and engaging event.

Welcome from Teagasc Westmeath / Cavan / Monaghan Advisory Region

Tom Kelleher
Regional Manager, Teagasc Westmeath/Cavan/Monaghan Advisory Region

On behalf of the Teagasc Westmeath Cavan Monaghan Advisory Region, together with my staff, I am happy to welcome attendees to the 2025 National Dairy Conference in the Kilmore Hotel in Cavan. 'Pathways to Progress' is the theme of this year's conference. This is an appropriate theme as dairy farmers face into the many challenges ahead in 2026.

Dairying is very important in the region with over 1,350 specialist dairy farmers and over 118,000 cows. Farming can be challenging with plenty of heavy soils across the region, but farmers are able to adapt and meet that challenge head on. The dairy enterprise makes a very significant contribution to farm families and the wider agri industry in this part of Ireland.

Teagasc very much appreciate our collaboration with Lakeland Dairies and Aurivo Co-op, two very important co-operatives in the region. We have delivered very successful joint programmes with both co-ops for several years now and hope this successful collaboration will continue for many more years.

Dairy farmers are very resilient and able to quickly adapt to meet the many challenges and uncertainties they face. Session 1 of today's conference will look at the international milk market, key performance indicators, and benchmarks for farmers to challenge themselves against. In session 2 there is a really important focus on generational renewal, and the many options that farmers can consider. Session 3 will review breeding and the very successful EBI while Session 4 should really interest all with various research updates.

Finally, I hope you enjoy the day and leave the conference with a positive outlook and reset for the year ahead.

Welcome from Teagasc Dairy KT Department

Joe Patton
Head of Dairy Knowledge Transfer, Teagasc

On behalf of the Teagasc Dairy team, I would like to welcome you the National Dairy Conference 2025. The theme for the event is "Pathways to Progress". Our host regions for this year's dual conferences are home to over 300,000 dairy cows supplying a number of dairy co-operatives, bringing over €1bn in primary income to the local economy. This underlines the central role that dairy farming plays in driving rural enterprise and development. Our aim today is to provide a platform for sharing new perspectives and sound experience for those involved in this key sector.

This year has seen milk production recover strongly compared to 2024, up 5.7% year to date. With good milk price returns in Q1 to Q3 annual milk revenues will be healthy, High beef prices have added to overall farm revenue later in the year, while favorable weather and grass-growing conditions for most areas of the country have resulted in a moderate reduction in overall costs. Winter feed stocks are in a healthy position also. However, a sharp downturn in market returns over recent months points to a much more difficult period ahead. The rate and scale of reduction in base milk price certainly point to the challenge of managing volatility at farm level.

As always, improvements in technical efficiency are a vital ingredient in success for dairy farms. Technologies such as sexed semen, CBV and DBI, and grass management technologies, are becoming embedded practices year-on-year. This year there was an 18% increase in the number of farms completing financial benchmarking through Profit Monitor; growing this practice is a core ambition for the Teagasc dairy programme.

The Economic Breeding Index has been a transformative technology for Irish dairy farming, and this year marks a quarter century of progress towards optimal genetics for our grass-based systems of production. Our conference today will hear how this technology has and will continue to drive real financial gains for the sector.

Generational renewal in farming has come to the fore as major area requiring progress. From a dairy perspective this will need innovative models such as share farming, leases and partnership arrangements. These will need to be delivered for current and future dairy farmers alike. Our conference Session 2 features excellent examples in this regard, and we sincerely thank our farmer speakers Michael, John, Conor and Tony, for sharing their experience on this vital aspect of long-term farm development. We also thank our Session 1 farmers Tony/Stephen and Oisin for their excellent insights into meeting key performance targets for successful farming in a volatile market environment.

Dairy farmers continue to play their part in meeting the challenges of emissions, water quality, and biodiversity. The catchment-based approach adopted by the Better Farming for Water campaign operates on the principle of '*the right measure in the right place*' which requires granular detail on water quality, and farm-by-farm implementation of actions. Retention of a Nitrates Derogation is contingent on achieving progress on water quality, however the challenge and benefits to maintaining and improving water quality extend far beyond nitrates derogation farms. Our conference will address this issue throughout the day

10.00am Session 1: Milk markets and key farm performance priorities for next year

Session 1 Speakers

Chris Walkland

Dairy Market Analysist

Chris Walkland is an agricultural journalist, market analyst and consultant specialising in the dairy sector. He has written about this industry for around 30 years on all aspects of the dairy supply chain from primary production on the farm through to the economics and politics at processor, retailer and consumer level. He now specialises in analysing and reporting on the dairy markets and writes the fortnightly Dairy Market Report for *The Provision Trade Federation* – a trade body that represents many of the UK's processors. Chris is also a commentator on the industry in the farming magazine *British Dairying*; and features every week on the Kite Consulting dairy podcast where he gives an update on market developments and the milk price outlook as he sees it.

Joe Patton

Teagasc, Head of Dairy Knowledge Transfer

Joe Patton has led the Teagasc dairy knowledge transfer team since 2021. Prior to that he held a number of positions in Teagasc, including contract research officer in Moorepark, winter milk systems specialist, and ruminant nutritionist. After graduating from UCD in 2002 with a degree in Animal Science, he completed PhD on relationships between nutritional status and fertility in dairy cows in 2006. He has also worked on design and delivery of a number of joint dairy industry development programmes.

Tony Kenny

Farmer Speaker (Clonmel)

Tony, Marie and Stephen Kenny farm in Ardfinnan Co Tipperary. They milk approximately 155 cows and supply Dairygold Co-op. All young stock and heifers are contract reared locally. The Kennys farm within a partnership structure with Stephen joining the team full time in 2019. They focus on producing high quality milk from a grass-based system.

Stephen and Tony are members of the local Teagasc ANC Discussion group who meet monthly throughout the year. This year, the Kennys hosted a discussion group meeting on their farm at which Billy Kelleher, MEP was in attendance to discuss the future of the nitrates derogation.

Oisin Gallen

Farmer Speaker (Cavan)

Oisin is a Cavan native, born and reared in the parish Killygarry. He now farms in partnership with his father Eamon in Ramelton, Co. Donegal. Inheriting his uncle's farm in 2016 Oisin embarked as a new entrant into milk in 2020 and today runs a successful 90 cow spring calving system on a mixed soils farm. Farming a total area of 48 ha with a milking platform consisting of 32 Ha. Yearling replacement heifers are contract-reared off-farm to a local drystock farmer within the county.

Oisin is a member of the local Teagasc Letterkenny Discussion Group and chairman of Teagasc Donegal Grass10 group. He is passionate about grass and takes every opportunity to get cows to grass. He has achieved 260 days at grass on a challenging farm which receives approx. 1150mm of rain per annum, and places a huge emphasis on soil fertility, reseeding and network of roadways and this has contributed to his success. Oisin was the 2023 Runner Up >500,000 Litres in the Lakeland Dairies Milk Quality Awards. When not farming Oisin will be with his wife Karen and 6-month old daughter. Family, friends and the local community are at the heart of this family run business

Dairy costs and margins – trends in real-farm data

Joe Patton and Laurence Shalloo

Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- Costs of production had remained remarkably stable over the period 2012 to 2020 despite significant growth in milk output at farm level
- Costs of production have increased dramatically on dairy farms between 2020 and 2023 with a slight reduction observed in 2024
- The key drivers of cost increased in the period of 2020 to 2024 were concentrate costs, pasture and forage costs, machinery depreciation and energy/fuel costs
- Analysis from the profit monitor suggests that the key drivers of profitability per hectare were pasture utilisation per hectare, concentrate feeding levels and the costs per kg of milk solids
- Each additional tonne of pasture utilised was associated with an increase in profitability of €333 per hectare
- Increasing stocking rate without increasing pasture utilisation will result in reduced profitability

Introduction

The Irish dairy industry has undergone a remarkable transformation since the removal of EU milk quotas in 2015. Since preparation for their removal began in the 2007 - 2009 period, and up to 2022, milk solids output increased by over 96%. While there was a reduction in output between 2022 and 2023, milk solids output increased by 1% in 2024. This increased output has been achieved through increased cow numbers, increased milk yield per cow, increased fat and protein percentages, increased stocking rate, and additional land entering the dairy industry. While it is clear the dairy industry still has great potential to both grow and improve efficiency, it is important farmers remain focused on their system to create a resilient and profitable long-term business. As grass silage and concentrate are 3 to 5 times more expensive than grazed grass, focusing on maximizing the proportion of grazed grass in the diet of the dairy cow has resulted in profitable dairy systems.

However, since 2020 production costs have increased due to external factors such as the Covid pandemic and the Ukraine war. This has been compounded by incremental increases in level of purchased concentrate feed use at farm level for no change in productivity, displacing grazed grass in the diet. The industry must navigate challenging conditions brought about by changing environmental policies, system creep, variable pasture production, increased reliance on concentrate supplementation, and an economy operating at full employment, all amid ongoing uncertainty in policy and trade conditions. This paper will describe the cost changes over time at farm level and the key associations and relationships that should be prioritised at farm level to control costs.

Trends in cost of production over time

Over the past number of years, there has been significant change in costs of production at farm level when expressed in costs per kg of milk solids (Figure 1). Between 2012 and 2020, there was relative stability in costs per kg of milk solids. However, since 2020, there has been a dramatic increase in costs of production driven mainly by factors outside the farm gate but also associated with changes within the farm gate. The increase in costs in 2022 was largely driven by the geo-political situation related to the war in Ukraine and was associated with input price inflation rather than on system change or system creep. Since 2022 there has been a significant retrenchment in input prices, yet this has not been directly associated with a reduction in costs.

The ‘sticky’ nature of the costs of production reflected two difficult weather years as seen in 2023 and 2024. The National Farm Survey (NFS) data shows that costs of production are dropping since 2023 albeit slowly. The NFS estimates for 2025 are based on the best information available, without the final quarter of 2025 being available. It is possible when the full information is available for 2025 that costs may have dropped to a greater extent.

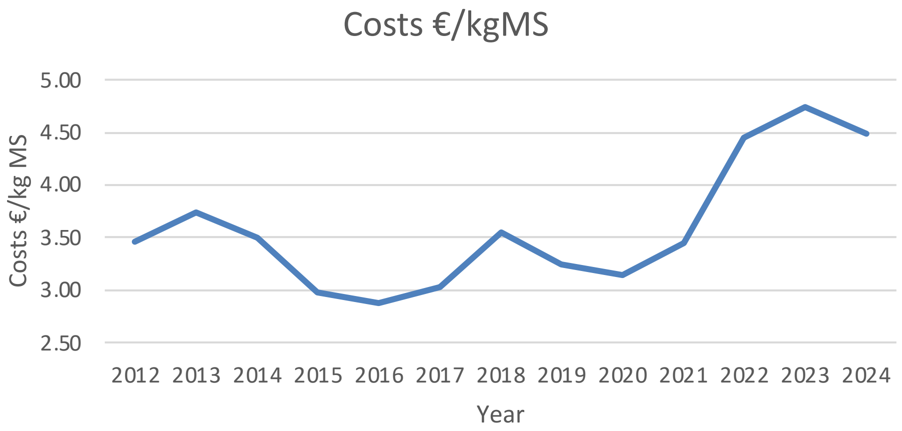

Figure 1. *Change in costs of production on Irish dairy farms between 2012 – 2024 (calculations based on NFS)*

The reality is with this level of cost increase that dairy farmer income would be under significant pressure if not associated with dramatic increases in milk price over the period from 2021 to 2025. The milk price increase observed in 2022 and again at the later end of 2024 and into 2025 has reduced some of the exposure of some dairy businesses to the dramatic cost increases (Figure 1). In reality, there is an urgent need to reduce costs of production to reduce the exposure of dairy farms in 2026. Family farm income was under €50,000 in 2023, which was the only year since 2012 where the family farm income was actually below €60,000, and this created significant income and cash-flow pressures on dairy farms. The impact was compounded and cushioned by the high income observed in 2022 (circa €150,000). Currently it appears that 2025 into 2026 is showing similar trends as were observed in 2022 into 2023 with one key exception being the value of beef which will put a floor under both calf and cull cow prices with projections suggesting that beef markets will remain stable in 2026. There is a key requirement for all dairy farmers to now start planning for 2026 by creating a cash buffer, completing a cash flow budget and discussing with your financial institution if there is an expectation of a budgetary problem in 2026.

Factors driving cost change over time

Table 1 shows the overall summary financial figures for dairy farms over the period 2020 to 2025 in euros per kg of milk solids. Between 2020 and 2025 variable costs increased by 46% per kg of milk solids while fixed costs have increased by 28%. Total costs have increased from €3.13 per kg MS in 2020 to €4.49 per kg MS in 2024 or a 43% increase, with that figure being 51% in 2023.

Table 1. Gross Output, costs and net margin per kg milk solids for the years 2020 to 2025

	2020	2021	2022	2023	2024
Gross Output	4.62	5.26	7.83	5.63	6.51
Direct Costs	1.79	1.90	2.57	2.74	2.62
Gross Margin	2.83	3.35	5.26	2.89	3.89
Overhead Costs	1.34	1.54	2.09	1.97	1.87
Total Costs	3.13	3.44	4.66	4.71	4.49
Net Margin	1.48	1.81	3.17	0.92	2.20

Source: Calculations based on the NFS

Table 2 shows a breakdown in cost changes between 2020 and 2024. It shows that pasture and forage costs increased by €0.24 per kg MS while concentrate costs increased by €0.38 per kg MS. The concentrate cost increase reflects a 52% increase in concentrate costs while the pasture and forage cost increase reflects a 47% increase between 2020 and 2024. In terms of overhead costs, energy and fuel increased by €0.12 per kg MS, hired labour by €0.05 per kg MS, rent by €0.05 per kg MS, machinery depreciation by €0.12 per kg MS and building depreciation by €0.05 per kg of MS.

Base on the NFS data, of the total increased costs at farm level increased pasture and forage costs accounted for 18% and concentrate cost 28%, In terms of fixed costs energy and fuel reflects 10%, hired labour 4%, rent 4%, machinery depreciation 9%, building depreciation 4%. Pasture and forage costs, concentrate costs, energy and fuel, hired labour, rent, machinery depreciation and building depreciation accounted for 78% of the cost increases.

Table 2. **Breakdown of cost increases over the period 2020 to 2024**

	2020	2021	2022	2023	2024
Direct Costs					
Pasture and Forage	0.59	0.57	0.85	0.89	0.83
Concentrate	0.73	0.82	1.13	1.17	1.11
Overhead Costs					
Energy and Fuel	0.26	0.30	0.40	0.39	0.38
Hired Labour	0.08	0.09	0.13	0.13	0.13
Rent	0.14	0.14	0.17	0.16	0.19
Machinery depreciation	0.21	0.26	0.40	0.41	0.33
Building depreciation	0.15	0.22	0.35	0.26	0.20

Source: Calculations based on the NFS

Analysis of factors driving dairy farm profitability

National Farm Survey data provides a highly representative picture of trends in average costs and margins for dairy farms across years. In addition to but separate from NFS, Teagasc also collates detailed physical and financial benchmarking data from approximately 1,200 dairy farmers annually through the E-Profit Monitor system (ePM). These farms are primarily members of Teagasc discussion groups, are larger in scale than the NFS average, and participate on a voluntary basis.

For these reasons the ePM data should not be interpreted as representative of 'national average' performance. However, given the detail and quality of data collected, and the significant range in farm performance observed within a given year, it is very useful as means to explore the underlying causes of farm-to-farm variation in costs and profit. In this way the most relevant physical performance metrics can be identified. The analysis presented looks at the key factors of grass utilisation, concentrate feeding levels, herd milk productivity, and cost control, and how they relate to overall profitability.

Grass Utilisation metric

Grass utilised is a very significant and frequently quoted KPI for dairy systems, but it is perhaps somewhat misinterpreted at industry level. It is not a direct measure of grazing intensity on a paddock-by-paddock basis. It measures instead, by calculated difference, the contribution of home-produced forage to the overall annual feed energy requirement of the herd, on a kg dry matter per ha basis (Figure 2). Important factors in the calculation are stocking rate, milk solids and cow bodyweight to determine annual feed demand, from which purchased concentrate and forage brought in from external sources are deducted.

Annual pasture production data is not required for the calculation itself, but certainly high levels of pasture production and good daily management of allocations and residuals are prerequisites for achieving a high annual result. Where grass growth data is available for comparison, the utilisation figure will usually be around 80% of annual measured pasture dry matter production.

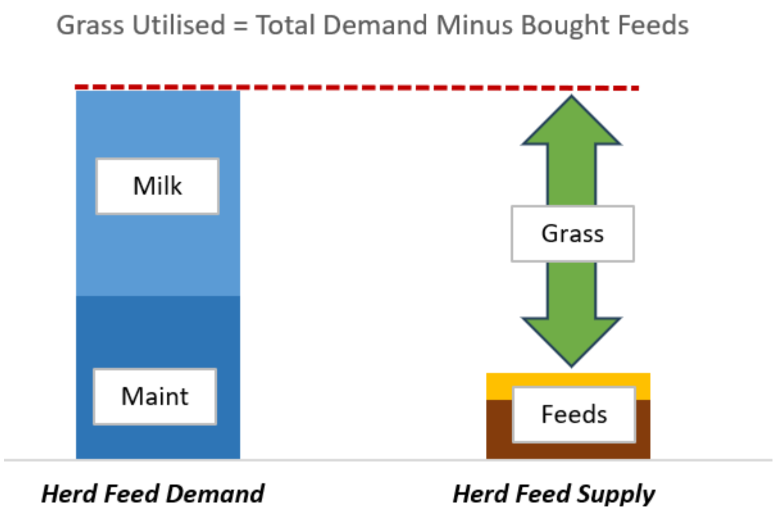

Figure 2. *Schematic of pasture utilisation calculation at farm level.*

Some of the main strategic decisions for the farm, which may not initially be considered as 'grass utilised' factors, directly affect grass utilisation for example target median calving date, herd EBI policy, and land leasing. It is useful therefore to think of grass utilised as the end-of-year outcome of pasture growth, grazing management, soil fertility, herd performance, feed purchase and stocking rate decisions. When considered on this basis, it should make good intuitive sense as to why grass utilised relates strongly to farm profitability.

