Irish Grassland Association Journal

2009 VOLUME 43

Design & Print by Modern Printers: 056 7721739

Irish Grassland Association

JOURNAL

Vol. 43   2009

Edited by
David McGilloway

ISSN 2009-1478

Printed by Modern printers, Kilkenny.

IRISH GRASSLAND ASSOCIATION
CORPORATE MEMBERS 2009

ACC
ACORN Independent Merchants
AIBP
Allied Irish Bank
Bord Bia
Dairygold Co-Operative
Dairymaster
Dawn Meats
Delaval Limited
FBD Insurance
Germinal Ireland Ltd
Glanbia
Goldcrop Limited
Goulding Fertlizers Ltd
IFAC Accountants
Interchem (Ireland) Ltd
Irish Cattle Breeding Federation
Irish Dairy Board
Irish Farmers' Journal
Irish Farming Indo
Kerry Group
LIC Ireland Ltd
Monsanto
Novartis
Packo Fullwood
Richard Keenan & Company Limited
Ulster Bank
Zero Grazing Systems Ltd

CONTENTS

		PAGE
M. Barry	Rearing of replacement dairy stock	5
B. Bateman	Controlling somatic cell count	8
A. Boland, J. Humphries and S. Lalor	Getting the best from slurry abd bag fertiliser	12
M.I O'Donovan, E. Kennedy & P. Creighton	Grass – can we grow and utilise more?	26
J. Donworth, G. Ramsbottom & R. Gayers	Off farm rearing of replacement heifers	41
B. Horan, J. Coleman, B. McCarthy & A. Brennan	Maximising grazed grass – pushing up stocking rate. Lessons from Vurlins 2008	50
B. O'Keeffe	A strategy for growth	61
S. Phelan	Grass measurement and budgeting to drive sustainable profits and better decision making	64
R. Sayers	BVD – How big an issue is it and what can we do?	74
P. Amer, T. Byrne, P. Donellan, G. Potterton, M. Lynch and A. Cromie	Sheep Ireland: new data, new indexes & new programmes for Irish sheep farmers	82
C. Cleland	What do we need from sheep breeding in the future?	87
M. McHugh	Finishing lambs in the summer	91
A. Kinsella	Increasing margins from sheep	99
M. L. Doherty	Improving sheep and flock health: some key pointers for farmers and industry	105
R. Evans, P. Donnellan, A. Cromie and P. Amer	Making more money from identifying the most profitable suckler cows	110
D. Kirwan	Grass budgeting – what it can do for suckler beef farmers	120
M. McGee	What feed efficiency in the suckler cow has to offer beef farmers	125

COUNCIL OF THE IRISH GRASSLAND ASSOCIATION 2009

President	Pearse Kelly
Vice-President	Andrew Cromie
Past President	William Kingston
General Secretary	Mary-Clare French

Council Members:

Andrew Cromie, Paul Crosson, Philip Donohoe, John Donworth, Michael Doran, Jan Frederiks, Padraig French, Bernard Ging, Michael Gottstein, Deirdre Hennessy, Tim Keady, Pearse Kelly, Jack Kennedy, William Kingston, Mary Bridget Lynch, Nicholas McGill, David McGilloway, Andrew Moloney, Padriag Mulligan, Gerard Murphy, Eddie O'Donnell, Frank O'Mara, John Renehan, Kevin Twomey.

Contact details
for the
Irish Grassland Association Office
available on
www.irishgrassland.com

Rearing of replacement dairy stock

Michael Barry

Background

The farm is situated near Mitchelstown, Co. Cork, and comprises 190 acres, of which 120 are in grass and are available for the rearing of dairy replacement stock. An article at the 2006,Teagasc National Dairy Conference in Limerick provided the kernel of the idea. A series of phone calls to Teagasc etc., to check out what systems were in place and provide advice, got the project started. In rearing dairy replacement stock, one knows the yearly payment at the start, thus reducing the likleyhood of a loss, even allowing for uncertainty, with costs of fertiliser and diesel.

With over 30 years experience of running a commercial dairy farm, the facilities and skills required to rear dairy calves up to the stage of the heifer calving down were second nature.

Starting Out

The business started out with an advertisement in the Farmers Journal offering to rear heifers for dairy farmers. Approximately 20 calls were received, enquiring as to how the system would work, and what was on offer (see below):

- Take in calves at 10 weeks when weaned of milk.
- Rear calves on grass and meals as required during the first summer.
- House weanlings November 1. Feed silage and 1.4kg meal.
- Dose calves every 3-4 weeks while on grass during first season.
- Dose for fluke, worms & lice three weeks after housing.
- Stop meal feeding on February 1 when animals approx. one year old (continue feeding meals to weaker yearlings).
- Yearlings to grass in early March (weather permitting).
- Heifers to bull or AI from April 1 or on a date requested by the owner.
- Heifers treated with fly repellent from July onwards.
- Heifers housed on November 1 and fed 1.4kg meal and silage *ad-lib*.
- Heifers return to owners' farm 1 month pre- calving.

<u>Developing a relationship with clients</u>

Having made the initial contact, interested farmers were invited to view the facilities on the host farm e.g. land and housing etc. A reciprocal visit to the stock owners farm was also arranged to view the stock concerned and get an idea of the standard of husbandry expected. These visits give both parties a better idea of each other's expectations. A list of queries are drawn up on both sides, discussed and agreed. The single most common question that tends to arise is what happens in the event of a disease outbreak, i.e. T.B. or Brucellosis.

All animals are tested prior to arriving on the host farm for T.B. Any animal over 12 months must be tested for Brucellosis. The last confirmed case of Brucellosis in the Republic of Ireland was April 2006. There have been a small number of false positive cases on the Brucellosis blood test since April 2006, but all have been subsequently proved negative. Today (30/06/2009), an application is being made to give the Republic of Ireland, Brucellosis free status.

As regards T.B, the number of animals failing the test has been falling in the past three years:

2007 - 2.94/1,000 tested.
2008 - 2.84/1,000 tested.
2009 - 2.46/1,000 tested.

The number of herds restricted, as a percentage of herds tested have fallen to 4.13% for the year ending 31/05/09. With the introduction of the proposed blood test for T.B, there is considerable confidence that it can be reduced further and even eliminated completely.

At all stages the owner is kept informed on what is happening, either by text or phone call. This may be only something like turn out & housing dates, vaccination, AI and introducing bull dates. The owner is also welcome to come and see his animals on a regular basis. Belief, confidence and trust are necessary on both sides. To date no written formal contracts exist with the dairy farmers concerned.

Future in heifer rearing

At the moment the farm is rearing dairy replacement stock for three farmers, consisting of 60 maiden heifers and a similar number of calves. It also carries 80, two year old bullocks. When more stable markets return for dairy products, with a milk price that gives a just reward for the inputs of labour and resources, there is a bright future for heifer rearing by non-dairy farmers.

There are a number of attractions to dairy farmers interested in off-farm heifer rearing. These are as follows:

1. With dairy farmers restricted by land base adjacent to milking parlour and with so many of them adjacent to each other, the opportunities available for expansion are restricted.
2. Dairy farmers want to concentrate on producing milk. Rearing replacement stock is an added burden, as in travelling to outside farms in the grazing season. Providing fodder and housing during the winter period are an additional expense.
3. Many dairy farmers have problems staying within their limits for the Nitrate Regulations, so sending replacement stock to another farm for off -farm rearing will help.

There are also a number of reasons why beef farmers should rear dairy replacement heifers for dairy farmers:

1. Regular monthly income.

2. No hassle buying or selling cattle.
3. No worry about fluctuations in the market.
4. No monetary outlay in purchasing livestock.

Controlling somatic cell count

Barry Bateman
Templemartin, Bandon, Co. Cork

Introduction

This paper describes the lessons learnt at farm level about controlling somatic cell Counts (SCC's). The paper I will cover the following topics.

- Farm setup;
- Cell count history over the last few years;
- How the problem arose;
- Approach to solving the problem;
- The cost to the farm of high cell count's;
- Management factors that all help in solving high SCC.
- What worked?
- Key messages.

<u>Farm set up</u>
The farm comprises 70ha near Bandon, Co Cork, milking 110 cows with the intention of increasing to 185 cows in 2009. The farm is situated in one easily managed compact block, well serviced with roadways.

Labour
The farm is a family run farm, with partner and children helping out.

Parlour
Simple 24 unit swing over herringbone, comprising parts from 3 different manufacturers (hybrid). There are no jars, no feeders, no cluster removers and no dump line.

Housing
Cows are housed in a conventional 30 year old cubicle house with easy feed and automatic scrapers. There is also a small standoff pad (for 55 cows) which is used for calving cows and holding an antibiotic herd in the spring.

