Animal & Grassland Research and Innovation Centre

Moorepark

Ballyhaise'22 Open Day

Futureproofing Irish Dairy Systems

Wednesday 13th July, 2022

teagasc

Agriculture and Food Development Authority

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Open Day

Wednesday 13th July, 2022
Ballyhaise Agricultural College, Cavan

Compiled by: *Margie Egan*
Edited by: *Brendan Horan*
Animal & Grassland Research and Innovation Centre, Moorepark

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Table of Contents

Principal's welcome

John Kelly

College Principal, Teagasc, Ballyhaise Agricultural College, Co. Cavan

Teagasc Ballyhaise Agricultural College is an estate of 220 hectares that mixes a rich mix of biodiversity and water courses with grassland based and forestry production systems. The college provides training in agriculture and forestry and has developed close links with the local Institute of Technology in Dundalk (DKIT). With the implementation of the Rural Development Programme (RDP) via CAP in 2015, the college has seen extraordinary demand for our programmes where it has delivered QQI courses at Level 5 and Level 6 to over 3,000 students. The college is also a significant Teagasc centre for advisory services as well as dairy research.

We continue to have a strong interest in dairy education and many of those graduating from our Level 6 Advanced Certificate in Dairy Herd management have progressed to the Level 7 Professional Diploma in Dairy Farm Management and ultimately have become successful dairy farm managers in the region playing a crucial part in the growth that has taken place in the industry. All our second year programmes have maintained a strong focus on the core skills and management required to implement progressive farming systems. We continue to deliver grass production and management training on a weekly basis to students while they attend the college. Farming sustainably has increased in focus on our programmes and, as a Teagasc Signpost farm, we utilise the college natural resources with all students to deliver a specific module on Sustainable Farming in the Environment. The farm including its soils, biodiversity and water courses are a critical resource that we can further utilise to impart knowledge to all those attending.

The college has to meet the challenges of improving our sustainability where all outputs of everything we do must be part of a circular economy. Our facilities are constantly being upgraded and improved and you will see examples of this at the open day including pasture renewal and improved farm infrastructure such as slurry storage, farm roadways and fencing. Likewise teaching and advisory staff continue to part take in in-service-training where they learn the most up-to-date technology that is emerging from our research. This is critical to allow us to impart key information to our students and farmer clients.

The current economic situation and international unrest brings many challenges and much uncertainty to our industry. However, it is worth remembering that Teagasc Ballyhaise College has been here for almost 120 years delivering research, education and advice within agriculture and food production throughout many uncertain times. The challenges our farm face are similar to those of farmers in this region and, together, we will continue to be involved in food production long into the future.

On behalf of Teagasc and Ballyhaise Agricultural College, I welcome you here today and wish all involved a successful event.

Foreword

Laurence Shalloo
Head of Animal and Grassland Programme, Teagasc, Moorepark, Fermoy, Co. Cork

The Irish dairy industry has undergone a transformational change since the removal of the EU milk quota in 2015. Indeed, since the Irish dairy industry began to prepare for EU milk quota removal (2007), milk solids output has increased by over 90% nationally. This increase in output has been achieved through increases in cow numbers, increased milk yield per cow, increased fat and protein percentages, increased grass growth and stocking rate and additional land entering the dairy industry. Although there has been significant investment at both farm and industry level, overall debt levels have remained relatively static at farm level, while debt levels per kg of milk solids have reduced significantly. The largely grass based systems of milk production have resulted in a low cost production system which has provided a comparative advantage for the Irish dairy industry within a seasonal profile of milk deliveries. Recent published studies have shown that Ireland's competitive advantage has increased further since milk quotas were removed. This has been achieved through a constant focus on grazed grass in the diet and this will continue to be the key factor driving the competitiveness of the system into the future. The benefits of the system have been further compounded by the development of the Economic Breeding Index, which has selected for a dairy cow, which has suitable attributes for the system (robust, high levels of fertility, ability to convert forage to milk, ability to withstand changes in feed supply).

Looking ahead, there are new challenges that the dairy industry will have to address as it matures in the new economic and policy environments. Recent geo-political events have exposed the need for increased feed, fertiliser and energy security. Systems of milk production that rely less on bought in feed, fertiliser and energy are more resilient in these challenging times. These issues coupled with environmental pressures (greenhouse gas emissions, water quality and biodiversity) require the industry to have a cohesive plan to meet these challenges. Key to this process will be the deployment of the currently available solutions at farm level coupled with further investment in research to develop new solutions to facilitate the industry to meet its overall commitments. The availability of skilled and motivated people to work and lead within the industry is, and will be, a central challenge now and in the future. Thus ensuring that education and training is delivered based on industry needs across different career roles within the sector will be central to delivering a more vibrant industry in the future. In addition, the development of a more integrated beef and dairy industry will benefit both sectors while the generation of improved dairy beef progeny with a reduced age at slaughter from the dairy herd will be an essential requirement to develop profitable, simple and sustainable grass based dairy beef systems.

Finally, after two very challenging years (associated with Covid19), it is our pleasure to welcome you here today to see the research being conducted in Ballyhaise and to liaise with the Teagasc teams present here. It is important to stop and take a step back and to recognise the achievements that you have made on your farm. Looking forward will bring new challenges but those farmers that are informed and that challenge and embrace new methods will be in a better position to deal with those challenges as they arise.

Ballyhaise Dairy Research Programme 2005-2022: Lessons learned and future direction

Donal Patton[1,2], Barry Reilly[1,2] & Brendan Horan[1]

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Summary

- The research programme in Ballyhaise has been running for 17 years with a continued focus on developing profitable grazing systems for the Border, Midlands and Western regions
- Large quantities of high quality pasture can be grown and efficiently utilised within the Border Midlands Western region when appropriate grazing management practices are adopted
- Extended grazing supports high levels of milk production and reduced requirements for concentrate and silage supplementation when compared to the average grazing season length in this region
- The challenge ahead is to further improve farm performance and profitability while simultaneously reducing the environmental impact of dairy systems.

Introduction

Among global dairy systems, pasture-based production, where the majority of animal feed requirements are derived from grazed or conserved pasture, are unique both in terms of prevalence and design. The economic impacts of increased pasture production and utilisation (t DM/ha) on farm operating profitability has been widely reported in such systems while there is also a growing awareness of the role of grazing systems in delivering additional benefits such as improved nutrient recycling and conservation, reduced Green House Gas intensity of milk production, enhanced farmland biodiversity and improved animal welfare. On that basis, further improving the efficiency of pasture-based milk production systems is considered as a primary opportunity for sustainable food production in Europe over the next decade as set out in the EU Farm to Fork proposals (EU, 2019).

The Border, Midland and Western Region (BMW) of Ireland consists of 13 counties including the six border counties with Northern Ireland which are characterised by marginal soil types. Despite accounting for 44% of the total national land area, it presently accounts for only 20% of national milk production. The regions wet mineral soils inhibit drainage and are associated with a shorter grazing season and reduced pasture utilisation and farm profitability. The focus of the research programme at Ballyhaise has been to investigate the potential of grazing systems within the specific context of drumlin soils in the BMW region. What level of grass growth can this land type support? Can it be utilised through grazing, particularly in spring and autumn? What level of profitability is realistic given the more challenging land and shorter growing season? A large database of information has been gathered since 2005 and the purpose of this paper is to answer these questions and discuss how the system practised at Ballyhaise can be future proofed to secure a profitable future for family run dairy farms in the region while also contributing to reduce the impact of dairy production on the natural environment.

Grass production and utilisation over an extended grazing season

Among the main opportunities to further increase productivity within Irish dairy systems, the potential to increase pasture utilisation on more marginal soils by extending grazing season length has been highlighted. Previous studies indicate that extending the grazing season by 20 days could reduce operating costs on dairy farms by 20% (or 3.2 c/l). However,

grazing dairy cows, particularly during the winter, spring, and autumn, can damage both the sward and upper soil layers, which can lower pasture production. Previous studies have shown that 60% of Irish dairy farmers identified wet soil conditions as the most important factor influencing their decision whether or not to turn livestock out to pasture. Even though grazing conditions can be challenging in spring and autumn a long grazing season been achieved with flexible grazing management and good farm infrastructure. Annual pasture production at Ballyhaise has averaged 14 tonnes DM over the last decade and our most recent study showed that a 235 day grazing season is achievable with no negative impact on pasture growth or soil structure at the site, which is 30 days more that the average for the BMW region. Moreover, extended grazing at Ballyhaise has reduced both supplementary concentrate (-15%) and pasture silage (-23%) requirements for the herd while the provision of additional high quality spring pasture within the early lactation diet has also resulted in superior milk constituents, increasing milk price and which subsequently persisted throughout the entire grazing season.

Silage Requirements

While flexible grazing management can overcome difficult grazing conditions; nevertheless, pasture growth and feed supply are constrained by lower soil temperature and grazing conditions during periods of inclement weather. By knowing the potential pasture production and pattern, realistic whole-farm stocking rate within limited exposure to external feed imports can be indentified. At 14 tons DM / ha growth and utilising 80% (including silage area), a whole farm stocking rate of 2.3 cows / ha and a milking platform stocking rate of 2.9 cows ha has allowed high levels of animal performance to be achieved over an extended grazing season while provisioning 1.4 tonnes DM /cow of silage to meet winter feed requirements. Just over half of this total silage is fed to dry cows so moderate quality well preserved high DM silage is needed for this purpose (70 – 72 DMD). This will maintain dry cow body condition over the dry period while avoiding metabolic issues caused by over conditioned cows. The remaining silage is fed to milking cows and so needs to be high quality (76+ DMD) to maintain high levels of performance.

Profitability

Despite a shorter grazing season and more difficult grazing conditions, high levels of farm profitability are being achieved. Over the past five years the average profitability was €2,300 per ha whole farm at Ballyhaise. This ties in with on farm data where top 10% of farmers completing profit monitors in the region are readily achieving above €2,000/ ha whole farm profit. Indeed, at constant average prices, the overall profitability of the dairy production system at Ballyhaise has increased year on year since the inception of the research programme in 2005 largely based on incremental improvements in key performance indicators illustrated in Table 1.

Table 1. Ballyhaise Key Performance Indicators

	2004	2010	2021	Target
Grazing Season (days)	225	255	265	280
EBI (€)	-16	44	188	200
Grass growth (t DM/ ha)	10.5	13.8	13.5	15+
Concentrate (kg/ cow)	700	630	600	500
Fertiliser (kg N/ ha)	150	250	225	<150
Six week in-calf rate (%)	38	49	75	80
Milk solids sold (kg / ha)	960	1,073	1,175	1,300
Profit / ha (€ @ 28 c/l base)	310	1,275	1,950	2,500

Increasing milk solids production per hectare while maintaining low levels of imported feed has resulted in a more robust and profitable dairy production system at Ballyhaise underpinned by highly productive swards supported by improved grazing management and a high EBI dairy herd. Ultimately, the net consequence of this change in milk productivity in association with the improved fertility performance evident in Table 1 is to increase overall farm profitability per hectare at a constant base milk price of 28 c/l and including full labour costs from €310 per hectare in 2004 to €1,950 per hectare in 2021.

Future Proofing Dairy Production in the BMW region

Looking ahead, the challenge for research and farmers alike is to continue to improve family farm profitability while reducing the environmental impact of the dairy system. As the pressure intensifies to reduce nitrogen losses to the environment from pasture-based dairy systems coupled with recent soaring costs of chemical fertilisers, interest in perennial ryegrass white clover (PRG WC) mixtures, where more N for pasture growth is supplied by N fixation has increased. While a growing body of research has shown the benefits of WC in intensive grazing swards, presently, there is little or no WC present on many intensive commercial dairy farms. The current trial at Ballyhaise is investigating the possibility of reducing imported nitrogen by rapidly transitioning the farm system from a Perennial Ryegrass (PRG) only system supported by 250 kg of chemical N application with a PRG WC system receiving lower levels of chemical N. Table 2 below outlines the details of the four treatments which are part of the new study.

Table 2. Treatment details for the new grazing study at Ballyhaise

Sward	Perennial Ryegrass only (PRG)		Perennial Ryegrass White Clover (PRG WC)	
Concentrate level	High	Low	High	Low
SR (cows/ha)	2.5	2.5	2.5	2.5
Chemical N (kg/ha)	250		125	
Concentrate (kg/cow)	1,200	600	1,200	600
Target clover content (%)	0	0	25	25

This study will be the first to document the impacts of transitioning from PRG only to PRG WC swards based on both reseeding and oversowing in terms of pasture productivity and botanical composition, animal performance and farm system profitability on a wetland soil type and will run from 2021-2026. The target for the project is to further increase farm performance and profitability while reducing purchased N sources (feed and fertiliser) by 50% over the lifetime of the project.

Conclusions

Results from a range of studies carried out at the Ballyhaise site demonstrate that considerable potential exists to further increase animal productivity from pasture in the BMW region by increasing sward productivity in combination with an appropriate stocking rate and a compact calving high EBI dairy herd. The Ballyhaise College dairy herd has made substantial improvements in productivity in the last decade. These productivity gains have arisen through increased grass utilisation, increased milk value and reduced production costs. To further build upon these productivity gains into the future and ensure that the overall business remains resilient requires a continued focus on increasing grass utilisation, further increasing herd EBI and minimising fertiliser use via the inclusion and management of clover within the dairy pastures will continue to be the focus of the research programme at Ballyhaise.

Acknowledgements

The research project at Ballyhaise would not be possible without the considerable efforts and support of a large number of people. We wish to thank the staff of Ballyhaise Agricultural College for their care of the experimental animals and assistance with measurements during the various studies. The impacts of the research programme on on-farm practice in the BMW region results from close co-operation between research, education and advisory staff who work with students and farmers to improve the resilience of family farms and their contributions to this programme is essential. Finally, the BMW region steering committee of farmers and co-op representatives who generously give their time to advise the research programme at Ballyhaise has been an immense support to the project. The financial support of the Irish Dairy Levy Funding administered by Dairy Research Ireland and the Teagasc Walsh Scholarship programme is also gratefully acknowledged.

