Animal & Grassland Research and Innovation Centre
Moorepark

Moorepark Dairy Levy Research Update

Ballyhaise Open Day - Resilient Dairy Technologies

Ballyhaise Agricultural College, Drumcrow, Ballyhaise, Co. Cavan

Thursday 5th April, 2018

Series 35

teagasc
Agriculture and Food Development Authority

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Welcome to Ballyhaise

John Kelly

Principal, Ballyhaise Agricultural College

Teagasc Ballyhaise College has been in existence for over 110 years. During this time there have been many challenges. The college was temporality closed during world war one and was affected by many economic downturns. The farm has had to cope with national outbreaks of animal disease and many significant weather events including the severe storms of this past winter. Like the industry the college has endured. Because we have a temperate oceanic climate with steady temperature and rainfall, we have the ability to grow and utilise grass and hence underpin the sustainable and profitable agricultural production systems that we promote in Teagasc.

Although most people think of research in Ballyhaise as a recent development, they might not realise that research and trial work was one of the corner stones for the opening of the college. This extract from the Department annual report in 1906 illustrates this "*The Department of Agriculture and Technical Instruction have acquired about 600 acres of land and premises at Ballyhaise, Co. Cavan, as a station in connection with their Agricultural Schemes for the selection and distribution of different kinds of livestock, poultry, or carry out of experiments in the breeding and feeding of livestock, in tillage and in dairying and for tests of inventions in all branches of Agriculture*". This piece of history is significant and is worthy of mention because to develop the industry we need to continue to do two important things. Firstly research to find better ways of farming and then teach and advise people how to use these new practices. This was the founding principle on which Ballyhaise was based.

The current dairy research programme has been running now since 2004. It has achieved much in demonstrating how successfully grass can be utilised in milk production. On our last dairy open day four years ago, there were 300 students registered on education programmes in the college, today over 1,100 are completing courses. All of these students are taught about the importance of growing and utilising grass in a sustainable way, irrespective of what farming background they come from.

The college has opened its gates today to invite the public in to hear about and see what the college dairy research programme has been working on in recent years. There is a focus on grassland management, breeding and heifer rearing. Findings from recent Teagasc dairy research trials will also be displayed. The information presented aims to allow farmers to make informed decisions on their own farming business. I am confident that if you take at least one message home and implementing it will allow you to become more efficient and in turn run a more successful farming business.

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

Ballyhaise College systems experiments review

Donal Patton[1,2] and Brendan Horan[2]

[1]Teagasc, Ballyhaise Agricultural College, Ballyhaise, Co. Cavan; [2]Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- High levels of pasture and animal productivity can be achievable within low cost grass based systems in the BMW region.
- Ultimately, the net consequence of this change in milk productivity in association with the improved fertility performance has been to increase overall farm profitability per hectare at a base milk price of 29 c/l and including full labour costs from €450 per hectare in 2004 to €1,500 per hectare in 2017.
- 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, matching the increasing feed availability with appropriate overall farm stocking rates and higher EBI dairy cattle. Current system development has focused on extending the grazing season on wetland soils to maximise pasture utilisation and annual farm profitability.

Background

The function of the Ballyhaise dairy research project is to provide farmers in the region with locally generated research information and to demonstrate best practice grass based milk production systems. From it's origin in 2005 the project has focused on improving the profitability of milk production systems for farmers through a number of avenues; increasing grass growth and utilisation, improving milk solids production per hectare, improving herd fertility performance and reducing feed costs. Over the last thirteen years these improvements have led to a more profitable and robust system which is capable of delivering a reasonable return to farmers within the constraints of a volatile production environment. Both milk price and input prices have become more volatile and are likely to continue this trend into the future. Therefore farmers must strive to keep production costs low in order to survive low milk prices or high input prices. Increasing the amount of grazed grass in the cow's diet is a sensible strategy that will reduce feed costs directly as well as other costs. This approach can deliver high profit per hectare at low risk to the farmer but requires a constant focus on the fundamental elements of a successful grass based system; 1) productive well managed pasture, 2) a compact calving pattern, 3) high EBI cows, 4) at the correct stocking rate. The removal of milk quotas in 2015 has provided farmers with an opportunity to increase the scale of their business which has not been possible over the preceding 20 years. However we should not loose sight of what makes us competitive at a world market level, which is our ability to produce excellent quality feed at a low cost i.e. grazed grass.

Grass production and utilisation

The production and utilisation of large quantities of high quality pasture has been a core principle of the Ballyhaise Dairy Research farm since the beginning of the research programme in 2005. Over that period of time investment in reseeding, grazing infrastructure and soil fertility have helped to achieve high levels of grass production and utilisation. In the early years of the programme an intensive reseeding programme was undertaken to improve grass quality and production potential. Since 2012, reseeding has returned to more normal levels with 10 to 15% being reseeded annually. Since some of the land is prone to flooding (*15% of total area*), this requires more frequent reseeding to maintain ryegrass swards.

Soil fertility is another cornerstone of productive grassland. Annual soil testing of every paddock on the farm is standard practice so that deficiencies are identified and rectified as quickly as possible. In Ballyhaise, soil P and K levels were high due to previous farming practices but soil pH was low resulting in underperforming swards. An intensive liming programme was undertaken between 2012 and 2015 to rectify this problem. This has resulted in 90% of area above 6 pH. In terms of Phosphorous, 90% of the farm is Index 3 and 4. While potassium status has been high in the past, deficiencies in K have been identified over the past two years with 50% of the area being below Index 3 for K in 2017. A nutrient management plan has been developed to target slurry and chemical K to areas deficient in K.

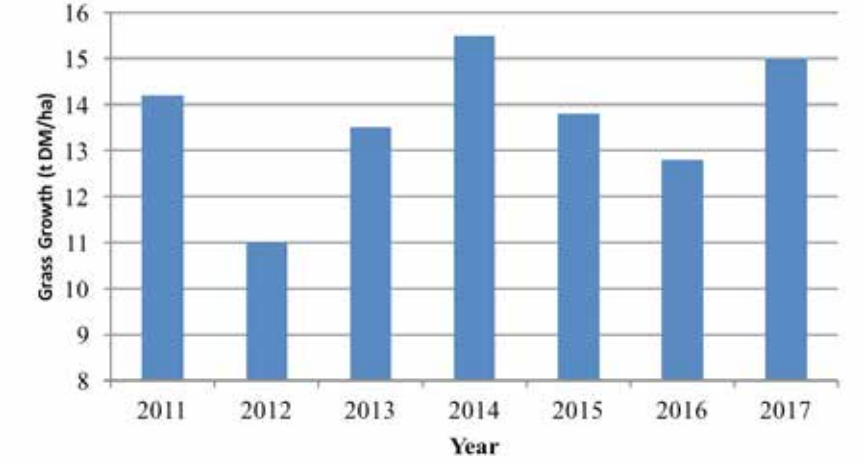

Figure 1. *Ballyhaise grass growth from 2011 to 2017*

Grass production has been measured in Ballyhaise since 2005; Figure 1 below illustrates grass production from 2011 to 2017. Over that period average grass production has been 13.7 t DM/ha. There has been quite a large variation in grass production between years across that period from 11 t in 2012 to 15.5 t in 2014. While improvements in soil fertility and reseeding have progressed steadily over this period the heavy soils present on the farm have struggled to produce very high levels of grass production during wet years like 2012 and 2016. This is a significant risk on farms with similar

soil types where wet years will reduce grass production and reduce grazing season length. Consequently, the programme has been focused on self-contained production systems where imported feed, be that concentrates or imported forage, is minimised.

Table 1. Ballyhaise key performance indicators

	2004	2010	2017	Target
Grazing season (days)	225	255	265	280
EBI (€)	-16	44	139	200
Grass growth (t DM/ ha)	10.5	13.8	15	16+
Stocking rate (cows/ ha)	2.2	2.9	2.75	2.9
Concentrate (kg/ cow)	700	630	570	500
Winter feed imported (kg/ cow)	700	600	150	0
Feed imported (kg/ cow)	1400	1230	720	400
Feed imports (kg/ ha)	3080	3567	1980	1160
Fertiliser (kg N/ ha)	150	250	250	250
6 week calving rate (%)	48	59	84	90
6 week in-calf rate (%)	38	49	75	80
13 week empty rate (%)	30	17	9	8
Milk solids sold (kg / cow)	433	370	420	450
Milk solids sold (kg / ha)	960	1,073	1,160	1,300
Profit / ha (€ @ 29 c/l base)	450	1,275	1,500	2,500

In addition to improvements in grass production, improvements in grass utilisation have been driven by improved grazing infrastructure which has simplified extended grazing. The original network of farm roadways has been extended and improved to help get cows to grass in wet conditions. Fencing has been adapted to allow a flexible approach to grazing where multiple access points to each paddock have been installed. Additional spur roadways are planned, particularly on the more marginal land, to help make grazing during wet weather more efficient. Simple grazing management practices such as on-off grazing and block grazing are techniques that have been applied to keep grass in the cow's diet during wet weather and minimise poaching. Weekly farm walks in conjunction with the use of rotation planners, grass budgets and the mid-season grass wedge help maintain grass quality and quantity on the farm. This combination of good grazing infrastructure and flexible grazing management has resulted in more days at grass (*Table 1*).

Reproductive performance

Genetic improvement of the national dairy herd is a key component of the smart and green objectives for agriculture as stated in Food Wise 2025. The successful adoption of the Economic Breeding Index (*EBI*) and related genetic progress of the national dairy herd has been an area of significant progress, with benefits for both the productivity and sustainability of grass-based dairy production in Ireland. Poor fertility performance is a major issue on many dairy farms in the region leading to reduced profitability and restricting the farms ability to grow herd size or sell surplus replacements. A compact spring calving pattern is essential to maximise the production of high quality milk solids from grazed grass. A recent analysis of Cavan and Monaghan farms has shown that the current average 6 week calving rate is 47%, whereas efficient grass based systems require a six week calving rate of 90%. Improvements in the fertility performance at Ballyhaise have been steady since the introduction of high EBI genetics. In addition to improving genetics, a strict culling policy was introduced where cows empty at the end of the 12 week breeding period were sold and not carried into the next year. The overall herd empty rate has decreased from 36% in 2004 to 9% in 2017, while the critical six week calving rate has increased from 48% to 84% during the same period (*Figure* 2). In addition to improving the calving pattern of the herd, improvements in fertility performance have resulted in reduced empty rates and in turn reduced replacement rates. This has meant that the college has sold surplus dairy stock every year since 2012.

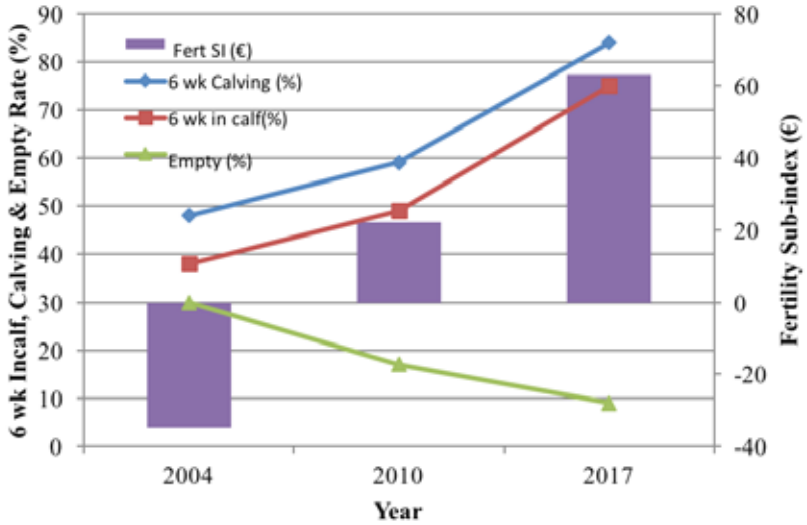

Figure 2. *Ballyhaise fertility performance and fertility sub-index*

Milk output and feed inputs

Increasing milk solids production per hectare while maintaining low levels of imported feed will result in a more robust dairy production system. To achieve this, three key ingredients are required namely; highly productive swards, highly productive cows, and the correct overall stocking rate. As

outlined above, the continuous improvements in grassland management practices have resulted in improved grass production in Ballyhaise. Milk production per cow decreased from 2004 to 2010, mainly due to the poor reproductive performance of the herd resulting in a high replacement rate within the compact calving system adopted. Since 2010, milk production per cow has increased at a steady rate with 420 kg milk solids sold per cow in 2017. Milk solids production per hectare has increased also through a combination of increased production per cow and increased stocking rate. Based on current grass production at the site, a stocking rate of 2.5 to 2.75 cows/ha will require low levels of imported feed and deliver high levels of milk production per cow in most years.

Profitability

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 base milk price of 28 c/l and including full labour costs from €450 per hectare in 2004 to €1,500 per hectare in 2017. While per cow performance has been reduced between 2004 and 2017, owing mainly to a reduction in supplementary feed use, the improvement in per hectare performance of the Ballyhaise herd during the same period has been realised through improved calving compactness, increasing the genetic potential of the herd for fertility with more cows calving in February and March and an increased use of grazed grass for milk production.