<u>Farm SCC history</u>
Somatic Cell count began to increase in autumn 2005. At that time the farming system was being changed from autumn calving to 100% spring calving, and some cows were milking for 12 to 14 months. Unfortunately this was used as an excuse to ignore the rising cell count. To make matters worse it decided not to change liners until March due to the small number of rows being milked. Cows calved in spring 2006 and immediately ran into trouble with sore and damaged teats; this quickly led to more infections and higher cell counts. It was March before an overall examination of the problem took place, and all rubber ware machines were checked out. Cell count remained high (between 200 and 400000 cells/ml throughout 2006).

Note also that the milk from 5 % of the herd was withheld until the last of the bull calves were sold in mid-June. By 2007 there was an improvement (cell counts were still fluctuating), but by 2008, the problem was under control, with co-op bonus points achieved each month.

What went wrong?

Mindset
Target was too high at 400000 cells/ml. This was the level the co-op bonus was set at, even though research was indicating that money was being lost if over 200,000 cells/ml.

Poor machine maintenance
Delayed change of liners and old buttons in the claws caused a lot of damage.

Teat end damage
Dry, cracked, and damaged teats caused by the delay in changing liners and buttons, developed into black spot which presented serious problems for the rest of the year.

Costs

Table 1 shows the cost that the increased SCC had on the business, which is estimated at €15,670. (Note that increasing cow numbers would be expected to result in an increase in SCC on the farm.

Table 1. Estimate of the cost to the farm business of inflated Somatic cell counts

	Cost per 540,000 litres
Milk dumped (€)	1000
Vet/drugs (€)	750
Co-op penalty/bonus (€)	1620
4 Cows culled (€)	2800
Milk loss (€)	9500
Total* (€)	15,670

*This does not include the extra labour resources required.

Solving the problem
To solve any problem it is necessary to acknowledge that a problem exists in the first place. Ignoring high cell counts and damaged teats, hoping the teats would heal and cell count improve without me making any effort to remedy the situation was a major catalyst to creating the problem. Once the problem is acknowledged, it is necessary to put a plan together. With an SCC problem, there is a need to look at every aspect of farm management that can affect cell counts.

The approach

A multidisciplinary approach was adopted. It was decided that the milking machine would be fully maintained at all times. A sub-group from the local discussion group visited the farm to watch the milking, look at the records, and produce a written report on the problem. Main points in the plan were;

- Keep the machine fully maintained;
- Use high quality teat spray on cows;
- Pre spray cows with infections or sore teats;
- Wear clean gloves and ensure good standards of hygiene control;
- Culture 10% of the herd (*Staph aureus* the main offender).
- Use an extended dry cow period (16 weeks) to cure damaged cows.

<u>Management factors</u>

Keep records

Having always milk recorded, along with having good records of cows treated, probably speeded up the whole process of getting cell counts below 200000 after 6 months. To decide what the losses were, and to make sure solving the problem was economical, accurate records of the costs incurred are needed. A written plan/report is very useful to refer back to at any time.

At least 50% of milkings are done with one person in the parlour, so it is essential that cow flow is good and the parlour works efficiently, cows walk calmly in and out of the parlour. Milking routine is kept to a simple cups on cups off and teat spray system.

A stand-off pad is used to keep an antibiotic herd separate during the spring. These cows come in at the end of the milking, reducing the spread of infection and give the milker time to deal with problem cows. It is management preference to have a separate herd over a dump line which carries big risks of spreading infection to other cows, antibiotics in bulk tank, loss of non antibiotic milk and loss of time treating the sick cow which can cause damage to other cows. It is important to be on top of all herd issues, and be aware that management factors like body condition score etc are very important.

For grassland management purposes roadways were improved, but reduced lameness, reduced stress and cows arriving in the parlour clean, all help reduce cell counts.

The ability of milkers to identify cows and recognise change of habit, poor form or a drop in milk yield is also an advantage.

As cow numbers are increasing, there are a lot of young cows in the herd. This will help to drop cell counts, but is only an advantage if heifers can calve out clean and healthy. Since changing to a spring calving pattern, it has been possible to send cows to grass day and night straight after calving. This reduces potential mastitis risks from housing freshly calved cows.

What worked?

Bringing in the vet and discussion group members - even though their comments hurt for 10 minutes; they were able to point out problems, and were essential in putting the written plan together.

Changing liners and the rest of the rubber ware regularly made a big difference.

Watch the vacuum level, every parlour is different but in this instance the parlour runs between 46 and 48 kpa. A digital meter is essential – clocks are usually poorly sited and do not show big fluctuations.

With teat spray, instead of aiming to have a drop of spray on the end of the teat, aim to cover the entire teat, to maintain teat condition and stop the spread of bugs from one cow to the next. This is very important in the spring.

Prespray cows for 1 week after calving

Treatments

Non clinical cases were identified with the Californian Milk Test (CMT) and are treated during the milking season. When treating chronic cows (usually *staph aureus*), treat only when necessary during milking season. At drying off, identify the quarter infected and inserted a milking cow tube at the same time as inserting a good quality dry cow tube. Providing the cow with an extended dry period is crucial to the healing process. A good degree of success resulted from with this treatment.

'The can of beans'

Some vets and other experts will often use a can of beans to illustrate a *Staph aureus* infection; a capsule inside the cow's udder that is impossible to penetrate. The advice to farmers is often to cull these cows. However, culling otherwise healthy cows is very expensive. It is estimated that culling a cow from the herd can cost approx €700/cow culled. Buying a replacement for €1300 and selling a cull for €300; - difference €1000. Drying off the cow early on the other hand will only cost €300/cow. Compared to culling, the only costs with this option are the loss of milk and the feed for the dry cow period.

Key Messages

Realise that a problem exists. Set targets;
Keep the milking machine fully maintained;
Keep accurate records;
Bring in help – a farmer, a vet, co-op/Teagasc advisor, someone to look at the routine and point out the problems;
Cull as a last resort.

SCC's can be controlled.

Getting the best from slurry and bag fertiliser

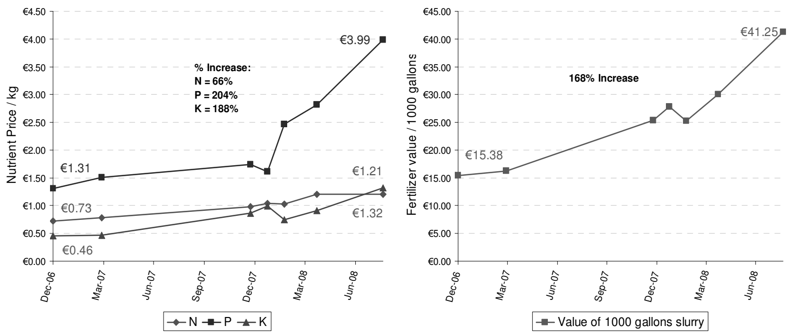
A. Boland, J. Humphreys and S. Lalor
Teagasc Moorepark, Fermoy, and Teagasc Johnstown Castle, Wexford.

Introduction

The high cost of chemical fertilisers experienced in the last year has contributed to a large increase in the relative value of cattle slurry to the farmer. The price of N has doubled and that of P and K almost trebled since December 2006 (Figure 1). These increases mean that the value of 1000 gallons (4.5m^3) has increased by 168% during this period. The manufacture of nitrogenous fertilisers is an energy-demanding processes and the cost of fertiliser N is closely linked to the cost of energy on the world market. Regulations stipulating the quantities of fertiliser N and P that can be applied to grassland have been implemented under the Nitrates Directive (Statutory Instruments (SI) No. 378 of 2006), which came into effect in Ireland on August 1, 2006. Under certain circumstances, derogations from this SI have been granted until July 17, 2010 on Irish farms. The competitiveness of Irish dairy production in a European context is largely based on our capacity to grow and efficiently utilize large quantities of low-cost grazed grass over a long grazing season. The production of large quantities of pasture per hectare is predominantly determined by input of fertiliser N. The increasing cost of fertiliser N, P and K is contributing to the erosion of the profitability of Irish grass-based systems of production.

Rising costs and statutory limits are focusing attention on fertiliser N and P use on farms. Improvements in fertiliser N and P use efficiency can be achieved by attention to detail when it comes to applying fertiliser N and P, making use of slurry to replace fertiliser N and P, regular soil sampling, application of lime if required, reseeding, grass measurement and by making more use of white clover in swards.

