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How the Irish Processing Sector Compares

Liam O'Neill, Irish Farmers' Journal

- The Irish dairy industry has a fragmented structure when compared to some of our international peers.
- Ireland has 30 dairy businesses of which 12 are involved in milk processing and while the industry has some strong companies with a global scope Irish dairy farmers would benefit from further consolidation.
- In Ireland six companies process 80% of the milk while in Denmark, the Netherlands and New Zealand one company processes 80% of their respective milk pools. Some of our processing plants are as efficient as anywhere in the world and significant improvements have been made within the industry in recent years. But it should be remembered that the global dairy industry is capital intensive and the Irish dairy industry is no different.
- There will be room for smaller players, as in any dairy producing region, but their products will need investment and their presence in the market can be undermined by stronger regional competitors.
- Before any conclusions about the future are reached it is important that we assess the strengths and weakness of the industry while being mindful of the social concerns, the opportunities and commercial threats which actually exist out there.

Returns

Measurement of some of our processing co-ops shows that they are operationally efficient, given our seasonal production curve, but under returns on investment measures the Irish industry is behind some of our competitors. In part, this is due to our seasonal production curve, high dependence on commodities, and lack of economies of scale so the quest for continuous improvement and strategies to maximise returns must continue.

Looking at scale, while improvements have been made, we still lag behind world class standards. In 2009, the average production capacity of a cheddar cheese plant in Ireland was approximately 29,000t. Arla's plant in Taulov, Denmark has a production capacity of 70,000t. In powders, Fonterra's Edendale site, are claiming to have the world's biggest drier, with a capacity of 30 tonnes/hour five times the hourly capacity of Ireland's largest drier. Edendale's peak processing capacity is approximately 15 million litres of milk per day.

Marketing

Ireland is one of the few countries in the world today where its dairy marketing division, the Irish Dairy Board, is separated from its processing and research function. The assets of the IDB are owned and controlled by the Irish co-ops and by extension Irish farmers, with its most valuable asset being the Kerrygold brand. Our dairy industry has a good image, produces high quality milk and has low production costs. But the simple fact of the matter is that there are other regions in the world where milk can be produced at a lower cost. The industry has developed some good routes to market such as the IDB having a 30% share of the British cheese market. The countries that operated separate marketing boards like New Zealand, Denmark and Finland have now fully integrated the marketing function into their dairy models.

Research and development

Ireland has attracted some of the leading players in the infant formula sector; these include Abbott, Wyeth and Danone. It is estimated that the combined turnover of these players in Ireland last year was in the region of €667m. Between them they supplied 15% of the global requirements for infant formula and in terms of the EU it is estimated that Ireland supplies 40% of the EU's infant formula requirements. Yet despite these economic successes and other downstream economic possibilities, the focus on research and development within the Irish dairy industry is extremely low.

The level of expenditure on R&D on an annual basis is estimated at less than 0.05% of overall turnover. Looking at some international Co-ops we see that both FrieslandCampina and Fonterra spent 0.5% of turnover on R&D in 2008 while Valio the Finnish dairy spent 0.9% of turnover on research. Further focus needs to be placed on R&D, however a prerequisite to this is a properly functioning dairy model. The disconnect between processors and the end customer is impacting on research and development within the Irish dairy sector and this disconnect is also having an impact on creating a new streamlined dairy industry. While we have some R&D expertise these talents are not being fully harnessed and it is difficult to see how R&D can evolve on a global commercial basis under the current structures, given the fragmented milk pool and the funding required.

Capital and cost structure

The capital expenditure programmes by the Irish dairy co-ops pales in comparison to our competitors (Table 1). As a consequence of this, the balance sheets of most processing co-ops in 2008 were not highly geared. Given the number of co-ops in Ireland it follows that there is duplication of functions across the sector.

Table 1. Capital expenditure for the years 2007 and 2008

Property Plant & Equipment	***2008***	***2007***
	€	**€**
Arla	206m	254m
FrieslandCampina	225m	269m
Fonterra*	302m	224m
Valio**	118m	94m
Arrabawn	8m	2m
Carbery	11m	9m
Connacht Gold	8m	6m
Dairygold	26m	26m
Glanbia	85m	52m
IDB	35m	33m
Kerry	160m	140m
Lakeland	3m	2m

Source: Annual reports and converted to € where applicable

**2008 is a 14-month period, **includes tangible and intangible*

The market

Ireland is ranked 31st in the world in terms of milk production and 80% of our end product is exported. Our competitors have taken the lead in consolidating their industries and are actively partnering with global food players at a time when these players are opting to work with fewer suppliers. The increased power of the multiples must not be underestimated. Retailers are now operating across borders and the way they conduct their business will have implications for all our dairy companies. Our current structures mean that we cannot bridge this gap and this will remain the case as long as these structures are in place.

At retail level intense competition has lead to a situation where, in the major markets, the three top retailers control more than two-thirds of the total purchases. While the increased sales of private label products will impact hugely on the global dairy industry. Milk utilisation and the basket of products produced needs to be aligned more closely with market strategy. Looking at the Irish dairy basket there has been a gradual increase in the amount of cheese produced in Ireland in recent years peaking in 2008 with 163,000 tonnes up 70% on 2000 cheese production.

Milk price

In terms of milk price, the average Irish milk price has trailed behind the EU 15 average for the year's 1996 to 2007. It should be noted that during this period the milk price paid to Irish farmers by some co-ops included gains in the form of dividend income, property and investment disposals. Given the downturn in the construction sector this support will be curtailed in the medium term. There is a view that the competition between Irish processors is a good thing. However it could be argued that this rivalry in the medium term will weaken Co-ops and farmer's incomes as we compete with each other in selling products to the same book of global customers and the multiples. With a fragmented milk pool the only winners will be the global customers and the multiples. The results of the 2008 IFJ/KPMG Milk price review showed a difference of €285 per cow (yield of 5,000l) between the top and bottom.

Governance

No analysis would be complete without making reference to corporate governance. I am not going to expand on the point other than to set out the number of directors on boards in some international dairy companies and some Irish players (Table 2).

Table 2. Board size

Board Size	2008
Arla	18*
FrieslandCampina	12
Fonterra	13
Valio	4**
Arrabawn	22
Carbery	8
Connacht Gold	24
Dairygold	12
Glanbia	21***
IDB	15
Kerry	15***
Lakeland	15

Source : Annual Reports

*Representatives; **Consists of four farmers and ***Plc Board

In Ireland, there are approximately 300 board members representing the dairy industry. In Finland, Valio is the dominant player and just four farmers represent their member's interests. In Denmark and Sweden Arla Foods is the dominant player with 8 Danish farmers and 6 Swedish farmers representing their farmer's interests. The same applies in New Zealand, with Fonterra being the dominant player and in the Netherlands with FrieslandCampina. The final point is in the setting of a strategic direction for the Irish industry is lost as local interests dominate. The real issue of repositioning the industry for the future, while discussed, cannot be formulated and actioned under the current structures.

The next step

The overall pace of change in the Irish dairy industry has been historically slow and behind that of our competitors. Based on our work, at the Irish Farmers Journal, Dairy Industry Focus, we have observed that there is a general consensus that some change is required in order to reposition the industry for the future. The dairy CEOs interviewed by us are broadly open minded to putting forward solutions.

In summary, the global market is competitive and weak businesses will not survive in the short to medium term. This also applies to weak co-ops. The ability to read the opportunities presented will determine success or failure, and how we ultimately compare to our peers. EU policy is moving away from direct supports so in order to have a sustainable Irish dairy industry a plan is required. Protectionist policies are a thing of the past. The impact of the global recession and credit crunch will see a different world emerge. Changing consumer trends, consolidation at all levels on a global scale, volatile dairy markets, changing EU policy and a quest for value and low cost will eventually shape the future of the Irish dairy industry. By ignoring the issues the inevitable adjustment will be more painful for everyone in the Irish dairy sector. They will most certainly be more severe when the economic turnaround comes unless we address the underlying problems of the Irish dairy industry now. Deploying appropriate strategies to cope with the challenges and opportunities ahead will be much more beneficial to dairy farmers. The easy option is to do nothing, but in the long term it is the stakeholders, the dairy farmers, who will suffer most from this ostrich like stance. Whatever conclusions are arrived at by Irish dairy farmers it is incumbent on all involved in the dairy industry to work together to make it happen.

I am reminded of the words of President John F Kennedy over 40 years ago.
"We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organise and measure the best of our energies and skills, because that challenge is one that we're willing to accept, one we are unwilling to postpone, and one we intend to win, and the others, too."

Nobody has the right to deny Irish dairy farmers a better future. How can we work together and achieve beyond what we can see? If the human race can put a man on the moon, then surely we can accept the challenges presented, for the future of the dairy industry, set clear goals, apply all our energies, and then create a dairy industry that compares superior to any other in the northern hemisphere.

How NZ Farmers Influence their Processors

Barbara Kuriger, (ex Fonterra Board Member)

Background

The history of NZ dairy processors prior to 2001 is that they were, in the main, suppliers to the NZ Dairy Board which was a marketing arm for the Dairy Industry. The Dairy Board also undertook some R&D on behalf of the industry both inside and beyond the farm gate. The farm consulting officers worked for the Dairy Board.

The restructuring of the industry in 2001 resulted in the formation of Fonterra which at that point had 95% of New Zealand's milk. Two small co-operatives, Tatua and Westland opted to stay outside of Fonterra. Since then a number of players have entered the market in a small way and Fonterra in latest estimates is just above 90% of the milk supplied. The on farm focus has been transferred to a levy paying organisation which most of you will recognise as DairyNZ. The other body that was formed with the Dairy Industry Restructure was the Fonterra Shareholders Council. I was a member of the Shareholders Council for six years until early 2007. *See Appendix 1 - Fact Sheet on the Shareholders' Council.*

Fonterra's strategic focus has changed in its short life of eight years. Initially the focus was on taking big brands to the world. The focus now is in my belief a much more sensible approach of using our branding locally i.e., NZ, Australia and Asia and partnering with the rest of the customer base as top quality suppliers of ingredients to the big brands. Of course this has allowed us to scale down the amount of dollars needed to fund the strategy as building brands is a costly business. We also are a large supplier of commodities to the world market.

New Zealand dairy farmers are very ownership focused when it comes to the processing of their milk. It is fair to say however that interest in co-operative meetings can be somewhat apathetic in times when payout is flush and there are no controversial proposals on the table.

But there is nothing like a low milk payout or the proposal of letting outside investment into the company to bring shareholders out in droves to either demand answers of the payout or to give very strong feedback about proposals that are not palatable and threaten their ownership state.

In the formation of Fonterra there were some complicated capital structure tools called Peak Notes. Peak Notes were developed to distribute the cost of using the stainless steel fairly and equally by the shape of the milk curve and the length of milking days. Nobody understood Peak Notes at the time but the message was "Fonterra is good for NZ – just vote for it and we will sort the minor stuff out later!"

Farmers either loved or hated Peak Notes but not many totally understood them and they proved hard to get rid of.

Fonterra lost their first vote in 2003 when trying to get rid of peak notes. The proposal was rushed. The Shareholders Council as a body had not been unanimous (or united) in accepting the proposal. There was opposition in the farmer base. The ducks were not all in a row in terms of preparation and support for the vote. There were a lot of lessons learned by both board and council in how proposals should be taken in the future.

There was a model developed in the Governance and Ethics Committee of the Council to ensure that this did not occur with the following vote. The model was followed first in 2005. The 2005 vote was successful bringing a new capacity charge which is a pricing instrument rather than a capital instrument.

The Shareholders Council Model (Appendix 2). It is a model for genuine consultation and dialogue that is instrumental in developing solutions for the cooperative.

2007 capital structure proposal

In 2007, the Fonterra Board came to shareholders with a proposal to let outside investment into the company. They did a less than ideal job of telling their story. Fonterra Shareholders did not understand the strategy of the company well enough to make a decision, asking questions about the use of the money, the length of time the proposed funding stream would last, and how long before the company wanted more funding leaving us in a state where others had the controlling say in the company.

The proposal appeared messy on the governance front as well with two boards being proposed – a commercial board and a co-operative board. There were to be some members who would be on both boards with shareholders asking about conflicts of the two roles.

The media had a field day soliciting opinions for every view they wished to portray. And in all of this, the Shareholders' Council was very, very quiet! The Council was conspicuous by its absence in the debate. As an ex-councillor, farmers would ask me what I thought of the proposal and if I thought the proposed February vote would happen. My answer was always the same. Nothing will happen until the Council comes out in support and the Council is not even coming out so this vote will not happen. The Board wisely decided that shareholders weren't ready for the vote and they withdrew the proposal for more work to be done. The lesson that came was that the model had been ignored and the Board had not got the support of the Council via farmer feedback. Some key learning from the process was that farmers had given some key messages about retaining ownership and control and telling Fonterra that they themselves would like the opportunity to provide needed capital so long as they understood the strategy and the purpose for the raising of capital. Those messages were picked up by our leaders and some major listening has taken place.

Many hours of thought and work has now gone into a current 2009 proposal, due to be voted on in NZ on 18 November. This model (as it stands on 25 October) allows farmers to invest up to 120% of their milksolids supply and receive a dividend on the extra shareholding. It gives individual shareholders a choice, with some already saying they would like to invest more than 20%. I believe this proposal is going to succeed as the Board is unanimous, the Shareholders Council is unanimous and they are presenting a united front in seeking support. There has been genuine consultation taking place with regard to tweaking the details to ensure that the implementation is fair and equitable to cooperative members.

My understanding is that the major difference this time is not only in the contents of the proposal but that the Shareholders' Council has been well and truly involved in its development. Any discussions in the formulation of the proposal (and I expect there have been some lengthy and heated ones) have gone on behind closed doors. The media has not been able to get its hands on the proposal before it became rock solid.

Every proposal comes with side effects. The side effect to this proposal, if successful is positive. Although as suppliers of milk, we have been receiving for a number of years a milk price and a value add payment, we still have not grown up to the point in our country where we separate the two in terms of farm budgeting.
I am hoping that this helps farmers to focus on efficiency even more closely, in that we should be able to make a viable living from the milk price and keep our return on investment to make further investment or debt reduction decisions.

A couple of further comments:

- While the New Zealand Dairy Industry has often been looked upon by the rest of the world as a very united group, and comparatively we are, it has taken a lot of work to get us there. There has never been a recent time in our history where I have seen such a unified approach from our major dairy and agricultural organisations.
- I am a member of the DairyNZ Board and we are working closely with Fonterra, Dairy Companies Association of NZ, Federated Farmers, Livestock Improvement Corporation, Agriculture Industry Training Organisation etc etc. Unity helps us to have more meaningful discussions with our Government.

- More and more farmers are becoming aware that there are too few of us to play games – we have much bigger challenges than each other.
- Unfortunately there are still some who struggle to see what we have in NZ and value it for the relatively good space we are in coming out of the global recession.
- I value the opportunity to present to your Teagasc conference and look forward to the discussions that follow.

Appendix 1

The Fonterra Shareholders' Council is a national body of shareholders that represents Fonterra farmers' interests in their co-operative. There are 35 Councillors elected by farmers in 35 wards throughout the country.

What we do

The functions the Council performs on behalf of shareholders are set out in Section 16 of Fonterra's Constitution. Our key responsibilities include:

Monitoring performance

We evaluate and report on the performance of the Board of Directors' and the direction of the co-operative.

The Council receives and reviews the Board's Statement of Intentions (SOI) for the performance and operations of Fonterra for the season. We track performance against budgeted SOI targets for key performance measures which currently include payout, value add earnings, milk production, the capitalisation ratio and Total Shareholder Return. We also scrutinise the co-operative's strategy and business plans.

We meet regularly with the Board and management to receive briefings and discuss the performance of the business. Each year we report to farmers with our assessment of Fonterra's performance and operations for the season.

Representing farmers

The Council makes sure that shareholders' voices are heard and factored into co-operative decision-making.

We initiate and report farmer feedback to the Board on significant issues and proposed changes to Fonterra.

The Council consults with the Board to provide a farmer perspective when change to the Fonterra Constitution is being considered. We fully debate and assess new initiatives so we can provide farmers with an independent view of proposed constitutional change.

Within our local wards, Councillors work with Area Managers to arrange meetings and other opportunities for farmers to discuss important issues and learn more about the co-operative.

Farmer development and succession

The Council provides education and development programmes for farmers to encourage understanding of their business and participation in Fonterra. These include the two-day Understanding Your Co-operative Programme as well as regional seminars and meetings. We administer training programmes for prospective Directors and Councillors including the Governance Development Programme.

Fonterra elections

The Council determines the elections process and sets the rules for the Fonterra Director and Directors' Remuneration Committee elections. We appoint an independent Returning Officer to provide election services for these elections.

Valuer appointment

We appoint an independent valuer to determine the co-operative's Fair Value Share range. The Council ensures the valuer fulfils the provisions set out in Fonterra's Constitution and maintains independence throughout the valuation process. We have two observers on the Board's Fair Value Share Review Committee.

Milk commissioner appointment

The Council appoint an independent Milk Commissioner to consider and facilitate resolution of shareholder complaints with the co-operative.

Structure

The Council is led by a Chair elected by Council members. The Council's Deputy Chair is also elected by members.

We operate four committees:Performance, Representation, Co-operative Development and Governance and Ethics – and establish project teams as required to address specific issues. An executive team of five full time equivalents support the Council.

Councillors also represent farmers' interests on a number of external and joint Fonterra committees including the Board's Shareholder Relations Committee. We work with the Board on two joint initiatives, the Governance Development Committee and the Candidate Assessment Panel.

Operations

The full Council meets at least six times a year to conduct business, debate and determine policy and receive updates on relevant co-operative matters from members of the Board and management.

Our annual work programme is guided by our Leadership Team, which consists of the Chair, Deputy Chair, elected Councillors and the Chairs of Council's four committees. Work streams, including policy development, are first considered and formulated by committees and project teams before recommendations are put to full Council for deliberation.

Council representatives meet regularly with members of the Board and management as well as industry stakeholders to discuss and progress matters of interest to Fonterra farmers.

Council elections

Councillors are elected to represent farmers in 35 regional wards throughout the country. Elections are held on a rotational basis every three years, so there is an election in one third of the wards every year.

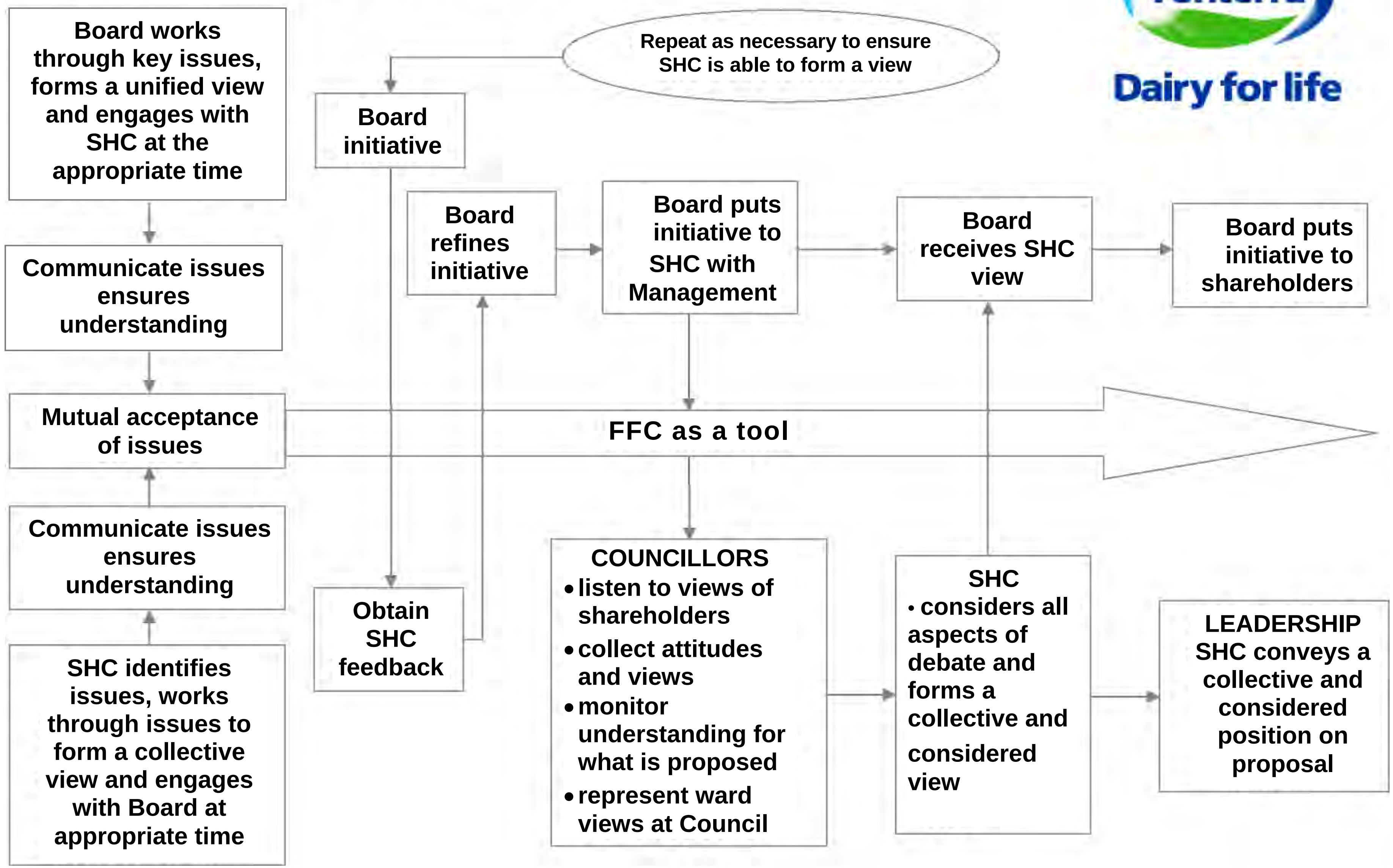
Find out more

To find out more about the Council, contact your local Councillor or visit our web pages on Fencepost by logging in through Fonterra.com. Here you'll find our blog, our latest news and information including Annual Reports and application forms for our development programmes.

Contact us

Contact details for your local Shareholders' Councillor are available in Farmlink or Fencepost.com. You can also contact our Executive Office on (09) 374 9464 or email us at shc@fonterra.com.

Agreed Shareholders' Council-Board Interface Template



Flourishing in turbulent times

Louis Kuriger, N.Z. Dairy Farmer

Barbara and I farm in Coastal Taranaki which has a reliable climate for pastoral dairy farming. While we do experience some summer dry in February /March, we are able to grow pasture through the winter months. We have been farming for 30 years, progressing from variable order to 50/50 sharemilking and on to farm ownership with the first farm purchase in 1988.

We have two dairy farm properties in Taranaki, 68 and 168 respective hectares. These are farmed under identical systems and our accounting model includes both farms into one set of accounts. Production from 635 jersey cows is around 200,000kg of milksolids from an all grass system feeding only hay and silage produced from surplus on the property. All young stock is grazed on farm. With allowance made for the area the young stock graze, the milking area produces around 1,000kg per hectare.

We milk once a day in the spring until mean calving or until grass growth can equal feed demand. All colostrum cows are milked once a day. Also, in some seasons we milk once a day in the autumn, but surprisingly this is usually the seasons where there is more feed on hand rather than less. We find in a dry autumn, cows think they are going on holiday when the feed supply is short if we put them on once a day.

Our farm labour preference is to employ variable order sharemilkers. Currently, our adult family is filling this role. Our son Craig is milking 200 cows and the remaining 435 are milked by our daughter Rachel and husband Kenneth. We also have a son Tony farming in the South Island while his partner Zoe is at University. Tony and Zoe plan to come back to Taranaki and join the farming business.

Our farm philosophy

Keep it simple, keep it enjoyable, keep it profitable, and keep it sustainable. Sustainability is not only environmental but also allowing people to follow a system that gives them a good work/life balance.

My success drivers

1. I understand my system. My system relies on maximising pasture utilisation which requires regular feed budgeting and grazing plans.
2. My expenses are someone else's profit so I choose wisely what I spend.
3. I test and measure every product I use to find the minimum amount necessary to produce required results.

4. I try to keep my system in balance. I find that cows are well balanced on pasture and pasture supplements. Adding in other feeds often requires counter-balancing which can be costly.
5. Never look in the vat to make farming decision. The amount in the vat is the result of historical decisions. Planning forward is the only way to obtain the best utilisation.

Controlling costs

The costs used in this paper are taken from DairyBase which is the DairyNZ benchmarking system. There were 421 farms in the group.

Category	Kuriger $/cow	Group Av $/cow	Note
Animal health	22	69	1
Breeding and herd testing	28	46	2
Shed expenses	7	22	3
Power and water	23	33	4
Phosphate fertilizer	83	193	5
Nitrogen fertilizer	0	26	6
R&M plant and equipment	20	32	7
Feed costs	0	250	8

1. Animal health: Cows are vaccinated against leptospirosis; given magnesium to prevent milk fever; bloat oil for prevention; zinc to prevent facial eczema. Dry cow therapy is used on cows above 150 SCC and heifers above 120 SCC. We use no CIDRs and don't do any inductions. No pour-ons or injectables are used – drenching is still the cheapest form. Our record for no dead cows is 7 consecutive years.
2. Breeding for 5-6 weeks AB with Livestock Improvement Premier Sires. Bulls used for additional six weeks. We achieve a tight calving pattern of 8-12 days to mean calving.
3. Detergent is measured carefully. While liners are replaced annually, the droppers are well maintained to last longer. We service the milking plants ourselves.
4. Power and water use: We aim to use water and power efficiently. Cooling water is used to fill hot water heater saving power. Minimal water used for cleaning yards to reduce effluent.
5. Fertilizer: Basic superphosphate is used with some addition of potassium – usually added at around 15%.

6. Nitrogen is only used in extreme circumstances and not as a regular tool. In the current season we have used it for the first time in 5 years due to an extremely cold winter. We used a total of 16kgs of N per hectare.
7. R&M: Maintenance saves on repairs.
8. Feed costs: zero – not only saving on feed costs but also in labour time and machinery costs.

Overall the savings equate to $320,000 less than the **average** for the equivalent size farm. This is a hell of a lot less than the biggest spenders! **$320,000 total costs divided by 650 cows wintered equals a massive $492 per cow!**

Golden rules

- Have a plan – If you fail to plan, then you plan to fail!
- Measure and monitor everything, but most importantly pasture. If you can't measure it, you can't manage it.
- Never spend money with the sole aim of saving tax – if you don't need the product in your system, don't purchase it.
- I use "The 5-day rule" – when growth is exceeding demand and I can see five days of sufficient feed for the herd in front of me, I will drop out a paddock for supplement.
- In the spring time, I never feed the cows more today than I can tomorrow.
- In the winter time, if the cows are still happy after three or four hours in the paddock then they have had enough to eat. This is a good check on your measuring.
- To run your farm at 90% of its potential production may be more profitable than attempting to get to 100% and spending more than 10% to get there.
- At certain times of the year I am prepared to feed my cows 1 or 2kg of drymatter less for a short period of time to gain two extra days in the round.
- I concentrate on cow health rather than condition score. I don't have skinny cows but neither do mine peak at 5.0 or 5.5 NZ condition score. Healthy cows will put weight on as soon as dried off or when more food becomes available. (People come in different shapes and sizes too and we produce better in a healthy range!)
- Contractors are normally only used for development. We spread our own fertiliser and do most of our own harvesting. We sow our own turnips which are used for a summer crop with the main focus of contouring the farm.
- Bells and whistles cost money!

- The easiest option may not be the cheapest option.
- The hardest thing to change on a farm is the mindset of the farmer! Cows adapt! Pastures adapt! To flourish in turbulent times the farmer needs to be adaptable!

Milk production costs – Can we compete?

Laurence Shalloo, Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary

- Compared to Ireland, cash costs plus depreciation were 31% and 29% lower in New Zealand and Australia and 23%, 38%, 32% and 28% higher in Holland, France, UK and US, dairy farms respectively over the period 2003 to 2007.
- To counter act milk price volatility Irish dairy farmers will have to place a greater emphasis on business planning incorporating risk and key performance indicators.
- Key components of a successful dairy farm business in the future will be based on low cost grass-based systems driven by high grass utilisation, low levels of supplementation and high fertility grass-based genetics.
- Grass utilisation per hectare is the best predictor of profit per hectare
- In the future key farm management skills required will be business planning/monitoring, grass measurement/budgeting, animal breeding/fertility and the adoption of low cost labour efficient practices

Introduction

Future milk price in both Ireland and the wider EU will be increasingly exposed to substantial fluctuation over the next number of years as the supports available from CAP recede. These supports regulated the EU milk price by placing product into intervention when prices were low and selling product out of intervention when prices were high. This kept milk price in the EU, to a large extent, stable. This, however, also had a stabilising effect on the world market as it took EU product out of the market at times when the market was weak and put it back on the market when price rose. This effect had been abolished through the huge reductions in quantities allowed into intervention storage and the abolishment of export refunds (until recently).

World milk production has increased from 389 million tonnes in 1975 to 580 million tonnes in 2009 (IDF, 2009) an increase of 49% in a 34-year period. This corresponds to an average increase in output of 1.40% annually. This increase in milk output has only kept pace with demand as was seen by dairy stocks dwindling to zero in 2007. Over the past ten years China has accounted for a large proportion of the increases in cow milk production with 44% of the 66 million tonnes increase in output between 2001 and 2007 attributed to China. The projected large growth areas for milk production in the future are China and India but this is also where the largest demand growth is expected to take place. The Chinese economy is one of the few economies worldwide that is currently not in recession and has significant growth.

Between 2000 and 2007 world demand exceeded milk supply resulting in stocks declining to virtually zero in 2007. There was a corresponding increase in milk price all over the world in 2007. The price increases encouraged a surge of production in late 2007 and 2008, to a small extent in the EU (1.3%), but to a large extent in the US (approx 2.0%) which for the first time became a major dairy exporter. This increased production coupled with a substantial reduction in demand due to product substitution, price resistance, global currency fluctuation, the Chinese melamine scandal and the world economic recession has led to substantial falls in dairy product value on the world and EU markets. The EU is, and will be, driven by commodity prices on the world market in the absence of substantial changes to intervention and export refund policies in the EU. World market price fluctuation is, and will continue to be, driven by small changes in the overall supply demand balance. Over the past number of months the supply demand balance seems to be coming back into balance with increased demand from China and a reduction in supply growth in the US (0.7% reduction in September) and New Zealand (2% higher). Worldwide, the rate of milk production growth has declined and is expected to continue to decline while the price remains low (IDF, 2009).