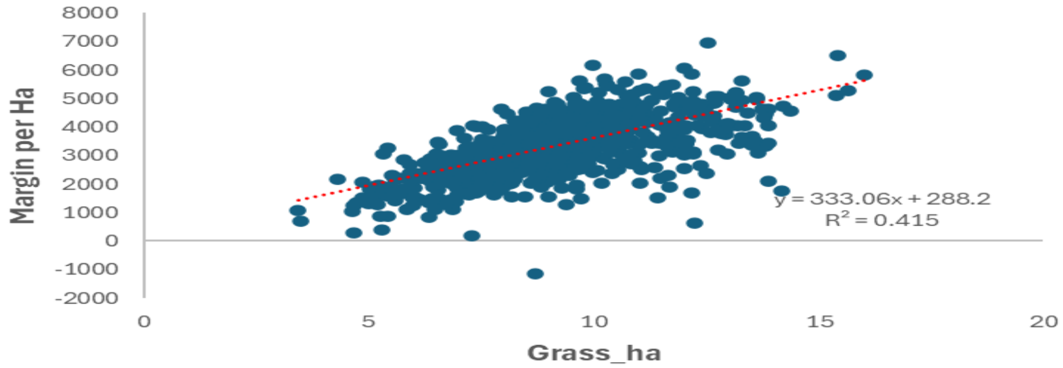

Figure 3. *Grass utilised versus common margin per ha for ePM herds 2024*

Analysis of 2024 ePM data (Figure 3) for dairy herds in ePM confirms the strong association between grass utilised and common margin per ha. Approximately 40% of the farm-to-farm difference in financial outcome is explained by this metric, which is a consistent finding across multiple years' ePM data with varying milk price and cost scenarios.

Stocking rate effects on cost and grass utilisation

The interactions between stocking rate and grass utilised is a key determinant of costs and margin per ha. Taken in isolation, stocking rate is positively associated with margin per ha and has an important role to play in driving grass utilised per ha (Figure 4). However, when stocking rate is analysed in conjunction with grass utilised (i.e. *what happens if I increase stocking rate for no gain in grass utilised*)', the ePM data show that increasing stocking rate could have a negative association with margin per ha. In other words, the positive effect on margin of increasing stocking rate is not direct but is rather a 'grass utilised' effect.

This is an important consideration for farms planning to increase (or decrease) stocking rate – what will the effect be on capacity to utilise grass, and how will this translate to margin? Where grass utilisation is currently limited by low stocking rate, increasing stocking rate is likely to improve margin per ha, *provided that* grass utilisation also increases. Data from ePM shows that profit outcomes will be less favourable if higher stocking rate results only in pro-rata increases in supplementary feed cost.

Where pasture production and management is good, and high grass utilisation is not currently limited by stocking rate, two broad scenarios tend to emerge in response to increasing stocking rate further i) the farm purchases additional supplementary feed to meet the additional demand resulting in a higher cost base or ii) the farm allocates the same total feed across more cows resulting in increased maintenance feed demand, no increase in milk productivity, and higher total non-feed costs on farm.

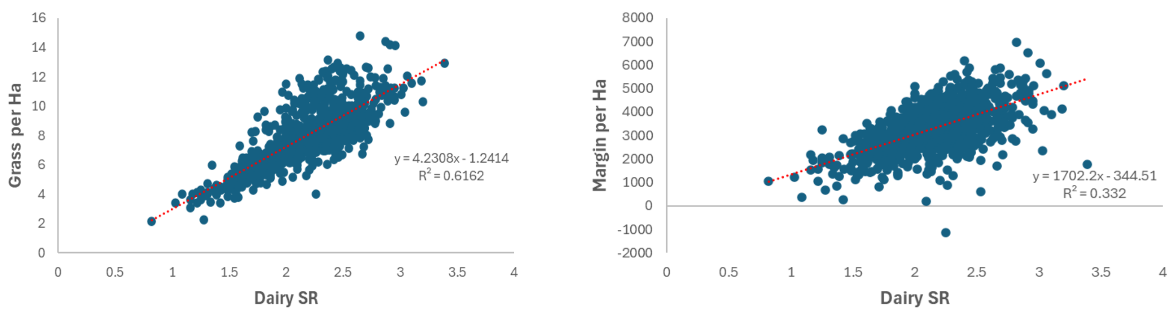

Figure 4. *Relationship between SR and grass utilised per hectare and margin per hectare*

Input costs, milk output measures and margin per ha

A range of milk output and cost efficiency metrics were also tested against margin per ha using the eProfit Monitor data for 2024. As illustrated in Figure 5, lower cost per litre (and per kg milk solids, not graphed) was strongly associated with improved margin per ha. Similar trends were apparent across multiple years which further underlines the need for tight control of cash costs in the system, irrespective of milk price. In further analysis of the top and lowest margin per ha farms in ePM for 2024 were compared, 32% of the total difference in margin was due to direct cash costs. The lower margin farms had €387 per cow additional annual costs in 2024, distributed across a range of variable and fixed costs. Cost differentials explain an even higher proportion of the spread in margin in low milk price years, due to a smaller range in milk revenues between farms. Benchmarking costs on a line-item basis, whether using per cow, per litre or per kg milk solids as the reference value, is therefore an essential management practice, and is absolutely vital during periods of low milk price.

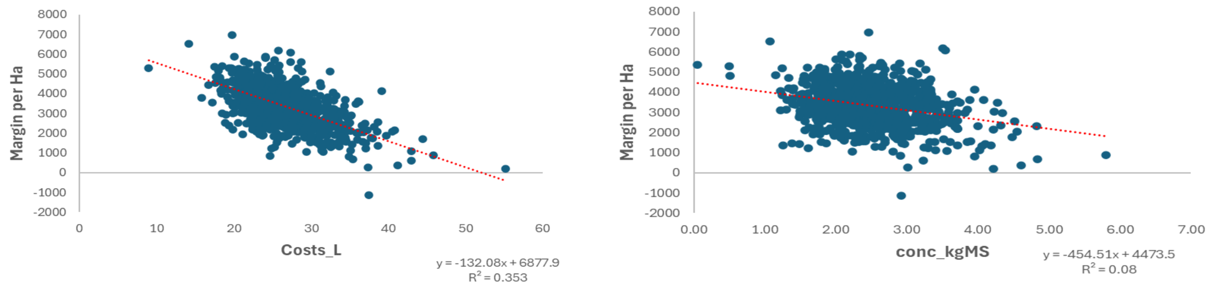

Figure 5. *Relationship between margin, costs and concentrate feeding levels*

Also illustrated in Figure 5 is a trend toward lower margin per ha as concentrate fed per kg milk solids increases. Mean concentrate fed in the data was 2.48kg per kg milk solids sold (for example 1190kg concentrate fed 480kg milk solids on average). As concentrate feeding per kg milk solids produced per cow increased common costs and margin per ha reduced. Comparing also the top and lowest margin farms in 2024 (Table 3), higher margin farms had significantly lower concentrate fed per kg milk solids produced, had an estimated higher grass intake of 0.6tDM per cow, and achieved higher pasture utilised per ha). Additional milk solids output was driven by maximizing pasture eaten.

Table 3. Physical performance of dairy farms ranked by margin per hectare

	Farm Stocking Rate	Milk Solids kg/cow	Milk Solids kg/ha	Conc. cost €/MS	Conc fed kg per kg MS	Pasture Intake per cow tDM	Grass Utilised ha tDM
Top 10%	2.43 2.92*	522	1266	0.89	2.41	4.0	9.8
Bottom 10%	1.90 2.71*	431	819	1.10	2.90	3.4	6.4

**Milking platform stocking rate*

Collectively, these trends show that increasing milk output through supplementation inflates the cost base of the farm system and will reduce margin per hectare, whereas higher milk solids achieved through other means (breeding, fertility, pasture intake and quality) can contribute positively to financial returns. Caution is strongly advised against comparing farms or setting targets based on output-per-cow metrics alone.

Conclusion

Given the expected strong reduction in milk price projected for 2026, it is extremely important for all dairy farms to complete a simple cash flow budget, identifying costs within the farm that can be targeted to reduce. The reality is that reducing costs in 2026 should be prioritised. Those costs that are not resulting in a return should be targeted first. With current cow prices, the first key decision should be around matching pasture production with feed demand corrected for utilisation. For example, a farm growing 14t DM/ha has a carrying capacity of 2.5 cows per hectare, where the herd is delivering 480 to 500kg of milk solids and feeding 500kg of concentrate. Adjustments should be made from there based on pasture production, milk solids delivered and concentrate feed level.

11.40am Session 2: Models for succession and progression in dairy farming

Session 2 Speakers

Ruth Fennell

Teagasc Collaborative Farming Specialist

Ruth Fennell is a Collaborative Farming Specialist with Teagasc, providing technical advice and support on farm partnerships, share farming, contract rearing, land leasing, and other collaborative models across Ireland. She holds a master's degree in Agricultural Science (Animal Science) from University College Dublin, awarded in 1997, and has extensive experience in various Teagasc advisory roles, primarily focused on the dairy sector. Ruth organised Teagasc's first "Generational Renewal Week" in September this year and is passionate about promoting collaborative models that enhance the long-term sustainability of Ireland's dairy industry.

Conor Hogan, Teagasc

Moorepark Research Centre

Conor has responsibility for the People in Dairy Programme in Teagasc Moorepark. He leads a number of projects in the areas of farm labour productivity, human resource management and generational renewal in dairy farming. A significant focus of his current work is on pathways for entry, progression, and transition within the sector. Prior to his current role, Conor completed a PhD in farm labour management and efficiency in Teagasc Moorepark and University College Dublin.

Michael Dunphy

Farmer Speaker (Clonmel)

Michael Dunphy is from Easkey, Co Sligo. Michael has grown up working on and expanding the home farm with his father Joseph and brother Joseph Jnr. Having graduated in 2016 with a Degree in Dairy Business and a keen interest in financial management, Michael joined IFAC in 2016. Michael won the Part-Qualified Accountant of the Year award in 2019. Michael is passionate about sustainable farming and business development. Michael worked for IFAC as an accountant and farm support advisor. The 7 years of industry experience has been invaluable. Michael is now in a collaborative farming arrangement with John Gilvarry in Killala, Co Mayo.

John Gilvarry

Farmer Speaker (Clonmel)

John Gilvarry is a dairy farmer from Lisglennon, Killala, Co Mayo. John started milking on a greenfield site with 70 cows in 1997 and has grown his business over the last 28 years to 330 cows on 221ha. Of the 221ha farmed, 121ha is owned and 100ha is leased. John is a member of the West Awake discussion group and the Killala Teagasc dairy discussion group. He also has experience in developing renewable projects. John has a keen interest in collaborative farming and, in 2023, formed a partnership with Michael Dunphy.

Conor Wynn

Farmer Speaker (Cavan)

Conor is a new entrant to farming, having taken on a 54ha dairy farm on a seven-year lease just outside Sallins, Co. Kildare in January of this year. Not directly from a farming background, Conor's grandfather was farming but with no identified farming successor in the immediate family, the farm was sold. Prior to completing his Level 5 and 6 Agricultural courses in Kildalton College, Conor began relief milking for Kevin, a local farmer and continued this all throughout his studies. Conor was awarded student of the year following the receipt of his Professional Diploma in Dairy Herd Management in 2024. In 2023, Kevin had mentioned his intention to step back from farming, inspiring Conor to develop a business proposal. Over several months, they agreed on a plan, which has now been implemented: Conor leases the farm, buildings, machinery, and cows, purchasing the herd gradually through natural wastage. His long-term goal is to own his own farm, and he sees this as his first step on the ladder to achieving that.

Tony McCormack

Farmer Speaker (Cavan)

Tony is farming 115 ha in Caddagh, Westmeath, in a registered partnership with Chris Cahill for the past four years. He graduated with a degree in Agricultural Science from UCD in 1995, worked as a sales representative for two years, and then joined Westmeath Community Development where he specifically deals with rural social schemes. He still remains in this position on a part-time basis. Married to Michelle, Tony has two daughters, Eva and Erin, who are not currently interested in farming on a full-time basis.

Tony took over the farm from his father, Seamus, in 2003—initially on a lease before full transfer in 2011. He increased cow numbers as quota gradually allowed with the beef and sheep enterprises being scaled back on the farm. To manage his off-farm work, cow numbers were maintained below 120 and Tony employed a full-time labour unit from November to May each year together with occasional relief milkers.

In 2021, seeking to reduce his day-to-day farm involvement, Tony established a collaborative arrangement, allowing him to step back while still remaining involved. The arrangement has proven highly successful for both partners to date.

Models for succession and progression in dairy farms

Ruth Fennell[1] **and Conor Hogan**[2],

[1]*Teagasc, Kildalton Agricultural College, Piltown, Kilkenny and 2Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork*

Summary

- Collaborative farming models can support smoother farm succession and provide a pathway to attract younger farmers into dairying.
- Registered Farm Partnerships, Share Farming, and Land Leasing represent three common options but differ in structure, risk, and level of involvement.
- Early and clear planning, good communication, and professional advice are essential to identify the collaborative model that best suits your goals, resources, and life stage.
- Strong farm performance and profitability provide flexibility and options for succession, providing capacity for the farm to sustain two incomes.

Introduction

The issue of generational renewal has become increasingly prominent within Irish agriculture. Recent data indicates that almost half of farm families do not have an identified successor, while career attractiveness, limited land mobility, and access to finance remain significant barriers restricting entry opportunities for younger farmers. At the same time, demographic change and increasing scale and operational demands are reshaping the structure and management of dairy farms, as well as the underlying value of the business. Ensuring the long-term continuity and productivity of family farms will therefore depend on structured mechanisms to facilitate both farm entry and transition.

There is growing recognition that collaborative farming arrangements can contribute to addressing these structural challenges. Such models provide mechanisms for the transfer of management responsibility, the sharing of labour and resources, and the gradual introduction of a new generation of farmers. They can also support the retention of experience and knowledge within the sector, mitigating abrupt transitions and maintaining business and farm viability during periods of change.

For individual farm families, early consideration of succession and collaborative options is critical to ensuring flexibility and choice when the time comes to transfer or step back from active management. Sustaining strong farm performance is equally important, as profitable, well-organised farms provide greater options for transition and are more likely to attract successors (either from within or outside the farm family). Establishing a clear plan in advance allows both generations to align their financial, operational, and personal objectives, reducing uncertainty and supporting continuity in farm performance.

A range of collaborative farming models are now in use in Ireland, each with distinct legal, financial, and management implications. The most common arrangements include **Registered Farm Partnerships**, **Share Farming**, and **Land Leasing**. These models vary in the degree of daily involvement required and in the structure of profit-sharing or asset control. In practice, hybrid arrangements are also possible, tailored to the objectives and capacities of the parties involved. The following sections outline the key characteristics, benefits, and considerations associated with each model.

Characteristics of key collaborative farming models

A **Registered Farm Partnership** (RFP) is a legal arrangement where two or more individuals operate as a single business, sharing profits, decision-making, and responsibilities. This model is often used as the first step in succession planning, bringing the next generation into the farming business at an earlier stage and officially recognising their role in the farming operation. They offer an effective method of blending experience with energy—combining the experienced farmer's knowledge with a younger partner's ambition. Partnerships are commonly used in farm transition within farm families and increasingly being utilised to bring unrelated farmers into the business structure where one partner doesn't have access to their own land. They can also be effective in bringing together two farming operations where resources can be pooled, efficiencies of scale can be maximised, and labour and management tasks can be shared between the partners.

There are three different categories of potential farmers associated with RFPs. Category One is a farmer that has been farming for at least two years with a minimum of 3ha of land (the experienced farmer). This can be a company, but the company must meet the two-year establishment requirement. Category Two is someone that holds a recognised agricultural qualification (a trained farmer) and must receive a minimum 20% share of the profits. Category Three is anyone that doesn't fit into Category One or Two such as a new company, a spouse etc. To be eligible to form an RFP, you are required to have a minimum of two Category One partners or a Category One and Two partner, and it is only when this requirement has been met that you can then add a Category Three partner to the arrangement.

The formation of the partnership is based on the legal agreement that the parties sign up to. This legal document outlines what assets each individual is bringing to the partnership. There is no requirement to transfer any of the assets as part of the agreement, and this provides security to the asset owner if and when the partnership is dissolved. The profits that are generated are then divided in line with the profit-sharing ratio that is outlined in the partnership agreement.

The partnership is registered with the DAFM Partnership office, and once the partnership number is issued they can apply for enhanced benefits. The Targeted Agricultural Modernisation Scheme (TAMS) ceiling for RFP's is capped at €160,000, compared to the €90,000 ceiling for sole traders. Where a partnership includes a young, trained farmer, the first €90,000 of this can be claimed at 60% and the remaining €70,000 at 40% (or 60% if there is also an eligible woman in the partnership).

In addition to the increased TAMS funding, partnerships that include a young, trained farmer can also avail of Complementary Income Support for Young Farmers and the National Reserve, where eligible. These schemes often provide capital funding to develop and enhance the farm, ensuring its future viability. There are also financial benefits relating to stock relief. The young farmer can avail of the young, trained farmer stock relief (€100,000 over a four-year period, with a maximum of €40,000 in any one year) while the other partners can avail of enhanced stock relief which increases from the standard 25% to 50% for those in RFPs (limited to €20,000 over 3-year period). In addition to this, there is a Collaborative Farming Grant that that will cover 50% of the costs of setting up the RFP; where it is a new RFP and contains a young farmer (maximum spend of €3,000).