Figure 1. Change in fertiliser nutrient prices and the potential economic value of cattle slurry between Dec. 2006 and Aug. 2008 (Teagasc, 2008)



Slurry nutrient content – 'Fertiliser Replacement Value'

The N, P and K content of typical cattle slurry in Ireland is shown in Table 1 (O'Bric, 1991). These are mean concentrations; a high level of variability (up to tenfold) will be observed in reality, due to variations in animal diet, animal type and dilution of slurry with water. Slurry variability is a major factor determining the reliability of slurry as a fertiliser resource, and every effort should be made to assess the nutrient content of slurry. This can be done using on-farm assessment tools, such as slurry hydrometer or N content assessment kits, or by having a slurry sample analysed in a laboratory. In any slurry nutrient content assessment, the importance of obtaining a well-mixed, representative sample is critical, and often difficult to achieve.

Table 1. Typical dry matter and nutrient contents of cattle slurry in Ireland (O'Bric, 1991). (Alternative total N and P contents, and N availability are used under the Code of Good Practice (Anon, 2006))

	Mean contents	Typical Availability	FRV/m^3	FRV/1000gallons
Dry Matter	6.9 %			
N	3.6 kg/t	25%	0.9 kg	9 units
P	0.6 kg/t	100 %	0.6 kg	6 units
K	4.3 kg/t	100 %	4.3 kg	38 units

The fertiliser replacement value (FRV) of slurry will depend on both the total nutrient contents, and on the nutrient availability for plant uptake. With the exception of soils with very low soil test P and K levels, P and K are generally considered to replace chemical fertiliser on a 100% basis; i.e. 1 kg of P or K applied in slurry is equivalent in fertiliser value to 1 kg of P or K applied as chemical fertiliser. The N content of slurry is less available. Approximately 50% of the N in cattle slurry is present in organic substances, and is not immediately available for plant uptake. This portion of the N may become available over time, but its release is slow and can take many years. The other 50% of the N is present as ammonium (NH_4^+), which is available for plant uptake, but can also be volatilised into the air as ammonia gas. Therefore, maximising the N fertiliser replacement value of slurry requires application management that ensures (i) high demand for N from the crop being fertilized and (ii) minimal losses of ammonia to the air.

At current fertiliser prices, slurry has a potential value of €9.17/m^3 (€41.25/1000 gallons). While much of the focus on slurry value is directed towards slurry N efficiency, it must be remembered that approximately 88% of the fertiliser value is attributable to the P and K content (Table 2). Slurry should therefore be distributed around the farm in a manner that utilises fully all the nutrients in slurry. The values shown in Table 2 are only achieved if the application of chemical fertilisers is reduced on account of the slurry application. Applying slurry without adjusting chemical fertiliser applications will result in failure to achieve the potential savings indicated in Table 2.

Table 2. The potential economic value of cattle slurry, and the proportion of value attributable to the N, P and K contents

	N	P	K	Total
Value/m^3	€1.09	€2.39	€5.69	€9.17
Value/1000 gallons	€4.88	€10.77	€25.60	€41.25
% of total value	12%	26%	62%	

<u>P and K fertiliser replacement value</u>
Each area of the farm will have its own specific requirement for P and K fertiliser. This requirement is normally determined by two factors. Firstly, the land use will be important. For example, the P and K requirements for a silage crop are normally higher than that of pasture that is only grazed. Also, the stocking rate of grazed pasture will affect the amount of P and K fertiliser that is required. The second factor determining the P and K requirement will be the soil test results. Soils with lower soil test P & K levels will have higher requirements for P & K fertilisers. In order to reduce fertiliser costs, slurry should be applied to areas that have a P and K requirement. If slurry is applied to fields that have no P or K requirement while other parts of the farm continue to receive chemical P and K fertiliser, then there will be no savings in fertiliser costs. Occasionally in the past, slurry may have been applied to fields that were more convenient to the farmyard and slurry storage tanks in order to minimise slurry-spreading costs. The distribution of slurry around the farm to fully maximise the fertiliser value of the slurry is worth re-examining. This may be particularly prevalent on out-farms that might have high P and K requirements, often deemed too far away to justify slurry transport costs. With slurry now being more valuable, the higher transport or spreading costs incurred may prove cost effective. Nitrates limits on P fertilization rates can be an equally important factor influencing the need to evenly distribute slurry around the farm to where it is most needed.

<u>N fertiliser replacement value (NFRV)</u>
The N fertiliser value of slurry is dependent on the losses of ammonia to the air following landspreading. Approximately 90% of the total losses of ammonia will occur in the first 24 hours following landspreading. The level of ammonia loss is greatly influenced by weather conditions, with dry conditions, warm temperatures, low humidity, sunshine, and wind all increasing ammonia loss. Since weather conditions are generally cooler and moister in spring than summer, savings on fertiliser N costs by using slurry will depend mainly on the timing of slurry application. 1000 gallons of cattle slurry will be worth approximately 9 units of N if applied in spring (25% NFRV). However, the same slurry applied in summer will only be worth approximately 3 units of N (10% NFRV).

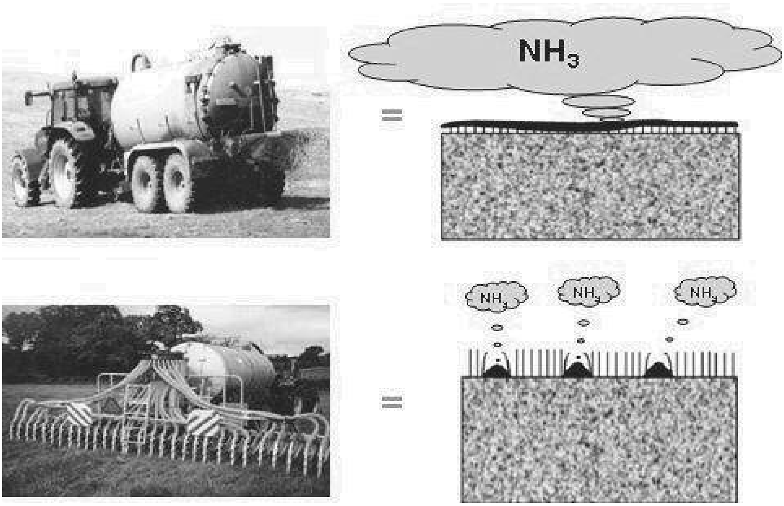
While spring application is generally recommended, it can often be difficult in practice due to soil trafficability or grass covers. Where spring application is not feasible, slurry application in the summer period (e.g. after silage harvest) should be managed so that the N efficiency can be maximised. Weather conditions at the time of application are very important, and slurry application should be targeted, where possible, to days when conditions are cool, overcast, or even misty. Hot days with sunshine and wind should be avoided where possible.

Diluted slurry will also be more N efficient, as diluted slurry will percolate into the soil faster than thick slurry. Diluted slurry will also be washed off any contaminated herbage more quickly. However, while diluted slurry will be more N efficient, the N, P and K concentration will be reduced on account of the dilution.

Slurry application method

Slurry application method can also improve the NFRV of cattle slurry. Low emission application methods such as shallow injection, bandspreading and trailing shoe apply slurry in confined bands/lines rather than broadcast evenly as with the conventional splashplate method (Figure 2).

Figure 2. Slurry application with splashplate (upper) results in a large surface area of slurry being exposed for ammonia loss. Low emission methods (lower) apply slurry in lines/bands, resulting in reduced surface area for ammonia loss



The reduced surface area of slurry exposed to the air with the low emission methods results in reduced losses of ammonia, which means that a greater proportion of the ammonium in slurry is retained and becomes available to the crop. Experiments undertaken in 2006 and 2007 have attempted to quantify the fertiliser replacement potential of these technologies, and results are shown in Table 3. Application method will not affect the P and K fertiliser replacement value of slurry.

Table 3. The effect of application method and timing on the NFRV, and economic value of cattle slurry applied to grass silage (Lalor and Schulte, 2008a; Lalor and Schulte, 2008b)

Application timing	NFRV		kg N/m^3 slurry (units/1000 gallons in brackets)		Value N/m^3 slurry	
	Splash plate	**Trailing Shoe**	**Splash plate**	**Trailing Shoe**	**Splash plate**	**Trailing Shoe**
April	29%	39%	1.05 (9)	1.40 (12)	€ 1.26	€ 1.68
June	10%	21%	0.36 (3)	0.75 (6)	€ 0.43	€ 0.90

The results shown in Table 3 are the mean NFRV% values observed in experiments on 3 sites in 2006 and 2007. The mean effect of the trailing shoe application method was to increase the NFRV of slurry by 3 units of N per 1000 gallons of slurry applied. The effect of switching application timing from June to April, without changing application method, increased the NFRV of slurry by 6 units per 1000 gallons of slurry. The largest benefit of 9 units per 1000 gallons was observed where slurry application could be moved from June with splashplate to April with trailing shoe.