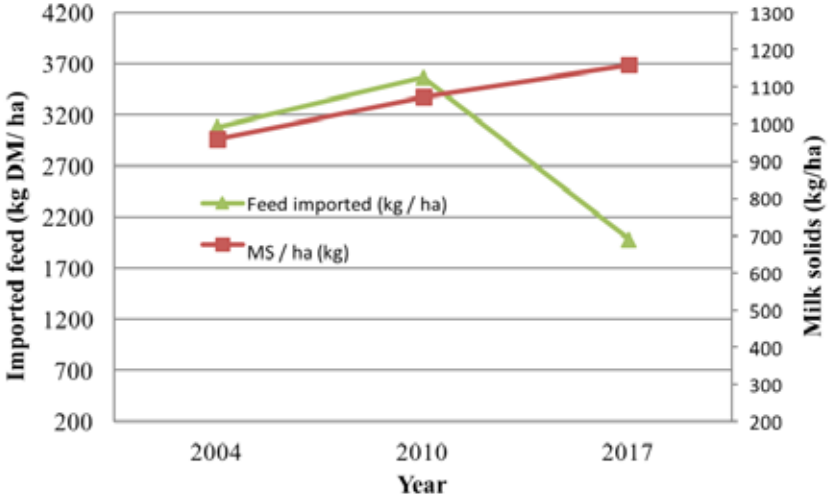

Figure 3. *Ballyhaise College milk solids sales and feed imports*

Conclusion

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, matching the increasing feed availability with appropriate overall farm stocking rates and higher EBI dairy cattle. 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.

Increasing dairy farm profit per hectare

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Summary

- A resilient dairy business will achieve high farm profitability per hectare on average while also minimising the detrimental impacts of low milk prices and producing high quality milk without adverse impact on the welfare of animals or the environment.
- The term resilient means to be able to "*recover, respond, deal, withstand*" different internal and external challenges that may manifest themselves within the farm business from time to time.
- There is significant potential to increase efficiency and productivity at farm level when compared with the average farm nationally.
- The focus at farm level must be about increasing grass growth and utilisation and converting that feed to milk solids sales in as low a cost as possible.
- Increasing labour efficiency by operating more streamlined work practices, using contractors and contract rearing of heifers will have a major impact on reducing requirements and costs and will ultimately improve the efficiency of the overall business.

Introduction

Milk price volatility is a key feature of dairy farming today and this is likely to continue as the world market responds to changes in product supply and demand. In the past, various levels of protection operating mainly at EU level, provided market support at times when there was an in-balance in the Global supply/demand dynamic. However, this protection has not operated at the market level to a large extent since 2007 (*except in exceptional circumstances*), which has meant that the milk price received by farmers is much more volatile now than has been the case historically (*See Figure 1*). Ireland's milk production represents approximately 0.9% of global production and irrespective of our scale or how much we expand; in general we are price takers. Recent global geopolitical insecurity and an increasingly uncertain international trading environment is likely to result in increasing price volatility into the future. This coupled with the many potential impacts of Brexit require dairy businesses to refocus on being highly profitable, labour efficient and low cost employing resilient technologies and prioritising all investment into making the farm more resilient. The term resilient means to be able to "*recover, respond, deal, withstand*" one or a number of shocks within any business. These shocks may originate in the form of weather events, disease incidence, troughs in milk prices, etc. How the business and system operated is implemented will determine the capability of the business to respond to these events. There is considerable potential to increase profitability at farm level by focusing on

the core technologies of grass based systems and by having the right cow for our system (*high milk solids, robust with good fertility*). The objective of this paper is to document the physical and financial requirements to achieve an overall farm profit of €2,500/ha and to describe the impact of technologies.

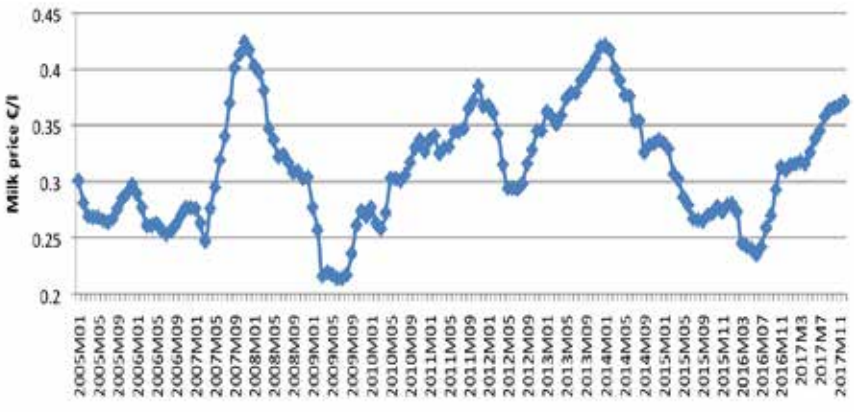

Figure 1. *Milk price at 3.3% Protein and 3.7% fat paid to Irish dairy farmers over the period 2015 to 2017 including VAT.*

Achieving €2,500 net profit per hectare

The target system operated on farm is based on maximising the performance from the existing platform while at the same time ensuring there is a minimum number of unproductive livestock on the farm and that the farm is operating to its full potential. Realistically, setting a net profit target of €2,500/ha and achieving that target is based on significant attention to detail across all of the components of the farm business. However, the rewards are huge and place the business in a very positive position when dealing with milk price volatility as well as realising returns from the business that are comparable with some of the best possible investments on or off farm. The targets will be broken out in this paper under physical and financial headings and will be compared to the national average performance over the period 2014 to 2016, all of which is completed with a base milk price of €0.29/l at 3.3% protein and 3.6% fat. Labour costs are included at €15/hr and all other costs are included based on the most up to date costs and prices. It is assumed that the farm operates contract rearing in the target system and that calves leave the farm at 2 weeks of age, while in the national average situation, it is assumed that calves are reared on the farm.

Table 1. The physical performance required to achieve an overall target farm profitability of €2,500/hectare compared to current average National Farm Survey performance

	National Average	Target
Milk production per cow (kg fat plus protein) (kg milk)	405 5,409	475 5,800
Milk production per hectare (kg fat plus protein) (kg milk)	825 11,090	1,380 16,820
Milk protein composition (%)	3.45	3.70
Milk fat composition (%)	4.06	4.50
Calving interval (days)	394	365
Mean calving date(day of year)	6th March	14th Feb
Six week calving rate (%)	58	90
Replacement rate (%)	23	18
Labour input (hrs/cow/yr)	30	16
Stocking rate (livestock units/ha)	2.05	2.90
Concentrate supplementation (kg/cow)	933	450
Grass utilised (t DM/ha)	8.0	13.1

The key driver to high profit per hectare is getting the physical performance of the farm to a very high level. Table 1 shows a breakdown of the physical farm performance included in the model in both the current national average and the target performance scenarios. Central to achieving the targets are both high animal and farm performance across a whole range of impact categories. The physical performance required to achieve the target include utilising in excess of 13.1 t DM/ha of grass, achieving milk solids output of 1,380 kg/ha, from a predominantly grass diet requiring moderate levels of concentrate supplementation (*450kg concentrate per cow*). In order to achieve these targets there is a requirement to have a highly fertile herd (*with an annual replacement rate below 18%; a 6 week calving rate in excess of 90% and a herd mean calving date of mid-February*). These physical targets must each be achieved within a farm operated at high levels of labour efficiency and requiring fewer than 16 hours of total labour input per cow per year. The performance targets are compared to the current national average performance (*over the period 2014 to 2016, inclusive*) for comparative purposes. In the target performance situation, a high stocking rate is achieved based on highly productive grassland swards and a specialised dairy enterprise with all replacement stock moved off the milking platform to a contract rearing enterprise. Cow numbers increase by 42% in the target scenario from 76 to 108 on the same available land area. This increase in cow numbers is also facilitated by both an increase in both grass growth and utilisation on the milking platform. It is also assumed that higher

fertiliser levels are applied under the target system with a higher level of annual reseeding carried out annually.

Table 2 provides a breakdown of the financial performance results for a 35.6 hectare farm achieving either the current national average or target physical outputs as defined in Table 1.

Table 2. Financial performance of current national average and target farm performance

		National Average		Target	
		(€/kg MS)	(€/ha)	(€/kg MS)	(€/ha)
Receipts	Milk	4.21	3,197	4.28	5,873
	Livestock	0.50	383	0.48	659
Gross output		4.72	3,580	4.76	6,531
Costs	Concentrate	0.65	493	0.21	294
	Purchased forage	0	0	0	0
	Fertiliser/reseeding	0.37	282	0.26	355
	Contract rearing	-	-	0.44	606
	Contractor other	0.28	210	0.22	305
	Vet/AI	0.30	225	0.25	346
	Electricity/phone/ car	0.25	190	0.16	214
	Hired labour	1.00	762	0.50	682
	Milk Recording/ parlour	0.14	104	0.10	131
	Insurance	0.07	52	0.04	59
	Sundries/Other	0.08	64	0.07	100
	Repairs and maintenance	0.09	70	0.10	140
	Owned labour	0	0	0	0
	Land lease	0	0	0	0
	Loan interest	0.26	200	0.16	224
	Depreciation - buildings - machinery	 0.44 0.16	 332 124	 0.31 0.12	 422 162
Total costs		4.09	3,107	2.95	4,043
Net profit		0.62	473	1.82	2,489
Cash surplus		0.90	682	2.00	2,740

The analysis is completed for the farm as a whole and on a per kg fat plus protein (*milk solids; MS*) and per hectare basis. Clearly, the differences in financial performance between the national average and target situations are in stark contrast with the target performance realising a four-fold increase in profitability per hectare and per kg MS. Analysis from both

the eProfit Monitor and National Farm Survey datasets show that the magnitude of performance difference between different cohorts of farms operating at the top and bottom levels of efficiency is large and consistent with the findings in Table 2. The major change in performance between the two farms is due to the greatly increased milk solids output (+82%) and associated receipts (+84%) per hectare in the target scenario based on an increased stocking rate which was facilitated by increased grass growth and utilisation. On the cost side, there are increases in overall costs per farm and per hectare (+30%) but there is a dramatic reduction in costs per unit of output (-28%).

The differences in financial performance reported in Table 2 mirror productivity gains on Irish dairy farms since the removal of milk quotas (*Hanrahan et al., 2017*). Overall costs of milk production on Irish farms declined in the years subsequent to milk quota removal. The major cost categories that showed significant reductions include concentrate feed and labour costs while the majority of other costs also showed more modest reductions based on increased milk solids output per hectare on farms during the period. While there is a very significant increase in labour efficiency in the target scenario, a large part of this increase originates from the removal of heifer rearing from the farm and is also reflected in increased contract rearing charges. Recent research has shown that there are substantial differences in labour efficiency across farms with the more labour efficient farmers tending to be larger, using the contractor more, more likely to be contract rearing young stock and having appropriate facilities (*Deming et al., 2017*).

Table 2 also includes the cash surplus that is generated from the farm. Cash surplus is an important metric because it reflects the business's ability to meet its long and short term cash commitments. The cash flow statement is easily prepared from the income and expenditure statements and includes only cash coming into and leaving the business (*and excluding depreciation, inventory change and owned labour charges*). For the purpose of this analysis, it was assumed that the labour costs and the drawings were equal (*and no single farm payment included*). Table 2 shows in the target scenario, the cash generated from the business is greater than the net farm profitability and illustrates how robust the financial position of the target farm is. On expanding farms, the cash surplus is typically less than the net profit figure as the growth in stock numbers would be reflected in higher net farm profits but reduced cash flows due to increased rearing costs.

Potential returns from various technologies to increase farm performance

Almost all of the increased financial performance shown in Table 2 is based on changing components of the farm system inside the farm gate to one extent or another. While it is important to acknowledge that there are unique physical constraints on every farm (*e.g. soil type, climate, etc.*) which prevent the achievement of this combination of targets, equally there is potential to make changes to increase key performance indicators on every farm and so the overall focus should be on investing in the right areas. Table 3 highlights the net financial benefit from various increases in technical

efficiency on farm financial performance to demonstrate the relative financial impact of each improvement area. The technical efficiencies evaluated include increasing fat and protein concentration, increasing milk volume from grass, increasing grass utilisation, increasing the age profile of the herd, reducing replacement rate and reducing calving interval. A similar approach was taken to the analysis undertaken in the previous section and once again on a farm of 35.6 hectares.

Table 3. Financial impacts of improvement in various technologies at farm level

	Unit change	Financial Benefit	
		Farm	€/kg MS
Increasing fat composition	+ 0.1 %	+ 1,195	+ 0.03
Increasing protein composition	+ 0.1 %	+ 2,530	+ 0.09
Increasing milk volume from grass	+ 100 litres	+ 2,027	+ 0.06
Increasing grass utilisation	+ 100 kg DM/ha	+ 484	+ 0.01
Reducing replacement rate	- 1%	+ 1,218	+ 0.04
Reducing calving interval	- 1 day	+ 247	+ 0.01

The analysis shows that while each individual improvement has a positive effect on farm profitability, the relative impacts of the various specific components vary considerably while the cumulative impacts of multiple improvements is highly significant. Over a 5 year period, increasing grass utilisation by 3 t DM/ha, milk fat concentration from 4.05% to 4.25%, milk protein concentration from 3.45% to 3.65%, reducing replacement rate from 23% to 20% and bringing herd mean calving date earlier by 1 week will increase net farm profit by over €27,353, net profit per kg MS by €0.71 and net profit per hectare by €768. This is achieved while the overall cost base of the farm is reduced and the value of what is sold is increased, ultimately increasing the resilience of the business as a whole.

