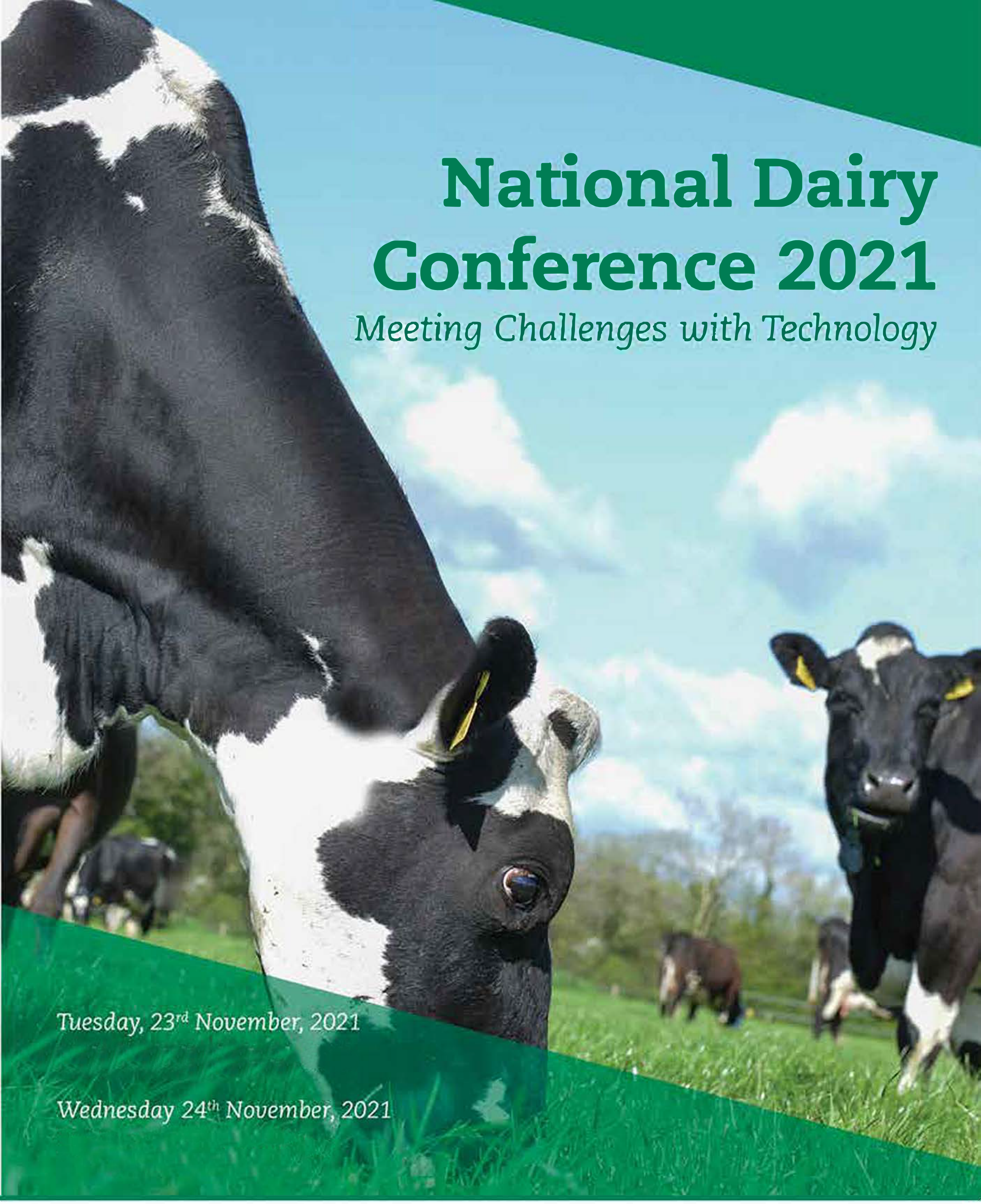

National Dairy Conference 2021

Meeting Challenges with Technology

Tuesday, 23rd November, 2021

Wednesday 24th November, 2021

Teagasc

Agriculture and Food Development Authority

National Dairy Conference 2021

'Meeting Challenges with Technology'

Tuesday 23rd November and Wednesday 24th November

Agriculture and Food Development Authority

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Foreword

On behalf of the organising committee, I would like to welcome you to the Teagasc Dairy Conference 2021- 'Meeting Challenges with Technology'. It is great to be able to hold this year's conference in person having had to hold last year's virtually. This allows attendees the opportunity to meet colleagues and acquaintances, and to debate the issues of the day in full. We also acknowledge that not everyone with an interest in the conference programme may be in a position to travel to Cork or Athlone, therefore, content of the sessions will be available on the Teagasc website following the event.

The year 2021 has been a mixed one for dairy farmers on the whole. Broadly, it has been positive in relation to both weather conditions and milk price, however, there have been plenty of stressors to contend with in relation to ongoing risks and concerns around Covid-19, proposed changes to environmental regulations, the increased focus on dairy farming's position in the climate debate, and of course a sharp rise in farm input prices.

Teagasc advisory and research staff are keenly aware of the potential implications of these factors for farm practices and profitability. There is also a recognition that while debates may continue at policy level, dairy farmers must also get on with the tasks of producing high quality milk, managing stock and growing quality forage. Our conference programme has been developed with this in mind and we hope that you find an appropriate balance of content around the important issues.

Finally, we would like to thank in particular our four dairy farmer guest speakers – Colm, Philip, Ger and Kevin- who have kindly agreed to share their experiences around the issues of dairy cow breeding and clover establishment on their farms. Their implementation of technologies provides a compelling example of what excellent management can achieve in 'real-world' conditions.

Where next for the EBI traits

Donagh Berry[1] and Siobhan Ring[2]

[1]Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Cork; [2]Irish Cattle Breeding Federation, Bandon, Co. Cork

Summary

- Higher EBI cows are more profitable across a range of different production systems as well as boasting a lower environmental footprint
- Possible improvements to the EBI are constantly discussed in light of likely future economic and policy changes
- Improvements include
    - New traits for consideration in the EBI or updating the relative emphasis on the already existing traits
    - Improvements in trait definition or underlying genetic evaluations for traits.

Introduction

The EBI celebrates its twentieth year in existence this year. Irrespective of whether analyses are based on animal or herd level data from the ICBF or Teagasc eProfit Monitor, respectively, the evidence is quite clear that the EBI delivers more profitable animals; this is further substantiated by evidence from research studies at both Teagasc and UCD again demonstrating the robustness of EBI in delivering profit across a range of contrasting production systems. The modern high EBI cow is also 14% more carbon efficient per kg milk solids than the pre-EBI cow as well as being more efficient at utilising nitrogen. Nonetheless, since its introduction in 2001, the EBI has evolved both in the traits included in the index, but also their relative emphasis (Figure 1). For any further trait to be considered in the EBI it must fulfil three criteria:

- The trait must be economically, socially or environmentally important
- Genetic differences among animals must exist for the trait
- Individual animal information must exist on the trait itself or a correlated trait (for example, live-weight as an indicator of feed intake).

Key characteristics of the Irish dairy cow of the future include

- production of a large quantity of high-value, nutritious output (i.e., milk and meat),
- good reproductive performance,
- favourable health status,
- good longevity,
- no requirement for a large quantity of feed, yet being able to meet requirements from predominantly grazed grass (i.e., feed efficient),
- easy to manage (i.e. easy calving, docile),
- good conformation (reflective of health, reproductive performance and longevity),
- low environmental footprint, and
- resilient to external perturbations.

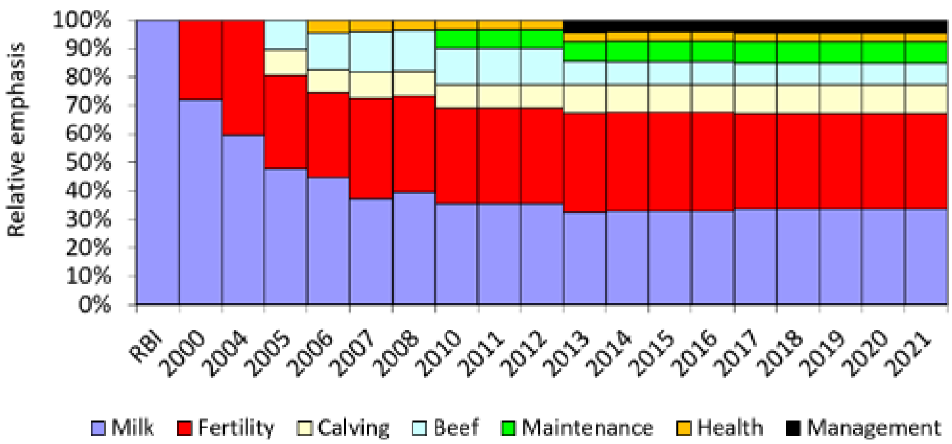

Figure 1. *Relative emphasis on different sub-indexes within the EBI as it evolved over the last 20 years since the Relative Breeding Index (RBI)*

New traits

Suites of traits of likely importance in future include:

- **Environmental efficiency** – both carbon emissions and nitrogen use efficiency
- **Feed efficiency** – ability to convert grazed pasture into products of high nutritive value
- **Milk-related traits** – lactation persistency and more granular measures of milk quality like caseins and milk processability characteristics
- **Beef-related traits** – age at slaughter and meat eating quality
- **Health** – a greater number of traits evaluated.

Improvements in current traits

Fertility remains a critical factor governing both economic and environmental efficiency. Calving interval as a trait in the EBI has contributed to rapid improvements in the mean reproductive performance of the Irish dairy herd. Nonetheless, recent research has demonstrated a need for more precise definitions of reproductive performance to achieve further gains, especially in high fertility herds. Research is well progressed in the development of a new fertility genetic evaluation which will improve the accuracy of the genetic evaluations and accelerate genetic gain.

As we strive to increase the number of lactations per cow, animal health is going to become more important. This is not surprising as health is generally more of an issue in elderly individuals. The extent of the contribution of differences in genetics to animal health status is much the same as exists for fertility. Therefore, breeding has a huge role to play in improving the health status of the national herd. A lack of health data, however, both in the quantity of data but also the range of traits recorded, hinders genetic gain. Advances in technological devices including sensors but also data capture systems has the potential to address this shortcoming.

Complementary tools

The success of EBI is conditional on adoption rate. A sire advice tool is available in the ICBF Herdplus for farmers where matings are allocated between the specified AI sires and the females in the herd; the tool maximises EBI while minimising the level of inbreeding in the resulting progeny; it also attempts to generate less extreme progeny for either milk or fertility.

Breeding involves identifying the genetically elite animals in a population and mating them (with due consideration of inbreeding); shifting the average of a population in a certain direction. Another way to shift the average of a population is to cull the least-performing animals. The ICBF generates a COW index for each female to reflect their expected remaining lifetime performance; this is used to identify cows for culling. It is complementary to the EBI and is updated as the EBI updates.