Towards spring application

Based on these findings, the priority for slurry application management should be to apply slurry in spring rather than summer. While spring application is generally advised, weather conditions at the time of application are the key consideration. Applications should be targeted towards days or periods of minimal sunshine and cool temperatures. Attempting to capitalise on spring application requires considerable flexibility. The two main restrictions to slurry application are soil trafficability conditions and the grass cover on the areas designated to receive slurry. Application in summer is normally easily facilitated due to soil conditions that are normally dry at this time, and the absence of new grass growth in fresh silage stubbles. With splashplate, earlier applications that are targeted towards optimising the weather conditions on the day of application are more difficult, as such opportunities often arise on occasions when there is little or no land area available with grass covers that are low enough to ensure that grass contamination will not limit the subsequent grazing palatability or silage quality of the pasture.

The trailing shoe offers advantages in this regard, as the slurry is concentrated in bands, with the result that the majority of the grass in the sward does not come into contact with the slurry. By reducing the grass contamination, the opportunity for more flexible application timing is increased as the consideration for grass cover is reduced. This means that on days when weather conditions that are ideal for slurry application arise (soil trafficability and reduced ammonia loss), more land is available to the farmer with the trailing shoe compared to splashplate, as he/she is no longer restricted to areas with grass covers that are low enough so as not to affect subsequent grazing or silage quality.

The trailing shoe is not the only option to improve the opportunity for spring application. The umbilical application system, which pumps the slurry directly through a pipe system to a low-weight slurry application unit in the field, can be used to reduce soil compaction, as heavy tankers are avoided. Umbilical systems are now available with either splashplate or trailing shoe attachments. Also, with tanker application, tyre selection is an important consideration to aid soil trafficability and reduce the potential for damage that can result from machinery traffic on soils sensitive to compaction.

Cost-benefits

The trailing shoe is an expensive technology to adopt. In the absence of grant aid, purchase costs of trailing shoe tankers are approximately two to three times that of splashplate tankers of equal capacity. This means that the technology will be more suited to contractors rather than farmer owned units.

The largest economic benefit of trailing shoe adoption to the farmer comes when spring application can be facilitated where it was previously restricted by splashplate application. However, the economic benefits of other means of facilitating spring application (umbilical system, tyre specification) are also worth considering.

Strategies to lower fertiliser N requirements on farms

Matching fertiliser N use to stocking rate

The amount of fertiliser N needed at a specific stocking rate can vary with the natural fertility of soils, growing conditions in a particular year, etc. Hence, there has always been a need for some flexibility in the quantity of fertiliser N needed for different stocking rates. Setting out a clear plan for fertiliser N use for the year can bring about savings in expenditure on fertiliser N. Recent work at the Teagasc Solohead Farm has shown that, with grass-only swards, around 170kg fertiliser N/ha is required to support a stocking rate of around 2.0 LSU/ha. Average fertiliser N use on Irish dairy farms stocked at 2.0 LSU/ha is 175kg/ha (Coulter *et al*., 2002). Therefore there is good conformity between the rate of fertiliser N being used on farms, generally, and that found to be necessary to support this stocking rate at Solohead. Under typical grassland management where most of the silage is made as first-cut and the amount of second-cut is kept to a minimum (between 0 and 30% of the grassland area), the fertiliser N application strategies presented in Table 4 are recommended. These recommendations adhere to best agronomic practice while complying with the new regulations.

Best response to fertiliser N will be achieved from applications made during late March, April and May. During this time of the year, it pays to put on high rates of fertiliser N on the grazing area, maximise the stocking rates on the grazing area and make as much ground as possible available for first cut silage. Due to the high rates of grass growth during late April and May, it is possible to make around 30% more silage per ha for approximately the same inputs costs compared to second-cut silage. Making a large first-cut lowers the need for a second-cut of silage. Therefore, a smaller area needs to be closed for second cut, making a greater proportion of the grassland area available for grazing providing substantial scope to lower fertiliser N inputs onto the grazing area from June onwards.

When it comes to lowering fertiliser N input to the grazing area from mid-summer onwards, one question that often arises is whether to make large applications of fertiliser at long intervals, for example, 40kg N/ha applied once every eight weeks, or a smaller application at shorter intervals; 20kg/ha every four weeks. Small and regular applications help to maintain a regular supply of high quality pasture. Large applications at long intervals result in a boom-and-bust situation where grass starts to run out of control, often triggering the decision to harvest bales, and then the grass begins to disappear because there is not enough N available in the soil. Applying rates of 15 to 25kg N/ha (around half a bag of CAN/acre) at four to six-week intervals during the summer is recommended on moderately stocked farms (Table 4).

The biggest problem with making recommendations is that most farms are not average or typical in terms of soil type, land use (for example, growing maize instead of first-cut or second-cut silage), the extent to which farms are fragmented, etc. In Table 5, fertiliser N rates are recommended for different stocking rates on the grazing area at different times of the year. For example, on a fragmented farm, where a large part of the silage requirement is made as maize silage grown on an outside block of land, the stocking rate on the grazing area on the home farm during May and June is relatively low and hence the requirement for fertiliser N during this period can be quite low. Putting on too much fertiliser N is only going to drive up costs if excessive grass production on the grazing area has to be harvested as baled silage. The recommendations in Table 5 should only be used as part of an overall plan that keeps fertiliser use on the farm compliant with the maximum permissible rates outlined in S.I. No. 378 of 2006.

Table 4. Recommended rates of fertiliser N for grassland during the year where approximately half of the farm is cut for first-cut silage and the amount of second cut is kept to a minimum (0 – 30% of the grassland area). Rates of fertiliser N are presented in kg per ha (units per acre in brackets)

Stocking rate (kg/ha organic N)	Jan/Feb	March	April	May	June	July	August	September	Total (kg/ha)	Total (u/ac)
155 – 170	0	28 (23)	43 (35)	34 (28)	34 (28)		25 (20)		164	(133)
170 – 180	28 (23)	28 (23)	43 (35)	34 (28)	34 (28)		25 (20)		192	(156)
180 – 190	28 (23)	37 (30)	49 (40)	34 (28)	34 (28)		34 (28)		216	(175)
190 – 200	28 (23)	49 (40)	49 (40)	34 (28)	34 (28)	34 (28)		25 (20)	253	(205)
200 – 210	28 (23)	49 (40)	49 (40)	51 (41)	34 (28)	34 (28)		34 (28)	279	(226)
211 – 250	28 (23)	43 (35)	49 (40)	34 (28)	34 (28)	34 (28)		25 (20)	247	(200)

The recommendations in this table are for farms on soils of average natural fertility. At stocking rates less than 200kg organic N/ha (2.35 LU/ha) substantially more fertiliser N than is recommended in this table can be applied on poorer soils to adequately meet sward requirements. Less fertiliser N than recommended in this table is needed on soils with above average natural fertility or where there is plenty of clover in the sward.

At very high stocking rates of greater than 200kg organic N/ha (2.35 LU/ha) slightly more fertiliser N (for example 8kg/ha) than is presented in this Table can be applied in southern counties (see Table 1) and this should be applied in spring as part of the first or later applications.

Table 5. Fertiliser N for different stocking rates on the area available for grazing during the year. Rates of fertiliser N are presented in kg per ha (units per acre in brackets). Care is needed when using this table not to exceed statutory limits

Stocking rate (LU/ha)	Fertiliser N kg/ha (u/ac)		Stocking rate (LU/ha)	Fertiliser N kg/ha (u/ac)		Stocking rate (LU/ha)	Fertiliser N kg/ha (u/ac)			
Mid March	Jan/Feb	March	May & June	April	May	July & August	June	July	August	Sept.
<1.2	0	28 (23)	<3.50	28 (23)	17 (14)	<2.00	17 (14)		17 (14)	
1.2 – 1.4	28 (23)	28 (23)	3.50 – 3.75	28 (23)	26 (21)	2.0 – 2.5	26 (21)		25 (20)	
1.4 – 1.6	28 (23)	38 (30)	3.75 – 4.00	38 (30)	34 (28)	2.5 – 3.0	34 (28)		34 (28)	
1.6 – 1.8	28 (23)	49 (40)	4.00 – 4.25	49 (40)	42 (35)	3.0 – 3.5	34 (28)	26 (21)		25 (20)
>1.8	28 (23)	49 (40)	>4.25	49 (40)	51 (41)	>3.5	34 (28)	34 (28)		34 (28)

Fertiliser N application in spring and autumn

Strategies for the application of fertiliser N during the spring have been outlined above. However, a question that often arises is whether it is better to apply CAN or urea during the spring. Numerous experiments have been conducted comparing the two. In all cases CAN was never found to be better than urea under Irish conditions whereas urea was sometimes better than CAN. The reason for this is fairly clear. Once urea is applied to the soil during the spring it is converted to ammonium. The ammonium is held reasonably well to the soil particles. In contrast, CAN contains both nitrate and ammonium and the nitrate is immediately at risk of being leached or denitrified. Furthermore, some recent research has shown that ammonium is more easily taken up than is nitrate under cold soil conditions. Urea is cheaper than CAN per unit of N applied. Taking into account that the N in urea is used as efficiently as the N in CAN during the spring, urea is clearly the more cost-effective fertiliser to apply during the spring.