Conclusion

Milk quotas are now gone over three years, and significant expansion has been realised at farm level. To date this expansion has been associated with increased grass utilisation, increased milk value and reduced costs (*excl. labour*) at farm level. Focusing on ensuring that the overall business is resilient into the future will involve a continued focus on increasing grass growth and utilisation and matching the feed available on farm with the demand by operating the appropriate stocking rate.

Compound gains in profit through breeding on EBI

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Summary

The benefit of breeding is compounded year-on-year. This means that the performance of a herd today is a consequence of past breeding decisions in recent decades. Such a phenomenon is favourable if the correct breeding policies have consistently been invoked, but can be deleterious should the breeding strategy of any one year be sub-optimal. Despite breeding now been known to contribute at least half the gains in observed performance in a whole range of species, proportionally very little time is spent in dairying selecting bulls to sire the next generation. The ramifications of a poor breeding policy can be disastrous.

The economic breeding index (*EBI*)

The EBI is now the main unit of currency when selecting parents of the next generation, be they AI sires or cows in the herd. The EBI is constantly evolving (*Figure 1*) in line with expected changes in the value of product (*e.g. milk price*) as well as the associated input costs (*e.g. fertiliser, concentrate costs*). Because the fruits of any breeding decision made today do not materialise for several years hence, all prices and costs are predictions.

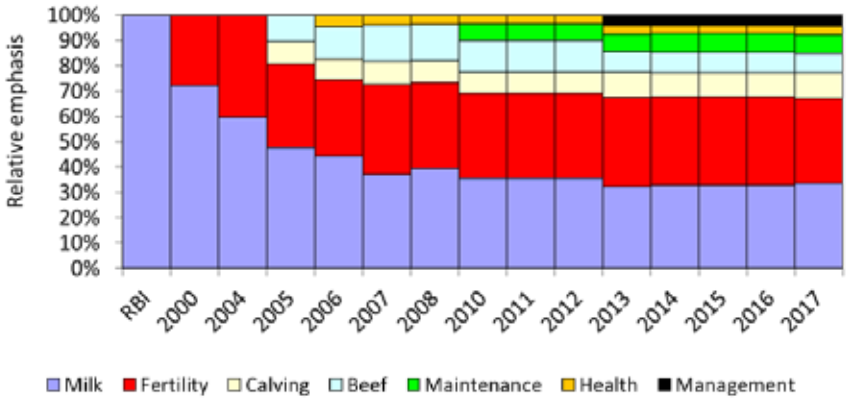

Figure 1. *Evolution of the EBI since its introduction in 2001*

The EBI now comprises of 7 sub-index of which the main two (*70% of the emphasis*) are made up of milk production and fertility/survival. Together, this combination of traits strive to identify animals that produce more higher value product over their lifetime, but do so at a lower cost and inconvenience (*i.e., minimal calving difficulty, fewer health events*) to the farmer. Cow longevity is key to achieving high profitability.

It is well established that the optimum average parity in a stable herd is 4.5 lactations, which equates to an annual replacement rate of 18%. The

average lactation number therefore of culled cows should be 5.5 or in other words cows, on average, should reach 5.5 lactations (*i.e. 7.5 years*).

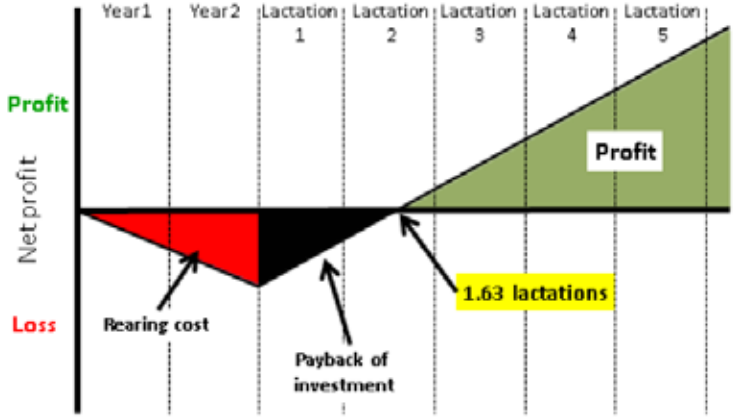

Figure 2. *Economic implications of number of lactations achieved per cow*

The full cost of rearing a replacement is over €1,500. This implies that a cow needs to complete 1.63 lactations to fully pay off her rearing investment as a heifer (*Figure 2*). In fact 16.5% of cows in Ireland do not survive beyond the middle of their second lactation meaning that they have not fully paid off the investment in rearing them as heifers. Each lactation extra a cow achieves beyond mid-way in the second lactation equates to extra profit.

It is sometimes stated that in the absence of milk quotas, then greater emphasis should be placed on milk production within any breeding index. Milk solids yield per cow, however, is a function of:

- Genetic merit for milk solids yield
- Lactation length
- Cow longevity

There is now overwhelming evidence both from Ireland and internationally that selection for increased genetic merit for milk solids yield will materialise in increased milk solids yield per lactation. Although the EBI has a negative weighting on milk yield, the positive weighting on both fat and protein yield is expected to increase genetic gain for milk solids yield.

Lactation length. The median lactation length in Irish milk recorded herds is 279 days. Relative to a 305-day lactation, a cow milking for only 279 days yields 4% less; this equates to 262 litres of milk for a 6000 litre cow or 390 litres of milk for a 9000 litre cow. Equivalently, assuming a dry off date on the 20th December, a March 1st calving cow will yield 6% more than an April 1st calving cow equating to 312 kg for a 6,000 kg cow. In a seasonal production system achieving optimal lactation lengths can be best achieved with superior genetic merit for fertility. A one day shorter calving interval equates to a one day shorter lactation length. This is cumulative and permanent. Genetic merit for calving interval was lengthening (*i.e. getting worse*) by 1.5 days per year before the introduction of the EBI. During the last

decade, genetic merit for calving interval has been reducing, on average, by almost half a day per year.

Cow longevity. Based on the national database of milk recorded cows, second lactation cows yield 14% more milk solids than first parity cows and mature (*third to sixth lactation cows*) cows yield, on average, 21% more milk solids than first lactation cows. Therefore, an older herd will achieve more of its genetic potential for mature cow yield. Genetic merit for survival is improving by almost 0.3% annually in the past 10 years compared to a year-on-year dis-improvement in survival before the introduction of the EBI. Based on an analysis of DairyMIS data between the years 1990 and 2001, the number of lactations achieved per cow declined by 0.1 per year (*i.e. one less lactation per cow was achieved when comparing the year 2001 to the year 1990*), while replacement rate increased by almost 1% per year, equating to a 10% increase in replacement rate over the 10 year period.

EBI and profit – does it actually work?

Access to e-Profit monitor data provides a globally unique opportunity to validate if herd EBI translates into more profit per cow. A €1 difference in herd EBI is expected to translate to an extra €2 profit per lactation. Using data from >1000 e-Profit monitor herds between the years 2008 and 2011, a €1 difference in herd EBI was associated with a €1.94 extra net profit per lactation in spring calving Holstein-Friesian herds. The analysis was recently re-run using data from the years 2012 to 2016 in spring-calving herds where EBI data were available on >70% of cows; >90% of the genetics of each herd had to be Holstein-Friesian to remove any confounding of heterosis which is not captured in the EBI. Based on these most recent years, a €1 change in herd EBI was associated with €1.96 net profit per cow; account was taken of the year, herd mean stocking rate and the level of concentrates fed per cow, as well as using a standard A+B-C milk pricing system across the whole country. This new and more recent-based analysis further supports the results from the Next Generation Herd that higher EBI equates to more profit.

Average versus top EBI herds in Cavan-Monaghan region

The performance of average EBI herds in the Cavan-Monaghan region versus those in the top 10% for EBI in the Cavan-Monaghan region is in Table 1. A mean difference of €64 in EBI was evident between the two groups with a €20 difference in milk production sub-index and a €33 difference in fertility sub-index. Despite the lower EBI herds producing 2% more milk yield (*96 kg*), the lower EBI herds actually produced 4% less solids (*18 kg*). This was attributable to a 0.31 percentage unit greater milk fat concentration and a 0.16 percentage unit greater milk protein concentration in the higher EBI herds; the mean milk price of the higher EBI herds was more than 2c/l greater than that of their lower EBI contemporaries. The reproductive performance of the higher EBI herds also excelled with a greater 6-week calving rate, and superior overall pregnancy rates. The multifunctional benefits therefore of selection on EBI are clear to see both nationally and including within the Cavan-Monaghan region.

Table 1. Milk and reproductive performance of the average EBI herds and those in the top 10% on EBI in the Cavan-Monaghan region		
	Average	Top 10% EBI
EBI	54	118
Production sub-index	20	40
Fertility sub-index	13	46
Fertility		
Calving interval	402	382
Six week calving rate	47	67
Calves per cow	0.87	0.95
Percent not in calf	10	4
Percent recycled	20	8
Production		
Milk kg	5447	5351
Milk solids per cow	408	426
Fat %	3.95	4.26
Protein %	3.34	3.50
SCC (1000 cells)	187	155

Conclusion

The EBI index is now mature and all evidence, from either controlled experimental studies, or from the analysis of large datasets, clearly show a benefit in profit from selection on the EBI. The benefits of greater cow longevity and fertility are key to realising the gains from breeding.

Improving dairy herd fertility in the BMW Region

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Summary

Achieving high herd fertility performance is the cornerstone of profitable, labour efficient dairy farming. The benefits to be gained include better annual milk revenues, reduced feed and replacement heifer costs, lower vet bills, and a more streamlined workload around calving and calf rearing. Establishing and maintaining good fertility performance remains a significant challenge for dairy herd managers. However, the continuous improvements made in breeding and technology over the last decade mean that it is now possible to achieve ambitious breeding targets year-on-year. This is clearly evident on many high-performance farms in Ireland, and represents a fundamental change from a previous situation where poor herd fertility was deemed largely outside of management control.

The primary objectives with regard to herd fertility can be simply summarised as:

- A calf per cow per year (*calving interval*).
- 90% of cows calved in six weeks (*six week calving rate*).
- Fewer than 10% empty cows after a 12 week breeding season (*empty cull rate*).
- All heifers calved at two years old (*replacement rearing efficiency*).

Meeting these headline targets indicates excellent overall performance. Numerous other indices can be used to describe the different components of fertility in more detail (*ICBF, 2018*). Analysis of these figures gives an excellent insight to the strengths and weaknesses of individual herds and allows appropriate management goals to be set. This is a key step to setting out a plan for improved herd fertility.

Fertility, breeding and milk solids- how are herds in the Ballyhaise region performing?

Data from dairy herds in the Ballyhaise catchment area were obtained from the ICBF database to benchmark current performance and identify potential focus areas for improvement. Summary data is presented in Table 1. This is based on 854 herds across counties Cavan and Monaghan- herds supplying <100,000 litres and/or having incomplete EBI data were excluded. Mean herd size in the final group was 62 cows, supplying 352,000 litres in 2017. Over 90% of herds in the analysis supplied Lakeland Dairies or Lacpatrick co-operatives. For comparison, data are presented relative to Ballyhaise research herd, to the top 10% of EBI herds in the region, and to Teagasc herd targets.

Overall, the data for 2017 indicates that significant progress on the main measures of fertility is required across herds in the region. The key fertility

measure of spring 6-week calving rate is particularly low at 47%, revealing a lack of compact early calving despite many herds commencing calving in early January. Low six week calving rate comes at a major cost, estimated at €8.22 per cow for each 1% drop below target. Much of the difference is explained by lost milk revenue due to late spring calving cows (*Fig 1*), plus extra feed and replacement costs. To illustrate the potential financial gains, an average scale herd for the region could generate an additional €14,000-€18,000 in dairy farm margin by shifting from current average 6-week calving rate to that achieved by Ballyhaise research herd.

Table 1. Milk and fertility performance of Cavan/Monaghan dairy herds (*n*=854) in 2017

	Cavan/ Monaghan Average	Ballyhaise Research Herd	Herds in Top 10% EBI	Teagasc Herd Targets
Six week calving %	47	84	68	90
Calving interval days	402	368	382	<370
Culling %	23	22	23	20
Recycled %	19	0	6	0
Not calved within year %	11	0	4.9	0
Heifers calved 24 mths %	48	98	75	100
AI heifers per 100 cows	9	32	30	25-35
EBI €	54	161	118	150+
Milk index €	25	51	40	60+
Fertility index €	13	63	46	80+
Milk solids kg per cow	406	427	428	450+
Fat %	3.95	4.64	4.26	4.50+
Pro %	3.34	3.66	3.50	3.60+

Empty culling rate is a very important metric of herd fertility but its interpretation can be skewed by extending the breeding season, or recycling ('*rolling over*') cows from one breeding season to the next. Examination of the 2017 data shows that while the average herd is coming close to meeting the overall culling target of around 20%, there is a heavy reliance on recycling cows to maintain this rate. In fact, almost one in five cows in these herds had been recycled between breeding seasons, while 11% of cows did not calve at all in the period. This represents a serious inefficiency in terms of reduced annual milk solids sold per cow, as well as maintenance feed costs. Eliminating the practice of recycling sub-fertile cows should therefore be foremost in herd fertility improvement plans.