Sexed semen use on dairy farms

Stephen Butler and Stephen Moore
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Cork

Summary

- In November 2021, Sexing Technologies established a semen-sorting lab located at Moorepark, with the service available to all Irish AI companies
- Using sexed dairy semen in tandem with more conventional beef semen can transform the calf crop on dairy farms.

Why use sexed semen?

Increasing the dam-side selection pressure by breeding replacement females from only genetically superior heifers and cows in the herd could accelerate herd genetic gain by up to 15%. This also means there is scope to have a corresponding increase in beef semen usage (to produce crossbred beef calf offspring). For example, a typical herd using conventional dairy semen for the first half of the breeding season followed by beef semen or natural service beef bulls for the remainder of the breeding season could expect a calf crop with 27% female dairy calves, 27% male dairy calves and 46% beef cross calves. This is consistent with the current national statistics for calf birth registrations in Ireland. By using sexed semen instead of conventional dairy semen to generate replacement heifers and using more beef semen for all other mating events, the calf crop could be readily changed to 27% female dairy calves, 3% male dairy calves and 70% beef cross calves. In the long term, this altered calf crop is a more sustainable option for the dairy industry, markedly reducing the number of male dairy calves.

International trends

Internationally, the usage of sexed semen has steadily increased during the last decade, especially in systems with year-round calving. A survey of 3,200 US dairy farms (700,000 cows) reported reduced usage of conventional Holstein semen, replaced by parallel increases in both sexed Holstein semen and beef semen. Even more striking, a recent survey of UK breeding companies indicated that for the first time farmers are buying more sexed dairy semen than conventional semen. In 12 months to March 2020, sales of sexed semen in the UK made up 51.3% of all dairy semen sales, up from 31.9% the previous year, and only 17.9% in 2017. These rapid increases in the usage of both sexed dairy semen and conventional beef semen is likely due a combination of improving pregnancy rates with sexed semen, and greater scrutiny and monitoring of the welfare and fate of dairy breed bull calves.

Maximising fertility

Maximising conception rate with sexed semen requires careful animal selection, appropriate timing of AI, and attention to detail regarding straw handling.

Bull selection

It is not possible to predict which bulls will have good field fertility and which bulls will have poor field fertility after the sorting process. To mitigate the risk, use sexed semen from a large team of bulls (≥5).

Dam selection

Sexed semen use must be targeted towards the dams with the expected best fertility to maximise the likelihood of conception.

- *Heifers*
  - Have achieved the target live-weight for breed and BCS ≥3.25.
  - Regularly cycling.
- *Cows*
  - Parity 1-4.
  - >50 days in milk on day of AI.
  - BCS ≥3.00.
  - Regularly cycling.
  - Free of postpartum disorders and uterine disease.

Timing of AI

When heifers/cows are being inseminated with sexed semen after observed heat, AI should be conducted 14-20 h after heat onset.

Fixed time AI is costly, but facilitates sexed semen usage on the best dams, and can be scheduled to be completed on the farm mating start date. This advances submission, and mitigates the risk of poor conception rates.

Straw Handling

- Organise sexed straws into one goblet on the tank, and minimize the frequency that the goblet is lifted.
- Change water in the thawing unit daily. Clean the thawing unit weekly.
- Check that the temperature in the thawing unit is 35-37 °C.
- Thaw a maximum of two sexed semen straws at a time.
- Using a timer, thaw the straws for 45 seconds.
- Load straws into pre-warmed AI guns.
- Keep AI guns warm after loading straws, and ensure that inseminations are promptly completed (<5 minutes after loading).
- Deposit semen in the uterine body.

Beefing up your efforts

Nicky Byrne and Donall Fahy
Teagasc, Animal & Grassland Research and Innovation Centre, Grange, Dunsany, Co. Meath

Summary

- High merit beef sires can help maximise the benefits of key reproductive technologies such as sexed semen
- A well devised and implemented health plan is key to maximise the potential of the entire calf crop
- A combined effort to improve calf quality and health will support higher performance allowing earlier age at slaughter, furthering the sustainability of grass-based dairy and beef systems.

Introduction

Dairy bred progeny account for 57% of the cattle processed in Irish meat plants. While the numbers of dairy-beef animals has increased in recent years due to the expansion of the dairy herd, there has been a decrease in carcass conformation score and weight. Grass-based dairy and dairy-beef systems have similar production principles, focused on maximising product value and output/ha, through the optimisation of animal genetics, health and grassland nutrition. Suboptimum performance across these key areas is partially responsible for the high attrition rate in the number of farmers rearing dairy calves.

Dairy farmers can contribute to improved dairy-beef performance by maximising the genetic and health potential of calves and their positive contribution to both beef and dairy sectors. In return for this effort, dairy farmers will have a more 'saleable' non-replacing calf crop, securing repeat custom over time and departure of calves off farm earlier in the spring, reducing pressure on housing and labour.

Use of beef sires

Improved reproductive efficiency of the dairy herd creates an opportunity to increase the use of high beef merit sires from the start of the breeding season. Dairy-beef enterprises favour earlier born calves due to their higher level of performance driven by their ability to better utilise grazed grass over the first grazing season. However, these earlier born calves are generally low carcass merit dairy males. Fertile herds using sexed semen to generate replacements from elite cows can replace low carcass merit dairy males with beef X dairy calves, however, high beef merit sires must be used to realise the full value of sexed semen. Although beef sires offer many efficiencies, much variation exists in their suitability for use on the dairy herd and their carcass traits. The Dairy Beef Index (DBI) is a valuable tool to identify individual sires for use on the dairy herd, which will maintain calving performance (gestation length, calving difficulty and mortality), while offering greater terminal efficiency to finishers. Purchasers of dairy-beef calves will and should focus on the beef sub-index of the sires DBI, ensuring this contributes to 50% of the overall index, as this combines traits of greatest economic importance to their system, such as carcass weight, conformation and fat, and feed intake. Importantly the DBI is an across breed evaluation, identifying the best individuals, and as a result, a greater range of breeds will be used on the dairy herd from earlier in the season, ultimately reducing the seasonality in supply of beef from the dairy herd.

Calf health

Calf health status explains much of the variation in lifetime performance and profit potential. As the availability of dairy-beef calves increases, rearer's will become more selective in the herds and individual calves purchased into dairy-beef systems. Specialist calf rearer's are focused on reducing the number of herds that they purchase calves from, selecting herds with a well devised and implemented herd health plan and proven calf performance. Preference is given to herds who vaccinate cows against infectious scours and implement strict colostrum management across the entire calf crop, ensuring sufficient quantity of high quality colostrum is given within the first two hours of life and up until they are transitioned on to a milk replacer/whole milk diet. This will ensure calves immunity is optimised and that they grow to their potential to maximise body weight when sold off-farm. Weight for age and body condition are important factors for calf purchasers, typically calves are traded off-farm at 21 days of age and should weigh in excess of 50 kg. From this point the objective of the rearing process is to transition the calf from pre-ruminant to ruminant by increasing the solid feed intake. The health of each calf should be assessed, only purchasing those who have/are:

- A dry navel, free from swelling or discharge
- No discharge from eyes or nose
- No temperature or laboured breathing
- Bright and alert
- Free from scour
- Well hydrated, displaying elasticity of the skin.

Practical implications

Dairy farmers have the opportunity to add value to the non-replacing calf crop from conception through to departure off-farm by enhancing their genetic and health potential. This added value shouldn't solely be seen as an opportunity for higher calf prices, but one to futureproof dairy and beef systems in terms of financial, environmental and social sustainability. High beef merit and healthy dairy-beef calves have the best ability to meet growth and carcass targets at reduced ages of slaughter within a grass-based production system. This will play an important role in achieving Irish agriculture's Green House Gas emissions reduction targets. Dairy farmers should pay close attention to the beef merit index when choosing high DBI bulls.

Kildalton Discussion Group

Philip Donohoe, Chairman

Introduction

The Kildalton Discussion Group has 18 dairy farmer members. They're mostly from Kilkenny, Tipperary, Waterford and Wexford and the group has been in operation for over 20 years. Group members have almost 5,000 dairy cows and run spring-calving, relatively low input systems of grass based milk production at a farm stocking rate of 2.5 livestock units per hectare.

Genetic trends

The current EBI of the dairy stock on the 'average' member's farm is presented in Figure 1

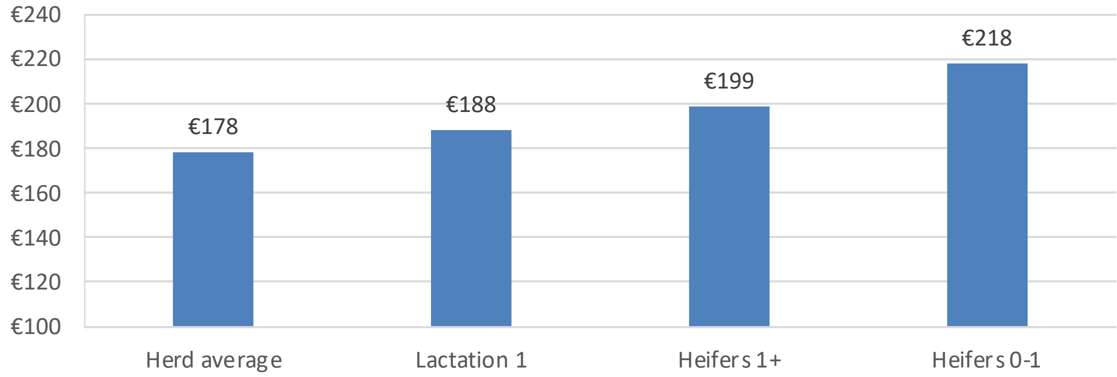

Figure 1. *Average EBI of the dairy cows, first calved heifers, breeding heifers and heifer calves on Kildalton discussion group members' farms*

Our herd EBI includes a milk sub index of €51 and a fertility sub index of €86, and is €47 higher than the national average. With higher EBI young stock we're going to keep increasing the genetic merit of our herds in the years ahead. To get an idea of the genetic progress being made in Figure 2, we compare the EBI of heifers entering the herd over the past decade.