There are currently over 5,000 partnerships registered with the DAFM's Partnerships office. Many of these are family partnerships but there are also a number that involve non-family members. As part of the application process, it is necessary to complete a partnership agreement and an on-farm agreement. The partnership agreement outlines what each party is bringing to the partnership, what land is to be farmed and how the profits are to be divided. The on-farm agreement outlines how the arrangement will work on a day-to-day basis, what duties will be assigned to each partner, what roles each will undertake and what work schedules will be in place. The on-farm agreement compels the parties to sit down and discuss how the agreement will work overtime, so each partner has a clear understanding of their role and requirements within the partnership structure. It is vitally important that there are open and honest discussions from the outset if the partnership is to last the test of time. Each party will have their strengths and weaknesses, and ideally the partnership model should make the best use of each individual's strengths within the agreement.

Where capital investment is planned, the agreement should outline how this will be funded and if the partnership was to be dissolved, what the financial implications are for the capital projects in place.

In a **Share Farming** agreement, two independent businesses operate on the same land. Each party contributes resources such as land, labour, livestock, or machinery and they share the output (crops, milk, or livestock) and associated costs.

The key distinction here is that no legal **partnership** is formed, instead they operate under a share farm agreement. **Both parties remain separate business entities, filing individual accounts and taking responsibility for their own portion of the inputs and outputs.** This model works particularly well in the tillage and dairy sectors where outputs can be clearly divided. It allows younger farmers to build capital and experience while giving landowners a continued role in the farm without full responsibility.

In the case of share farming arrangements within the dairy industry, the share farmer will often provide the livestock and labour while the landowner provides the land and facilities. Costs are divided in line with the agreement, and the milk cheque is then split according to the agreed ratio. There are also alternative scenarios in operation where the landowner also provides the livestock and where agreed, these may then be purchased by the share farmer over the lifetime of the arrangement. At the outset, capital investment may be required to allow the farm to maximise its profit potential to provide for the two incomes (landowner and share famer) required from the farm.

Finding the right individuals for such an arrangement requires careful consideration. From the landowner's perspective, it is vitally important that any potential share farmer has good stockmanship skills, is capable of managing and running the farm efficiently and to a high standard, has the right cow type to maximise milk production in a low-cost system. The share farmer should also have personal and business attributes that align with the landowner's goals. As the farm's output, and therefore income, is shared between both parties, technical and financial efficiency are critical. The farm must be managed to a high level of performance so that it provides a sustainable return for the landowner, while also allowing the share farmer to build equity and progress towards establishing their own independent business. In this sense, technical proficiency and attention to cost control underpin the success of the arrangement for both parties. The initial start-up costs for the share farmer are often less than the capital that would be required in the case of operating on a leased farm. Therefore, it is generally a more financially viable first step towards running their own independent farm business.

While land leasing is often considered a "hands-off" approach for the landowner, registered farm partnerships and share farming offer more collaborative, involved models. These are ideal where both parties want to remain active in the business or share resources. In both of these options, the asset owner continues to invest in the farm and its infrastructure, ensuring that it is continually modernised and retained in good order, offering greater long-term opportunities if the current arrangement was to be discontinued.

Land Leasing is perhaps the most straightforward and widely used collaborative model in Ireland. In essence, it involves a landowner leasing out land to another farmer for an agreed period and payment. Long-term leasing can provide a steady, tax-efficient income while stepping away from the physical demands of farming. For farmers without access to land, especially young, ambitious individuals, it offers a viable pathway to build a business without the financial burden of land ownership.

The Irish government supports land leasing with tax incentives that reward leasing arrangements that are in excess of five years. These leases can provide significant tax-free income, with tax relief starting at €18,000 per year for a five-year lease and rising to €40,000 in the case of a 15+ year lease. There can be current and future tax implications when dealing with land leasing arrangements, so it is important that landowners discuss any potential options with a financial or legal advisor before they proceed.

Table 1. Income tax thresholds for long-term land leasing

Term of Lease	Max Tax Free Income/Year
5-7 Years	€18,000
7-10 Years	€22,500
10-15 Years	€30,000
>15 Years	€40,000

Table 2. Overview of different collaborative farming models and their operational implications

	Registered Farm Partnership (RFP)	Share Farming	Land Leasing
Day-to-day input	Yes- but sharing	Significantly reduced for landowner	No for landowner
Structure	Formal partnership between two or more parties	Two individuals, separate businesses	Based on land lease agreement
Bank Account	One account- shared income/expenses	Individual accounts for landowner & sharefarmer	Separate accounts
Labour	Provided by partners	Provided by sharefarmer	Provided by farmer
Ownership of Assets	Individually and/or jointly owned	Separately owned	
Control & decisions	Jointly	Independent; some collaboration	Based on land lease agreement
Herd number	All Partners/partnership name	Landowners name	Farmers name
TAMS Ceiling	€160,000	€90,000	
Complementary Income Support for Young Farmers and National Reserve	Where RFP contains eligible young farmer	No as herd number remains in landowner's name	Where farmer is eligible
Stock Relief	100% for young, trained farmer (YTF) for 4 years, enhanced relief of 50% for other partners, subject to limits	Only available if they own livestock: 100% for young, trained farmer for 4 years, standard relief of 25% for landowner, subject to limits	

Aside from the models descbribed, there are many other examples of collaborative arrangements in operation within the Irish agricultural sector. Examples of these include contract rearing, cow leasing, machinery sharing and contract growing of crops. The most suitable model for any situation will depend on the individual farmer's or farm family's goals, resources, and stage of life. When considering collaborative options, the individual farmer, in consultation with family members and trusted advisors, should carefully reflect on the following questions to determine which arrangement best aligns with their goals and circumstances.

- Do I want to be actively involved, or step back entirely?
- Am I looking for a long-term commitment or short-term/ seasonal arrangement?
- Do I have a successor in mind, or am I open to partnering with a non-family member?
- What level of responsibility and decision-making am I willing to share?

Seek professional advice before making a decision. Speak with farmers that are currently operating in different collaborative arrangements, discuss the legal and tax implications with your accountant and solicitor, explore your options, do your homework, and find the right model that works for you.

2.00pm Session 3: Driving further progress in Irish dairy breeding

Session 3 Speaker

Dr. Donagh Berry

Teagasc Senior Principal Research Officer, Teagasc

Donagh is a senior principal investigator in statistical genetics at Teagasc for the past 25 years, Donagh has led the various research strings underpinning both the Economic Breeding Index and the Dairy-Beef Index. Following his Bachelors of Agricultural Science at University College Dublin he undertook a PhD in quantitative genetics at Wageningen University, The Netherlands followed by an MSc in Bioinformatics at University College Cork. Working across species (i.e., dairy cattle, beef cattle, sheep, greyhounds, horses), his research interests are in measurement strategies, breeding goal development and deployment, genetic evaluations, genomic predictions and the development of value-creating decision support tools.

A quarter of a century of the Economic Breeding Index

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Summary

- The EBI was first introduced in 2001
- Regular updates to economic values ensure the EBI remains focused on long-term profitability amid changing input costs and market conditions
- Validation studies reveal high-EBI cows outperform others in milk solids, fertility, survival, and profitability across various production systems
- The EBI of Irish herds has increased by €191 in the past quarter of a century equating to a potential gain in profit over that time of €5.5 billion
- The EBI is future-proofed; the global first inclusion of carbon has cemented this
- Expanding reliable data on especially health traits, and leveraging DNA and sensor technologies, will help deliver the next phase of genetic gain in Ireland

Introduction

Animal breeding offers numerous distinct and far-reaching benefits complementary to those delivered through other forms of animal husbandry. These are:

- Breeding is a well-proven and validated technology
- Gains from genetic improvement cumulate over time
- Gains achieved through breeding programs can be long lasting
- Effective genetic gain can be achieved without altering existing management practices
- Investing in good genetics does not incur an additional cost for producers thereby translating to a high return on investment
- Breeding achieves close to complete adoption rate nationally meaning the performance of all herds improve concurrently
- Breeding is a sustainable strategy to deliver gains where changes made are reversible – example is the reversal in trend in fertility in the last quarter of a century
- Breeding can improve many traits concurrently – the EBI now contains over 20 traits
- Breeding indexes are easy to benchmark both across herds, but also within herds over time
- The progress from well-designed breeding programs complements improvements in other animal husbandry practices

Overall, breeding programs represent a sustainable and cost-effective approach to delivering ongoing performance gains across multiple traits simultaneously. Three primary approaches can be used for selecting on multiple traits: 1) independent culling levels, 2) tandem selection, and 3) index selection. Index selection, which is the framework underpinning the Economic Breeding Index (EBI) is an approach that combines genetic merit estimates for individual traits into a single composite score based on predetermined weighting factors, genetic parameters, and available data. The resulting index provides a clear ranking of animals and is user-friendly for decision-making. However, the relative emphasis placed on each trait within the EBI can be a source of debate. Another limitation is that indexes are a simple sum of a series of traits; therefore genetic superiority in some trait(s) can mask severe genetic deficiencies in another trait.

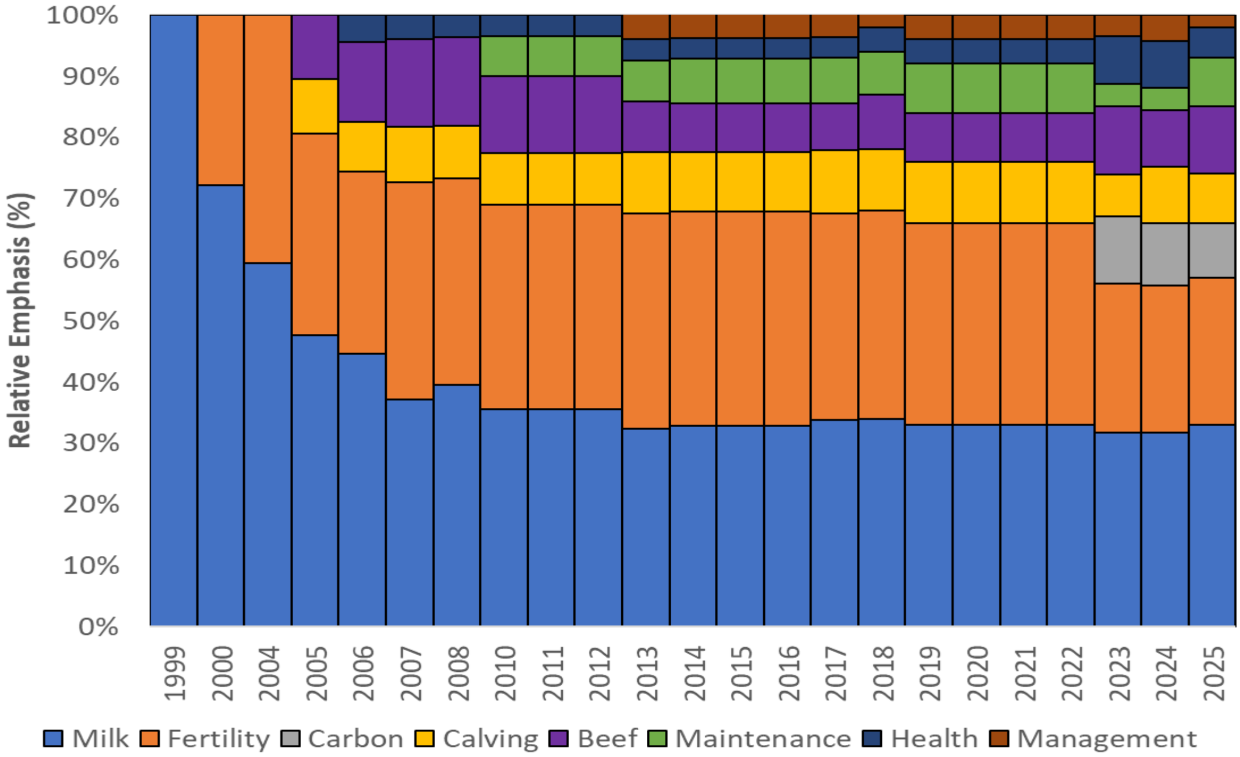


Figure 1. *Evolution of the emphasis on the various sub-indexes in the EBI over the past 25 years*

Here we review the 25-year development and impact of the EBI, concluding with future perspectives on its continued evolution. The review also discusses the strategies employed to validate the EBI as an effective tool for enhancing productivity. The EBI was officially launched to the dairy industry in February 2001 by the Irish Cattle Breeding Federation replacing the Relative Breeding Index (RBI) at the time. Reliability estimates of the EBI were introduced in 2002. The EBI is reported in euros and reflects the expected profit per lactation of the progeny of an animal producing in the average environment. How the construction of the EBI has changed over the past 25 years is summarised in Figure 1. The main changes to the EBI over the last 25 years can be categorised into:

- Inclusion of new relevant traits
- Updating of economic values and weights
- Improvements to data quality control pipelines and the statistical models used in genetic and genomic evaluations

History of new traits in the Economic Breeding Index

For a trait to be included in a breeding index such as the EBI, it must satisfy three fundamental criteria (Figure 2):

- It must be of economic, environmental, or social importance,
- It must display exploitable genetic variation, enabling a meaningful selection response, and
- It must be measurable in individual animals, preferably at low cost and early in life, or be strongly correlated with a trait that can be measured reliably.

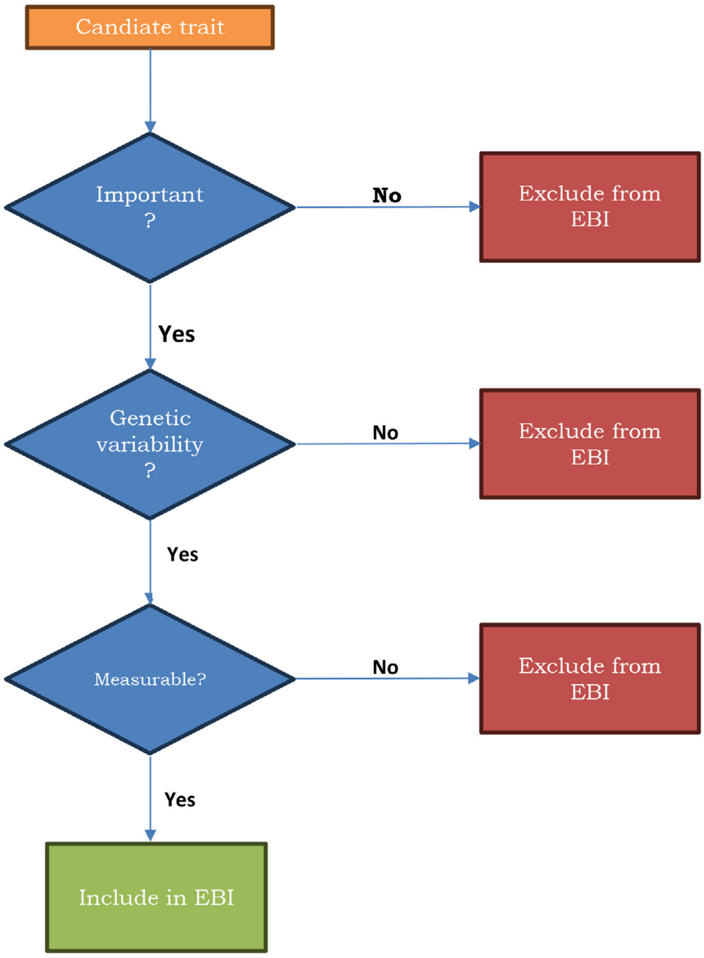


Figure 2. *Process for considering a trait in a breeding index like the EBI*

2001: The primary factor dictating whether a trait could be incorporated into the EBI was the availability of individual animal data for genetic evaluations so estimates of genetic merit could be derived. Post-BSE, the compulsory recording of calf ID, birth date and dam ID, as well as date of death facilitated the calculation of calving intervals (i.e., the number of days between two consecutive calvings) and survival to the next lactation. Both of these traits were incorporated into the EBI in 2001, alongside milk yield, fat yield, and protein yield. The simultaneous consideration of calving interval and survival was crucial, as cows that failed to re-calve (and therefore had no calving interval) were appropriately penalised through poorer estimated genetic merit for survival.

2002: The Animal Events System was launched by ICBF in January 2002, initially targeting milk recording herds. Within its first six months of operation, approximately 200,000 calving events were recorded. The system served as a mechanism to facilitate and incentivise the recording of calving events by farmers, alongside complementary information such as calving difficulty and health-related occurrences. The fundamental principle underpinning the Animal Events System was to provide a single, centralised point of data entry. This was particularly significant when the Department of Agriculture, Food and Rural Development formally recognised the system as a legitimate source of calf registration data upon which animal passports would be issued. Concurrently, carcass information for all slaughtered animals was being regularly uploaded by the abattoirs to the ICBF database. Given that both calving performance and beef merit contribute to overall profitability in dairy herds, both suites of traits were incorporated into the EBI in 2005. The calving performance traits were direct calving difficulty, maternal calving difficulty, gestation length, and perinatal mortality. The beef and cow size-related traits were progeny carcass weight, conformation score, fat score, and cull cow carcass weight. The weighting on cull cow carcass weight was underpinned by three key economic animal features: (i) the cost implications of rearing heifers of differing mature size, (ii) the maintenance cost per lactation of cows of varying body weight, and (iii) the revenue associated with differences in cull cow carcass weight.

2004-2005: Debate emerged around 2005 regarding the suitability of a single EBI across diverse production systems. Also emerging was the challenge of striking an appropriate balance between the complexity of bull selection based on the genetic evaluations of all thirteen traits in the EBI, and the potential oversimplification inherent in relying solely on a single composite EBI value. In response to these concerns, the concept of sub-indexes was introduced in 2005. Four sub-indexes of milk, fertility, beef, and calving were established. This framework enabled individual breeders and farmers to differentially weight particular sub-indexes according to their production goals and preferences while maintaining overall national progress through selection based on the composite EBI.