This paper deals with key efficiency factors that need to be implemented by Irish dairy farmers if they are going to survive at low milk price and prosper during high milk price. The paper finishes by summarising the key actions that need to be adopted by all dairy farmers.

International comparison

There are a number of complexities associated with comparing the costs of production in different regions of the world. Complexities arise out of differences in methodologies, currency, system of milk production and the markets in which the products are being sold. Each year the International Farm Comparison Network (IFCN) completes an appraisal of international costs and returns. The costs are taken from representative farms (not average) in each country. For example in Ireland there are two farm groupings included in the analysis representing differing herd sizes of 51 and 94, which means that some care is required when interpreting the data, but the general trends still apply. The methodologies chosen to complete the comparison are similar for different countries and conversions are carried out to correct for differences in currency between countries. For this analysis seven countries (Ireland, New Zealand, Australia (Victoria), Holland, France, UK and US) are compared across five years between 2003 and 2008. The IFCN comparisons are carried out in US Dollars per 100kg of milk. An average conversion from Dollars to euros for each year was taken based on a web based currency converter (http://www.iccfx.com/history.php). The milk prices were then converted from values per 100kg to values per litre.

Table 1 shows the cost categories broken down into cash costs, depreciation, and the opportunity costs which include a charge for land and labour for the years 2003 to 2008. These costs are compared against receipts (milk, cull cows, calves, heifers and other returns but exclude all direct payments). There is significant variation between years because the data selected is based on a typical farm for each year and not from an average farm. However a good indication can be drawn from the table from the relationship between costs of production, receipts and net returns between the different countries.

Across all years the exposure to the world market can be observed from the New Zealand and Australian data. Milk price on average across the years was 39% lower in New Zealand and Australia than the rest of the countries analysed. When other sales are included, total receipts per litre of milk are 38% lower in New Zealand and Australia. Average milk price in Ireland was 27.6c/l which was similar to the price in Holland, France, UK and US over the 5 year period. While 2008 and 2009 receipts are not present it is noted that the milk price difference between countries producing commodity type products (whole milk powder, skim and butter) reduced in 2007 and increased again throughout late 2008 and 2009.

The countries analysed can be divided into three categories with New Zealand and Australia having the lowest costs followed by Ireland, and then Holland, US, UK and France. Milk production costs were 3, 44, 70, 84, 90 and 98% higher in Australia, Ireland, Holland, US, UK and France, respectively, compared to the NZ over the five years investigated. The opportunity costs (returns to owned resources including labour) were lowest in New Zealand indicating strong labour and land productivity and were highest in France where the herd sizes are small and productivity per hectare is low.

Over the five years analysed the net margin including depreciation was highest in Ireland highlighting the benefits of being able to produce milk from grass while at the same time not being exposed to the world market price. This adds a distinct competitive advantage to milk production from Ireland and is one that should be harnessed through focusing on cost reductions at farm and processor level while continually adding value at processor level through continued research and innovation.

Table 1. International comparison of costs, returns and margins for Ireland, New Zealand, Australia, Holland, France, UK and US for 2003 to 2008 (c/l)

		Ire	NZ	Aust	Holland	France	UK	US
2003	Milk returns	25.8	15.0	13.8	30.1	29.2	24.1	25.4
	Other sales	3.4	1.3	2.6	3.0	3.4	2.6	1.7
	Cash costs+Depr	22.4	11.2	11.2	17.2	24.1	21.5	27.5
	Opportunity costs	9.0	5.2	4.3	6.0	13.3	5.6	3.4
	Net Margin	6.9	5.2	5.2	15.9	8.6	5.2	-0.4
	Net Margin Econ	-2.2	0.0	0.9	9.9	-4.8	-0.4	-3.9
2004	Milk returns	25.8	15.6	15.6	28.5	28.5	27.7	29.7
	Other sales	3.1	0.8	2.3	3.1	2.7	2.7	2.3
	Cash costs+depr	18.8	12.1	14.5	24.6	24.2	22.7	23.4
	Opportunity costs	10.9	4.3	3.9	10.2	12.9	7.8	3.1
	Net Margin	10.2	4.3	3.5	7.0	7.0	7.8	8.6
	Net Margin Econ	-0.8	0.0	-0.4	-3.1	-5.9	0.0	5.5
2005	Milk returns	26.6	18.8	18.0	27.3	27.7	26.6	27.7
	Other sales	3.1	1.2	2.3	3.5	3.9	2.3	3.9
	Cash costs+depr	16.4	14.8	10.9	24.6	24.6	22.7	23.1
	Opportunity costs	9.8	5.5	3.5	9.8	12.1	7.0	3.5
	Net Margin	13.3	5.1	9.4	6.3	7.0	6.3	8.6
	Net Margin Econ	3.5	-0.4	5.9	-3.5	-5.1	-0.7	5.1
2006	Milk returns	26.3	17.8	18.6	26.3	27.5	26.3	23.2
	Other sales	2.7	1.2	2.3	3.1	5.4	3.1	5.4
	Cash costs+depr	20.9	15.1	15.1	25.5	26.3	30.2	23.2
	Opportunity costs	9.3	5.4	5.8	10.8	17.4	7.7	5.4
	Net Margin	8.1	3.9	5.8	3.9	6.6	-0.8	5.4
	Net Margin Econ	-1.1	-1.6	0.0	-7.0	-10.8	-8.4	0.0
2007	Milk returns	33.3	15.6	19.5	32.3	29.8	29.8	31.2
	Other sales	2.1	1.8	2.1	3.5	3.5	2.8	3.5
	Cash costs+depr	19.1	14.5	18.1	28.4	35.1	31.6	27.7
	Opportunity costs	9.9	4.3	3.5	17.1	16.3	9.9	5.7
	Net Margin	16.3	2.8	3.5	7.4	-1.8	1.1	7.1
	Net Margin Econ	7.8	-2.1	-1.8	-5.0	-17.7	-6.0	2.1

While data was not available for 2008 and 2009 it is clear that milk production based around high input, high capital intensive systems is under extreme pressure as a result of the large reduction in milk price in 2009. For a large number of producers worldwide, including Irish dairy farmers, 2009 is about survival. While the EU and the US both have stepped in to manipulate the market there effect has not prevented their dairy farmers from experiencing extreme financial difficulties. As a result milk output is expected to increase at its lowest level over the past ten years in 2009 (IDF, 2009). The future ability of individual countries to be able to survive these situations will be the key factor effecting future success.

While the data presented in Table 1 quotes from representative farms and not average farms for each country the trends shown would be expected to concur with the average data.

Business focus and business planning

In the past dairy farmers in Ireland could be described as not having a clear business focus. There is a requirement that this changes. Milk price volatility is a new phenomenon for Irish and EU producers. Price volatility is on ongoing experience for farmers exposed to the world market (e.g., New Zealand and Australia). There is a requirement at farm level to refocus the dairy farm business in a way that will ensure survival in an increasingly volatile environment. Every dairy farmer who remains committed to dairying for the longer term should develop a business plan that can be used to drive the farm business forward. The development and application of a business plan is the first stepping stone in the development of a thriving and successful business. In order for any business to survive and prosper long term they must constantly innovate to reduce costs and increase output. This model has been successful (e.g., Ryanair, Kerry Group, CRH, Dell etc.). A dairy business is no different. In the business plan a review is required of resources and from this a plan for the future can be prepared. The business model that dairy farmers select for the future must be based around surviving price and weather shocks and be about setting up the business to capitalise when the price increases. This ultimately means producing milk at the lowest cost possible and reducing the investment requirement by expansion through the use of low cost housing technologies.

1. Mission statement

There are a number of tasks to complete when developing a business plan. The first and most important task is to determine what the goals are for the business over the time horizon being looked at. This should be incorporated into a short statement on what you want the business to deliver including both financial and personal objectives. Every individual is different and therefore requirements will be different and may change depending on stage of life and/or family. For example one possible mission statement may read; “In five years time I will be milking 100 cows, working 40 hours per week and earning €80,000 from the farming enterprise.” Until you sit down and think about what you want the business to deliver it is extremely difficult to develop a plan that will be successful.

2. Identifying the risks

Uncertainty is a fact of life. It creates a business environment that provides both opportunities and threats (Shadbolt, 2009). Risk can be both positive or negative. The important question is how much is the business “at risk”, or how vulnerable is the business to the external pressures (weather, price, etc). It can be expected that milk price fluctuation will pose the greatest risk to the dairy business. However, there are other risks to the business. These include financial risks (feed, fertilizer, interest rates and fuel), weather risks and disease risks (BVD, IBR, Johnes, etc.). There may be other risks that are relevant depending on circumstance and locations. The business plan should set about developing strategies that will test the effect of each of the identified threats. Figure 1 shows the volatility in price for a selected number of countries over the past ten years. It is clear that the volatility in price has become much more pronounced in recent years. This is the case not only in the EU, but also in New Zealand and Australia, where milk price increased by 60% from 2006 to 2007 and then slipped back again. Price fluctuation will force dairy farmers to focus on lowering costs. It is no accident that the lowest costs were observed in the regions where price fluctuation was largest. Risk reduction strategies may be implemented, depending on the aversion to risk of the producer. For example one source of insulation that has helped some producers in 2009 is being in a position where they have a large proportion of heifers reared that could be used for expansion but in a scenario where cash flow is a problem they can also be sold.

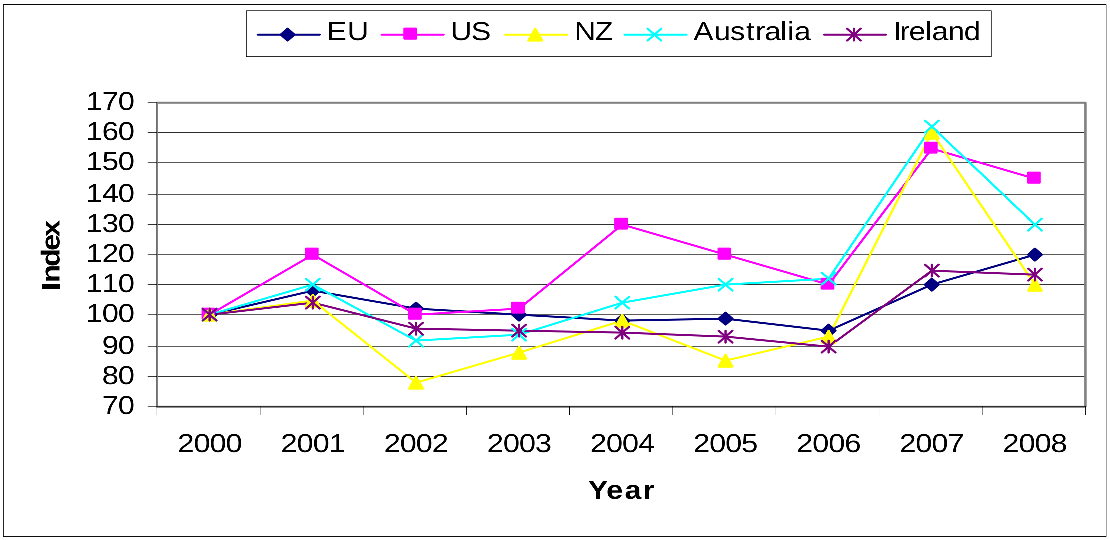


Figure 1. Milk price between 2000 and 2008 in the EU average, US, NZ, Australia and Ireland

3. Developing the business plan

The business plan should be relatively detailed and should encompass all of the business over the period of the plan. The plan should use realistic assumptions in relation to price projections, milk yields, herd health, herbage production and utilisation etc. and should have realistic targets that have to be achieved at different stages. The key technologies (grassland management, genetics, etc) that will affect the overall success of the plan and the business should be identified and highlighted. A set of key performance targets or indicators (KPI) should be identified. A strategy of how each of the individual components of the plan will be delivered should be identified and implemented.

There is a requirement to implement a measurement protocol for each of the KPI in order to benchmark performance within and between years and also benchmark against the potential that can be achieved. These protocols will be essential if the plan is to be implemented successfully and include grass budgeting, financial budgeting and herd recording. Each year the farm should be benchmarked against the plan, against other farmers in the locality or discussion group, against the top farmers and finally against what is being achieved at research level. There may be a need to adjust the plan periodically but the overall mission statement should be kept central to the plan of the business.

Key components of the future Irish dairy farm

The key components of the successful dairy farm of the future will centre around producing milk at low cost in a simple system that is sustainable for the animal and the personnel working in the system, with a cow suited to the system in an environmentally sustainable manner. Ireland’s competitive advantage centres around low cost grass based systems of milk production. To ensure the maximum possible gain can be achieved at farm level grass harvested must be maximised through increased grass growth and utilisation with a cow that calves compactly, at the right time of year, while maximising grass utilisation and minimising supplementary feeding. The key technologies centre around grass utilisation and having the right cow for the system.

1. Grass utilised per hectare

Grass utilised per hectare is a feature of grass grown per hectare, stocking rate, grassland management and the level of supplementary feeding that is carried out on the farm. Nationally dairy farmers operate at a stocking rate of 1.78LU/ha (O’ Donnell et al., 2008) on the grazing platform. It is estimated that nationally there is approximately 7.1t DM/ha being utilised on the average specialist dairy farm. Figure 2 shows the relationship between grass utilised per hectare and net profit for 200 farms selected from the Profit Monitor System for 2008. Figure 2 shows that approximately 44% of the difference in net profit per hectare between farms can be explained by overall grass utilised per hectare. Carrying out the analysis over a number of years showed that the relationship was extremely robust ranging from 45% to 34% over a five-year period. The key drivers effecting grass utilised per hectare are grass growth, stocking rate and supplementation level.

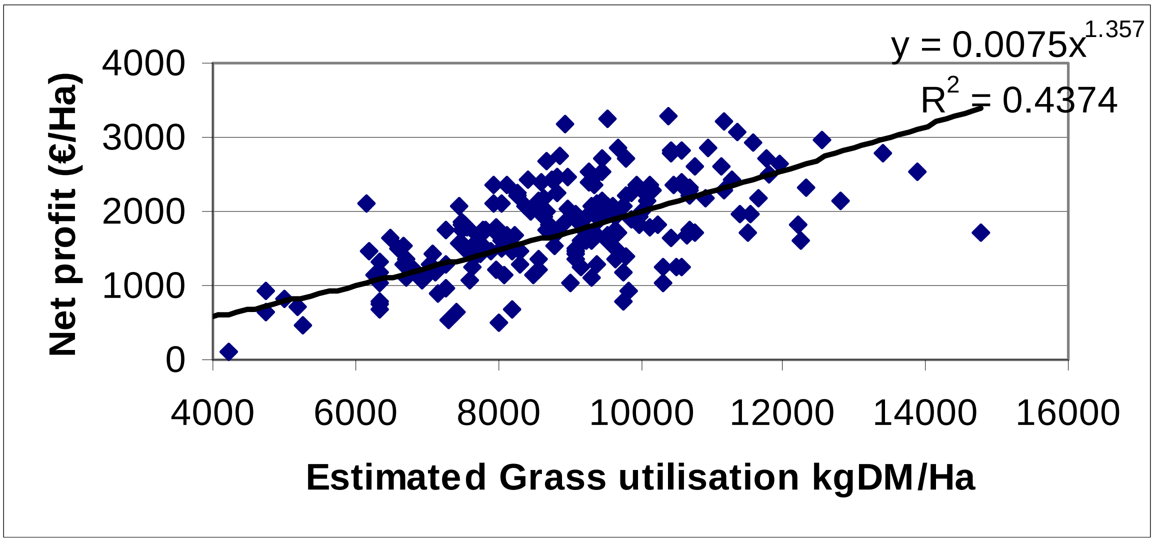


Figure 2. The relationship between estimated grass utilised per hectare and net profit per hectare.

Stocking rate

Pasture is the main source of feed on a dairy farm. Therefore the hectare of pasture is a crude measure of feed supply on the farm. The choice of stocking rate remains the single most important decision which influences pastoral dairy farm productivity. The optimum stocking rate is achieved where a balance is found between the amount of feed grown on the farm, the quality of the feed and the feed requirements of the herd. McMeekan (1956) and Rattray (1987) highlighted stocking rate as the major factor governing animal productivity from pasture due to its dominant effect on animal demand and hence pasture use. When pasture growth remained static, a 10% increase in pasture utilization from 75% to 85% resulted in €258/ha, €141/ha and €355/ha additional farm profit at a milk price of 27.0c/l, 20.0c/l and 30.0 c/l, respectively while the stocking rate on the farm increased by 0.2LU/Ha. This analysis was carried out with high EBI genetics in a typical Moorepark blueprint scenario (Table 2).

Table 2. The effect of herbage production, grass utilisation and stocking rate on key herd parameters in a fixed land scenario using anticipated future costs and prices.

Utilisation (%)		75			85	
DM (t DM/ha)	12	14	16	12	14	16
Utilisable DM (t /ha)	9,000	10,500	12,000	10,200	11,900	13,600
Total hectares (ha)	40	40	40	40	40	40
Cows calving (no.)	76	86	95	84	95	105
Stocking rate (LU/ha)	1.88	2.13	2.36	2.08	2.35	2.59
Milk solids sales (kg)	38,498	43,594	48,399	42,598	48,087	53,230
Fat sales (kg)	21,591	24,449	27,144	23,891	26,969	29,854
Protein sales (kg)	16,906	19,144	21,254	18,707	21,117	23,376
Labour costs (€)	23,011	26,057	28,929	25,462	28,743	31,817
Total costs (€)	118,909	129,392	139,735	127,305	139,079	149,614
Milk Price 27 c/litre						
Milk returns (€)	151,705	171,787	190,722	167,866	189,493	209,763
Margin per cow (€)	673	731	775	721	772	811
Margin/kg milk (c)	10.83	11.77	12.48	1,160	12.43	13.06
Total profit/farm (€)	51,031	62,809	73,912	60,509	73,191	85,075
Milk Price 20 c/litre						
Milk returns (€)	113,208	128,194	142,323	125,267	141,407	155,984
Margin per cow (€)	162	221	264	210	262	295
Margin/kg milk (c)	2.61	3.55	4.26	3.38	4.21	4.75
Total profit/farm (€)	12,292	18,941	25,209	17,643	24,802	30,959
Milk Price 33 c/litre						
Milk returns (€)	184,711	209,162	232,217	204,388	230,721	255,340
Margin per cow (€)	1,111	1,169	1,213	1,159	1,210	1,249
Margin/kg milk (c)	17.9	18.82	19.52	18.65	19.48	20.11
Total profit/farm (€)	84,245	100,418	115,667	97,260	114,677	130,998

Increased utilisation of pasture through increased stocking rates is the main avenue to increased productivity and profitability on Irish dairy farms. Achieving higher stocking rates requires flexible grazing management practices as well as increased grazing management standards. Feed demand must be managed firstly via grass budgeting, as this will ensure that the increased stock numbers are maintained on grazed grass. Increasing stocking rates without firstly focusing on grassland management and measurement will result in reduced farm profit through an increased requirement for supplementary feeds therefore exposing the business to risk when the milk price drops. Flexible management in relation to stock movement and feed supplementation, and feed supply management through the more efficient use of fertilizers and slurry to overcome the variability in pasture supply, will become a more important requirement of the production system. In heavier soils increasing stocking rate may expose the farm to the potential for feed deficits and requires a risk management plan within the feed budget. The potential to increase stocking rate economically may be lower in heavier soils. The importance of supplementary feeds or strategic N fertilizer use to remove the constraints of pasture seasonality will depend on both the feed supply pattern, the price of supplementation and the price paid for additional milk product produced (Hodgson and Maxwell, 1988). Higher stocking rates can be facilitated on most farms by removing beef cattle, young stock and replacements from the grazing platform, reseeding pastures to increase grass growth rates and improving grassland budgeting. Increasing grass utilised from 9 to 13.6t DM/ha would increase farm profitability by between €850, €450 and €1,170/ha at milk prices of 27c/l, 20c/l and 33c/l respectively. The absolute potential for grass growth and utilisation may differ between regions. However until there is individual paddock measurement and recording on-farm that potential cannot be determined. Nationally, grass utilisation is estimated at 7.1t DM/ha. As a first step, there are significant profit gains to be achieved by increasing from 7.1 to 10t DM/ha.

Supplementation

The ability to exploit the increased profitability of pasture-based systems may be curtailed by land costs (both rental and purchase). The debate has often been raised as to the best approach to increase profitability through increased milk output from the herd: is it through increasing milk yield per cow through supplementation or through increasing stocking rate? Increased feed supplementation may be an alternative expansion strategy for some producers where land availability is limited and therefore the development of efficient profitable pasture-based systems incorporating greater proportions of supplementary feeds merit consideration. The use of imported supplementary feeds on many farms has introduced greater flexibility into the management of feeding, as pasture deficits caused by slower than expected growth can be filled by these other feeds thus meeting the requirements of both animals and pastures. There is considerable debate as to what response rates will be achieved for every additional kg of concentrate fed. Numerous studies from Moorepark have shown response rates ranging from 0.5kg to 1.1kg of additional milk for every additional kg of concentrate fed (Kennedy et al., 2006; McEvoy et al., 2008; Horan et al., 2004). The key factors affecting the response are the amount of pasture available to the cow and the genetic make up of the herd. The higher the level of pasture available the lower the milk yield response.

Table 3 compares the effect of increased concentrate supplementation versus increased stocking rate with two different concentrate costs and three different milk prices. The initial farm was assumed to be stocked at 2.09cows/ha producing 824kg MS/ha with 316kg concentrate DM per cow, utilising 8,905kg herbage DM. The effect of two milk production responses were compared (0.6kg and 0.9kg milk/kg concentrate fed) on farm profitability. An additional 500kg of concentrate was fed per cow. Profitability was expressed on a farm basis, per cow and per litre. This was compared to increasing the farm stocking rate from 2.09 to 2.34 and 2.71cows/ha without increasing the concentrate supplementation level. It was assumed that milk yield per cow would be reduced by 6% for every 1LU increase when expressed on a per hectare basis (based on McCarthy *et al.,* 2009).

Increasing concentrate supplementation resulted in reduced grass utilisation by 342kg DM/ha and 200kg DM/ha for milk production responses of 0.6 and 0.9kg milk/kg concentrate respectively. This was due to a substitution effect which reduces grass intake for every kg additional concentrate. The level of substitution will depend on the type of cow, grass availability, weather conditions and the level of concentrate feeding. At a concentrate cost of €200/t and a milk production response of 0.6kg of milk/kg concentrate, farm profitability was only increased at a milk price of 33c/l with the profitability per litre reduced on all counts. At a response rate of 0.9kg of milk/kg concentrate the profitability was reduced at a milk price of 20c/l. When the same analysis was carried out with a concentrate cost of €250/t, all profitability indicators were reduced at a response rate of 0.6kg of milk/kg of concentrate while at 0.9kg milk/kg of concentrate profitability was reduced at 20c/l.

While there was an increase in profitability at the higher milk prices, high response levels and lower concentrate costs, the benefits were marginal. Based on the concentrate feeding trials carried out in Moorepark the response rates expected at farm level would be closer to 0.6kg milk/kg of concentrate where cows are at a low stocking rate and are therefore fed well as pasture. Therefore, the benefits of feeding concentrate would be marginal at best. If the farm is operating at high stocking rates, the benefits from feeding additional concentrate will depend on the concentrate to milk price ratio. However if high stocking rates are facilitated by higher supplementary feeding the business may be exposed when milk price drops.

Increasing the stocking rate from 2.09 to 2.34 and 2.71LU/ha increased grass utilisation by 1,260kg DM/ha and 3,216kg DM/ha respectively. The profitability of the farm was increased per litre, per cow, per hectare and on the farm as a whole at all milk prices. At a milk price of 27c/l, the profitability of the farm was increased by 22% and 50.4% respectively by increasing stocking rate to 2.3 and 2.7LU/ha. The benefits of increasing stocking rate at farm level far out weight the marginal benefits from increased supplementation. There is significant to potential to reduce costs and increase output at farm level through focusing on increasing grass utilisation while at the same time holding the supplementation levels static. When the effects of increasing output through increased supplementation and increased stocking rate are compared the benefit of increasing stocking rate far outweighs increased supplementation and insulates against price volatility.

Table 3. The effect of changing stocking rate and/or concentrate supplementation on the overall system profitability

	Stocking rate			Concentrate					
					€200/t			€250/t	
	Base	***2.3LU/ha***	***2.7LU/ha***	***Base***	***+500kg***	***+500kg***	***Base***	***+500kg***	***+500kg***
Response (kg milk/kg conc)	-	-	-	-	0.6	0.9	-	0.6	0.9
Grass utilised (kg DM/ha)	8,905	10,165	12,166	8,905	8,563	8,705	8,905	8,563	8,705
Grass (kg DM/cow)	3,439	3,409	3,363	3,439	3,330	3,381	3,439	3,330	3,381
Concentrate (kg DM/cow)	316	316	316	316	756	756	316	756	756
Cows calving (no.)	85	95	110	85	85	85	85	85	85
Stocking rate (LU/ha)	2.09	2.34	2.71	2.09	2.09	2.09	2.09	2.09	2.09
Fat sales (kg)	17,609	19,393	21,956	17,609	18,574	19,057	17,609	18,574	19,057
Protein sales (kg)	15,335	16,889	19,122	15,335	16,173	16,592	15,335	16,173	16,592
Labour costs (€)	25,732	28,759	33,300	25,732	25,732	25,732	25,732	25,732	25,732
Total costs (€)	129,246	139,961	155,798	130,910	137,375	137,456	130,729	140,885	140,966
Milk Price at 27 c/litre									
Margin per cow (€)	285	310	330	285	272	313	267	230	271
Margin per kg milk (c)	5.23	5.77	6.31	5.23	4.74	5.32	4.91	4.01	4.61
Total profit/farm (€)	24,193	29,404	36,407	24,193	23,106	26,603	22,710	19,558	23,055
Milk Price at 20 c/litre									
Margin per cow (€)	-115	-84	-54	-115	-150	-119	-132	-191	-161
Margin per kg milk (c)	-2.11	-1.57	-1.03	-2.11	-2.61	-2.03	-2.43	-3.34	-2.74
Total profit/farm (€)	-9,777	-8,004	-5,951	-9,777	-12,723	-10,155	-11,260	-16,271	-13,703
Milk Price at 33 c/litre									
Margin per cow (€)	627	647	661	627	633	684	610	591	642
Margin per kg milk (c)	11.53	12.07	12.60	11.53	11.05	11.63	11.21	10.32	10.92
Total profit/farm (€)	53,318	61,485	72,723	53,318	53,824	58,118	51,835	50,276	54,570

Systems of production based on supplementation at pasture must be clearly defined to ensure that supplementation is efficient and does not lead to a reduction in pasture utilisation on the dairy farm. It is envisaged that the cost of external supplements will continue to increase due mainly to increases in contractor charges associated with inflation in labour, energy and machinery costs. The profitability of supplement inclusion will be determined by the milk to concentrate price ratio and the level of additional milk production achieved in response to supplementation. If the market value of the additional milk achieved outweighs the costs of supplement inclusion and pasture utilisation is not compromised, higher supplementation levels may yield greater farm profit. However, if milk price reduces, the economic feasibility of concentrate use within the dairy feed budget declines as the marginal benefit of increased milk output is outweighed by the cost of the additional supplementation.

Ultimately, future farm systems must be based on achieving consistently high profit margins regardless of the wider financial climate. Therefore within a volatile milk price environment, it is our recommendation from this analysis that producers should initially focus on achieving high performance from high margin low cost systems based on the maximum utilization of grazed grass and limited use of alternative feeds. Only when this base system is developed and managed to a consistently high standard should greater supplementation be considered in a favourable economic climate.

2. Genetics for the system

The dynamics of dairy farm expansion are far reaching. Amongst the factors that limit the potential expansion of any dairy farm business, is the sourcing of additional cows or in-calf heifers. Irish dairy farmers currently generate approximately 240,000 replacement heifers each year (CMMS, 2007). This level of heifer rearing is insufficient to grow the national herd and is just enough to sustain the national herd at its current level. Currently, only approximately 50% of in-calf heifers entering Irish dairy herds originate from AI, with the rest sired by stock bulls of inferior genetic potential. For those producers preparing to expand, purchasing additional cows is both expensive and risky in terms of the associated herd health threats which can be posed. On that basis, the generation of additional high quality replacements from within the herd is critical to support future expansion on Irish dairy farms.

Future farm systems will require a dairy cow of considerably higher economic value than the current average dairy cow. Compared to the current population, tomorrows herd will produce more milk solids through increased intake and energetic efficiency, achieve a 365-day calving interval and require less labour per cow to survive in a larger herd. The performance potential of higher EBI sires has been well documented in recent years. For over ten years research comparing alternative strains of Holstein-Friesian dairy cattle on contrasting systems of milk production based predominantly on grazed grass have been underway at Moorepark (Buckley et al., 2000; Kennedy *et al.*, 2003; Horan et al., 2005; McCarthy *et al.,* 2007; Coleman *et al.,* 2007). The results show selecting sires with high milk production potential and low fertility potential will result in reduced fertility performance and ultimately farm profitability.

Two areas that will be focused on in this paper are the effect of increasing milk solids concentration and the effect of reducing infertility costs.

Milk solids concentration

The rate of milk composition (fat and protein) increase in Ireland is slow. Milk fat and protein concentrations have increased from 3.56% and 3.21% in 1992 to 3.82% and 3.34% in 2008 (www.cso.ie) or by 0.016% and 0.008% per year respectively. Increasing milk solids concentration through the combination of both management and genetic selection has a significant effect on farm profitability. The recent introduction of the A+B-C system of milk payment in many Co-Ops and its proposed introduction in others will compound this increase in milk value. An increase in milk solids concentration increases the efficiency of protein and fat production within the cow due a reduction in lactose output for every additional unit of protein and fat. Increasing milk solids concentration has a significant effect on dairy farm output and inevitably farm profitability. Table 4 shows the effect of increasing milk solids concentration in incremental steps of 0.04% protein and 0.08% fat in a non EU milk quota scenario. The results show that increasing milk solids concentration will substantially increase profitability with a higher increase observed at higher milk prices. Increasing milk protein and fat concentration from 3.34% and 3.82% to 3.54% and 4.22% increased profitability by €11,600, €9,081 and €13,669 at milk prices of 27c/l, 20c/l and 33c/l respectively on a 40ha farm. While it is accepted that these types of increases will not happen overnight the benefits are there to be seen. These benefits can be captured by focusing on increasing grassland management, grazing season length and grass quality as well as on the permanent effects of increasing the genetics for increased milk solids concentration.