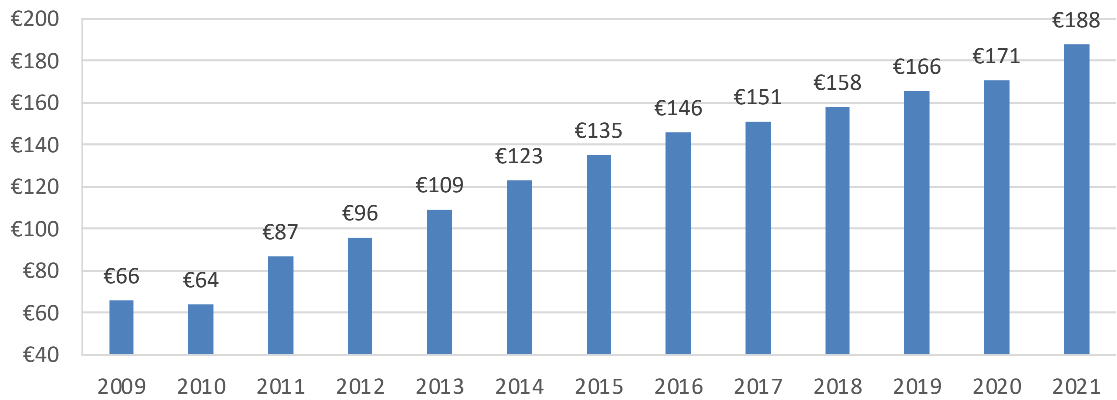

Figure 2. *Average EBI of the first calved heifers entering the Kildalton Discussion Group herds since 2009*

The graph in Figure 2 shows that the EBI of every generation of heifers entering the herd since 2009 is on average €10 greater than the previous one and indicates that group members have been using high EBI bulls for more than a decade. Such improvement in EBI over the years is great, but the trends in milk production and fertility are the real payback for the years of genetic improvement.

Milk production and fertility trends

The data in Table 1 shows the change we have seen over the past decade in terms of milk production, milk composition and herd fertility performance.

Table 1. Change in average milk solids production, milk composition and fertility performance of the Kildalton group members' farms between 2010 and 2020 and its economic value

	2020	Change	Value	Value per cow	Value to group
Milk solids sold (kg/cow)	474	+115	€4/kg	€460/cow	€2.3m
Fat (%) / Protein (%)	4.83 / 3.81	+0.44 / +0.31	3.0c/l/1% / 7.2c/l/1%	3.6 c/litre	-
6-week calving rate[1] (%)	85	+16	€8.22/1%	€132/cow	€650,000
Calving interval[1] (days)	370	-11	€3.86/day	€42/cow	€210,000

The data in Table 1 shows that using a value of €4 per kg milk solids (the equivalent of approximately 30 c/litre), the increase in milk solids yield per cow of 115 kg is valued at €460 per cow in 2020. Certainly part of the increase in milk solids yield per cow can be attributed to milk quota removal, but some of it is due to improvements in genetics for milk production, milk composition and fertility. Milk fat and protein content has increased by a total of 0.75% over the decade which represents an increase in the value of every litre of milk sold of at least 3.6 c/litre at a base price of 30 c/litre. We have also seen substantial improvements in herd fertility. The 16% improvement in 6-week calving rate and the 11-day reduction in calving interval are valued at €132 and €42 per cow, respectively. This fertility improvement is an important contributor to the increase in milk yield. When we reviewed the trends in meal feeding by group members (see Table 2), there has not been an increase in the quantity of meal fed per cow. Instead, we have seen a substantial increase in grass utilisation as we have focused a lot on increasing soil fertility, grazing management and reseeding over the past decade. Grassland management improvements and genetics are responsible for the increase in milk solids yield per cow.

Table 2. Trends in milk yield, purchased feeds and forage, farm stocking rate (LU/ha) and grass used (t DM/ha) for various years between 2010 and 2020 for the Kildalton group members' farms

	2010	2014	2017	2020
Milk solids sold (kg/cow)	359	358	434	475
Meal fed (kg/cow)	804	429	726	772
Purchased forage (kg DM/cow)	241	70	123	102
Stocking rate (LU/ha)	2.39	2.37	2.64	2.59
Grass used (T DM/ha)	8.9	10.2	11.6	11.8

Looking to the future

The group identifies three areas for improvement in the years ahead. Firstly with the environment issue facing us all, breeding for greater milk production and fertility have taken on a new relevance. We need to breed cows that are both productive and retain the ability to quickly and easily go back in calf to minimise replacement rate and the number of replacement heifers we have to rear.

Secondly, with greater awareness of and a need to reduce antibiotic use, genetic improvement of cow health has become increasingly important. So we all need to step up and record incidences of lameness and mastitis as they occur within our own herds.

Thirdly, a big challenge for specialised spring calving herds is the ability to sell calves quickly and easily after they are born. Reducing the use of dairy AI by using more sexed semen is an approach that an increasing number of the group members will adopt next breeding season. We particularly welcome the opening of the lab in Moorepark for 2022. Finally, we all need to adopt the DBI to breed quality beef breed calves from the dairy herd.

1 *Fertility metrics based on the 2012-2021 period.*

Reducing energy costs on dairy farms

John Upton
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Cork

Summary

- Benchmark your farms energy costs against other farms. The average cost of electricity usage on Irish dairy farms is €5 per 1,000 litres milk produced
- Check your electricity unit cost against the best unit rates using a cost comparison website
- Solar Photo-Voltaic panels can reduce farm CO_2 emissions and deliver a short payback period.

Introduction

The average cost of electricity usage on Irish dairy farms is €5 per 1,000 litres of milk produced. There is a large variation in that figure, from €2.50 to €9.00 per 1,000 litres produced, or from €15-€50 per cow per year. The main drivers of energy consumption on dairy farms are milk cooling (31%), the milking machine (20%) and water heating (23%). A more detailed breakdown of energy consumption is illustrated in Figure 1.

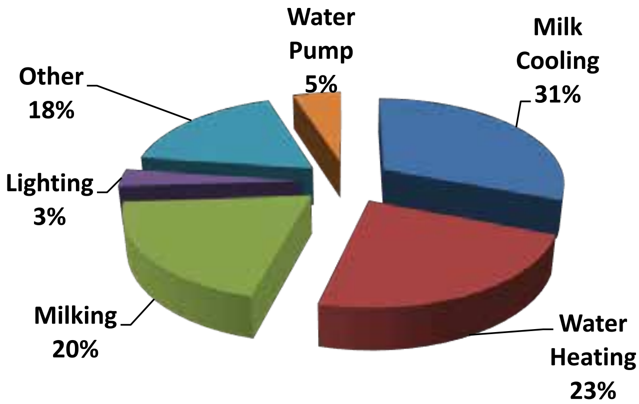

Figure 1. *Average electricity component consumption on 60 commercial dairy farms*

How to calculate your energy costs

A simple calculation can be made to approximate your on-farm electricity costs. Firstly, add up the total electricity charges over a year excluding standing charges, VAT and PSO levy; these figures can be found on the electricity bill. Next, add up the total number of litres of milk sold to the processor over the same period. Dividing the electricity cost in Euro by the number litres will give the cost in Euro per litre, multiply by 1,000 to get costs per 1,000 litres. The average three-bedroom house in Ireland uses approximately 5,000 units of electricity per year. This can be deducted to account for domestic usage if the dwelling house is on the same meter as the farm.

How to reduce your energy costs

The first place to start to reduce energy costs is to utilise night rate electricity wherever possible (especially for water heating and morning milking), because it is roughly half the price per unit compared with day rate electricity (~€0.09 per unit vs ~€0.19 per unit). Next use a cost comparison website (e.g. www.bonkers.ie) to check if you are paying over the odds on your unit rates. Once this is in order, evaluate the possibility of using more energy efficient technologies such a plate coolers, heat recovery units and variable speed drives.

The benefit of these technologies on your farm can be evaluated very quickly using the Dairy Energy Decision Support tool (DEDST). It is available to use for free via an online platform at: https://messo.cit.ie/agri-energy. The DEDST can be used to obtain farm specific recommendations related to energy use, technology investments, CO_2 mitigation and renewable energy generation.

How to deploy renewable energy on your farm

Solar Photovoltaic (PV) cells are the most cost effective method of generating renewable energy on a dairy farm. These PV panels generate electricity using energy from the sun, which in turn can be used by the farm. These systems can be stand-alone (i.e. the generated electricity is only used by the farm) or grid connected (where surplus electricity is fed into the national electricity grid). In Ireland, there is currently no payment for export of electricity to the grid from small scale PV systems (though this may change in the future). Hence, the most logical solution for Irish farmers would be a stand-alone system, sized so that all electricity generated is consumed by the farm. For a 100 cow spring calving herd, the ideal PV system size is approximately 6 kWp of installed capacity, which would cost in the region of €7,500 (plus VAT). In the absence of a capital investment grant, this system would have a payback period of 10 years. If a 40% capital grant was utilised (PV systems up to 11 kWp are covered by TAMS), the payback period would fall to six years, while a 60% grant would make the payback period fall to four years. The inclusion of a 6 kWp PV system would result in 30% of the farm's electricity being provided by a renewable source and would offset more than 2.4 tonnes of CO_2 per year. PV systems qualify for accelerated capital allowances (i.e. the entire cost of the installation can be written off against tax in the year of purchase), which would further reduce the payback period (check the benefit of accelerated capital allowances for your farm with your accountant).

Practical implications

Calculating the energy costs of your farm in cents per litre of milk produced is a useful exercise to benchmark efficiencies against national averages and other farmers. To reduce farm energy costs, deploy efficiency technologies first to reduce demand. The next step is to evaluate Solar PV panels to further reduce fossil energy use. Solar PV panels can reduce farm CO_2 emissions and deliver a short payback period if the TAMS grant and accelerated capital allowances scheme are availed of.

Sward utilisation Pasture Profit Index update

Tomás Tubritt, Laurence Shalloo Noirín McHugh and Michael O'Donovan

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

Summary

- The Pasture Profit Index (PPI) is used by the grassland industry to identify and select the best varieties when reseeding
- Grazing Utilisation is a new trait included in the 2021 PPI with variety performance expressed using the 'Star rating system'.

Introduction

Grazing to post-grazing heights of approximately 4 cm is optimum to maintain/increase sward quality as the grazing season progresses. High grass quality maximises grass utilisation which has a positive impact on profitability and sustainability. Farmers involved in the 'Teagasc on-farm variety evaluation' study reported that some perennial ryegrass varieties were easier to graze to lower post-grazing heights compared to others but no indication of a varieties grazing efficiency was available within the Pasture Profit Index (PPI). Plot studies at Moorepark found differences in variety grazing efficiency, and these results were used to generate a new grazing utilisation trait within the PPI.

Variety plot grazing evaluation

Plots of different grass varieties were grazed by dairy cows when average pre-grazing herbage mass was 1400 kg DM/ha. At each grazing event pre-grazing height was recorded on each plot using a rising plate meter. Dairy cows then grazed all plots at the same time to an average post-grazing height of 4 cm. Cows had free access to select what varieties they wished to graze. Once grazed, individual plot post-grazing height was recorded.