Managing cost inflation on dairy farms in 2022/2023

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Summary

- Excluding own labour, capital repayments, drawings and tax, the average cost of keeping a cow in 2021 was €1,478 for farms completing Profit Monitor in the Border, Midlands and Western region
- Input costs are projected to increase by an average of 40% on these farms in 2022 bringing the total cost of keeping a cow to €2,069
- Feed and fertiliser costs are projected to increase by 56% and 127%, respectively
- There is a large range in financial margin on dairy farms in Northern Ireland for a given level of milk output per cow. However, farms with better feed efficiency tend to return higher margins. This trend is expected to continue in 2022.

Introduction

This year has been turbulent on dairy farms with both input costs and output prices rising by unprecedented levels. Input costs for dairy farms are projected to increase by 40% in 2022. Although milk price has masked the impact on margins in the short term, the potential impact could be much more significant in the medium term. Table 1 summarises the trend in costs and output on dairy farms in the Border Midlands and Western (BMW) region over the last five years and projections for 2022.

Table 1. Cost and dairy farm outputs for 2017 – 2021 in BMW region

	2017	2021	Diff '17-21	Assumptions 2022 v 2021	Projected 2022
Meal €/cow	255	345	+90	+56%	538
Fertiliser €/cow	117	130	+13	+127%	295
Contractor €/cow	96	117	+21	+22%	143
Other costs €/cow	742	886	+144	+23%	1,093
Total costs €/ cow	1,210	1,478	+268	+40%	2,069
Milk solids kg/cow	440	487	+47	+2.7%	500
Milk price €/kg MS	4.69	5.03	+0.34	+33%	6.69
Farm stocking rate, LU/ha	2.14	2.18	+0.04	+0.5%	2.19

Figures used in this analysis are based on a subset of client herds completing the Teagasc Profit Monitor. The figures are shown for cost categories associated with running a commercial dairy farm business prior to own labour, capital repayments, drawings and taxation. Data are indicative of cost trends but should not to be used as representative of total production costs on dairy farms.

Trends in costs and output per cow on dairy farms

In 2017, the average cost to keep a dairy cow in this region for farms who completed Profit Monitor was €1,210/cow. For 2021, the average cost per cow increased to €1,478/cow or an average increase of 5.5% per year over the period. There was an increase in all costs over that period and the total cost of keeping a dairy cow on the average dairy farm has increased by €268 during that period. The average level of meal feeding increased by 180 kg per cow over the five year period which accounts for €50 of the additional costs. At the same time, milk solids (MS) production has increased from 440 kg/cow in 2017 to 487 kg in 2021, an increase of 47 kg MS/cow. The stocking rates on dairy farms on average

have remained relatively static, with additional land added offsetting any increase in cow numbers. The increase in cow performance represents an increase in grass utilised of +0.4 t DM/ha over the five years.

Cost and output projections for dairy farms in 2022

Looking ahead, assuming no change in the quantity of inputs in 2022, purchased meal cost is projected to increase by 56% while the cost of fertiliser is projected to increase by 127% and contractor costs projected to increase by 22%. All other costs are projected to also increase by an average of 23%. This potentially could leave the cost per cow for 2022 at €2,069/cow, an increase of €591/cow from 2021, or €70,920 in a 120-cow herd. This would require an increase in milk price of €1.18 per kg MS or 9.5–10.0c/l on average across the year to offset the increase in costs. There will be large farm-to-farm variation in the relative effect of input cost increases, with herds that are more reliant on purchased feed and fertiliser inputs impacted to a greater extent.

Considerations for 2022/2023

When looking at cost savings for 2022, it is important to protect the inputs that have a long-term beneficial effect on your farm business. For example, choosing to cease milk recording to save money could increase SCC problems and will reduce herd quality over time, while deciding not to apply lime may have an impact on the total amount of grass grown. Feed and fertiliser will account for approximately 40% of your total running costs for the farm, so practices that improve efficiency in these categories will have the most impact. Changes made to these inputs that result in large reductions in pasture growth and/or cow performance should be avoided.

Cash budget

Complete a cash flow budget for your farm. This does not have to be complicated but be realistic when completing your figures. Budgeting is not an exact science however, a 'best estimate' is better than 'no estimate'. Avoid cutting productive costs (e.g. P and K, lime, herd health, etc.) when identifying areas where savings can be made. Capital investments should be assessed and a cash budget prepared in advance of any expenditure. Be very wary of taking on capital projects funded by cash flow, especially where cost overruns are likely. Act early where cash flow deficits are identified.

Grass measuring

Increasing the level of grass utilised by 0.25 t DM/ha through better grazing management could reduce feed purchases by 10% (110 kg/cow or 0.4 kg/cow/day). At 2022 costs, this would represent a cost saving of €54 per cow or €6,480 for a 120-cow herd. Grass utilised can be increased by mapping the farm and adjusting paddock layout (size, access and water) to suit the herd, being proactive in grazing covers at the correct stage (worth 40 kg MS per year), correcting soil fertility, reseeding the worst performing paddocks and incorporating clover to improve sward quality.

Nutrient management plan

The relative value of slurry has never been higher. Make best use of fertiliser inputs with a targeted nutrient management plan which makes better use of the slurry available on farm. Timing and application method have a large effect on slurry value. The use of low emissions slurry spreading (LESS) technology can replace 10% of fertiliser (or approximately 0.4 bags Protected Urea/acre). At 2022 costs, this would equate to a cost saving of €30 per cow or €3,600 for a 120 cow herd.

Clover

Incorporating clover in ryegrass swards can reduce fertiliser N by 100kg/ha. The details of establishing and managing clover swards are discussed in detail later.

Breeding

Continue to invest in high EBI genetics. High EBI dairy cows have higher production and fertility performance than low EBI counterparts. High EBI stock also deliver a higher return on investment over a shorter timeframe. For farms that have achieved a stable herd size, the decision should be taken to finish out the breeding season using high dairy beef index (DBI) bulls that have good predicted carcass traits to improve beef merit of dairy progeny.

Winter feed budget

With the projected increase in fertiliser and energy prices, fodder stocks are very valuable. Most dairy farms in the BMW region have a good reserve of silage stocks (20%) built up over recent years. However, it is the cost of replacing silage stocks, and not the original cost of production, that needs to be considered when planning for winter. This needs to be factored into decisions on when to sell cull cows, surplus replacement heifers, beef stock etc. Completing a winter feed budget is essential. For farms that are likely to be short of silage, offloading some non-productive stock before housing should be the first option. Seemingly small changes can have a large effect, for example a herd 100 cow herd that sells eight culls before winter instead of keeping them through, will spare enough silage to feed the whole herd for two weeks next spring.

Low performing cows

Keeping poor performing cows by using additional feed and fertiliser to sustain them may not make economic sense. Based on the projected figures in Table 1, an individual cow would have to sell at least €2,100 in milk sales to break even on cash costs; this figure will be at least €1,000 per cow higher if silage must be purchased to balance the feed budget. Are all cows in the herd meeting this threshold? Complete a breakeven analysis on your own herd to determine the milk solids yield needed to cover operational costs and make a decision on whether to keep individual cows on that basis. Milk recording reports are an excellent way of identifying 'passengers' in the herd.

Managing costs in 2022-a perspective from Northern Ireland Benchmarking farms

Similar to the Teagasc eProfit Monitor system, dairy farmers in Northern Ireland who participate in the CAFRE Business Development Group programme have the opportunity to assess their physical and financial performance relative to industry peers using the CAFRE Benchmarking system. Data is collected over a 12-month period from which, it is possible to calculate the cost of production and Net Margin for each farm business. Results are presented on a per cow basis rather than per litre as it can be a more useful way to present figures where herd size and not milk quota is considered a limiting factor.

A summary of the main physical and financial performance features collected for the 2021/2022 season to date is given in Table 2, showing the performance figures for the average benchmarked farm as well as the top 25% and bottom 25% of recorded farms (based on Net Margin per cow). While data is still being collected for the 2021/22 year, it is anticipated that the relationships between key physical performance indicators and profit margin per cow are unlikely to change significantly. This is despite the large increase in input costs (principally fertiliser, feed and fuel). It is also anticipated that increased milk price will largely offset input cost changes in the annual figures. Therefore, while input costs and milk prices for 2022 are radically changed compared to previous years, the most profitable farms are likely to remain the most profitable due to better technical efficiency.

Maintain technical efficiency levels despite increased input costs

There is a range in performance across the Benchmark farms, with the top 25% of farms in 2021 having higher levels of milk production and lower replacement rates, which in turn lead to a higher Gross Margin and Net Margin per cow. Analysis of benchmarking data in previous years has also shown that increases in milk yield per cow tend to be correlated with increases in Gross Margin/cow and this may help to explain the interest in increasing

milk output in the Northern Ireland dairy industry. Our annual data consistently shows large variation in yield achieved for a given level of feed input. For example, in 2021, the average benchmarked farm fed 2,527 kg concentrate/ cow to produce 7,696 l milk per cow. The milk yield achieved on farms recording this level of concentrate fed ranged between 6,500 to almost 9,000 l milk per cow. This in turn had a major impact on the Margin-Over-Concentrate (MOC; purchased feed cost minus milk revenue). In general, farms exhibiting a higher MOC also tend to have a higher Gross Margin and Net Margin. Clearly, however, financial margins on those farms operating at a lower feed efficiency may be affected more severely by input cost inflation, due to a greater reliance on purchased inputs per litre of milk sold. It is also interesting to note that the top 25% of benchmarked farmers tended to have higher fertiliser and feed costs than the average producer. However, because this increase was accompanied by increased output, which in turn improved feed efficiency, returns for this group were higher. This is a trend which has also been observed in previous years.

Table 2. Summary of physical and financial performance of CAFRE benchmarked farms (2021/22 to-date)

Physical performance	Average	Range	
		Bottom 25%	Top 25%
Milk yield (l/cow/year)	7,681	7,146	8,679
Butterfat (%)	4.24	4.17	4.19
Protein (%)	3.41	3.34	3.40
Replacement rate (%)	30.8	34.9	29.0
Concentrate (kg/ cow/ year)	2,330	2,433	2,731
Financial performance			
Margin over concentrate (£/cow)	1,778	1,503	2,018
Total variable costs (£/cow)	996	1,077	1,093
Gross margin (£/cow)	1,454	1,095	1,754

Figures prepared for a recent series of industry workshops would suggest that input costs and milk product prices have increased by similar relative amounts for Northern Ireland farms in 2022. The range in margin per cow is very significant however, which is largely driven by farm-to-farm differences in technical performance. Recording and analysing key performance indicators such as MOC is vital in helping to improve feed efficiency on Northern Ireland dairy farms.

Conclusions

The international dairy industry is in the midst of huge pressure and uncertainty as regards cost and availability of inputs. This trend is apparent in the farm-level cost data compiled from dairy farms participating in Teagasc eProfit Monitor and CAFRE Benchmarking alike. Milk price increases have, to date, insulated farm margins however caution is required particularly with regard to capital costs. Teagasc eProfit Monitor data analysis confirms that in 2022, as for other years, dairy farms that focus on utilising more grazed grass and achieving high milk solids production efficiency per cow, are likely to return better margins. In a similar vein, while CAFRE benchmarking figures indicate improvements in Net Margin and sustainability on Northern Ireland dairy farms can be achieved through increases in milk output, such benefits will only occur if this extra output is driven by a focus on maximising feed efficiency. Grazing management, silage quality, soil nutrient planning and herd fertility are all major factors in this process.

EBI is as relevant tomorrow as it is today

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Summary

- Higher EBI herds outperform their lower EBI contemporaries
- Each €1 change in herd EBI is associated with €1.79 more profit per lactation based on data from the BMW region.

Introduction

The Economic Breeding Index (EBI) summarises the expected performance of an animal's progeny for a range of characteristics into a single value. Both bulls and cows receive an EBI value. The EBI is useful for comparing which cows to breed from and which dairy bulls to use. The daughters of a bull with an EBI of €300 are expected to be, on average, €50 more profitable per lactation (i.e. >€200 per lifetime) than the daughters of a bull with an EBI of €250. The EBI itself is comprised of seven sub-indexes of which profit from milk (i.e., milk sub-index) and profit fertility (i.e., fertility sub-index) constitute two thirds of the emphasis. In fact, there is currently 19 traits in the EBI. The EBI must always be forward thinking – the EBI bred for A+B-C milk pricing well before processors adopted this payment system. The significance of being forward thinking is as important today as it has been heretofore.

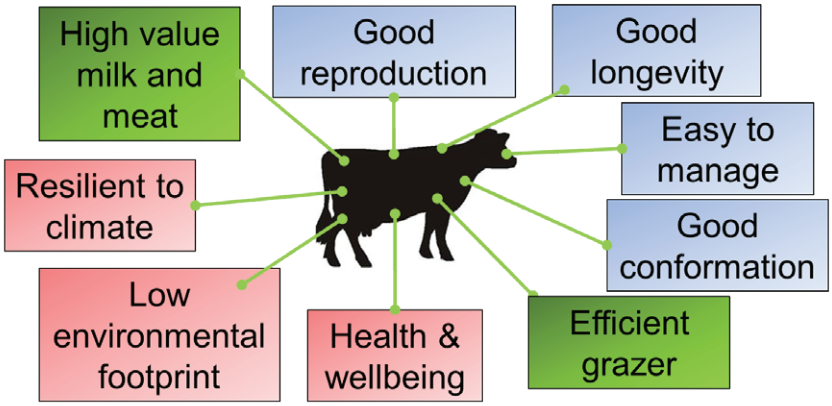

Figure 1. *Characteristics of the ideal cow of the future*

The characteristics of the dairy cow of the future are in Figure 1. The characteristics highlighted in green are those that are well covered in the EBI; those in blue, while included in the EBI, can be improved and those in red require attention. Nonetheless, indirect improvement in the traits in red continue to be realised without explicit inclusion in the EBI. For example, the carbon efficiency of milk production has improved 14% per unit milk solids since the introduction of the EBI.