Table 4. The effect of increasing milk solids concentration on farm profitability

Milk protein %	3.34	3.38	3.42	3.46	3.50	3.54
Milk Fat %	3.82	3.90	3.98	4.06	4.14	4.22
DM Utilised (t DM/ha)	8,832	8,911	8,989	9,065	9,146	9,223
Total hectares (ha)	40	40	40	40	40	40
Milk sales (kg)	452,586	452,586	452,586	452,586	452,586	452,586
Cows calving (no.)	85	85	85	85	85	85
Stocking rate (LU/ha)	2.09	2.09	2.09	2.09	2.09	2.09
Milk solids sales (kg)	32,426	32,978	33,514	34,048	34,614	35,149
Fat sales (kg)	17,274	17,643	18,012	18,364	18,733	19,085
Protein sales (kg)	15,153	15,335	15,502	15,684	15,881	16,064
Labour costs (€)	25,732	25,732	25,732	25,732	25,732	25,732
Milk Price 27 c/litre						
Milk returns (€)	127,766	130,142	132,360	134,640	137,076	139,357
Margin per cow (€)	258	286	312	339	367	394
Margin/ kg milk (c)	4.74	5.25	5.73	6.22	6.75	7.25
Total profit/farm (€)	21,908	24,286	26,505	28,788	31,226	33,508
Milk Price 20 c/litre						
Milk returns (€)	94,531	96,363	98,109	99,904	101,822	103,618
Margin per cow (€)	-136	-114	-94	-72	-50	-29
Margin/kg milk (c)	-2.49	-2.10	-1.72	-1.33	-0.92	-0.53
Total profit/farm (€)	-11,535	-9,704	-7,960	-6/165	-4,249	-2,454
Milk Price 33 c/litre						
Milk returns (€)	156,351	159,102	161,725	164,421	167,301	169,997
Margin per cow (€)	596	629	659	691	725	757
Margin/kg milk (c)	10.96	11.55	12.12	12.70	13.33	13.91
Total profit/farm (€)	50,672	53,427	56,053	58,754	61,639	64,341

Infertility costs

There are significant costs associated with infertility in the national dairy herd. Based on results from a study of commercial dairy farms in 2004 (Evans, 2005), it is estimated that the average replacement rate nationally is close to 25%. The optimum replacement rate (balance between requirement for new genetics and cost) is estimated to be 17% (Esslemont and Peeler, 1993) in a spring calving herd. Sub optimal fertility adds significant cost to the dairy business. Sub optimal fertility effects herd in a number of ways:

1. Replacement rate

The cost associated with the requirement for increased replacements is a topical one. It has been estimated that it costs approximately €1,500 to rear a replacement heifer when the value of the calf and labour, land and housing costs are included, as well as the direct costs. The value of a not in-calf cull cow at the end of lactation will vary from €300 to €400 depending on year. Therefore the cost associated with having to replace an additional 10 cows is €11,000 or €275/ha on a 40ha farm with 100 cows.

2. Calving date and spread

Sub optimal herd fertility will result in a spread-out calving pattern with an average calving date slip to later and later each year. More often than not this will result in the farmer starting to calve earlier in an effort to stop the slippage and subsequent increase in the breeding and calving seasons. This has a significant feed budget effect as some cows are then calving too early to match the supply of grass with the demand and others are calving too late to capitalise on early grass. There will be an effect on milk solids concentration as more milk is produced from grass silage. There may also be a significant milk yield effect with some cows in the herd having a significantly shorter lactation length. The national calving date has slipped by eight days over the past six years. Nationally the mean calving date is close to mid March with a target of mid to late February. This is costing approximately €300/ha/year.

3. Milk yield per cow

Higher replacement rates in the dairy herd result in reduced herd milk yields. This is caused because 1st, 2nd and 3rd lactation animals are only capable of producing 75%, 92% and 97% of that of a mature cow. Therefore a higher proportion of 1st and 2nd lactation animals in a herd will result in the herd not reaching its milk production potential. A replacement rate 10% above the target of 17% will reduce a herd that has a mature cows milk production potential of 6,200l from 5,871 to 5669l. This will reduce the potential profitability of the herd by up to €100/ha/year depending on milk price.

4. Infertility treatment

It is much more difficult to quantify the costs associated with infertility treatment, with huge variation between herds. However, in herds with poor fertility, there are a greater number of straws used per calf born, increased veterinarian intervention with hormone treatments and higher levels of scanning. Good fertility versus poor fertility could account for 0.6 less straws used per cow in calf with a conception rate to service of 60% versus 40%. This will result in €12 difference between cows @ €20/straw. When coupled with additional scanning and treatments the total could amount to €30/ha.

5. Labour

A herd with higher levels of infertility will result in the amount of dairy cows that an operator can handle being significantly reduced. Increased breeding, calving, and herd intervention reduce the number of cows that can be handled.

All of these costs result in reduced profitability and add significant pressure to the system being operated. Other costs that are more difficult to quantify are reduced potential for expansion, reduced genetic gain, inability to maintain a closed herd, drudgery factor associated with breeding and calving for a 20 week breeding season as well as the lost opportunity for the second most potentially profitable enterprise on the farm. The EBI and in particular the fertility sub index within the EBI as well as cross breeding urgently need to be explored and exploited if the costs associated with infertility are to be reduced on farm.

Actions for 2010 and beyond

(1) Develop Mission Statement for the business
(2) Identify somebody that can help you with the business and technical plans
(3) Identify the risks
(4) Develop and refine the plan
(5) Identify the additional skills required to implement and measure KPIs
(6) Start training process
  - Grassland management
  - Financial budgeting and recording
  - Fertility recording - ICBF
(7) Develop budgets for the year.
(8) Monitor and adapt budget versus performance

Conclusion

Milk production in Ireland in 2009 is built around survival. Current market indications show positive signals in relation to the supply demand balance and therefore price. Price volatility will be a key feature in milk production systems of the future. There is a positive future for dairy farming if a clear business focus to the dairy business. Central to all dairy farm business plans for the future should be the objective or the goals of the business. Focus should be placed on reducing costs while maximising grass utilisation with minimum supplementary feeding. This can only be achieved through grassland measurement and budgeting. Central to the plan for the future will be a cow that can exploit grass efficiently with minimal inputs and is easy care. Action must be taken now if your dairy farm is going to have a positive future.

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Supporting Each Other to Achieve

Fanesiders Dairy Discussion Group

Introduction

The Fanesiders Discussion Group was formed in 2003. There were 10 members in the original group from the Inniskeen area of Counties Monaghan and Louth. The aim at that time was to improve grassland management skills through grass budgeting with the ultimate goal of reducing the costs of milk production. The group employed Carol Doagh, a consultant in grassland management for a period of two years.

Today the group has 16 members (seven original members and nine new members). Herd size ranges from 47 cows to 185 cows. The group view this as being close to the optimum number based on current activities. The group has been facilitated by Trevor Dunwoody, Teagasc since 2005. The objectives of the group has evolved to include detailed financial analysis, improve breeding of members herds and help individuals to achieve their particular goals e.g. maximise income, reduce workload and encourage herd expansion.

Benefits of being a member of Fanesiders Discussion Group

- Tap into a lot of experience (16 opinions vs. 1 opinion)
- Better information to make informed decisions
- Confidence to carry out on-farm developmental work
- Challenge each other to achieve goals
- Share problems (a problem shared is a problem halved)
- Personal and family friendship (members always at end of phone)

Impact of Group

As a direct result of joining the group some members have changed to 100% spring-calving from split-calving herds while one member has changed to 100% autumn-calving. One member is now zero grazing part of his land.

Group members have shown considerable progress over the past six years as indicated in the table below.

Table 1. Group details for 2002 and 2008

	2002	2008	Difference
Cow numbers	62	93	+51%
Milk produced (litres)	372,000	529,500	+42%

In 2008, the Fanesiders group entered the EBI €100 competition and won the Connacht/Ulster Regional Award.

What system do we practice

Our AGM is held each autumn where a new chairman is elected and the following year's agenda is outlined. At last years AGM all group members agreed milk price was predicted to be much lower in 2009 and all plans for 2009 were based around methods to minimise the impact of this price reduction on profits.

Monthly meetings take place on the last Tuesday of each month. Current production details and grassland management details are texted to our facilitator on the day before each meeting. These details are handed to all members at the start of the meeting and form the basis for discussion during the meeting.

Profit Monitor

We held our profit monitor meeting in January 2009 as normal. A complete financial analysis of the precious year's performance is conducted. Following analysis of 2008 figure each member completed a cash flow projection for 2009 based on an average milk price reduction of 10.4cpl. The group then set targets to increase output and reduce costs by 2.4cpl. All members completed a projected e-profit monitor for 2009 at the end of September. Table 2 outline the group performance for 2008 targets for 2009 and projections for 2009 completed at end of September.

Table 2. Group performance for 2008 with 2009 targets and projected performance

	2008	Target 2009	Projected 2009
Cow No	93	100	101
SR milking platform (cows/ha)	2.53	2.60	2.54
Milk Produced (litres)	529,500	570,000	540,500
Protein %	3.39	3.41	3.40
Fat %	3.98	4.00	3.96
KG MS/ha	1132	1132	1062
Milk price (cpl)	34.1	23.7	24.3
Feed costs (cpl)	4.46	2.96	3.04
Common cost (cpl)	17.9	15.5	15.3

Grass budgeting

The group has identified that increasing grass production and utilisation is one way to reduce cost of milk production. The following tools are used by all group members:

- Regular weekly measuring
- Grass budgeting
- Use of wedge technology

- Small sub-groups visiting farms regularly
- Grazing lower covers.

There is a fine line here between success and failure. This year conditions were poor and growth rates were low in May. Pre-grazing cover dipped at this time and post grazing cover were lower than target. In hindsight intakes appear to have suffered with a corresponding drop in output and possibly a higher empty rate on some farms.

Bull selection

The group devoted an indoor and outdoor meeting to bull selection this year. There is huge potential for significant and long term gains in this area. A bad choice of bulls for one year can lead to a generation of bad cows. Group members use the following tools to and aid bull selection:

- Herd Plus
- Sire selection programme
- Discussion Group reports
- Active bull list.

Current herd EBI for the group is €72 with €39 from milk sub index and €27 from fertility sub index. The group target is to increase EBI by €10 per year. This year the focus was on increasing fertility sub-index and increasing protein %. A team of eight bulls was selected from which individual members chose bulls. Genomic bulls were included in this panel.

Other events

As a result of winning the Connacht/Ulster EBI €100 award for 2008 we held a successful open day on one of our members farm (John Mc Elroy) in March.

We also arranged a trip to visit dairy farms in Manchester in September. We visited 3 large scale dairy farms with slightly different systems. This enabled us to compare our performance with those in another country.

Where do we go from here

Information gathered over the previous years regarding profitability, grassland management and bull selection will be used to drive group decisions going forward. There is potential in the group to increase cow numbers and milk production.

Table 3. Goals and targets for group members from 2009 to 2014

	2009	2014
Cow Numbers	101	138
Milk Production (litres)	540,000	850,000
Milk Solids/ha (kg)	1,062	1325
Grass utilised (tDM/ha)	9.5	11.5
EBI (€)	72	122
Common cost (cpl)	15.3	13.0

Financial management

- Group objective to reduce common cost to less than 13cpl for each member.
- Following this year we know that costs and output is within our control while milk price is determined by markets.
- We, as a group, will continue to benchmark ourselves against the industry best. Each member will complete a five year plan for there farm. All members will contribute to this plan. Each year plans will be reviewed and updated.

Grass budgeting

- Aim to increase grass utilisation to 11.5 t/ha for each member.
- Continue regular measuring to identify and improve poorly performing paddocks.
- Use grass utilisation figures to determine optimum stocking rate for farms.
- Group may consider outsourcing weekly grass measuring to reduce labour requirement for this task.
- We are developing a website where weekly figures can be inputted by group members and accessed by all other group members and facilitator.

Breeding

- Aim to increase herd EBI by €10 per year with a target of €122 in 2014.
- Place strong focus on increasing fertility sub-index.
- Increase number of replacements to 45 per 100 cows. This will facilitate expansion or group scale of surplus stock.

Labour

- Although we are planning to increase herd size group members don't necessarily want to spend more time on the farm. We will continually focus on ways to reduce labour requirement on our farms through increased use of contractor, pooling labour among members and increasing milking parlour size.

Subgroups

- Specialist sub-groups will be formed around particular areas of interest. Sub-groups will research specialist topics and report back to group at regular monthly meetings. Such topics will include heifer rearing, milk quality and reducing wintering costs. As a group we also want to improve our awareness of what's relevant outside the farm gate.

Supporting Each Other to Achieve

John O'Connor, Group Chairman, William Dennehy and Martin Brosnan
C.F.S Discussion Group (Currow/Firies/Scartaglen)

Summary

- We are a group of ordinary dairy farmers constantly looking for a more profitable way of providing for ourselves and our families.
- We have to constantly question what we are doing. Questions like; What is the right cow type for our system? What is the right stocking rate for our farms?
- Our CFS discussion group is just another way we use to try and answer these questions. Sometimes we get answers more times we don't. But if the group idea helps we say why not…? It's worth the effort.

Background

Our Dairy Discussion group has evolved over the past 14 years (Table 1), from three smaller groups that met a few times a year, to our group today that meets on a monthly basis on members' farms. We are all running family farms and find that the business of farming is more profitable and rewarding when we share and pool the farming experience and knowledge that we all hold individually.

The overall objective of the group is to be as good as we can be in the business of dairy farming. We want to be viable and be highly efficient in our spring calving grass based systems thereby maximising farming profit and achieving a good lifestyle for ourselves and our families.

We firmly believe that maximum grass utilisation in a compact spring-calving system offers the best chance of achieving our objective. The four key measures of progress in achieving our group objective are: a) milk solids production per hectare; b) six week in calf rate; and c) EBI and fertility sub-index and d) Profit per hectare.

Table 1. A profile of some key group production parameters

Farm Size (Ha)	45.2
Farm Stocking Rate (LU/ha)	2.12
Dairy cow numbers	68
Milking platform area (ha)	34.6
Milk solids per cow (kgs)	372
Milk solids per hectare (kgs)	807
Six-week calving rate	60%
Herd EBI 2009	€74
Milk solid sub-index	€34
Fertility sub-index	€34

Our members -the drivers

In a nutshell, it is the 18 members that drive our agenda. The group operates on the basis of a strong trust and commitment. We are a group of like minded individuals who get on well together and this has resulted in a more honest exchange of information. A number of developments which have made the group stronger in recent years include:

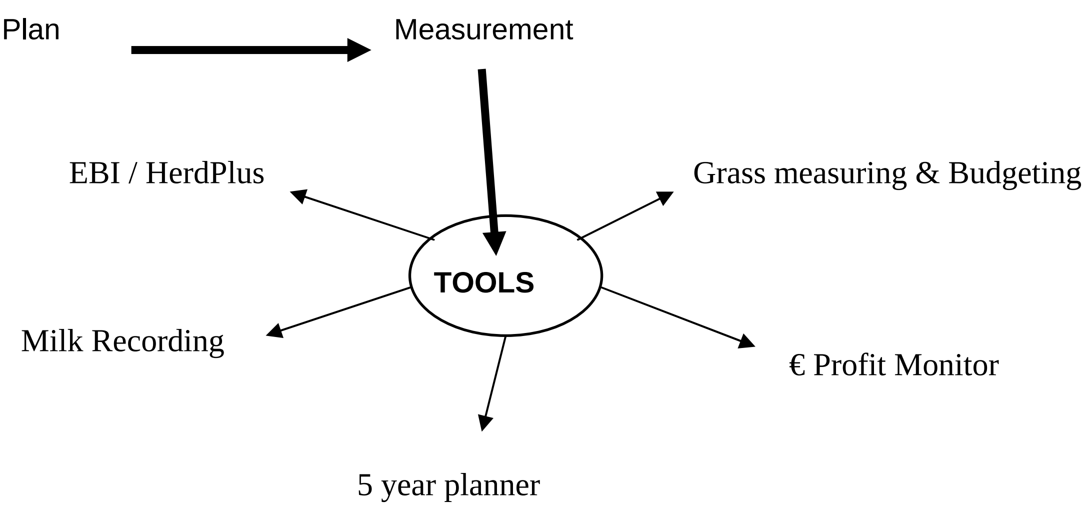
- Members drive the group themselves and are fully committed to attending all our meetings;
- The group is well organised (the chairmanship is rotated each year);
- A definite programme of monthly meetings and activities is set out at our AGM; and,
- Between monthly meetings the group members keep good contact and review progress.

The demand for more information or discussion on a particular topic initially comes from one or two members. They invariably drive that topic, coming back with more information or asking the questions that we then set out to answer. Topics may range from discussing different reseeding methods or grass varieties, criteria for selecting our bulls just to name but a few.

Information – a key driver

Discussion without information is a waste of time. Decision making without information is no better. That is why provision of timely information is central to all our meetings. The tools we now use to help us make key decisions are shown in Figure 1.

Figure 1: The tools used by the group when making key decisions



These tools provide us with solid information that focus our minds on the bottom line - will we be better off, financially or labour wise, by the decisions we make as a group?

After a few trips to our discussion group neighbours across the county bounds, we decided that a simple report prepared before our meetings would improve the quality of discussion. Now, key financial, production/grass supply information is submitted to a group member before each meeting and a one page summary report is available for the meeting.This has brought a more business like approach to our meetings and saves time spent in assembling information during the meeting.

Seeing is believing…..a driver

As a group we are all familiar with each others farms and figures. We have built confidence and trust, based on this sharing of each others way of farming. We notice small improvements, something that made life that bit easier - that decision that left more money. These are the benefits; progress slowly gained often stays.
Likewise, in our group trips away and our recent participation in the grass budgeting course, seeing other ways of doing things gets lively debate going and a different perspective on things.

Of course familiarity breaks down barriers and as we got to know each other a more rigorous assessment of a situation was often called for…..What the……….are you at lad!…can sometimes be the opener to some plain talking that would lead to a better decision being taken!

Listening - a driver

A discussion group, by its nature, needs communication but sometimes we learn more by just listening. We don't have to make any comment but often a remark will trigger a thought in our minds that might just put us thinking.

Survival - a driver in 2009

As 2009 developed it became clear that we needed to react to extremely poor cash flow aggravated by extremely difficult weather conditions (25 inches of rain fell from mid April to mid September with a serious impact on our soil type). How we reacted to this situation is covered in the next section. The groups support structure was invaluable during this difficult time.

What have we done this year?

In the most challenging year that we have ever faced as dairy farmers the solid support of a group of individuals in similar circumstances was invaluable. Knowing that we were all in the same boat (at times heading for the Atlantic!) was reassurance in itself. They say that misery loves company, but in a year like this, knowing that others were also feeding the last silage reserve when we should be cutting it, helped us to ride out the storm….eventually the sun shone in June and we all moved on! This was also the time that we had our most important meeting of the year. Serious feed costs had been incurred and it wasn't sustainable just to do nothing. We made a few decisions at that June meeting; the outcomes are discussed further below.

Monitoring ourbBusinesses

The year started off as it has done over the past five years with a Profit Monitor meeting in early February. Once the profit monitor reports are done we spend a lot of time going through each individual report and every cost. We cannot farm and monitor our business if we do not measure our costs – otherwise we're walking around in the dark. We discuss the weakest points of all individuals but pointing out mistakes and weakness is not enough. We decided that we should all do out an achievable and realistic budget for the year. At that time we based our budgets on 25c/l and set a target of 350kg concentrate/cow and the elimination all non-core expenses.

We were on budget, cost wise, to 30 April but milk price had fallen to 23c/l. Poor growth, and soil conditions deteriorating in May, led to feed costs rising sharply. Group members had fed about 120kg concentrate/cow during the month of May. Silage stocks were gone. We got together in June to revise our budgets and discuss them in detail (Table 2). This was a very rewarding meeting as we discussed ways in which we could tackle our squeezing income. We considered ways of cutting costs both large and small.

Table 2. 2009 feed and fertilizer budget to 31 May

	Budget	Actual
Feed/cow (€)	€80	€90
Fertilizer/cow (€)	€82	€57

The main decisions made at the June meeting included:

- Any further meal feeding would have to be a cheap high energy coarse ration.
- Nitrogen levels to be increased with a plan to bale grass surpluses at every opportunity over the summer months.
- Nitrogen would only be applied in the form of straight CAN

We thought the crisis was temporary, but it rained most days during July and August!!

Improving herd genetics and herd fertility

One of the most important things for us as a group is to improve the genetic merit of our stock. We met up towards the end of 2008 to discuss herd breeding targets for 2009. Our targets for the year were to select a team of bulls with an EBI of €150 and with a fertility sub index of at least €70. Our members immediately set out to order dairy straws that met these criteria. The results are shown in Table 3.

Table 3: Weighted average Dairy AI straw use in CFS herds 2009

Avg. EBI	Number straws	Straws/cow	Fertility subindex
€143	117	1.72	€70

Source : ICBF competition report

We have all spring-calving herds and the aim is to get them to grass as soon as they calve. Therefore, we need to select bulls that match this system. We know it is more profitable to have a cow that will calve early and get her to grass early; that is why fertility is more important than milk when selecting bulls.

Selecting the right bulls is only half of the equation, heat detection is vital during the breeding season. This year we discussed different aids for heat detection and we decided as a group to order chin balls. Some of the lads in the group had used them in the past and had got very good results.

Investigating the role of crossbreeding

One question we've discussed at numerous meetings is; are we using the right cow for our systems and for our soil type'? So in August we went to visit the Ballydague research farm to investigate the Jersey crossbred. Also, on a separate trip to Cork we went to see a herd with three to four generations of crossbred Jerseys – seeing is believing!

What about grass?

Grass is vital in our farming systems. At our costing and budget meeting at the start of the year, we looked at cutting costs and we all agreed that feed and fertilizer are our two biggest costs. To try and reduce these we must increase the amount of grass grown and utilised.

- For the second year running we were involved in a grass budgeting group on a host farm.
- We walk the farm and measure the amount of grass in each paddock. We then come back to the shed and come up with decisions for the host farmer on what he should do to maintain the targets set out during the year.
- We built up new skills in using the grass wedge to make decisions about mid-season grass management.
- This year we also set up four 'mini' grass groups each comprising of four members who met weekly. This was one of the toughest years we've

experienced and I suppose the main reason for setting up these groups was to support each other when making key management decisions. The fact that we learnt how to measure and budget grass helped us make key grassland management decisions during the year.

- Most of the group members could say that their cows were housed for 20 days during the main grazing season. This is one key decision that was made to prevent poaching, reduce demand on farms and now has helped stretch out our grass until mid- November.

Sharing knowledge and experiences

In September we visited the Crookstown Dairy Discussion group. Even though rainfall levels recorded by that group were similar to our own, they were still out grazing full time. Our soil types meant that we were housing at night, some of us fulltime, again emphasising the ability of different soil types to handle wet weather. We have to be more proactive in our decision making when faced with difficult climatic conditions. Our final task for 2009 is to complete the Profit Monitor and evaluate the lessons we have learned in this difficult farming year.

Where do we go from here?

As we see it, in future we need a plan, otherwise we are walking aimlessly in the dark! Everyone in the group has different plans for their own farms but the one thing we all have in common is that we need to work from a solid plan and draw out a budget. Each member has completed a five-year plan and we assess and amend this plan every year.

We must complete a farm budget

When drawing up a farm budget we are targeting to earn enough cash to meet day to day living expenses and farm running costs including loan repayments. This is an exercise that we can be slow to do but can be very rewarding. This is central to taking control of our business.

Looking to the future with a no quota scenario, large price fluctuations are inevitable. We therefore acknowledge that we need a liquid fund or a ‘bad weather fund’. This can be in the form of:

(i) Adequate heifer replacements (40% of herd)
(ii) 20% silage reserve
(iii) Cash reserve if future milk price allows.

This must be incorporated into our five year plan. This will help us to handle difficult conditions as experienced this year. Most of us have young children either at the school or college stage so we need to budget for their future. The bottom line is to increase profit/year which must be attributed to either increased efficiency or farm expansion.

Measuring progress

Table 4 outlines the Key medium term targets for our group (average)

Table 4. Medium-term group targets

	5-Year Target
6-week calving rate	80%
Herd €EBI	€110 (€60 from fertility)
Milk solids/ha	1,000kgs
*Profit/ha €	€1,700

*Dairy area; **2009 Profit Monitor results are being assembled as we write (October 2009). Preliminary financial outcome figures will be available at the National Dairy Conference

What actions are needed to achieve these targets??

Achieving a more compact calving pattern is the biggest challenge facing the group. Breeding adequate high EBI AI bred replacements must be the priority. As grass utilisation improves so will the stock carrying capacity of our farms. Individual group members are already achieving utilisation of over 12 tonnes grass dry matter per hectare (as measured in 2009).

Breeding

The average EBI of the group is €74 with a milk and fertility sub index of €34 each. We are aiming to increase herd EBI by €8 each year and are focusing that much of the improvement will be in the fertility sub-index. We have made great head way with the young stock coming through with a group average EBI of €92 for the 2008 replacement heifers and €99 for the 2009 weanlings. This year many of the group members used the new genomic bulls – hopefully we will see good results on the ground in 2011.

Actions to be taken by the group

- Continuing use of the highest EBI available sires is vital. Minimum 2010 AI bull target is set at €180 (with €80 coming from fertility).
- The key to future expansion is to have enough replacement heifers. This is the main message we took from the 2009 EBI open day in Cork where the winning group aimed to have **40 replacement heifers for 100 cows**.
- This will require us to use an average of 150 dairy AI straws (2 straws/cow) on our herds in 2010.

Land availability

Land is the limiting factor for those of us in the group wanting to expand. A lot of land is tied up with other enterprises such as beef and replacement heifers. Some of us have the choice to increase dairy numbers by reducing or eliminating other enterprises such as dry stock. To free up more land on the milking platform some of our members this year sent heifer calves off to be reared elsewhere. This is a real solution for many of us and we can see more of us contract rearing heifers in the future so as to free up more land for expansion.

Actions to be taken by the group

With an ongoing reseeding program (10% of the farm per year) and continuing use of new grassland management technology there is scope for many of us to increase stocking rate on our milking platform. Given the year we've been through this has to be planned carefully. However, a realistic target for the milking platform stocking rate is around 2.5 cows/ha on our soil types. With more compact calving we will still aim to produce 400kgs of milk solids per cow and 1000kgsMS/Ha.

Lessons we have learned in 2009

- Flexibility is vital in our grassland management. Our records show that the most severe drop in milk solid production occurred in the month of May. Unfortunately most of us did not have a reserve of good quality baled silage left at that stage, feed that was needed to fully feed the herd during the period when ground was waterlogged. Valuable production was lost at that time which coincided with peak milk yield. Holding our good quality bales until the spring time will give the best return in milk solid production.
- Savings in silage in the February/March period (on-off grazing/rotation planner/grass budgeting) contribute to a vital feed reserve.
- Looking back on the results of our June review meeting the decisions we made then have certainly put us in a stronger position financially at years end.
- 2009 has been a year of survival with margins from milk production at best being breakeven. Leaning on direct payments helped us to survive this year. This is not a satisfactory or sustainable situation. However, we will continue to plan our dairy farming systems as a group so that we are better armed to face future milk price volatility and difficult grass growing years.

Acknowledgments

We wish to acknowledge the important role that Teagasc has played in facilitating our development. We wish to sincerely thank Sean Leen and Sean Brandon, the early pioneers, to the present day staff in Teagasc .Thank you.

Grass Roots Project 2008- 2010

Abigail Ryan, Teagasc

Summary

- The Germinal Seeds/Teagasc grass budgeting project aims to improve the grassland management skills of participating farmers resulting in production costs decreasing by 2c/l.
- Seventeen host farmers were each individually visited every three weeks to teach grass measurement and budgeting. As a result the host farmer walked and measured the farm himself every intervening week. Grass management decisions were made in consultation with the grass specialist adviser. Progress has been made despite two difficult grazing seasons.
- Grass grown per hectare increased by 2.70 tDM from 8.30 to 11tDM/ha) while meal fed per cow decreased by 242kg (45% decrease) since the project started two years ago.
- Around each host farm, local support farmers attend once every three weeks with their B and T (Business and Technology) Dairy Adviser and the author. They have improved their grassland management skills and utilised 0.8 tonne grass DM/ha more in 2009 while meal fed per cow decreased by 186kg (30% decrease).
- This project has given an increased momentum to the adoption of grass measurement in the 11 counties involved in this project.

What does this project involve?

Grass Roots 2008 to 2010 is a cornerstone project of the Teagasc dairy advisory programme. The objective of this project is to bring up to date Teagasc dairy research into practise on commercial farms by giving participating farmers the skills to grass budget and increase grass utilisation.

The project was established across 11 counties with 17 host farmers and the support of local Teagasc B and T advisors. Host farmers are the farmers around the country who host a public grass budgeting farm walk every three weeks. In the intervening weeks they complete their own grass measurement. The intention of the project is to have sufficient scale and critical mass to deliver the key grass message to a large number of farmers. To achieve this we established a group of support farmers around each host farm who visit the farm and monitor progress every three weeks. Between seven and 18 support farmers attend each host farmer meeting. In total, approximately 200 support farmers are currently engaged in the programme.

Every three weeks we walk the host farm. Fourteen meetings are held on each of the 17 host farmers per year. The local support farmers join the host farmer, myself and the local advisor for the measuring and decision making debate. When we are finished walking the farm we return to the classroom on the farm. We then review the management decisions made at the previous meeting and create a grass wedge or grass budget to determine the host farmer's position relative to the seasonal targets. Everyone participates in this as we use the multimedia projector to present the grass budget. At each session we make 3-4 key management decisions for the next three weeks.

These decisions are recorded on a white board to remind the host farmer of the actions he has to take then and during the weeks between farm walks. These on-farm 'walking' meetings give the support farmers the confidence to use the same targets on their own farms. The host farmer benefits from the contributions of the Teagasc advisors and 'support' farmers associated with their farm. The regular meetings per year on the host farms allow the support farmer groups to gain the experience and knowledge that they need to make informed decisions on their own farm.

Grass Roots project 2008 to 2010 is partly funded by a commercial company Germinal Grass Seeds, for which we are grateful. However, the rest of the project is self financing. The host farmers pay €1,500 per year and the support farmers pay €150 per year. Some support farmers have said that each meeting is worth €150 per visit to them!

Given the variation in farm size and soil type the decisions taken on the host farm may or may not reflect the management decision local support farmers take but the principles are the same. You will see later what the support and host farmers strategy is for improving the management of wet farms.