It must be noted that while it takes time for urea to break down to ammonium and that the ammonium adheres reasonably well to soil particles, any ammonium that is not taken up by the sward will eventually be converted to nitrate in the soil. Therefore the application of urea fertiliser does not prevent nitrate leaching or denitrification during the spring. It just means that the N in urea is likely to be safely held in the soil for longer than the N from a similar application of CAN, during the early spring.

The responsiveness to fertiliser N declines during the autumn. In general, research has shown that there is no worthwhile response to fertiliser N from around mid-September onwards in the southwest and from around the end of August in the north. Conditions may often seem ideal for the application of fertiliser N later in the year. However, when fertiliser is being applied during the early spring, it is being applied in anticipation of expected growth. When fertiliser is being applied during the autumn, growth is inexorably declining. Also, not all of the applied N will be taken up in one go. Fertiliser applied in mid-September will be taken up at a rate of around 0.5kg N/ha/day during the remainder of September and October. Therefore, it takes around 60 days for 30kg N/ha to be taken up from the soil. By mid-November, the requirement for fertiliser N will be very low and will be within the supply capacity of the background soil N. Therefore as the application of fertiliser N is delayed into late September or October the demand for available soil N is disappearing while the risk of loss increases exponentially.

Grassland Measurement

The frequent monitoring of grass supply during the grazing season allows the farmer to make earlier and better grazing management decisions. Grass supply varies on the farm from week to week due to factors such as growth, level of concentrate feeding, weather, etc. The main way to monitor grass supply is to measure farm cover weekly, thereby allowing management decisions to be made according to the supply of and demand for herbage on the farm. Data from Teagasc Monitor Farmers show that substantial savings in fertiliser N costs can be made on farms by measuring the cover (supply) of grass on the farm every week. With high N fertiliser prices there is little point in spreading a standard amount week in week out across the middle six months of the year. Applying Nitrogen fertiliser at levels in excess of the requirement for adequate herbage supply will result in waste, either in the form of topped grass or, the production of very costly round bales.

Lime

As well as providing information on the P and K requirement of the farm, soil tests also provide the pH of the soil and give information on the requirement for lime. Maintaining the soil pH at approximately 6.5 improves the natural capacity of the soil to supply N to growing crops. Increasing soil pH from 5.5 to 6.5 will increase soil N supply. Applying ground limestone improves N availability at a cost equivalent of around 60% of applying additional fertiliser N. This figure does not take into account that applying lime also increases the availability of other nutrients, particularly of phosphorous, as well as the availability of a range of trace elements. The higher the soil lime requirement (lower soil pH) the greater will be the benefit of applying lime.

White clover

While different ways of cutting back on fertiliser N have been outlined above, by far the biggest savings in fertiliser N costs that can be made on many farms is by growing white clover. White clover is a legume and so has the capacity to generate its own supply of N through a process known as biological N fixation. It can supply the equivalent of 120 to 150kg/ha of fertiliser N (100 to 120 units per acre) per year. This is a lot of N when it is considered that average fertiliser N use on dairy farms in Ireland is around 170 kg/ha (140 units per acre) per year. White clover offers huge potential to cut fertiliser N costs on farms. The supply of 100 to 120 units of N is the equivalent of 3.5 to 4.5 bags of CAN. With CAN costing €360 per tonne, this supply of biologically-fixed N is worth €60 to €80 per acre. Growing white clover is a bit like having your own fertiliser N factory on the farm and this N can be manufactured at relatively little cost. It provides the opportunity to sidestep the escalating price:cost squeeze.

Research at Solohead over the last seven years has shown clover-based grassland receiving fertiliser N input of 72 units per acre can support a stocking rate of 2.2 LU/ha (0.9 LU per acre or 190 kg/ha of organic N), producing 500 kg milk solids per cow, while being fed less than half a tonne of concentrate per cow per year. This is a high stocking rate and milk output per acre compared with the majority of dairy farms in Ireland.

Conclusions

Escalating costs and regulation under the Nitrates Directive are creating pressure to lower fertiliser inputs and increase the efficiency of nutrient-use on farms. Increases in efficiency are possible once there is a clear understanding of the factors that promote the efficient uptake of available nutrients from the soil by grassland. The following are ways to cut fertiliser N and P costs on the farm:

- The P and K fertiliser value comprises the largest component of slurry value. Targeting slurry applications using soil analysis results is an essential component to maximising the value of slurry;
- Targeting slurry applications towards optimising weather conditions that result in reduced ammonia losses can help reduce fertiliser N costs. Such conditions are normally more prevalent in spring;
- By reducing grass contamination, the trailing shoe system can increase the flexibility of slurry application, and help to apply slurry when timing, weather and ground conditions are optimal;
- Other benefits of trailing shoe adoption, such as reduced odours, may be of significant value in individual cases;
- Umbilical application systems, or improved tyre specification on tankers are also very effective methods for improving the opportunity for spring application;
- Apply 23 units/acre (29 kg/ha) for the first application in spring (mid-January to early March depending on location and soil type etc.). Urea is more cost effective than CAN in spring;
- Replace the first application of fertiliser N by an application of watery slurry. 1000 gallons of watery slurry = 8 to 10 units of N per acre. At Solohead around 2,500 gallons per acre are applied on two-thirds of the farm in late January using an umbilical system. The other one-third is grazed during February and early March. Allow around six weeks between application and expected date of grazing;
- Apply the second application of fertiliser N between 4 and 6 weeks after the first. A 6-week interval should be allowed with earlier start dates (mid-January) and a 4-week interval with later application dates (mid-February). The second application should take place sometime during March. The third application should roughly coincide with closing up for silage in April. Match fertiliser N applications to stocking rates on the farm at various times of the year (see Table 4 & 5);
- Replace some of the fertiliser N for first cut silage by slurry. If 92 units per acre (115 kg/ha) is applied for first cut silage, this can be lowered to around 69 units per acre (85 kg/ha) along with an application of 3000 gallons slurry per acre. At Solohead 3000 gallons per acre is applied to around two-thirds of the first-cut silage area in late March (this is the proportion of the silage area that will have been grazed at that stage). The slurry is applied allowing <u>at least</u> 6-weeks between application and expected silage harvest date. An interval of around one week is allowed between application of slurry and the application of fertiliser N for first-cut silage. Do not apply fertiliser N immediately before or shortly after the slurry because this leads to losses of N by denitrification;

- Try to make as much silage as possible as first cut. i) work out how much silage is required, ii) depending on requirements, aim to maximise stocking rate on the grazing area during April and May. This makes as large an area as possible available for first-cut silage. There is a very high response to fertiliser N during April and May. First cut silage yields will be at least 30% higher than second cut for more-or-less the same input costs. High grazing pressure on the grazing area during April and May is good for grass quality later in the season;
- Diluting slurry with dirty water will increase the efficiency of utilization of N in the slurry when it is applied to silage stubble after first-cut silage. Although dilution will lower the DM and N content of the slurry, it will increase the efficiency of N utilization (a higher rate of infiltration into the soil lowers volatilization losses). Dilution should only be carried out where it is a convenient means of managing dirty water and at times of the year outside of the closed period for slurry application;
- If possible, avoid making second cut silage. Having the whole farm available for grazing from June onwards lowers the requirement for fertiliser N. Apply fertiliser N in line with stocking rate (Tables 4 & 5) and also pasture cover. If pasture cover is above target, lower the amount – or increase the interval between applications – of fertiliser N. Do not skip applications;
- Plan to build pasture cover by extending the rotation from mid- to late-July depending on stocking rate and location (later on higher stocked farms in more favourable locations and vice-versa). Fertiliser N applied in July and August has greater bearing on grass supply in November and in the following spring than applications later in the autumn;
- Keep records of quantities and dates of application – and study them. Blanket spreading of fertiliser N simplifies record keeping and this helps to keep overall fertiliser N use on the farm under control (this can bring about a considerable saving in annual fertiliser N use while also lowering baled surpluses). The first three applications during the spring (during calving) and applications during August and September can be blanket spread with no loss of production. Blanket spreading during the summer months can result in slight (3.5%) lowering of production;
- White clover has the potential to supply up to 120 kg N/ha/year through the fixation of atmospheric N by *Rhizobium* bacteria that grow in symbiotic association with the clover. The wider adoption of white clover in Irish grassland has the potential to halve the amount of fertiliser N used on the majority of grassland farms in Ireland.