EBI in the BMW Region

An analysis of herd performance in the Border, Midlands and Western region was undertaken based on the change in herd EBI between the years 2017 and 2021. Three categories of herds were formed:

- Herds that were categorised average for EBI in 2017 and remained in the average EBI category in 2021 (AVG-->AVG)
- Herds that were in the top 20% for EBI in 2017 and remained in the top 20% on EBI in 2021 (TOP-->TOP)
- Herds that were average for herd EBI in 2017 but moved into the top 20% for EBI in 2021 (AVG-->TOP). Performance metrics of the herds are in Figure 2.

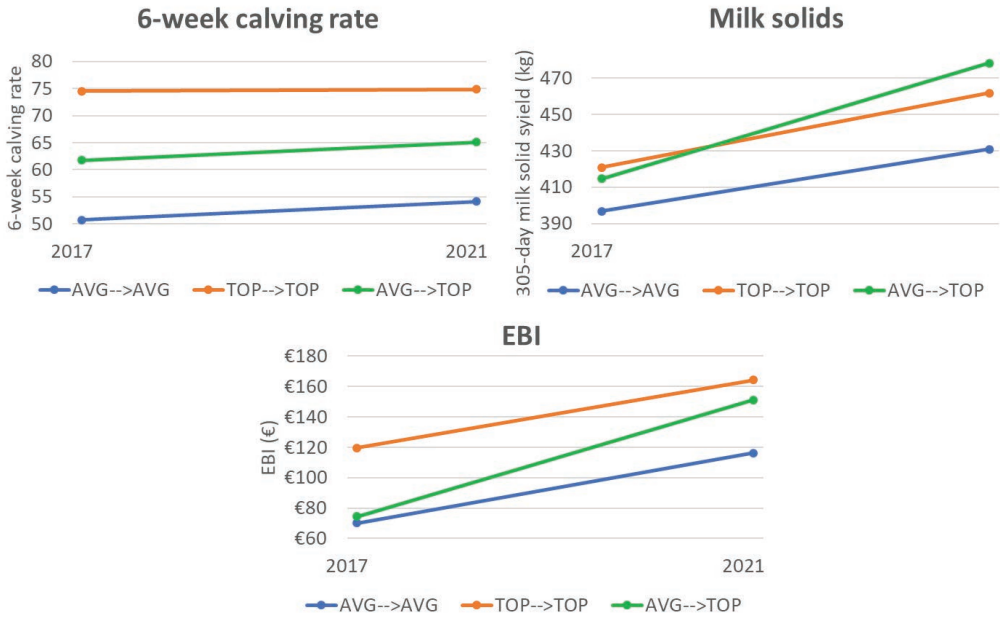

Figure 2. *Change in herd EBI, 305-day milk solids yield and 6-week calving rate for AVG-->AVG, TOP-->TOP and AVG-->TOP farms in the BMW region*

The average EBI of the AVG-->AVG and TOP-->TOP groups increased by €45 between 2017 and 2021 while that of the AVG-->TOP increased by €77. Milk solids per lactation increased by 9% and 10% for the AVG-->AVG and TOP-->TOP groups, respectively while that of the AVG-->TOP increased by 15%. Irrespective, the mean milk solids yield per lactation of the two TOP groups in 2021 was 7% to 11% higher than the AVG group in 2021. The 6-week calving rate of the TOP-->TOP group did not change over the four years albeit it already was achieving 75% (calving interval of 379 days); the 6-week calving rate of the AVG-->TOP group in 2021 was 65% (calving interval of 385 days) while that of the AVG-->AVG group was 54% (calving interval of 401 days). A further analysis was undertaken using e-profit monitor data from 262 farms in the catchment from the year's 2018-2021 relating herd EBI to profit per lactation. Each €1 increase in herd EBI was associated with €1.79 more profit per lactation. This is similar to the response observed for many years across the country as a whole. In other words, due to the increase in herd EBI within the AVG-->TOP herds (increase of €77 over the period 2017-2021) profit per lactation is expected to have increased by €137.80 per lactation. Assuming an average herd size of 89, this difference equates to €12,264 more profit per year.

Conclusion

Many studies have now clearly demonstrated the applicability of EBI in improving herd profit. The present study substantiated this claim even when limited to suppliers in the Ballyhaise catchment area, while also proving the suitability of high EBI genetics on heavier land types.

Benefits of clover incorporation in grazing swards

Deirdre Hennessy[1], Brian McCarthy[1] and James O'Donoghue[2]

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Summary

- Grass-white clover swards can fix 100–250 kg nitrogen/ha per year
- Incorporating white clover in fertilised grass swards can increase herbage and milk production
- Reducing N fertiliser application to grass-white clover swards can increase N use efficiency of the farm system.

Introduction

White clover is the most commonly sown legume species in temperate grassland. White clover grows well in association with grass, is tolerant of grazing and can grow over a fairly wide range of climatic conditions.

Grazing management

Good grazing management is crucial to ensuring that white clover persists. Grazing swards out to 3.5 cm in the first and last rotations will benefit clover persistency. It is important that light penetrates to the base of the sward for clover stolon production. Stolon production is the means by which the clover will be maintained in the sward. In mid-season, target pre-grazing herbage mass should be 1,400-1,600 kg DM/ha and swards should be grazed to 4-4.5 cm post-grazing sward height in an 18-21 day rotation. Weekly farm cover combined with the spring rotation planner, grass wedge and autumn grazing planner tools available in PastureBase Ireland should be used to manage the grass-white clover swards.

Sward clover content

Sward clover content varies across the year. Clover growth is low in spring. Clover needs soil temperature of about 8°C for growth compared to about 5°C for grass. Sward clover content increases from approximately 0-5% in February to a peak of 35-40% in early September and then declines (Figure 1).

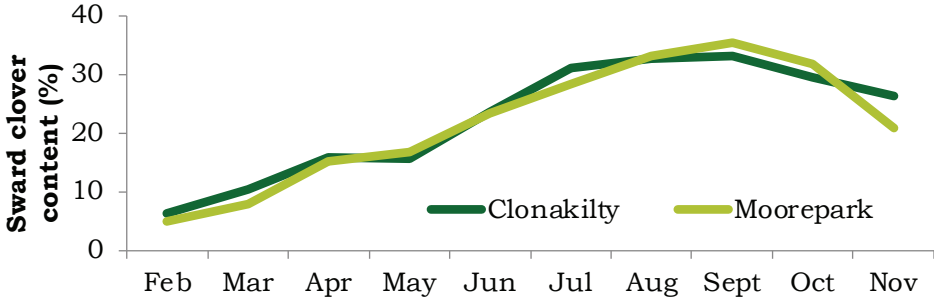

Figure 1. *Annual sward white clover content at Moorepark (eight years) and Clonakilty (four years)*

Benefits of white clover

There are several benefits associated with the use of white clover in grass-based milk production systems.

Nitrogen fixation

White clover can fix nitrogen (N) from the atmosphere and make it available for plant growth. Rhizobia bacteria that live in nodules on the roots of the white clover plant exist in a symbiotic relationship with the clover whereby they fix N making it available for plant growth using energy provided by the clover plant through photosynthesis. Many experiments have been undertaken examining the quantity of N fixed in grass-white clover swards. In frequently grazed swards (8-10 times per year), up to 250 kg N/ha per year can be fixed. The rate of N fixation is influenced by the N fertiliser supply to the sward and the sward clover content. Generally, an average annual sward clover content of at least 20% is required for N fixation. In fertilised swards, as N fertiliser application rate increase, N fixation generally declines (Figure 2).

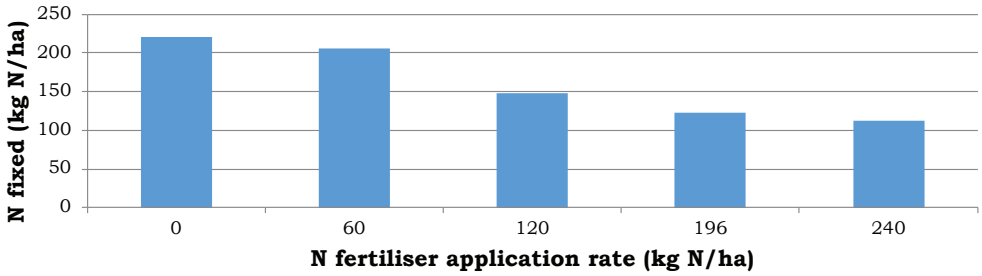

Figure 2. *Nitrogen fixation (kg N/ha) on grass clover swards receiving 0, 60, 120, 196 and 240 kg N fertiliser/ha over three years*

Herbage production

Incorporating white clover into grazed grassland can increase herbage production, particularly at lower N application rates. Research from Clonakilty Agricultural College found that incorporating white clover into intensively managed swards increased annual herbage production by 1.2 t DM/ha, on average, relative to grass only swards (where both sward types received 250 kg N/ha) over a four year period and where sward clover content was 23%. Research at Moorepark shows that grass-white clover swards receiving 150 kg N/ha grew the same quantity of herbage as grass-only swards receiving 250 kg N/ha (13.4 t DM/ha).

Milk production

Grass-white clover swards tend to be higher quality in mid-season compared to grass-only swards as sward clover content increases from May onwards. Clonakilty and Moorepark research both show increases in milk and milk solids production from grass-white clover swards compared to grass-only swards (Table 1).

Table 1. Effect of white clover inclusion on milk and milk solids yield in the Moorepark and Clonakilty grazing experiments

Moorepark Experiment	Grass-only 250 kg N/ha	Grass-clover 250 kg N/ha	Grass-clover 150 kg N/ha
Milk yield (kg/cow)	6,108	6,498	6,466
Milk solid yield (kg/cow)	460	496	493
Clonakilty experiment	**Grass-only 250 kg N/ha**	**Grass-clover 250 kg N/ha**	
Milk yield (kg/cow)	5,222	5,818	
Milk solid yield (kg/cow)	437	485	

Nitrogen use efficiency

Nitrogen use efficiency is hugely important in grazing systems as N is a key nutrient lost from our systems. It is influenced by many factors including N fertiliser application rate, quantity and crude protein content of concentrate fed, and N removed from the system in milk and meat. The N use efficiency of a farm systems experiment undertaken at Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork from 2013-2016 was examined using a farm-gate N balance model. The experiment compared herbage and milk production from a grass-only sward receiving 250 kg N/ha per year (Grass250) and grass-clover swards receiving 150 kg N/ha per year (Clover150). Each treatment was stocked at 2.74 cows/ha. The N inputs were purchased concentrate, fertiliser and replacement animals, and the N outputs were milk and livestock. The N fixed by the clover was not included. The N use efficiency of the systems increased from 37% on Grass250 to 55% on Clover150 due to the reduction in N fertiliser application and the increase in milk production on that treatment.

Long term research at Moorepark

Eight years (2013-2020) of research at Moorepark comparing the standard grass-only grazing system receiving 250 kg fertiliser N/ha with a grass-white clover system receiving 150 kg N/ha have been completed. Both systems were stocked at 2.74 cows/ha. The chemical N fertiliser application for each treatment is shown in Table 2.

Table 2. Nitrogen fertiliser application strategy by rotation on grass-only swards receiving 250 kg N/ha and grass-white clover swards receiving 150 kg N/ha

Date (rotation)	Grass 250	Grass-white clover 150
Mid-late January	28	28
Mid March	28	28
April (2nd rotation)	33	28
Early-May (3rd rotation)	30	9
Late-May (4th rotation)	30	9
June (5th rotation)	17	9
Early-July (6th rotation)	17	9
Late-July (7th rotation)	17	9
August (8th rotation)	17	9
Mid-September	33	12

Herbage production was similar on the two sward types despite the 100 kg/ha reduction in N fertiliser used on the grass-clover swards. Approximately 75 kg DM/cow more silage were fed during lactation to the grass-clover cows, mostly in autumn. Neither system was self-sufficient in terms of herbage production due to the high stocking rate. Milk and milk solids yield were greater on the grass-clover system compared to grass-only. Reduced N fertiliser input and increased milk production contributed to increased net profit in the grass-white clover system compared to the grass-only system (Table 3). Average sward clover content was 22%.

Table 3. Average animal and sward production on grass-only swards receiving 250 kg N/ha and grass-white clover swards receiving 150 kg N/ha from 2013-2020

	Grass-only 250kg N/ha	Grass-white clover 150kg N/ha	Difference
Stocking rate (cows/ha)	2.74	2.74	-
Annual herbage prod. (t DM/ha)	13.5	13.4	-0.1
Silage conserved (t DM/cow)	1.00	0.98	-0.02
Silage fed during lactation (kg DM/cow)	259	333	+74
Average sward clover content (%)	-	22.0	-
Milk yield per cow (kg)	6,068	6,331	+243
Milk solids yield per cow (kg)	490	510	+20
Concentrate fed (kg/cow)	438	438	-
Nitrogen use efficiency (%) (2013-2016)	40	58	+18
Net profit (€/ha) (2013–2016)	1,974	2,082	+108

Conclusions

Incorporating white clover in grassland swards results in a reduction in N fertiliser use and an increase in milk production; farm profitability and N use efficiency.