How did I feel about the project at first?

It was frightening! The sheer scale is daunting which meant set up, organising and participating wasn't easy at the start! However, I am very fortunate to be working with such a brilliant team of host farmers, local B&T advisers and researchers. There is an excellent 'team approach' within the Grass Roots wider circle which works very well. Everyone helps and works beside each other and there is no preaching from the top table.

Was it difficult to find a suitable team of host farmers?

No. We received a large number of applicants. Reducing the number to 17 was the challenge! Sometimes the host farmer will joke with me saying they should be called the support farmers! They are all very flexible, good thinkers, and excellent communicators who are prepared to adopt new grassland technologies to maintain/increase their farm incomes.

What are the interim results from the host farms?

All of the host farmers have found that engagement in the programme over the past two years has been of great advantage to them. Measuring has had a huge impact on their confidence to get more from their farm and grow their business.

Farm and herd size

The data in Table 1 shows the herd size and stocking rate increase between 2007 and 2009 on a matched sample of the host farms.

Table 1. Average herd size and grazing platform stocking rate between 2007 and 2009 on the host farms.

	2007	2008	2009	Change
Herd size (cow no.)	92	107	113	+ 23%
Stocking rate (cows/ha)	2.08	2.28	2.53	+25%

In summary, average herd size has increased by an average of 21 cows per farm over the period. The range in herd size is now from 56 to 320 cows per farm. The average stocking rate has increased by 0.45 cows per hectare on the grazing block over the period. Host farmers plan to increase herd size by a further one third by the end of 2011. One farmer admits that as a result of this project he now can increase his cow numbers by another 50% - all as a result of utilising more grass.

Grass production and management

Farmers are grazing all paddocks out very well, all year round. The post grazing height (what's left when the cows come out of a paddock) of the 17 farms is between 4 and 5 cm all year. In terms of pre grazing yields (what cows go into), all farmers attempt to graze lighter covers in the main grass growing season with rotation length of 16-18 days, depending on stocking rate and grass growth rate. This means cows are going into paddocks with covers between 1,500 and 1,700 kg DM/ha for most of the main grazing season, a big change from a few years ago.
Table 2 shows the average number of days that cows spent at grass on the host farms in 2008 and projected for 2009.

Table 2. Days cows spent at grass in 2008 and 2009 on the host farms

	2008	2009
Turnout date	29 Jan	3 Feb
Housing date	23 Nov	10 Dec
Days at grass	299	310

The data presented in Table 2 shows that cows will spend an average of 310 days at grass in 2009. This increase of 11 days compared with 2008 is coming at the end of the grazing season this year. Very poor grazing conditions in early spring delayed turnout this year. Nationally cows spend an average of 220 days at grass. All except one farmer plans to keep grazed grass in the diet for over 300 days in 2009. They prepared an autumn budget in August to ensure that they will have sufficient grass on their farm to do this.

The data in Table 3 shows that host farms grew approximately 11 tonnes of grass DM/ha in 2009. This ranged from 8.8 tonnes/hectare for the heavy farms in high rainfall areas to 13 tonnes/hectare on reseeded dry farms. This 33% increase in grass dry matter production is due to a combination of higher fertiliser N use, an increase in the area of reseeded pasture and possibly because of the higher stocking rates as detailed in Table 1. Teagasc Curtin's farm grew 15.8t/ha in 2008 and they are on target to grow the same for 2009. All farmers are still within the nitrates guidelines for fertilizer usage.

Table 3. Quantity of grass grown (tDM/ha) on host farms during 2008 and 2009

Host farm no.	Grass grown 2008 (tonnes DM/ha)	Grass grown 2009 (tonnes DM/ha)
1	6.6	9.5
2	5.8	8.8
3	7.9	10.6
4	10.0	12.6
5	n/a	10.6
6	n/a	10.7
7	n/a	10.6
8	10.3	13.9
9	7.8	9.6
10	n/a	10.3
11	10.1	10.8
12	6.6	12
13	8.1	9.5
14	8.0	12.6
15	n/a	12
16	9.1	10.6
17	n/a	12.3
Average	**8.3**	**11.0**

At this time of the year farmers are closing paddocks to set the farm up for next spring. The grass grown over the December-January period in 2007/8 and 2008/9 for the host farms is presented in

Table 4. Grass grown (kg DM/ha) and grass growth rate in the December/January periods of 2007/8 and 2008/9 on a matched sample of the host farms.

	2007/2008	2008/2009
Total over-winter growth (kg DM/ha)	333	52
Daily over-winter growth (kg DM/ha/day)	5.4	0.8

Winter growth varied dramatically between farms and between years. In 2007 we had a very mild autumn and winter. The average farm cover increased by 333kg DM/ha in total or a growth rate of 5.4kg DM/day during December and January. This means that farms that closed at 500kg DM/ha opened with a cover of 832kg DM/ha in February.

However, last winter was much colder than the previous one. Over-winter growth was much poorer. Five of the seventeen host farms recorded a decline in average farm cover (i.e. a negative growth rate). The average farm cover increased by only 52 kg DM/ha or an average of 0.8 kg DM/day from 1st December to 1st February.

Meal fed per cow

So in summary herd size and farm stocking increased but we have not yet discussed how the extra cows were fed. The trend in meal fed per cow between 2007 and 2009 for a matched sample of host farms is presented in Table 5.

Table 5. Average meals fed per cow (kg) on the host farms between 2007 and 2009.

	2007	2008	2009
Meals fed per cow (kg)	540	417	298

While stocking rates have increased as outlined in Table 1, host farmers also managed to reduce meal fed per cow by 45% since 2007. The data in Table 5 shows that on average meal fed per cow has reduced by 242kg/cow over the period. In 2007, the range in quantity of meals fed varied from 350 to 800 kg/cow. By 2009, the range is between 50 and 600kg/cow. This reduction in meal feeding came despite the two very wet grazing seasons that we experienced in 2008 and 2009. National Farm Survey data suggests average meal fed per cows is 1,000 kg at a stocking rate of 1.8 cows/ha. Provisional estimates from scanning carried out on the host farms indicates that empty rates will average 10% this year.

Milk solids production

Milk solids yield decreased over the three years mainly due to a reduction in volume produced per cow. Milk produced per cow and composition is measured from co-op deliveries and an estimate of milk fed to calves is included. The key driver of profit in a non-quota environment is milk solids/hectare. This is driven by stocking rate which increased on the grazing blocks of the host farms by over 0.4 cows/ha. Milk solids produced per hectare have increased by 45kg (5%) over the period. This occurred in conjunction with a 40% reduction in meals fed per cow and the very difficult grazing conditions prevailing during both 2008 and 2009. Further projected stocking rate increases over the next two years will see milk solids production per hectare increase by a further 25%.

Table 6. Trends in milk composition, stocking rate and production per cow and per hectare for the host farms over the 2007 to 2009 period.

Year	2007	2008	2009
Fat %/Pr %	4.02 / 3.50	4.02 / 3.50	4.02 / 3.57
Stocking rate (LU/ha)	2.06	2.28	2.53
Milk solids (kg/cow)	426	387	363
Milk solids (kg/ha)	878	882	923

The data presented in Table 6. Trends in milk composition, stocking rate and production per cow and per hectare for the host farms over the 2007 to 2009 period, shows the trends in milk solids production on the host farms over the 2007 to 2009 period. Fat and protein content increased only slightly over the period. The increase of 0.07% higher milk protein % was only observed in 2009. Milk solids produced per cow declined over the period. This can be accounted for by a significant reduction in meals fed per cow and by an expansion in cow numbers on the host farms. Almost half of the cows in host farm herds are in their first and second lactation. On average, this accounts for approximately half of the 60kg decline in milk produced per cow. Nationally, milk solids/cow is 330kgs or 600 kg milk solids/ha.

Farm profitability

As the project is still ongoing and figures for 2009 are still coming in we are unable to include measures of farm profitability in this paper.

Has progress been observed on the support farms?

The data presented in Table 7 show that the support farmers increased stocking rate on the milking platform by increasing herd size. Despite this increase in stocking rate and milk solids production <u>per hectare</u>, they reduced the amount of meal fed by 30% per cow. This reduction in meals fed per cow is the equivalent of almost 0.5t DM/ha which corresponds closely to the estimated increase in grass utilised of 0.8 tonnes DM/ha. Previous estimates have shown that such an increase in grass utilised per hectare is worth the equivalent of €160 additional profit per hectare.

Table 7. Trends in milk solids production, meal input and grass use on a matched sample of 40 support farms during 2008 and 2009

Year	2008	2009	Change
Herd size (cow no.)	84	93	+ 9
Fat / Protein (%)	3.97/3.45	4.00/3.45	+ 0.03 / 0.00
Milk solids(kg/cow)	374	374	0
SR (LU/ha)	2.25	2.40	+ 0.15
Milk solids(kg/ha)	842	897	+ 55
Meal fed (kg/cow)	624	438	- 186
Grass utilised (T DM/ha)	8.81	9.61	+ 0.8

What are the host farmers' views on the project so far?

The host farmers met last year and made a list of 'things they did well in 2008 and 'lessons they learned' in the first year of the project.

Host farmers summary of 'Things they did well in 2008'

- Reduced meal
- Increased milk solids produced per hectare
- Fertiliser usage decreased
- Profit increased
- Improved grass budgeting skills
- Improved computer skills – all now able to email and save material
- Better understanding of the true potential of their own farm – confidence to expand and able to make better business decisions.
- Recording is crucial (I can't believe you said that!!)
- **MINSDSET** is the hardest thing to change
- Support farmers important

Lessons learned from 2008

- Reseeding is really important
- Good to get grass quality results – you can see what grass quality is like
- It is easier to manage a higher stocking rate
- We all want to go to a higher stocking rate
- More reseeding is so important
- Spring is best time of year for reseeding
- LAND TYPE IS NOT LIMITING (wow!!)
- Post grazing height of 4cm is achievable on all our farms - it results in very high quality grass in the next rotation
- You must graze tight from the start of the year

- Keep silage out of diet as soon as cows go out to grass
- On/off grazing is an excellent way to manage in wet weather
- We need a better fertilizer plan for 2009
- Pick a day to measure your farm and stick to it as this leads to more effective grass measurement.

Mid-season

- Grazing lower covers mid season is important
- Taking out higher covers fast is important
- We have gained confidence in 2008 to manage grass and reduce meal feeding and we will have even more confidence in 2009
- Most of us are under-stocked
- Magic day varies on farms – but we must ration out the grass so as to get to the correct date
- The second rotation was too long in 2008

Autumn

- We are not mentioning the wet weather as this is outside our control so there is no point in moaning about it!
- Good infrastructure and on/off grazing worked well for us
- Rationing was important in the autumn
- It was difficult to reach the autumn targets – some of us had to put in more meal to reach the 2008 target
- If we did not reach target covers by mid Sept then we were in trouble for the rest of the year. SO WE MUST REACT FAST IF NOT REACHING TARGETS IN TIME!
- Minimise poaching – an absolute key management decision.

These past two years have being challenging as a result of bad weather and poor milk price. What impact did this have on the project?

The torrential rain we have experienced has made grazing difficult and challenging. Measuring, planning, and creating the right infrastructure for grazing can go some of the way to lessen the impact of wet weather. The challenge is of course greater on heavy or wet farms. However, we continue to measure despite the weather. Some of the team identified a few suggestions on how to improve the grassland management of wet farms.

Some suggestions to improve grassland management on wet farms

- Twice the number of roadways is required as on a dry farm.
- Front loading of nitrogen onto wetter paddocks for two rotations in dry periods as you may miss a round when the paddock is wet.
- Plenty of access points to paddocks.

- Spread farm yard manure (slurry?) in June or July when weather is drier. Be conscious of taking every spreading opportunity. Farm yard manure helps rebuild organic matter and improve growth rates in that paddock.
- No poaching should be allowed – practise on-off grazing technique (2.5 to 3 hours grazing bouts).
- If you have an 'outside' farm try to cut your silage there. Generally the silage paddocks tend to be the dry paddocks on the farm. These tend to be closed in wet times. You need to be flexible on what paddocks you can graze
- Maybe your stocking rate is too high for a wet farm? Should you reduce cow numbers (dry off/sell) during these periods and restock again the year after.
- Perhaps your cow size is too big for a wet farm?
- Never let out cows in torrential rain (always use the weather forecast) as it may be perfectly fine in afternoon. Bring cows in again when it starts raining.
- Buy a rain meter preferably an electronic one approx. cost €80. This applies to dry farms and advisors too. It makes decision making easier to know how wet it has been.

Conclusion

Personally the project has been very rewarding for me to see the progress that the Host farmers have achieved in terms of understanding and managing a grass based production system. I feel the increased measurement has driven better on farm decision making and better understanding of farm potential. To date Grass Roots Host farmers have been able to control and improve variable costs and improve milk solids per hectare at the expense of milk solids per cow. A farmer that measures grass weekly said to me recently; "I strongly believe that the more you measure grass the better your business runs overall, which in turn leads to higher profit".

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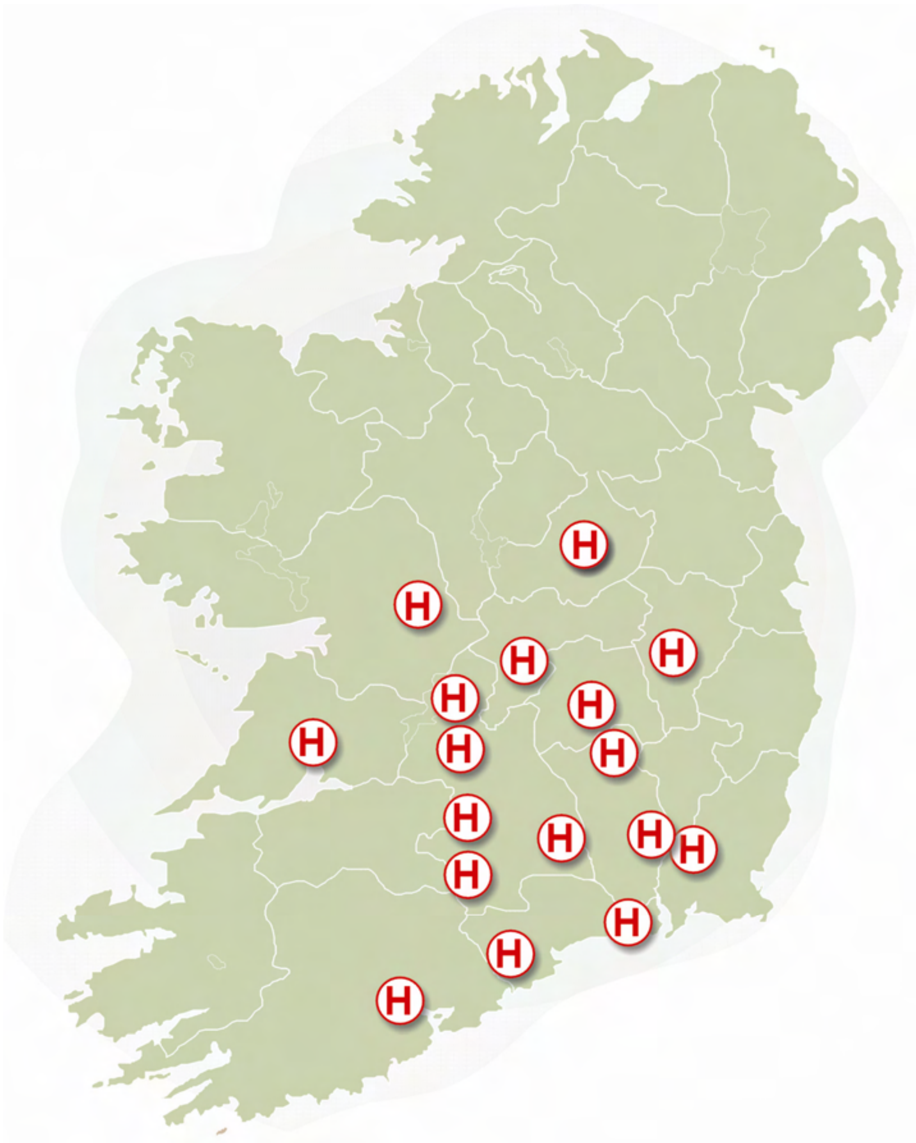
Appendix

Map of Ireland showing location of Host farmers (H = Host)



Spring Rotation Planner

Sean McCarthy and James Moyles, Teagasc B&T Dairy Advisers

Summary

- Each additional day grazing in spring improves profit by €2.70/cow.
- Grazing in February, March and April will reduce production costs in spring while also setting up the farm for excellent milk production for the remainder of the year.
- The spring rotation planner works on the principle of allocating a set area for the herd to graze each day in spring from early February.
- The spring rotation planner allows you to maximise the proportion of grazed grass in the diet of the herd and overcomes the uncertainty with grass availability.
- Paddocks grazed in early February will not be re-grazed again until mid April. This allows approximately 60 days re-growth and thus ensures adequate pre-grazing yields.
- Every dairy farmer in the country can use this Planner. All that is required is a map of the farm and an open mind to try something new.

Introduction

As we come to the end of a challenging year we should undertake an in-depth analysis of our farm systems and strive to begin 2010 with a revised focus. The fundamentals of higher farm profits should be re-examined. Grazed grass (as good as, if not better than concentrates in quality terms) costs approximately 7c/kg dry matter (DM) compared to grass silage at 13c/kg DM and concentrates at 22c/kg DM. Therefore, its proportion in the cow's diet in early lactation must be maximised. Low levels of grass utilisation is related to issues such as stocking rates, levels of concentrate supplementation, poor grassland management, low levels of reseeding, and significantly, a low number of days at grass. Currently we achieve on average 220 days or a little over seven months grazing. Therefore, issues relating to this need to be addressed.

The achievement of early turnout is fundamental. A survey carried out by Creighton *et al.,* (2009) focusing on grassland management in Ireland found that partial turnout occurred on average on the 26 February with full turnout occurring on the 17th of March. The main reasons given by farmers for delayed turnout were grass availability and soil conditions. Good farm infrastructure and the implementation of management techniques such as use of On/Off Grazing will help overcome difficulty with soil conditions. The use of a spring rotation planner will ensure grass availability in March and April will not become an issue.

Increasing the proportion of grazed grass in the diet of the cow in early lactation will result in increased total DM intake and higher milk solids production (Dillon *et al.,* 2002 and Kennedy *et al.,* 2005). Early turnout to grass also increases sward quality in subsequent rotations and most importantly increases farm profitability by €2.70/cow for each additional day at grass. This financial reward relates to production gains such as improved milk composition/yields and to a greater degree on reduced concentrate and silage costs.

On/Off Grazing, turning cows out for three to four hours after morning and evening milking, is a key management tool on wetter more difficult farms and when used in conjunction with the spring rotation planner offers enormous potential to increase the number of days cows are at grass. A good farm road network, along with multiple paddock access points are prerequisites. It is also important to remember that grazing conditions in the months of February and March of the past two years have often been better than those experienced during our summer months, and hence represents a missed opportunity if cows remain indoors until mid March.

Demand for grass from lactating cows in February is low as it includes a large number of freshly calved cows and a large proportion of heifers. This combined with a current National average stocking rate of 1.8 LU/ha and six-week calving rate of 53%, means that on the majority of farms overall grass demand per hectare in the first rotation is low. Therefore with the implementation of a simplified grazing plan one can determine the date on which the 1st rotation is completed, ensure grazed grass forms a large part of the cow's diet in early lactation and maximise grass growth rates. Furthermore, the planner works regardless of farm location, stocking rate or herd calving pattern.

How does the Spring Rotation Planner work?

The spring rotation planner relies on the principle of grazing a set area each day and adjusting herd demand to grass availability. Defined weekly and monthly targets relating to the proportion of the farm to be grazed are given.

The aims of the planner include:

- Simplify spring grass management
- Inclusion of grass in the lactating cows diet every day in Spring
- Maximisation of farm grass growth rates
- Avoid uncertainty in relation to grass availability in April
- Achievement of an 18 to 20 day rotation in late April
- End 1st rotation at the beginning of April
- Set up the farm for quality grass production for the year

By adhering to the planner it ensures that any paddock which is grazed gets adequate recovery time before it is re-grazed. Paddocks grazed in early February will not be re-grazed again until mid April. This allows approximately 60 days re-growth and thus ensures adequate pre-grazing yields. February grazing also encourages improved growth, especially important with stagnant paddocks. It is important to realise that the area grazed in February represents the area which will be grazed at the beginning of the second rotation. Therefore this area should be grazing area rather than silage area.

For the planner to be most successful, one must:

- Close paddocks in the previous October (middle two weeks of month) to provide grass in February
- Turn out freshly calved cows fulltime from 1 February (7-10 days later in more northern or wetter farms)
- Stick to your target area; do not graze more or less per day
- Have 33% of the farm grazed by 1 March
- Have 60% of the farm grazed by 17 March
- Use a strip wire to allocate grass on a 12-hour basis
- Adjust supplementation to grass supply

Grazing pressure or post grazing height should be used to determine if supplementation is required. Where grazing conditions permit, it is essential to achieve a post-grazing height of 4cm (mobile phone on its side). The grazing area should be back fenced in wet weather to avoid damage and cows should be housed after three to four hours of grazing during inclement weather conditions without silage.

EXAMPLE FARM

Milking block		36ha
Herd size		72 cows
Number calved:	**February**	40 cows
	March	22 cows
Turnout date		1 February

Table 1 below is the 2009 spring rotation planner for this farm highlighting the proportion of the farm to be grazed each week. During the first week of February, approximately 0.36 of a hectare (0.89 acres) or 3,600m^2 (0.36 x 10,000) must be allocated to the calved cows each day. By the end of the week the target grazed area is 2.5ha or 7% of the farm with 11.5ha (32%) of the milking platform to be grazed by the end of February. For the week commencing on the 1 March, 1/68th of the area or 0.53ha of the farm must be grazed each day.

Table 1. SPRING ROTATION PLANNER for the farm outlined above with 72 spring-calving cows on 36ha

Week	Fraction of farm grazed per day	No. Ha (or acres) that should be grazed each day	m^2 grazed per day	Cumulative % of total farm area to be grazed by end of week
1-Feb to 7-Feb	1/100	0.36 (0.89)	3600	7
8-Feb to 14-Feb	1/92	0.39 (0.97)	3900	15
15-Feb to 21-Feb	1/84	0.43 (1.06)	4300	23
22-Feb to 28-Feb	1/76	0.47 (1.17)	4700	32
1-Mar to 7-Mar	1/68	0.53 (1.31)	5300	43
8-Mar to 14-Mar	1/60	0.60 (1.48)	6000	54
15-Mar to 21-Mar	1/51	0.71 (1.74)	7100	68
22-Mar to 28-Mar	1/43	0.84 (2.07)	8400	84
29-Mar to 4-Apr	1/35	1.03 (2.54)	1030	100
5-Apr to 11-Apr	1/27	1.33 (3.29)	1330	**Rotation 2**
12-Apr to 18-Apr	1/19			

Notes on Table 1: All target areas based on 36ha farm; 1st rotation ends on the 4th of April; at the beginning of rotation two, stocking rate increases as silage area is closed

The main focus is to graze the set area each day to the desired post grazing height and adjust herd demand accordingly. If the cows have too much grass and fail to graze out paddocks properly, supplementation must be reduced. In a case where targets are still not being achieved more animals may be turned out (replacements or dry cows, etc). In order to achieve the target area grazed by March some paddocks with low covers may be grazed.

On occasion where cows are short of grass and consequently being forced to graze too tight, supplementation must be increased. Extra areas of the farm perhaps not intended for grazing with the dairy herd could also be grazed or perhaps more use could be made of the silage area if near the parlour.

For this farm, if we compare fulltime turnout on 1 February as opposed to mid March this represents almost €4,000 additional farm profit, with this figure improving as more cows are calved in early February. 1 ha = 10,000 sq metres (e.g., 100m x 100m) = 2.471 acres.

Table 2 below is a blank copy of the spring rotation planner for your use next spring

Table 2: Spring Rotation Planner for your farm in 2010

Week	Fraction of farm to be grazed each day	Area to be grazed each day	m^2 grazed per day	Cumulative % of total farm area to be grazed by end of week	Actual area grazed
1 Feb - 7Feb	1/100			7	
8 Feb -14Feb	1/92			15	
15Feb - 21Feb	1/84			23	
22Feb - 28Feb	1/76			32	
1 Mar - 7Mar	1/68			43	
8 Mar – 14 Mar	1/60			54	
15 Mar – 21 Mar	1/51			68	
22Mar – 28 Mar	1/43			84	
29 Mar – 4 Apr	1/35			100	
5 Apr – 11 Apr	1/27			Rotation 2	
12 Apr – 18 Apr	1/19				

Note: 1 ha = 10,000 sq metres (e.g. 100m x 100m) = 2.471 acres

For a computerised version of the table above go to the link below, enter your own data and print off your planner or contact your adviser to do so.: http://www.agresearch.teagasc.ie/moorepark/Articles/springrotationcalculator.xls

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Farmers Using *Grass Budgeting to Utilise More Grass*

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Summary and conclusions

- To increase grass utilization the farm cover should be measured weekly. Key decisions should then be made based on these figures.
- During the main grazing season the 60:40:20 rule works well on our Kerry soils. It is a simple and effective grass measurement/budgeting guideline.
- Flexibility is important when making key grass budgeting decisions. Quick decisive actions need to be taken to maximize grass utilisation both in the short and long term.
- Five specialised budgeting grass groups were set up in Kerry. The farmers involved are now confident when measuring grass and making key decisions to help achieve a more profitable business through grass budgeting.
- A grass growth rate graph has been developed for Kerry with two years data. This is local data which is highly useful when making out a spring and autumn budget. Continued measurement of local growth rates is required.

Introduction

It has been well documented that grass is the cheapest feed source available to spring-calving dairy cows, and is also of high feeding value. Therefore increasing the amount of grass in the diet of a dairy herd can significantly reduce fixed and variable costs in a market where prices are becoming more volatile. Irish pastures have the potential to grow between 11 and 16 tonnes of grass DM per hectare. This advantage puts Ireland on a very competitive platform in the international dairy industry. Much research has been carried out on ways to grow and utilise more grass from grassland management techniques to breeding more persistent grass varieties. To minimise costs farmers need to optimise the amount of grass in the diet of the cow through grass measurement, budgeting and utilisation.

Grass measuring means putting a figure on how much grass is on the farm. Each farmer should walk their farm weekly to calculate how much grass they have, it is a more important figure than knowing how much concentrate is in the meal bin yet few farmers know how to measure grass. Grass budgeting is about making decisions on how to manage the amount of grass on the farm. It is the decisions that are made after each farm walk that will impact on the profitability of the farm business.

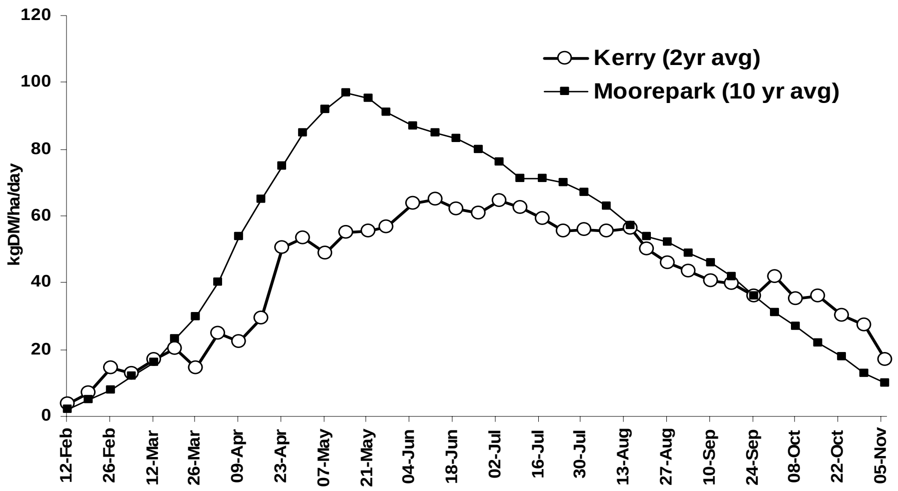
Grass budgeting in Kerry

In spring 2008, three grass budgeting groups were established across County Kerry by Teagasc. The primary purpose of these specialized groups was to teach farmers basic grass measuring and budgeting skills and the terminology involved. In spring 2009, two additional grass budgeting groups were formed. Five host farmers were selected for each grass budgeting group. Approximately ten 'support' farmers were assigned to each group. These farmers had to be part of a dairy discussion group as it was anticipated that the information that they gathered at the grass budgeting groups would be disseminated by them at their dairy discussion group meetings. Members also had to keep a cost control planner. Support farmers had to do their own grass measuring and budgeting on their own farms.

Each group met every three weeks on the host farm. We walked each paddock where we used the 'cutting and weighing' technique to measure average covers in each grazing paddock. We then returned back to a shed where we calculated such figures as the average farm cover (kgDM/ha), cover/cow (kgDM/cow), demand and growth rate (kgDM/ha/day) and pre-grazing yield using the Teagasc grass budget computer program. These figures can also be easily calculated manually. The farm cover was compared to the grass wedge during the summer period or to the spring/autumn budget which was prepared for each host farmer. The ultimate objective after each walk was to come up with a set of recommendations for the host farmer based on data collected during the farm walk. When the group revisited at the next meeting the decisions previously made were then assessed. Pre-grazing herbage samples were analyzed in the Moorepark grassland lab for dry matter %, crude protein and dry matter digestibility. This gave the group members an indication of grass quality.

Data were collected from both the host and support farmers who were grass budgeting on a weekly base. Data included cover/cow (kgDM/cow), demand (kgDM/ha/day), grass growth rate (kgDM/ha/day) and milk solids produced/cow/day. From this data a weekly grass growth graph for county Kerry was compiled. This was the first time that such data was made available and there was a real need for these local figures.

Figure 1. Comparison of Moorepark 10 year average grass growth rates and Kerry 2-year average grass growth rates



It is clearly visible from Figure 1 that large differences exist in the grass growth rates between Moorepark and Kerry. Growth rates within Kerry are much reduced during the spring and summer period. It must be stressed; however, that climatic and soil conditions have been more difficult than 'normal' across Kerry over the last two years (2008 – 2009) which may have impacted on normal growth rates. With the high level of rainfall on heavier soil types a lot of damage has been done to the soil through poaching and soil compaction. This has reduced the percentage of perennial ryegrass in grazing swards so there is a continued need for renewed reseeding.