2006-2010. The three health-related traits—somatic cell count, mastitis, and lameness—were incorporated, either directly or indirectly, into the EBI in November 2005 for implementation in 2006 (Figure 1). Somatic cell count data were readily available from routinely milk-recorded cows. However, high-quality phenotypic data for mastitis and lameness were not yet available at that time to generate genetic evaluations. Consequently, the economic value for mastitis was assigned to the somatic cell count, while that for lameness was assigned to the linear type trait of locomotion.

Although no additional traits were incorporated into the EBI in 2010, there was understandable confusion on why smaller-framed breeds had beef sub-index values comparable to those of larger-framed breeds. This ambiguity stemmed from the inclusion of cow maintenance cost within the beef sub-index. Consequently, smaller-bodied animals benefited from lower maintenance costs, which were often offset by lower cull cow beef revenue; in contrast, larger-bodied animals incurred higher maintenance costs that were typically counterbalanced by greater cull cow beef revenue. To resolve this issue, a distinct maintenance sub-index was introduced in 2010. Under this revision, the cost of cow maintenance per lactation was separated from the composite cull cow trait and reassigned to the new maintenance sub-index. The cost of rearing heifers of different mature size however, remained within the beef sub-index.

2011-2015. The methodology for incorporating genetic merit estimates for mastitis and lameness into the EBI was revised in 2012 with both traits being explicitly included as traits in their own right in 2012. This development was partly driven by the three-year Dairy Efficiency Programme where mastitis, lameness and cow temperament were recorded. Approximately 3,500 Irish herds participated in the programme.

Cow temperament and milking duration were both also introduced as new traits in the EBI in 2012. Cow temperament estimates of genetic merit were based on data from the dairy efficiency program. Genetic merit estimates for milking duration, in seconds, was derived from the DIY milk meters; of the 1,193,145 dairy cows in Ireland in July 2012, 43% were milk recorded and, of those, 34% were using electronic DIY meters which were collecting milking duration information per milking. To mitigate any potential adverse effects of direct selection for shorter milking duration outside the framework of the EBI on any unintended reduction in milk yield or greater somatic cell count, the milking duration trait, as implemented in 2012, was formulated to be genetically independent of both milk yield and somatic cell count.

2016-2025. Although not a new trait *per se*, genetic evaluations for cow live weight became available in 2020, facilitating a refinement of the EBI where cow maintenance costs, which were previously assigned to cull cow carcass weight estimates of genetic merit, were instead applied to cow live weight estimates of genetic merit; this provided a more biologically accurate representation of maintenance energy requirements avoiding the necessity to assume a common kill-out percentage for all cows. Similarly, while not involving the introduction of new traits, the modelling of calving difficulty within the EBI was modified in 2021 where severe calving difficulty animals were more heavily penalised.

No new traits were incorporated into the EBI between the years 2012 and 2023. However, growing awareness of the increasing prevalence of bovine tuberculosis in Ireland and the existence of exploitable genetic variability in same prompted its inclusion in the EBI in 2023. During the same period, the importance of age at slaughter as a trait for genetic selection in Ireland also became evident, leading to its addition to the EBI. While the economic value assigned to progeny carcass weight already captured the cost of growth associated with heavier carcasses, it did not account for the daily maintenance cost of heavier animals throughout their life. Consequently, age at slaughter was introduced to represent this and other costs, with animals who required longer to reach a given carcass weight being economically penalised. Until 2023, the economic value assigned to genetic merit for carcass fat in the EBI was negative, reflecting the inverse relationship between fatness and saleable meat yield at a constant carcass weight. However, concerns arose that this negative weighting could inadvertently favour later-maturing animals. To address this, the economic value for carcass fat was removed completely from the EBI in 2023. In its place, a new suite of carcass specification traits was incorporated in 2023, introducing minimum and maximum thresholds for both carcass weight and carcass fat. For carcass conformation, only a minimum specification threshold was applied.

A carbon sub-index, the first of its kind globally, was introduced into the EBI in November 2022, with full deployment in spring 2023. While the economic value of each trait within a selection index like the EBI is defined as the change in profit per unit change in that trait, holding all other traits constant, the underlying bioeconomic model was further utilised to estimate the expected change in carbon emissions associated with a unit change in each trait, under the same assumption of constancy; a complete life cycle analysis was used in the calculation. A carbon cost of €80 per tonne was applied, thereby enabling the translation of the predicted change in carbon emissions per unit genetic merit change in a given trait into an equivalent carbon cost. The traits included within the carbon sub-index comprised milk yield, milk fat yield, milk protein yield, calving interval, survival, and cow live weight. This carbon index future proofs the EBI, positioning to avail of any incentive to reduce carbon footprint.

Economic values

The weightings on individual traits within the EBI are called economic weights, contributing to the overall Economic Breeding index. The economic value on a trait is the expected change in profit per unit change in that trait, holding all other traits in the index constant. Hence, the actual economic value is a function of, amongst other things, what other traits are included in the breeding index. The economic weight, which is used to value each trait, is the product of the economic value and how often and when the trait is expressed. For example, the genes for milk and fertility are expressed annually but the genes for cull cow weight are only expressed once in a cow's lifetime, and this is, on average, several years later. Similar to other breeding indices used internationally, economic values are routinely reviewed and, where necessary, updated to reflect the most up to date information available on future costs, price, regulations and policies.

The prices and costs of production are some of the main drivers of the economic values on traits within the EBI. The economic values themselves are derived using the Moorepark Dairy Systems Model. Because breeding is long term, it is future expected costs and prices that are important, and of course reliable sources of prediction have to be used in these situations. For example, the peak in fertilizer and feed costs during the beginning of the Ukrainian war did not necessitate an immediate update of the EBI; the long-term base price projections, however, were expected to increase so the prices were updated, but not to the peak levels. The same is true for the current beef price – while welcomed, the long-term projections are not as high, so the more modest beef price projections are what are included in the EBI. The same economic values on carcass weight and conformation score as well as the carcass specification impacts are used in the EBI, dairy-beef index and the two beef indexes.

Milk production and fertility. Milk price and feed costs (e.g., concentrate, fertilizer, contractor) are large contributors to the economic value of milk, fat and protein in the EBI. The *A+B-C* milk pricing system was implemented in the EBI in 2001 despite not being rolled out for milk payment for several years later – this again reflects the importance of the EBI, or any breeding index, to be forward thinking. The *C (volume)* component of the EBI is different to what is paid by processors because it considers only the volume-associated processing costs but also the costs of higher volume within the farm gate. The fat to protein ratio in the EBI does not directly reflect that of the milk payment system because the cost of producing fat is far greater than that for protein – the economic value reflects profit so must consider costs and not just simply the revenue.

The economic value on a delay in calving interval is due, in part, to lower livestock sales per cow calving, and while higher milk returns are expected, the costs of production are also higher due to an incremental shift in calving pattern. A large component of the economic value of survival is the differential between the revenue receivable from a cull cow versus the cost of a replacement heifer along with the impact on cow maturity and associated gains in performance attributable to that. While changes in milk price and costs of production have changed the economic values on the milk and fertility traits, a major change was introduced in the 2008 EBI revision when the model assumptions shifted from milk quota being the limiting factor to land being the limiting factor – this was obviously several years before milk quotas in the EU were abolished again reflecting the importance of forward thinking when it comes to breeding.

Calving performance. Calving difficulty may be partitioned into two components: direct calving difficulty and maternal calving difficulty. Direct calving difficulty refers to the characteristics of the calf itself (e.g., body size) while maternal calving difficulty describes the characteristics of the dam giving birth (e.g., pelvic dimensions). They have different economic weights; both have costs associated with labour and veterinarian intervention. For a service bull, a resulting difficult calving will impact the survival, milk production and fertility of the mate. For the sire of the cow, however, these costs are already implicit within the rest of his EBI. For example, if the cow progeny of a bull are more prone to difficult calvings, then they will, on average, have poorer fertility and survival as well as produce less milk – the bull, therefore, will have lower estimates of genetic merit for these traits and will be penalised for such in the rest of his EBI. Big contributors to the economic value for calving difficulty are labour costs, veterinarian costs (i.e., call out and caesarean costs), the difference between cull cow price and replacement heifer costs, milk price and the cost of impaired fertility.

A notable change to the economic value of calving difficulty in 2020 was the transition to what is called non-linear economic value to more heavily penalise bulls of extreme calving difficulty in line with a survey undertaken to assess the opinion of calving difficulty among Irish farmers. The economic value for the direct gestation length of a service bull is linked to calving interval (i.e., a 1 day longer gestation is equivalent to a 1 day longer calving interval). The calf mortality economic value is a function mainly of calf price.

Beef & cow maintenance

The original suite of beef traits when incorporated into the EBI in 2005 comprised four components: genetic merit for progeny carcass weight, carcass conformation, carcass fat, and a genetic merit trait termed cull cow. The cull cow component combined the costs of rearing a heifer and maintaining a cow along with the revenue from cull cow carcass sales; the resulting economic values were assigned to the genetic merit for cull cow carcass weight having taken into consideration the differences in the timing and expression of each trait.

The (projected) base beef price is one of the main influences on the economic value for progeny carcass weight and cull cow weight; the other main contributing factor is obviously the cost of feed. The economic value for carcass conformation score is based on the relationship between carcass conformation and the yield of different groups of primal cuts, adjusted to a common carcass weight.

The year 2023 marked the introduction of the age at slaughter trait into the beef sub-index of the EBI. The economic value reflects all the costs (including capital) of maintaining the progeny for an extra day. In 2023, a new series of carcass specification traits were introduced into the EBI. The specifications imposed for thresholds were:

- Carcass weight: 280 to 380 kg
- Carcass fat score: 3 to 9 on the 15-point scale
- Carcass conformation score: ≥O=

Penalties were designed to reflect economic inefficiencies arising from deviations outside these carcass specifications. Lighter carcasses incur penalties due to reduced dilution of fixed abattoir costs (e.g., boning labour). Heavier carcasses are penalised due to excess trimming required to meet retailer specifications. Similar penalties apply to carcasses that are under- or over-fat, or of poor conformation. The cull cow component of the beef sub-index when originally included in the EBI in 2005 comprised three elements:

- the revenue obtainable from cows differing in carcass weight.
- the rearing cost associated with heifers of differing mature sizes, and
- the per-lactation maintenance cost of cows of varying live-weight.

In 2010, the maintenance cost of the cow was transferred to a separate maintenance sub-index, meaning that the cull cow component of the beef sub-index from that point forward reflected only the cost of heifer rearing along with the revenue from cull cow carcass. In 2025, the heifer rearing cost was also moved to the maintenance sub-index, leaving cull cow revenue as the sole remaining cow-related trait within the cull cow component of the beef sub-index.

Health

The health sub-index within EBI, when first introduced in 2006, accounted for the economic consequences of somatic cell count, mastitis, and lameness. The economic values for both lameness and mastitis are estimated as the marginal cost associated with shifting the mean prevalence of both in a herd. The monetary cost of both lameness and mastitis includes losses in milk production, reduced fertility, and decreased survival. However, to avoid double-counting within the EBI, these indirect effects are not included in the economic value because they are already captured through the milk, fertility, and survival sub-indices of the EBI of an animal. Daughters of a bull that succumb easily (because of genetics) to mastitis will produce less and will be more prone to culling; therefore, the bull's estimate of genetic merit for milk production and survival will be poor, so these costs cannot then be included twice. This is why the presented relative emphasis on health within the EBI (Figure 1) appears low – in reality it is higher, but the costs of reduced performance are captured elsewhere within the EBI. Consequently, the costs included in the economic value for mastitis and lameness are those associated with farmer labour, treatment costs, veterinarian or farm relief intervention for a proportion of the cases, and the opportunity cost of milk withdrawal.

Management

The economic value for temperament, originally recorded on a 5-point scale (1=bad; 5=good) when introduced in 2012, is derived from the additional labour costs and the likelihood and cost of injury associated with poorer temperament. Separate economic values are estimated for cows and heifers which are then combined into a single value, accounting for differences in the timing and frequency of each trait expression. In 2025, the genetic evaluation system for temperament transitioned from a 5-point to a 3-point scale, and the associated economic value was adjusted accordingly.

The economic value for milking duration, when first included in the EBI in 2012, was -€0.25 per second, based on a labour cost of €12.44 per hour. The economic value increased to -€0.305 per second when labour costs rose to €15 per hour in 2017, and further to -€0.35 per second when labour costs reached €17 per hour in 2025.

Genetic evaluation methodologies

The methodological pipelines for genetic evaluations of traits within the EBI are constantly being updated both in relation to the quality control imposed on the recorded data, the definition of the traits, the genetic evaluation model itself (e.g., with or without genomics) and the use of correlated trait information. For example, a constant shape of lactation curve for milk production for sub-populations of cows (e.g. February calving first parity cows) was assumed up until 2017 after which it was replaced by what is called a test-day model. This approach is now used in most dairy cow populations globally. It facilitates a different genetic-based lactation milk, fat and protein profile per cow. Another notable recent change was the splitting of the single calving difficulty genetic evaluation into calving difficulty genetic evaluations for dairy heifers, dairy cows, beef heifers and beef cows. Of course, a big change to all genetic evaluations occurred in 2009 with the launch of genomic evaluations.

Genomic evaluations are the modern way of predicting how good a young animal's genetics are, long before she starts milking or a bull sires calves. Instead of waiting years for milk records or daughter proofs, genomic selection looks directly at the animal's DNA. Every animal has thousands of genes that influence traits like milk yield, fertility, health, and survival. In genomic evaluations, what variants each animal has across 50,000 regions of the DNA are determined in a process called genotyping. By comparing these pieces of DNA markers with performance data from thousands of animals that already have records, it is possible to estimate which DNA patterns are associated with good animal performance. DNA exists within hair follicles, blood, semen and tissue biopsies so when a calf is born, its 50,000 pieces of DNA can be read from its biological sample and its future performance predicted. Because each animal transmits a random half of its DNA, it can also be used to predict the average performance of its progeny – however, because the half inherited is random, and cannot be predicted, the estimated genetic merit of offspring is just that, an estimate.

A question often asked is how much weight is on genomics relative to a cow's own performance or indeed parental or progeny information. Although it varies per animal, the average emphasis on the different sources of information for milk production or live-weight traits is in Figure 3; the actual values depend on how similar the animal is to the genomic training population as well as the reliability of the genetic evaluations for the ancestors. Nonetheless, what is clear is that the contribution of genomic information to a calf far outweighs each of the other individual sources. As the animal accumulates progeny information, then their impact on the genetic evaluation of the animal increases while the impact of the other sources reduces accordingly.

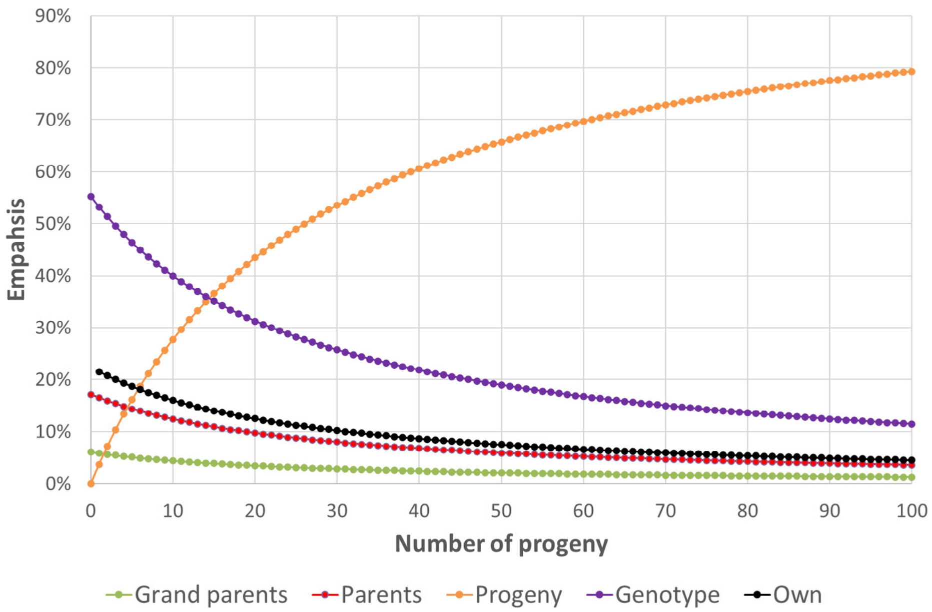


Figure 3. *Relative emphasis of different sources of information to the genetic evaluation of a cow for moderately heritable trait (e.g., milk production, liveweight) as the number of progeny increases.*

The other action that causes a systematic step change in the estimated genetic merit of all animals is a base change. Genetic evaluations or genetic indexes, like the EBI, are always measured relative to a reference point, which is called the base population. It is a bit like zeroing a weighing scale. The base population is usually a group of animals from a certain year or generation and every animal's EBI is then expressed as a difference from that base. If, for example, the base population was animals born in 2000, a bull with an EBI of +€300 is expected to produce progeny that are, on average, €300 more profitable than those born in the year 2000. Having a base provides stability in genetic evaluations when new data, methods, or traits are added. All countries have a base population for each trait. Some countries update their base population annually, others update it every 5 years while others, like Ireland, update it periodically. The advantages and disadvantages of updating the base are in Table 1. Ireland last updated the base for dairy cows in 2016-2017 with the impact being that all animals dropped €71 in EBI. The old base for production and fertility was 2005 born cows, calved and milk recorded in 2007, with at least 2 years out of 5 milk recorded. The base for milk production and fertility was updated in 2025 to a more recent base which is 2015-born cows milk recorded in 2017, 2018 and 2019; the genetic evaluations for the other traits are undertaken across dairy and beef so the base was not updated for these traits. The most important thing to know about a base change is that it has no effect whatsoever on the ranking of animals. Although a base change shifts the genetic evaluation of all animals, the shift is uniform across all animals, so therefore does not impact their ranking. The impact of the base change on the estimates of genetic merit for the milk and fertility traits as well as the sub-index values and EBI is in Table 2. Due to a change in base, all animals dropped in €97 for EBI of which €45 was the drop in the milk sub-index and €52 was the drop in fertility sub-index. These values mean that good genetic progress has been achieved in the 10-year period reflecting the updated base (i.e., from 2005 to 2015).