Making the necessary long-term changes to six week calving and recycling rates first requires development of a steady supply of high quality

replacement heifers into the herd. High quality in this context is defined as healthy well-grown heifers, calving at 22 to 24 months old in the first six weeks of spring, and bred from high EBI AI bulls. However, our data shows that only 48% of heifers in the region calved at 22-24 months old, while just nine AI-bred heifers were born per 100 cows in 2017. Although progress is being made on genetic merit, the EBI of dairy heifers born in 2017 remains low (€106) relative to national standards, particularly in relation to fertility traits (*average €36 EBI*). Improving the quality of replacement stock must also form part of herd fertility plans.

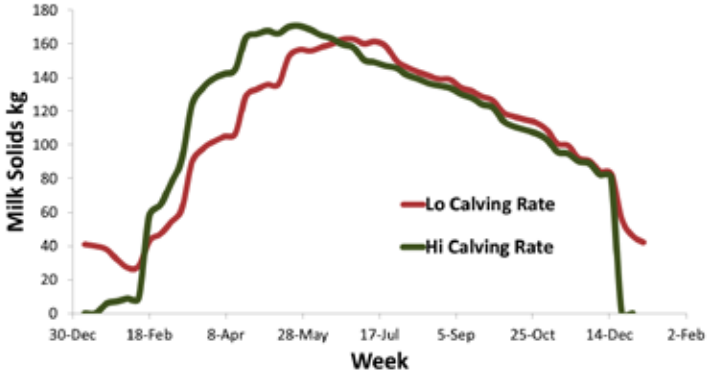

Figure 1. *Milk solids profile for 84 % calved in 6 weeks (Hi) versus 54% calved in six weeks (Lo)*

Steps to improving herd fertility performance

Analysis of breeding data for the Ballyhaise catchment area identifies a clear need to address average herd fertility performance. There are multiple management factors to be considered in this regard. Therefore progress will only be made not though 'quick fix' solutions, but by implementing a comprehensive herd plan based on proven practices. Based on the information generated at Ballyhaise and other research herds, plus the experience of high performance commercial farms, the following are suggested as 10 key practices to improving herd fertility:

High EBI: Cows with a high fertility sub-index have been shown to cycle earlier, require less fertility interventions, and have stronger active heats, higher conception rates and less embryo mortality. In short they make the job a lot easier! Target an AI bull team with >€120 fertility SI on average. Crossbreeding to high EBI Jersey bulls has a definite benefit where herd fertility and solids indices are currently poor.

Focus on submission rate: Research has shown that submission rate (*the number of cows served*) is a much stronger driver of 6-week calving rate than conception rate to first service. The target is 90% of eligible cows in the first three weeks and 100% in the first six weeks. This is impossible without heat detection aids. Tail paint/card, vasectomised bulls or other electronic technologies all work well. Choose a system and implement it well. Do not delay later-calved cows after mating start date (*MSD*)-all eligible cows can be submitted for AI after 35 days calved.

Body condition score (BCS) gives a good estimate of long-term nutrition and energy balance and has important links to fertility. For high conception rates and six week calving rates, the target is to have cows at 3.0 to 3.25 at calving and losing less than 0.5 units before mating start date. Late lactation, dry cow and early lactation plane of nutrition all play a part in meeting these targets. Research has shown that where quality grass is plentiful, there is little benefit to BCS or herd fertility of increasing concentrate feeding around time of breeding. Milking thin cows once a day from mid-March can be beneficial instead. Higher EBI cows have a key advantage of being able to retain BCS better in early lactation.

Mineral nutrition: The goal of dry cow mineral nutrition is to have cows in the correct calcium and trace mineral status at calving, so that problems such as dystocia, milk fever, retained placenta etc. are minimised. To prevent metabolic issues, ensure that cows receive adequate Magnesium supplementation (*0.4% of diet*) and are on a low potassium diet pre-calving. Minerals should be fed for at least 6 weeks pre-calving through early lactation. Test herbage in the second rotation to determine supplementation levels at grass. Do not feed trace minerals beyond recommended rates- it is costly, will not improve fertility, and may lead to issues with milk residues (*Iodine in particular*).

Keep good records: Many problems around breeding stem from difficulties in the weeks around calving. Keep accurate records of problem calvings, downer cows, retained placenta etc. If you have more than 5% of cows with these health problems and more than 5% assisted calvings (*jack/vet*) there is an issue in the herd that needs to be addressed.

Intervene early: Cows that are thin, have cystic ovaries or are carrying uterine infection will not be available for breeding in the early weeks of the season. Previous thinking was to allow these animals time to self-repair but this reduces overall breeding efficiency. Anoestrus cows should be treated (*e.g. CIDR protocol*) 1 week in advance of MSD so that they can be bred early in the season. This principle can also be applied to late calving cows.

Eliminate the dairy stock bull: Excellent genetic gain cannot be achieved by using stock bulls to produce dairy heifers. In any case, stock bulls will not have the capacity to achieve to achieve submission rate targets in the early weeks. Use short gestation easy-calving beef bulls to mop up in the late season if necessary.

Vaccinations: Diseases such as leptospirosis, BVD, IBR, salmonella pose a big risk to fertility. Formulate a herd health plan for you herd in consultation with your vet, with the specific goal of achieving high fertility in mind.

Replacement heifers: Heifers are expensive to rear in any case, but the additional cost of calving at >28-30 months olds is huge (*close to €400 per heifer compared to 24 months calving*). In addition, older heifers have been shown to have poorer lifetime fertility and milk production irrespective of breed or production system. A recent project on heifer rearing conducted locally by Teagasc found that almost two thirds of dairy farmers achieving >90% two-year old calving weighed their heifers regularly, compared to 0% of those who failed to meet this target. Interestingly, the majority of farms failing to meet age-at-calving targets also tended to delay breeding of perceived lighter heifers, and to overestimate required weight at first breeding by 40-50kg despite no difference in target weight at calving. A strong focus on meeting optimum weight at first breeding is needed for these herds.

Have a defined breeding season and culling policy: Setting defined limits to weeks of breeding can be difficult when starting from a spread out calving pattern, but it is essential to drive long-term progress. Experience on commercial herds is that empty culling rate will increase to >15% for a few years, but this can be tolerated provided high quality replacements are coming into the herd. In time, the number of empty and late calving cows will decline as EBI improves. For herds at average current performance, the recommendation is to limit breeding to 16 weeks initially, reducing to 12 weeks within three years. Eliminate recycling of cows from the system up front. Driving a high submission rate moderates the impact of a shorter breeding season.

Grazing management for high productivity dairy herds

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Summary

- Dairy farms will have to increase both grass production and utilisation substantially to support higher stocking rates regardless of geographical location.
- Autumn closing management and targeting the correct closing cover (≥650 *kg DM/ha*) are vital to ensure adequate spring grass availability.
- The importance of early turnout and spring grazing management is underestimated. For every 1% of the farm area grazed in February, an additional 14 kg DM/ha is grown by April 10th.
- The first rotation needs to be finished by mid-April in order to achieve two grazing rotations by early May and 8-10 grazing rotations in the year.
- Post-grazing sward height and pasture quality are key drivers of the feeding status of the herd during mid-season.
- Grazing management requires continuous improvement on Irish dairy farms.

Introduction

There are major improvements needed in the areas of grazing management and the conversion of grass into milk. While every farm situation is unique with varying soil types, local climatic conditions, stocking rates and farmer management capabilities, grass production is limiting on most Irish farms. Irish farms have expanded rapidly over the last number of years. While average herd size nationally is approximately 74 cows/ farm, farm size in the Border Midland West Region (*BMW*) is 66 cows/ farm, and has increased by 30% since 2010. This increase in herd size requires farms to increase the amount of grass grown to meet an increasing herd feed demand. Increasing stocking rates and more compact calving has resulted in increased feed demand on dairy farms. Extra grass must be grown and utilised in this period to avoid increases in supplementary feed use. It is clear from Teagasc eProfit monitor results that farms targeting high levels of grass utilisation are more profitable (*+€173/ha higher net profit per additional t grass utilised*). In 2017, farms measuring grass on PastureBase Ireland grew 14.4 t DM/ ha while farms in the BMW region produced 13.9 t DM/ha (*Figure 1*). These results indicate that geographical location is not the limiting factor in terms of DM production and high levels of grass production can be achieved, through good grazing management practices, soil fertility and grazing infrastructure. However, there can be a large variation between years and paddocks in herbage production. This paper examines where Irish dairy

farms can improve the feeding management of the dairy herd at grass, to further increase output and lower farm costs. The paper will focus on seasonal grassland management for Irish grassland farmers in the BMW region to help reduce some of the year to year variation in grass production.

Figure 1: *Cumulative herbage production for PastureBase Ireland farms from 2015 to 2017.*

Autumn grazing management

Autumn closing date is one of the most important management factors influencing the supply of grass in early spring. Grass budgeting during this period will ensure that adequate quantities of grass are available to extend the grazing season in autumn and have an adequate quantity of grass at the start of calving in spring on highly stocked farms. Extending the grazing season and ensuring a high proportion of the cow's diet is made up of grazed grass can have significant effects to reduce feed costs and increase animal performance. Teagasc research has shown that each additional day at grass in autumn is worth an extra €1.80/cow/day. There are two main objectives of autumn grazing management for spring calving herds: (*1*) to build grass supply on the farm during autumn; and (2) manage the final grazing rotation.

Budgeting grass and building autumn covers

Feed budgeting is a vital tool in achieving a longer grazing season length. A grass budget is a plan for grass supply based on expected growth and animal requirements during the shoulders of the year. In the absence of grass budgeting, increases in stocking rate will reduce the grazing season length and grass proportion in the diet resulting in increased variable and fixed costs of production. The main benefits of a feed budget are; to assist in identifying short term surpluses and deficits and to provide a medium term plan to achieve a long grazing season. In order to achieve a long grazing season (+250 *days*) and maintain a predominantly grass based diet, rotation length needs to be extended from late July to build a high average farmer cover to ensure adequate grass availability. Average farm cover should be

increased from 500 kg DM/ha in late July to a peak of 1,150 kg DM/ha by 1st October (*Figure 2*). Rotation length should be increased from late July by 10 days each month. Research has shown that extending rotation length from 21 days in late July to 35 days by mid-September and up to 45-50 days by early October will increase grass supply by 500 kg DM/ha on the farm. Budgeting grass and building covers can be more complex on wet soils. Building heavy covers on wet areas can be very risky; as a result the location of the feed is important. If peak average farm cover is greater than 1,150 kg DM/ha, very heavy pre-grazing covers (*>2,700 kg DM/ha*) can arise on paddocks resulting in reduced grass utilisation efficiency.

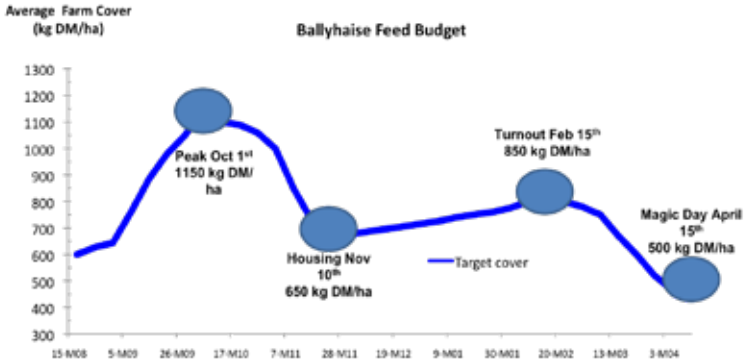

Figure 2: *Feed budget at Ballyhaise Agricultural College from August 15th to April 15th*

Closing date

Autumn closing date is one of the most important management factors influencing the supply of grass in early spring. To ensure adequate quantities of grass are available at the start of calving in spring on highly stocked farms, farmers must ensure an average farm cover of ≥650 kg DM/ha is achieved at closing (*Figure 2*). To achieve these targets, farmers should use the autumn rotation planner, which allocates the area of ground to be closed from October to November. Over winter growth rates can vary greatly on heavy soils, average over winter growth rates for the previous 10 years at Ballyhaise have been 1.5 kg DM/ha with a range of 0 to 3 (*Figure 3*). As a result the closing of paddocks should start between September 25th and 30th, with 70% of the paddocks grazed by November 1st and housed by November 10th on farms in the BMW region. On drier soil types, closing usually commences on October 5th to 10th with 60% grazed by November 1st and housed on November 20th. Paddocks should be closed in rotation to ensure a wedge shape of grass the following spring. Farmers should try and close some of the drier paddocks first as these will be grazed first in early spring as they will have the greatest quantity of grass and best ground conditions. Avoid closing the wetter paddocks early and all in one block, if they are wet in autumn there is a chance they will be wet in early spring and will be impossible to graze. The best approach in closing strategy is to have a mix of the drier and wetter paddocks closed so as to avoid all the wetter paddocks together. At all times, farm cover should be closely

monitored to ensure that it does not drop too quickly due to poor autumn growth rates, if farm cover is low (<650 *kg DM/ha*) farmers should house or increase silage supplementation to prioritise grass for early spring grazing.