However, the key point to be extrapolated from the graph is that growth rates on average during the main growing season (mid April – mid August) are maintained around 60kgDM/ha/day in Kerry. These growth rates will maintain a 60 cow herd across 40 acres (stocking rate of 3.7LU/ha) on a 20-day rotation **(60; 40; 20 rule)** with little or no concentrate included. (The balance of the grazing ground can be closed for extra silage, which is needed on most farms). This is a simple but effective grassland management guideline that can be used during the main grazing period. This rule can also be applied across different stocking rates. There will be weeks where surpluses will have to be taken out in the form of high quality round bales or weeks where supplement will have to be introduced. These are key decisions will be made by grass measuring and grass budgeting on a weekly basis.

How do I get started with grass budgeting?

Firstly, set up your farm for easy grassland management.

- It is a good idea to measure each paddock. This can be done by either 'stepping out' boundaries or use a wheel meter or more accurately hire someone to measure paddocks using GPS technology.

- Have enough paddock entry/exit points. Square paddocks are the easiest paddocks to manage and less prone to poaching.
- Resize paddocks and take down permanent wires to suit a 24/36-hour grazing (strip wires can be easily put up in the spring and autumn period). For example, for a 60 cow herd in a 36 hour grazing paddock each cow will eat 27kg DM so the herd requires 1,620kgDM. For high quality lush grass aim for grass covers cows of 1,400kgDM/ha, so divide 1,620kgDM by 1,400kgDM/ha which equals 1.2ha. Resize paddocks at 1.2ha (3 acres). Farmers in grass groups who have resized paddocks have said that cows are more content with 36 hour grazings, noticed an increase in milk protein and found paddocks easier to manage.
- Purchase a plate meter or grass shears and weigh balance. Get your Teagasc advisor, discussion group or another farmer to show you how to use it.

Grass budgeting

Grass budgeting is about walking the farm weekly and then making decisions. The three basic grassland budgeting tools/methods that are used during the year are as follows:

1. Grass Budget

A grass budget is used in the spring and the autumn. A budget is about setting targets and rationing out grass. At the start of the autumn (mid-August) the amount of grass on the farm is measured. The main objective at this time is to build up a bank of grass and achieve peak farm cover in mid-September. This will allow continued grazing into early/mid-November. To build grass, the farm needs to be growing more grass than what the herd requires on a daily basis. Decrease demand by reducing stock numbers off the milking platform, introducing supplement or bringing in more ground. A budget takes account of what animals are on the grazing block, how much they eat and how much grass will grow. It is important to assess these budgets weekly to make sure targets are being met. The most important part of the autumn budget is to make sure that there is enough grass on the farm for next spring.

Examples of decisions made using an autumn budget

In late August 2009 a farmer involved in a grass budgeting group was stocked at 2.6cows/ha and had a farm cover of 481kgDM/ha or 185kgDM/cow. This was below target and he was unable to build grass for the autumn as growth rates were only 20kgDM/ha and herd demand was greater at 47kgDM/ha. Also the farm had received a staggering 12 inches of rain since the start of July and paddocks were severely waterlogged. Due to the high rainfall little nitrogen had gone out since June and there was little or no response to nitrogen that had gone out. It was obvious the farm was going to run out of grass within a few weeks so the farmer had to make some critical and quick decisions. The big advantage the farm had in this crisis was that the second cut silage had been cut, unlike many neighbouring farms at this time. It was decided that the cows were to be housed fully for two weeks and were given 6kgs of supplement and 8kgs of high quality silage that was cut three weeks previous. These were severe but crucial actions. They had to be made due to the wet weather and also to keep grass in the diet for as long as possible. The farmer was unable to spread nitrogen until the 15 September; however, the response to nitrogen at this time was excellent. This helped build the average farm cover up to nearly 700kgDM/ha in early October. The farm was again revisited in mid October to assess the decisions made in August. Even though the farm cover was low at 544kgDM/ha, the farmer had budgeted to keep the cows out on grass until the first week of November.

In the spring, a grass budget is drawn out again similar to an autumn budget but the aim is to have enough grass on the farm until the end of the first rotation (early to mid April). The objectives in doing a spring budget are to assess if there is enough grass to:

- Put the cows to grass as soon as they calve;
- Get the cows out to grass day and night as soon as possible;
- Determine when and how much silage ground can be closed up ;
- Determine when to finish the first rotation;
- Put out other stock e.g., replacement heifers go to grass; and,
- Measure spring growth rates.

2. Spring Rotation Planner

The spring rotation planner should be used in conjunction with a spring budget. The spring rotation planner is a simple method of rationing out spring grass on a daily or area based basis in the first rotation. It is discussed in detail in the previous paper.

3. Grass Wedge

The simple objective during the main grazing season is to keep growth rate and demand equal. For example a farmer is stocked at 2.5cows/ha. Each cow has an intake of 18kg grass DM grass per day so the demand on the farm is 45kgDM/ha grass. A growth rate of 45kgDM/ha/day is required to maintain the grass on the farm. The grass wedge is a very simple and visual tool to use during the main grass growing season to keep a close eye on grass supply and demand.

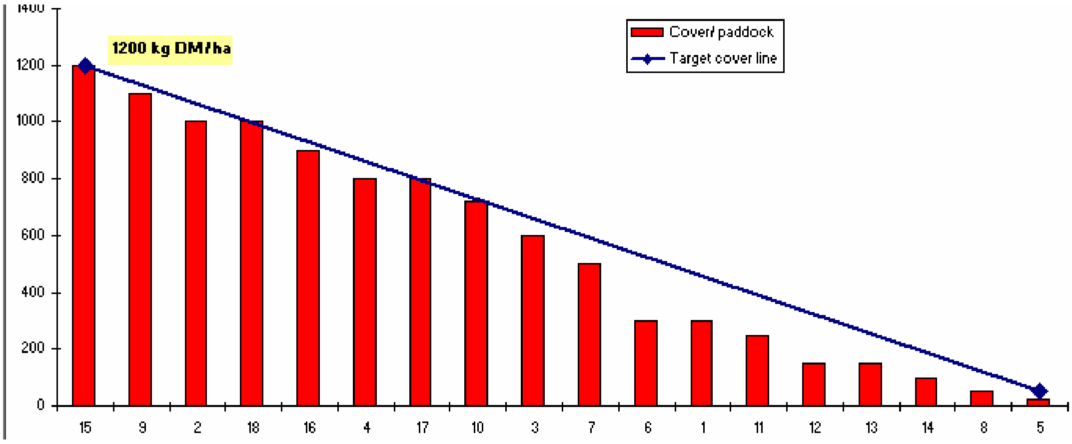


Figure 2. Example of a 'perfect' grass wedge

Figure 2 shows a diagramme of the grass wedge. Each bar represents the amount of grass in each paddock on the farm. The line represents the target cover line. This is an ideal wedge; almost all the bars are just touching the target line. The target pre-grazing cover can be calculated by multiplying rotation length by stocking rate by grass intake per day e.g. 18 days X 2.5cows/ha X 18kgs + 100 (residual left over) = 910kgDM/ha. During the main grazing season this is equivalent to about 7cm pre-grazing height.

A week later the farmer again measured the grass on the farm. The demand on the farm was 56kgDM/ha/day but the growth rate was 70kgDM/ha/day, therefore the farmer knew there was going to be a surplus of grass. He did out the grass wedge as seen in Figure 2a. As can be seen some of the red bars are gone over the target blue line.

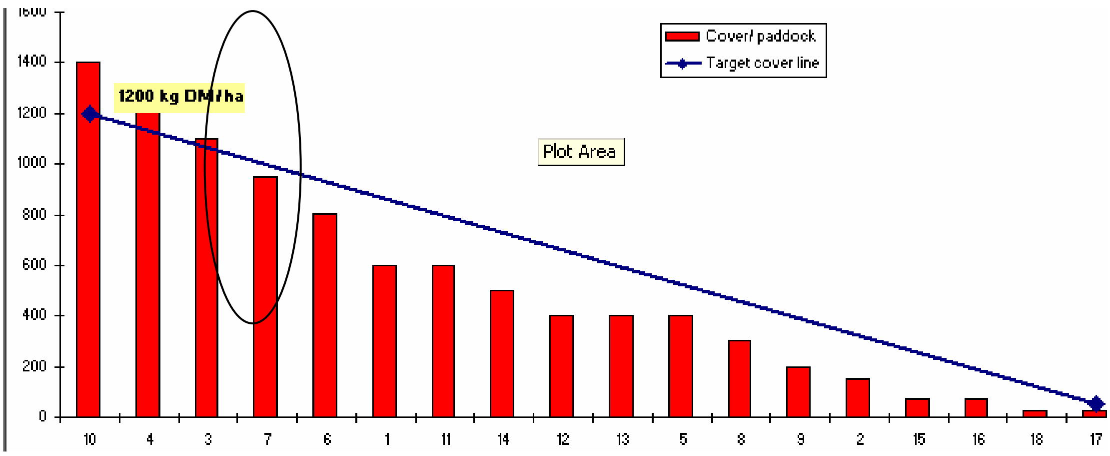


Figure 2a. Example of a grass wedge with slightly too much grass

With this information the farmer made the decision to skip paddock 10 which had the heaviest cover, and he made bales. These bales were of high quality as the grass was not too strong. These bales were subsequently fed back to the herd during difficult grazing conditions in late August/early September. The key to budgeting grass during the main grazing season is:

a) Walk the farm at least once a week;
b) Calculate the herd demand (stocking rate X grass intake (kg);
c) Match growth rate to herd demand;
d) Use the grass wedge to make decisions; and,
e) Act on these decisions quickly.

How much grass can be grown?

The amount of grass that can be grown is dependant on many factors including soil type, weather conditions, level of reseeding, grass varieties and grazing technique. Grass only begins growing once soil temperatures reach 6^0 C; therefore growth is slow in early spring and late autumn and almost nil during the winter. In Ireland the current average of grass utilized is 7.8tonnes DM/ha. Increasing the amount of grass utilized is related to how the grass is managed and the use of grass budgeting. A cow yielding 400kgs of milk solids has a total intake of 4.6 tonnes of feed. In 2008 up to 12.5t DM/ha of grass was measured by members of the grass budgeting groups in Kerry. This amount of grass can easily sustain a stocking rate of 2.7 cows/ha in a 100% grass based system. In 2009, the amount of grass grown by the grass budgeting groups ranged from 8 – 12.5 tonnes DM/ha. This figure had decreased by 2-3 tonnes DM/ha for most farmers. This was as a result of higher rainfall, difficult ground conditions and a poor response to nitrogen which all impacted on growth rates in 2009.

Acknowledgments

I wish to acknowledge all the farmers involved in the grass budgeting groups who contributed their data during the last two years. I would like to especially acknowledge the five host farmers and their families. I would also like to thank my Teagasc colleagues for their help and advise especially Ger Courtney.

Poaching: How to avoid it and how to fix it

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Summary

- Poaching is a problem that requires a farmer to use all the tools available to him to control.
- There are many tools available to farmers to reduce the risk and/or the severity of a poaching incident which include farm infrastructure investment and farm management changes.
- By using the full range of structural and management options most land can be effectively farmed and poaching avoided or limited and stock given the opportunity to graze more days of the year which is a big boost to farmer profit and greatly reduces the farmer work load.

Introduction

The risk of poaching is a fact of life on most Irish soils and in most seasons of the year. The cost to a farmer is as much in increased stress as it is in financial costs and the reduced pasture growth may result in the need to purchase additional much more expensive feeds. Most good farmers are aware of this cost but fears about poaching are the primary reason that farmers house their cows for a long time. Financial analysis shows that if farmers have the confidence and ability to keep cows out on grass earlier and later in the season, then there is an additional profit of over €2.50/cow/day.

A single poaching event will reduce pasture growth over the next few months by 20 to 40%, the more severe the poaching the greater the reduction in growth and the longer this will continue to occur. A poaching event will also make this area of the farm much more susceptible to future poaching events which will often be even more severe.

The cost effective remedies for poaching are few and take a long time to rectify the damage so the essential approach is to take sensible strategic and management precautions to avoid poaching in the first instance. On occasion, the weather is simply too severe and too prolonged to avoid poaching, but making the effort to minimise it will have a dramatic impact on the overall cost to the farm.

Strategies to avoid poaching (in order of importance)

Infrastructure investment

- Drainage
- Standoff facilities
- Paddock shape
- Number and location of entrances
- Wide crowned cow tracks that shed water and stay clean
- Stand off facilities
- Cow type
- Pasture species

Management

- On/off grazing
- Strip grazing using a back fence
- Using narrow temporary lanes for cows to access the back of paddocks
- Closely watching reliable weather forecasts
- Selection of paddocks for grazing in wet weather
- Setting up longest pasture covers at calving on the driest ground

Investment in effective drainage remains the most important strategy to avoid poaching. Different soil types and localities require different types of drainage and there is no value at all in taking shortcuts and not doing it properly. Investment in the correct drainage strategy will give a solid return over many decades.

In wet land open drains should be a feature of all of the boundaries of the paddock. The wetter the land the smaller the paddocks should be and therefore the more drains there should be. Drains need to be kept free of vegetation which impedes water flow and each drain must have enough fall to allow it to shed water away from the farm.

Hump and hollow the land surface fits in well with open drains where the soil is heavy clay. The objective here is to provide a contour so that during rain water does not pond on the surface but easily follows slope to the open drains. This is necessary because clay tile and other sub surface drainage systems are ineffective in these heavy clay soils.

Clay tiles or perforated drainage pipes along with drainage gravel and cross mole ploughing is a very effective system on moderately draining land as long as the whole package is properly done. There needs to be fall on the clay pipes or perforated piping so that water entering it moves steadily to the open drains. Drainage metal above these structures improves the ability of the pipes to draw surplus water from the soil profile. Mole ploughing can be a very useful addition to this but it must be done at the end of the spring and just before a dry period in the summer. The soil must be moist enough to form a mole when a mole plough is dragged through the soil but for this to become effective the clay sides of the cut and mole have to dry and crack so that moisture can move into the mole. If these moles intersect with the drainage gravel above a perforated pipe the water is quickly drained from the paddock. This also means that moles can be pulled on an angle across the slope and because they only have a short run to the drainage gravel they do not have to have as much fall as the lower piping.

Deep-ripping to shatter an impervious pad is only an option in limited situations where test holes confirm a shallow pad with free draining gravels beneath. Ripping typically has to be done at the end of a dry summer otherwise the land is to soft to allow this operation and it the water table is not also lowered the pad will quickly reform.

Tapping out the head of springs is an art form and required patience. This is best done with an open drain dug along the side of the wet area and curving around the top of the wet area, where this drain may need to be quite deep to intercept the source of the water. It is best to leave this as an open drain for several years so that the wet area properly dries out and it is clear that all the spring heads have been tapped. Once this phase is complete large drainage pipes can be laid directly to the source of each spring and then covered with some drainage gravel and the drain filled. Tapping springs can change large troublesome areas of paddocks, often on the side of hills.

Standoff facilities can be located centrally which is the norm in Ireland but smaller hard surface (compacted stone) ones can be located at the ends of cow lanes so that cows can be stood off for short periods with out having to walk long distances.

Paddock shape can have a huge impact on the ability to avoid poaching. Paddocks on wet land should be longer along the cow lanes then they are away from the lanes. This allows the use of multiple entrances and exists, and makes strip grazing much easier. It also allows for cows to enter paddocks where they will not cross a particularly wet/soft area on the way to the majority of the feed in the paddock. The extra investment in cow lanes also means that each lane gets less pressure and lasts longer especially if they are properly constructed with well compacted rock that has been shaped so that the lane has a crown. If any build up of material is regularly removed from the sides these cow lanes shed water and dry quickly. This greatly reduces the tramping of mud into paddocks which will soil pasture and cause stock to become unsettled.

The weight of cows has a great bearing on how quickly soils will poach. Small cows do not have proportionally smaller feet and so the down pressure that they exert on the soil surface is much less. In marginal conditions this is frequently the difference between poaching and not poaching. Breeding to select for small cows within a desired breed is an essential tool and ideally this should be taken further through cross breeding with an even smaller dairy cow.

The selection of particular pastures for wetter paddocks is also a very useful option. Some pasture variety such as Timothy are very tolerant to poaching damage but are much more difficult to establish and require different management than ryegrass pastures. Even within ryegrasses there is a great deal of variation. Varieties that are very dense tillering are ideal for wetter paddocks as they provide more cover between the cow's foot and the soil. They often are also slower growing in the winter and early spring and so require less grazing during the worst of the weather. Tetraploid ryegrasses often result in more open pastures and often have improved autumn, winter and early spring growth. These varieties should only be sown on the driest paddocks so that the extra growth can actually be utilized.

Grazing stock during the day and then keeping them in at night has been practiced for a long time but recent work at Moorepark shows that On/off grazing is much more effective if it is for short periods of 3 – 4 hours both at limiting pasture damage (to less than 5%) and maintaining cow intakes (at 98% of a full 24-hour grazing). In the case of milking cows each three-hour period grazing should occur after each milking with some consideration of the immediate weather at that time i.e., if it raining heavily delay the grazing until the rain eases, but before the next milking. It is also essential that these cows do not get any additional feed while they are not grazing. This makes then hungry and focused on grazing rather than walking around making mud.

Strip grazing is also a very effective tool. Research showed that strip grazing using a backing fence reduced the damage on the whole paddock by over 50%. This can also be improved if the groups of cows are reduced and the area of new pasture given is a square of sheltered from the wind.

The use of narrow (one cow wide) temporary lanes in a paddock to get the herd to the new grass at the back of a paddock is also very effective at limiting the damage especially when doing on/off grazing. This confines the damage to a very small area and even though it is severe the impact on the total yield of the paddock is very small. It also reduces the area to be fixed. There are farmers with herds of 350 cows using this very effectively.

Fixing poaching

Machinery manufactures offer lots of options that are supposed to reduce compaction and fix poaching. In controlled trials the impact of these machines has been marginal at best and not enough to justify the cost of the machinery or the time on the tractor. The only economically effective option is to sow more ryegrass to replace the plants that have been lost. In minor to mild poaching cases the plant is able to repair itself reasonably quickly and tiller density quickly returns back to normal. In mild to moderate poaching events grass seed should be broadcast as soon as the ground has firm up. Often the best time to do it is just before the cows come to graze the paddock again. The cow's feet push the seed into the ground and so it quickly germinates. By the next grazing the new grass plants will be still too small to be grazed by the cows but they will respond to receiving direct light and will grow quickly. The addition of more grass seed will have a big impact on reducing the invasion of weeds. By the third grazing they will by a normal part of the sward.

The use of a light roller which will just flatted the worst of the foot marks will not worsen or improve the pasture growth rates but it will make the paddock more usable for making silage and much easier to measure the amount of grass in the paddock.

After severe poaching events the paddock will need to be properly re-seeded. A pasture will return without doing anything but it will be dominated by weed grasses that will produce much less usable food for stock. Reseeding is an expensive exercise and not economically sustainable if large areas of the farm (more that 20%) need to be fixed in this way each year.

Conclusion

Poaching in most cases is a problem that requires a farmer to use all the tools available to him to control. By using the full range of structural and management options most land can be effectively farmed and poaching avoided or limited and stock given the opportunity to graze more days of the year which is a big boost to farmer profit and greatly reduces the farmer work load.

The issue of land being damaged is no longer acceptable to the urban population and all round the world, land that can not be sufficiently drained or managed to prevent repeated severe poaching and erosion, is being taken and removed from agriculture.

Evaluating the economic performance of grass varieties

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Summary

- Grass variety evaluation protocols must meet the current and anticipated future needs of the grassland industry to identify superior varieties for our grazing systems.
- Management influences grass variety performance with some varieties more suited to intensive grazing and some suited to silage systems.
- The Grass Economic Index applies monetary values to grass production and quality parameters.
- The Grass Economic Index identifies varieties suited to grazing or silage based systems depending on the requirements of the individual production system.

Introduction

The primary objective of forage breeding is to produce a grass capable of being utilised as the main source of feed for ruminants (in temperate regions), thus improving the economic and environmental sustainability of ruminant production systems. Gains from grass breeding have varied widely from one region to another. Increases of 4 - 5% in DM yield over a 10-year period have been achieved in North West Europe (Reed, 1994), compared to less than 1% in the US. The DMD of perennial ryegrass has improved by 10g/kg in a similar period with little or no improvement evident in the US.

Recent research at Teagasc Moorepark, funded by the Department of Agriculture, Fisheries and Food (DAFF), focused on improving the grass evaluation protocol to ensure breeders select and breed varieties suited to Irish ruminant production systems. Furthermore, an economic index designed to rank varieties based on yield, quality and persistency is being developed. The objective of this paper is to discuss the effect of management on variety performance and introduce the Grass Economic Index to Irish dairy farmers.

Grass variety information

The Recommended List for grass and clover varieties is published annually by DAFF. This list provides information to growers on varieties which have performed well throughout the country in terms of DM yield, quality and ground cover score. It identifies the varieties which have a proven performance based on a second-cut silage evaluation system. As the silage proportion in the diet of the grazing cow reduces we must ensure that greater emphasis is placed on evaluating varieties under a system which closely represents the grazing scenario in place today on Irish dairy farms. This will also ensure that grass breeders focus their breeding programme to meet the requirements of a grazing based system rather than one which places a large degree of emphasis on silage conservation.

Identifying the optimum grass variety protocol

A recent three-year study, funded by DAFF, was completed in Moorepark in November 2009, has shown that the management imposed on a variety significantly influences its dry matter yield and quality performance. The consequences of this suggest that the way we evaluate grass varieties for National and Recommended Lists must represent the grazing system as closely as possible in order to ensure the most appropriate varieties are being recognised for our system.

Four managements were imposed to represent a simulated grazing system, as well as a first-cut, second-cut and third-cut silage system. The simulated grazing system incorporated 10 defoliations from March to November. The first-cut silage system imposed seven defoliations from February to October including one silage cut. The second-cut silage system imposed six defoliations from late March to October including two silage cuts and the third-cut silage system incorporated five defoliations from late May to September with three silage cuts.

Table 1 shows the change in the rank order of the varieties relative to the mean DM yield (t DM/ha) depending on which management they are exposed to. In the simulated grazing system, Bealey and Tyrella were the two highest yielding varieties. However, when the number of silage cuts increased to the second-cut and third-cut silage systems, these two varieties were outperformed by other varieties and their position in the table dropped significantly. Conversely, Malone performed poorly in the simulated grazing system, but re-ranked as the number of silage cuts increased and was the highest yielding variety in the third-cut silage system.

These results highlight that certain varieties are suited to grazing-only systems, while other varieties are more suited to use in silage systems. The evidence of re-ranking of cultivars based on their total DM production highlights the need to ensure that grass varieties are evaluated using the optimum protocol to represent the current and anticipated future needs of the industry. This will also ensure that breeders select and breed for perennial ryegrass varieties which meet the needs of current management systems and are suited to Irish grazing requirements.

Table 1. **Effect of management system on ranking of varieties across a 3-year period relative to the mean DM yield**

Rank	Simulated grazing (11.7 t DM/ha)		1st-cut silage (13.4 t DM/ha)		2nd-cut silage (15.1 t DM/ha)		3rd-cut silage (15.3 t DM/ha)	
1	Bealey	1.06	Tyrella	1.03	Dunluce	1.05	Malone	1.07
2	Tyrella	1.05	Navan	1.02	Arrow	1.05	Portrush	1.04
3	Arrow	1.03	Bealey	1.02	Lismore	1.02	Alto	1.04
4	Dunluce	1.02	Lismore	1.01	Greengold	1.01	Lismore	1.00
5	Alto	1.00	Dunluce	1.00	Malone	1.01	Greengold	1.00
6	Dunloy	0.99	Greengold	1.00	Navan	1.01	Navan	0.99
7	Navan	0.99	Malone	0.99	Glencar	1.01	Arrow	0.99
8	Glencar	0.98	Glencar	0.98	Bealey	0.98	Glencar	0.98
9	Malone	0.97	Dunloy	0.97	Alto	0.98	Bealey	0.98
10	Greengold	0.97	Alto	0.97	Tyrella	0.97	Tyrella	0.98
11	Lismore	0.97	Arrow	0.97	Portrush	0.96	Dunluce	0.97
12	Portrush	0.96	Portrush	0.97	Dunloy	0.96	Dunloy	0.96

Grass Economic Index

The most important variety characteristics for herbage production are seasonal DM yield, total DM yield, quality and persistency. In areas of seasonal grassland production there is generally a deficit in grass availability at the shoulders of the season and surplus grass is available during the main grazing season. The availability of grass and the demand for it fluctuates across the season, resulting in changes in the economic benefit of additional grass in the system. Cultivars with high winter and spring growth rates would make a large economic contribution to grass based systems as they would reduce the concentrate and silage feed costs in the system during periods of grass deficit e.g., early lactation/spring. Therefore the resulting economic weighting on grass production will have increased emphasis on out-of-season growth and less focus on high DM yields during the main growing season when grass supply generally exceeds demand. The selection of grass varieties with higher seasonal growth alone will not necessarily result in a superior grass on the farm. Other factors such as persistency and quality as well as silage DM yield must also be considered.

In order to derive economic values the Moorepark Dairy Systems Model (MDSM) was used to simulate herd parameters, nutritional requirements, land use and total inputs and outputs. A full description of the model is reported by Shalloo et al. (2004). The major revenues in the MDSM are milk sales and livestock sales. The costs were determined based on cow numbers, fertiliser costs, feed costs etc. In the model the calving interval was 365 days, with 70, 20 and 10% of the cows calving in February, March and April, respectively. Total herbage produced was 13 t DM/ha. The breeding season began in late April and lasted 13 weeks. The base stocking rate (SR) within the system was 2.42 LU/ha with a 300 day grazing season. Annual fertiliser nitrogen input was 255 kg N/ha. Animals were turned out full time post-calving and housed at the end November. The total annual feed budget for the dairy cow was comprised of 3.7 t grass DM, 1.1 t silage DM and 0.37 t concentrate DM.

Key traits of interest in grass production including DM yield, sward quality and persistency can contribute significantly towards overall profitability within the farm system. Economic values were derived by simulating a physical improvement for each trait of interest independent of all other traits (improved spring, summer and autumn DM yield, higher grass DMD value from April to September (inclusive), improved persistency and increased silage (1st and 2nd cut) yields. The final Economic Value for a variety is reported on a € per ha per year basis).

The base milk price used in the model is assumed at 27 c/l based on long term projections (Binfield *et al.,* 2008). The model parameters were investigated through the application of the economic values to actual production data. The production values, generated by twenty grass varieties which were managed under a simulated grazing protocol, and also a second-cut simulated conservation protocol across a three-year period.

Table 2. Economic value per unit change in each trait of interest: DM yield, quality, silage yield and persistency.

€/ kg change in DM yield	Spring **0.27**		Summer **0.03**		Autumn **0.16**	
€/unit change in DMD/kg	April **0.01**	May **0.02**	June **0.02**	July **0.02**	August **0.02**	September **0.02**
€/kg change DM silage yield	1st cut **0.09**			2nd cut **0.06**		
€/ % change in persistency/ha	**4.96**					

The economic value for spring DM yield is based on the financial benefit of each 1kg increase of grass DM yield in the spring. An increase in grass growth and hence increase in grass available to the cow reduces the requirement for silage or concentrate during this period with no effect on milk production. The value for autumn DM yield is based on the same principal as that for spring yield. The lower value for summer DM yield occurs as a result of grass not being limiting during this period, therefore each kg increase in DM yield is less valuable to the system. The economic value for quality expressed per kg, is based on a 1% change in DMD and is calculated on a monthly basis. The economic values of each variety to a grazing system are shown in Table 3. Persistency data is not included. Based on a 10-year reseeding plan any variety which has a shorter lifespan and is therefore less persistent will result in a decrease of €4.96 per % change in persistency per ha per year. Work is currently being carried out at Moorepark to assess persistency of varieties. Until data is available on the persistency of a variety, no economic value will be included in the economic index for persistency. It is envisaged that Moorepark will introduce persistency data into the index in the near future. Silage remains an important part of the diet of ruminants during the winter period. The economic value for silage is based on a kg increase in silage DM yield above the average of all varieties for both first and second cut.

Table 3. Ranking of varieties based on economic values applied to grazing parameters of 20 varieties.

	€ DM yield			€	€/ha per year
Variety	**Spring**	**Summer**	**Autumn**	**Quality[1]**	**Grazing EV[2]**
Bealey	121.3	9.0	16.0	101.3	248
Dunluce	50.4	5.4	-17.6	111.9	150
Tyrella	70.5	8.0	21.9	29.4	130
Dunloy	-9.3	-3.4	14.7	127.1	129
Navan	-4.0	-3.9	4.8	107.9	105
Arrow	153.3	-0.9	-27.9	-33.8	91
Greengold	31.3	-5.9	-34.3	77.6	69
Glencar	25.2	-1.3	-31.6	70.5	63
Alto	114.1	-8.7	-15.0	-52.3	38
Malone	38.2	-7.3	-33.2	31.3	29
Aberdart	-10.3	5.6	42.6	-19.5	18
Aberavon	-74.9	15.7	63.0	-0.9	3
Lismore	-2.4	-1.0	-49.0	51.3	-1
Portrush	-8.9	-6.6	-33.4	-9.4	-58
Fennema	-41.3	-0.2	13.0	-72.2	-101
Foxtrot	-87.3	4.8	30.0	-59.8	-112
Mezquita	-67.1	14.2	29.6	-109.3	-133
Melle	-82.4	-9.2	22.3	-106.9	-176
Twystar	-87.6	-3.4	11.6	-115.5	-195
Corbet	-128.7	-10.8	-27.5	-128.9	-296

[1]Quality value is a sum of the April to August DMD values, no data available for September
[2]Economic values (EV) relate to grazing value only for inclusion of silage EV see table 4.
*No persistency data is available and therefore persistency is excluded from the calculations. Therefore results must be treated with caution as the final EV for a variety could alter significantly depending on the persistency of the variety.

Table 4 presents the total economic values of the 20 varieties including a value for first and second-cut silage. If a farmer is using a variety for grazing only the values can be obtained from Table 3 to identify the varieties which will give the greatest economic contribution to the grazing system. If silage is also to be cut, Table 4 presents the economic values for a system combining a 2-cut silage with rotational grazing.

Table 4. Ranking of varieties based on the economic values applied to grazing and silage parameters of 20 varieties*.