Acknowledgements

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Education options at Teagasc for careers in dairying

Teri Acheson[1], Emma-Louise Coffey[2] and John Kelly[1]

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Summary

- The continued growth and sustainability of the Irish dairy industry is dependent on highly skilled dairy farmers
- Formal agricultural education is associated with greater farm size, income per hectare and overall farm efficiency compared with those with no formal agricultural education
- The progression through the Level 5 Certificate in Agriculture to the Level 6 Advanced Certificate in Dairy Herd Management and the Level 7 Professional Diploma in Dairy Farm Management (PDDFM) equip the next generation of dairy farmers with the skills and technical knowledge required for success
- There is a huge demand for skilled labour across a number of roles on dairy farms including farm managers, technicians, operatives as well as relief staff. Furthermore, there are an increasing number of progression opportunities such as leasing, partnerships and share farming.

Introduction

The sustainability of the dairy industry, following a decade of significant growth, is heavily reliant on skilled farmers. They require the ability to keep up-to-date with skills and knowledge, adopt new technologies and methods, and manage financials and people as well as day-to-day farm tasks. The progression through the Teagasc programmes (Table 1) equip the next generation of farm owners and managers with the requisite knowledge, skills and experience to secure the long term future of their dairy businesses. Work experience carried out during each level with high quality dairy farmers reinforces learning experiences and offers mentors throughout future farming careers.

Figure 1. *Progression through Teagasc education programmes*

**Green Cert achieved following completion of Level 6 Advanced Certificate in Agriculture*
Certificate in Agriculture - Level 5

This Level 5 programme provides graduates with the knowledge and skills to carry out day-to-day dairy farm tasks assigned from management. Students typically complete 26 weeks in college and 8 weeks of practical learning with a host farmer in Ireland. Course content provides the basic principles of agricultural practices, which includes soils, grassland, breeding and farm safety.

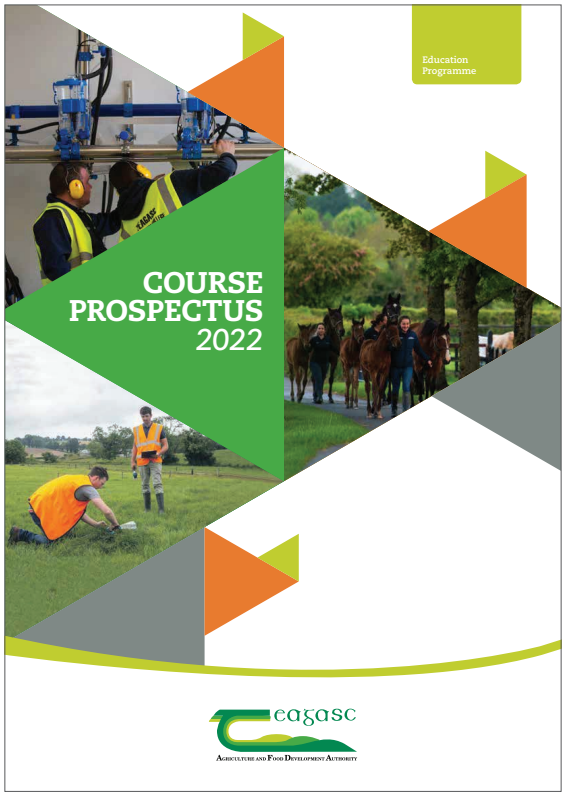
Advanced Certificate in Agriculture - Level 6

Having completed the Level 5 programme, students typically progress to the Advanced Certificate in Dairy Herd Management which consists of 22 weeks college and 16 weeks of practical learning with a host farmer in Ireland or abroad. Course content aims to build on

the basic academic knowledge gained during the Level 5 programme as well as developing new technical expertise in sustainable farming, health, nutrition and farm management practices. This Level 6 programme provides graduates with the knowledge and technical skills required to operate dairy herds as a skilled technician. Progression for students at Ballyhaise Agricultural College following the Level 6 programme includes the Teagasc/ UCD Level 7 Professional Diploma in Dairy Farm Management or the Level 8 Bachelor of Science in Sustainable Agriculture at Dundalk Institute of Technology. Students who successfully complete the level 6 programme obtain the Green Cert.

Professional Diploma in Dairy Farm Management

This Level 7 programme is the gold standard for farm ownership and farm management training. The programme aims to provide enthusiastic farmers with the latest research and best practice management knowledge to successfully run dairy businesses.



The main component of the programme is two years paid professional work experience based on high performing dairy farms in Ireland, with an opportunity to complete a 6-month placement abroad. During this time, there are 20 course days, where students further develop a broad range of skills in technical farming as well as a greater understanding of financial skills and people management. Course days are typically delivered at Teagasc Moorepark. Course days incorporate both formal (lectures) and informal (discussion groups and workshops) training. Guest lectures are invited from key industry stakeholders and highly successful commercial dairy farmers. Students who successfully complete the PDDFM programme have the skills and competencies to successfully manage large-scale dairy farms to a high level.

Continuous training opportunities

Following formal agricultural education, Teagasc offer a wide range of training opportunities for farmers in order to meet future environmental, social and economic sustainability needs of their dairy farms. Such training opportunities include discussion groups, short training courses, workshops, information days and conferences.

Conclusion

The continued buoyancy and profitability of the Irish dairy industry is underpinned by highly skilled farmers. The Teagasc education programmes outlined above provide young farmers with the necessary skills, knowledge and competencies for successful careers in dairy farming.

Greenhouse gas and ammonia emissions from dairy production systems in the Border Midlands Western region

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Summary

- An average dairy system in the Border Midlands Western region has a greenhouse gas intensity of 1.03 kg CO_2-eq per kg fat and protein corrected milk (FPCM), and 9,420 kg CO_2-eq per hectare. The national average is 0.97 kg CO_2-eq per kg FPCM, and 9,628 kg CO_2-eq per hectare
- An average dairy system in the same region was reported to have ammonia (NH_3) intensity of 3.7g NH_3 per kg FPCM, and 33.8g NH_3 per hectare. The national average is 3.6g NH_3 per kg FPCM, and 37.1g NH_3 per hectare
- The industry target system as outlined in the Teagasc Roadmap has GHG and NH_3 intensities of 0.75 kg CO_2-eq per kg FPCM and 2.56g NH_3/kg FPCM, respectively.

Introduction

Under the recent Climate Action Plan, the agriculture sector is required to reduce greenhouse gas (GHG) emissions by 22 to 30% by 2030 based on 2018. The long-term aim is to become climate neutral by 2050, an economy with net-zero greenhouse gas emissions. Ireland also has a national NH_3 emissions reduction target of 5% (2005 vs. 2030) under the National Emissions Ceiling Directive. As the agricultural sector contributed 37.1% and 99.4% of national GHG and NH_3 emissions, it will play a key role in ensuring Ireland meets international obligations. A suite of management practices that can be adopted on dairy farms have been identified to reduce both GHG and NH_3 emissions. This work therefore aims to establish the GHG and NH_3 intensities of an average dairy farm in the border, midlands and western region and to determine the effect of proposed management practices and outline the 2030 industry target.

Model updates and mitigation strategies

Average herd calving and fertility performance was obtained from the Irish Cattle Breeding Federation's (ICBF) annual dairy calving statistics report. National milk production data was obtained from the Central Statistics Office. Data for on-farm management practices were obtained from Teagasc's National Farm Survey. All emissions up to the point in which the product (milk and animals) leaves the farm were accounted. Improving the efficiency of the system by improving soil fertility, incorporating clover into swards, and increasing grass growth and utilisation can reduce reliance on synthetic fertilisers and concentrate feeds. The adoption of low emission technologies includes the substitution of nitrate fertiliser with protected urea, and low emissions slurry spreading. The industry target for 2030 is based on a system achieving all key performance indicators and adopting all technologies as outlined in the Teagasc Dairy Roadmap.

Future carbon footprint

Table 1 outlines the performance indicators, GHG and NH_3 intensities of the average dairy system and industry target system. The GHG intensities of an average dairy system was 1.03 kg CO_2-eq per kg fat and protein corrected milk (FPCM), and 9,420 kg CO_2-eq per hectare in the border, midlands and western region. The NH_3 intensities of an average dairy system was 3.7g NH_3 per kg FPCM, and 33.8 g NH_3 per hectare. Increasing forage production and utilisation through enhancing soil fertility and improving grassland management along

with the incorporation of white clover into swards reduces GHG emissions by efficiently utilising homegrown forage and reducing reliance on synthetic fertilisers and concentrate feeds. The trailing shoe slurry application method places slurry in bands directly onto the soil surface below the grass thus reducing ammonia emissions and increasing the fertiliser value of the slurry. Protected urea emits less nitrous oxide per kg N than nitrate fertilisers while achieving similar forage production, thus reducing GHG emissions. Table 2 reports the individual and combined effect of the above practices on GHG and NH_3 emissions. Achieving industry targets for grassland management and genetics further reduces the GHG and NH_3 intensities per kg milk, however due to the increase in production GHG and NH_3 intensity per ha increase.

Table 1. Performance indicators for average and target dairy systems

	Average	Industry target
Stocking rate (LU/ha)	1.95	2.7
Milk solids production (kg/cow)	422	480
Replacement rate (%)	20	18
Calving rate (% calved in six weeks)	65	90
Fertiliser N (kg N/ha)	185	150
Grazing days(t DM/ha)	250	280
Concentrate intake (kg DM/cow)	1,400	450
LESS spreading (% slurry applied)	35	100
Protected urea (% N applied)	5	100
GHG intensity (kg CO_2-eq/kg FPCM)	1.03	0.75
GHG intensity (kg CO_2-eq per ha)	9,420	10,500
NH_3 intensity (g NH_3/kg FPCM)	3.72	2.56
NH_3 intensity (kg NH_3/ha)	33.83	36.22

Table 2. The effect of management practices on the greenhouse gas and ammonia intensity (per kg FPCM of an average dairy system in the Border Midlands Western region

Reduction strategy	Measures	GHG	NH_3
Protected urea	90% of nitrate fertiliser displaced by protected urea	-6.3%	0%
White clover	Reduce N fertiliser by 25%	-4.0%	-1.6%
Grassland management	Increase forage production and utilisation. Reduce concentrate feeding	-3.4%	-1.0%
Manure management	100% low emission slurry spreading	-1.0%	-7.4%
Combination	All above	-12.9%	-10.4%

Conclusion

There are technologies available for farmers to adopt that can reduce the GHG and NH_3 emissions per unit product and per hectare. Large scale adoption of current technologies need to be adopted on farms. Further reductions in GHG and NH_3 emissions will require investment in new research strategies around methane, nitrogen and carbon sequestration.

Protected urea – maintaining yield, improving sustainability

Áine Murray[1], Brain McCarthy[1], Donal Patton[2] and Patrick Forrestal[3]

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Summary

- Extensive Irish trials show that protected urea delivers on grass yield
- The use of calcium ammonium nitrate (CAN) and urea fertilisers have high greenhouse gas (GHG) and ammonia emissions
- Irish trials show protected urea giving a 71% reduction in N2O loss compared to CAN and a 79% reduction in ammonia loss compared to urea.

Introduction

Protected urea (urea fertiliser protected with the urease inhibitors NBPT, NBPT+NPPT or 2-NPT) is one of the main tool's farmers can utilise to reach GHG emissions reduction targets and improve on-farm sustainability. There has been a growing interest in the use of N stabilisers such as protected urea to reduce ammonia emissions. Nitrogen stabilisers are compounds that prolong the period of time the N component of the fertiliser remains in the urea form by blocking the reaction site on the urea granule.

Does protected urea produce as much grass as CAN?

Cutting and grazing trials conducted by Teagasc over multiple locations during the past eight years have shown that protected urea delivers top yields (Figure 1). There was an overall benefit detected over the 10 site-years from using urea protected with NBPT versus using standard urea. Similar herbage production was observed for CAN and urea + NBPT under grazing conditions, at all sites and providing further evidence of the reliability of urea + NBPT.

Fertiliser grazing plots Ballyhaise (2020/2021)

Fertilizer N rate	250 kg N/ha			150 kg N/ha			SE	N type	N rate
Fertilizer N type	CAN	Urea + NBPT	Urea	CAN	Urea + NBPT	Urea			
Pre-grazing yield (kg DM ha^{-1})	1,568	1,567	1,519	1,317	1,342	1,250	34.5	0.088	<0.001
Herbage production (kg DM ha^{-1})	14,690	14,822	14,184	12,127	12,742	11,320	425.9	0.060	<0.001

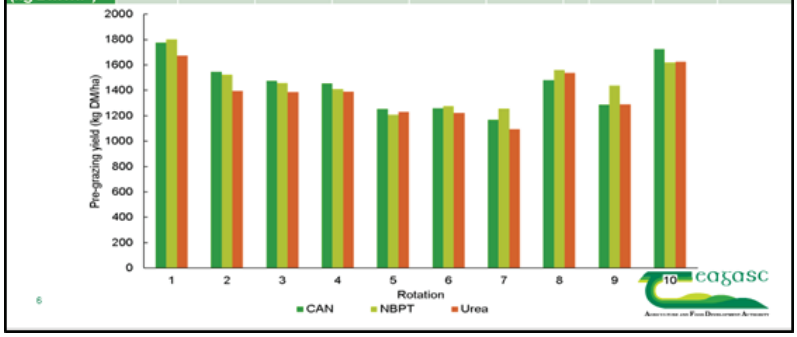

Figure 1. *Performance of protected urea matching CAN in grazing trials at Ballyhaise site*

Does protected urea reduce emissions?

Extensive and published Irish trial work has shown that protected urea can reduce the emissions of the potent greenhouse gas nitrous oxide (N_2O) by 71% compared to CAN (Figure 2). As a result, substituting protected urea for CAN is a key GHG reduction measure of the Teagasc Marginal Abatement Cost Curve (MACC). The MACC provides farmers with a menu of options to reduce Greenhouse Gas Emissions. The Signpost Farmers are implementing and demonstrating the MACC measures. Protected urea is also an effective tool for reducing ammonia-N loss from urea, cutting ammonia loss by 79% in published Irish trial work (Figure 2). For this reason, using protected urea in place of standard urea is a key ammonia loss reduction option on the Teagasc Ammonia MACC. Retaining N lost from urea by volatilisation will contribute to increasing farm Nitrogen Use Efficiency (NUE) over time.