References

Anon. (2006). European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2006. SI 378 of 2006. Department of Environment, Heritage and Local Government, The Stationary Office, Dublin, 49 pp.

Connolly, L., Burke, T. and Roche, M. (2001). Teagasc National Farm Survey 2000. Teagasc, 19 Sandymount Avenue, Dublin 4. 13 pages. *www.teagasc.ie*

Coulter, B.S., Murphy, W.E., Culleton, N., Finnerty, E. and Connolly, L. (2002). A survey of fertiliser use in 2000 for grassland and arable crops. Teagasc, Johnstown Castle Research Centre, Wexford.

Humphreys, J., Lawless, A., O`Connell, K. and Darmody, P. (2005). The development of systems of milk production and grazing management based on low stocking rates and very low artificial nitrogen inputs. *End of Project Report No. 4468*, Teagasc, 19 Sandymount Avenue, Dublin.

Humphreys, J., O'Connell, K. and Watson, C.J. (2003). Effect of nitrate legislation on fertiliser nitrogen management for grassland. *Proceedings No. 517. The International Fertiliser Society*, York, 35 pages.

Lalor, S. and Schulte, R.P.O. (2008a). Nitrogen fertiliser replacement value of cattle slurry applied to grassland. Teagasc, Johnstown Castle, Booklet of 'slurry and nutrient efficiency display', 1 May 2008.

Lalor, S.T.J. and Schulte, R.P.O. (2008b). Slurry application using trailing shoe - potential benefits come at a price, *TResearch*, pp. 35-37.

O'Bric, C. (1991). A survey of the nutrient composition of cattle and pig slurries, M.Sc. Thesis, University College Dublin.

O'Connell, K. (2005). Environmentally sustainable fertiliser nitrogen management practices for pasture production. PhD Thesis. Faculty of Science and Agriculture, School of Agriculture and Food Science, Queen's University Belfast, May 2005, 229 pages.

O'Connell, K., Humphreys, J. and Watson, C.J. (2004). Apparent recovery of fertiliser nitrogen by pasture. *Agricultural Research Forum*, Tullamore, 1 & 2 March 2004, page 18.

O'Donovan, M. Delaby, L., Stakelum, G. and Dillon, P. (2004). Effect of autumn/spring nitrogen application date and level on dry matter production and nitrogen-efficiency in perennial ryegrass swards. *Irish Journal of Agricultural Research*, **43**: 31-41.

Teagasc (2008). N, P and K fertiliser prices. Unpublished data.

Pain, B.F. (2000). Control and utilization of livestock manures. In: Hopkins, A. (ed.): *Grass: Its Production and Utilization*, 3rd edition, pages 343-364. Blackwell Science Ltd.

Grass – can we grow and utilise more?

Michael O'Donovan, Emer Kennedy and Philip Creighton
Teagasc, Moorepark

1. Irish dairy farmers should target an average farm grass DM production of 18t DM/ha/year.
2. Grass cultivars with over winter growth offer huge potential for increased spring grass utilisation with clear environmental gains (less N leaching).
3. The DM production difference between old permanent pasture and newly reseeded swards is 3t DM/ha or €292/ha.
4. Reseeded swards have 8% higher milk output per hectare relative to permanent pasture.
5. The level of reseeding practised in Ireland is too small to make a difference in overall productivity and too heavily focussed towards the autumn period.
6. Grass breeding has increased grass DM production by 4-5% over the last decade.
7. Future grass breeding and evaluation needs to focus more on characteristics that influence animal performance under grazing rather than under cutting and conservation.
8. Grass variety breeding and testing has, and will continue to play an important role into the future in enhancing the profitability of Irish grassland farmers.

Introduction

The production and utilisation of grass has a central role in maintaining the competitiveness of the Irish dairy industry. Economic analysis (Shalloo *et al*., 2004) shows that maximum profitability within Irish milk production systems is achieved through the optimum management of pasture both within the current quota regime, and within future scenarios where additional quota will be available to Irish dairy farmers. The ability of dairy farmers to maximise the performance of their herds from grazed grass produced within the farm gate will be a significant factor deciding their future business success. Dillon *et al*., (2005) suggests that regardless of country or quota existence, a 10% increase in grazed grass in the feeding system will reduce the cost of milk produced by 2.5c/l. One strategy to increase competitiveness, irrespective of milk price is to continue to increase the grazed grass proportion of the diet. Irish dairy farmers can reap greater benefits from improved pasture management compared to any of our main competitors, through the uptake of better grassland management techniques.

The objective of this paper is to explore and discuss the current and potential avenues of increasing grass production and utilisation on Irish dairy farms:

- The potential performance from pasture;
- Management practices to increase grassland productivity;
- Current reseeding levels in Ireland;
- Productivity of permanent pasture versus reseeded swards;

- The contribution of grass breeding and grass evaluation programs to grassland productivity;
- Future challenges facing grassland production systems.

Potential performance from pasture on Irish dairy farms

In 2008 Teagasc Moorepark undertook a survey of a number of Co-op's in different regions across the country to investigate a number of grassland related issues at farm level. In total 320 milk suppliers were surveyed, 200 from Kerry Co-op and 120 from Connacht Gold. In addition, two discussion groups (Technical groups) that represent the top 10% of dairy farmers in the south of Ireland were also surveyed. Table 1 shows the current physical performance of the two surveyed Co-op regions compared to the technical farmer group. A number of key issues are evident in this Table; i) Irish dairy farms are under stocked, ii) milk solids production per cow and per ha are too low for the levels of feed input, and iii) high levels of milk production per cow and per ha can be achieved on less concentrate when technologies such as grass budgeting are adopted. Farmers undertaking grass measurement have substantially increased their grazing days. Further increases in efficiencies can be undertaken through increased grass DM production, better grassland management, increased utilisation, compact calving and longer lactations. To achieve current research targets of 1250kg milk solids/ha, efficiency will have to increase by nearly 60% in Kerry and Connacht Gold and 20% in the technical group. Is this achievable?

Table 1. Current physical performance of two co–op regions and a high performance technical group

	Connacht Gold	Kerry	Technical group
Grazing platform (ha)	30.9	36	80
Stocking rate (cows/ha)	1.9	1.7	2.3
Milking cows	55	55	182
MS/cow	286	309	434
MS/ha	560	520	995
Grazing days	220	239	291
Concentrate/cow	934	726	464
% Grass budgeting	17.4	6	85

Management practice to increase grassland productivity

Many changes have been adopted in grassland management practices over the past decade. Rising costs (5%/year in the last three years) require increased production efficiency on Irish dairy farms to offset falls in farm income. Increased emphasis must be placed on technology to extend the grazing season earlier into spring and later into autumn to reduce the requirements for alternative higher cost feeds. Early turnout (post-calving) is now normal practise on many farms with clear benefits (Kennedy *et al*., 2006). Autumn management has evolved to utilise higher farm grass covers - built to provide a grass supply into November, with some pastures closed to store grass over winter so that herbage is available for spring grazing. A 300-day grazing season is now an achievable target for focussed grassland farmers. However at farm level, survey results indicate a wide range from 211 – 311 (100 days) as more typical.

The evolution of management practice within Moorepark since the mid-1980s is summarised in Table 2. Over the past 24 years, mean calving date has been delayed, and stocking rate has been reduced to facilitate the incorporation of a greater proportion of grazed grass in the diet of the dairy herd. However stocking rate is still substantially higher than average stocking rates at farm level. Current grazing season length is 300 days, with the main increase in the number of grazing days realised through earlier spring turnout. The grass growth potential of the sward has increased, achieved mainly through reseeding of older pasture and through the more efficient use of artificial and organic fertilizer. There has been a consistent reduction in the proportion of second cut grass silage taken, as the demand for grass silage has been substantially reduced with a longer grazing season. The demand for grass silage has been almost totally replaced by grass in the early lactation period.