	€ DM yield			€	€ DM yield silage		€/ha per year
Variety	**Spring**	**Summer**	**Autumn**	**Quality[1]**	**1st cut**	**2nd cut**	**Total EV**
Bealey	121.3	9.0	16.0	101.3	-28.6	-1.9	217
Dunluce	50.4	5.4	-17.6	111.9	24.2	35.5	210
Tyrella	70.5	8.0	21.9	29.4	10.2	-1.5	139
Greengold	31.3	-5.9	-34.3	77.6	22.6	29.1	120
Navan	-4.0	-3.9	4.8	107.9	-2.5	17.9	120
Dunloy	-9.3	-3.4	14.7	127.1	-30.9	14.8	113
Arrow	153.3	-0.9	-27.9	-33.8	5.8	16.2	113
Glencar	25.2	-1.3	-31.6	70.5	2.2	27.4	92
Lismore	-2.4	-1.0	-49.0	51.3	59.4	11.6	70
Malone	38.2	-7.3	-33.2	31.3	31.7	-1.9	59
Alto	114.1	-8.7	-15.0	-52.3	-0.3	1.8	40
Aberdart	-10.3	5.6	42.6	-19.5	-1.7	-32.1	-15
Aberavon	-74.9	15.7	63.0	-0.9	-3.9	-16.5	-18
Portrush	-8.9	-6.6	-33.4	-9.4	-18.2	8.2	-68
Foxtrot	-87.3	4.8	30.0	-59.8	20.8	0.3	-91
Fennema	-41.3	-0.2	13.0	-72.2	45.8	-44.8	-100
Melle	-82.4	-9.2	22.3	-106.9	-16.4	-13.1	-206
Twystar	-87.6	-3.4	11.6	-115.5	-11.7	-17.6	-224
Mezquita	-67.1	14.2	29.6	-109.3	-74.2	-21.7	-229
Corbet	-128.7	-10.8	-27.5	-128.9	-34.1	-11.9	-342

[1]Quality value is a sum of the April to August DMD values, no data available for September

*No persistency data is available and therefore persistency is excluded from the calculations. Therefore results must be treated with caution as the final EV for a variety could alter significantly depending on the persistency of the variety.

Overall, the objective of the Grass Economic Index is to introduce the value of each variety into the National Recommended List for Grass Varieties in conjunction with the Department of Agriculture, Fisheries and Food. This will provide clear guidelines to farmers on the potential economic value of each variety to their system as a whole. If silage is an important factor the farmer can focus on the silage EV (e.g. from Table 4 it is clear that the varieties Dunluce and Lismore performed well under a silage system). Whereas if spring grazing is considered more valuable then varieties which provide a EV that is highly positive for the spring DM yield value can be identified. It is recommended that when selecting varieties, farmers should look at all the data and identify the varieties most suited to their system based on grazing DM yield, silage DM yield, quality and persistency. The underlying objective of the Grass Economic Index is to allow farmers have more confidence in choosing varieties that are suitable to their respective systems.

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Grass: a Greener Alternative

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Summary

- Ireland's 2007 national emission of greenhouse gases was 69 million tonnes (CO_2 equivalent). This exceeds Ireland's average annual commitment under the Kyoto protocol for the period 2008 to 2012 and the 2008 EU commitment for a 20% reduction in greenhouse gas emissions by 2020. It is likely that further reductions in Ireland's greenhouse gas emissions will be required under any future international treaty established for the post Kyoto period.
- Methane from ruminant animals and nitrous oxide from nitrogen fertilizers are the most significant sources of greenhouse gases from Irish milk production systems.
- Dairy cows belch and exhale about 500 litres of methane every day, representing an approximate 6% loss of feed energy, the single largest source of greenhouse gas emission from dairy farms. It is estimated that the dairy sector contributes approximately 10% of Irelands total greenhouse gas emissions.
- Key opportunities for reducing greenhouse gas emissions include:
  (i) Increasing the proportion of the annual feed budget filled by high quality grazed pasture. This is achievable via management choices for earlier calving date, higher stocking rate, increased grazing season length and strategic use of nitrogen fertilizers.
  (ii) Herd management for reduced replacement rate and higher milk solids composition. This can be facilitated by an increasing herd EBI and improved grazing management.
- There is scope for Ireland to increase the efficiency of milk production thereby achieving target reductions in greenhouse gases without necessarily having to reduce the overall output of the dairy sector.

Introduction

Ireland's current total annual emission of greenhouse gases (GHG) is estimated to be 25% higher than in 1990, at 69 million tones of CO_2 equivalents for 2007. The agriculture sector remains Ireland's largest producer of greenhouse gases and was responsible for 26% of total emissions in 2007. This was despite a decrease of nearly 8% since 1990, due to reductions in the national cattle herd and an associated decrease in nitrogen fertilizer use (McGettigan *et al*., 2009). While the agricultural sectors contribution to the nation's emissions has reduced, it has been estimated that the dairy sector is responsible for approximately 10% of total GHG emissions (Lovett *et al*., 2008).

Increasing European and international pressure to reduce greenhouse gas emissions in order to stop the rise in atmospheric concentrations of CO_2 and other greenhouse gases can be expected to impact upon Irish milk producers with international negotiations on emission limits for the post-Kyoto period set to begin in Copenhagen next month.

Greenhouse gases in dairying

Three important greenhouse gases arise from dairy production systems. These are methane, the main component of natural gas, nitrous oxide and carbon dioxide. The relative contribution these make to the emissions of an average Irish dairy farm and their main sources are shown in Figure 1. Greenhouse gases are ranked according to their ability to trap heat and their rate of decomposition in the atmosphere. Known as their global warming potential, this value is expressed relative to carbon dioxide. Unfortunately for the dairy sector, methane and nitrous oxide are considered highly potent and have a calculated global warming potential 25 (methane) and 298 (nitrous oxide) times greater than carbon dioxide.

Methane (CH_4) arising mainly from the anaerobic fermentation of feed in the fore stomachs of ruminant livestock and also from slurry storage tanks, contributes approximately 50% of the GHG emissions from an average Irish dairy farm. The next largest source is nitrous oxide (N_2O). Emissions of this non-carbon gas are principally affected by the application of nitrogen fertilizer, along with losses from volatilization of urine and slurry nitrogen.

Reducing greenhouse gas emissions via pasture diets

Grazed pastures contribute to reduced GHG emissions from a dairy farm in two ways. Firstly, the GHG cost in producing pasture is considerably less than that emitted in the production of alternative lactation feed sources, such as whole crop maize silage and cereal grains. These crops require significant energy and nitrogen fertilizer inputs during their cultivation, harvesting, transport and feeding that are not required in the production and grazing of persistent pasture swards such as those based upon perennial ryegrass. This difference in the relative emission of greenhouse gases in feed production infers that every additional day spent at pasture offers the opportunity to reduce whole farm emissions associated with feed production.

Secondly, well managed perennial ryegrass based pastures are a high quality feed that yield lower enteric (rumen) methane emissions per unit of intake and per unit of milk solids produced than total mixed ration (TMR) diets based upon whole crop maize silage, pasture silage and cereal grains. Cattle have the ability to digest low-cost fibrous plant material through the microbial breakdown of plant cells in the rumen. Methane is a by-product of this microbial activity and results in the loss of approximately 6% of feed energy. A typical dairy cow will belch and exhale up to 500 litres of methane gas every day.

A study conducted at Teagasc Moorepark during the 2009 season has demonstrated the relative difference in enteric methane emissions between herds fed either 100% grazed perennial ryegrass pasture or a 100% TMR diet indoors, when both diets were fed to appetite. Forty eight Holstein-Friesian cows from the Moorepark herd were used in this study to directly compare the milk production and methane emissions associated with feeding these diets. Each cow's methane production was determined over two five-day periods, in mid-April and late May, using the sulphur hexafluoride technique. Milk production, milk composition and feed intake were also recorded.

Cows fed TMR achieved higher intakes, higher methane emissions and higher milk volume yield than those offered pasture. However pasture fed cows achieved significantly higher milk protein concentrations. Crucially the TMR groups increase in milk yield above the pasture fed cows was not large enough to offset their significantly higher enteric methane emission in either month (Figure 2). As a result pasture fed cows were significantly more efficient than their TMR fed counterparts, emitting significantly less methane per unit of milk solids produced (Figure 3).

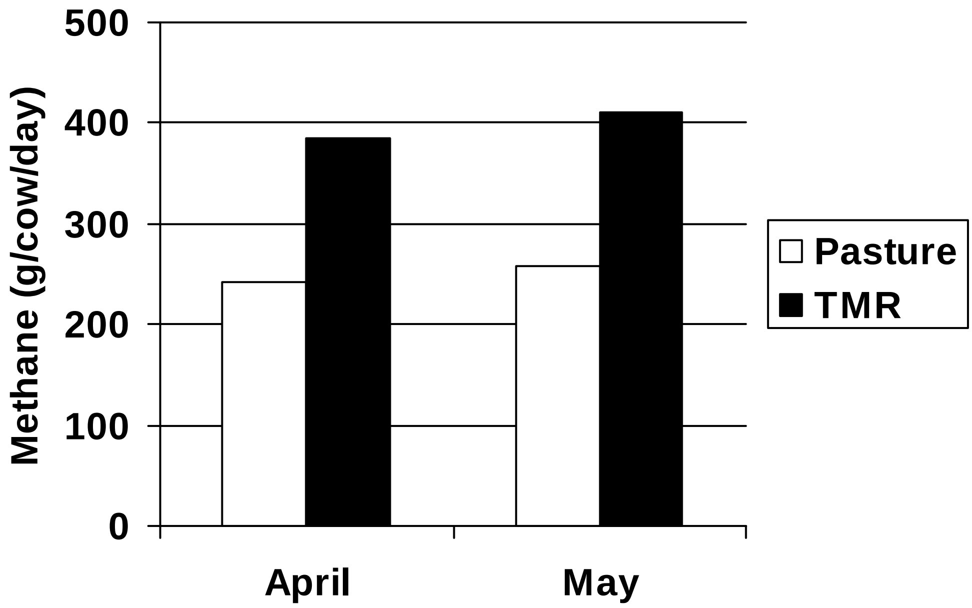

Figure 1. On and off farm sources of greenhouse gas emissions from an Irish milk production system. Proportions corrected for global warming potential.

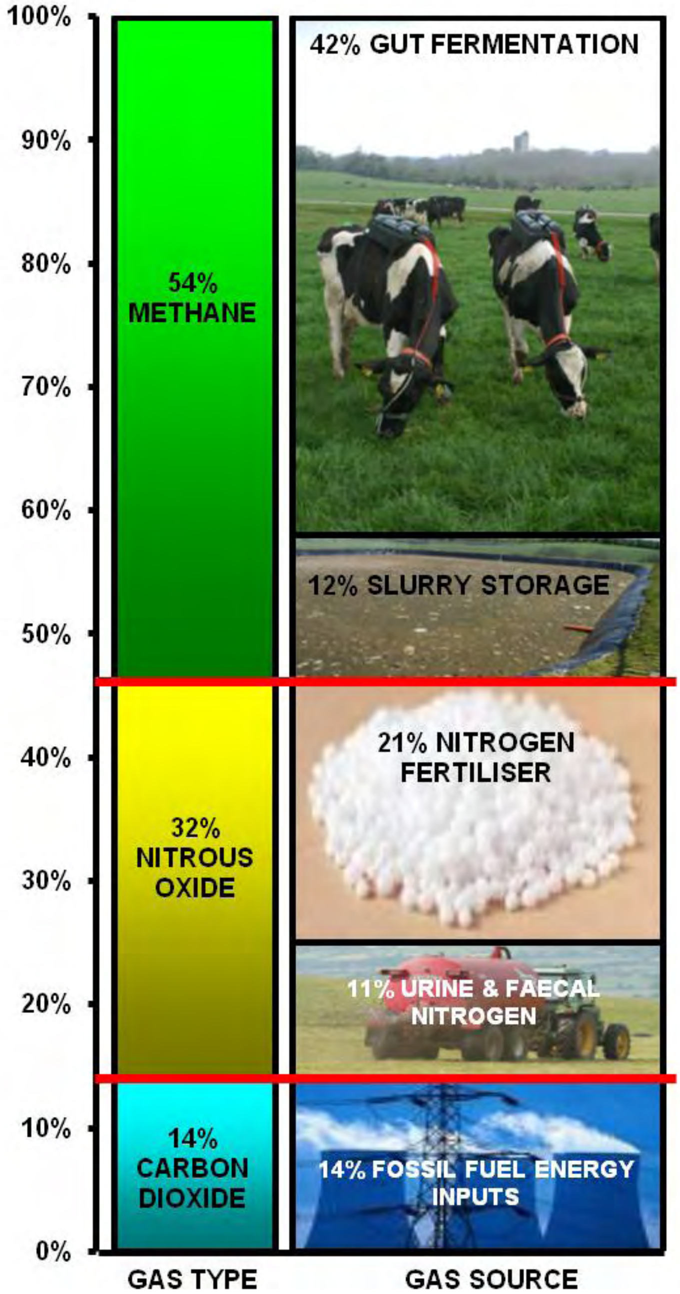

Figure 2. Average daily methane emission by diet

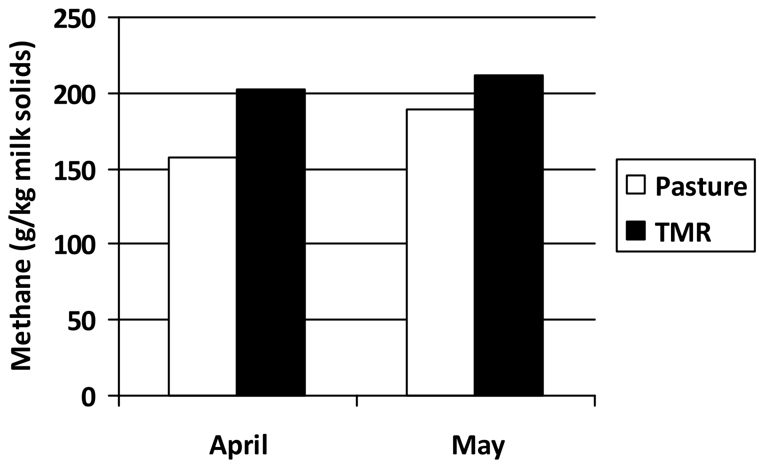

Figure 3. Average methane emission per kg of milk solids produced

This study has found that an increase in GHG efficiency from a grazed pasture diet is partly due to an increase in milk protein concentration and also due to a lower emission of methane per unit of feed consumed. It currently represents the only direct comparison of the methane emissions from a TMR compared with a grazed perennial ryegrass pasture. These results clearly demonstrate that enteric methane emissions are increased through the feeding of a TMR diet. Therefore maximizing the grazed pasture component of the annual feed budget while reducing reliance on TMR rations can be expected to reduce the GHG emissions per unit of milk solids produced.

Strategies to reduce greenhouse gas emissions

Computer simulation of dairy farm emissions enables the evaluation of strategies for their reduction by accounting for emissions from the entire production system, both on and off farm. Off-farm emissions are associated with inputs purchased onto the farm to maintain productivity. These include nitrous oxide and ammonia from the production of fertilizers, the emissions arising from cultivation, harvest and transport of off-farm feed supplements such as cereal grains or crop silages, along with carbon dioxide emissions associated with electricity generation and transport fuels.

It is imperative that farm strategies to reduce GHG emissions are not viewed in isolation, as attempts to reduce emissions from one source may impact upon another. For example, feeding diets containing high levels of cereal grains may reduce rumen methane production; however emissions associated with cereal grain production may actually increase the emissions from the overall milk production system. If GHG emissions are to be reduced within the dairy sector, then the entire production system should be considered.

Simulation work undertaken at Moorepark reveals there is potential to significantly reduce emissions from an average Irish dairy farm. Computer simulations allow the comparison of current farms, using 2008 national data for GHG emissions per kg milk and milk solids, against a forecast emission level for 2020 (assuming adoption of key farm technologies). Performed using two different methodologies, the International Panel for Climate Change and a simulation approach, all scenarios resulted in an increase of both milk output and total GHG emissions (per hectare) when compared to the 2008 system, while emissions per kg of milk and milk solids were reduced in all scenarios.

Improvements predicted in the GHG efficiency of milk production are achieved via adoption of key technologies in relation to improved grassland management and herd genetic merit. Grassland management can be improved via earlier calving, increased grazing season length (220 to 265 days), higher stocking rates, inclusion of white clover to fix freely available atmospheric nitrogen, and the judicial early season use of nitrogen fertilizers (less than 150 kg N/ha/yr). Improved herd genetic merit offers potential to reduce replacement rates (25 to 20%) and increase milk solids concentrations.

Increased genetic selection for profitability using an economic breeding index (EBI) has been shown to have the most significant effect on reducing GHG emissions per kg of product, followed by increasing the proportion of the annual feed budget filled by high quality grazed pasture, and a reduction in nitrogen fertilizer application via the use of clover.

These changes will result in increased milk solids yield per hectare, thus having a positive effect on the financial performance of the sector, and have the potential to reduce current GHG emissions from 22.5 kg to 16.8 kg CO_2 equivalents per kg milk solids produced. In the long term, emissions per kg milk solids could be reduced by as much as 40% from the current national average.

Focusing on the technologies that both reduce greenhouse gas emissions and increase farm profitability will result in the maximum gain to the dairy industry. If these changes occur at farm level there could be a significant increase in milk production without significantly increasing the dairy sector GHG emissions. Alternatively there is potential to reduce the total emissions of GHG from the Irish dairy sector whilst maintaining milk output at its current level. The choice of these possible scenarios will be directly influenced by the cost of carbon under the terms of any future emissions trading scheme.

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Crossbreeding: Is it more profitable?

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Summary

- Studies at Moorepark evaluating the merits of crossbreeding with Jersey and Norwegian Red sires have demonstrated considerable animal performance benefits with crossbred cows.
- Economic analysis undertaken using biological data generated from these studies indicate superior profit generating potential per lactation with a herd of first cross Jersey×Holstein-Friesian and Norwegian Red×Holstein-Friesian cows compared to the pure Holstein-Friesian cows at Ballydague, equating to over €16,000 and €7,000, respectively, based on a 40 ha unit.
- There is a growing requirement for the ICBF and Teagasc to provide profit predictions for crossbred cows in addition to those currently provided for purebred cows.

Introduction

The ideal cow for Ireland is one that will efficiently deliver high yields of milk solids from grazed grass, while continuing to go back in calf year on year. Robust reliable cows will maximise profit generation regardless of future milk price swings. Until relatively recently in the world of dairy cattle breeding, the term “high genetic merit” was synonymous with high milk production potential. What’s more, international dairy production has been dominated by North American Holstein genetics. Now, however, more balanced breeding objectives are in place, with emphasis on survival and functional traits, as well as production performance. In Ireland, the economic breeding index (EBI, weighting in parentheses) includes milk production (42%), fertility (34%), beef performance (11%), calving performance (9%) and health (4%). Nevertheless, some dairy farmers are becoming open to the fact that such a balance may more immediately be obtained via crossbreeding with high genetic merit Jersey and Norwegian Red sires.

What does crossbreeding offer?

There is evidence from a diverse range of environments around the world to demonstrate that crossbreeding can provide an alternative means of counteracting the negative consequences (reduced reproductive efficiency/survival) of past selection programs via heterosis or indeed in some cases via a combination of heterosis and breed difference. Although as a mating strategy for dairy cows, crossbreeding is not novel concept, with the exception of New Zealand, crossbreeding has not been popular. This is most likely due to the historical divergence in yield potential between the available alternative breeds and the Holstein. However, acceptable levels of genetic improvement for milk production within these breeds, together with a requirement to improve reproductive efficiency at farm level, mean that interest in crossbreeding has been rejuvenated in many countries, including Ireland. Fundamentally a successful crossbreeding strategy aims to 1) introduce favourable genes from another breed selected more strongly for traits of interest, 2) remove the negative effects associated with inbreeding depression, and 3) to capitalise on heterosis or hybrid vigour, where crossbred animals usually perform better than that expected based on the average of their parents.

Crossbreeding research at Moorepark

Since 1996, studies have been run at Moorepark evaluating the merits of a number of alternative breeds for crossbreeding under Irish conditions. The aim of the research is to provide a greater insight into the potential of these breeds via crossbreeding and to assist the identification of a greater variety of top EBI (high profit) sires for use by Irish dairy farmers. The breeds of particular interest currently are the Jersey and Norwegian Red. The Jersey trial is based at the Ballydague research farm (since 2006) and the primary aim is to evaluate the merit of Jersey×Holstein-Friesian cows under Irish conditions. Evidence from New Zealand suggests that Jersey crossbred cows are well suited to seasonal grass-based dairy production. The study at Ballydague is relatively small scale but with each passing year more data is generated, providing a clearer insight into what crossbreeding with Jersey could offer Irish dairy farmers.

The Norwegian Red is a breed that has been selected with an index not dissimilar in approach to the Irish EBI since the 1960's. Interest in the breed emanated from its long history of selection for female fertility and udder health along side milk yield. A preliminary study carried out at Ballydague (2001-2005) demonstrated these positive attributes and was followed up with a larger on-farm study (2006-2008) run across 46 commercial dairy herds i.e. a study with large numbers, to 1) more conclusively evaluate the merits or otherwise of crossbreeding with Norwegian Red, and 2) provide suitable data that could be used by the ICBF to enhance breeding value estimations for crossbred cows.

Detailed animal performance results from both the on-farm Norwegian Red and Ballydague Jersey crossbreeding studies have been presented via a number of forums in recent times: periodic articles in the Irish Farmers Journal, various Teagasc Moorepark Open days e.g., "Moorepark '09" etc. The findings from both studies suggest a very favourable response to crossbreeding. Until now, however, how the crossbred performance translates to monetary benefit, has not been presented. The objective of this paper, therefore, is to offer a preliminary economic analysis, to provide some feel for the extra profit generating capability that might be expected by those who have recently implemented or are contemplating crossbreeding on their farms.

Typical Jersey/Norwegian Red crossbred cow

Jersey×Holstein-Friesian cows in general will tend to be dark brown/black in colour. On average they will be smaller and more compact; on average 50-60kg lighter than Holstein-Friesian contemporaries, but body condition will tend to be superior. Milk volume will be reduced, but milk solids content will be significantly increased and as a result the yield of milk solids will be maintained, or as observed at Ballydague, increased. Increased production efficiency is a consequence of maintained solids production at a reduced body size. This is due to an innate ability of the Jersey crossbred to achieve higher grass intakes relative to its size (compared to the Holstein-Friesian) and a consequent dilution of the energy associated with maintenance. This is a trait the crossbred inherits from the Jersey breed. High solids production in conjunction with lower milk volume is favoured by the multiple component milk pricing payment system i.e. 'A+B-C'. On the negative side cull cow and male calf values will be reduced.

Mating Holstein-Friesian cows with Norwegian Red sires will typically result in a type of cow very similar in general appearance and production characteristics to the Holstein-Friesian. However, improved fertility, udder health and body condition can be expected. Thus, it is an option for those wishing to avail of the benefits of crossbreeding but who feel crossing with Jersey is too drastic i.e. for those farmers who want to keep the type of cow they have; similar colour, size, weight, production characteristics, calf value etc.

Preliminary economic analysis

The analysis undertaken is based on the biological (animal performance) data generated at the Ballydague research farm (Jersey crossbreeding trial) and extrapolated for the Norwegian Red and Norwegian Red×Holstein-Friesian, based on the findings of the Norwegian Red on-farm study. The economic analysis was carried out using the Moorepark Dairy Systems Model (MDSM) (Shalloo *et al.,* 2004), a stochastic budgetary simulation model which simulates the outcome based on a number of assumptions – very similar to what is done to determine the economic values used in the EBI. The model incorporates animal inventory and valuation, milk production, feed requirement, land, labour and economic analysis. Variable costs including fertilizer, contractor charges, medical and veterinarian, artificial insemination, silage and reseeding, fixed costs (machinery maintenance and running costs, farm maintenance, car, telephone, electricity and insurance) and sales values (milk, cull cow and calf) were evaluated on current prices (Teagasc, 2008). Fertilizer application is assumed to be 250kg of N per hectare per year. Assumed values for various performance traits used in the model are presented in Table 1. Relative production values are those obtained at Ballydague since the beginning of the study. The yield performance of the Jersey crossbreds at Ballydague suggests a heterosis estimate for this trait of 185 kg of milk or 3.8%. This is in line with previous estimates for milk yield. While, for example 6 week in-calf rates differed considerably between the three breed groups at Ballydague over the first three years (52%, 56%, 70% for the Holstein-Friesian, Jersey and Jersey×Holstein-Friesian, respectively) the implications of these differences on calving pattern was not incorporated into the model. Instead the proportion of cows within each breed group that actually calved (adjusted for the poorer performing groups to maintain a balanced study at Ballydague) in each month from January to April of each year was used and parity structure adjusted based on assumed replacement rates. Replacement rate in the model was calculated as the mean proportion of cows that failed to become pregnant by the end of the breeding season plus a voluntary culling rate of 10% of the cows remaining. The difference in the in-calf rate used in the current analysis (based on the findings at Ballydague) represent 9% units or a heterosis value for this trait of about 11.5%. This is not unrealistic based on findings from the New Zealand national data base.

The model was limited to 40ha of land and 13t DM of grass was assumed to be grown. Cow numbers were determined ensuring adequate supply of both grazed grass and grass silage for the annual feed budget. Herd default parameters in the model farm are presented in Table 1. Milk price was set at 27c/l at 33.0g/kg protein and 36.0g/kg fat with a ratio of the value of protein to fat of 2.6 to 1. It is assumed that all calves were sold from the farm at four weeks of age. Female calves realised the same value across breeds (€330). However, this was not so for the male calves. The purebred Jersey male calves were assumed to have zero value, the male calves out of the Jersey×Holstein-Friesian cows were assumed a value of €30, while those off the Norwegian Red, Norwegian Red×Holstein-Friesian and Holstein-Friesian were valued at €80. All replacements were brought onto the farm at the time of first calving. Cull cow values were based on end of lactation BW and assumed kill out percentage for each of the breed groups; 42% for the Holstein-Friesian, Norwegian Red and Norwegian Red×Holstein-Friesian, 40% for the Jersey×Holstein-Friesian and 38% for the Jersey. The differences in the value per kilogram of carcass were assumed to be €1.00, €1.25, €1.50, €1.50 and €1.50 for the Jersey, Jersey×Holstein-Friesian, Holstein-Friesian and Norwegian Red×Holstein-Friesian, respectively.

Sensitivity analysis was carried out on the key variables affecting the differences in profitability between the groups. Milk prices of 20 and 33c/l were investigated as well as the relative value of protein to fat. Differences in replacement heifer values were modelled to capture the effect of differences in replacement rates.

Table 1. Assumptions of the model farm

Farm size (ha)	40.0
Milk production characteristics	
Holstein-Friesian	5297 kg @ 4.12 F% and 3.49 P%
Jersey	4232 kg @ 5.32 F% and 4.03 P%
Jersey crossbred	4977 kg @ 4.77 F% and 3.88 P%
Norwegian Red	5032 kg @ 4.05 F% and 3.49 P%
Norwegian Red crossbred	5297 kg @ 4.05 F% and 3.49 P%
Replacement rates	
Holstein Friesian	29.8%
Jersey	29.8%
Jersey crossbred	21.7%
Norwegian Red	21.7%
Norwegian Red crossbred	21.7%
Cull cow price (€)	
Holstein-Friesian	244 kg @ €1.50 = €366
Jersey	149 kg @ €1.00 = €149
Jersey crossbred	214 kg @ €1.25 = €268
Norwegian Red	231 kg @ €1.50 = €347
Norwegian Red crossbred	244 kg @ €1.50 = €366
Male Calf value (€)	
Holstein Friesian	80
Jersey	0
Jersey crossbred	30
Norwegian Red	80
Norwegian Red crossbred	80
Concentrate cost (€/tonne)	200
Opportunity cost of land (€/Ha)	267
Cow housing costs (€/cow)	600
Ratio of value protein to fat	2.6
Replacement heifer costs (€)	1,540
Labour costs (€/mo)	1,905

Economic outcomes

The effect of breed group on expected herd performance and overall farm profitability based on a 40 ha farm at a milk price of 27c/l is presented in Table 2. According to the model 100 Holstein-Friesian, 113 Jersey, 99 Jersey×Holstein-Friesian, 102 Norwegian Red and 100 Norwegian Red×Holstein-Friesian cows would be facilitated at the given land base. The lower BW and milk yield per cow of the Jersey is the explanation for the resulting higher stocking rate for this group. Productivity by the way of milk volume is expected to be highest for the Holstein-

Friesian and Norwegian Red×Holstein-Friesian, slightly lower for the pure Norwegian Red, followed by the Jersey×Holstein-Friesian and lowest for the Jersey. However, sale of milk solids (yield of fat plus protein), and consequently milk receipts from the farm, is expected to be highest for the Jersey, followed by the Jersey×Holstein-Friesian, followed in turn by the Holstein-Friesian, Norwegian Red×Holstein-Friesian and purebred Norwegian Red. Labour and concentrate costs were not dissimilar across the five groups, slightly higher for the Jersey, again associated with the higher cow numbers. Total replacement costs were significantly lower for the Jersey×Holstein-Friesian, purebred Norwegian Red and Norwegian Red×Holstein-Friesian due to superior reproductive performance. Despite almost €20,000 higher milk receipts with the Jersey compared to the Holstein-Friesian, overall profitability was over €2,000 lower with the pure Jersey. For the most part the erosion in profit is attributable to higher labour costs (larger herd size), lower revenue from cull cow and male calf sales, and higher replacement costs. The pure Norwegian Red on the other hand was slightly more profitable compared to the Holstein-Friesian, despite a shortfall in milk receipts of over €5,000. This is due primarily to reduced costs associated with superior fertility/survival. Both crossbreds were more profitable than the Holstein-Friesian. Over all farm profit was predicted to be just over €7,000 higher for Norwegian Red×Holstein-Friesian compared to the Holstein-Frieisan almost exclusively due to the benefits of reduced replacement costs (adjusted for differences in the sale of culls). However, the highest farm profit was obtained with the Jersey×Holstein-Friesian. The difference between the Jersey×Holstein-Friesian and the Holstein-Friesian was just over €16,000. The difference in profit between the Jersey×Holstein-Friesian and the Norwegian Red×Holstein-Friesian is due to the substantial improvement in milk receipts, off set marginally by reduced livestock sales. In summary, on a 40 ha farm the Jersey×Holstein-Friesian and Norwegian Red×Holstein-Friesian cows increased profitability by 59% and 27%, respectively, over the Holstein-Friesian.