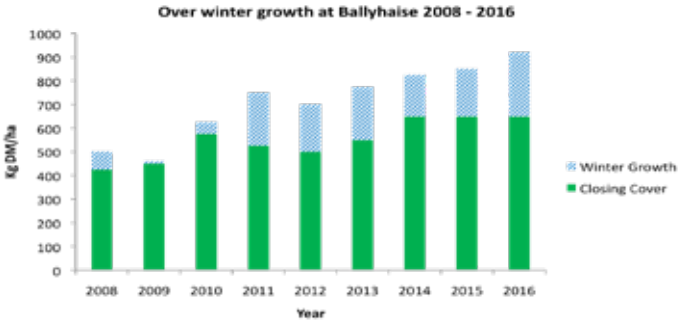

Figure 3. *Average closing and opening farm cover at Ballyhaise College between 2008 and 2016.*

Spring management

The aim in spring is to increase the proportion of grazed grass in the diet of the grazing animal, while at the same time budgeting so that there is enough grass until the start of the second grazing rotation in early to mid-April. The main objectives of spring grazing management are (1) to increase the proportion of grazed grass in the diet of the dairy cow and (2) to condition swards for subsequent grazing rotations. The first rotation should start in mid-February (*ground conditions allowing*) and continue until mid-April in the BMW region. This varies from farm to farm and year to year but the most important aspect of grazing management is to make good use of spring grass. The period from calving to breeding is a critical time for both cow and grassland management. Cows should be turned out to grass as soon as ground conditions allow post-calving to increase dietary feed quality, milk production and composition and resulting in increased milk solids production and overall milk revenues. Profitability will increase as higher cost feeds such as grass silage and concentrate are reduced or eliminated from the diet. Research at Teagasc has shown that each additional day at grass in spring is worth €2.70/cow/day, due to reduced feed cost, reduced labour and increased milk sales.

Spring rotation planner

Grazing management in the first two months after calving largely determines spring grass growth and how well fed the herd is at the onset of breeding. The spring rotation planner (*SRP*) is an excellent tool to guide farmers in tracking the area of the farm grazed off at different time points in the spring; it divides the area of the farm into weekly portions and takes the guesswork out of grazing management over this critical period in early spring. The best way of managing grass in spring is to set out the area to graze weekly and implement this plan during the spring period. The SPR is based on planned turnout date, grazing area and the targeted finish date for the first rotation. The SRP shows the proportion of the farm to be grazed by three key points in the early grazing season namely; March 1st, March 17th

and the desired end of the first grazing rotation (*approximately April 10th - 15th; magic day – when grass growth equals grass demand*). The SRP however, will not tell the farmer the quantity of grass available in the paddock at grazing, so farmers will have to monitor the quantity of grass in each paddock to ensure the grazing animals are fully fed, and provide supplementation accordingly.

PastureBase Ireland shows a range from January 16th to March 6th in turnout date on commercial dairy farms. Soil type has a huge impact on initial turnout date; a typical SRP can be seen in Table 1a. In general, the dates by which a certain proportion of the farm should be grazed are 10 to 15 days later on heavy or slow-growing farms compared to dry farms (*Table 1b*). It is important that these targets are achieved regardless of soil type as it will ensure that grass grows in spring and that there is sufficient grass available by the start of the second rotation. The targeted end date for the first rotation may need to be adjusted as average farm cover is monitored in spring

Table 1. Spring grazing area allocations when grazing commencing in early February (*A*) and on heavy soils with grazing commencing in mid-February (*B*)

(*A*) Week end date	% of total farm area grazed at week end	(*B*) Week end date	% of total farm area grazed at week end
1st February	Start grazing	15th February	Start grazing
1st March	30% grazed	15th March	30% grazed
17th March	66%	27th March	66%
5th April	Begin rotation 2	15th April	Begin rotation 2

The impact of early spring grazing has been advocated on many occasions for grass production, as growth rates are usually greater on grazed swards compared to ungrazed swards at this time of year. In a comparison of early spring grazing versus late turnout, swards grazed in February subsequently grew more grass in the second rotation than March grazed swards. By grazing a certain area per week, it will create a wedge shape grass supply for the second rotation. PastureBase Ireland shows that for every 1% of the grazing area grazed in February, an additional 14 kg DM/ha was grown by April 10th. If it is proving difficult to meet the target proportions grazed, low pre-grazing covers should be grazed first as this will increase area allocated per day, and allow the SRP planner targets to be met, until such a time when there are sufficient numbers of cows calved to increase daily intake. A target of 1,200 kg DM/ha must be grown from January 1st to April 10th to meet the majority of the cow requirements from grazed grass. The first rotation end date can have a large impact on spring DM production, as PBI data indicates mean spring grass production from January 1st to April 15th was 1,239 kg DM/ha on farms completing the first grazing rotation on or before April 15th compared to 994 kg DM/ha for farms completing the first grazing rotation after April 15th. This 20% difference clearly shows that some farms are finishing the first rotation too late.

Spring DM production has a large effect on cumulative herbage production, accounting for 43% of the variation in annual DM production. Looking at PBI data, Irish farms are not meeting the required targets set by the SRP and are finishing the first rotation too late and are missing out on producing additional grass in spring and as a result potentially reducing annual DM production.

Average farm cover in spring

Having a grazing management plan in place for spring grazing is important because of the increased likelihood of feed deficits during early spring, because demand for grass is usually higher than growth. This results in a decline in average farm cover and, therefore, a plan is required to control the rate of farm cover decline. The SRP is a vital tool for spring grass management; however, it should not be used in isolation. By combining the decisions from the SRP with a spring feed budget, while actively monitoring average farm cover, spring milk production off grass will be optimised.

Opening farm cover has a large impact on spring grazing and herbage allocation to the herd. Opening with a low average farm cover (*<800 kg DM/ha*) means there will be less grass available for grazing. In 2015, the autumn closing cover on 65 PBI farms was 782 kg DM/ha, (*ranging from 312 to 1,153 kg DM/ha*). The corresponding opening farm cover in 2016 was 998 kg DM/ha, (*range 417 to 1,307 kg DM/ha*) which equate to an overwinter daily growth rate of approximately 3.5 kg DM/ha. The target opening farm covers is ≥850 kg DM/ha; and with less than this level of grass available, higher supplementation rates are required. A spring feed budget is essential to make the best decisions around managing feed requirements at this time of year. An additional 100 kg of opening farm cover results in an extra six days of grazing, improved animal performance and reduced feed costs at farm level.

Spring nitrogen fertiliser

One of the most important factors affecting spring grass growth on Irish dairy farms is the date and quantity of spring N fertiliser application. The application of N in early spring increases grass growth to allow the majority of the nutrient requirements of cows to be met from grazed grass. A number of experiments across Ireland have shown responses of in excess of 10 kg DM/ha/kg N applied in spring. The date in spring at which a given grass yield is obtained could be brought forward by three weeks when N fertiliser is applied at the correct time. Precise prediction of the appropriate N application date is difficult because of variation in soil and air temperatures from year to year. Date of N application will also depend on when grass is required and if it can be utilised as grazed grass. There is considerable variation in the optimum time for applying N but that the optimum date for the southern half of Ireland is usually in mid- to late-January and mid-February for the midlands and north of Ireland. The optimum level of N used for early grass will depend on grass demand (*stocking rate*). For intensive dairy farms, the optimum level of N to apply is 30 kg N/ha (*23 units/acre*) in late-January to mid-February and 56 kg N/ha (*46 units/acre*) in early to mid-March, or a total combined application of 85 kg

N/ha (*70 units/acre*) by April 1st for early spring grass (*Table 2*). There is large variation in the types, timing and quantities of spring fertiliser applications on Irish dairy farms. This variation can have a large impact on grass DM production in the spring period with farms appling less than 85 kg N/ha (*70 units/acre*) growing 24% (*275 kg DM/ha*) less DM by April 10th compared to the recommended application rates.

The most appropriate timing for compound fertiliser is typically in mid-March to early-April as the application of early P fertiliser affects the grass plants' ability to increase tiller production which results in increased levels of DM production. Typically 50% of the total requirement for P fertiliser should be applied by May 1st with the remaining applied across the remainder of the year. With increasing stocking rates, herbage production and the removal of surplus silage, the need for more accurate applications of compound fertiliser is of the upmost importance to maintain high levels of herbage production.

Table 2. Nitrogen fertiliser application plan for the spring period

Month	Product	Rate	Area
January	Slurry	2500 gal/acre	1/3 of grazing platform
January/February	Urea	23 units/acre	2/3 of grazing platform
March	Urea	46 units/acre	Entire grazing platform
February/March	Slurry	2000 gals/ acre	1/3 of grazing platform
Total applied N by 1st April	**70 units/acre**		

The effects of Poaching damage during periods of inclement weather

A major impediment to earlier turnout and later housing is the increased risk of poaching damage. A survey carried by Teagasc in 2011 reported that 60% of farmers stated that soil conditions were the most limiting factor in extending the length of the grazing season. Poaching damage is caused from the combined effects of animal, soil, plants and soil moisture content. Poaching damage can cause leaf burial in mud, crushing and bruising of the plants and reductions in plant root growth. Poaching damage also causes increases in unevenness of the soil surface and can often increase soil compaction. As a result, subsequent losses in herbage production can often be recorded following poaching damage. Poaching can be divided into different classifications based on cow hoot-print depth; (*i*) light damage; hoof-print depth 3 – 4 cm, (*ii*) moderate damage; hoof-print depth 4 – 7 cm and (*iii*) severe damage; hoof-print depth 7 – 11 cm.

Poaching damage on two soil types 1) freely-draining acid-brown-earth and 2) poorly-drained heavy brown-earth of sandy loam texture were quantified in Ireland. That study found that a severe poaching event in spring on a freely-draining soil can reduce herbage production by 30% in the following rotation, with no effect with little or moderate poaching damage, cumulative herbage production is unaffected. However, poaching damage on heavier soils results in reductions of 21, 69 and 97% in regrowth during the following grazing and 31, 52 and 88% at the second grazing (*little,*

moderate and severe damage, respectively) compared to undamaged plots. This poaching damage resulted in a 14 to 30% reduction in cumulative herbage production on heavy soils damaged in the spring. The same study reported that tiller density was not reduced on the free-draining soil; however on the heavy soil perennial ryegrass tiller density was reduced by 15% as result of poaching, which accounted for the reduction in cumulative herbage production. When swards were poached during two consecutive grazing events, there was a significant detrimental effect on herbage production resulting in a reduction in cumulative herbage production of 22 to 49% compared to undamaged plots. The difference in herbage production between the poaching treatments was as a result of time taken for full recovery of production, meaning the number of days taken for damaged plots to achieve similar daily growth rates as un-damaged plots. It was reported that poached swards recovery times ranged from 73 on the once damaged free draining soil to 275 days on a twice damaged heavy soil with once damaged heavy soils intermediate.

Given the weather condition in spring and autumn, soil conditions are generally saturated in many parts of the country, making them prone to poaching damage. Poaching damage can be minimised by reducing grazing pressure using grazing management techniques such as 'on/off grazing' during periods with a high risk of poaching damage.

Wet weather grazing management

The main asset necessary for spring grazing is a flexible attitude. Do not be afraid to turn animals out early and bring them back in if soils get too wet. Any increase in the proportion of grass in the diet will pay dividends in terms of animal performance and also spring growth. On/off grazing has been successfully used on dairy farms to retain animals at pasture during periods of wet weather. It is also used as a strategy for earlier turnout of animals on heavier soil types. On/off grazing is where the animals are let out to grass for short grazing bouts and graze continuously for a fixed period of time, and are returned to the shed once they finish grazing. On/off grazing takes advantage of the animal's natural grazing pattern, letting them graze when they naturally choose to graze, i.e. immediately after morning and afternoon milking. Research at Teagasc Moorepark concluded that if access time to pasture is restricted due to poor weather, then total access time of 6 hours split into 2 distinct periods results in similar milk production to animals with full access to pasture. Likewise, animals with 2 × 3 hour access time had 95% of the daily DM intake of animals with full access to pasture. Consequently, there is no reduction in milk production or loss of body condition while on/off grazing. In addition, restricted access time minimises soil damage but ensures that grass is being well utilised. Supplementation management is also a critical part of effective on/off grazing. When supplementation (*access to silage when housed*) during on/off grazing is practiced, there was no benefit in terms of additional milk production as long as there was adequate grass available for grazing. Sward utilisation however, was reduced from 82% to 67%, by adding silage into the animal's diet and grass DM intake was reduced from 12.2 to 9.6 kg/cow/day.

Grazing infrastructure for grazing during periods of inclement weather conditions is of critical importance as a good network of farm roadways and multiple access points to each paddock help to minimise poaching damage resulting in increased pasture productivity as discussed earlier.

Mid-season management

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 growth exceeds herd demand. Pre-grazing herbage 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*). One of the biggest issues in mid-season is not stocking the farm appropriately to match grass growth, resulting in large surpluses (*understocked*) or large deficits (*overstocked*). Farm cover should be maintained at between 150 to 180 kg DM/cow from mid-April to mid-August with a rotation length of 18-21 days. In order to maintain this, average farm cover should be monitored weekly and three times every two weeks during peak growth periods. Paddocks with surplus grass should be quickly removed from the grazing cycle and surpluses conserved. Improving pasture quality offers the potential to achieve further increases in animal performance from pasture.