Table 1. Advantages and disadvantages of changing the base population

Advantages
• Often commented that excessively high index values do not make sense
• Easy to biologically interpret a published estimate of genetic merit when the base is recent
• Base change can be used to minimise upheaval when synchronised with a change in the index like economic value updates
• Easy to quickly determine which traits are making more genetic progress when the base is common to all traits
• When genetic gain is rapid, apparently good animal will still have negative estimates of genetic merit
• Breeding companies and breeders find it difficult to sell negative genetic merit animals

Disadvantages
• Every single animal will decrease (assuming positive genetic gain) which can cause upheaval and will require a national communication campaign
• Target estimates of genetic merit for given herd (e.g., maximum calving difficulty) will need to be updated
• Cannot easily compare against previous genetic evaluations
• A recent base population will result in a lot of negative genetic merit animals (this is also an advantage)

The change in base means that many bulls will now have negative estimates of genetic merit for several traits. However, it is not the estimate of genetic merit per se that is important, it is the genetic merit relative to others. All else being equal, bulls will high kilograms of milk are penalised because of the cost of this water; this is especially true with nitrate banding. It is high kilograms of fat and protein yield that are important. While most of the bulls at the top of the active bull list are currently estimated to be negative for milk kgs, almost all are positive for the revenue generating traits of fat and protein yield. This reflects the EBI's emphasis on milk solids, which promotes higher fat and protein yields through improved composition rather than increased volume.

Table 2. The impact of the recent change in the base population on the index and genetic evaluations of all animals.

EBI base change: -€97			
Production sub-index	-€45	Fertility sub-index	-€52
Milk yield	-74 g	Survival	-1.33%
Fat yield	-7.0 kg	Calving Interval	+2.66 days
Protein yield	-5.6 kg		

The actual performance of the base cow is not relevant when choosing bulls. Of importance when selecting bulls is knowing the mean genetic merit of the herd relative to the actual performance of the herd. Figure 4 illustrates the distribution of mean herd milk solids production for herds of the same genetic merit for milk solids. Clearly large differences in yield exist among herds even of the same genetic merit; grassland management and concentrate feeding level no doubt contribute to this variability. Hence, it is not possible to choose a team of bulls for a herd based solely on examining its production; bull selection can only be undertaken in light of the genetic merit of the herd. If there is a desire to increase the performance of the herd for a given trait, then the average of the team of bulls chosen should be higher than the average of the herd for that trait – the greater the difference between the average of the herd and the average of the team of bulls, the faster will be genetic progress. Although management can affect cow mature size, Figure 5 provides a ready reckoner for the approximate mature liveweight of cows for a herd of different maintenance sub-index values. All else being equal, the smaller the cow, the greater the profit. However, some farmers have an idea of what live-weight best suit their system. To achieve this, the average maintenance sub-index of the mature cows in the herd with the desired live-weight should be calculated – this is then the desired maintenance sub-index value for the entire herd given the production system and management under operation.

The gains made by using superior genetics take time to materialise in terms of herd performance. Where the replacement rate in the herd is 25%, then the genetic merit of the milking herd in three years is only 1.25 units higher for every 10 units higher the sires are relative to the herd average. So for example, assuming a herd has an EBI of €100 and uses a team of bulls with a mean EBI of €300, this will result in a milking herd mean EBI of €125 in three years. Therefore, using bulls far greater than the herd average is needed to achieve rapid genetic gain.

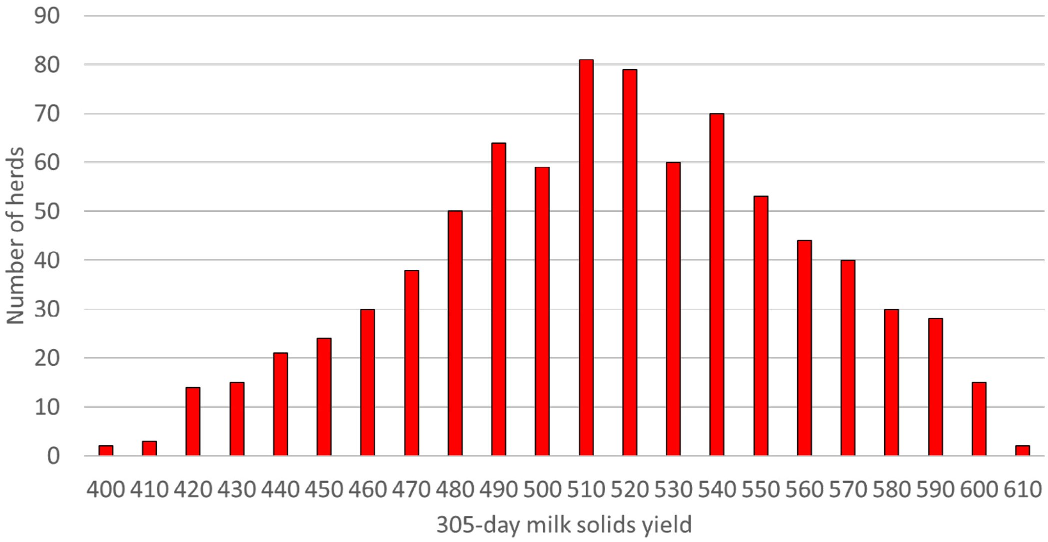


Figure 4. *Mean herd performance for 305-day milk solids yield for herds with the same genetic merit for fat and protein yield*

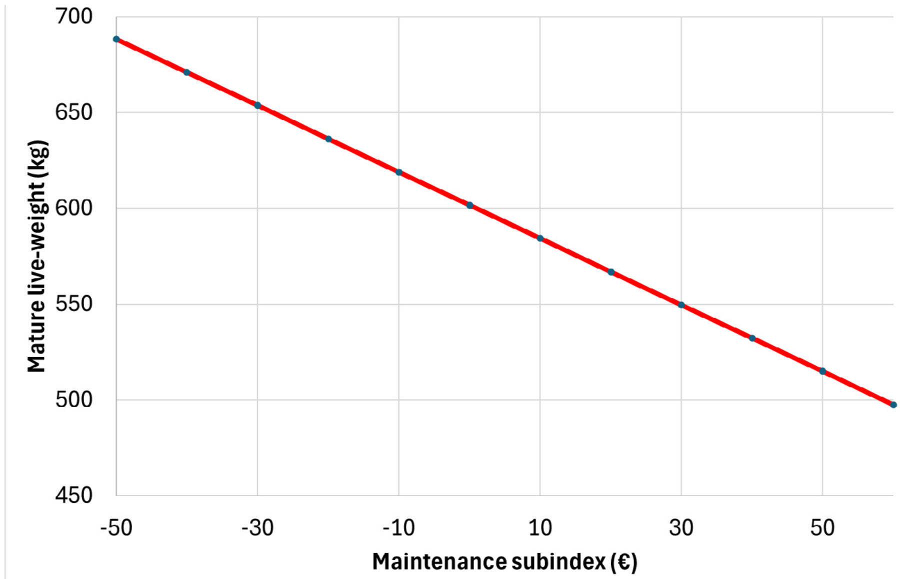


Figure 5. *Predicted mid-lactation mature cow live-weight for different maintenance sub-index values using the 2025/2026 maintenance subindex*

Bull EBI rankings across the years

An interesting aspect of the EBI's evolution is how bull rankings have shifted over time as new traits were introduced and economic weights updated. The correlation between the RBI and successive versions of the EBI, where just the economic weights per trait differed, is shown in Table 3. A correlation of 1 means the bulls on the compared indexes rank identically for both. A correlation of zero means their rankings were random. Correlations between the RBI and the different versions of the EBI between 2001 and 2006, inclusive were between 0.78 and 0.79 suggesting moderate consistency but also meaningful re-ranking among bulls. Thereafter, the correlations weakened to 0.68 to 0.76, being on average 0.72 reflecting further reshuffling as the EBI itself evolved to include greater emphasis on non-milk traits.

In contrast, the correlations among all EBI versions themselves were consistently greater than 0.90, with those among versions published after 2006 exceeding 0.96. This indicates that while early refinements—such as the introduction of new traits and rebalancing of economic weights—had a notable effect on bull rankings, subsequent adjustments have had only minor impacts. It is important to note that these correlations capture only the re-ranking expected from formal changes to the traits and economic weightings within the index. Additional re-ranking over the past 25 years has also resulted from improvements in data quality, updates to statistical models, revisions to variance components, and enhanced data editing and processing pipelines. Collectively, these developments reflect the EBI's dynamic yet stable nature, ensuring that while the methodology evolves, the overall ranking of superior sires remains consistent and reliable.

Table 3. Correlation between the ranking of sires for the various versions of the EBI over the last quarter of a century.

Index	RBI	EBI2000	EBI2004	EBI2005	EBI2006	EBI2007	EBI2008	EBI2010	EBI2012	EBI2013	EBI2017	EBI2020	EBI2023	EBI2024	EBI2025
EBI2000	0.857														
EBI2004	0.792	0.981													
EBI2005	0.792	0.978	0.994												
EBI2006	0.779	0.973	0.987	0.997											
EBI2007	0.727	0.949	0.984	0.991	0.992										
EBI2008	0.760	0.964	0.991	0.996	0.994	0.997									
EBI2010	0.706	0.931	0.974	0.966	0.955	0.974	0.977								
EBI2012	0.700	0.927	0.972	0.963	0.953	0.972	0.974	0.999							
EBI2013	0.701	0.925	0.970	0.959	0.948	0.968	0.971	0.999	1.000						
EBI2017	0.707	0.929	0.973	0.963	0.953	0.969	0.973	0.998	0.999	0.999					
EBI2020	0.730	0.951	0.988	0.987	0.983	0.992	0.993	0.991	0.991	0.989	0.991				
EBI2023	0.724	0.944	0.983	0.984	0.979	0.989	0.989	0.987	0.987	0.985	0.987	0.996			
EBI2024	0.724	0.944	0.983	0.984	0.979	0.989	0.989	0.987	0.987	0.985	0.987	0.996	1.000		
EBI2025	0.675	0.904	0.959	0.952	0.942	0.966	0.964	0.991	0.993	0.992	0.992	0.984	0.989	0.989	
EBI2025 (without carbon)	0.720	0.934	0.975	0.975	0.970	0.982	0.982	0.988	0.989	0.987	0.988	0.993	0.998	0.998	0.994

Comparison with International Dairy Breeding Indices

Comparing the ranking of bulls on EBI with equivalent breeding indexes used internationally provides valuable insight into how selection goals differ between production systems. Genetic evaluations for Holstein-Friesian sires born since 2000 were compiled from the United States, Canada, Australia, Ireland, the United Kingdom, the Netherlands, and New Zealand, and the correlations among these indexes are presented in Table 4.

The mean correlation among the major confinement-based breeding indexes, the Total Performance Index (TPI; US), Net Merit index (NMI; US), Lifetime Profit Index (LPI; Canada), the Dutch-Flemish Index (NVI; The Netherlands and Flanders) and the Profit Lifetime Index (PLI, The United Kingdom) was 0.74 reflecting broadly similar selection priorities. The mean correlation among the four grazing-based indexes (i.e., GMI, BW, EBI and SCI) was 0.65. The mean correlation between grazing indexes with the TPI, NMI, LPI, NVI and PLI was 0.61; the mean correlation between the latter group of indexes with both the Economic Breding index (EBI; Ireland) and Breeding Worth (BW: New Zealand) both of which are based on genetic and economic models representing of grazing dairy herds was 0.49. This indicates substantial re-ranking of bulls when comparing indexes designed for confinement production systems with those optimised for pasture-based dairying.

The correlation of 0.63 between the EBI and BW demonstrates moderate alignment but also considerable divergence in bull ranking between Ireland and New Zealand. Some of this variation arises from differences in the traits and economic assumptions underpinning each index which then give rise to different economic weights on different traits across both countries; the trait definition and the genetic variability in those traits also impacts the ranking in an index. For example, the correlation between the milk production sub-index in the EBI and that in BW is 0.76, while the correlation between their fertility sub-indexes is 0.84, reflecting stronger agreement in fertility and survival rankings than in milk traits.

The economic weights used in the two systems further illustrate these distinctions. In New Zealand, the weights for milk yield, fat yield, and protein yield are –€0.056, €2.56, and €3.45, respectively, compared with –€0.09, €2.08, and €5.88 in the EBI. These figures highlight the relatively higher economic emphasis placed on protein yield within the EBI, as well as its greater focus on milk composition rather than achieving yield through increased milk volume carrier.

Table 4. Correlations between the total merit dairy indexes[1] of various countries

Index	TPI	NMI	LPI	NVI	PLI	BPI	GMI	EBI	BW
TPI									
NMI	0.87								
LPI	0.73	0.60							
NVI	0.73	0.71	0.69						
PLI	0.75	0.75	0.73	0.81					
BPI	0.58	0.51	0.64	0.58	0.71				
GMI	0.85	0.99	0.58	0.70	0.76	0.66			
EBI	0.45	0.46	0.52	0.53	0.63	0.58	0.52		
BW	0.45	0.57	0.45	0.46	0.39	0.52	0.58	0.63	
SCI	0.58	0.62	0.59	0.66	0.90	0.66	0.67	0.84	0.64

[1] TPI = Total Performance Index (United States), NMI = Net merit Index (United States), LPI = Lifetime profit index (Canada), NVI = Dutch-Flemish Index (The Netherlands and Flanders), PLI = Profit Lifetime Index (United Kingdom), BPI = Balanced Performance Index (Australia), GMI = Grass Merit Index (United States), EBI = Economic Breeding Index (Ireland), BW = Breeding Worth (New Zealand), SCI = Spring-calving index (United Kingdom)

Why a bull's proof may change

There is nothing more frustrating than an individual bull's EBI changing; while there is an equal probability of a bull's EBI increasing as there is decreasing, it is the bulls who drop in EBI that catches the eye. There are many reasons why individual genetic evaluations and overall indexes of bulls can change over time. These include:

- The construction of the index (i.e., traits) and their respective economic weights change over time with the most recent being in 2025; this may also include the combination of traits like what happened in 2025 when the cost of rearing a heifer which was previously in the beef sub-index was moved into the maintenance sub-index
- The base population against which all animals are compared can change as was the case in 2025
- The genetic evaluation models and processes are regularly improved with the most recent being an updating of the health genetic evaluation process.
- The pedigree information may be cleaned up as is happening as more animals are genotyped – cleaning of pedigree is particularly important for those with limited progeny as is the case with young sires
- New information on the animal itself or its relatives may have been recorded which will increase the reliability of the genetic evaluation but could also alter the estimated genetic merit. A new record can also influence the individual gene effects estimated in genomic selection and, in doing so, can influence the genomic evaluations of the entire population
- Because genetic evaluations are founded on comparing animals to their contemporaries, new information on contemporaries, or indeed new contemporaries or correcting the ancestry of contemporaries can impact the genetic evaluation of an animal

Does EBI work in practice?

The EBI is, by far, the most extensively validated dairy cow breeding index globally. Three principal approaches have been employed in Ireland to validate the EBI. These include controlled studies complemented by cross-sectional analyses based on either animal-level data, or herd-level data. Importantly, convergent evidence across the different validation strategies provides strong confidence to the sector on using the EBI or the individual genetic evaluations.

Controlled studies comparing different strains of Holstein-Friesians have been conducted at Moorepark for decades. More recently, these studies have focused on sub-populations that were divergent for the EBI at the time of evaluation. The primary advantage of such controlled studies is that they enable detailed investigation of complex or deep measurements that would otherwise be challenging to measure at scale on commercial farms. Beyond their scientific value, these controlled studies also serve as high-visibility demonstration sites, enabling farmers to observe the animals and their performance data first-hand. The regular dissemination of results, often through social media and open day events, helps foster a sense of ownership and engagement among farmers, thereby enhancing trust and adoption of the EBI. Results from controlled studies comparing dairy cows representative of the national average EBI, with those in the top

5% nationally, demonstrated that the genetically elite cows produced more milk solids, had a greater dry matter intake capacity relative to body weight, maintained better body condition throughout lactation, exhibited superior reproductive performance, and had increased longevity. Collectively, these advantages translated into higher net profit per farm and per hectare for the high-EBI group. The superiority of the elite EBI cows was consistent across three feeding systems that differed in concentrate supplementation level and stocking rate. Furthermore, sensitivity analyses of milk price and concentrate costs did not result in any re-ranking of genotypes in terms of profitability.

A cross-sectional analysis of 536,923 individual records from Irish dairy cows was recently undertaken to relate on-farm performance to corresponding genetic evaluations for each trait; the study also examined associations between the EBI, its sub-indexes, and animal performance. The conclusions from the large study were that selection on EBI is expected to, on average, improve productivity through increased yield and concentration of milk fat and protein, despite a modest reduction in milk volume. Furthermore, EBI selection was associated with improved reproductive performance, greater survival, better health, lighter bodyweight, and fewer calving complications, with minimal impact on the beef merit of progeny.

A complementary herd-level cross-sectional analysis of 1,131 Irish dairy herds with both herd physical and economic performance and herd mean EBI data over a three-year period was originally undertaken over 13 years ago. Results from that study concluded that, as expected, higher mean herd genetic merit for individual traits was associated with superior herd-level performance for those traits. Herd EBI was negatively associated with milk yield but positively associated with milk composition, resulting in higher milk price. Mean herd net margin per cow increased by €1.94 for each one-unit increase in mean herd EBI. Given that EBI is expressed on a predicted transmitting ability scale, the expected increase was €2 per unit, indicating excellent agreement between observed and expected responses.