The economic performance of the group denoted as Norwegian Red×Holstein-Friesian is for the most part what is to be expected if the Holstein-Friesian cows had similar fertility performance (replacement rates) to the Jersey×Holstein-Friesian cows. So the benefits from the Jersey×Holstein-Friesian is more than that accounted for by improvements in fertility.

Table 2. Physical and financial components of Holstein-Friesian (HF), Jersey (J), Jersey×Holstein-Friesian (JX), Norwegian Red (NR) and Norwegian Red×Holstein-Friesian (NRX) cows on a 40 ha farm.

	Breed group				
	HF	J	JX	NR	NRX
Annual milk yield (kg)	529,939	482,356	493,665	514,848	528,106
Milk Sales (kg)	518,353	469,169	482,118	502,939	516,500
Milk protein (kg)	18,085	18,959	18,732	17,586	18,059
Milk fat (kg)	21,334	25,003	23,033	20,375	20,924
Milk protein (%)	3.49	4.03	3.88	3.49	3.49
Milk Fat (%)	4.12	5.32	4.77	4.05	4.05
No. of cows	100	113	99	102	100
Land area (Ha)	40	40	40	40	40
Stocking rate (LU/Ha)	2.34	2.66	2.38	2.45	2.39
Milk price (c/l)	30.64	38.16	35.44	30.51	30.51
Labour cost (€)	28,455	32,386	28,931	29,840	29,081
Concentrate costs (€)	6,206	7,063	6,344	6,544	6,377
Livestock sales (€)	30,941	23,197	23,200	28,379	28,049
Replacement costs (€)	45,636	51,940	33,175	34,218	33,348
Feed costs (€/kg)	6.4	7.1	6.9	6.6	6.4
Milk price 27c/l					
Milk returns (€)	154,207	173,824	165,894	149,006	153,009
Profit/kg milk solids (€)	0.68	0.56	1.03	0.74	0.88
Profit/Ha (€)	674	615	1,075	702	857
Profit Farm (€)	26,966	24,592	42,989	28,062	34,283

Sensitivity analysis shows that at a milk price of 20 c/l, all groups are unprofitable (Table 3). The economic loss was greater for the Jersey compared to the Holstein-Friesian. At a higher base milk price of 33 c/l farm profitability was similar for the Holstein-Friesian and Jersey but remained substantially higher with both crossbred groups. At a higher milk price, the higher milk solids concentration of the Jersey and Jersey×Holstein-Friesian results in increased profitability compared to Holstein-Friesian, Norwegian Red and the Norwegian Red×Holstein-Friesian cows. When the value of protein to fat is increased from 2.6 to 1 to 3.3 to 1 the difference in profitability between the Jersey×Holstein-Friesian and the Holstein-Friesian is reduced by €440, while the difference between the Jersey and Holstein-Friesian increased by €1,205. Increasing the cost of replacements increases the difference in profitability between the Holstein-Friesian and the Norwegian Red and both crossbred groups (€1,578, €1,698 and €1,721 for the Norwegian Red, Jersey×Holstein-Friesian and Norwegian Red×Holstein-Friesian, respectively).

Table 3. Sensitivity on key economic variables as a result of variability of milk price, ratio of fat to protein and replacement heifer value.

		Breed group				
		HF	J	JX	NR	NRX
Milk price 20c/l	Milk returns (€)	114,060	130,253	123,824	110,184	113,144
	Profit/kg milk solids (€)	-0.34	-0.44	0.02	0.29	-0.15
	Profit/Ha (€)	-336	-482	16	275	-146
	Profit Farm (€)	-13,448	-19,261	641	-11,016	-5,846
Milk price 33c/l	Milk returns (€)	188,627	211,300	202,079	182,291	187,189
	Profit/kg milk solids (€)	1.56	1.42	1.90	1.62	1.76
	Profit/Ha (€)	1,540	1,558	1,985	1,539	1,717
	Profit Farm (€)	61,616	62,310	79,412	61,566	68,688
Fat to Protein ratio of 3.3 to1	Milk returns (€)	153,501	171,923	164,751	148,482	152,471
	Profit/kg milk solids (€)	0.67	0.52	1.00	0.72	0.87
	Profit/Ha (€)	656	567	1,046	688	844
	Profit Farm (€)	26,255	22,679	41,838	27,535	33,742
@ replacement heifer cost of €1,750	Livestock costs (€)	51,859	59,023	37,699	38,824	37,895
	Profit/kg milk solids (€)	0.52	0.40	0.92	0.62	0.76
	Profit/Ha (€)	517	436	960	584	742
	Profit Farm (€)	20,673	17,430	38,417	23,347	29,688
@ replacement heifer cost of €1,200	Livestock costs (€)	35,560	40,473	25,851	26,664	25,985
	Profit/kg milk solids (€)	0.94	0.82	1.21	0.94	1.07
	Profit/Ha (€)	929	905	1,260	892	1,043
	Profit Farm (€)	37,155	36,188	50,391	35,697	41,724

The difference in EBI between the sires of the Jersey×Holstein-Friesian and the pure Holstein-Friesian cows (Table 4) indicates an expected differential in profit per lactation in the region of €3000 in the current example i.e., explains approximately 20% of the profit differential identified by the economic analysis of the results obtained. The reproductive efficiency/survival of the Jersey crossbreds in Ballydague has been good over the past four years. That of the pure Jerseys has been poor, particularly when the fertility sub-index and fertility PTAs of the Jersey sires used in the Ballydague study are considered. The animal performance data suggests that the current genetic evaluations are over estimating the 'breed effect' for fertility of the Jersey breed. The fertility performance differences observed across the three breed groups at Ballydague would suggest that much of the superior reproductive performance exhibited by the Jersey crossbreds is not due to additive genetic improvement associated with the Jersey breed. Rather, it would seem to be borne primarily out of hybrid vigour, suggesting that part of the heterotic effect is being attributed to the Jersey breed. If this is true, the decision with regard to sire choice to generate the next generation (i.e., to use on the first generation Jersey×Holstein-Friesian cows) is not trivial because about half of the hybrid vigour effect may be lost in generation two if either a Holstein-Friesian or Jersey sire is used. Hence, when using high EBI sires to generate the subsequent generation, careful consideration to the fertility sub-index of the sire used is critical to avoid/minimise a reversal in the subsequent generation of the gains to reproductive performance (the quick fix) made in the first cross. While hybrid vigour is accounted for somewhat by ICBF in the genetic evaluation, a general hybrid vigour value is assumed across all breed crosses.

Table 4. Weighted average EBI and PTA data (reliabilities in parentheses) of the sires of the Holstein-Friesian, Jersey, Jersey×Holstein-Friesian breed groups at Ballydague.

	Breed group		
	HF	J	JX (Jersey sires)
EBI (€)	105 (94)	97 (78)	132 (88)
Milk (€)	58 (97)	48 (93)	75 (97)
Fertility (€)	36 (90)	81 (61)	80 (75)
Calving (€)	20 (96)	11 (87)	14 (94)
Beef (€)	-7 (96)	-40 (77)	-35 (92)
Health (€)	-2 (92)	-3 (61)	-2 (69)
Milk production PTAs			
Milk (kg)	+159	-391	-322
Fat (kg)	+11.2	+13.6	+17.2
Protein (kg)	+8.5	-0.6	+3.5
Fat (%)	+0.09	+0.65	+0.65
Protein (%)	+0.06	+0.28	+0.31
Reliability (%)	97	93	97
Fertility PTAs			
Calving interval (days)	-1.72	-3.99	-4.04
Survival (%)	+1.39	+2.98	+2.85
Reliability (%)	91	61	75

Where to after the first cross?

Three options exist with regard to the breeding strategy that can be employed when it comes to breeding the first cross (F_1) crossbred cow. These are as follows:

1) Two-way crossbreeding. This entails mating the F_1 cow to a high EBI sire of one of the parent breeds used initially. In the short term HV will be reduced but over time settles down at 66.6%.
2) Three-way crossing. Simply use a high EBI sire of a third breed. When the F_1 cow is mated to a sire of a third breed HV is maintained at close to 100%. However, with the reintroduction of sires from the same three breeds again in subsequent generations the HV levels out at 85.7%.
3) Synthetic crossing. This involves the use of high EBI crossbred bulls. In the long term a new (synthetic) breed is produced. HV in this strategy is reduced to 50% initially and is reduced gradually with time.

Further research is warranted on this issue. At Ballydague, for the past 2 breeding seasons the Jersey×Holstein-Friesian cows have been mated to Norwegian Red to determine the benefit of a three-way crossbreeding strategy. A follow-on study to the Norwegian Red crossbreeding study has engaged a further 20 commercial farms to generate and subsequently evaluate three-way crossbred cows (both Jersey×Norwegian Red×Holstein-Friesian and Norwegian Red×Jersey×Holstein-Friesian) on a larger scale.

Genetic Evaluations - ICBF

Use of foreign data for minority breeds

Identifying high EBI bulls of other breeds such as Jersey or Norwegian Red is central to obtaining optimal results from cross breeding. At the moment the amount of data available on Jersey and Norwegian Red bulls in Ireland is such that they are precluded from the Interbull international evaluations. At least 20 AI bulls fully progeny tested per breed in Ireland is necessary. Being part of the Interbull evaluations for these breeds would allow the most accurate evaluation of foreign bulls most suitable to Irish dairy farmers. Hence the participation of Irish data in an Interbull evaluation for the smaller breeds is the ultimate goal. At the moment country specific conversion equations are available for New Zealand Jerseys and Norwegian Red bulls, however, these are based on limited numbers of common sires. In addition to these converted EBIs the country of origin figures should also be consulted, but it’s important to look at the individual traits that are most relevant in Ireland rather than just selecting bulls on the total merit index in the country of origin. ICBF are investigating ways of better utilising the foreign proofs until the Interbull criteria on data is realised. In future it is anticipated that genomics will also play a role in increasing the reliability of proofs for minority breeds as bulls from these breeds will be included in the genomic evaluations. However, this aspect is some time away.

Improved fertility evaluation

Several impending improvements on our own national evaluations are also currently under active research with a view to updating bull proofs for the Spring 2010 breeding season. A new model for the fertility traits, calving interval and survival is nearing completion which will include information on the first five parities (currently three parities are used). The new evaluation will also see the introduction of insemination related traits such as calving to first service as an early predictor of fertility. This will increase the reliability of the calving interval and survival evaluations as well as provide an earlier indicator of fertility of young bulls without having to wait for first lactation daughters to re-calve. More specifically in relation to crossbreeding the new evaluation will facilitate the calculation of specific heterosis effects which will more readily identify the better combinations of breeds and hence give more accurate EBIs.

Sire advice and culling index
The current sire advice program does not yet handle the positive effects of heterosis on profit but modifications to the programme are currently underway with a view to implementing it in the near future. ICBF, Teagasc and other organisations are also developing a culling index which will aid farmers in identifying animals to voluntarily cull from the herd (as opposed to the EBI which identifies the cows to breed from). This index will reward cows that are performing better than their EBI suggests and vice versa and will factor in expected calving date, age of the cow, and level of heterosis in the decision making process.

Conclusions
The most profitable genotype or breed is the one that returns the highest profit per unit of the most limiting input. In Ireland the impending removal of EU milk quotas will result in land becoming the most limiting resource. The analysis undertaken therefore assumes that fat adjusted milk quota will not be a constraint at farm level in the future. The results indicate that with a fixed land base and across 3 milk price scenarios Jersey and Norwegian Red crossbred dairy cows can offer immediate substantial improvements to farm profit. This is particularly true with the Jersey×Holstein-Friesian due to a combination of improved fertility/survival and improved milk receipts. In the analyses presented Jersey×Holstein-Friesian cows increased farm profit by €16,023, €14,089 and €17,796 compared to Holstein-Friesian cows at base prices of 27c/l, 20c/l and 33c/l, respectively. In addition, the results highlight that losses resulting from reduced cull cow and male calf value are clearly overshadowed by the overall performance of the Jersey×Holstein-Friesian.

The analysis presented, which is based on the performance of purebred and crossbred cows evaluated within Moorepark studies, suggests that the EBI does not entirely reflect the performance outcome under crossbreeding. There is a need for Teagasc/ICBF to provide profit predictions for crossbred cows, taking cognisance of heterozygosity, in addition to those currently provided for purebred cows. This is essential to enable accurate sire advice and female culling decisions to be made in herds with both purebred and crossbred cows.

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Working Smarter Not Harder to Improve Milking Performance

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Summary

- Farmers and their staff spend 1,000 - 1,200 hours a year milking cows.
- Reducing time spent on this task by 30 minutes per day will free up the equivalent of 19, eight-hour days to spend on other productive jobs, time with your family or just doing something other than milking cows!
- Harvesting milk from cows is a simple task that can become complicated and time consuming.
- This paper reviews the key elements of highly efficient milking operations in New Zealand and describes opportunities for efficiency gains on Irish dairy farms.

Milking practices and parlour design in New Zealand

New Zealand dairy farmers operate a low-cost, highly efficient production system. At the core, are an extensive grazing system and the ability to grow and utilise high quality pasture to produce milk. Herd size is large on the world scale for pasture based dairying (national average 351 cows, NZ Dairy Statistics 2007/08) and the systems are highly labour efficient (134 cows per person, DairyNZ Economic Survey 2007/08).

To achieve these levels of labour efficiency New Zealand farmers have refined batch-milking to extreme levels with large swing-over herringbone and rotary parlours being best practice. The median number of clusters for herringbone dairies is 24 and for rotary dairies 44 (Cuthbert, 2008). Throughput rates of over 300 cows/h are common for herds milked through large rotaries, over 200 cows/hr for herds milked through large herringbones and between 100 and 150 cows/hr for smaller parlours. This level of efficiency has been achieved by using minimal pre-milking routines, reducing attention time per cow to 8-12s, taking advantage of the efficiencies of scale and investing in infrastructure that enhances cow flow (e.g., backing gates, wide laneways and simple parlour designs) and reduces tasks (e.g., automatic cup removers (ACR) and drafting systems), allowing one person to handle a larger number of cows.

Parlour type

Parlour designs and milking routines have evolved in response to the demand to milk more cows and at the same time keep milking sessions within a reasonable duration (Figure 1). The rotary parlour is now the design of choice for new and upgraded installations and is experiencing growth similar to the uptake of the herringbone design during the 1970s. In 2008, 79% of parlours were swing-over herringbone with the remainder rotary design. The latter design is used to milk approximately 34% of the national herd (Jago and McGowan, 2008), highlighting their increasing role in milking larger herds.

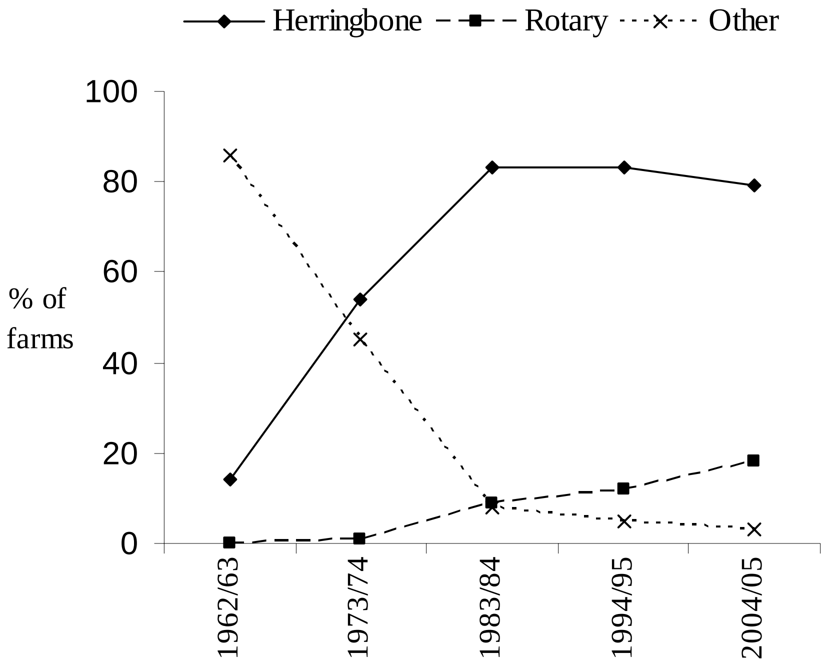

Figure 1. The change in parlour type over the past forty years in New Zealand (source: Jago and McGowan, 2008).

The number of clusters in herringbone parlours has increased as herd size has grown (Figure 2). On average, there is one cluster for every 10-12 cows. In very efficient parlours one person can manage up to 24-26 clusters without ACR, although in late lactation care must be taken to avoid excessive over-milking. Beyond this number two people are usually required. In herringbone parlours the time it takes to unload and load a row becomes the main barrier to greater efficiency as the number of cows per row increases. In rotary parlours with ACR and automatic teat spraying and drafting, one person can milk around 500 cows.

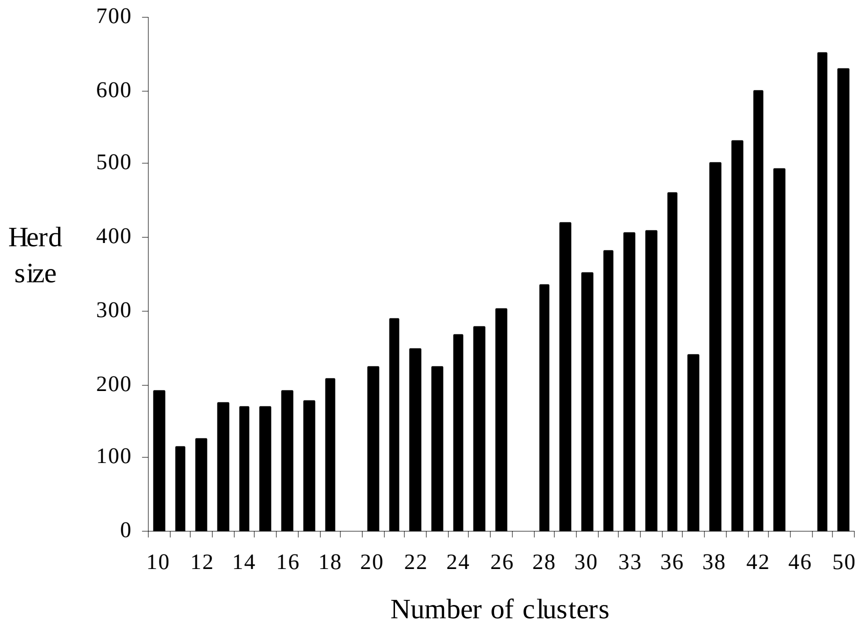

Figure 2. Number of clusters and average herd size for herringbone parlours in New Zealand (Source: Cuthbert, 2008).

Adapting practices and technology to improve milking performance

Milking routines have become progressively streamlined. The majority of farmers will only wash cows' teats before milking if they are 'dirty'. Routine sanitising and fore-stripping of teats before attaching teat cups is rarely practiced (<6%), except during the post-calving colostrum period. However, the majority (91%) of farmers routinely sanitise teats after removing the cluster (Cuthbert, 2008).

The use of automation is increasing. An automated backing gate is an essential feature on most farms with 80% of farmers using this technology. Over 55% of rotary dairies have automatic cup removers (ACR) installed, along with 9% of herringbone parlours. Interest in automatic teat disinfectant devices is also increasing (currently 18% of farms have installed this equipment; 49% of rotary parlours and 10% of herringbone parlours). Automatic drafting gates, especially in rotary dairies (11% of rotary parlours; 2% of herringbone parlours, with 38% of farmers in a recent survey suggesting that this is a technology they would like to adopt, Cuthbert, 2008) are also becoming popular.

Milking practices and parlour design in Ireland

Like New Zealand, the predominant parlour design on Irish dairy farms is a swing-over parlour with an almost even split between side by side and herringbone designs (Kelly *et al.,* 2008). The most common number of milking units is six with just 14% of farms using over 12 units.

Milking practices are more varied than in New Zealand possibly reflecting the difference in environmental conditions, partial housing, more varied production systems and regulation. In a survey of 398 farms, approximately half practiced some form of teat preparation (wash only, wash and dry or dry wipe) with little variation through the year. A large number of farmers (22%) never disinfect teats after removing teat cups, 69% apply disinfectant after every milking and 9% intermittently. Fore-milking is common, with 34% of farms drawing foremilk at each milking, a further 20% in response to a change in somatic cell count or clots on the filter sock (Kelly *et al.,* 2008).

Herd size in Ireland is expected to increase rapidly as regulation regarding milk quota changes (Hennessy, 2004). Data from Irish studies have shown that around 33% of net labour input per day in a dairying enterprise is associated with the milking process (O'Brien *et al.,* 2004). As herds become larger it will be important for farmers to adapt their milking management to fully take advantage of the efficiencies of scale.

While Irish farms are much smaller than in New Zealand the principles of efficient milking still apply. Increasing herd size does not have to mean spending more time milking, and in many cases should not require more labour.

Opportunities for improving milking performance

The time from first cluster on until last cluster off accounts for about 60-64% of the total time required to milk the herd (O'Brien *et al.,* 2001; Jago and Taylor, 2007). The rest is taken up by fetching the herd, preparing the parlour for milking and post-milking cleaning. For this reason it is important to view the milking process from the time the cows leave the paddock and not just from the time the first cluster is attached.

From paddock to parlour

Well designed gateways and properly constructed and maintained laneways are essential. Herds up to 200 cows need about four metres of clear width and larger herds a meter wider for each 50 cows added to the herd, up to about seven metres. The surface should be hard, free of sharp stones and crowned very gently. Eliminate all sharp turns as these can each add five minutes to the time it takes to fetch the herd. Avoid changes in width, mud holes and uneven climbs. After a steep climb, cows will stop on the flat section so it's better to even it out. The holding yard should be large enough to contain the whole herd. Avoid cows stepping down when entering the yard as this can cause lameness when cows step on stones dragged in from the race. Instead have the entryway leveled and, if concerned about stones being dragged in, fit a concrete nib. Entrances should be wide so cows don't slow down entering the yard.

Cow flow in the parlour
Good cow flow is often the difference between a pleasant or a frustrating milking. Cows are very sensitive and react to changes in their environment so it is important to make milking a stress-free experience for the cow. Cows do not like loud, unpleasant noises or being hit and slapped when aligning themselves in the row or exiting after milking. The best stock people use calm voices and body position to encourage cows to move.

Avoid going out into the yard to load cows as they will learn to wait for you before entering the row. When training cows it is better to go out the exit end and to the back of the holding yard to encourage the cows to enter. The lead-in to the bail area should be long enough to allow several cows to be lined up and ready to follow the exiting cows. The first bail space is critical. It needs to be about 200mm longer with no intrusive pipe work – so the biggest cow in the herd can stand in comfort. Head gates need to be at the correct angle so cows fit in easily and they should be operable from well along the pit.

Any pain or discomfort for the cow will inevitably lead to a hesitant approach when loading. The breast rail height should be such that it does rub on her shoulder blades which lack a protective covering of muscle. Zigzag rump rails control the cows' positions giving better cow flow because cows know when they are in the 'right' position. The resulting good alignment with the cluster gives faster, more even milking. Stanchion bailing aids in cow-cluster alignment but increase row times because cows cannot enter until the previous row has exited and the bailing has been repositioned. A backing gate with a control that is operable from most of the length of the pit avoids interrupting cluster changing and therefore wasting time.

Exiting cows should be able to walk freely without obstruction. Widely spaced vertical supports avoid cows getting hit on the way out. The pit-side post supporting the head gate should be in line with the rump rail and not stuck out into the cows' pathway. Avoid sharp bends, walls and narrow exits. Make sure surfaces are not slippery as this will make cows cautious and reluctant to move.

People in the parlour
It is just as important to make milking a pleasant experience for the people, as it is for the cows. Milking needs to be a safe and enjoyable job. Milking in a quiet parlour is always more pleasant than one with loud noises so vacuum pumps should be sited well away from the pit area and in a sound-proof room. Ensure there are enough water droppers in the pit so that it is easy to keep hands (gloved) and the milking area clean. Make sure the parlour is well lit and concrete areas are clean so that they are not slippery.

It is important to learn to attach the cluster in an efficient way that protects the person from overuse injuries and reduces the danger of being kicked. The 'Round-the-Circle' is the simplest, easy-to-learn, reasonably quick method. For swing-over parlours, use the right hand to put on the teat cups on the right hand side row of cows (with you facing the exit) because it is easier to reach through the back legs. Pick up the claw with the left hand and reach over the left arm to pick up the left back teat cup at the same time. Put it on then the left front then right front then right back. On the left hand side use the left hand to put on the teat cups.

Cluster removal technique is very important. The vacuum should always be turned off before removing the teat cups. Do not drag the claw squarely backwards – this upsets the cow. Pulling one teat cup off while the others are still attached, and before the vacuum falls, risks more new infections.

Milking routines

The number of clusters one person can handle will depend, in the first instance, on the work routine time (WRT). This is the time taken to carry out all operations associated with the milking of one cow. If the WRT is around 20 seconds, then the maximum number of animals an hour the operator can milk is 180 cows. The data in Table 1 illustrate the impact of WRT on potential cow throughput per hour (i.e., the shorter the WRT the more cows one person can milk per hour, unless parlour size is the limiting factor. With a unit-on time of 7.0 minutes, reducing the WRT below 30s does not provide efficiency gains as the number of clusters is the limiting factor. The optimum parlour size will depend on the operator work routine as well as unit-on time (determined by milk flow rate and yield). With seasonal calving herds it can be difficult to size a parlour optimally as one person can handle more clusters at peak lactation than in late lactation when unit-on time decreases with lower yields.

If there are two operators, make sure they are changing clusters on the cows at the same time. By both working together this allows more time for row changing, the key to speeding up the routine. Both people start changing more or less at the exit end and skip past any slow cows. Teat spraying is normally done three or four cows at a time as the people work down the pit. As they reach the end, one person works their way back towards the exit end to change the slow cows. As soon as possible, the head gate is opened to start the cows exiting. The backing gate is used carefully to tighten up the cows when working about half way down the pit. Over a minute can be lost on every row by not opening the head gate early enough and a further minute if the second milker starts changing clusters part-way down the pit instead of near the front of the row.

Table 1. A theoretical estimation of the predicted and potential cows per operator-hour for a range of work routines (WTR A-D in a 14-unit parallel milking parlour (adapted from O'Donovan, 2008).

	WRT A	WRT B	WRT C	WRT D
Cow entry	3.4	3.4	3.4	3.4
Washing teats and drawing foremilk	11.5	-	-	-
Drawing foremilk	-	-	5.1	-
Washing teats	-	10.0	-	-
Drying teats	5.0	5.0	-	-
Attaching clusters		10.1	10.1	10.1
Changing clusters*	14.8	-		-
Disinfecting teats	1.9	1.9	1.9	1.9
Cow exit	1.9	1.9	1.9	1.9
Washing cow standings	3.9	3.9	3.9	3.9
WRT (s)	42.4	36.2	26.3	21.2
WRT (min)	0.71	0.6	0.44	0.35
Row time (min)	9.8	8.3	6.1	4.9
Maximum predicted cows/operator-hour	85	99	137	170
Unit time (min)	7.0	7.0	7.0	7.0
Units	14	14	14	14
Potential cows/operator-hour	120	120	120	120
Limiting factor	Routine	Routine	Parlour	Parlour
Optimum number of units	9.9	11.7	15.9	20.0

** detaching and attaching clusters (i.e. no ACR)*

To load up a row of cows, walk to the entry bringing up a batch of 6-10 cows and start changing as soon as practical. The second operator brings up the next batch and starts changing. With good dairy design, the rest of the cows row up by themselves. Long pits work against short row times because cows take too long to exit and reload. Long pits therefore require better staff coordination with both milkers changing clusters quickly and at the same time. This gives enough 'free' time for the milked cows to move out and the unmilked cows to move in.

Slow milking cows

A few cows that are slow to milk-out will slow down the whole row, adding to milking time. Recent research from Australia (Clarke *et al.,* 2004; 2008) and New Zealand (Jago and McGowan, 2008) has shown that leaving a small amount of milk behind in the udder does not effect either production or incidence of clinical mastitis. Guidelines published on the Australian CowTime website (www.cowtime.au) show that for a cow producing 12L at a single milking that clusters can be safely removed after 7.2 minutes. This practice can have a major effect in small dairies where the number of clusters is limiting throughput – i.e. the operator is waiting for cows to milk out before releasing a row.

Cleaning up

The ultimate quality of a farm's milk is determined in large part by the cleanliness of the milking machine and the whole dairy environment. A clean milking machine ensures that microbial contamination of the milk is minimised. Clean yards and surrounds reduce other sources of contamination and keep cows clean.

Cleaning up is a routine job that can be almost fully automated, so the potential for time saving is great. Bucket cleaning should be avoided as this is very time consuming and labour intensive. A jetter system for cleaning the milking plant (which can be automated) provides a consistent clean every time and reduces the chance of mistakes being made by tired operators. For manual hosing of yards and concrete areas, high volume, low pressure systems are generally best for removing manure and reducing cleaning time. Multiple short hoses located at convenient positions are more efficient than a single hose that must be dragged from one area to another for cleaning. The use of exfoliation gloves is a quick and easy way to keep clusters and pipe work clean

Gains in cow throughput must not be at the expense of milk quality and animal health standards. It is important to balance the needs of people and cows when targeting improvement in milking practices.

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Disease risk analysis in the control of costly infectious diseases

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Summary

- Introduction of infectious diseases such as BVD and IBR into Ireland have resulted in significant economic losses.
- The introduction of additional infectious diseases (Bluetongue, Enzootic Bovine Leukosis) through importation of livestock must be avoided in order to protect the disease status of the national herd.
- Prevalence of BVD, IBR and Leptospirosis has reached levels that necessitate 'farmer-driven' regional and national control programmes.
- Disease-risk analysis provides a vehicle whereby appropriate disease control strategies can be applied at both farm and national level.
- The probability of introducing BVD, IBR or Leptospirosis into an Irish dairy herd is high, and as such, risk avoidance and/or reduction measures must be employed.
- Greater awareness of infectious disease control amongst dairy farmers and implementation of the combined approach of biosecurity, diagnostic testing and vaccination will lead to reduced national prevalence of economically relevant infectious diseases.