Grass quality varies across the season; however, some of these changes can be negated by good management practices, the correct pre-grazing herbage mass and post-grazing sward height. If pre-grazing herbage mass and post-grazing sward heights are not kept correct, it has adverse consequences for sward quality and regrowth capacity in subsequent rotations as well as reducing animal performance. Maintaining high quality grazed grass has the ability to maintain milk production at 2 kg milk solids/cow/day. For each one-unit increase in organic matter digestibility (*OMD*), grass dry matter intake can be increased by 0.20 kg, which can result in an increase of 0.24 kg milk/cow per day. Well grazed swards (*grazed to 4.0 cm*) will contain a high proportion of leaf in the mid-grazing horizon (*4 to 10cm*). Previous studies have shown that the proportion of leaf in the grazing horizon has a strong influence on the grass DM intake achieved by the dairy cow, so it is imperative that swards are leafy to the base. Poorly managed swards (*with residuals of in excess of 4.5 cm*) can fall to 65% leaf during the reproductive period, resulting in more stem and reducing overall sward quality and animal performance.

Conclusion

All farms can grow more grass through improved grassland management. Managing a farm to produce more grass requires attention to detail and improved seasonal grassland management. There is potential to produce a significant amount of profitable milk from grazed grass during the extended shoulders of the grazing season. The grass budget for the farm must inform all grazing and supplementation decisions based on achieving the target average farm cover during each week of the autumn period. Achieving a closing farm cover above 650 kg DM/ha in early-November ensures that sufficient grass is available in spring to turn animals out to graze. The

SRP targets are not being met by many farmers, and as a result, spring DM production on many farms is below that of farms that are reaching the SRP targets. Increased focus must be placed on utilising grass early in the lactation and trying to stimulate high farm grass growth rates earlier (*late February/March*). Spreading N to influence spring growth (*70 units by April 1st*) and hitting the grazing targets across the spring period are part of this process. Autumn and spring pasture management, spring fertilizer application and farm layout all have major implications for the success of seasonal grazing management.

Getting your replacement heifers on target

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Summary

- A successful heifer rearing programme has defined targets e.g. target weights and calving between 22 and 26 months of age.
- Feed conversion efficiency is greatest in the young calf and should be taken advantage of – feed calves well pre-weaning as it effects post-weaning weight gain.
- Ensuring high quality feed is offered to replacement heifers will help attain target weights at key time points e.g. 30% mature bodyweight (BW) at 6 months and 60% mature BW at breeding.

Introduction

Replacement heifers are the building blocks of the future dairy herd. In order to ensure that maximum production is achieved from replacement heifers during their lifetime, they need to calve as early as possible. Data from ICBF's annual calving report show that 63% of heifers are now calving at the target 22 to 26 months of age, while this is an improvement over the last few years there is still a lot of room for improvement; the top five percent of farmers are achieving 100% of heifers calved at 22 to 26 months of age.

Heifer rearing costs

The total costs associated with a replacement heifer from birth to calving is €1,545 (*Table 1*), this however increases substantially if the heifer enters the milking herd at greater than 26 months of age. In order to recoup the investment made while rearing a replacement heifer, a cow needs to complete 1.63 lactations. Recent Teagasc data shows that 16.5% of Irish cows do not survive beyond the mid-point of their second lactation; consequently, their rearing costs are not fully paid off. Achieving specified targets while rearing replacement heifers is an integral component of the system, especially when aiming to maximise return on investment.

Target weights

A recent Teagasc Moorepark study has shown that the most profitable replacement heifer rearing systems are those where heifers attain a target bodyweight (BW) which is 60% of mature herd BW at mating start date (*MSD*). As average daily weight gain during the pre-weaning or milk feeding period affects BW post-weaning, this may have repercussions on the attainment of target weight at MSD. Therefore, it is critical that farmers aim to achieve target weights at specified time points from the day the heifer calf is born. Bodyweight and body condition score (*BCS*) are of greater importance at mating start date (*MSD*) than age. Recently a Moorepark study gathered BW and BCS information at MSD from over eight hundred and seventy Holstein-Friesian (*HF*) heifers on 48 farms across the country.

It was clear that age (*i.e. calving at <24 months*) does not affect calving date, survivability or subsequent milk production performance. Heifers that achieve target weight at MSD were more productive and were more likely to survive to second and third lactation and ultimately result in greater profitability. Thus, ensuring maiden heifers achieve target weight at MSD is of critical importance. Every heifer rearing program should have a target BW or proportion of mature BW at MSD. Moorepark studies have shown that heifers should be mated at 60% of mature BW and should calve at 85 to 90% of mature BW. A further target of 30% of mature BW at six months of age can also be set. Based on this research target BW at four critical periods are outlined in Table 2 for the more popular dairy breeds.

Table 1. Costs associate with rearing replacement dairy animals

Category	Cost
Variable Costs	
Concentrates	165
Fertiliser, lime reseeding	155
Land rental	200
Machinery hire	15
Silage making	90
Vet, AI and medicine	128
Total Variable Costs	**753**
Fixed Costs	
Car use, water and electricity	30
Labour	203
Machinery operation and repair	20
Phone	10
Insurance. A/Cs, Transport, sundries	39
Interest repayments – term loan	86
Total Fixed Costs	**388**
Depreciation Costs	
- Buildings	55
- Machinery	22
Total Costs	**1,218**
Initial value of the calf	350
Sales of heifers failing to conceive	-23
Net cost of rearing a replacement heifer	**1,545**

(*Source: Shalloo et al., 2014*)

Table 2. Bodyweight targets (*kg*) for maiden heifers at weaning, six months, breeding and pre-calving

	Weaning	6 month	Maiden heifer	Pre-calving
% Mature Weight	15-18	30	60	90
HF	105	175	350	525
NZFR*HF	100	165	330	495
NR*HF	105	175	350	525
J*HF	90	150	300	450

HF = Holstein-Friesian, NZFR = New Zealand Friesian, NR = Norwegian Red, J = Jersey

Calculating mature bodyweight of the herd

In order to calculate target BW which heifers need to achieve at certain time points during rearing, it is necessary to identify the mature BW of the herd by weighting a sample of mature, fully grown cows from the herd. Cows which are in their 3rd or greater lactation and in mid-lactation should be used, so for spring calving cows an ideal time to weigh cows to calculate mature herd BW is during June.

Pre-weaning nutrition & weaning by BW

Good nutrition is fundamental to animal health, welfare and productivity. As average daily gain (*ADG*) during the pre-weaning period affects BW post-weaning, this may have repercussions on the attainment of target BW at MSD. Feed conversion efficiency of younger animals is a lot higher than older animals. Therefore, it is more economically efficient to feed young calves to ensure high rates of BW gain, particularly during the milk feeding period. A recent Moorepark experiment investigated the effect of weaning BW on heifer BW gain during the following summer months. Obviously, calves weaned at a higher BW will require a greater number of days drinking milk or milk replacer. Interestingly, calves weaned at 18% of mature BW (*100 kg for a heifer with a mature BW of 550 kg*) were still heavier than those weaned at <15% of mature BW when they were weighed again at 190 days (*approx. six months old*). The calves weaned at 18% of mature BW had a greater weight gain from birth to 190 days than the calves weaned at lighter BW. There was no difference in weight gain from weaning to 190 days of age between treatments, indicating that no compensatory growth occurred and that differences in BW at 190 days were due to differences in weaning BW rather than differences in post-weaning BW gain which may lead to differences at MSD. Thus, calves should be weaned at 18% of mature BW.

Achieving target BW

The BW of replacement heifers needs to be continually monitored from weaning onwards. When heifers are brought back to the yard for dosing every six to eight weeks, their size and if possible BW gain should be observed. Some lighter heifers may require concentrate during the summer months to ensure that they maintain similar BW gains to the rest of the herd. If weanling heifers are below target BW, they should be supplemented with concentrate in early autumn as waiting to discover calves are under target BW at housing is too late. Recent Moorepark experiments show that

calves supplemented with concentrate in autumn (*September and October*) gained 0.20 kg/calf more per day than unsupplemented contemporaries during the autumn period.

A silage only diet is not suitable for heifers either at or below target BW over the winter months as BW gains are too low. Concentrate will need to be included to ensure heifers achieve target BW at MSD. The quantity of concentrate will depend on heifer BW at housing.

Early turnout

Regardless of the diet offered over the winter, weight gains achieved post-turnout are higher than those achieved during winter. Heifers should be turned out to grass as soon as possible in spring, as they can gain up to 1 kg/day at grass compared to <0.70 kg/day while on their winter diet. Consequently heifers have a greater chance of attaining their target BW with early turnout.

Conclusion

The evidence is clear, good nutrition is fundamental to animal health, welfare and productivity. Through correct feeding and continuous monitoring from the day of birth, target BW can be achieved. Reaching these targets will result in more productive cows when they reach the lactating herd. Furthermore, these animals should last in the herd for greater than two lactations which will result in the initial investment during the rearing phase being recovered, thereby allowing cows to generate a profit for the remainder of their lactations.

Contract rearing dairy replacements - A rearer's perspective

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Summary

- The increase in popularity of contract rearing is driven mainly by expanding dairy herds and farmers who want to streamline labour at their current scale.
- As with any collaborative farming structure, there are benefits and risks for both parties involved.
- Dry stock farmers view contract rearing as a means of increasing stocking rate with little capital outlay, to grow gross output and the overall profitability of their holdings.
- A detailed contract agreement specific to the farms involved should be put in place and agreed including a herd health plan and target weights at arrival and return.

Introduction

Contract rearing of dairy heifers has become more popular in recent years. The increase in popularity is driven mainly by expanding dairy herds but also by dairy farmers who want to streamline labour at their current scale. As with any collaborative farming structure, there are benefits and risks for both parties involved. It is perhaps fair to say that the majority of information published to date has focussed on the issues at hand for the dairy producer. However, this paper will outline the pros and cons of contract rearing from the rearer's perspective, using the collective experiences of farmers in a dedicated contract rearing discussion group based in the Sligo/Leitrim region.

Contract rearing in practice

In November 2015, a number of drystock farmers in the Sligo/Leitrim area came together to investigate the potential of contract rearing dairy heifers as a means of increasing stocking rate and increasing the profitability of their farms. An initial meeting was held on a farm that had been successfully contract rearing heifers since 2010. The Sligo/Leitrim contract rearers discussion group was duly formed and now consists of contract rearers and farmers who intend to contract rear in the near future. To look firstly at the farmers in the group, they were all relatively good grassland managers, more are on the PastureBase grassland measurement system, and all had the ability to make high quality silage. They all looked on contract rearing as a means of increasing stocking rate with little capital outlay, to grow gross output and the overall profitability of their holdings. Group members were asked to list the benefits associated with contract rearing from their perspective and those are outlined hereunder

- A means of increasing stocking rate with immediate effect, making better use of available land and buildings without the requirement to

invest in stock.

- Allows for a clear direction in farm planning as the risk associated with market and price fluctuations is eliminated with an agreed contract price per day established.
- It is good for cash flow as the rearer gets paid on a monthly basis by direct debit.
- Clear guidelines are outlined regarding targets weights and pregnancy rates which keeps the rearer focused on the job in hand.
- A means of building a long term trustworthy relationship with the dairy farmer with each farmer focused on how the relationship will benefit both.
- Contract rearing has substantially increased the profitability of farms involved either as a sole enterprise or in combination with an existing enterprise on the farm.

Group members were also asked to list the negatives and associated risks

- It takes time to build trust and form a working relationship with the dairy farmer - the first bump on the road and how it is dealt with is vital.
- Heifers arriving on the rearers farm under target weight for age was one of the main problems. These animals will be the ones that the rearer will continually struggle with to meet the targets and the ones that will reduce farm profitability. Dairy farmers need to ensure that all heifers sent out for rearing are on target.
- Heifers arriving on the farm sick will also have a huge effect on their potential to reach targets. The dairy farmer and rearer need to draw up a health plan with a veterinary surgeon to manage the health status of the animals leaving both farms.
- The initial contract is difficult to get up and running with some dairy farmers pulling out at the last minute and leaving the rearer without stock.
- The contract rearer needs to be technically efficient, an excellent grassland manager and aware of the benefits of reaching target weights.
- There is a cost associated with changing the annual herd test date to earlier in the year to allow enough time for retesting stock in the case of a TB outbreak. The rearer should liaise with his local DVO prior to entering into an agreement.
- There is a disease risk when stock are taken onto the farm especially where there are existing animals on the farm.

Finally, group members were asked to advise on some key factors and targets that should be put in place and agreed upon between dairy farmer and rearer in advance of the first animals arriving on farm:

- A detailed contract agreement specific to the farms involved put in place and agreed including a herd health plan, target weights at arrival and return and a breeding plan.