Despite having the same regrowth interval, differences in pre-grazing yield/sward height was recorded between varieties, due to varietal growth potential and previous post-grazing height. Comparing grazing efficiency based on post-grazing height alone was biased towards varieties with lower pre-grazing height (i.e. low pre-grazing yield = low post-grazing height). Residual Grazed Height (RGH) measures the grazing efficiency of varieties, taking into account pre-grazing yield/height differences between varieties. Figure 1 displays the RGH of the varieties currently on the Irish Recommended List. Negative values of RGH are desirable as this indicates that a variety was grazed lower than expected, thereby showing high grazing efficiency. Tetraploid varieties dominate the left (negative value) side of Figure 1 indicating that they are grazed more efficiently than diploid varieties.

Grazing utilisation sub-index and using the PPI

The RGH data of varieties was used to develop the Grazing Utilisation sub-index within the 2021 PPI (Appendix 1). A variety's grazing efficiency is expressed in the Grazing Utilisation sub-index as a star rating. Varieties with five stars are highly suited to intensive grazing, while one star varieties are poorly grazed by cows. When choosing varieties for paddocks intended for intensive grazing (e.g. those located on the milking platform), varieties performing strongly in grazing utilisation, quality and spring/autumn DM sub-indices should be selected. Variety selection for paddocks destined for regular intensive silage harvesting would benefit from prioritising silage and spring yield traits. Research investigating variety mixtures found that the trait performance of a mixture could be accurately predicted as the average of the included varieties for all traits.

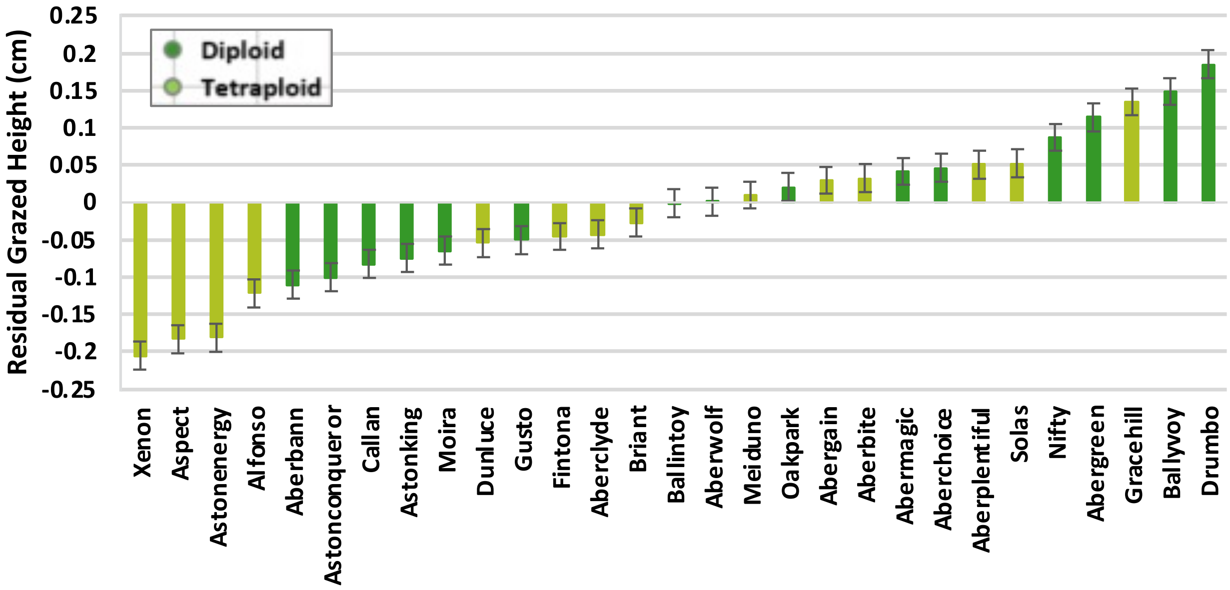

Figure 1. *Residual grazed height of PPI varieties 2021*

Practical implications

Poor graze-outs can be a major source of dissatisfaction for farmers, particularly where paddocks have been recently reseeded. The Grazing Utilisation sub-index can guide farmers to select varieties with high grazing efficiency. Tetraploid varieties are more utilisable than diploids which is linked to their higher digestibility and more open growth habit which creates a more appealing sward for cows to graze. High proportions of tetraploid varieties should be included in seed mixtures destined for intensive grazing. This is also true for wetter soils, as the additional benefits that tetraploids swards bring to dairy production systems (higher quality and grazing efficiency) outweigh any perceived deficiencies in persistency. On-farm evaluation of varieties conducted across a number of farms in Ireland have shown little difference in variety persistency over time.

Appendix 1. 2021 Pasture Profit Index

Variety	Ploidy	Heading date	PPI values €/ha/year							
			Tot.	Sub-indices						
			PPI	Spring	Summer	Autumn	Quality	Silage	Persistency	Utilisation
Aberclyde	T	25-May	225	42	62	48	41	31	0	****
Gracehill	T	4-Jun	222	35	57	61	12	56	0	*
Abergain	T	4-Jun	212	18	56	54	52	32	0	***
Nashota	T	3-Jun	200	37	51	45	32	36	0	-
Abermagic	D	28-May	199	24	63	81	17	14	0	**
Astonconqueror	D	27-May	195	70	50	52	-7	30	0	****
Glenfield	T	3-Jun	188	48	50	44	5	31	0	-
Moira	D	26-May	187	97	36	61	-33	25	0	****
Aberplentiful	T	8-Jun	186	42	60	54	13	16	0	**
Aberchoice	D	11-Jun	182	9	62	60	43	8	0	**
Meiduno	T	3-Jun	180	34	53	50	30	13	0	***
Aberwolf	D	30-May	179	44	49	50	10	26	0	***
Abergreen	D	31-May	169	23	68	74	0	4	0	*
Fintona	T	24-May	168	38	50	53	-9	36	0	****
Ballyvoy	D	3-Jun	167	54	42	50	21	-1	0	*
Dunluce	T	29-May	161	10	54	54	20	22	0	****
Ballintoy	T	4-Jun	159	19	55	47	19	19	0	***
Elysium	T	27-May	157	38	46	36	13	24	0	-
Aberbite	T	1-Jun	156	-13	52	56	35	26	0	**
Bowie	D	16-Jun	152	9	50	57	31	5	0	-
Gusto	D	31-May	149	31	46	64	11	-4	0	****
Astonenergy	T	1-Jun	138	-7	45	48	51	0	0	*****
Briant	T	3-Jun	137	-1	55	49	15	19	0	***
Oakpark	D	2-Jun	132	21	49	55	-10	16	0	***
Drumbo	D	5-Jun	129	12	40	45	27	4	0	*
Solas	T	10-Jun	129	-2	46	61	6	19	0	**
Xenon	T	7-Jun	128	2	46	40	31	9	0	*****
Nifty	D	28-May	127	28	57	61	-34	15	0	**
Callan	D	3-Jun	123	59	38	41	-25	11	0	****
Aspect	T	3-Jun	122	1	47	34	29	12	0	*****
Triwarwic	T	2-Jun	122	9	50	33	9	21	0	-
Astonking	D	5-Jun	115	52	42	36	-19	4	0	****
Smile	D	4-Jun	68	-8	35	48	-9	0	0	-

Milking interval relationship with PM finish time

Martina Gormley[1] and Noirin McHugh[2]

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Summary

- Milking interval has no effect on milk kg per cow, therefore, there is no cost to reducing milking interval to a 16:8 hr interval
- There is a strong relationship between milking interval and length of the normal working day on dairy farms
- Average finish time in study herds was 18:43 across the year. There was a large range in PM finish time. This a key issue for attracting and retaining people in the industry.

Introduction

Farm structure in Ireland has seen a dramatic change in recent years. Average herd size has increased from 64 cows in 2010 to over 80 cows in 2019 (NFS 2020). This increase in average herd size means that the traditional owner-operator plus additional family input model is struggling with the new realities of herd size. The sustainability of dairy farming increasingly relies farms being able to provide employment opportunities where pay and conditions of work are at least as attractive as alternative careers. Previous studies with dairy farm employees found that the hours worked on dairy farms can make employment unattractive. PM finish time was cited as the critical issue for employees. As Irish farms are competing with industries that typically offer a 5pm or 6pm finish time, this is an topics that needs to be examined. The aim of this paper was to investigate the average PM finish time on Irish dairy farms.

Data

To investigate the relationship between PM finish time and milking interval, milk recording data from 2,366 herds across 23 counties for one year (2020) were analysed. Across all herds, the mean PM finish time was 18:43pm. The length of the working day was nearly 12 hours (Table 1). However, there was large variation between herds with PM finish time ranging from 16:39-11:22pm and the length of the working day ranging from 8.5 hours-16.4 hours.

Table 1. The mean milking time data from 2,366 herds recorded in 2020

	Mean
Start time AM (Bringing cows in)	06:57
Finish time AM	08:55
Start time PM	17:14
Finish time PM	18:43
Hours spent milking (hrs)	02:58
Milking interval (hrs)	09:48
Length of working day (hrs)	11:47
Herd size (No. cows)	118

Relationship between milking interval and milk kg/cow/day

Milking interval is defined as the time from when the first cluster goes on in the morning to the time the first cluster goes on again in the evening. To reduce the length of the working day in a twice a day? milking scenario, previous research has shown a 16:8 hour interval split is feasible, for example morning milking start time of 7am and 3pm. In this study the mean milking interval of was closer to 10 hours (Table 1). One of the reasons for having a longer milking interval in the evening is the legitimate concern of reducing milk kg per cow. However, data collected on commercial herds for the current study showed no relationship between milking interval and daily milk yield. Similarly, milking interval had no effect on SCC.

Outside of the calving season, on most farms the last task of the day is usually milking. Therefore, evening milking start time and duration can dictates the time at which the working day ends. A key finding from this study was that milking interval had a very strong relationship with the length of the working day (Figure 2); it was a more important factor than duration of evening milking. This result shows that for many farms, changing milking time should be the first step to improve labour efficiency before any high cost solutions such as adding extra units to speed up milking.