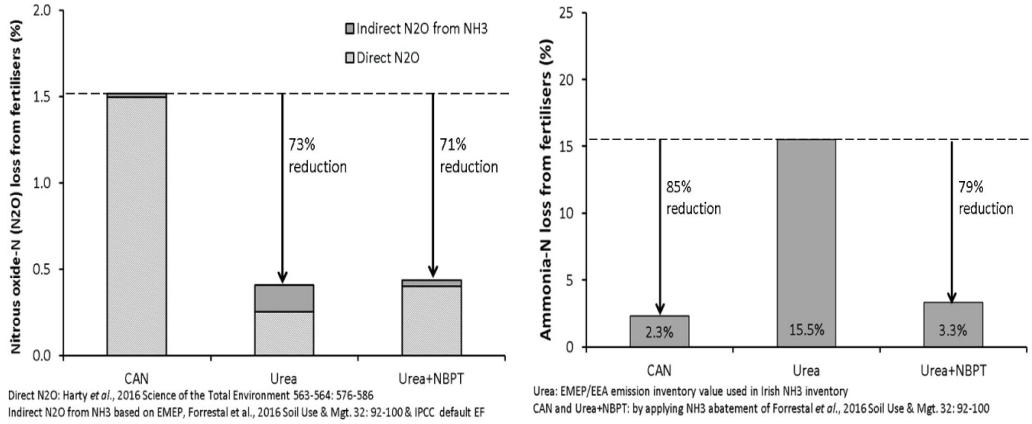

Figure 2. *Reductions in emissions of the greenhouse gas nitrous oxide (N_2O) and of ammonia using protected urea based on published Irish trial work*

Which product should I use?

Products with the urease inhibitors NBPT, NBPT + NPPT or 2-NPT. Currently, 17 products are available from six fertiliser companies:

- Six straight N products (46% N)
- Six N+S products (typically 35-38% N, 5-7.6% S)
- Five N+K+S products (typically 29-30% N, 14-15% K, 2-4% S)

Check out the most up to date list at www.teagasc.ie/crops/soil--soil-fertility/

Conclusion

Protected urea is a relatively easy emission reduction tool, which most farmers can adopt particularly where straight N or N+S slots exist in their fertiliser programme. Adoption of emission reduction technologies demonstrate the willingness of the farming community to be part of the solution for reducing emissions. Such adoption also helps to safeguard Ireland's green credentials as a low carbon footprint producer of top quality food.

Optimising the management of poorly drained soils: Lessons learned from the Heavy Soils Programme

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Summary

- The Heavy Soils Programme was developed to act as a test bed for strategies that could be implemented to improve the efficiency and performance of farms dominated by poorly drained soils
- Farm output in terms of milk solids/Ha has increased by 84% (850-1,565 kg/Ha) since the start of the programme.

Introduction

The initial development of the Heavy Soils Programme was encouraged by a number of factors, namely; a number of years of extreme summer rainfall, particularly 2009 and 2012; an appetite for more detailed research with regard to the management of heavy soils and the impending removal of quota restrictions which would incentivise the need for sustainable use of all resources, including land. Of the 3.18 million Ha of managed grassland nationally, it is estimated that 0.96 million Ha (30%) are imperfectly or poorly drained. Farms on such soils are subject to shorter grazing seasons, due to a need to limit damage to soils/swards, and lower productivity, profitability and resource efficiency than those on free draining soils. The level of volatility associated with such soils will depend on the proportion of such soils on a given farm and weather in a given year. It was decided in 2011 to establish the Heavy Soils Programme to develop a network of farms to act as a test bed for management practices that could be implemented to improve the efficiency and performance of farms dominated by poorly drained soils. The programme comprises 10 farms, representing counties Cavan, Monaghan, Mayo, Limerick, Kerry, Tipperary, Clare and Cork. The objective of the Heavy Soils Programme is to demonstrate methods to sustainably improve grassland productivity and utilization, decrease volatility in these parameters and sustain viable farm enterprises on poorly-drained soils. Initially the major focus areas were land drainage and grassland management. Over time, this has evolved with soil fertility, fodder reserves, and farmyard & grazing infrastructure among other issues, requiring greater consideration as the project developed.

Farm performance and development

Since the beginning of the programme, herd size has increased by 50% from the 2011 level (78-117 cows), with a corresponding increase in milking platform stocking rate from 2.12-3.05 cows/Ha. Output in terms of milk solids/Ha has increased by 84% (850 to 1,565 kg/Ha).

The natural variability of soils is apparent between different regions of the country, and indeed within farm boundaries. A campaign to classify, sample, measure and map soil type and characteristics at a paddock scale across the programme farms was undertaken as part of the Heavy Soils Programme. This survey produced high-resolution soils maps and detailed soil classifications of every soil subgroup on each farm.

Table 1. Average farm output and financial performance							
Year	Milk solids	Gross output		Total cost		Net margin	
	kg/Ha	€/ha	c/L	€/ha	c/L	€/ha	c/L
2011	850	3,236	35.6	1,838	20.3	1,398	15.3
2012	869	3,092	35.4	2,143	24.7	948	10.7
2013	940	3,689	40.0	2,332	25.4	1,357	14.6
2014	935	3,725	39.3	2,134	22.4	1,591	16.9
2015	1,091	3,245	32.0	2,145	21.2	1,100	10.8
2016	1,068	2,865	28.3	1,911	19.7	954	8.6
2017	1,289	4,508	38.4	2,355	20.1	2,153	18.4
2018	1,404	4,530	35.9	2,961	23.3	1,571	12.6
2019	1,338	4,250	35.7	2,676	22.4	1,574	13.3
2020	1,405	4,406	36.2	2,591	21.1	1,815	15.0
2021	1,565	4,761	44.6	2,754	25.8	2,007	18.8

Figure 1. *Soil profiles in heavy soils programme farms in Stradone, Co. Cavan and Kishkeam, Co. Cork*

Annual grass production has shown a steady increase over the period of the programme. HSP productivity and financial performance has been built on investment in land drainage, soil fertility, farm infrastructure and reseeding. These strategies developed through on farm research have facilitated increases in efficiency and scale. These gains have shown that management strategies can be applied which overcome limitations associated with challenging soils. All heavy soils programme information, regular programme updates and links to other resources is available from the dedicated website www.teagasc.ie/heavysoils.

Agricultural Sustainability Support and Advisory Programme (ASSAP)

Noel Meehan[1] and Domhnall Kennedy[2]

[1]ASSAP Manager, Teagasc, Deerpark, Ballinasloe, Co. Galway; [2]ASSAP Advisor, Ballyhaise, Co. Cavan

Summary

- Ireland has been set a target by the E.U. Water Framework Directive of achieving 'Good Status' for all waters
- The River Basin Management Plan for Ireland sets out Irelands plan to achieve good status
- The ASSAP service is available to farmers in 190 Priority Areas for Action (PAA's) and is a key part of helping achieve good status
- The ASSAP is a free and confidential advisory service available to all farmers in a PAA.

Introduction

In Ireland all water policy and management is led by the Water Framework Directive. Under this directive Ireland has been set a target of achieving 'good status' for all waters in Ireland. However, despite a lot of good work over the last 20-30 years, we are falling short in achieving this target and water quality has declined slightly in recent years.

Ireland's response to challenges around water quality is set out under the national river basin management plan. As part of this plan, 190 priority areas for action (PAA) have been identified across the country where water quality improvements need to be made. There are multiple pressures across each of these PAA's including industry, waste water treatment plants and septic tanks, forestry, agriculture and urban pressures.

Implementation of the ASSAP

The Local Authority Waters Programme (LAWPRO) have deployed a catchment assessment team of 60 scientists across the country to assess the PAA's in detail and identify the significant pressures in each PAA. This group communicates the detailed information about the PAA to all of the stakeholders across the local community including agricultural and non-agricultural landowners and businesses.

Where an agricultural pressure is identified, the farmers in the area will receive the offer of a free farm visit from an advisor under the ASSAP programme.

The ASSAP programme is made up of a group of 33 advisors (20 working under Teagasc jointly funded by DHLGH and DAFM and 13 advisors from the dairy processing co-ops. These advisors are available to provide farmers with a free and confidential advisory service that farmers in a PAA can avail of on a voluntary basis.

The advisors will meet the farmer to assess the farm for any potential issues that are having an effect on the water quality in the local stream. In general, an advisor will assess the farmyard, nutrient management practices and general farmland management practices including the use of pesticides etc.

At the end of a visit, the advisor and farmer will agree on where the farmer should focus improvements or actions, if any are required, on his farm. The practical advice will be designed to 'break the pathway' and prevent nutrients and other contaminants from entering water. A written summary of the advice and actions will be provided and a timeframe for completion agreed between them.

Figure 1. *Heavy rainfall leads to overland*

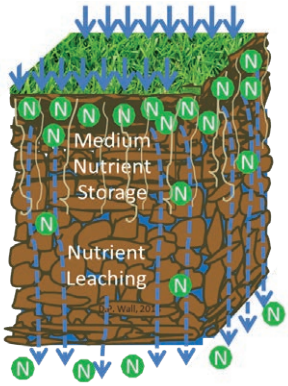

Figure 2. *Nitrogen that is not used up by flow of water, Phosphorus and soil grass/plant growth is available to be particles leached to groundwater/streams during heavy rainfall*

Conclusion

The ASSAP programme is collaborative and the funding and support received from DAFM, DHLGH and the dairy industry has been critical to allow a new approach to enabling local landowners to engage positively in seeking solutions to local problems with the support of a confidential advisory service. Support from the farming organisations for the programme has been very strong and this is vital in communicating and informing farmers about the ASSAP programme and its key messages.

Improving soil fertility on dairy farms

Mark Plunkett[1] and William Byrne[2]

[1]Teagasc, Johnstown Castle, Wexford; [2]Dairy Advisor, Co. Meath

Introduction

Grass production is the main source of animal feed for our livestock systems and here in Ireland we have a great ability to grow grass due to our favourable weather conditions and productive soils. Our soils have good levels of soil organic matter and have a great ability to store and supply major plant nutrients during the growing season. The soil also contains an enormous population of living organisms which are key to the recycling of applied nutrients such as farm yard manure (FYM) and cattle slurry. Maintaining high levels of production is very much dependent on active healthy soils coupled good soil fertility levels. Managing the application of both organic and chemical fertilisers will play a key role in the productivity of soils and producing a quality feed source for our grazing livestock.

Fertiliser planning and balancing soil fertility

Soil analysis is a low cost technology and will provide the basis to nutrient applications. Take soil samples to the correct sampling depth of 10cm, every 2-4 ha and take fresh soil samples every 3-4 years. Comparing new and old soil samples provides a great insight to the soils on your farm and how responsive they are nutrient applications such as lime, P, K & Mg.

Soil pH

Aim to maintain soils in the agronomic range pH 6.3-6.5 for productive rye grass swards and pH 6.5-6.8 for clover dominated swards. For successful clover establishment aim to build soil pH in advance of sowing. Optimum soil pH increases soil nutrient availability and efficiency of applied organic or chemical fertilisers. For example, soils can release up to 80kg N/ha/year.

Soil phosphorus (P)

Aim to maintain soil P at Index 3 (5.1-8.0 mg/l) for optimum productivity. Increasing the soil P Index from 1 to Index 3 will increase grass production capacity by ~1.5t/ha DM/ year. Sufficient P supply is important throughout the growing season for example early P applications are required to drive grass yield in the early part of the season (March / April). Grass P concentration is critical when we reach peak grass growth (P dilution) in grazing paddocks to ensure sufficient herbage P to maintain good animal health and production, for example >0.35% P in grass herbage is required. Building soil P will very much depend on the soil type and the intensity of production across the farm. In general it takes on average 50 kg P/ha (10 to 100kg P/ha) to increase soil P levels by ~ 1 mg/l. To move a full soil P Index it will take on average 150 kg P/ha/year (3 x 50 mg/l). Research clearly indicates that maintaining optimum soil pH 6.3 + is the first step to improving soil P availability and efficiency. Figure 1 below shows the benefits of applying lime to acidic soils and building soil P levels cost effectively.

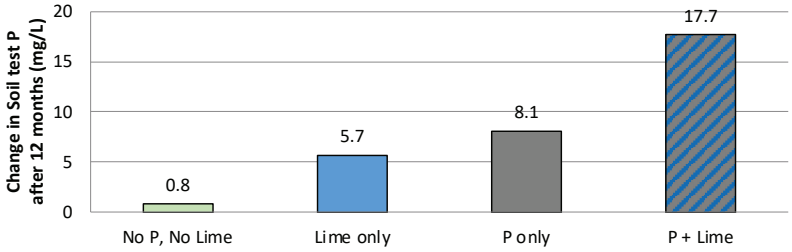

Figure 1. *Average change in soil test P (Morgan's P test) across 16 mineral soils treated with P (100 kg/ha of P), Lime (5 t/ha of lime), and P + Lime and re-tested after 12 months*

Soil potassium (K)

Aim to maintain soil K at Index 3 (101-150 mg/l) for optimum productivity. Increasing the soil K Index from 1 to Index 3 will increase grass production capacity by ~2.0t DM/ha/year. Apply maintenance (Index 3) levels of K in spring time based on stocking rate to reduce risk of grass tetany. Aim to apply build up K rates in the autumn to reduce the risk of luxury uptake of K during the growing season. Recent research from Johnstown Castle indicates that autumn applications of K improve N efficiency compared to either spring or mid-season applications. Maintaining optimum levels of soil K increases the per cent clover in both rye grass and clover swards. Building soil K levels depends on soil type but rates of build-up will be more rapid than phosphorus. For example, it takes ~ 2 to 5kg K/ha to increase soil K levels by 1mg/l.