- Regular weighing of stock should be undertaken to identify underperforming animals for timely corrective action. The ICBF weight recording link will allow the dairy farm to view weighings and monitor heifer performance.
- In the first year of the contract agreement, both parties found it beneficial for the dairy farmer to hold onto a percentage of the heifers and rear them himself as a means of comparison. This can be used as an aid in the trust building process.
- The use of heat synchronisation and tail paint/patches as an aid to heat detection to ensure pregnancy rate targets are reached and reduce workload on the rearer.
- The use of an intermediary person appointed by both parties to dissolve disputes and find solutions when things don't go to plan.
- To continue to meet as a discussion group sharing experiences and acquiring additional knowledge to reduce the cost of heifer rearing and ensure targets are met.

Conclusion

Contract rearing is a win-win for dairy and dry stock farmers. The dairy farmer has the use of the contract rearers land, labour and buildings which should reduce his own labour requirement and need to invest in additional building for heifer rearing. The drystock farmer, who is technically efficient, a good grassland manager and makes excellent quality silage, will meet the dairy heifer rearing targets and generate a viable farm income. The Sligo/ Leitrim contract rearers group are focused on farm income and want to build long term contracts with suitable dairy farmers. They treat the heifers as their own and take pride in reaching targets. I would say that the heifers reared by group members far exceed the performance of heifers reared on dairy farms nationally.

Evaluating the biological implications of extended grazing at Ballyhaise

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Summary

- The objective of a new farm system project at Ballyhaise College is to quantify the biological and financial effects of alternative stocking rate and grazing season length combinations over 4 consecutive grazing seasons.
- The preliminary results from year 1 of the project indicate that extending the grazing season by 60 days resulted in similar individual animal performance but in a significant reduction in the requirement for both concentrate and silage supplementation.

Background

The Border, Midland and Western Region (BMW) of Ireland consist of thirteen counties including the six border counties with Northern Ireland. 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 production compared to the south and east of Ireland. Previous data suggests that the dry matter production in the BMW region can be reduced by up to 25% while National Farm Survey data revealed a reduction in average farm profitability of 25% in the BMW region compared to that of the traditional dairy producing regions in the South. On this basis, in 2005, Teagasc, along with a local stakeholder group consisting of regional milk processors and industry representatives, established a regional research programme on the existing dairy farm at Ballyhaise Agricultural College, Co. Cavan. Since then the BMW research programme has investigated the effects of various farm management practices on animal and sward productivity as well as economic efficiency of grass based milk production systems. Looking ahead, the sustainable intensification of agricultural production on dairy farms in the region will require new innovative blueprints of dairy production with larger scale, environmentally sustainable processes and resulting in increased animal productivity from the limited feed available. As grazed grass is the cheapest feed source and commonly comprises 0.75 to 0.90 of animal diets, the production and utilisation of increased quantities of higher quality grazed grass has the potential to contribute significantly to increase farm profit. This increase in milk production per hectare will be facilitated by the identification of the optimum combination of stocking rate (SR) and grazing season length combination at farm level. A new research project was set up in 2017 to examine the biological and economic efficiencies of extending the grazing season on the heavy drumlin soils at Ballyhaise. This new research project aims to provide local dairy farmers in this region with

locally generated, relatable research on best practice research technologies to support the development of the dairy sector within the region.

Extending the grazing season into earlier spring and later autumn is the primary grazing management practice which can simultaneously increase pasture utilisation per hectare and the proportion of grazed grass in the diet of spring calving dairy herd. In addition, previous shorter term experiments have documented both animal and sward benefits into mid-season arising from extended grazing. This project proposes to quantify the biological effects of alternative SR and grazing season length combinations on animal and pasture productivity and overall farm business economic performance in the BMW region. This study will investigate the cumulative effects of extended grazing in spring and autumn on animal and pasture productivity on a wetland soil within a multi-year whole farm systems framework.

Project objectives

This project will quantify the biological effects of alternative SR and grazing season length combinations on animal and pasture performance within wetland grass-based dairy production systems over four consecutive grazing seasons. The results of the proposed study will indicate if increased milk production per hectare can be consistently attained with grass based milk production systems in the BMW region. The study will express treatment effects in terms of;

- Milk production performance, general health and reproductive performance.
- Pasture growth and utilisation, sward quality and winter feed production.
- Economic efficiency.

Treatments

Table 1. The four treatment herds at Ballyhaise Research Farm

Stocking rate (LU/ha)	2.5	2.9
Grazing season length (days)		
Mid-March to Mid-October (205 days)	Average X LSR	Average X HSR
Mid-February to Mid-November (270 days)	Extended X LSR	Extended X HSR

In 2017, 140 animals (*consisting of 50% Holstein-Friesian and 50% Holstein-Friesian Jersey crossbred*) were assigned to one of four grazing treatments before calving based on breed, parity, calving date, and Economic Breeding Index. The four experimental groups were comprised of two grazing season lengths: average (*205 days; March 15th to October 20th*) and extended (*270 days, February 15th to November 20th*) and two SR treatments: medium (*2.5 cows/ha*) and high (*2.9 cows/ha*). Each experimental group has its own farmlet that is managed separately depending on grazing season length and stocking rate requirements. Each treatment was assigned a colour code to ensure ease of management at farm level; these treatments are further explained in Table 1.

Experimental measurements

Detailed animal and sward measurements will be undertaken during the study while the total feed budgets of each treatment will also be recorded. The collated biological data will subsequently be evaluated using the Moorepark Dairy Systems Model to quantify the economic implications.

Detailed sward measurements will include biomass yield, quality and utilisation efficiency throughout the grazing season, sward tiller density, ground scoring, poaching and soil structure. Individual animal milk yields are recorded at each milking with milk fat, protein and lactose composition determined weekly. All lactating animals are weighed and body condition scored biweekly.

Results to-date

The effect of grazing season length and stocking rate on animal and pasture productivity during the 2017 grazing season is displayed in Table 2. Grazing season length varied from 209 days for the average grazing season treatment to 262 and 259 days for the low and high SR extended grazing treatments thereby resulting in total grazing days per hectare of 523, 607, 655 and 751 days for the average grazing low SR, average grazing high, extended grazing low SR and extended grazing high SR treatments, respectively.

Stocking rate and grazing season length had no significant effect on individual animal performance (*either in terms of yield, milk composition, Bodyweight (BW)* or Body Condition Score), the high SR treatments achieved increased production per hectare. Milk fat plus protein (*Milk solids; MS*) production varied from 1,132 and 1,136 kg/ha for the low SR average and extended treatments respectively, to 1,311 and 1,360 kg/ha for the high SR average and extended grazing treatments, respectively. In addition, as the average turnout treatments were indoors for an additional 60 days between February and November, a considerable difference exists between grazing season treatments in terms of both concentrate and silage supplementation. Both average turnout treatments consumed between 2.3 to 2.5 t silage DM/ha/yr compared to 0.9 and 1.4 t DM/ha/year for the respective extended grazing treatments. In addition, the average grazing season length treatments required 20% more concentrate than the comparable SR groups on the extended grazing treatments.

There was no statistical difference in total grass growth (*t/DM/ha*) between treatments during 2017 however this trial is in its infancy and sward chemical analysis results are as yet unavailable and which are expected to display significant differences in sward quality between grazing season treatments.

Ultimately, the results to date suggest that extending the grazing season by 60 days in the BMW region delivers similar milk production performance to current average grazing season length but requiring 100 kg less concentrate and 450 kg DM less silage. A full economic appraisal of the production systems will be undertaken at the end of the project incorporating both animal performance and feed cost effects in addition to any other differences arising between treatments.

Table 2. Effect of grazing treatment on milk production performance, purchased feed requirements and grass production and utilisation				
Grazing season length	Average		Extended	
Stocking rate	Low	High	Low	High
Stocking rate (Cows/ha)	2.5	2.9	2.5	2.9
Turnout date (day of year)	Mar 15th	Mar 15th	Feb 15th	Feb 15th
Grazing season length (days)	209	209	262	259
Grazing days achieved (d/ha/yr.)	523	607	655	751
Milk production performance				
Milk yield (kg/cow)	5,224	5,154	5,056	5,287
Milk solids (kg/cow)	452	452	454	470
Milk solids (kg/ha)	1,132	1,311	1,136	1,360
Milk composition				
Fat (%)	5.26	5.21	5.35	5.14
Protein (%)	3.89	3.85	3.95	3.87
Lactose (%)	4.95	4.93	4.88	4.87
Bodyweight & body condition score				
Average bodyweight (kg)	501	496	499	503
Average body condition score	2.90	2.86	2.90	2.90
Lactation supplement (*t DM/ha*)				
Concentrate	1.36	1.58	1.12	1.30
Silage	2.31	2.48	0.91	1.39
Grass production				
Grazing (t DM/ha)	9.6	10.4	10.6	11.6
Silage (t DM/ha)	5.1	4.5	4.0	3.8
Total (t DM/ha)	14.8	14.9	14.6	15.4

Conclusion

The preliminary results from year one of the extended grazing and stocking rate project at Ballyhaise indicate that extending the grazing season by 60 days at Ballyhaise resulted in similar individual animal performance but in a significant reduction in the requirement for both concentrate and silage supplementation during lactation. The results of the project also demonstrate the significant potential to increase productivity from pasture by increasing stocking rate on dairy farms in the region. A full economic appraisal of the production systems will be undertaken at the end of the project.

Career opportunities in dairy farming

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Summary

- There are exciting career opportunities on dairy farms in Ireland created by the significant recent expansion due to milk quota removal, the profitability of dairying compared to other farming enterprises and an aging farming population.
- Teagasc expects that by 2025, approximately 6,000 people will be needed to enter the industry to work on larger scale dairy farms and to succeed farmers who plan to retire.
- There are a variety of employed career roles available on Irish farms from part-time relief work to full-time assistant or management positions. There are also a growing number of progression opportunities via leasing, partnerships or share farming arrangements with land owners.
- Key to having a successful career in dairying is having the skills needed to successfully fulfil each career role. Education in combination with relevant work experience on high performing farms with employers who take an interest in their employee's learning are the best ways to develop the skills needed for successful farming.

Introduction

Dairy farming in Ireland is changing rapidly. Over the last six years, an extra 300,000 cows have been added to Irish dairy farms. In 2016, nearly 50% of cows in Ireland were milked in herds of greater than 100 cows. Teagasc expects that by 2025, approximately 6,000 people will be needed to enter the industry to work on larger scale dairy farms and to succeed farmers who plan on retiring. This increase in the number of larger scale farms has and will continue to create employed opportunities.

Reasons for increased career opportunities

There are a number of other factors along with increased herd size creating opportunities in dairy farming. These include:

- Future demand for dairy products. The long term projections, based on a growing world population, are for the demand for dairy products to continue to grow. Ireland, with its grass based system of milk production, is in a great position to capitalise on this growing demand.
- Profitability of dairying compared to other enterprises. Even in low milk price years like 2016, dairy farming far exceeds the income that be earned from other farming enterprises.
- Increased interest in collaborative farming models. While many people were sceptical about the role of collaborative farming in Ireland, there is a large and growing interest in this area. The creation and subsequent success of the Macra Land Mobility Service, which has facilitated the change of land

use of over 25,000 acres in three years is evidence of the strong interest of Irish farmers in collaborative farming. Successful business arrangements involving farms that have been converted to dairying and also existing dairy farms which have been reinvigorated by the addition of a young, enthusiastic and skilled person are now in operation.

- Long term leasing tax incentives, can allow a farm owner to receive up to €40,000 per year without paying income tax (*if leased for 15 years*). This is increasing land availability to skilled farmers.
- Average age of farmers and lack of successors. The 2013 CSO data showed that the average age of farmers in Ireland was 57 years old. Specifically in dairying, 17% of farmers were over the age of 65. Macra surveys have identified that 50% of farmers over 50 also have no identified successor. There is a lack of successors and a shortage of people with the necessary skills to take on the operating of farms. If a farmer has no successor, they may consider employing labour or entering a collaborative farming arrangement in the future to continue in dairying.

A rewarding career

For the first time in a generation, there are now exciting opportunities and a career progression framework in place on Irish dairy farms. A person with no farming background can enjoy as much success as a person from a dairy farm and with opportunities for both to progress to business ownership. In addition to the potential to build your own business, there are many other reasons to consider a career in dairying such as:

- the opportunity to earn a good income and have a good work life balance
- the variety of work outdoors with animals and nature
- the opportunity to work both on your own and as part of a team
- seeing the rewards of your effort every day by producing a high quality product
- using the latest science to try and improve farm performance
- working within growing businesses undertaking exciting expansion plans
- the strong social aspect of farming through Macra, discussion groups and other farming events

Skills required

Key to having a successful career in dairying is having the skills needed to successfully fulfil each career role. Education in combination with relevant work experience on different farms with employers who take an interest in their employee's learning are the best ways to develop the skills needed for successful farming. Agricultural education is an essential starting point for any young person and Teagasc provide specific dairy training through the Advanced Dairy Certificate and the Professional Diploma in Dairy Farm Management.

Creating labour efficient systems to ensure a sustainable workload

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Summary

- To effectively manage larger herds, work practices need to be adapted so that extra cows can be managed without taking more time. Making changes to how work is done on the farm can save time without any reduction in farm performance, and often with very little cost.
- Spring workload can be planned well in advance to ensure that adequate facilities, equipment and help is available to cope with the demand. Important factors to reduce workload include having suitable high EBI cows that do not require individual attention, an appropriate calving date and stocking rate for the farm that minimises the need for supplementary feed, good grazing infrastructure that facilitates easy movement of animals to and from grazing and adequate well organised farmyard infrastructure.
- Research has also shown that highly efficient farms finish evening milking by 6pm, feed calves once a day from three weeks old and had a good milking parlour setup.