Collectively, findings from these validation studies confirm that genetic merit estimates for performance traits reliably translate into corresponding phenotypic differences that generally align with expectations. Moreover, selection based on EBI consistently increases profit per lactation, and this response was robust across diverse production systems.

Gains achieved

One of the advantages of animal breeding is that the benefits accrue or cumulate over time much like compound interest in that the money earns interest on both the original amount and the interest already gained. This cumulative nature means that even small improvements made today can yield substantial long-term benefits. Consequently, examining genetic trends provides valuable insight not only into the direction of change, but also into the rate at which genetic progress is occurring.

The rate of improvement among individual traits or sub-indexes naturally varies, as both the degree of genetic variability and the relative economic importance of each trait differ. For example, a one-unit genetic gain in fertility carries greater economic value than a similar gain in beef traits. Figure 6 illustrates the rate of genetic progress in Ireland, measured by the year of first calving. Several milestones have underpinned this progress, most notably the implementation of the Gene Ireland dairy breeding programme and the integration of genomic selection into national breeding evaluations.

Over the past twenty-five years, the EBI of first-calving heifers has increased by €215, while the average EBI of the national cow herd has risen by €191. When applied to the national dairy population each year, this cumulative improvement represents an estimated €5.46 billion in additional profit for the Irish dairy sector. Furthermore, of the total genetic gain achieved over the past decade, 43% has been attributed to improvements in milk-related profitability, with a further 54% arising from enhanced fertility and cow survival.

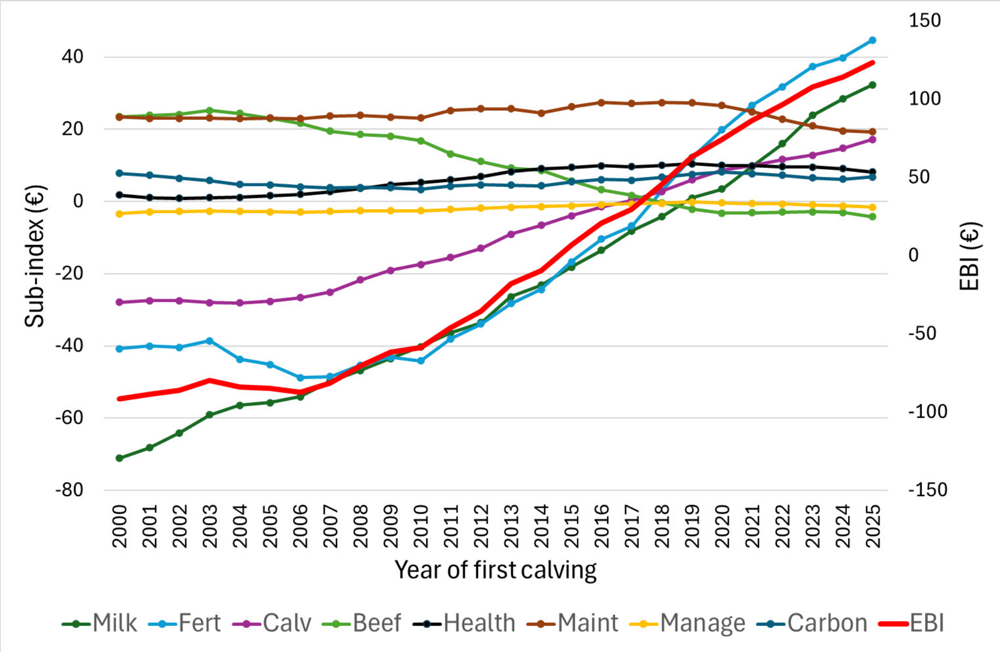
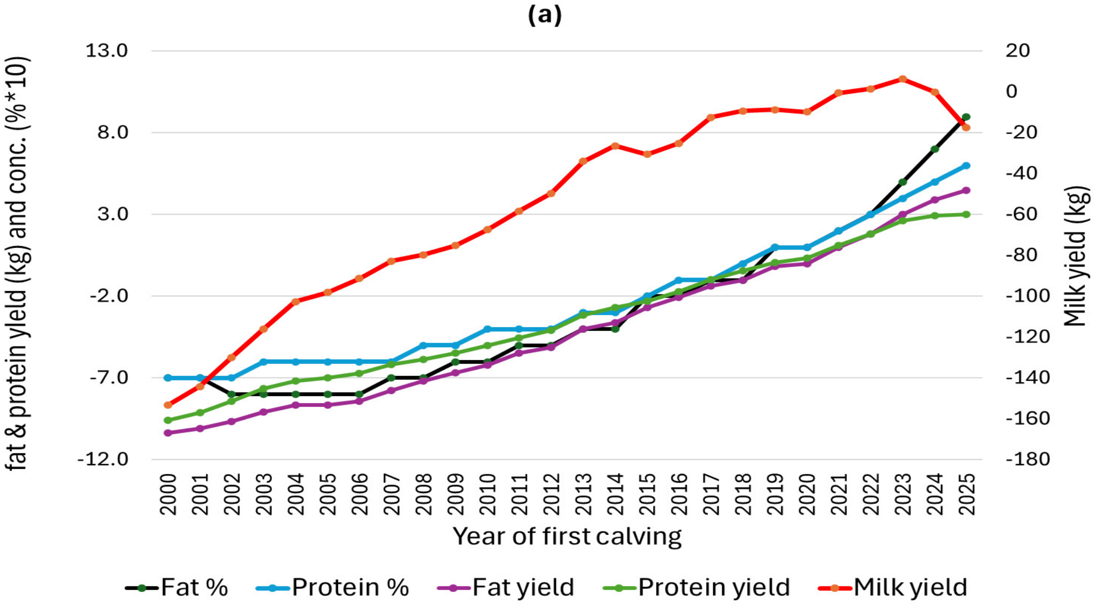


Figure 6. *Rate of genetic gain for the EBI (right vertical axes) and each subindex (left vertical axis) by year of first calving*

Focusing on milk production, the genetic trends for yield and composition traits are illustrated in Figure 7. Figure 7a displays the traits in their original units of measurement, while Figure 7b standardises the results according to the level of genetic variability so that the rate of improvement in each trait, relative to the year 2000, can be directly comparable across traits. Historically, gains in milk solids yield were achieved through a combination of increased milk volume carrier and milk fat and protein concentration. However, in recent years, improvements have been driven almost entirely by higher fat and protein concentrations, rather than by greater milk volume. Notably, the rate of genetic gain in milk solids yield has remained strong despite milk volume yield itself showing little or even negative change.

Over the past 15 years, the genetic merit (i.e., twice the predicted transmitting ability) for milk fat concentration in first-calving cows has increased by 0.27 percentage points (a 7% improvement), while milk protein concentration has risen by 0.21 percentage points (a 6% improvement). Combined 305-day milk solids yield has improved genetically by 37.8 kg during the same period. Importantly, this progress has been achieved without a large concomitant increase in cow live weight, demonstrating that production efficiency, reflected in milk solids per kilogram of live weight, continues to improve in line with advancements in the EBI. In fact, when divided into five groups within herd on EBI, the milk solids per kg body weight of the highest 20% of cows on EBI was 15.8% better than the lower 20% of cows on EBI; the difference in mean EBI between the divergent groups was just €110.



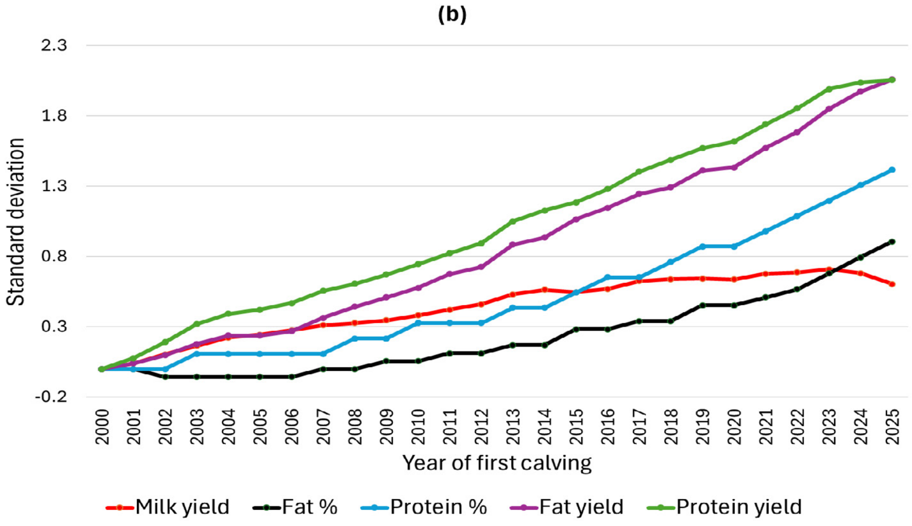


Figure 7. *Rate of genetic gain for the milk production traits (milk yield on the right vertical axis) by year of first calving based on (a) the actual units of measure and (b) standardised to be directly comparable relative to the extent of genetic variability.*

The genetic merit for beef traits, particularly carcass conformation, within the dairy cow population has declined steadily since 2003. On average, the genetic merit for carcass conformation in purebred dairy progeny from first-calving cows in 2025 is two EUROP conformation scores lower than at the launch of the EBI.

This decline primarily reflects the negative genetic correlation between carcass conformation and other dairy-focused traits emphasised in the EBI, the limited genetic variability for beef traits within the Holstein-Friesian population, and the poor economic return from improving carcass conformation. As a result, prioritising conformation would come at the opportunity cost of slower progress in higher-value dairy traits. Modelling exercises suggest that quadrupling the emphasis on carcass conformation within the EBI would be required merely to half the decline in carcass conformation. Advancements being achieved in genetic gain for the dairy-beef index, along with the strategic use of sexed semen, could help offset some of this deterioration for the dairy sector as a whole.

Future perspectives

The animal health sub-index is arguably the weakest component of the EBI; health is likely to be more important in the future as the reproductive performance of the herd is improving (Figure 6) thereby leading to an older cow herd. Firstly, only somatic cell count, lameness, mastitis and tuberculosis are considered in the index despite the wide range of other diseases affecting dairy cattle. Even for mastitis and lameness, the two most costly diseases on Irish farms, data recording is limited. Only 1,821 herds (dairy and beef) recorded lameness in 2024 and only 3,710 herds (dairy and beef) recorded mastitis.

Health traits are typically lowly heritable, meaning that large volumes of accurate data are required to achieve reliable genetic evaluations for both bulls and cows. The need to record more data is particularly important for health traits which tend to be unfavourably correlated with the highly heritable economically important milk production traits. Hence, without active consideration of genetic merit for health, the rapid genetic gain being achieved for milk production will inadvertently lead to a deterioration in the genetic predisposition of the national herd to health conditions, an effect that may worsen with an aging cow population. While the recording of health traits has historically been challenging, recent advances in sensor technology such as the widespread adoption of activity and health-monitoring collars offer a promising solution. These technologies can capture large quantities of objective, continuous, and accurate health data, providing the foundation for more robust genetic evaluations and the future strengthening of the animal health component within the EBI.

The design of the national breeding programme warrants re-evaluation in light of recent advancements in both reproductive technologies and DNA exploration. This review must consider both the dairy and the dairy-beef breeding program. The need for such an examination is particularly timely given the rapid increase in the use of sexed semen from high-index bulls. While this technology accelerates genetic progress, it also reduces the opportunity for potential bull dams, those bred using sexed semen, to contribute genetically as mothers of the next generation of young test sires. In parallel, restrictions on the use of germplasm from certain breeding companies further highlight the necessity to reconsider existing practices and ensure a coordinated national approach.

A unified national breeding strategy, with strong commitment from all stakeholders, is now more important than ever. However, the growing intensity of selection, characteristic of highly commercialised and competitive breeding environments, also poses a risk. While inbreeding can serve as an indicator of genetic advancement, an excessively rapid increase, much like inflation in an economy, becomes a cause for concern. Rising inbreeding levels can lead to the accumulation and expression of deleterious alleles, reducing fertility and viability.

The rate of increase in inbreeding in many global dairy populations has reached worrying levels. Encouragingly, Figure 8 shows that both the level and rate of inbreeding among Irish Holstein cows remain lower than in comparable populations, such as in Canada. Nonetheless, vigilance is essential. Higher inbreeding increases the likelihood that carriers of harmful or lethal mutations will mate, leading to the expression of genetic disorders and, in severe cases, embryo or foetal loss. Careful management of genetic diversity must therefore remain a core principle of Ireland's breeding strategy to safeguard long-term herd health and productivity.

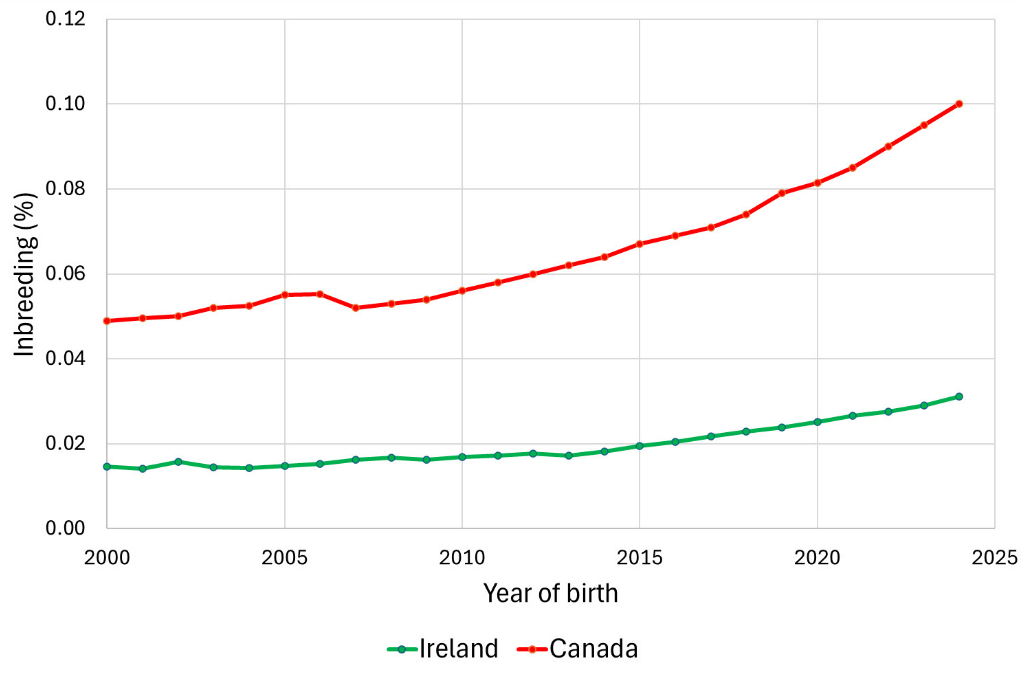


Figure 8. *Mean inbreeding of the Holstein dairy cow population in Ireland and Canada*

With the growing availability of detailed animal-level and farm-level data, the future of dairy production lies in personalised management and breeding; this can be at the individual cow level or that of the herd itself. Advances in artificial intelligence will enable the integration and analysis of vast datasets, helping to optimise productivity, efficiency, and profitability through smarter, data-driven decision-making. Personalised breeding is not a new concept; farmers have long selected bulls with higher milk composition for cows with lower composition or avoided mating related individuals. Improved DNA insights have also enabled the detection of lethal and undesirable mutations within the population. In response, the ICBF sire advice system was updated in 2024 to incorporate this information and prevent matings between carriers of known lethal mutations. Two such mutations currently screened across all animals are Holstein Haplotype 1 (HH1) and Holstein Haplotype 3 (HH3). In the Irish Holstein population, the prevalence of HH1 and HH3 is 1.8% and 4.7%, respectively. HH1 is associated with embryonic and foetal loss occurring mainly between 60 and 200 days of gestation, while HH3 causes spontaneous abortion during the first 60 days of pregnancy. When two carriers are mated, there is a 25% probability that the resulting embryo will inherit two copies of the deleterious allele, leading to early embryonic death.

Conclusion

The development and refinement of the EBI over the last 25 years has provided Irish farmers with a powerful, data-driven tool to select animals that are not only more productive but also more sustainable and resilient. Through continuous evolution such as incorporating new traits, updating economic values, and integrating genomic technologies, the EBI has ensured that Irish dairy sector is future-proofed. The success of this is grounded in three fundamental pillars: 1) scientific credibility, 2) validated economic return, and 3) national adoption. Scientifically, the index reflects decades of research in genetics, bio-economics, and production systems translating complex biological relationships into actionable on-farm decisions. Economically, the EBI remains up to date and relevant to the ever-changing landscape of input costs, market prices, and policy expectations. Its widespread adoption, achieved through industry collaboration and farmer engagement, has enabled near-universal genetic progress at a national level.

Validation studies at both animal and herd levels have consistently demonstrated the effectiveness of the EBI. High EBI cows outperform their contemporaries in milk solids yield, fertility, survival, and profitability across a range of production systems. The cumulative genetic gains achieved since the introduction of the EBI 25 years ago is worth a potential €5.5 billion to the dairy sector, underscoring its tangible impact. Importantly, these gains have been achieved with an improved carbon footprint per kilogram of milk solids and without compromising efficiency; genetic merit for milk solids output has increased without a large concomitant increase in cow live-weight delivering improved biological efficiency per unit of body mass.

The EBI has also adapted to emerging challenges, most notably environmental sustainability. The introduction of the carbon sub-index in 2022 marked a global first, embedding long-term future climate considerations directly into the EBI. This forward-thinking approach ensures that future genetic progress contributes more to reducing the carbon footprint of Irish dairy production, aligning national breeding objectives with environmental policies and the commitment of the dairy industry to environmental stewardship.