Introduction

At present, there is a legislative requirement for pre-movement testing of cattle for bovine tuberculosis within the previous year, and pre- and post-movement testing of cattle for bovine brucellosis within 30 days of movement. There are a number of additional contagious diseases, however, which are not subject to governmental regulation but that can be introduced onto farms, often with devastating consequences. The disease agents in question are:

- Bovine Viral Diarrhoea Virus (BVDv);
- Infectious Bovine Rhinotracheitis (IBR) caused by Bovine Herpes Virus 1 (BHV-1);
- *Salmonella dublin & Salmonella thyphimurium;*
- *Leptospira hardjo;*
- Johnes Disease caused by *Mycobacterium avium* subspecies paratuberculosis; and
- *Neospora caninum.*

These diseases are currently impacting profit margins on Irish dairy farms as they result in decreased productivity in infected animals, an increase in culling rates and an increase in veterinary costs. Taking BVD as an example, it is estimated from a number of studies carried out abroad (Duffell et al., 1986; Chi et al., 2002; Gunn *et* *al.,* 2004), that active BVD infection in a herd can result in on-going losses of anywhere between €20 - €70 per cow. They may also, in future, impact international trade as Ireland is one of the few EU countries that is not actively engaged in either the eradication or control of these diseases, in particular BVD and IBR. Animal Health Ireland (AHI), ICBF and Teagasc are actively undertaking work to rectify this situation, with studies currently underway in Teagasc, Moorepark, for example, to establish the on-going costs of active BVD in an Irish context. A number of individual BVD outbreaks in Irish dairy herds in 2008 and 2009 have already been investigated and losses of up to €37,000 for a single outbreak have been recorded. How can the impact of such diseases be contained in a controlled and efficient manner? The business community commonly use RISK ANALYSIS in order to define appropriate control strategies and such a logical approach is easily transferable to the control of infectious diseases on dairy farms.

Risk analysis

Disease-risk can be defined as follows:

Probability of disease occurrence
(how likely is a disease to occur?)
X
Impact of disease occurrence
(how much will it cost?)

By determining how likely a disease is to occur and the expected or known cost impact of that disease, it is possible to define the type of strategy most appropriate to the control of that disease, whether at a national or individual farm level. The practical application of an on-farm disease-risk analysis involves the following four steps:

1. Decide on the likelihood of a disease occurring in your herd (important to establish whether the disease already exists in the herd using a suitable testing regime).
2. Decide on the likely cost impact of the disease if introduced, or if already present in the herd.
3. Based on this information, decide what disease control strategy is most appropriate to your farm (risk avoidance, risk reduction, risk acceptance or risk sharing – Figure 1).
4. Implement the necessary control measures based on your decision.

This four-point approach will allow the Irish dairy farmer to approach disease control in a logical manner and to rationally choose the correct approach to each individual disease that may impact the herd. The four distinct disease control strategies (risk avoidance, risk reduction, risk acceptance or risk sharing) are outlined in Figure 1, as are the circumstances under which the various strategies should be used. The remainder of this paper outlines each disease control strategy in detail and the measures that can be employed for each.

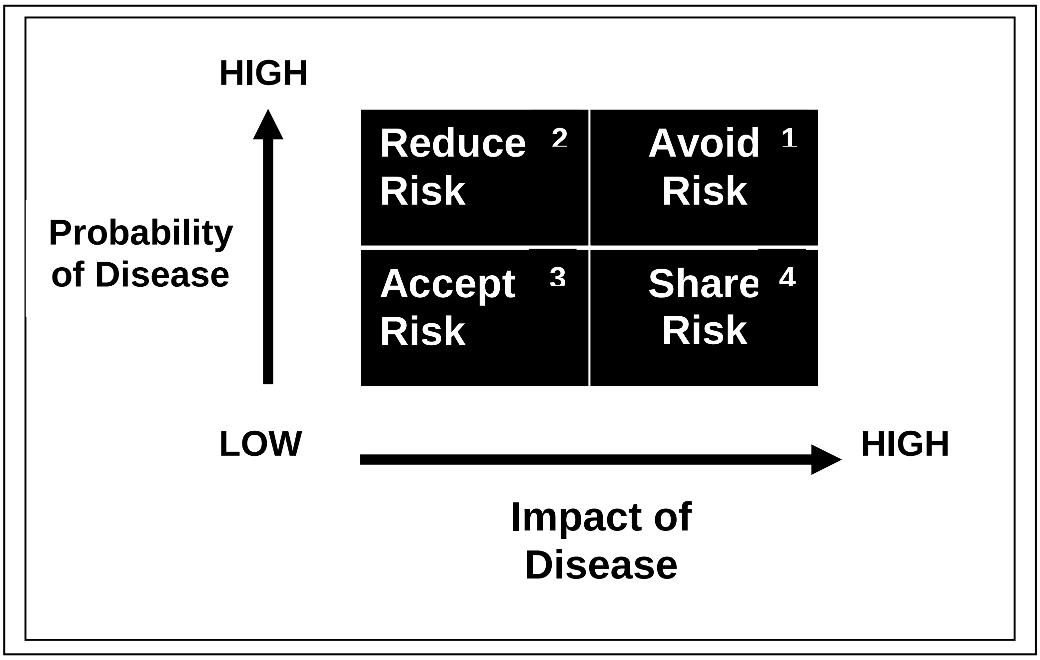


Figure 1: Disease risk analysis chart (1, 2, 3, 4 = disease control strategies).

Disease control strategies

1. Avoiding disease risk

This strategy should be employed where the probability of a disease occurring is high and also the cost impact is high. It is the most suitable strategy for control of infectious diseases currently exotic to Ireland. As an island nation, Ireland is almost uniquely positioned within Europe to maintain a high herd health status amongst its livestock by avoiding disease introduction at a national level. Our lack of lengthy international land borders allows for effective control of disease importation. However, in the past, this advantage has largely been negated by the advent of the single European market and abolition of strict quarantine protocols, which allowed unrestricted importation of livestock and with them, previously exotic diseases. The introduction and current widespread distribution of Bovine Viral Diarrhoea (BVD) and Infectious Bovine Rhinotracheitis (IBR) can almost be directly attributed to the increase in importation of livestock into Ireland in the early 1990's. Infectious diseases which pose a real threat to Ireland, but which have not yet been imported, include Bluetongue and Enzootic Bovine Leukosis (EBL). Ireland is one of the very few EU countries that has so far remained free of Bluetongue, and we should use our island status to ensure that this remains the case. In the current disease climate, importation of animals from other European countries, especially those at risk should be avoided and the practice actively discouraged. If imported, it is likely that Bluetongue would become rapidly established in Ireland, as a number of species of the disease carrier, the *Culicoides* midge (common midge), are highly prevalent in all parts of the country. We have a unique opportunity within Europe to avoid the risk of Bluetongue and we must take advantage of that opportunity. We lost the opportunity of avoiding disease in the early 1990's and now face the implementation of what should and could have been unnecessary disease control programmes.

The considerable amount of animal movement between farms in Ireland is also a significant contributor to the increase in prevalence of non-regulatory diseases in Ireland. A national survey of Irish dairy farmers in 2008 found that over 50% of Irish dairy herds can be classed as open herds (i.e. free movement of cattle onto the farm is permitted), while only 25% of herds classified themselves as closed herds (i.e. no movement of cattle onto the farm is permitted) (Sayers, 2008). Implementation of a strict closed herd policy is ***the*** most important biosecurity measure that can be implemented on a dairy farm in terms of disease-risk avoidance and is a practice that should be actively engaged in. Other livestock enterprises may find closed farming a difficult goal to achieve, given traditional farming practices, but it is certainly an achievable goal on dairy farms and should be viewed as the strategic first step in achieving effective infectious disease control. A closed herd policy (i.e., no cattle movement, including bulls, onto the farm) will block the direct importation of disease). A restriction of animal movement combined with some simple additional on-farm biosecurity measures, such as stock and disease-proof boundaries (a three-meter gap between neighbouring farms to prevent animal nose-to-nose contact) will optimise protection against the introduction of infectious diseases. The importance of both stock- and disease-proof boundaries should not be under-estimated; the considerable effort involved in maintaining a completely closed herd can be easily undermined by nose-to-nose contact between animals on neighbouring farms allowable by poor boundary fencing. The use of additional biosecurity measures as outlined in Table 1 will also reduce the risk of disease transmission. Many of these measures are not costly to implement, and in an economic climate where a disease outbreak could potentially devastate a dairy enterprise, are measures that should become standard on all dairy farms.

ON FARM PRACTICAL APPLICATION OF AVOIDING DISEASE-RISK

- **DO NOT IMPORT ANIMALS FROM ABROAD**
- **MAINTAIN A CLOSED HERD**
- **IMPLEMENT BIOSECURITY MEASURES IN TABLE 1**
- **RESTRICT ANIMAL MOVEMENT BETWEEN LAND PARCELS**

MOST APPLICABLE TO FARMERS CURRENTLY FREE OF ACTIVE DISEASE

2. Reducing disease risk

This strategy should be employed where the probability of a disease occurring is high and a cost impact exists although it is not as great as a disease that would affect international trade. The majority of the non-regulated diseases listed earlier fit into this category of disease control. As of yet, however, there are no national prevalence figures available for non-regulated diseases in Ireland and, in order to determine whether the likelihood of one of these diseases occurring is high, it is first necessary to define the prevalence of the disease nationally. In this regard, in early 2009, Teagasc initiated the 'Herd Ahead' project in order to gain some insight into the levels of BVD, IBR, Leptospira, Neospora and Salmonella in Ireland. This project involves quarterly bulk milk sampling of approximately 300 ICBF HerdPlus herds nationally (Figure 2), followed by blood sampling of a random selection of weanlings and completion of biosecurity and management questionnaires.

Data is being inputted into a dedicated herd health monitoring software package, and once complete, this project will provide invaluable information in determining the levels of disease exposure in Irish dairy herds. It will also allow valuable insight into the disease control methods currently employed nationally. The ICBF database is being used to compile all results and an eventual outcome will be the generation of farm specific health statements which can be used for trade purposes. The value of the ICBF database cannot be underestimated in this regard, and will provide an on-going resource in the control of disease nationally. The 'Herd Ahead' project began in March 2009 and all quarterly bulk milk sampling is now complete. Blood sampling of weanlings is currently underway and approximately 100 farms have already been visited. Biosecurity and management questionnaires are in the process of being forwarded to project participants and completed questionnaires will be available for analysis by the end of the year. This is a highly significant project for Irish dairy farmers in terms of prioritising and designing disease control strategies into the future and the participation of all 300 farmers and ICBF is gratefully acknowledged. The outputs of the project will allow dairy farmers to apply the concepts of disease-risk analysis outlined in this paper in an informed and practical manner.

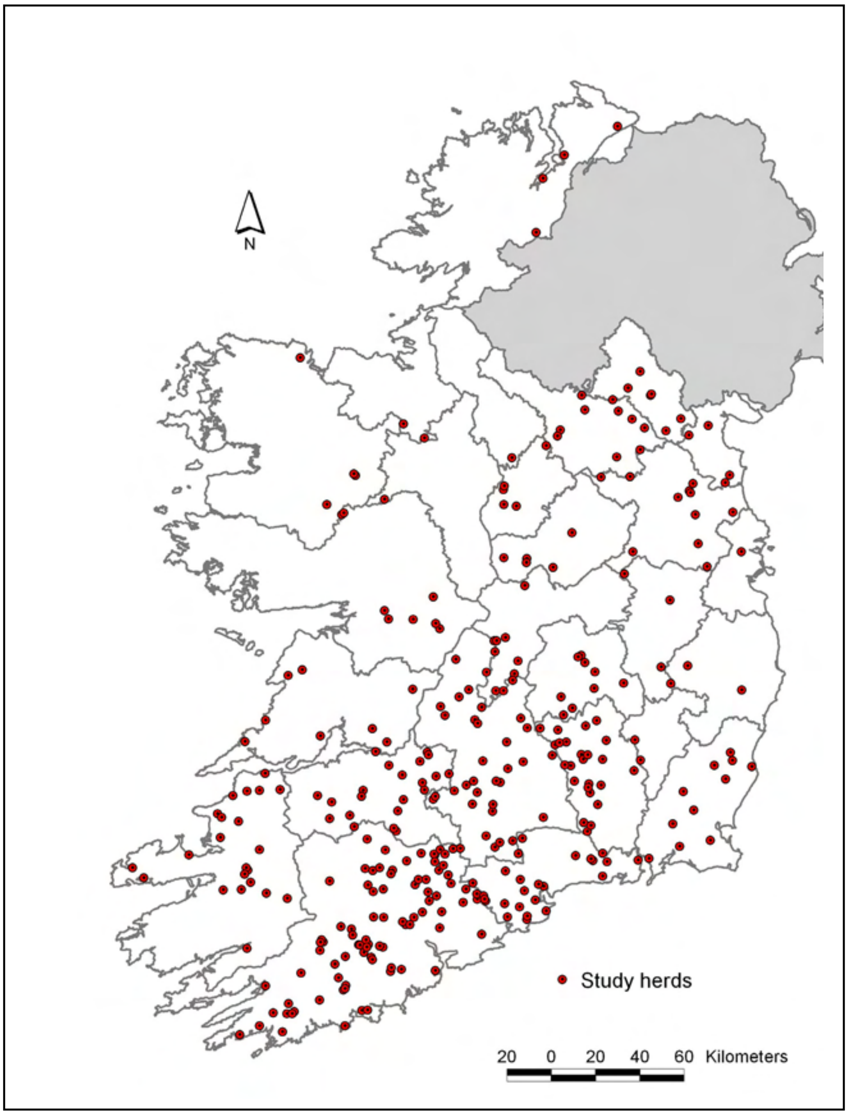
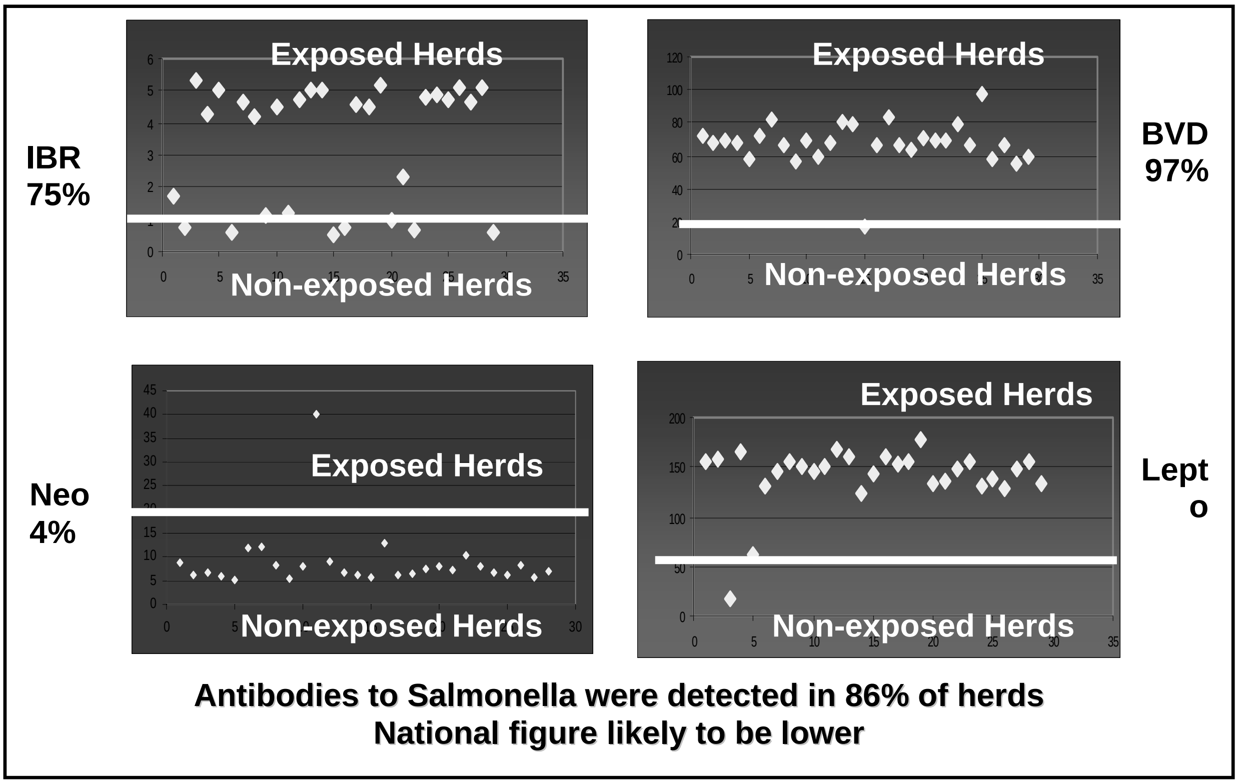


Figure 2: Location of study herds participating in the 'Herd Ahead' project.

In order to understand the applicability of the project to disease-risk analysis, interim results from a subset of 'Herd Ahead' farmers in the Munster area are presented (Figure 3).



IBR : Infectious Bovine Rhintracheititis — BVD : Bovine Viral Diarrhoea

Neo : *Neospora caninum* — Lepto : *Leptospira hardjo*

Figure 3: <u>Interim</u> results of a subset of Teagasc 'Herd Ahead' study herds in Munster indicating high levels of disease exposure in Irish dairy herds. The solid white lines indicate the demarcation between herds exposed and not exposed to the various diseases

These results show that, on the basis of the testing already carried out, over 95% of herds examined contain animals that had been previously exposed to BVD and Leptospirosis, approximately 75% of herds contain potential IBR carrier animals, and over 85% of herds recorded exposure to Salmonella (Figure 3). <u>These are interim results only</u> and research is continuing to determine the levels of active infection in the study herds, as historical exposure does not indicate active infection in all cases. (Note: It is essential to differentiate between historical disease exposure and disease currently active on the farm. The results presented here relate to historical disease exposure only and no information is available, as yet, as to whether these diseases are active). As mentioned previously, additional diagnostic testing of youngstock, coupled to an examination of management and biosecurity practices is required to identify actively infected herds and this work is currently being undertaken. However, what can be stated at this stage is that the results do indicate that the level of dairy herd exposure in Ireland to BVD, IBR, Leptospirosis and Salmonellosis is high and as such the probability of disease occurrence is high.

In terms of the cost impact of these diseases, an additional aim of the 'Herd Ahead' project is to identify the costs (direct or indirect) associated with the presence of non-regulated diseases in a herd. Data on BVD has been presented earlier in the paper and costs can vary quite significantly from farm to farm. As such, many farmers may choose a disease-risk reduction approach rather than a disease-risk avoidance approach, as a high cost-impact may not be visible as direct clinical/animal losses. The disease-risk reduction approach, while not as strict as disease-risk avoidance, does encompass many of measures that are included in a disease-risk avoidance plan and follows the same basic plan of combining biosecurity, diagnostic testing and vaccination in order to control disease risk (Figure 4). In order to classify biosecurity measures in terms of importance to disease control, a survey of experts from Ireland, UK, Australia, New Zealand and the US was carried out. A summary table of the results of this survey is included in Table 1 and should provide the basis for a biosecurity standard across dairy herds who are interested in reducing disease-risk. These biosecurity measures mirror those necessary for a disease-risk avoidance strategy but may be employed in less strict a fashion if the cost of disease is perceived to be lower.

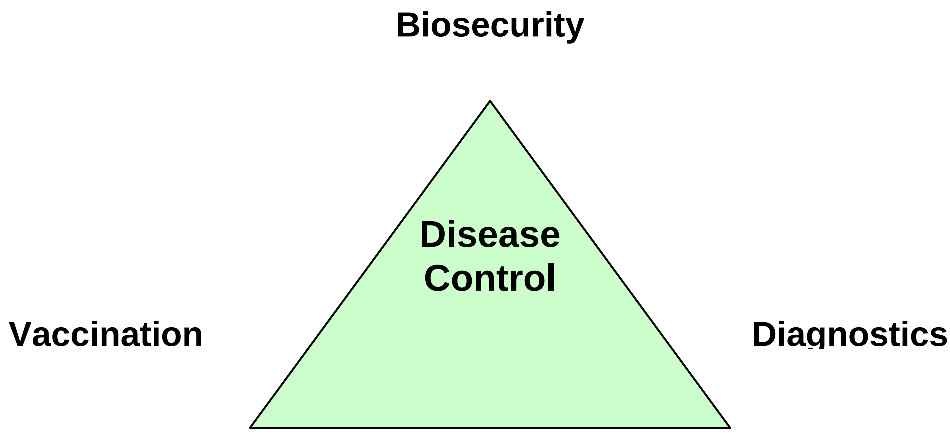


Figure 4: Disease control triangle outlining the critical components of an on-farm disease control programme (Sayers, 2008).

An individual farm biosecurity/disease control plan must incorporate three critical components; (i) routine on-farm biosecurity measures, (ii) diagnostic testing, and, (iii) strategic vaccination. None of these components should be neglected as none should be overly relied upon.

Table 1: Biosecurity measures ranked in order of importance to infectious disease control on dairy farms

Biosecurity Measure	Ranking
MAINTAINING A CLOSED HERD	Very Important
QUARANTINE FOR NEWLY INTRODUCED ANIMALS	Very Important
FARMER UNDERSTANDING OF INFECTIOUS DISEASE	Very Important
STOCK-PROOF BOUNDARIES	Very Important
ISOLATION OF SICK ANIMALS	Very Important
AVOIDING IMPORTATION OF MANURE / SLURRY / POULTRY LITTER / COLUSTRUM	Very Important
VETERINARY ADVICE	Very Important
GOOD HYGIENE (Housing, Yards, Parlour, etc.)	Important
ACCURATE DISEASE RECORDS	Important
ROUTINE DIAGNOSTIC TESTING	Important
USING A NEW NEEDLE PER ANIMAL WHEN GIVING	Important
PREVENTING ACCESS OF CATTLE TO WATERCOURSES	Important
RAPIDLY DISPOSING OF DEAD CATTLE	Important
VACCINATION	Important
WELL MAINTAINED FOOTBATHS	Moderately Important
INSPECT ING CATTLE TRAILERS FOR CLEANLINESS AND	Moderately Important
RESTRICTION OF FARM VISITORS (e.g. other farmers, sales	Moderately Important
MINIMISING VISITORS TO AND VISTOR MOVEMENT ABOUT	Moderately Important
ROUTINE CLEANING OF WATER TROUGHS	Moderately Important
REGULARLY CLEANING ORAL DRENCING EQUIPMENT	Moderately Important
HAVING WRITTEN BIOSECURITY GUIDELINES IN PLACE	Moderately Important
PREVENTING MIXING OF DIFFERENT FARM ANIMAL SPECIES	Moderately Important
SIGNS TO EMPHASIZE DISEASE CONTROL MEASURES	Moderately Important
PEST CONTROL	Moderately Important
CLEAN ING VEHICLES ENTERING THE FARM	Moderately Important
ANNUALLY DISINFECTING ALL CATTLE HOUSING	Of lesser Importance
LOGBOOK OF ALL VISITORS TO THE FARM	Of lesser Importance
TESTING OF WATER SUPPLY	Of lesser Importance

If feasible, therefore, a closed herd policy should be the primary biosecurity measure implemented on a dairy farm in terms of both disease-risk avoidance or, reduction. However, for those farmers who do wish to purchase breeding or replacement stock, the following biosecurity measures should be implemented;

- The health status of the 'home-herd' with regard to infectious disease should be established using diagnostic testing e.g., bulk milk analysis and/or random blood sampling of animals from different management groups on the farm.
- Animals should be purchased from a single source if possible.
- Data on the health history of the source herd, the individual animals to be purchased and their vaccination status should be requested.
- All newly purchased animals including bulls should be quarantined correctly i.e. isolated for at least 30 days in an area that is at least three metres from other cattle groups, with no sharing of feed or water troughs and no mixing of dung and urine. Using an isolated paddock is an ideal solution to avoid problems with indoor quarantine. Animals from different source herds should be quarantined separately. Purchase of lactating animals should be avoided, as quarantine cannot be effectively maintained in the milking parlour.
- On day 21 of the quarantine period approximately, newly purchased animals should be tested for BVD virus and antibodies against IBR and Leptospira (check vaccination status). If economically feasible, and if previous health history highlights the need, newly purchased animals should be tested for Johnes Disease, Salmonellosis, Neosporosis and *Mycoplasma bovis*. It is also essential to verify the Johnes status of the entire source herd as well as for the individual animal due to the difficulties encountered with Johnes diagnosis.
- If in-calf heifers are purchased, both the dam <u>and calves born subsequent to purchase</u> should be tested for BVD virus to prevent introduction of a persistently infected calf to the herd.
- All new purchases should be dosed for parasites (including lungworm) during the quarantine period.

These procedures will protect the 'home-herd' from introduction of a new disease, but will also allow protection of newly introduced animals against diseases already endemic in the herd by implementation of appropriate vaccination protocols.

It should be noted, however, that for those farms showing no evidence of disease exposure or those farms already engaged in an eradication or control programme, avoiding the risk of disease introduction remains the top disease control option as the cost impact of disease introduction into such herds can be devastating. The cost impact of a disease may also change annually based on farm income and therefore influence the type of disease control strategy employed. In any given year, when profits margins decrease, the cost impact of a disease on those margins will increase, and paradoxically, it is in those years with tighter profit margins, that a greater proportion of farm income and effort should be devoted to disease control and minimising the risk of disease introduction.

ON FARM PRACTICAL APPLICATION OF REDUCING DISEASE-RISK

- **IMPLEMENT BIOSECURITY MEASURES IN TABLE 1**
- **QUARANTINE AND TESTING OF NEW PURCHASES ESSENTIAL**

MOST APPLICABLE TO FARMERS WITH KNOWN ACTIVE DISEASE OR ACTIVELY ENGAGNED IN PURCHASING LIVESTOCK BUT WISHING TO IMPLEMENT CONTROL MEASURES

3. Accepting disease risk

Prior to 2009, disease-risk acceptance was the most common disease control strategy employed by Irish dairy farmers with regard to non-regulatory infectious diseases i.e. no disease control measures implemented and accept the consequences. This may in part be due to the perception that diseases such as BVD and IBR were not costly diseases to have in your herd, unlike bovine TB, Brucellosis or BSE, all of which could lead to herd depopulation. The actual likelihood of having one of these non-regulatory diseases in a herd was also not well acknowledged in the past. This perception has changed and a Delphi study carried out by Animal Health Ireland (AHI) which involved a priority identification study amongst Irish experts and farmers highlighted BVD, IBR and Johnes disease as the top three non-regulatory diseases that require intervention (Anon, 2009). Accepting the risk of disease introduction by non-implementation of appropriate disease control strategies has proved to be a poor disease control option as evidenced by the current levels of infectious disease exposure in Irish dairy herds. It could also prove a very costly disease control option in terms of future international trade should trade embargos be placed on Irish livestock and produce due to the levels of non-regulated diseases in our dairy herds. Risk acceptance is a strategy that should only be employed when the likelihood of a disease occurrence is low and also when the cost impact of the disease is also low. With the increasing knowledge being generated in relation to non-regulated infectious diseases in Ireland, risk avoidance and risk reduction must become the driving forces of disease control strategies in Irish dairy herds and acceptance of disease introduction must become a thing of the past. In this regard, Animal Health Ireland are implementing a new initiative whereby a number of technical working groups are being set up in order to outline the best disease control strategies for a number of diseases based on most recent expert advice. This will prove an invaluable resource and should be used as the basis for disease-specific control plans leading to a reduction in disease risk (Anon, 2009).

ON FARM PRACTICAL APPLICATION OF ACCEPTING DISEASE-RISK

- **HAS NO PLACE IN DISEASE CONTROL IN IRELAND**

ONLY APPLICABLE TO FARMERS HAVING ACTIVE DISEASE AND WILLING TO ACCEPT FINANCIAL AND WELFARE

4. Sharing disease risk

Should the cost implications of an infectious disease be high, eventhough the likelihood of the disease occurring is low, sharing the disease risk becomes an interesting disease control option, and essentially revolves around setting up of community, regional, or national control programmes. Of the diseases examined in the Herd Ahead project, interim results would indicate that Neospora does not have a high probability of occurrence in Irish dairy herds but can result in costly 'abortion storms' should it be introduced onto individual farms. *Neospora caninum* is a parasite that can be transmitted to cattle via contact with canine (domestic or wild) faeces, resulting in lifelong infection of a dam and her subsequent calves (Radostits *et al.,* 2006). Appropriate control involves treating infected canines, removal of infected dams from a herd and minimising contact between dogs and breeding cattle. In terms of using disease-risk sharing as a control strategy, voluntary local, regional, or national groups could be set up to promote and actively engage in implementation of Neospora control. The cost of control would be shared across the group and all members of the group would be obliged to actively engage in implementation of control measures. The ultimate result would be the minimisation of disease-risk on a regional basis to the benefit of all farmers in that region. This type of strategy can realistically only be applied in situations where the likelihood of a disease occurrence is low, or the level of interest in disease control across the community is very high, as a high level of voluntary involvement in such schemes is required. Having said that, variations of such schemes would prove beneficial to the control of diseases such as BVD and IBR, even though the probability of disease occurrence is high. A prominent example of how disease risk could be shared amongst farmers (both in terms of costs and benefits) is the operation of a centralised diagnostic testing laboratory. Ireland currently has a Brucellosis testing laboratory, which receives individual blood samples from every farm in Ireland annually, and dairy farmers are currently contributing a disease levy of 0.06 cent per litre towards a proportion of the operational costs of this facility. Maintaining this disease levy and annual blood testing thereby allowing adaptation of this testing resource to the control of BVD and IBR should be a top priority for farmer lobby groups and farmers, and is an excellent illustration of how sharing of disease-risk could be achieved. All farmers contribute to the cost and all farmers reap the benefits through a lowered national disease risk. Eradication of these costly diseases could ultimately be achieved. Scaling back or closure of such a resource would prove a very short-sighted strategy in terms of disease control nationally in Ireland, with the farmer being the ultimate looser.

<u>ON FARM PRACTICAL APPLICATION OF SHARING DISEASE-RISK</u>

- **COMMUNITY / REGIONAL / NATIONAL DISEASE CONTROL**
- **ACTIVE PARTICIPATION OF MAJORITY OF FARMERS REQUIRED**
- **SHARED RESPONSIBILITY & SHARED REWARDS**

APPLICABLE TO ALL FARMERS INTERESTED IN DISEASE ERRADICATION

Conclusion

Ireland is lagging behind its global trading partners in the implementation of disease control strategies for non-regulated diseases (More, 2007; More, 2008). This situation has to be reversed in order to protect both Irish livestock and international trade into the future. This can only be achieved by individual farmers and their service providers (veterinary practitioners and agricultural consultants) taking control of infectious diseases. Disease-risk analysis provides a vehicle whereby appropriate disease control strategies can be applied at both farm and national level. Research outputs from Teagasc, ICBF and Animal Health Ireland will allow informed disease-risk analysis to be carried out in a logical manner to the ultimate benefit of the Irish dairy farmer into the future.

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