Building soil fertility

Additional P and K will be required to build soil fertility levels above maintenance rates (Index 3). Standard P and K build up rates at Index 1 and 2 are shown in Table 1 below. Building soil P and K levels takes time (10 years +) with standard rates and will depend on the soil type. Higher P build up rates are permitted under the nitrates directive as shown in table 1 to build soil P more rapidly.

Table 1. Soil P & K build-up rates (kg/ha)[1]

Soil index	Standard P	K	Extra P[2]
1	20	60	**50**
2	10	30	**30**

[1]0.8 x kg/ha = units/ac; [2]Extra P for soil P build-up as per nitrates directive

Increasing nitrogen use efficiency

Optimised soil fertility, leads to increased N use efficiency and opportunities to save fertiliser N on farms. A recent study across 15 intensive dairy farms in Ireland showed that where soil fertility was less than optimum (i.e. Soil pH < 6.3, and P & K < index 3) N fertiliser use efficiency was only 35% on average (Figure. 2). Correcting soil pH alone gave the largest increase in N fertiliser use efficiency (to 53%) followed by optimising soil P and K respectively. Overall, highest levels of N fertiliser use efficiency were achieved in fields with balanced soil fertility (optimum soil pH, P and K) on these grassland farms. Therefore, more frequent soil fertility testing and greater use of nutrient management planning will help to increase nitrogen use efficiency on grassland farms.

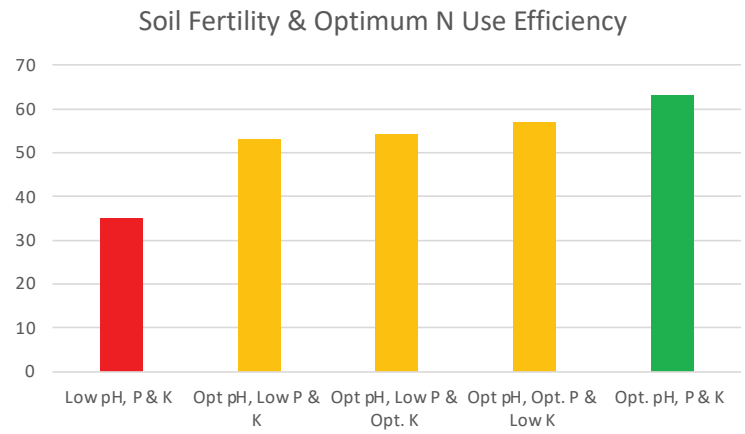

Figure 2. *Percentage nitrogen use efficiency and grass growth response to N fertiliser across grassland fields according to the status of soil pH, phosphorus (P) and potassium (K) fertility*

EveryCalf: contract rearing of dairy-beef calves

Brendan Horan[1], Chloe Millar[1], Alan Twomey[1], Nicky Byrne[2] and Tom Coll[3]

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Summary

- Contract rearing agreements provide an excellent opportunity for both dairy and contract rearing farmers
- The Everycalf project aims to evaluate the potential for profitable dairy calf-to-beef systems in collaboration with commercial rearing farmers
- The results demonstrate the potential of high-quality pasture management on commercial farms to deliver high levels of animal performance in dairy calf-to-beef systems
- Results from the initial slaughter data indicate the significant impact of both sire and dam genetic merit on carcass characteristics within pasture-based dairy-beef production systems.

Introduction

Increased cow numbers on dairy farms coupled with increased adoption of improved breeding technologies (Economic Breeding Index; synchronised breeding programmes, sexed semen, etc.) have resulted in consistent improvements in the six-week calving rates on Irish dairy farms in recent years resulting in large numbers of additional male calves being born each spring (Figure 1).

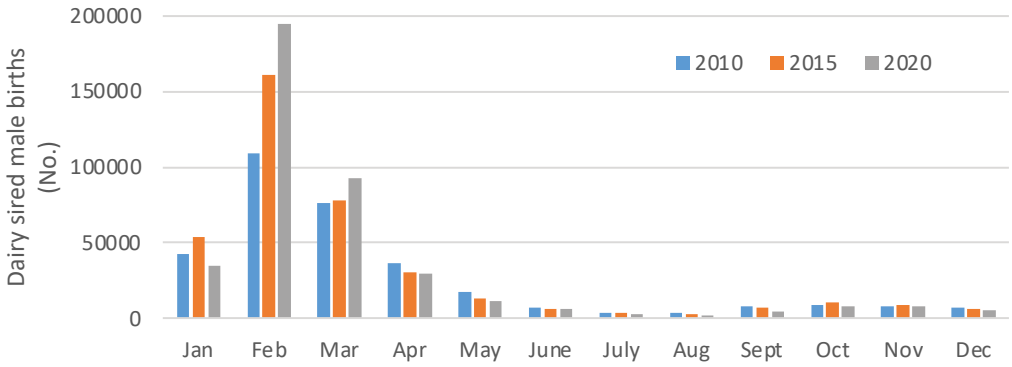

Figure 1. *Male dairy sired calf births by month (AIMS, various years)*

While this trend has substantial benefits for the productivity of dairy farms (increased lactation length and improved pasture utilisation), it has nonetheless, created additional pressures in managing the peak calving period in terms of increased numbers of young calves, availability of skilled seasonal labour and the adequacy of calf rearing facilities on dairy farms. A substantial increase in both the number and proportion of male dairy sired calves born during early-spring has been an additional consequence of the increased seasonality of dairy calvings. Consequently, there has been a significant increase in the number of male dairy calves which are reared to beef on existing dairy farms, in addition to increased farm-to-farm movements of unweaned calves (<6 weeks old). In response to the changing dynamics of dairy calf-to-beef systems, Teagasc has recently developed a project looking at the biological performance of male dairy and dairy-beef calves in partnership with commercial rearing farms. The objective of the Everycalf project is to evaluate the potential for profitable dairy calf-to-beef systems in collaboration with

commercial dairy and rearing farmers. In the programme, Teagasc and 10 drystock farmers have entered a collaborative arrangement where the drystock farmers contract rear all of the male progeny from five Teagasc dairy research farms (Moorepark, Kilworth, Curtins, Clonakilty and Ballyhaise) each year. The 'rearers' were selected as Teagasc clients who are members of Teagasc discussion groups and who have demonstrated their capacity to achieve target weights as existing heifer contract rearers. Teagasc retain full ownership and risk associated with the potential market value of the animal at the end of the rearing period, while the rearers are paid a daily rate subject to the achievement of target animal weight gain during the contract. The calves are contract reared from three weeks of age to 14 months of age (mid-April of the subsequent year) or 330 kg live weight (LW) on the 10 rearing farms. Thereafter, the animals are moved to a 'grazier' and finishing unit for slaughter under 24 months of age. In addition to the rearing of animals via commercial rearing agreements, the project is unique as all male animals generated within the source herds comprising of various breeds are included in the study. All animals are weighed every six weeks by Teagasc during the programme to monitor animal performance. The project is anticipated to run for four years (2020 to 2023 inclusive). A complete financial analysis will be undertaken and published at the end of the rearing period to evaluate the potential of the project to increase the value gained from male progeny from the dairy herd. As part of the programme, the calf rearers are provided with substantial advisory back up and advice and the programme is based on a pre-agreed protocol and contract rearing agreement.

Results to-date

In total, 422, 374 and 260 dairy calves were enrolled in the project in 2020, 2021 and 2022, respectively. All animals were transported in accordance with Department of Agriculture, Food and the Marine Guidelines for the transport of live animals (DAFM, 2007) and were monitored closely prior to transport to ensure they were achieving adequate LW gain in the weeks prior to movement. Overall mortality rates have been kept below the target level of 3% during the initial two years of the project. Over the initial two years of the project the breed composition of the calves born during 2020 and 2021 was 60% dairy (with equal parts Holstein-Friesian (HF), Holstein-Friesian crossbred (FRX) and Jersey Holstein-Friesian cross (JFX)) and 40% beef cross (primarily Aberdeen Angus (AAX) but also including Limousin (LMX), Hereford (HEX), Charolais (CHX), Belgian Blue (BBX) and Aubrac (AUX)) from dairy dams. The proportion of beef crossbred calves increased from 34% in 2020 to 46% and 41% during 2021 and 2022, respectively, due to increased daily use of sexed semen on all research farms. The mean carcass weight breeding value (BV) of the calves born over the initial two years of the project was -5 kg based on a maternal population with an average Economic Breeding Index of €190 and a Beef sub-index of -€15 (equivalent to an average mature LW of 575 kg).

The mean birth weight of the calves was 37 kg in both years, and they were moved on average at 30 days of age (and 54 kg LW) to the rearing farms in both years. All calves were weaned at 63 days of age when eating in excess of 1 kg of concentrate per day. During the first grazing season, mean daily live weight gain (ADG) of all calves was 0.80 kg during 2020 and 0.70 kg during 2021 on a predominantly pasture-only diet (Figure 2).

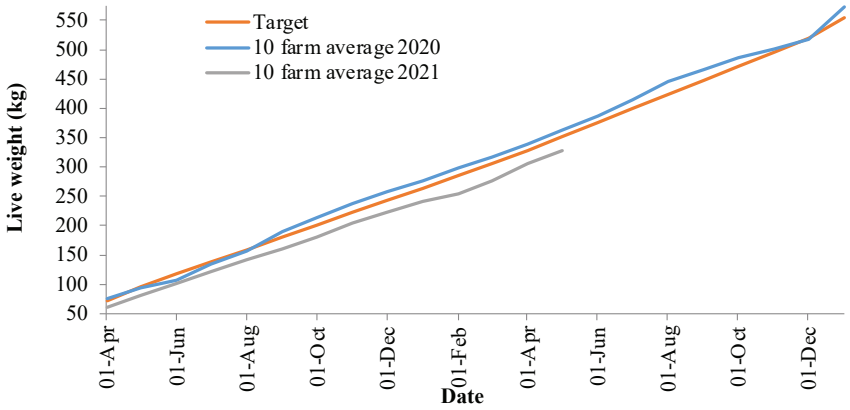

Figure 2. *Mean live weight (kg) of dairy-beef cattle during the initial two years*

Over the entire measurement period from birth-to-14 months of age, the ADG for the entire group of 2020-born calves was 0.74 kg (exceeded the target of 0.7 kg) and the 2021-born animals was 0.68 kg. Thereafter, the 2020-born animals achieved an ADG of 0.83 kg during the second grazing season and reached an average LW of 486 kg at the beginning of the finishing period in October 2021. Over their entire lifetime, the 2020 born calves achieved an ADG of 0.75 kg from birth-to-slaughter. Mean slaughter weight was 573 kg at 23 months of age resulting in a mean carcass weight of 293 kg at a fat score of 3= and conformation score of O- and a carcass value of €1,278 for all breeds.

Both sire and dam genetic merit for carcass weight (Figure 3) and breed (Table 1) had had a significant impact on both carcass weight (Figure 3) and carcass quality (conformation and fat score) with each additional 5 kg increase in genetic merit for carcase weight corresponding to 6 and 7.5 kg of additional carcass weight for a 24 month steer at slaughter for the dam and sire, respectively.

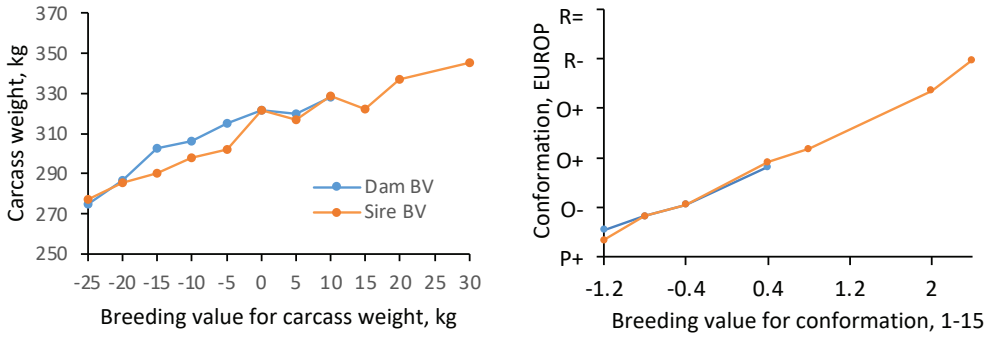

Figure 3. *Association between carcass performance of progeny with the breeding value (BV) for carcass traits for sires and dam. Reference animal was a steer slaughtered at 24 months of age*

Table 1. Carcass performance of progeny from each of the sire breeds					
Sire breed	Number of progeny	Carcass weight, kg[1]	Conformation score, 1-15 (EUROP) [1]	Fat score, 1-15 (EUROP)[1]	Age at slaughter, d[1]
AA	89	304	5.5 (O+)	7.8 (3=)	673
BB	8	347	7.1 (R-)	6.6 (3-)	692
CH	7	341	6.5 (R-)	7.5 (3=)	695
HF	200	299	4.0 (O-)	7.2 (3-)	713
HE	20	301	5.0 (O=)	7.8 (3=)	678
JE	60	273	3.4 (P+)	7.1 (3-)	714
LM	17	332	6.8 (R-)	7.4 (3-)	686

AA = Aberdeen Angus; BB = Belgian Blue; CH = Charolais; HF = Holstein-Friesian; HE = Hereford, JE = Jersey; LM = Limousin

In addition to the LW performance of the animals, the project also affords the opportunity to closely monitor physical and financial characteristics of dairy calf-to-beef production systems on commercial farms. While not all rearers are measuring pasture on farm, on average 13.2 t DM/ha per annum were grown on rearing farms during 2020. During the initial rearing period (28 days to 14 months of age), silage requirements were 0.65 (+/- 0.2) t DM per head in 2020 on the rearing farms due to the extended 'winter' indoor period (175 days) during 2021. In addition, 250 kg concentrate were fed to calves up to 14 months of age during the 2020 season (equivalent to €70 per head) while veterinary costs were equivalent to €59 per animal. Total variable costs during 2020 ranged from €0.81 to €1.07 per day with fixed costs of €0.25 per day. Finally, average net margin from the rearing contract was €0.20 to €0.44 per animal per day during the rearing phase in year one to remunerate the rearers for their own labour and land. Farms where greater net margins were realised achieved increased ADG by 14 months of age, over an extended grazing season to minimise both concentrate and silage supplementation costs.