Due to the extension of the grazing season the feed budget of the dairy cow has also changed over the past 24 years – grass allowance has increased by 40% coupled with a 30% decrease in grass silage input along with a 50% reduction in concentrate offered. In the future a further increase in the quantity of grass in the overall feed budget is likely. There is no time for sitting still – further progress has to be made to increase stocking rate at low concentrate levels. The aim is to produce more pasture to utilise and further reduce production costs on the farm unit.

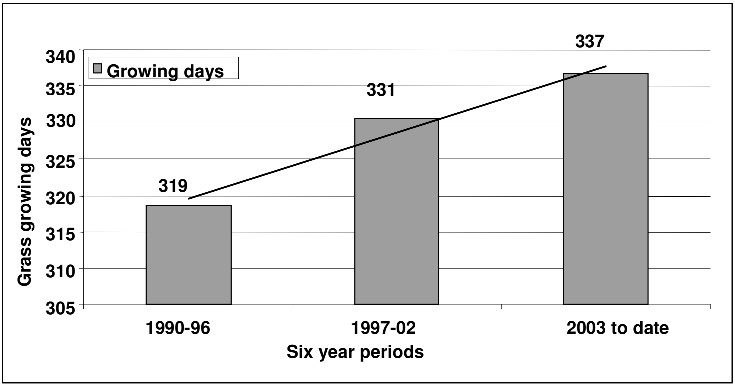
Table 2. Changes in the Moorepark system for spring milk production between 1984 and 2008

	1984	2008
Mean calving date	2/2	24/2
Stocking rate (LU/ha)	2.91	2.8
N input (kg N/ha)	423	240
Grazing season length (days)	250	290
Turnout by day	March 10	Feb 1
Turnout full time	April 1	Feb 1
Housing date	Nov 15	Nov 28
Annual dairy cow feed budget		
Grass (t DM/ cow)	2.8	3.9
Silage (t DM/ cow)	1.5	1.0
Concentrate (t DM/ cow)	0.75	0.30
Grass DM produced (t/DM/ha)	14.5	15.9

Grass production, quality and grazing management
Typically in highly stocked, technically efficient systems that implement a good reseeding programme, grass production is of the order of 15 - 16t DM/ha. In such systems, grazing management is focussed on providing high quality pasture to the herd over a long grazing season. Increases in grass production on farm have not come in the mid season but more in the winter/spring periods.

Winter grass growth
A growing day is classified in the context of Figure 1 as a day where soil temperature is >5 degrees at 09:00am. Figure 1 shows a substantial increase in the number of growing days at Moorepark from 1990 to the present day. As expected large year-to-year variation exists; in 1996 there were 300 growing days (the least) but in 2005 a total of 349 growing days were recorded. In total there has been an 18-day increase in growing days from 1990 to date, which is a substantial increase given the 1990 base level was 319 days. Whether this advancement in growing day's increases grass growth is debatable, what is important however is that varieties are selected which can capitalise on the higher temperature in the autumn/winter period. November and December are the months with greatest increase in growing days.

Figure 1. The increase in growing days from 1990 to present day



Such a change or advantage is useless if not capitalised upon. In recent years at Curtins farm in Moorepark and on commercial farms measuring pasture production, substantial increases in winter growth rates have been recorded. In Clonakilty Agricultural College, winter grass growth from October to February for the period 2006 – 2008 has averaged 8kg grass growth per day. In recent years some New Zealand grass varieties have been investigated at Moorepark to examine levels of out of season DM production relative to European bred varieties. Table 3 shows the potential of these winter tolerant grass varieties and their potential to grow over winter. Such varieties have the capacity to increase the grass growth potential by 500 kg DM/ha in the closed (winter) period.

Table 3. Effect of closing date and opening date on the DM production and over winter growth of 9 perennial ryegrass varieties defoliated in February, March and April across two years (2007-2008)

	Alto	Arrow	Bealey	Dunluce	Glencar	Greengold	Lismore	Navan	Tyrella
DM yield Feb (kg)	816	802	848	459	479	543	394	504	465
Winter growth Feb (kg/day)	7.0	6.9	7.3	3.9	4.1	4.5	3.3	4.2	3.9
DM yield Mar (kg)	1406	1565	1538	1136	1151	1091	1045	1002	1094
Winter growth Mar (kg/day)	9.9	11.0	10.9	7.9	8.0	7.6	7.3	6.9	7.6
DM yield April (kg)	1271	1287	1261	1092	1092	1075	1095	1059	1184

Over the past two years winter production (from October to March), of the three New Zealand varieties was substantially higher than Irish and European bred varieties; 50% higher in October closed swards and 28% higher in November closed swards. Of the three New Zealand varieties Bealey, appears to be the most productive over winter. However, Bealey is an aggressive growing variety and needs to be frequently grazed during the mid season, therefore if grazing management practices are not optimum it may be wiser to consider an alternative variety. Additionally, Bealey has an open growth habit. This limitation can be overcome by combining it with a compatible late diploid with good tiller density. Varieties such as these when combined with appropriate autumn closing strategy, can transform the winter closed period into a period of DM accumulation on Irish farms.

<u>Spring grazing</u>

Spring grazing is the key to increasing farm grass DM production, the number of days at grass and increasing the proportion of grazed grass in the cow's diet. The first grazing rotation stimulates herbage growth and leads to higher DM production on early grazed pastures relative to swards grazed in the late March/April period. It is normal to record higher grass growth on grazed swards in late March compared to ungrazed swards. Kennedy *et al.*, (2007) found early spring grazed swards had 6% higher growth rate in subsequent rotations compared to April grazed swards; further to this sward quality was 2 units higher with the early grazed swards. O'Donovan *et al.*, (2004) found similar results with a study completed in France.

Tight spring grazing, which is now widely advised (grazing to 3.5 - 4cm), clearly increases sward quality in subsequent rotations (Holmes and Hoogendoorn, 1992;

Stakelum and Dillon (2007). Increased levels of milk production performance (+2kg milk/cow/day) are due to swards with higher leaf content, lower pre grazing masses and higher sward quality.

Summer

In recent years, the concept of grazing lower herbage masses (1200 - 1600kg DM/ha) has been adopted. The basis of this work comes from grazing swards at the '3 leaf stage'. The fundamentals behind this philosophy are that grass is a '3 leaf plant' - that is only 3 green leaves/tiller exist at any one time, with the initiation of a new leaf coinciding with the senescence of the oldest fourth leaf. Grazing swards older than 3-leaves/tiller will not only lead to wastage of grass but also the senescent (dead) material builds up at the base of the sward and reduces overall quality of herbage. In Moorepark over the past 2 years (Table 4) a study investigating the milk and sward production of grazing swards at two different herbage masses (1600kg DM/ha versus 2300kg DM/ha) was investigated. The results show that higher milk production per cow and per ha was achieved by grazing swards at a low herbage mass 1200 - 1600kg DM/ha. Grass growth on the low herbage mass farmlets was 5% higher than that grown on the high herbage mass farmlets (15.2 versus 14.4t DM/ha). More frequent rotations stimulate higher growth; lower herbage mass swards have higher levels of green mass in the lower horizons of the sward.

Table 4. Effect of low and high pre grazing herbage mass on milk production per cow and per ha from (April to October)

Pre grazing mass (kg DM/ha)	1600		2300	
DHA	16	20	16	20
Year I				
Milk yield (kg/cow)	18.0	19.3	18.0	18.5
Milk Fat (%)	4.07	3.98	4.13	3.97
Milk protein (%)	3.41	3.47	3.41	3.45
SR (LU/ha)	4.45	4.04	4.31	3.8
Year II				
Milk yield (kg/cow)	18.2	20.1	17.9	18.9
Milk Fat (%)	4.08	3.99	4.06	4.06
Milk protein (%)	3.50	3.55	3.52	3.52
SR (LU/ha)	4.0	3.85	4.01	3.93
MS/ha 2007	1295	1248	1259	1121
MS/ha 2008	1104	1174	1104	1124
Difference	+52 (+4%)			

Economic impact of increased herbage production

Animal productivity from grass is determined by the amount of grass grown, utilised and its quality. Table 5 shows that as pasture grown increased from 12 to 16 t DM/ha, the stock carrying capacity on 40ha increases from 2.25 LU/ha to 2.81 LU/ha.

For a 4t increase in DM production, carrying capacity increased by 25%, resulting in milk solids increasing from 32,353kg to 40,435kg. While total costs increased due to extra animals, feed costs per kg reduced (from 5.3 to 4.5c/kg) as additional grass was grown for the same overall land rental and maintenance costs, and the overall profitability of the system increased. When pasture utilisation is maintained, increasing total pasture growth increases farm profit by €3,610 (€90/ha) and €5,611 (€140/ha) where milk price is 22.3 and 30.0c/litre, respectively.