Introduction

The national dairy herd has grown from 1.1 million cows in 2010 to 1.4 million cows in 2017. During that same period, average herd size has increased from 58 to 75 cows, with half of all cows now milked in herds of in excess of 100 cows. This trend is likely to continue as indicated by national statistics of dairy young stock and from supplier surveys being carried out by some of the milk processors. These extra cows have posed a significant workload challenge and led to a renewed focus on labour efficiency and the sustainability of the workload farmers are undertaking.

To effectively manage larger herds, work practices need to be adapted so that extra cows can be managed without taking more time. Working too hard can lead to health and safety risks on the farm (*for everyone on the farm*) and ensuring farming involves a sustainable workload is essential for a number of reasons. Sustainable workloads ensure that a person can spend quality time with family, friends and at their other interests outside of farming. Having a good work/life balance will also help improve the image of farming and help attract more people into the industry.

How to achieve a sustainable workload

On some farms nearly 50% of the total hours worked on the farm occur during February, March and April. Pregnancy scanning data and fertility reports can make this workload very predictable. Therefore, the spring workload can be planned well in advance to ensure that adequate facilities,

equipment and help is available to cope with the demand. Having the herd of cows in the appropriate body condition score, having enough grass on the farm to allow cows be turned out to grass as they calve (*opening cover >750kgDM/ha*) and being personally in good mental and physical health at the start of calving are all very important to reduce the stress associated with compact spring calving. Other important factors to consider are:

- Suitable cow type that doesn't require individual attention i.e. high EBI genetics.
- An appropriate calving date and stocking rate for the farm that minimises the need for supplementary feed (*reducing both workload and farms costs*).
- Good grazing infrastructure that facilitates easy movement of animals to and from grazing by a single operator.
- Adequate well organised farmyard infrastructure that facilitates the easy movement of stock, particularly at calving.

Dairy specialisation is known to increase technical efficiency as it is easier to manage a minimal number of enterprises. By maintaining the minimum number of enterprises on the farm (*e.g. sale of all surplus calves and contract rearing replacements*) it ensures the farm system is kept simple and can be easily communicated to and operated by others.

Changing work practices

Making changes to how work is done on the farm can save large amounts of time without any reduction in farm performance, and often with very little cost. Work practices that have been done routinely for years may no longer be suitable on a farm given the increased workload with extra cows.

Research has shown that highly efficient farms have a set evening milking time and are on average finished evening milking by 6pm. Having a set finishing time in the evening is essential to being labour efficient as it provides clarity around the length of the working day and forces better time management. The most efficient farmers start evening milking by 4pm and research shows no effect of 18/6 hour compared with a 12/12 hour milking interval in herd averaging <6,000kg/cow. An 18/6 hour milking interval should be practiced on all farms averaging <6,000kg/cow.

Once a day milking can be used as a management tool to reduce labour demand. A high labour demand particularly in spring can be offset by changing to once a day milking for the first three weeks of the calving period. Once a day milking can result in reduced income in that period but this may be outweighed by increased labor flexibility and overall reduced labor demand.

Labour demand can also be reduced by feeding calves once a day from three weeks old. Feeding calves once or twice a day had no effect on calf performance or health. However, if feeding milk once a day, calves still need to be checked thoroughly twice a day and fed concentrate at an alternative time to milk feeding. For example feed calves milk in the morning and offer concentrates in the evening.

Restricting silage feeding time resulted in 9% less night calvings compared with cows with full access to silage. Fifteen percent of cows still calved by night (*between 00.30 and 06.29*) and 85% by day (*between 06.30 and 00.29*) when silage feeding time was restricted and 24% calved by night and 76% by day when cows had continuous access to silage. Alterations to daily management routines to allow dry cow's access to silage during the night and not during the day would appear to be worthwhile in limiting the number of calvings by night. It is important to have adequate feed space (*0.6m/cow*). Avoid machinery work at night by putting feed out during the day and locking cows off silage at day. It is important to restrict and feed at the same time intervals and allow cows have ad lib silage access from 6pm until 8am. Allowing cows access to silage only by night should only be practised on cows 10-14 days before calving.

Making the farm set-up more labour efficient

Facilities have a major influence on labour efficiency. A study found that farms with facilities modernised in line with expansion were more profitable than farms that expanded without modernising facilities. Milking is the main task on a dairy farm and typically consumes over 30% of total labour input. Therefore the milking parlour set-up has a large influence on farm labour efficiency. Milking time should be less than two hours as it is reported that after two hours, the efficiency of the operator irrespective of training and experience can decrease resulting in interruptions and errors. Key considerations that effect milking time are cow flow into and out of the parlour, the number of rows to be milked and drafting facilities. Calf rearing facilities tend to be the least modern on many farms, and this has negative effects on labour efficiency as it increases the workload during the busiest time of the year. Having tractor access to clean out pens, being able to pump milk to calves or not having to carry milk long distances and being able to rear calves in batches of 10+ are all essential on a labour efficient dairy farm.

Setting up the paddocks to allow grass to be allocated every 24/36 hours during summer avoids the need for wires and 12 allocations. Setting up the farm for a long grazing season by having extra entry gaps will allow for more access which is particularly important in getting the cows out in early spring and keeping them out in autumn. Having a longer grazing season will save labour by reducing the amount of cubicle cleaning and slurry spreading required.

Out-sourcing work

Many of the most labour efficient farmers reduce the hours of work by out-sourcing work. On larger scale farms this can mean machinery work being done by contractors (*fertilizer, slurry, silage*) and on smaller scale farms this might involve using contractors at particularly busy times of the year (*e.g. slurry and fertilizer spreading in spring*). Many farmers rule out this option due to the cost of the service but fail to consider the huge potential gains – your time as the manager of the business is extremely valuable, especially in the first half of the year during calving and breeding. Ensuring the job gets done on time is another important benefit for example a delay in getting fertilizer out in spring can be a cost in terms of lost grass growth.

Lower machinery running costs is another advantage. Some farms using all contractors for machinery work have a lower contracting bill than the combined contracting and machinery running bills of farms with their own machinery.

There are also many other options to out-source work. Contract heifer rearing is one option as an increasing number of farmers are getting calves contract reared from two weeks of age to further reduce the workload during the spring. Contractors can be used for almost any jobs on the farm. Out sourcing work is an ideal method for any farmer to reduce their workload.

Hiring full or part time help

As dairy farms continue to increase in scale there will be a greater requirement for part time and full time help. Previously, the workload on many farms was manageable for one person but, increased scale and the seasonality of the workload means that extra help is needed. The key change on becoming an employer is that the farm is now a place of work for another person. Farm set-up is important as the easier that jobs are to do, the better they are likely to be done.

How many cows can one person sustainably manage?

When discussing labour efficiency, a question is often asked: how many cows can one person manage? The first point to make is there should be no such thing as a one person farm. Every person needs a break from work and so every dairy farm business should have people available to offer the farmer time away from the farm, regardless of scale. This may be family members or paid relief help.

Cows per person are influenced by two things:

- How many hours of work does each cow require during the year?
- How many hours is the person willing to work?

Based on the national average herd size (*75 cows in 2016*), average labour efficiency nationally is estimated to be 40 hours per cow per year. This includes the workload associated with rearing replacement heifers for the farm. Farms operating very labour efficient systems are achieving efficiency levels of <20 hours per cow per year by having labour efficient facilities and work practices, contract rearing heifers and contracting out machinery work.

The other key variable is how many hours is a person willing to work? Achieving high levels of labour efficiency by simply working longer hours is unsustainable. The farm will look impressive using the key performance indicator of cows per person, but chances are that profit is not being maximised as people are too busy working and management decisions suffer. Combining current national average levels of labour efficiency with maintaining a reasonable working week of 50 hours per week over 48 weeks would mean that one person can effectively manage 60 cows. Another key consideration is the seasonality of the workload.

Conclusion

With increasing cow numbers it is essential that workloads are sustainable to ensure a resilient farm business into the future. Additionally a growing industry means there is a need to attract people to the industry and to achieve this dairy farming must be an enjoyable and rewarding career that offers a good work/ life balance comparable with other careers. To ensure a good work/life balance it essential that farmers focus on adopting labour efficient farm systems and by evaluating, changing or adopting current work practices if necessary.

Appendix 1. Labour efficiency checklist

Farm practice	Yes/No
Milking	
Do you finish work before **6.00pm** each evening (outside of the calving period)?	
Do you start milking before **4.30pm** each evening?	
Is total daily milking time (in pit) less than **3hr (2 x 1:30)**?	
Is the daily milking interval less than **9hrs 30mins**?	
Breeding	
Is the breeding season less than **13 weeks**?	
Is there a working **drafting facility**?	
Is the **parlour closed** over winter (during the dry period)?	
Calf rearing	
Are calves over three weeks of age fed milk **once a day**?	
Are calves put to grass before **March** 10th?	
Calving	
Do you get up fewer than **15 nights** during the calving season?	
Are less than 5% of cows assisted (jacked) at calving?	
Contracting	
Is greater than **50%** of slurry management contracted out?	
Is greater than **50%** of fertiliser contracted out?	
Are heifers **contract reared**?	
Grassland	
Are paddocks topped **once or not at all**?	
Is the grazing season greater than **40 weeks** (cows out, cows in)?	
Are there **three grazings** available per paddock in summer?	
Yard management	
Is less than **15 minutes** spent scraping yards each day in winter?	
Is there a working **handling facility** on all parcels of land?	
Are there **four or fewer groups** of stock over winter?	
Office	
Do you complete all office work in the **morning**?	
Is there a **farm map** available?	

Labour efficient farms would tick "*Yes*" to the majority of these questions (80%+).

Appendix 2

Profile of Ciaran McDermott

Clones, Co. Monaghan

Education/training	• Level 5 Certificate in Agriculture • Level 6 Certificate in Dairy Herd Management at Ballyhaise College • Level 7 B. Agriculture Degree at DKIT.
Dairying experience	• Milking on home farm from a young age • Work placement with Gerard Sherlock • 300 cow farm in NZ in 2011
Discussion group	3 D group Monaghan
Farming history	Father James milked 40 cows, bought land in 2000 which increased milking platform, formed partnership in 2015. Since partnership formed a lot of investment in new milking facilities, slurry storage, cubicles and grazing infrastructure.
Brief description of current farming operations	Milking 80 cows, rearing all replacements, bull calves sold. 14 unit parlour with ACR's. Contract out all silage and half of slurry. Very little relief milking used.
Main skills/abilities required now	• Positive outlook • Grassland management • Stockmanship • Financial management
Advice to young people seeking a career in dairying	• Be prepared to compromise • Listen to other peoples opinions
Farming mentors	• My father, James • Olin Greenan • Discussion group members
5 year farming goals	• 80 cows • 450kg MS / cow • 75% calved in 6 weeks • Good lifestyle
Interests outside of farming	• Going to music gigs / festivals • Macra • Socialising

Appendix 3

Profile of Ed Payne

Tulsk, Co. Roscommon

Education/training	• Green cert Mountbellew College
Dairying experience	• Worked on 200 cow high input unit in Scotland • Jonathon Tighe in Waterford • Milking on own farm since 2011
Discussion group	• South Roscommon group • West awake
Farming history	My father, Jimmy, ran a suckler and sheep farm. Converted an outside block to dairy in 2011. In the process of converting the home farm to dairy in 2018.
Brief description of current farming operations	• Spring calving grass based system • Milking 320 cows twice a day on main unit and 150 cows once a day on second unit
Main skills/abilities required now	• Willing to learn and be open minded • Be able to work as part of a team
Advice to young people seeking a career in dairying	• Follow available research • Be open to new ideas
Farming mentors	• My father, Jimmy Payne • Peers in discussion group
5 year farming goals	• Consolidate the farm business • Develop a mature herd • Start voluntary culling for low production and lameness
Interests outside of farming	• Cycling • Rugby

Appendix 4

Profile of Patrick Traynor

Corduff, Carrickmacross, Co. Monaghan

Education/training	• Green cert Monaghan Agricultural College
Dairying experience	• Home farm • Milking for neighbours
Discussion group	• Fanesiders discussion group
Farming history	Started with 50 acres and 30 cows. Bought 30 acres over the years and leased and swapped land to increase the milking platform. Started with traditional black and white cows which were crossed with Holsteins to increase production. Began crossbreeding with jerseys over the last 8 years to improve solids and fertility.
Brief description of current farming operations	36 ha milking platform with 12 ha outside blocks. Milking 130 crossbred cows in a spring calving grass based system. Using contract rearing to simplify system. Built a new 20 unit milking parlour in 2017.
Main skills/abilities required now	• Stockmanship • Grass Management • Financial Management
Advice to young people seeking a career in dairying	• Get away from home farm and see different ways of doing things • Get as much experience as possible
Farming mentors	Discussion group members
5 year farming goals	• Grow 15 tonne of grass per ha • Improve labour efficiency • More time off • Grow business
Interests outside of farming	• Cycling • Travel

Notes

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