Preliminary conclusions

The objective of the Everycalf project is to evaluate the potential for profitable dairy calf-to-beef systems in collaboration with commercial rearing farmers. In so doing, the ambition of the programme is to optimise male dairy calf performance and welfare and enhance the profitability of dairy-beef rearing systems on Irish farms. The preliminary results from the project are indicative of the potential of high-quality pasture management on commercial farms to deliver excellent animal performance in dairy calf-to-beef systems and provide a strong basis for the development of such operations into the future.

Acknowledgements

The authors wish to acknowledge the essential contribution of the 10 rearers to the project.

Bovine TB in dairy herds: Taking action to reduce the risk of a breakdown

Eoin Ryan, Philip Breslin and Rosanne Greene
Department of Agriculture, Food and the Marine

Summary

- Levels of bovine TB have been increasing since 2016
- Dairy herds accounted for 34% of all TB breakdowns in 2021
- There are several practical actions that farmers can take to reduce the likelihood of a TB breakdown
- Stakeholders working together through the TB Forum can help to reduce disease levels through new policies.

Introduction

Levels of bovine TB have been rising since 2016. Dairy herds accounted for 34% of breakdowns in 2021, an increase of 3% over 2020. In 2021, 59% of reactors were in dairy herds, an increase of 4% over 2020.

In June 2022, 4.3% of herds had a breakdown in the preceding 12 months, with 22,231 reactors in that period.

In Cavan and Monaghan the equivalent figures were 4.33%/562 reactors and 5.38%/825 reactors respectively.

These figures highlight the need for urgent action by all stakeholders.

Actions which can reduce TB risk in dairy herds

Individual dairy farmers can protect their cattle from TB by taking steps to address the risk factors for a breakdown.

- Consider culling older animals, particularly those that were alive during a previous breakdown. The risk is that some may have undetected TB infections which can re-start a breakdown
- Source cattle from herds which have not had a TB breakdown in recent years and buy cattle with a recent test date
- Maintain a closed herd if possible. Cattle exposed to TB recently may have undetected infections and bring the disease into your herd
- Animals that previously tested inconclusive and subsequently tested clear are at a higher risk of being infected with TB and spreading disease within your herd. These cattle should be culled no later than the end of their current production cycle
- Look for badger setts and activity on your farm
    - » Notify the Department of any setts you find using the new badger app available to download at www.bovinetb.ie
    - » Take steps to reduce badger to cattle contact on your farm by securing sheds/feed stores, raising troughs and fencing off setts and latrines
    - » Do not feed concentrates on the ground as badgers can spread saliva in that area while finishing any leftovers, exposing cattle if they then feed off that area again
- When selecting bulls for breeding choose ones that are genetically more resistant to TB by using the ICBF traffic light system, this can reduce the number of exposed cattle which become infected, if your herd does subsequently experience a TB breakdown

- Ensure good quality testing facilities are available and provide your vet with any assistance required. Each animal must be identified and have its skin thickness measured on both days of the test. If TB is present but is missed, it will spread further within your herd
- Cleanse and disinfect shared machinery and areas where bTB infected cattle were kept, as the TB bacteria can survive in the environment and cause new infections
- Maintain good hygiene practices even when your herd is not in a breakdown including regular cleaning and disinfection of feed and water troughs and facilities where cattle are gathered and handled
- Ensure boundary fences are well maintained and avoid mixing groups of cattle which are normally managed separately
- If you engage in contract rearing, ask the rearer to take steps to reduce TB risk and have a contingency plan for a TB breakdown in either herd.

Consultation

In 2021 a new Bovine TB Eradication Strategy 2021-2030 was launched, based on recommendations from the Bovine TB Stakeholder Forum.

Membership of the Forum and its working groups are drawn from stakeholders across the agricultural industry including the farm organisations and the Department.

One of the policies introduced as part of the strategy is the blood testing of inconclusive reactors. To-date, circa 62% of the animals blood tested have tested positive. The removal of these infected animals prevents them spreading disease further and shows the value of the collaborative approach taken as part of the TB Forum process.

Challenge

Being free of TB remains critical, from a farm family profitability and sustainability perspective and from a trade perspective. Every TB restriction represents a significant emotional and financial challenge to the farm family concerned.

Working together, we can reduce TB levels, protect cattle from infection, prevent the stress caused by TB on farm families, and mitigate the threat TB poses to our exports.

See www.bovinetb.ie for videos, advice leaflets, maps and information on how to protect your herd from TB.

Farm succession and inheritance planning

James McDonnell

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Summary

- Farm Succession and Inheritance are subjects for every farm family
- Planning for succession is one of the most important aspects in the life of the farm business
- Planning for and carrying out succession can be a complex process. It needs to be given time at an early stage in the business cycle to ensure that the process is successful
- Open communication within the family is one of the most important factors contributing to a successful succession and inheritance process
- Use all the available supports.

Introduction

The subject "Transferring the family farm" is one that every farm family should plan for during the life of the farm. People in general do not like to talk about succession and inheritance. It is a sensitive subject as farmers may feel it marks the end of their farming career. If the goal is for the farm business to continue functioning (well) beyond the tenure of the current owner/operator, then talking about and planning for succession is vitally important to ensure a smooth transition and viable future. It is important to understand that within farm transfer, there are two processes: succession and inheritance.

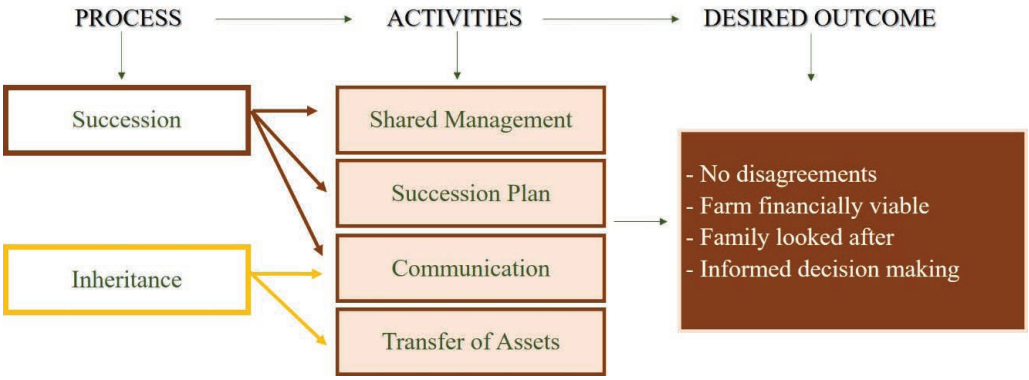
- Succession is defined as the gradual transfer of management of the farm from one generation to the next
- Inheritance is defined as the legal transfer of the farm assets from one generation to the next.

Planning for both these processes in an open, collaborative way is critical to avoid extreme conflict and breakdown within the family unit.

Succession planning

Succession is very important for the farm business, but it can be difficult and complex. The farmer and spouse are faced with trying to maintain a viable farm business for the next generation, treat all of their children fairly (not necessarily equally) and provide financial security for their own retirement. Fortunately, succession also incentivises the next generation to expand or change the farm in order to generate sufficient income for additional family members, and it provides the necessary resources, labour and skills to carry the plan through.

It is important to note that succession is not a single event but a process which occurs over a period of time. Planning early for succession allows for a lot of the main issues to be addressed and resolved before transition starts. The goal in involving all family members in planning is to build consensus over the plan and proposed outcomes for the farm. A key starting point to this is establishing the needs, expectations and fears of all family members with regard to the farm business.



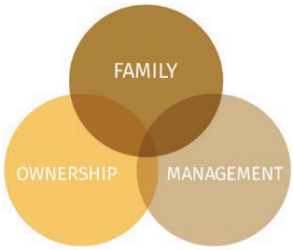
Communication

Effective communication is the key ingredient to successful succession planning. It allows for family members to share concerns, decide on options available and what actions to take. It also allows for effective planning and helps prevent disputes, misunderstandings and unnecessary anger.

Typically, when it comes to discussions around succession and inheritance, farmers are "passive" communicators. This means that there are a lot of assumptions around who is getting the farm and the plans for the future, but these are not always explicitly communicated to the people involved.

When communicating on succession and inheritance, it is important to discuss and clarify the three key aspects of how family, ownership and management will play out, overlap and change over time/at different points in the future. When planning any discussion on succession, the following should be considered:

- Who should be involved in the discussion?
- What needs to be discussed?
- When and where to meet?
- What life stage are the children at?



Conclusions

Communication is the key to effective succession planning. It is important to have the discussion early and with all family members. This should help prevent disagreements and ensure that all family members have had the opportunity to discuss their needs, fears and requirements as what how the farm business will continue. For further information, log onto the farm succession page on www.teagasc.ie at the following link https://www.teagasc.ie/rural-economy/farm-management/succession--inheritance/ or open the camera on your smartphone and scan the QR code.

A farm succession case study – The Hannon family

Laura and David Hannon

Derrypatrick, Navan, County Meath

Summary

- A farm partnership should have clearly laid out roles that are meaningful and enhance the overall farm business
- In recent times, more farm transfers are taking place during the owners lifetimes.

Introduction

In Ireland, farms have typically been passed on to the next generation at the point of a family bereavement. In recent times, social changes have resulted in more transfers taking place during the owners lifetime. There are 135,000 farms currently in Ireland (CSO 2020) with an average farm size of 33Ha. The age profile in Irish farming is a challenge with 32% of farm holders over the age of 65 and just 7% currently less than 35 years old. In many cases, parents are not ready to retire but the successor is reaching the age of 35 or needs the security of a career to deal with their stage of life. There are many concerns in this area such as family farm income, security for parents and other family members. Currently, only 46% of farm holders have a succession plan in place.

On the Hannon Farm at Derrypatrick, County Meath, farm succession has always been high on the agenda. There are now three generations with a real interest in the farm. While Joe and Camilla Hannon are retired, they look on with great satisfaction at their son and grand-daughter now running the farm.

Three generations of Hannon's – Joe, Laura and David

Farm performance and development

The Hannon Farm have a succession plan in the form of a partnership. Laura has now joined her father David and mother Catherine in running the farm. In 1975, Joe and Camilla Hannon established a dairy Herd of 40 cows with a six unit parlour at Derrypatrick. Whilst being new entrants, the Hannon's quickly established an attention to detail, a strong focus on grassland management and always carefully selecting the genetics for the herd. In 1987,

David returned home to farm alongside his father Joe after completing a B.Agr Sc degree. He then took over full management of the 80 cow herd in 1995. David steadily increased herd size by buying and leasing adjoining land blocks, The farm has now expanded to 345 cows with new buildings and shed conversions used to accommodate this expansion while a keen focus has remained on grass production and improving the genetic merit of the herd during the entire period.

The latest expansion coincided with Laura returning home to the farm in May 2019. The farm staff team consists of David, Laura, Stephen Myles (8 years at Hannon's) and Daithi Marron who is on a yearlong student placement. The farm has recently leased a 53ha block, for heifer rearing and silage production. Some of the 2021 farm performance figures are presented in Table 1 below.

Table 1. Farm characteristics on the Hannon Dairy Farm

Farm physical		Herd performance (2021)	
Farm stocking rate (Lu/Ha)	2.52	Protein %	3.69
Milking platform stocking rate (LU/ha)	3.51	Fat %	4.68
Grass grown (full farm; t DM/ha)	14.5	SCC	95
Cows	345	Milk solids (kg/cow)	523
Herd EBI (€)	176	Meal (t fwt./cow)	0.9

Laura graduated from DCU in 2017 with a B.Sc in general nursing. From 2017 to 2019, she worked in the operating theatre in Beaumont hospital. She left nursing in May 2019 to go full-time farming. She completed the distance learning Green Cert in Navan in 2020. When asked about this change of career, Laura replies ''I loved my job as a theatre nurse but was getting tired of living in Dublin and working indoors, I enjoy farming more." Laura always had an interest in the farm and helped out during her time in school and college.

The partnership works based on clear division of work and responsibilities. Now however she is working in partnership with her parents running a busy dairy farm. So how does this work? Firstly, there is a divide on the overall farm responsibilities. Laura looks after the grassland management and takes the key decisions involved with David as a good spring board to advise. She also takes care of the newborn calves to get them up and going and completes the calf registration work. She takes care of the milking rosters and the cows for auto drafting. She also manages the 45ha rearing block and the rearing of the heifers. David looks after bull selection and day-to-day repair work, troubleshooting and arranging farm payments. Most of the day-to-day decisions are taken over breakfast each morning. There is also a very clear procedure for everyone to follow around sound milking practices. The decisions around reseeding and new buildings are taken together. David is a member of the Grange and Navan discussion groups while Laura is a founding member of the Royal Tara Discussion group. With her discussion group and her father's farming experience as back up, Laura will assume more responsibility in the coming years.

Incorporating white clover into my grazing swards

Ger Pardy
Dairy Farmer, Killaun, Birr Co. Offaly.

Summary

- The positives from incorporating white clover into my milking platform have certainly outweighed the negatives
- After initially chasing the extra animal performance benefits, in recent times, both the savings in chemical N inputs plus the reduced environmental impact have reinforced my decision to go the clover route.