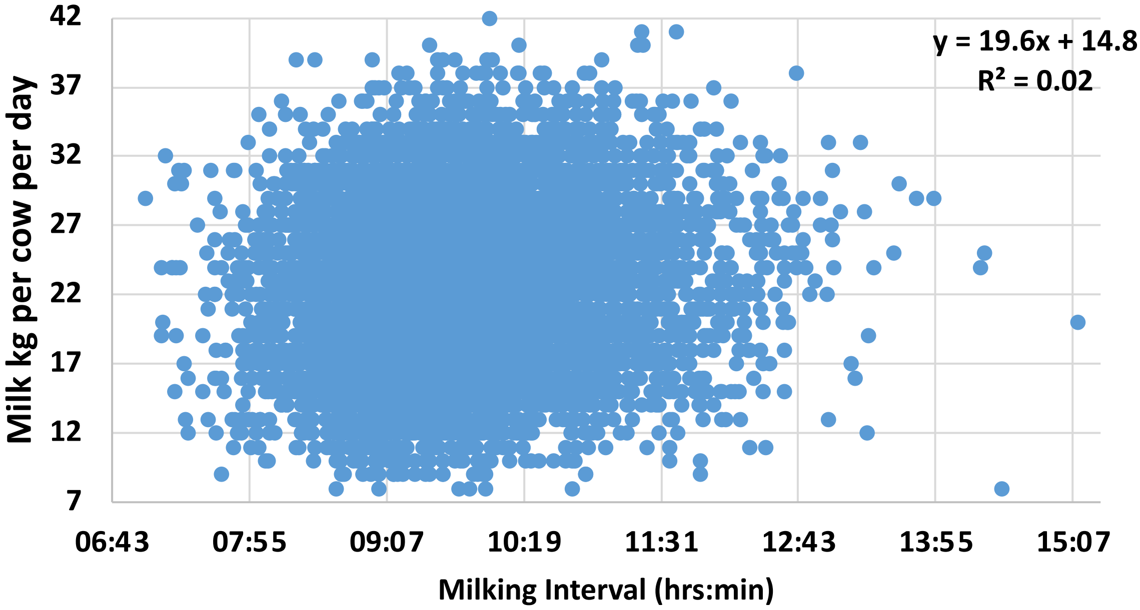

Figure 1. *Relationship between milking interval and milk kg per day*

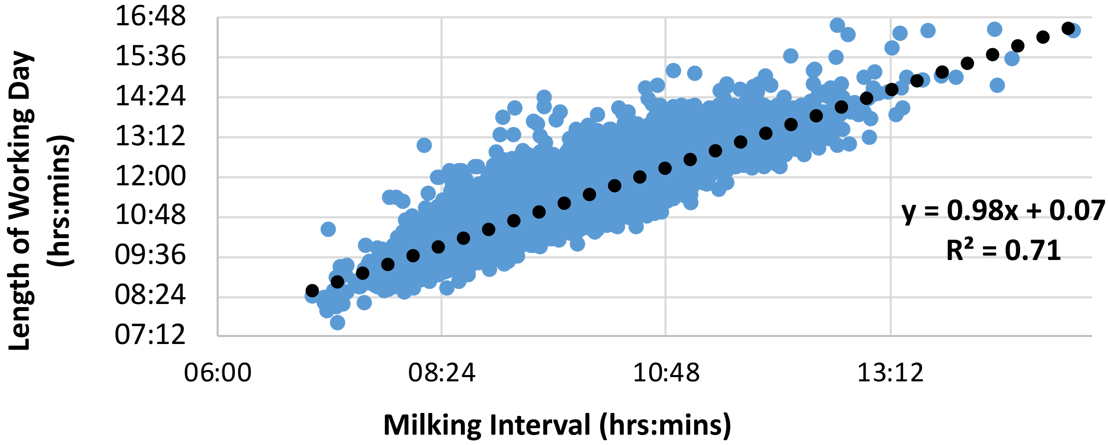

Figure 2. *Relationship between milking interval and length of the working day*

Seasonal variation in milking time

A large daily workload is understandably cited as a reason why milking times cannot be changed on many dairy farms. Previous labour survey work has shown that spring is by far the busiest time of the year for spring-calving herds, with daily workload reducing from mid-summer. With this in mind, one might conclude that milking intervals could potentially be shortened later in the season. However, our analysis found that there is very little change in mean milking interval by season (Figure 3). This would suggest that longer milking intervals are fixed and habitual on many farms, rather than being solely dictated by workload.

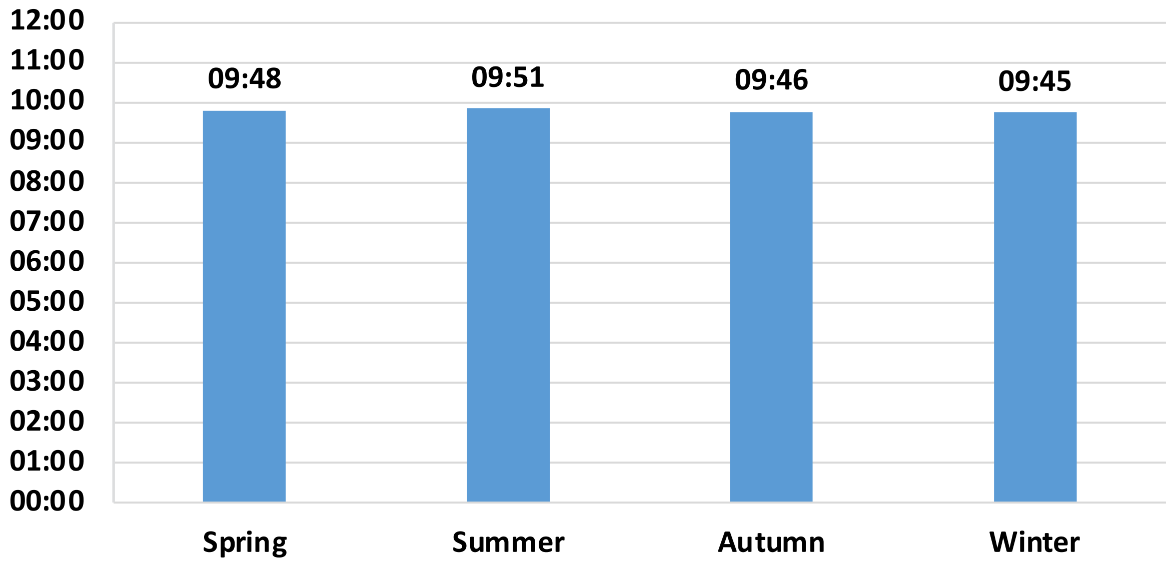

Figure 3. *Mean milking interval by season*

Practical implications

As herd size grows, some adaptations to work routine may need to be made to ensure a good quality of life for both farmers and employees. A long milking interval is a driver of late PM finish time and long working days. Reducing milking interval in line with the target 16:8 milking interval has no effect on milk kg per cow per day. This provides an opportunity to shorten the standard working day on farms at no milk yield loss. This has benefits for the farmer and potential employee alike. Reviewing how work is organised and executed on the farm is crucial to changing milking interval.

Optimizing vaccination strategy

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Summary

- Vaccines should be used as part of an overall infection control strategy
- Both diseases already present in the herd and those that are a risk for introduction into the herd should be included in a vaccination programme
- Planning ahead with a herd vaccination calendar is useful to ensure the vaccination programme is as effective as possible.

Role of vaccines

Whether an animal becomes infected with a virus or bacteria is a balancing act between the animal's immune response and the strength of the challenge by the infectious agent. Biosecurity and hygiene measures are important to reduce the infectious challenge. On the other side of the balance, colostrum management, nutrition and stress all influence whether the animal's immune system can effectively fight off a virus or bacteria. Vaccines help to strengthen this side of the equation, by boosting the immune response against a specific infection. Vaccines greatly reduce the risk of clinical disease in a herd; however, they are only one side of the equation, and cannot offset the requirement for biosecurity measures to reduce the burden of infectious agents on a farm.

Vaccination programme

There is no one-size-fits-all approach to deciding on herd vaccination programmes. The veterinary practitioner for each herd should be consulted to advise on the best approach, considering both infectious diseases present already and those that are a risk.

Infectious diseases present in the herd

It is important to identify the diseases that are already circulating in the herd when planning a vaccination programme. Some have obvious clinical signs, such as abortion caused by salmonellosis, while others can have more subtle impacts. Subclinical infection with IBR is common and can cause milk drop, immunosuppression or infertility that may not be noticeable. Bulk milk tank antibody testing or cohort blood sampling can be used to screen herds for various infectious diseases that could be causing subclinical disease. The objective when vaccinating for diseases present in the herd is to stop the spread of the infection and to prevent clinical disease. Vaccinating adult animals for IBR will help to reduce clinical disease and shedding of virus, while vaccinating young stock and calves will prevent the formation of new carrier animals, and over time will help to eradicate the infection from a herd.

Risk of infectious disease in the herd

A vaccination programme should also consider those infectious diseases that may not be present in the herd, but pose a risk to herd health if an outbreak occurs. Leptospirosis is an extremely common infectious disease in Ireland that is present in a high proportion of herds. As such, if leptospirosis is not already present in a herd, there is a high risk of introducing the infection through purchasing an infected animal or from environmental sources. In contrast, BVD virus is very uncommon in Ireland at present and the risk of introducing the virus into a herd is low. However, an outbreak of BVD in a naïve herd could have severe consequences. In this situation, a herd that purchases animals regularly from various sources may be advised to vaccinate, whereas a herd that operates a strict closed herd policy may decide to stop vaccinating.

Table 1. Common infectious agents in cattle and timing of vaccines for each

	Leptospirosis	IBR	BVD	Salmonella species	BRSV, Pi-3V, M. haemolytica	Rotavirus, coronavirus, E.Coli
Clinical signs	Abortion, infertility, weak calves	Respiratory, milk drop, infertility	Abortion, diarrhoea, respiratory	Abortion, diarrhoea	Respiratory (calves + young stock)	Diarrhoea (calves)
Vaccine timing*	Before breeding	Housing	Before breeding	Mid-pregnancy	Housing	Before calving

**Each herd is unique and may be exposed to different disease risks so it is important to develop a personal herd plan with a vet*

Practical considerations

Table 1 summarises common infectious diseases affecting cattle in Ireland for which vaccines are available. All animals at risk of disease should be given a vaccine course. For IBR, this includes young stock and sometimes calves, in addition to adult animals. For BVD and leptospirosis, pregnant animals are most at risk. The veterinary practitioner for the herd can advise which animals to vaccinate for each disease.

It is important to plan ahead and identify the correct time windows for each vaccination. Most vaccines require a primary course of two shots in young stock or when given for the first time. Some vaccines are most effective when given at certain times of the year (Table 1). Planning the annual programme for the herd with a calendar is very useful to ensure boosters are not missed and the vaccines are as effective as possible.

Cost control for 2022

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Introduction

Input costs for dairy farms are projected to increase through early 2022. Although milk price has to some extent masked the impact on margins in the short term, the potential impact across a full production cycle is likely to be significant. It is very important therefore that dairy farmers complete a physical and financial budget for the coming year. For this paper, we have examined the trends in costs per cow on dairy farms since milk quota abolition in 2015, with a view to identifying potential areas for adjustment.