The next phase of the breeding programs in Ireland will need to focus on improving data quantity and quality, particularly for health traits, where heritability is low but economic and ethical importance is high. Advances in sensor technology and automated recording offer new opportunities to collect large-scale, objective health data, thereby enabling more accurate and comprehensive genetic evaluations. Parallel progress in reproductive technologies and genomics will facilitate more personalised breeding strategies at all levels of the breeding pyramid.

As Ireland continues to navigate the intertwined challenges of sustainable food systems along with rural viability and sustainability, the EBI will remain a cornerstone of progress demonstrating how evidence-based breeding can deliver economic, environmental, and social value simultaneously.

Acknowledgments

Many people across the entire dairy sector, not least dairy farmers themselves, have contributed to the success of the EBI in Ireland, a project spearheaded by the visionary Dr. Brian Wickham.

2.50pm Session 4: Bite-size research updates

Session 4 Speakers

Cathal Sommers

Water Quality Specialist, Teagasc Johnstown Castle Research Centre, Wexford

Cathal Somers is the manager of the Agricultural Sustainability Support and Advisory Programme (ASSAP). He works closely with the Local Authority Waters Programme, Dairy co-ops and Meat Industry Ireland to support farmers across the country, in improving their local water quality. Cathal has a background in dairy farm management and has extensive experience over his 24-year career in Teagasc in research and advisory, whilst holding a Masters degree in Environmental Management from the University of Ulster. Formally a water quality specialist, working closely with advisors, farmers and the wider agricultural industry, he has extensive experience in supporting advisors to accelerate the adoption of actions by farmers on farms, to improve water quality.

Michael Freaney

Teagasc Dairy Advisor, Tipperary Region

Michael Freaney is a Dairy Adviser based in Clonmel, Co. Tipperary. He graduated from UCD in 1991 with a Honours Degree in B.Ag.Sc. He lectured in Kildalton Agricultural College and then moved to Advisory in Mullinavat, Co. Kilkenny where he spent 22 years as a Dairy Advisor working with farmers to improve farm profitability, lifestyle and sustainability. He moved to the Tipperary region in 2018 and worked as an Organic Advisor and Drystock Advisor before returning to the role as Dairy Advisor in 2023.

Owen McPartland

Teagasc Dairy Advisor, Westmeath, Monaghan, Cavan Region

Owen graduated in 2017 from DKIT with a Bachelor of Science Honours in Sustainable Agriculture. Owen subsequently commenced working with Teagasc on the Teagasc/ Lakeland Dairies Joint Programme in 2018, with a specific focus on herd genetic improvement, new entrants and improving key system KPI'S on Lakeland Dairies supplier's farms. In 2025 Owen joined the Cavan/Monaghan/Westmeath advisory team as a Business & Technology dairy advisor.

Dr Sarah Walsh

Teagasc Grassland Research Officer, Moorepark

Sarah graduated in 2019 from UCD with an Honours B.Ag.Sci (Animal Science) and completed a PhD in Teagasc Moorepark, in collaboration with UCD, in 2024. Her PhD investigated the effect of spring grass availability on milk production and dry matter intake during early lactation. Sarah is now working as a research officer based in Teagasc Moorepark researching grass and clover varieties and the Pasture Profit Index.

Dr Elodie Ruelle

Senior Research Officer, Teagasc Grassland Research Officer, Moorepark

Elodie Ruelle is a Senior Research Officer in Grassland Modelling at Teagasc Moorepark, and Head of the Climate Adaptation research pillar. She leads the development and application of models to support sustainable grassland management and climate resilience in Irish livestock systems.

What Dairy Farmers Can Do to Improve Local Water Quality

Cathal Somers
Manager of the Agricultural Sustainability Support and Advisory Programme (ASSAP)

Summary

- Localised Solutions: research shows water quality issues vary by catchment. A tailored, science-based approach "the right measure in the right place" is essential for impact
- Focus on Local Water Quality: Begin by assessing local water quality data to identify critical source areas and tailor actions effectively
- Nutrient Management: Maintain balanced soil fertility (P/K and lime), use sulphur to reduce nitrate leaching, optimise slurry use to cut chemical N & P applications and adopt good reseeding practices
- Farmyard Management: Ensure adequate slurry and soiled water storage, manage rainwater through gutters, downpipes and good yard management, collect silage/FYM effluent and direct farm road runoff away from watercourses
- Land Management: Use PIP maps to locate high-risk areas, careful management of nutrient applications in critical source areas, maintain riparian margins, buffer strips and avoid poaching or machinery damage through good farm management and infrastructure
- Mitigation Measures: Nitrogen balance must be reduced and improve nitrogen use efficiency through reducing chemical N applications with clover, apply nutrients only to meet crop demand, remove livestock access to streams and implement nature-based solutions to slow overland flow

Introduction

Water quality remains one of the most pressing environmental challenges facing Irish agriculture. Under the EU Water Framework Directive, Ireland must achieve good or high ecological status in its waterbodies. Agriculture can play a significant role in this effort and the solution lies in compliance with GAP regulations and tailored advice for farmers in their local area. This advice must be led by research and catchment science, with a focus on putting the right measure in the right place. Farmers have put in a lot of work to date on farms across the country, implementing measures to improve water quality. This needs to continue into the future and the volume of farms implementing measures must increase also to meet out targets.

The EPA Water Quality in Ireland (2019-2024) report shows that over half (52%) of our surface waters are in satisfactory ecological health being in either good or high ecological status. This means that 48% of the surface water bodies in Ireland are not where they should be. This is a decline from the previous assessment when 54% were satisfactory (EPA, 2025). On a more positive note, the report has identified some improvements in nitrate (39% of sites) when compared to the 2016-2021 report, however concentrations are too high at 44% of rivers sites, predominantly located in the east, southeast and south of the country (EPA, 2025). There is evidence that phosphorus concentrations have improved in priority areas for action, where the Agricultural Sustainability Support & Advisory Programme (ASSAP) advisors work and support farmers.

Why Local Actions Matters

Teagasc's research shows that water quality issues vary greatly between catchments. A one size fits all approach simply doesn't work. Instead, advisors must use local data and catchment science to identify the right measure for the right place. This ensures that every measure delivers maximum impact on improving water quality and this is a core principle of Teagasc led Better Farming for Water campaign.

The Better Farming for Water Campaign

- Teagasc's Better Farming for Water campaign highlights eight practical actions that farmers can take to reduce nutrient, sediment and pesticide losses.
- Reduce nutrient surplus: match nitrogen (N) and phosphorus (P) inputs to crop and grass demand
- Optimize soil fertility: maintain correct lime, P, and K levels for efficient nutrient use
- Apply fertilisers and slurry wisely: avoid high risk periods and wet conditions
- Improve slurry storage: ensure adequate capacity to prevent winter spreading
- Protect farmyards and roadways: stop nutrient rich runoff entering drains
- Fence watercourses: keep livestock out of streams and rivers
- Install buffer zones and riparian margins: trap sediment and nutrients before they reach water
- Maintain green cover on tillage soils: reduce soil erosion during winter

By combining science-based advice with local knowledge, farmers can protect water quality while maintain profitable farms. This is not just compliance; it's about safeguarding Ireland's natural resources for future generations.

Main Nutrients of Concern

Diffuse nitrogen losses

Nitrogen (N) loss typically occurs on soils that have high permeability. These are 'light' free draining soils and water can quickly permeate through these soils.

Where excess Nitrogen fertiliser is applied above crop requirement, this N is not utilised by the grass and is left in the soil. N does not bind tightly to soil and therefore when there is heavy rainfall, the water leaches N away to groundwater, streams and rivers. The natural biological processes in the soil increase the N available particularly in autumn. This requires careful management to minimise N losses at that time of the year.

Diffuse Phosphorus and Sediment losses

Phosphorus (P) loss typically occurs on soils that have low permeability. These are poorly draining soils and get quickly saturated with rainfall. When there is heavy rainfall on these saturated soils this leads to overland flow of water, particularly on fields with slopes.

The overland flow of water across fields can carry P in soluble form. It can also wash away soil clay particles that have P attached to them, P binds tightly to soil clay particles. The soluble P and soil clay particles can then be washed into the drainage network and streams located in the farm and end up impacting water quality.

Three Areas dairy farmers can target to reduce losses

The first thing a farmer should look at is their local water quality; this will help to focus in on areas of concern and associated issues.

- Nutrient management
- Farmyard
- Land management

Nutrient Management

- Balanced fertility on moderate to heavily stocked farms is hugely important to ensure nitrogen is used efficiently by the grass.
- Ensure appropriate fertility (p/k) and liming for the intensity of the farm
- Sulphur can reduce nitrate leaching
- Reduce chemical N & P applications through improved use of slurry
- Good grassland management and reseeding practices can help reduce nitrogen applications
- Focus on reducing nitrogen surplus on the farm through improved nitrogen use efficiency, this can be achieved through reducing chemical N application with good slurry and clover management

Farmyard

- The yard is an important area on any farm and needs to be managed correctly. Slurry storage, silage effluent, FYM, soiled water, effluent, clean water and clean yard areas must comply with regulations.
- Slurry and soiled water storage is a priority; for slurry, it is advised to have a buffer beyond regulatory requirements for years where the housing period increases due to poor land conditions for grazing
- It is important to ensure all rainwater from roofs is managed correctly and collected through working gutters and downpipes to avoid clean water becoming soiled
- Identify the areas of the yard that need to be collected and reduce traffic on clean yard areas as much as possible, always keep areas in the yard defined as clean brushed or scraped and in clean condition
- Ensure all silage and FYM effluent is collected
- Farm roads must be sloped away from any waters and directed towards fields or appropriate mitigation measures as advised by ASSAP advisors

Land Management

Pollution Impact Potential (PIP) maps found on catchment.ie can be used to identify areas on a farm susceptible to nitrogen and phosphorus loss, this tool can also be used to identify critical source areas (CSA's) on the farm. CSAs are areas that are at highest risk of impacting a water body through overland flow. These are often low-lying parts of farms where runoff accumulates in high concentration. Runoff from CSA's carries sediment and nutrients to waterways. Once the potential issue is identified, a plan can be put in place for addressing the issue.

Nitrogen balance & mitigation measures

Nitrogen Balance is a farm level metric that measures the difference between nitrogen inputs (such as chemical fertiliser, slurry, concentrates and purchased feed) and nitrogen outputs (mainly in the form of milk, meat, or crops sold off the farm). A high nitrogen balance means more nitrogen is remaining on the farm, which can increase the risk of losses to water and air, a lower nitrogen balance indicates more efficient use of nitrogen and reduced environmental impact

Know your nitrogen balance number which can be accessed through AgNav and aim to reduce it through improved management, as this will help to reduce your N surplus and reduce potential N leaching

- Reduce chemical N applications through use of clover
- Only apply nitrogen to meet crop requirement, grass measuring and good management is important in knowing crop requirement
- Appropriate fertility and liming will improve nitrogen use efficiency
- Use slurry to reduce chemical N application
- Reduce application during droughts and periods of poor growth, soil temperature, soil moisture deficit and grass growth rate data can be useful in making decisions

Phosphorus

- Aim for index 3 soils, index 4 soils have the potential for increased loss
- Avoid nutrient applications in critical source areas in the shoulders of the year
- Bare soil can be prone to losses in an area susceptible to overland flow, such as maize ground. Ensure carful placement of this type of crop and avoid locating in land connected to rivers and drains
- Remove animal access points to rivers
- Good use of riparian margins, buffer zones, trees, hedgerows and nature-based solutions to break the pathway of overland flow, these measures also slow down the movement of water across land during heavy rainfall events
- Avoid poaching and machinery damage, good infrastructure on the farm is important

Conclusion

The key to improving water quality is identifying the problem by using the tools and data available and finding the correct solution for your farm. Measures must be adopted across the areas of farmyard, land and nutrient management to reduce nitrogen, phosphorus, sediment and effluent loss. Using up to date science, research, advisory, TAMS and services like ASSAP if it's available in your area, can help to improve water quality across the country if adopted widely.

Controlling Dairy Production Costs in 2026

Owen McPartland[1], Michael Freaney[2], Patrick Gowing[3], and Padraig O'Connor[3]
[1]Teagasc Ballyhaise Advisory, 2Teagasc Clonmel Advisory, 3Teagasc Dairy Knowledge Transfer Dept

Summary

- Production costs have risen significantly in recent years driven by a combination of unit price increases and higher usage rates for major inputs such as feed and labour.
- More individual dairy farms need to benchmark their inputs usage and costs more closely. Teagasc have developed a set of reference costs to assist with this process
- The reference model quantifies usage rates for all farm inputs. Current market unit prices are then applied to establish total costs
- All variable and fixed costs are included
- Purchased feed inputs account for pasture production, stocking rates and herd performance, returning a valid and balanced feed budget
- Famers can access the reference figures to benchmark their own annual costs on a line-item basis

Introduction

Over the last 3 to 4 years production costs have jumped significantly on dairy farms from around 27 cents per litre to 35 cents per litre. In real terms this equates to an extra €42,000 in annual costs for the average milk producer, or €813 per week to be covered by the milk cheque. While market returns for milk and beef were strong in 2025, the sharp downward trend in milk price brings greater urgency to the need to examine production costs. From analysis of over 1000 farm Profit Monitors each year, we see a consistent and very wide range in milk production costs among farms. Some of this is structural e.g. loan interest, but much of it also comes from routine inputs like feed and machinery costs. To get to grips with costs, it is vital not only to look at the unit cost/price inflation side, but also to examine the input usage levels on a line-by-line basis.

Cost benchmarking

In response to the significant cost differences between high margin and low margin dairy farms, the Teagasc Dairy Specialist Team launched a Dairy Bill of Quantities (BoQ) tool in November 2024. This simple tool helps dairy farmers benchmark their physical inputs and put more focus on the costs of producing milk. Cost categories are broken down into variable and fixed costs under the same headings as the Teagasc Profit Monitor.

The BoQ itemizes the quantity of each input used across the year e.g. tonnes of purchased concentrate, number and type of vaccine shots used, hectares of silage made by contractor, milking parlour detergent used, and electricity kwH consumption etc. Level of inputs for each item are based on Teagasc best-practice protocols. Annual feed budgets are balanced for stocking rate, annual pasture growth and level of milk solids production.

For the purpose of this exercise, the following assumptions were made:

- 120 cow herd with 25 replacement units
- 60 ha farm – 40 ha owned, and 20 ha leased
- Overall Stocking Rate of 2.42 LU/ha
- Planned milk production of 465 Kgs of Milk Solids (MS)/cow delivered
- 11 ton/ha of grass DM utilized

The model assumes a high level of pasture efficiency. Pasture maintenance items such as P, K and lime are included annually. Unit costs of inputs are updated annually to reflect market prices, while rates of input remain fixed. This allows indexing of costs over time. For example, updated costs for 2025 show a 1.7% reduction in total cost of inputs, which is the cumulative effect of a reduction in feed prices offset by some increases in items such as veterinary, professional fees and sundry items. Of course, this change in costs will not be sufficient to compensate reduction in milk sales, but nonetheless any opportunity to make saving on the cost side will be beneficial to the net financial position.

Examples of Variable Costs

The BoQ itemises each of the category costs into unit type, unit rate, units per cow, cost per unit and €/cow. If we take a category like Animal Health and Vet for example, all veterinary items needed for the animals in this herd are costed. There is also a distinction made between vet general and vet vaccines. When the total cost of all items are added together, it amounts to €115 per cow per year.

Another category under the variable costs section is purchased feed costs. This accounts for all concentrate fed to cows and replacement stock. It also includes the cost of dry cow minerals and the cost of two silage samples taken annually for analysis. The usage of concentrate per cow is 800 kgs fresh weight and this figure results from utilizing 11ton DM/ha of grass (growth of 13.8 ton DM/ha at 80% efficiency). The total calculated costs for purchased feed is €276 per cow including minerals and youngstock feed.

Examples of Fixed Costs

All costs associated with machinery are included, for instance a tractor service plus a front and rear tractor tyre replaced annually. The total average cost for machinery running and repair amounts to €59 per cow per year for 2025.

Infrastructure spending is capitalized and financed through borrowing, therefore changes to interest rates affect annualized costs. A depreciation value of 10% is deducted each year for machinery, with 5% for buildings used as standard. The machinery deprecation figure works out at €94 per cow per year for this herd, based on the schedule of machinery on hand.

Table 1. Sample variable and fixed costs per cow for benchmarking 2025

Category	Cost per cow	Cost per kg MS
Variable		
Veterinary – vaccines	38	0.08
Veterinary- treatments, callouts	77	0.17
Concentrates	276	0.60
Fertilizer	169	0.37
Contractor	262	0.57
Milking parlour running costs	71	0.15
Fixed costs		
Machinery running	60	0.13
Interest	42	0.09
Hired labour (excl own labour)	155	0.34
Electricity, car, phone	104	0.22
Hire labour (excl own labour)	155	0.34

How can Dairy farmers make use of the BoQ?

It is important to note that no valid inferences on industry-average costs can be drawn from the model-National Farm Survey data is the appropriate source such data. The figures generated are not 'target' levels *per se*, instead they provide a reference point for individual farmers to start looking at their own input costs in detail. The cumulative 'cost per litre' is thus less relevant than comparison on individual cost categories. Some years will understandably see higher repair costs for example, but the figures generated by the BoQ give a good approximation over a number of years. The first step in utilizing the BoQ tool therefore is that dairy farmers compile their own figures for their farm and input them into the Teagasc Profit Monitor system. This can be completed by the farmer's advisor or the farmer themselves. A number of reports can then be generated to facilitate comparative analysis.

The Consolidated Dairy Report is one such report and this can be used to benchmark and compare individual farm cost categories on a per cow, per kg milk solids or per ha basis. If your figure is significantly higher or lower than the BoQ figure one can drill down and explore the differences. The line inputs comparison can be made on usage units, units per cow and €/cow. Is it a unit rate or price issue for example? Is there scope for correction or management adjustment?