Farm background

Together with my wife Margaret, we milk 280 crossbred cows in Killaun, outside Birr, Co. Offaly. This year we are farming 147 ha, of which, 82 ha is milking platform (MP). Less than a quarter of the total area farmed is owned. We use our outblocks to make all our silage requirements, plus rear 77 replacement LUs. Our whole farm stocking rate is 2.50LU/Ha, while the MP stocking rate is 3.5 cows/ha. We have a high EBI herd, delivering in excess of 500kgs MS/cow to our Co-Op annually, feeding in the region of 700-800kgs of concentrate/cow. We try to get the most we can from grazed grass, growing approx. 14 t DM/ha on the MP in 2021.

What was the motivation for clover?

A discussion group trip to Clonakilty Agricultural College in 2014 was the first time I began to seriously consider clover for my farm. That day we learned about the increased animal performance from white clover. Teagasc trial work showed an extra 30 kgs of MS/cow/annum could be achieved by grazing grass/white clover swards. My original motivation to start to introduce clover onto my farm had nothing to do with the environment or the savings that could be made from reduced chemical N fertiliser. I saw clover as purely a way to increase the level of milk solids we were producing.

How far down the road am I with clover

This past spring, Teagasc Moorepark identified that 45% of my milking platform had clover (>5%). The average clover % in these clover swards was 16%, ranging from a minimum of 8% to a maximum of 40%. In 2021, I made an effort to cut back on chemical Nitrogen on my clover paddocks. Last year, these swards got only 10 units N/acre after each grazing during the summer months and ended up getting approx. 65 units of chemical N/acre in total for the year. Our non-clover swards would have got their full nitrates allowance of close to 200 units/acre.

The less fertiliser N we used on the clover swards, the more the clover kicked in. This spring we found that the high clover swards with reduced chemical N performed every bit as well as the regular chemical N paddocks. We saw no difference in grass growth and had no swards pale or yellow in colour. These paddocks would have got nitrogen in the form of slurry applied using the trailing shoe.

What has worked well?

Some farmers have found oversowing to be 'hit and miss', but we have found it to work very well on our farm. Our preferred month for oversowing is April, we are at the end of the first round and swards are grazed out very tightly and are more open. This gives the new clover plant a great chance to establish. Also, we have practically the full grazing season ahead to manage the new clover sward. Good soil fertility is also something I credit with helping us successfully establish clover. We are lucky to have soils that are naturally

high in pH. After years of investment in soil fertility, nearly all our MP is now Index 4 for both P & K. We have also been very fortunate down through the years in that we have had no issues with bloat. This, I put down to having some level of clover in all paddocks, using a 12 hour grazing wire plus holding cows back after milking, so that they all enter a high clover paddock together.

Things that I have got wrong

Full reseeding is often advocated as the easiest method of incorporating clover into your farm. In the early years of trying to introduce clover, I found this method most problematic. This was down to my subsequent grass management. I didn't have the knowledge I have now, I allowed grass covers get too strong, 'crowding out' the new clover plant. I have learned from this and my target now is to graze reseeds at a cover of approx. 700-800kg/ha. This problem can also arise with oversowing, especially if too much ground is oversown together, making it close to impossible to graze it all at the targeted lower covers.

The future for clover on my farm

Our ambition now is to increase the clover area further on our cow grazing area. We are aiming to have at least 90% of this area with a significant amount of clover by the end of 2025. This spring, we have oversown 25 acres with 2kgs/acre of a medium leaf mix, with another 15 acres fully reseeded with 2kgs of clover/acre included in the grass mix. We also plan to further tweak the amount of chemical N being used on the high clover swards. Clover is a lazy plant and in order to make it work you need to take away the chemical Nitrogen. Our longer term ambition is to replicate some of the results being achieved at Teagasc Solohead, Tipperary, where there is an ongoing trial with clover paddocks receiving zero chemical Nitrogen input.

Figure 1. *Paddock on Ger Pardy's farm with 40% white clover content on 6th April, 2022*

Breeding for a better herd

Killian Brennan
Kilcogy Upper, Co. Cavan

Summary

- From 2017 to 2021, herd EBI has increased from €93 to €163
- Milk solids have increased by 49 kg per cow or an additional €249 per cow in additional milk sales
- Butterfat and protein contents have increased by 0.40% and 0.16%, respectively.

Introduction

Together with my wife Madeline and our three children, we milk 120 spring calving High EBI cows in Kilcogy Upper, Co. Cavan. We are farming 56 ha, of which 34 ha is milking platform (MP). Our MP stocking rate is 3.50 LU/ha leaving a whole farm stocking rate of 2.20LU/Ha. As our replacement heifers are contract reared our out-blocks are used to produce our silage requirement before being grazed in October / November with the returning incalf heifers. Our focus is on growing and utilising as much grass as possible. We completed over 40 grass walks and grew approx. 15t DM/ha on the MP in 2021. The herd is a mixture of both high EBI black and white and jersey crossbred cows.

Herd genetics 2017-2021

Historically the herd breeding decisions were often outsourced with my only real concern being that we had cows with "plenty of milk". With this policy around breeding in place up until 2017, the herd produced 424 kg MS/cow at 3.87% butterfat and 3.37% protein on approximately 1,000kg of meal. These annual constituents delivered a milk price less than that of base price for the months of April, May and June. The calving interval for the same year stood at 381 days. From 2017, the decision was made that I would select bulls through the ICBF sire advice tool based on the milk and fertility sub-index with a keen focus on combined fat & protein rather than kg's of milk, though I continued to breed from all the cows within the herd something I would do differently today.

In 2019, the opportunity to lease 15 hectares adjacent to the MP came about. With this in mind, a business plan was developed for the farm, which was to see cow numbers increase from 70-120 cows over a two-year period. A key element within this plan was to improve the genetic merit of the herd through improved breeding and with the purchase of High EBI stock. The decision was made in 2019 to use some Jersey genetics along with High EBI black and white bulls to improve the milk solids potential of my own calves. Furthermore, in 2019, we selected 10 heifer calves and 25 incalf heifers to purchase based on their EBI figures. This ensured the herds EBI jumped from €133-€149 in one year (Figure 1) which is double that of the national average yearly gain. In the autumn of 2020, a further 18 incalf heifers were purchased and along with my own heifers coming into the herd meant we calved down 120 cows in the spring of 2021. The herd had a six-week calving rate of 81% and a calving interval of 371 days. We saw a dramatic increase in the herds milk performance in 2021 where the cows produced 473kg MS at 4.28% butterfat and 3.53% protein on approximately 800 kg of meal. This is an increase of 49 kg MS/cow on 2017 levels or an additional €249 per cow in additional milk sales. Milk butterfat and protein increased over the same period by 0.40% and 0.16%, respectively.

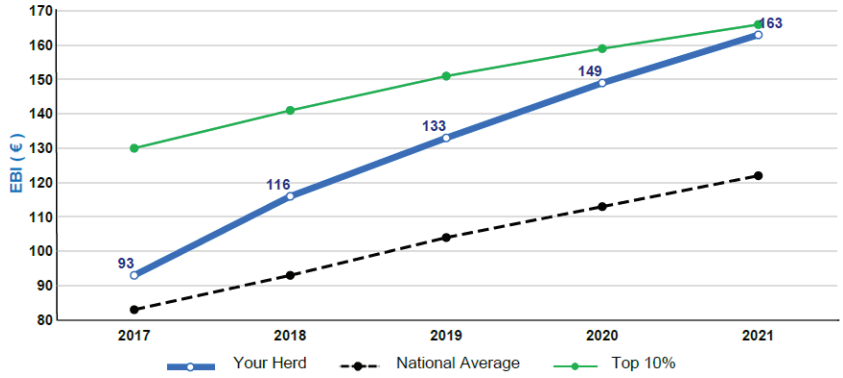


Figure 1. *Herd EBI Gains 2017-2021*

2022 breeding plan

After successfully trialling a small amount of sexed semen in 2021 the decision was made to breed the best cows in the herd to sexed semen this year. Therefore, the best young cows were identified using both EBI and milk recording records to get sexed semen (50 straws) in the first 3 weeks of breeding. The bull team (Figure 2) was selected based on their milk and fertility sub-index being >€100, > 30kgs combined fat and protein and >0.30 and >0.20 for butterfat and protein potential respectively. Any cows not selected for dairy AI received a high Dairy Beef Index (DBI) straw from the start of the breeding season. As the heifers are contract reared they received conventional dairy straws for the first three weeks with high DBI Angus straws being used on any repeats.

The following is the output of Sire Advice program for your herd.

		EBI Sub Index							PTA's							
	EBI(€)	Milk (€)	Fert (€)	Calv (€)	Beef (€)	Maint (€)	Mmgt (€)	Hlth (€)	M Kg	F Kg	P Kg	F+P Kg	F %	P %	CI days	SU %
All Cows in Herd	167	60	64	37	-19	19	3	3	31	9.6	7.3	17.0	0.14	0.11	-3.2	1.9
Predicted 2023 Calves	232	88	93	41	-20	21	5	5	-45	14.7	9.1	23.8	0.29	0.19	-4.5	3.0
Bulls Weighted Averages	297	116	122	46	-21	22	6	6	-121	19.8	10.9	30.6	0.44	0.27	-5.7	4.1

Figure 2. *Overview of 2022 bull team*

Future herd objectives

Over the coming seasons, the target is to produce 500kg MS/cow while maintaining concentrate inputs. This shall be achieved through the continued use of High EBI genetics, targeted breeding with sexed semen and through the use of genomic testing of our replacement females.

The Signpost Programme

Siobhán Kavanagh[1] and Seamus Kearney[2]

[1]Teagasc, Crops Research Centre, Oak Park, Carlow; [2]Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- The Signpost programme will provide leadership to farmers as we move towards more sustainable farming systems
- Ambitious targets have been set for dairy farmers to reduce gaseous emissions in areas including fertiliser use, soil fertility, pasture utilisation, slurry management, replacement rate, protein content of concentrate feeds as well as biodiversity, water quality and profitability.

Introduction

The Signpost Programme (Figure 1) is a partnership of almost 60 companies and organisations from across the Irish agricultural sector working with farmers to reduce greenhouse (GHG) emissions, improve water quality and enhance biodiversity. There are 54 Dairy Signpost Farms as part of the Programme.

- The primary objective is to reduce GHG emissions on Signpost Farms, in line with the Climate Action Plan and to reduce emissions on all farms by 2030.
- The Signpost Programme will take a holistic view of sustainability, encompassing economic, social and environmental sustainability.
- Signpost Farmers will be central to the programme and will point the way forward for all farmers. Steven Fitzgerald, Teagasc Glanbia Signpost Farmer said "*Farmers look over the ditch to the next door neighbour's farm all the time. So it's my turn for people to look over our ditch (as a Signpost Farmer). Where we can, we have always trusted science, trusted research and brought it home. It has worked for us and has got us to where we are today*".
- The Signpost Programme will be delivered by Teagasc and industry advisors. The education of the next generation of farmers as well as training of all farmers will be important in the programme.

Figure 1. *A Schematic of the Signpost Programme*

While the solution for each farm will be somewhat different (and will be tailored to suit the individual farmer and his/her farm), we expect that the dairy Signpost Farmers will be striving to achieve the type of targets listed in Table 1. Teagasc Advisers will work with and support the Signpost Farmers as they change how they farm.

Table 1. Indicative Key Indicators of Success (KIS) for Dairy Signpost Farms

Area 1	Target
GHG Emissions	0.70 kg CO^2 Eq. per kg milk solids produced
Pasture productivity & stocking rate	• Identify and reseed unproductive swards – target an increase of 2 tDM/ha utilised over five years • Stock the farm appropriately: < 250 kg org. N/ Ha (whole farm)
Reduced fertiliser use	• Reduce chemical N fertiliser usage by 10% over five years • Increase sward clover content to 20% over five years • Spread at least 50% of chemical N as protected urea and all slurry using LESS
Optimum soil fertility	• 90% of soils to have optimum soil fertility status • Adhere to NMP to correct soil deficiencies
Adequate slurry storage	• 16, 20, 22 weeks slurry storage to be available for all livestock, depending on location. • No spreading during closed period
Replacement rate	• Target 18-20% for stable herd • Target five lactations herd average lactation number • Increase EBI by €10 per year
Concentrate CP %	• Reduce concentrate CP% to 14% (main grazing season)
Biodiversity	• Target 10% of high value biodiverse area per farm • Increase quantity and quality of biodiversity on the farm
Costs & returns	• Reduce costs/save money • Target net profit > €800 per cow or > €2,000 per ha

Conclusion

The Signpost Programme is a first step in the target towards net zero greenhouse gas emissions by 2050 and there will be further policy changes, regulations and incentivisation towards achieving that target. Teagasc and the partners will work with the Signpost Farmers to reduce their environmental footprint, while also improving both the profitability of their farming businesses.

Where are you on the 12 Steps to reduce Gaseous Emissions on YOUR FARM?

	Action needed
12. Incorporate clover	Incorporating **5 kg/ha** (**2 kg/ac**) will replace up to **100 kg/ha** (**80 units/ac**) of chemical N/year
11. Finish cattle earlier	Use Dairy Beef Index (DBI) to produce earlier finishing cattle
10. Reduce age at first calving	Calf heifers at **22** to **26** months and aim for **20%** replacement rate
9. Increase milk solids/cow	Milk record, cull poor cows and aim for **305** day lactation
8. Improve dairy herd quality	Use high EBI bulls and increase herd EBI by >**€10**/year.
7. Improve animal health	Use sexed semen to accelerate genetic gain
6. Better grassland management	Create a herd health plan
5. Reduce chemical N by 10kg/ha	Weekly farm walk, measure grass and extend grazing season
4. Use 100% LESS	Apply lime, incorporate clover and make best use of slurry / FYM
3. Build or maintain soil fertility	Apply slurry in spring / early summer using Low Emission Slurry Spreading Technology (LESS)
2. Apply lime	Continue to use P & K fertilisers such as **18:6:12**
1. Use protected urea	Identify fields low in pH using soil analysis
	Apply protected urea instead of CAN/straight urea

Notes

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