Trends in costs per cow on dairy farms

In 2015, the average cost to keep a cow on an Irish dairy farm who completed an e-profit monitor was €1,115/cow. For 2017, the average cost per cow increased to €1,180/cow or an average increase of 1.9% over the three years. Increased feed costs per cow accounted for half of the increase. When we look at the period from 2017-2020, the cost per cow increased to €1,311 or a 3.4%/year increase in the period from 2017-2020. There was an increase in all costs with the exception of fertiliser in that period (Table 1). Therefore, over the year year period, the total cost of keeping a dairy cow on the average dairy farm has increased by €196 per year based on these cost categories.

Table 1. Cost analysis per cow for 2015-2020 on spring calving dairy farms

	Costs per cow 2015-2020				
	2015	2017	2020	Diff '15–'20	2022
Feed	€210	€248	€288	+€78	€348
Fertiliser	€142	€126	€128	-€14	€256
Other variable costs	€283	€292	€336	+€53	€342
Total variable costs	€635	€666	€752	+€117	€946
Total fixed costs	€480	€514	€559	+€79	€570
Total costs	€1,115	€1,180	€1,311	+€196	€1,516

The average level of meal feeding has increased by 200 kg per cow over the five-year period which accounts for €55 of the additional costs. In that period, milk solids (MS) production has increased from 437 kg/cow in 2015 to 476 kg in 2020, an increase of 39 kg MS/cow. The stocking rates on the 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 +0.5t DM/ha over the five years.

What's projected to happen in 2022?

As we, project forward for 2022 we have assumed no change in the quantity of inputs used but have adjusted the unit cost of feed to €330/t and have assumed a doubling in fertilizer prices over 2020. All other costs are inflated by 1%. This potentially could leave the cost per cow for 2022 at €1,516/cow. That would represent an increase of over €200/cow from 2020, or €20,000 in a 100-cow herd. It would require an increase in milk price of 3.5–4.0c/l on average across the year to offset the increase in costs. Of course, there will be a large farm-to-farm variation in the relative effect of input cost increases, depending on the physical inputs per cow. Herds that are more reliant on purchased feed and fertiliser inputs per unit of milk solids are likely to be impacted to a greater extent.

Considerations for 2022

When looking at cost savings for 2022, it is important to protect the inputs that have a long-term beneficial effect on your business. For example, choosing to cease milk recording next year to save money 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 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 however.

In planning ahead for 2022, it is useful to ask the following questions:

- **Are you grass measuring to make best use of your grass?**
  - » Increasing the level of grass utilised through better grazing management could reduce feed required by 10% (100 kg/cow or 0.4 kg/cow/day) and will save €35/cow.

- **Have you a nutrient management plan in place for 2022?**
  - » Make best use of your fertiliser inputs with a targeted nutrient management plan which makes better use of the slurry available on farm through LESS technology. A 10% reduction in fertiliser (or 0.5 bags urea/acre) will save each farm €26/cow.
- **Are there cows on the farm not paying their way?**
  - » Keeping poor performing cows by using additional feed or fertiliser to feed them may not make economic sense. Complete a breakeven analysis on the 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.
- **Is there a fodder budget completed for the farm?**
  - » Given the stark increase in projected fertiliser prices coupled with energy price increases, fodder stocks have become more valuable. This needs to be considered before deciding when to sell cull cows, surplus replacement heifers, beef stock etc. Farms should also minimise the level of fodder wastage this winter which can be between 10%-20% in some cases.
- **Have you a cash flow budget completed for 2022?**
  - » Complete a simple cash flow budget for your farm. Be realistic when completing your cash flow budget. Act early where cash flow deficits are identified, consult and draw up a plan with your local Teagasc advisor. Remember budgeting is not an exact science but in most cases a 'best estimate' is better than 'no estimate'. Avoid cutting productive costs when identifying areas where savings can be made.

**All figures used in this analysis are based on spring calving herds from the Teagasc E profit monitor. Data for both variable and fixed costs were used. The figures quoted are for cost categories associated with running a commercial dairy farm business prior to capital repayments, drawings and taxation. Results shown highlight the changes within each category but should not be extrapolated to represent the full economic cost of milk production in these years.*

Economic and environmental performance on Irish dairy herds-what are the measures of success?

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Summary

- Optimal stocking rate should be decided based on grass growth potential of the farm and not cows per unit area, in order to avoid drift into higher cost systems with greater environmental risks
- Nitrogen use efficiency can be increased through implementation of proven technologies such clover and low emission slurry spreading, lessening the reliance on chemical fertilizer N
- Breeding robust cows with good fertility and calving heifers at 24 months, improve lifetime milk performance of the herd and reduce the carbon intensity of milk production.

Introduction

The Irish dairy industry has changed significantly in terms of its output and efficiency over the last 10 years, delivering an increase of over 70% in milk output from a 43% increase in dairy cow numbers in 2020 relative to 2007-2010. This growth and technological progress has added approximately €3bn to the value of food exports from the country and sustains around 60,000 careers across the economy. Despite some concern and commentary regarding the 'industrialization' of dairy farms, the supplier base in Ireland has largely retained its family farm profile during the period. The average farm is now milking 82 cows at a stocking rate of 2.1 livestock units per ha (Teagasc National Farm Survey, 2020), with a spring-calving, pasture-fed model predominating.

As with all industries and sectors of society, agriculture is being increasingly challenged to play its part in improving climate and environmental sustainability. Issues such as greenhouse gas (GHG) and ammonia emissions, water quality, and biodiversity are now foremost in the minds of government and private citizens. There is legitimate concern among many dairy farmers as to the implications for economic sustainability of potential changes to their production system. Nonetheless, there are a range of practices and technologies that can improve economic and environmental outcomes in tandem. This short paper summarizes some concepts and examples in this regard.

Optimising stocking rate and pasture utilised

Stocking rate is generally defined and understood as livestock per unit area, e.g. cows per hectare. It is an important driver of the overall system due to its effect on sward utilisation, feed budget inputs, milk yield per cow and farm infrastructure requirements. Stocking rate as a stand-alone measure has a positive effect on profit per ha and accounts for 25-30% of the variation between farms (based on eProfit Monitor data). However an obvious limitation is that it takes no account of feed supply per ha; this is dictated by annual pasture growth which can vary from 9-15 tonnes of DM per ha across proximate farms within a given year (PastureBase). Assuming that a dairy cow requires 5.5 tonnes of DM per ha pasture grown to meet forage demand, the true stock carrying capacity of a farm may range from 1.6-2.7 Lu per ha depending on annual pasture growth rate.

Optimal stocking rate cannot therefore be defined in the absence of reliable annual grass production data. Grass utilised on the other hand incorporates purchased feeds, stocking rate, and herd nutrient demand per cow, to calculate a figure for forage utilised per ha. The current industry average is eight tonnes of DM grass utilised per ha with a research target of 12 tonnes of DM per ha. The grass utilised metric explains 55-60% of the herd-to-herd variation in profit, so farms with more grass utilised per ha can be reliably expected to have higher profit margins (milk yield per cow explains less than 10% of farm profit variation in comparison). Importantly, when grass utilised and stocking rate are analysed together, the stocking rate relationship to profit tends to become negative. This indicates that while stocking rate as a metric is linked to farm profit, it is through its effect on grass utilised that the effect is realised, and that increasing stocking rate beyond the point at which grass utilised is maximized may result in lower profit per ha.

How then does stocking rate interact with economic and environmental sustainability? The annual cost of purchased forage and concentrate to sustain stocking rates beyond grass growth capacity of the farm is estimated at €1100-1300 per cow at 2020 input costs, depending on farm circumstances. Overheads, accommodation and other capital costs must also be accounted for, therefore it is vital that farms complete a cost budget relative to herd milk solids output before adding marginal cows to a system. In terms of environmental impact, previous life-cycle analysis of the carbon intensity of the dairy system has shown that a system based on grazed pasture can achieve lower CO_2 output per kg of saleable product that systems reliant on conserved forages and imported concentrate sources. The current estimate for an optimized grass based system in Ireland is 0.86kg CO_2 per kg of milk, with potential for a reduction to under than 0.75kg CO_2 per kg of milk with the implementation of new technologies. Furthermore, a key measure of abatement of ammonia emissions is maximizing days at grass to reduce losses associated with slurry handling. Maintaining a focus on grass utilized, and avoiding a gradual drift into more intensive hybrid indoor/grazing systems, is an important objective that can deliver economic as well as environmental benefits. It is well understood at research and advisory level that issues of scale and fragmentation must be accounted for at farm level, therefore careful case-by-case analysis should be conducted around optimal stocking rate for individual farms.

Targeting nitrogen use efficiency

EU policy is targeting a significant reduction in chemical fertilizer N application rates in the coming years. The potential environmental benefits include reduced risk on N leaching to water, lower ammonia emissions, and a reduction in the GHG levels associated with fertilizer manufacture and losses post-application. However, N remains a critical nutrient in the production of forage quality and quantity for dairy production systems. A potential risk at a farm level is reduced DM production, leading to forage shortages and an increase in the level of supplementary feed required. Therefore, improvements in the efficiency of N use, and maximising the contribution of N fixed from legume swards, will be key targets. An important metric in this case is N use efficiency, calculated as the proportion of N imported onto the farm that is transferred to saleable product. Current estimates put average N use efficiency at 25% on dairy farms, with a potential to increase this to 35% and above. The steps to be taken to achieve this also present opportunities for improving economic efficiency.

The potential of white clover swards to transform N use efficiency is the principal avenue to improve N use efficiency while maintain animal performance. It is discussed in detail elsewhere in this booklet. Similarly, low emissions slurry spreading (LESS) is a well proven means of maximising the recovery of nutrients from slurry while reducing losses to the environment. This is essential cost-saving technology in the context of higher fertilizer prices. It also improves the flexibility of grazing management at key times of the year. The level of uptake of this practice on dairy farms is very encouraging and the benefits are clear.

Dairy concentrate rations have traditionally been traded on the assumption that crude protein (CP) content is the primary measure of feed value. However, on typical ryegrass or ryegrass/clover swards, crude protein is rarely limiting for milk production (the exception being in extreme drought conditions). A reduction of 2% in ration CP can reduce ration costs by around €8 per tonne while improving N efficiency and maintaining milk solids performance at grass.

Improving herd fertility and longevity

Better herd fertility increases annual milk yield relative to genetic potential, by maximizing days at peak lactation and increasing the proportion of more productive mature animals in the herd. It also leads to lower involuntary culling and replacement heifer inventory costs. Herds with better fertility have more control over median calving date and therefore can achieve closer alignment of feed demand and pasture supply across the year. These factors are beneficial from a profitability and carbon intensity perspective alike.

Within the national herd, there has been steady progress in the key fertility metrics of 6-week calving rate and calving interval over the last 8-10 years (Table 1), reversing the dis-improvement that had occurred over the previous two decades. The inclusion of fertility/longevity traits in the EBI and better reproductive management practices have contributed strongly to the trend. This has been verified in results from the *Next Generation Herd* and numerous analyses of farm data. There remains however ample scope for gains on average 6-week calving rate within the sector. Dairy farmers should continue to focus on breeding for fertility traits using EBI, and benchmarking annual herd performance against industry targets.