The BoQ may also create a good discussion around category costs between you and your advisor or within a discussion group setting. Some examples to date of the questions and adjustments made by individual farmers using the process are:

- Veterinary call-out costs 30% higher than the reference cost, all in spring. Solution was to improve dry cow mineral feeding and colostrum feeding management
- Feed costs (concentrate per cow) 50% higher than reference costs for a 10% lower milk solids yield. Solution was to calibrate feeders in parlour, bale out heavy grass covers in summer, increase paddock sizes to achieve better grass intakes

- Parlour running costs were significantly higher than reference costs. Solution was to calibrate auto washers (1.5litres more detergent being used daily than was needed, costing >€1200 annually). Changed to best-practice teat prep routine for miking.
- Electricity costs and usage 25% higher than reference. Switched electricity provider, installed variable speed milk pump and increased plate cooler capacity. Replaced all yard lighting with LED, applied for solar on TAMS
- Paid labour charges were much lower than reference costs at <€25 per cow, reflected in hours per week worked by the client. Solution was to ring-fence a budget for 80-100 additional milkings per year, with a roster in place for same.

The BoQ reference herd may not be exactly comparable for your farm but can be used as a guide or an indicator. Further versions for larger scale and greater proportions of land leasing/hired labour are being developed, using similar principles, which may be more relevant for a given herd.

Conclusions

The BoQ is a tool that lists all of the inputs and costs for a typical dairy herd run to best practice protocols. It separates the effect of price and usage rates for each input to allow farmers compare their own situation on a per cow, per ha, or per kg milk solids basis. To make the most of the BoQ, the farmer needs to have their own figures completed for their farm first and then benchmark their figures against the BoQ with the help of their advisor. If there is a large variance in costs, then the farmer and the advisor can compare he actual inputs the farmer is purchasing against what is required. It should also create a platform for a good discussion in a discussion group setting. If you need further information on this, please contact your local Teagasc advisor.

Improved focus and updates to Pasture Profit Index 2026

Sarah Walsh and Michael O'Donovan

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Summary

- The Pasture Profit Index ranks perennial ryegrass varieties based on economic merit and should be used to identify the most suitable varieties when reseeding
- The index allows for trait specific selection of varieties depending on the system
- The base values used within the Pasture Profit Index have recently been updated to reflect the genetic gain of perennial ryegrass varieties

Introduction

Regular reseeding improves herbage production and animal performance through greater grass dry matter (DM) yields and pasture quality, which boosts feed self-sufficiency and enhances sustainability of pasture-based farms. The Pasture Profit Index (PPI) is a variety selection tool which can be used to choose the most appropriate varieties to sow when reseeding. The PPI outlines, in economic terms, the agronomic differences between perennial ryegrass (PRG) varieties for traits that influence the profitability of ruminant production systems.

The data for the PPI is evaluated through the Department of Agriculture Food and Marine's Recommended List trials, conducted across five locations in Ireland. Varieties are ranked based on their total PPI value which is calculated by summing the variety performance in each trait that make up the PPI. These sub-indices (and their relative emphasis within the PPI) are spring (20%), summer (9%) and autumn (10%) DM production, mid-season quality (DM digestibility; 27%), silage DM yield (21%), persistency (6%) and grazing utilisation (7%). For each of the traits in the PPI the agronomic advantage for the trait value is multiplied by the economic value of the trait. The agronomic advantage of a variety is the performance greater (or less) than the base value.

Updates to the PPI for 2026

The PPI is calculated using base values for each trait, however, there has been significant genetic gain made from grassland varieties and the base values need to reflect this. For DM yield this gain is 40 kg DM/ha/year (McDonagh *et al.*, 2016), which equates to a 520 kg DM/ha increase in the annual yield base value. This will be proportionally divided between spring, summer and autumn based on herbage production in each season (11%, 68% and 21% increases for spring, summer and autumn, respectively). The silage DM yield base value will also be increased by 520 kg DM/ha, proportionally divided for first and second cut (56 and 44%, respectively). Grass quality base values will be updated using the available data for the previous 4 years across 2 sites used for quality analysis for the PPI. The economic value for each trait will remain the same apart from persistency. Previously, the cost of reseeding was valued at €800/ha and over 12 years this equates to €67/year. Twelve years was set as the maximum length of time a variety could persist before reseeding is considered necessary due to the availability of superior varieties (O'Donovan *et al.*, 2017; Creighton *et al.* 2011). The cost of reseeding has increased substantially since this was calculated and is currently estimated at €1100/ha (Teagasc, 2025), which equates to €92/ha/year over 12 years.

Grazing utilisation is currently presented on the PPI using a "Star rating system" whereby superior varieties are given 5 stars and inferior varieties are given 1 star. Stars are assigned based on the additional (or reduced) herbage utilised as calculated from a variety's Residual Grazed Height (RGH) score. Residual Grazed Height is calculated from the perennial ryegrass variety grazing studies in Teagasc Moorepark (Tubritt *et al.*, 2021). This is based on comparing a varieties post-grazing sward height to the predicted post-grazing height, which is calculated based on the pre-grazing herbage yield and sward height. Varieties which are grazed below their RGH will receive a negative value and are more grazing efficient while varieties that do not achieve their predicted post-grazing height are less grazing efficient. To create more cohesion between all traits in the PPI, it is planned to include grazing utilisation as an economic trait in the index. This value will be calculated across the 5 summer rotations when differences in grazing utilisation typically occur. The value of grass during these 5 rotations is €0.04 and as such this will be the economic value used to calculate the grazing utilisation value within the PPI. Herbage density is assumed at 250 kg of DM/ha per cm, as this value is commonly used in grassland research and grassland management calculations (McSweeney *et al.*, 2019). Thresholds are assumed as the biological significance of superior/inferior grazing utilisation beyond a certain point is assumed. These limits are +€30 to -€30. The complete PPI compilation of traits, their economic values and relative emphasis is summarised in Figure 1.

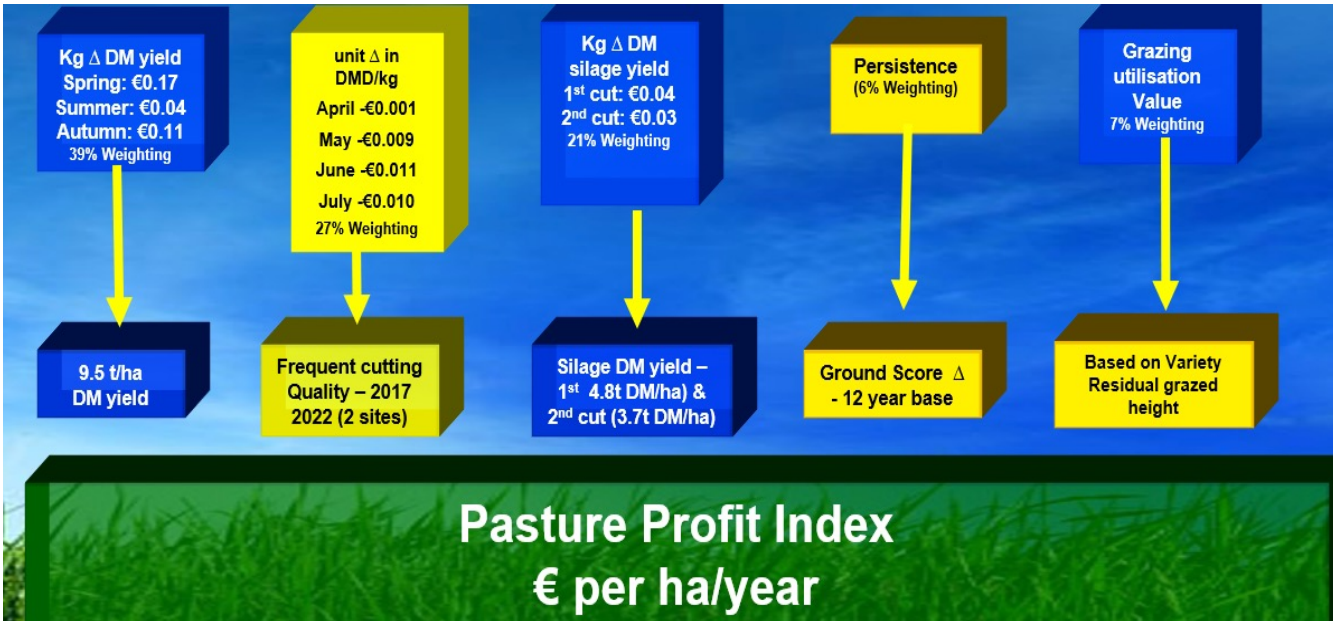

Figure 1. *Pasture Profit Index new updates and weighting 2026.*

The results of the updates described above were applied to all of the 2025 PPI varieties. On average there was no difference in ranking among varieties (rank correlation of 0.97 between the previous and updated PPI) and the average PPI value decreased by €17 compared to the 2025 recommended varieties list. On average quality increased by €36, however, spring, summer and autumn herbage production decreased by €9, €14 and €13, respectively, and silage production also decreased by €18. The grazing utilisation value ranged from - €28 for the least grazing efficient variety to + €11 for the most grazing -efficient variety. However, annually new data is added to the grass variety evaluations to it is likely that PPI values for the new evaluation may reduce.

Using the Pasture Profit Index

Utilising the PPI allows farmers to choose varieties that deliver the best return on investment when reseeding. Seed mixes can be tailored to specific systems by focusing on traits of importance. For example, paddocks located on the milking platform which will be intensively grazed should be sown with varieties performing strongly in the grazing utilisation, quality and spring/autumn DM production sub-indices. Paddocks for regular intensive silage cutting should include varieties which perform well for silage and spring DM production traits. Paddocks located on the grazing platform but destined to be closed for silage should aim to combine high silage and utilisation traits. Seed mixes performance can be accurately predicted by averaging the trait values of the individual varieties.

Conclusions

The PPI is a powerful decision tool that aids farmers select the most profitable grass varieties for their specific system which can increase productivity and profitability. By understanding and applying the PPI sub-indices, farmers can design optimum seed mixtures that align with their production goals, whether focused on producing milk from pasture or maximising silage production.

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Update on the MoSt Grass Growth prediction model

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Summary

- The MoSt Grass Growth (MoSt GG) model has been developed to predict grass growth, grass nitrogen content and nitrogen leaching at the paddock and farm level
- The MoSt GG model is currently used bi-weekly on 80 commercial farms to predict grass growth for the following week
- The main factors impacting the MoSt GG model prediction weather, soil type and, N fertiliser application
- When looking at the prediction, the trend of the growth (increasing or decreasing) is more important than the exact number
- The MoSt GG model is now integrated into PastureBase Ireland and more farms will be simulated in the near future.
- When looking into the future, annual grass yield is expected to increase, but the seasonality will change with a higher growth in the winter and spring month and a decrease in the summer month.

Introduction

PastureBase Ireland (PBI) is a grassland management tool for farmers. It helps farmers to manage the grass on their farm, identify grass supply surpluses or deficits and to take appropriate action. Even though the Irish temperate climate allows grass growth throughout the year, grass growth is highly seasonal and depends heavily on climate conditions and soil type. As the climate is changing it will become more and more important to be able to react quickly to the variation in weather. The integration of grass growth predictions, using the MoSt Grass Growth (GG) model, into PBI has huge potential to help farmers make better grassland management decisions based on the future grass growth and not on historical grass growth.

Model description

The MoSt GG model was developed in Moorepark for Irish grazing systems and Irish meteorological conditions. The model predicts daily grass growth (grass-only swards - kg dry matter (DM)/ha) depending on weather conditions, soil type and grazing management. Farmer decisions that impact grass growth within the model are nitrogen fertiliser application rates, as well as the pre and post grazing sward height, or the pre and post cutting height. The model takes into account the impact of soil type and the grazing animal (through urine and dung patches) on grass growth. The MoSt GG model has also been developed with the aim of recreating the nitrogen flow in the soil and the plant to predict the nitrogen content of the grass as well as nitrogen leaching at the paddock level. This can be used to predict the impact of different grazing management strategies on nitrogen leaching.

On-farm grass growth prediction

The number of farms participating in the grass growth prediction project started at 30 and currently has 80 farms. These farms are mostly commercial farms. Most of the data required to do the prediction are present in PBI including: the paddocks and their area, the grazing and cutting dates, the number of animals grazing, feed supplementation used, and the nitrogen fertilizer rates (chemical and organic). The other data necessary are soil type for each paddock, which is determined by using the Irish Soil Information System, and the weather data, both historical and forecasted by Met Éireann. The 80 farms chosen in this program are farmers that are measuring grass at least weekly during the main grazing season and are recording their nitrogen fertilizer applications on PBI, as without this the model could not accurately predict grass growth. The farms are geographically spread across the country to take into account the variability in growth due to location and soil type. More farms will be predicted in the future providing they are entering enough information (at least 30 grass measurements a year, chemical nitrogen fertilizer and slurry applications).

Where can I access the grass growth predictions and how to use them?

The grass growth predictions are now directly accessible on PBI for the farmers involved. They are also sent weekly to Teagasc advisors, with other information such as predicted rainfall and predicted soil temperature for the coming week to help them advise farmers. The grass growth predictions are also fully available to the public weekly trough the Grass10 newsletter, which is on the PBI website. Since August 2020, the grass growth predictions are also presented each Sunday on National Irish television by Met Éireann on RTE 1 during the farming forecast.

While the grass growth predictions are currently shown in the form of a precise number, each farm is different. This is why the trend of the grass growth prediction (increase or decreasing compared to the previous week) is as important, or more important, than the actual number. A specific farm could be growing consistently less than the prediction for example. but the overall trend should be similar.

Future developments for growth prediction and climate adaptation

Currently, the model can only predict growth on grass-only swards. The development of a new sub model allowing the prediction of growth on grass-clover swards is ongoing. A project is starting to use the model to help predict the impact of future climate as well as finding new adaptation strategies. Primary results using Met Éireann TRANSLATE weather projection is showing that in a scenario with a 1.5 °C as well as 3°C global warming compared to historical temperatures, grass growth is predicted to increase throughout the country. However, when looking at the seasonality (Figure 1), growth is likely to increase in the winter months but decrease in the summer months, especially for the south east region. This change in seasonality is due to an expected change in weather with an overall increase of temperature across the year, decrease of summer rainfall and increase of winter and spring rainfall. This change in weather could induce more challenges on farm as the increase in growth in winter and summer combined with increased rainfall will make the utilisation of this grass more challenging. Similarly, variability between years is predicted to increase which means that increased flexibility will have to be incorporated into systems. More developments are coming to help farmers deal with climate variation including a trainability predictor at the paddock level directly into PBI as well as local and national alerts for drought and N leaching.

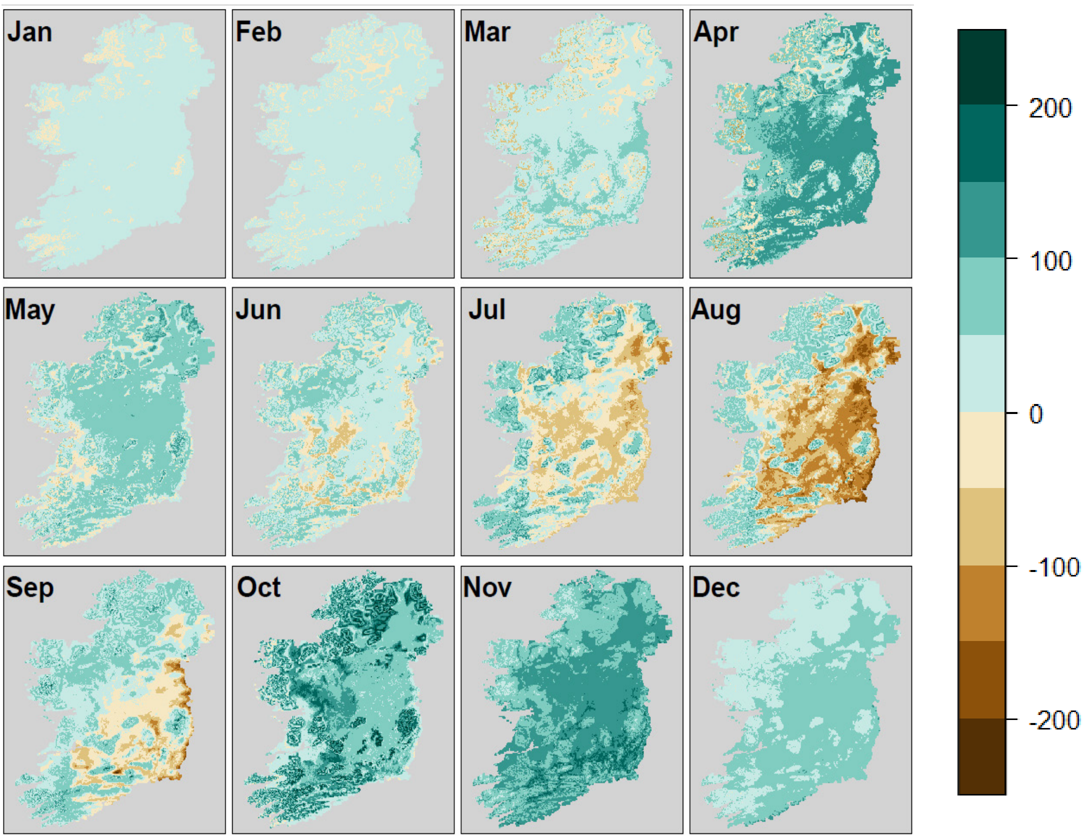

Figure 1. *Monthly cumulative grass growth difference (kg DM/ha) between a 1.5 °C warming simulation and the baseline simulation (1976-2005).*

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Notes


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