Age at first calving can be a very important factor in determining carbon intensity of milk production – calving at an older age generates additional C02 from a mature animal for zero additional saleable product. Older heifers will also contribute to higher organic N loads on a whole-farm basis. A similar effect occurs with older age at slaughter for beef animals. There is little or no evidence in the literature to indicate that delaying age at first calving confers any benefit on animal productivity or longevity; in fact, the opposite is the case.

On a positive note, ICBF animal-level data shows that the proportion of heifers calving at two years old is improving steadily since 2012, with up to 74% now calving at 24 months of age. Further examination of this trend shows that the distribution of mean calving age is polarized between herds. In other words, herds tend to have either a high proportion (>90%) or a very low proportion of heifers calving at target age. These data indicate that herd-level practices are the primary determinant of variation in age at first calving. Furthermore, recent survey work conducted by Teagasc showed that fewer than 5% of farms who regularly weighed replacement heifers were failing to meet age-at-calving targets. A specific cohort of farms can therefore make economic and environmental gains by addressing young-stock management protocols.

Table 1. Fertility traits over the last 8-10 years						
	2012	2014	2016	2018	2020	Target
Six-week calving rate	58	57	63	65	67	90
Calving interval	394	392	391	390	388	365
Recycled cows	16	14	14	13	12	<2
Calving 24 months	59	56	63	59	74	100
Heifers bred to AI	52	52	53	55	58	100

Summary and practical implications

The issues faced by dairy farmers to maintain family farm income while meeting environmental targets are numerous. However, it should be recognized that the industry has achieved much in the last decade, not by growth alone but by continuous investment in technological improvement. The system of milk production practiced in Ireland compares very well internationally in terms of carbon intensity, and further progress is possible. Much can be achieved by optimizing stocking rate and feed system, and improving herd fertility and genetics. Altering fertilizer N type and rate will contribute much also. The development of methane abatement feed technologies has great potential but requires tailoring for grass based systems; this work continues in Teagasc and elsewhere. As regards N use efficiency, implementation of proven technologies such as LESS, soil fertility management, grass measurement and of course clover swards, offer excellent options. Uptake and implementation of these practices is not simple by any means, but the economic and environmental benefits are clear. The long tradition of dairy farmers meeting challenges by implementing new practices and technologies looks set to continue.

Making better grazing management decisions in 2022 – the PastureBase Ireland story

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Summary

- There has been a 7% increase in the number of farms measuring grass in 2021 (3,813 versus 3,549)
- The total number of farm covers recorded by farms has increased by 12% in 2021
- The top 25% of highest performing farms grew 14.5 t DM/ha with 9.1 grazing/silage events, compared to the bottom 25% which grew 9.0 t DM/ha with 5.6 grazing/silage events
- Mid-season pre-grazing yield is too high on many farms averaging > 1600 kg DM/ha during May, June and July periods.

Introduction

Enhanced grazing management has the potential to yield further improvements in milk production efficiency and nutrient use efficiency. To maintain this comparative advantage, considerable research and development has focussed on increasing grass production and the direct consumption of grass under grazing. While maintaining grass production and utilisation will continue to be a challenge, other challenges are emerging in terms of environmental impacts (greenhouse gas emissions and water quality).

The level of grassland measurement within PastureBase Ireland (PBI) has grown substantially in recent years, over the period 2017-2020, the number of grassland farmers using PastureBase Ireland has increased from 2,696 to 3,664, while the number of grass cover measurements completed per farmer has increased from 14 to 19, and this increased further to 20 walks per farmer in 2021. In 2021, there was an increase of 7% in the number of farms measuring grass (3,813 vs. 3,549) and 12% more grass covers were completed.

While this level of engagement is extremely positive, it has not been possible until recently to begin to analyse some of the results of the data coming into the database. In total, 983 farmers completed > 30 measurements in 2020, which was the dataset used to compile this paper. Nationally, the representation was extremely good with many counties having large numbers of farmers measuring. The objective of this paper is to investigate the major differences between farms who have a large number of measurements completed in PBI.

Grass DM production and grazing management

In 2020, the mean grass DM production for the 983 farms was 12.5 t DM/ha with 7.4 grazings/silage events. The breakdown on a quartile basis shows that the top 25% of the highest performing farms grew 14.5 t DM/ha with 9.1 grazing/silage events, compared to the bottom 25%, who grew 9.0 t DM/ha with 5.6 grazing/silage events, a difference of 5.5 t DM/ha and 3.5 grazing/silage events. The difference in grazing days between these quartiles was 17 days (280 vs. 263), however the top 25% of farms are allocating substantially more grass, based on their growth figures (Figure 1).

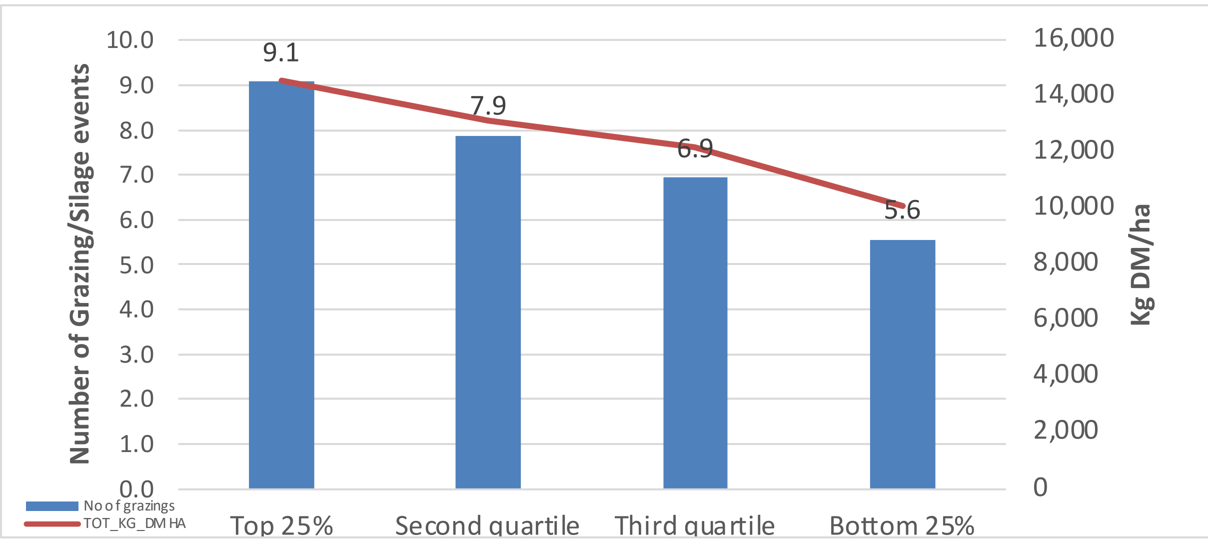

Figure 1. *The number of grazings and silage events linked to total DM production on farms measuring > 30 occasions in 2020*

Grass DM production in mid-season and autumn for the top 25% of farmers was higher by 1,798 kg DM/ha in mid-summer and 1,350 kg DM/ha in autumn compared to the bottom 25% (Figure 2).

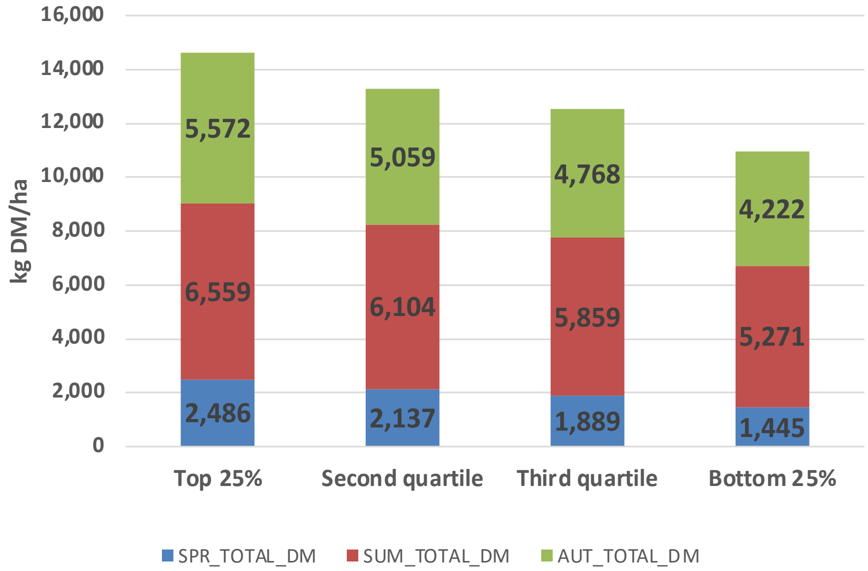

Figure 2. *The seasonal DM production differences between quartiles*

Mid-season pre grazing yield

The primary objective during the main grazing season is to maintain high animal performance from an all-grass diet, while at the same time maintaining pasture quality. In general, from late April onwards, grass supply exceeds demand, and pre-grazing pasture mass should be maintained at 1,300 to 1,600 kg DM/ha, with a grazing residual of 50 kg DM/ha (4 cm post-grazing height). Excellent pasture quality is required to maximise the potential animal performance from pasture in summer. From mid-April to mid-August, farm cover should be maintained between 160-180 kg DM/cow with a rotation length of 18-21 days, with the aim of achieving 5-6 grazings/silage cut rotations and utilising 7,000-8,000 kg DM/ha, in that period. Improving pasture quality offers the potential to achieve further increases in animal performance from pasture.

The management of grassland mid-season continues to be a problematic area for a lot of farmers, which is apparent from the commercial farm data available from PBI. Over 50% farmers maintained a pre grazing yield of >1,650kg DM/ha in the mid-season, which is excessive.

The key aspect of all the grass DM production data originating from PBI is the very small regional difference in DM production observed. Figure 3 shows the DM production difference between counties in 2020. There was little difference in DM production between counties and very many of the Midland and North Western counties are preforming very well. While some of the farm numbers are small in these counties, it is not surprising that the differences are small as the farmers who are measuring grass would tend to be the better grassland farmers in those respective areas.

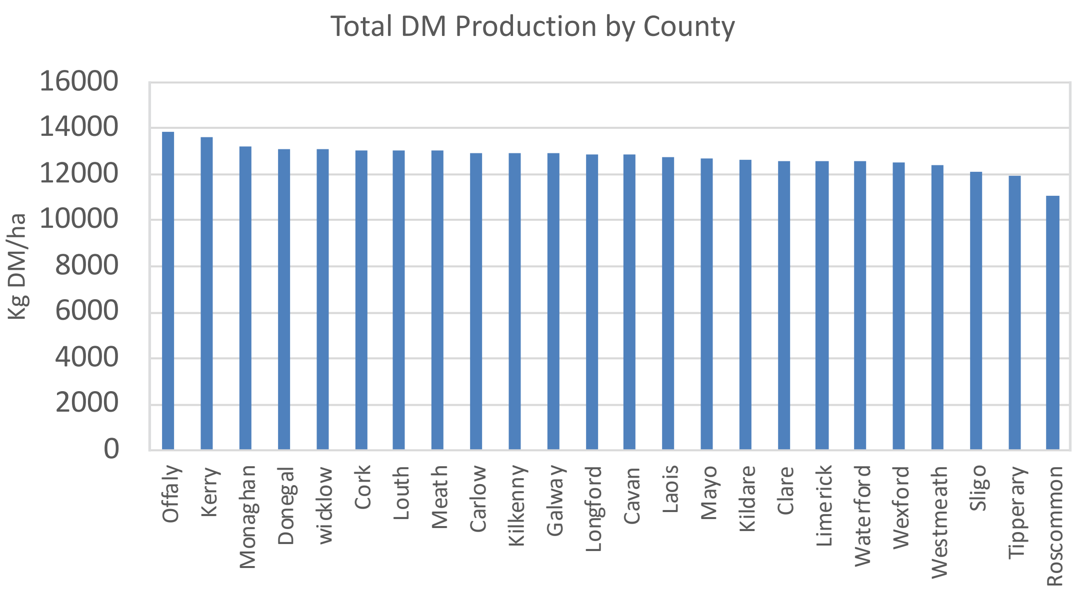

Figure 3. *The county difference in DM production in 2020*

Implications

There continues to be a reasonable level of uptake of grassland measurement and PBI usage. It is important that the level of grass measurement and grazing management continues to improve. Within this dataset, which is somewhat biased as all the farms have > 30 measurements completed, there is very little difference in DM production between the different regions. Grazing management imposed can overcome many of the perceived location effects. On the highest producing farms, irrespective of season, these farms continued to achieve the highest DM production. While there is very little difference between the number of covers completed between the different quartiles of farms, it is the decisions made by the farmers which drives the differences between farms.

The effect of sward type and nitrogen fertiliser application rate on milk and herbage production

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Introduction

There is renewed interest in the use of white clover in grazing systems due to its ability to biologically fix nitrogen (N) making it available for plant growth, increase herbage nutritive value and improve animal performance. Research into white clover has been ongoing at Clonakilty Agricultural College since 2012. The first experiment at Clonakilty, which ran from 2014-2017, achieved high sward white clover contents and found large increases in milk and grass production for perennial ryegrass (PRG)-white clover compared to PRG-only swards. This paper will present the results of the new Clonakilty Agricultural College research experiment from 2019-2021. The experiment entitled "The effect of sward type (grass-only vs. grass-clover) and N fertiliser level (150 vs. 250 kg N/ha) on the productivity of spring milk production systems" is investigating how reducing N fertiliser application levels on PRG-only and PRG-clover swards will effect grass and milk production.

Clonakilty experiment 2019-2021

Four separate grazing treatments were utilised for this experiment; a PRG-only sward receiving 150 kg N/ha (GO-150), a PRG-only sward receiving 250 kg N/ha (GO-250), a PRG-white clover sward receiving 150 kg N/ha (GC-150) and PRG-white clover sward receiving 250 kg N/ha (GC-250). There was a separate farmlet of 20 paddocks for each treatment. There were 30 cows in each treatment group, stocked at 2.75 cows/ha and target concentrate supplementation was 450 kg/cow for each treatment. In the previous experiment at Clonakilty from 2014-2017, sward white clover content declined over time due to a number of factors, including high fertiliser N use, silage and grazing management. However, little work was undertaken during the experiment to try to increase sward white clover content by either over-sowing or reseeding swards. As part of the new experiment, a programme of reseeding and over-sowing was undertaken to increase sward white clover content at Clonakilty. In 2019, 20% of the farm was reseeded and in 2020 15% of the farm was reseeded. Additionally, approximately 20-30% of the farm was over-sown with white clover each year.

Results 2019–2021

Sward white clover content increased in 2019 (13.8%) and 2020 (16.4%) from the low levels (<10%) achieved in 2018, however there was a difference between fertiliser rates. The GC-150 treatment had greater sward white clover content (14.4% and 19.1%, in 2019 and 2020, respectively) than the GC-250 treatment (11.1% and 13.6%, in 2019 and 2020, respectively). In 2021 to-date, sward white clover content is 20.5% and 18.2% for the PRG-white clover 150 kg N/ha and PRG-white clover 250 kg N/ha treatments, respectively. Both sward type and N fertiliser rate had an effect on grass DM production (Table 1). Perennial ryegrass-only swards grew 14.5 t DM/ha compared to PRG-white clover swards, which grew 15.1 t DM/ha and there was a 1.26 t DM ha difference between swards receiving 150 kg N/ha or 250 kg N/ha. The PRG-white clover 150 kg N/ha treatment produced an extra 0.8 t DM/ha compared to the PRG-only 150 kg N/ha treatment but produced 0.6 t DM/ha less than the PRG-only 250 kg N/ha treatment. The differences in grass growth occurred during the main grazing season and are illustrated in Figure 1. Due to the lower total grass DM production on the 150 kg N/ha treatments, silage fed during lactation was greater for these treatments compared to the 250 kg N/ha treatments. Silage produced was also below target for all treatments on average over the two years but was lower for 150 kg N/ha treatments. When silage fed during lactation is accounted for the 150 kg N/ha treatments only made 49% of their winter-feed requirement compared to 70% for the 250 kg N/ha treatments. Nitrogen fertiliser rate did not affect milk production but sward type had a significant effect. Cows grazing PRG-white clover swards produced 5,861 kg milk compared to 5,499 kg for cows grazing PRG-only swards, with similar fat and protein contents resulting in cows grazing PRG-white clover swards producing 495 kg milk solids compared to 465 kg for cows grazing PRG-only swards.

Table 1. The effect of sward type and fertiliser rate on herbage and milk production from 2019-2021 (data from 2021 is provisional and is only up to 1st of November)

	GO-150[1]	GO-250	GC-150	GC-250
Nitrogen fertiliser spread (kg/ha)	152	250	151	248
Grass production (t DM/ha)	13.8	15.2	14.6	15.7
Silage made (kg DM/cow)	872	1,037	943	1,101
Silage fed - lactation (kg DM/cow)	331	221	311	240
Silage deficit[2] (kg DM/cow)	658	383	569	339
Concentrate (kg/cow)	597	598	598	595
Milk yield (kg/cow)	5,452	5,546	5,849	5,873
Fat content (%)	4.78	4.77	4.74	4.73
Protein content (%)	3.78	3.81	3.83	3.78
Milk solids yield (kg/cow)	461	470	495	495

[1]GO-150 = perennial ryegrass (PRG)-only sward receiving 150 kg N/ha, GO-250 = PRG-only sward receiving 250 kg N/ha, GC-150 = PRG-white clover sward receiving 150 kg N/ha, GC-250 = PRG-white clover sward receiving 250 kg N/ha; 2Silage deficit based on a winter silage requirement of 1,200 kg DM/cow (4-month winter)

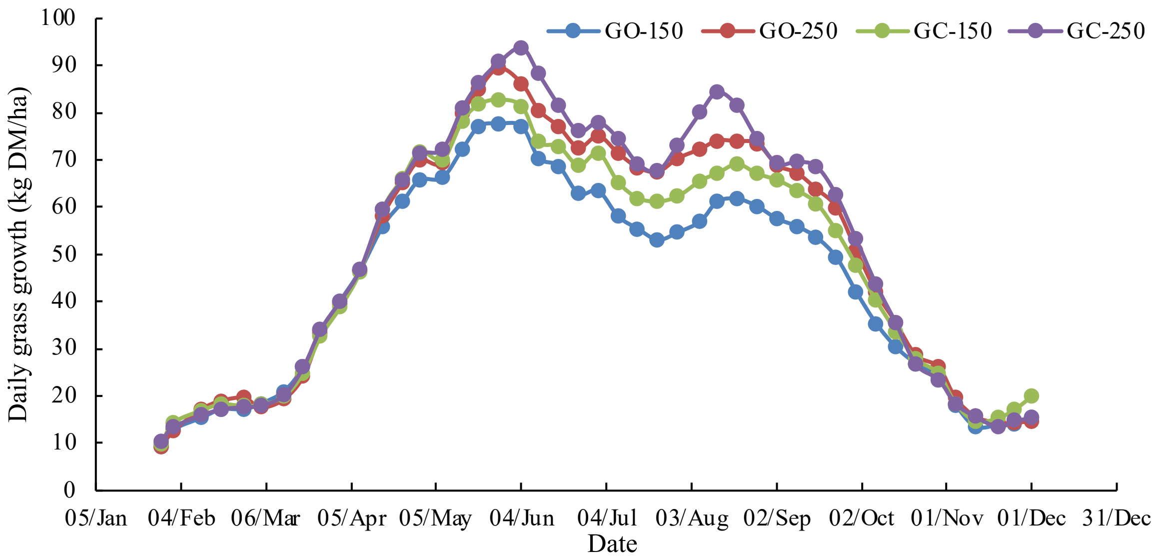

Figure 1. *The effect of sward type and fertiliser rate (GO-150 = perennial ryegrass (PRG)-only sward receiving 150 kg N/ha, GO-250 = PRG-only sward receiving 250 kg N/ha, GC-150 = PRG-white clover sward receiving 150 kg N/ha, GC-250 = PRG-white clover sward receiving 250 kg N/ha) on 3-week rolling average daily grass growth*

Conclusion

Perennial ryegrass-white clover swards continue to show benefits in terms of milk and milk solids production. This milk response was evident compared to PRG-only swards even at lower sward white clover contents than those observed in previous experiments. Sward white clover content increased during the experiment due to a combination of reseeding and over-sowing. In terms of grass production, sward white clover content was likely not high enough on the GC-150 treatment to fully offset the 100 kg reduction in N fertiliser compared to the GO-250 treatment; however, the GC-150 treatment still produced 96% of the total grass DM production of the GO-250 treatment. The results observed are similar to the Moorepark white clover experiment (2013-2020), although in that experiment the PRG-white clover 150 kg N/ha treatment produced the same amount of total grass DM as the PRG-only 250 kg N/ha treatment (13.5 t DM/ha). Sward white clover content on the PRG-white clover 150 kg N/ha treatment in the Moorepark experiment was 22% on average over the time period of this experiment. The results from both experiments show that white clover will continue to play an important role in facilitating reductions in N use on dairy farms.

Notes

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