Table 5. The effect of herbage production per hectare and grass utilisation on key herd parameters in a fixed land scenario using anticipated future costs and prices (Horan and Shalloo, 2007)

Herbage utilisation	75%			85%		
Herbage production (t DM/ha)	12	14	16	12	14	16
Utilisable herbage (t DM/ha)	9	10.5	12.0	10.2	11.9	13.6
Total hectares (ha)	40	40	40	40	40	40
Cow calving (LU/ha)	77.2	87.3	96.9	85.4	96.2	106.4
Stocking rate (ha)	2.14	2.42	2.68	2.36	2.66	2.94
Labour units (h)	1.38	1.48	1.57	1.46	1.57	1.67
Milk produced (kg)	452,794	512,044	567,764	500,486	564,153	623,653
Milk solids sales	30,735	34,756	38,538	33,972	38,293	42,332
Labour costs (€)	31,466	33,778	35,952	33,327	35,811	38,133
Feed costs/kg milk (c)	5.4	5.1	4.8	5.1	4.8	4.5
Total costs (€)	100,519	108,018	115,062	106,317	114,348	121,851
Milk Price @ 22.3c/l						
Milk returns (€)	96,763	109,425	121,322	106,955	120,561	133,276
Margin per cow (€)	151	216	265	205	262	305
Margin per kg milk©	2.58	3.69	4.51	3.49	4.47	12.71
Total profit/farm (€)	11683	18871	25629	17469	25192	32406
Milk Price @ 30.3c/l						
Milk returns (€)	131,458	147,654	163,721	145,304	162,680	179,837
Margin per cow (€)	603	656	705	657	702	745
Margin per kg milk©	10.29	11.2	12.03	11.2	11.98	12.71
Total profit/farm (€)	46,590	57,333	68,277	56,052	67,568	79,252

DM productivity of permanent pasture versus reseeding swards

The focus of reseeding is to establish swards that will allow high animal performance, DM production and grass utilisation. Much reseeding in the past has focused on the silage area, with little reseeding on the grazing platform. This strategy is changing. On dairy farms cows are the income generators and their grazing area should have preference for pasture renovation. Feed and fertiliser costs are increasing, and so it is logical therefore to establish swards that are responsive to fertiliser and facilitate the opportunity to replace grass silage and concentrate at the shoulder grazing periods.

The advantages to reseeding are;

- An 8% higher milk output per hectare relative to permanent pasture;
- Increased sward productivity (+50% in spring and 20% in autumn);
- Improved grass quality, up to 4 units (up to mid May);
- Nitrogen responsive swards (24% more responsive);
- Reduced silage requirement – more grass available in spring;
- Set up the farm to produce grass for high stocking rates.

Current reseeding levels in Ireland

The total amount of reseeding in Ireland (on an annual basis) is low at about 3% of the agricultural area (c. 140,000ha) being reseeded each year. To attain high levels of performance from grass, the level of reseeding by dairy farmers will have to be significantly increased. Given poor performance nationally per cow and per ha, it appears that the quality of grass swards on farms is poor. Table 6 shows the amount of certified forage mixtures sold in the last decade. Last year the level of seed sales dropped considerably (24%), due mainly to the poor weather conditions last autumn where farmers didn't get a chance to reseed pasture.

Table 6. Certified forage mixtures (tonnes/year)

Year	Tons/sold
07/08	2492
07/06	3281
06/05	3334
05/04	3232
04/03	3315
03/02	3165
02/01	3353
01/00	3341
00/99	3511

Source: Department of Agriculture, Food and Fisheries

One of the interesting results from the reseeding survey (carried out in autumn 2008), is the time of year when reseeding is carried out. It appears that (especially in the Kerry and Connacht Gold regions - Table 7), too much reseeding is being targeted for the autumn period. From the weather conditions of 2007 and 2008, spring reseeding appears to offer a more reliable window. Difficulties encountered with autumn reseeding are: i) weather can be variable, and ii) if there is a delay tilling land, post emergent spraying of the new reseed is delayed to the following spring. This is too late to kill seeding docks, which have become well established. Generally farmers are now giving preference to the grazing area when reseeding and this is correct, silage ground, which might not be part of the grazing block, should not be given preference over the grazing platform. From the three groups surveyed on average 23% of farmers did not reseed in the past three years, this figure is too high.

All farms irrespective of location have poor performing pastures. Overall farm DM productivity, can only be increased by renewing the worst performing of these annually. Dairy farmers should be targeting at least 8-10% of the farm for reseeding annually. In an era of dairy production expansion, the DM production capacity of expanding farms must be increased; pasture reseeding will achieve this.

Table 7. Results of Kerry, Connacht Gold and a Technical group on reseeding management on dairy farms in the last three years

	Area reseeded annually					
Area reseeded (ha)	0	<2	<4	<8	<12	>12
Technical group	24.6	12.3	14.0	21.0	6.1	21.9
Kerry	26.5	26.7	37.4	8.2	0.6	0.7
Connacht Gold	17.1	8.6	60.1	12.4	1.5	0.3

	Timing of reseeding			Area completed		
	Spring	Summer	Autumn	Grazing Area	Silage Area	Grazing and Silage
Technical group	32.4	8.4	32.2	52.8	0	47.2
Kerry	11.9	5.2	69.1	54.8	5.9	39.3
Connacht Gold	5.6	0.9	82.0	39.5	12.0	48.5

The net result of a successful reseeding programme is to create a longer and more productive grass-growing season. The target for intensive dairy farmers is to grow 18t grass per annum and utilise 85-90% of what's grown (Moorepark currently achieves 16t DM/ha). In addition, high dry matter intakes can be achieved from reseeded pastures that promote high production levels. Research work at Moorepark has shown milk output per ha increased by 8% with a higher grazing stocking rate, from reseeded swards compared to permanent pasture (Table 8). The biggest limitation of permanent pasture is poor growth in spring and poor pasture quality mid-season. On dairy farms this is the key period where major economic gains are made. At grazing, a 1-unit increase in digestibility will increase milk yield by 0.24kg/cow/day and grass dry matter intake by 0.2kg cow/day.

Reseeding doesn't mean all of the above will be realised, it has to be combined with good grazing management practice and adequate soil nutrient status. However, protecting the new sward in the initial grazing year will help achieve some of these benefits.

Table 8. Milk production from permanent and reseeded pastures (litres/cow)

Stocking rate	Low (2.09cows/ha)		High (2.63cows/ha)	
Pasture	Permanent	Reseed	Permanent	Reseed
1978-1981	3307	3418	3177	3420
Increase	3.4%		7.7%	

Source; McCarthy, 1984

How much DM production is lost by not reseeding?
On farms, swards vary in productive capability; the perennial ryegrass content of the pasture determining differences in total DM and seasonality of production. A recent study in Moorepark quantified these differences, ,where swards with different perennial ryegrass (PRG) content were established (grass seeding rates varied from 2-12kg/ac to achieve this). All swards received the same level of chemical fertiliser (230kg N/ha). The differences in DM production are shown in Table 9. As expected the largest difference in DM production (23%) was between the swards with the lowest and highest PRG content. Over half of the DM production difference took place in the first two grazings of the year (February and April), illustrating that increasing the proportion of grass in the diet in early spring grazing is virtually impossible with swards with low levels of PRG. Even swards with 40% PRG had up to 46% lower DM production in the Feb – April period compared to the 100% PRG pasture. The increases in DM production are obvious when comparing reseeded versus old permanent pasture; however the difference in response to nitrogen is also important. Nitrogen responses decreased by 7, 13, 18 and 24% for the 65, 40, 25 and 10% PRG swards compared to the 100% PRG treatment.

Table 9. Effect of swards with different levels of perennial ryegrass on seasonal and total DM production and the difference (2008)

% Ryegrass	Feb 28	April 22	May 12	June 3	June 27	July 24	Aug 13	Sept 11	Oct 26	Total kg DM/ha
10	474	806	1319	1664	526	1405	1192	1309	1054	9749
25	520	1081	1537	1687	704	1625	1113	1228	920	10415
40	626	857	1456	1921	641	1451	1312	1471	1218	10958
65	969	1127	1576	1903	704	1607	1195	1426	1191	11697
100	1417	1347	1718	1921	783	1613	1263	1362	1253	12678
Percentage reduction in DM yield as percentage of perennial ryegrass increases										
10	67	40	23	13	33	13	6	4	16	23
25	63	20	10	12	10	1	12	10	27	18
40	56	36	15	0	18	10	4	8	3	14
65	32	16	8	1	10	0	5	5	5	8

The economic loss associated with reductions in DM production between productive and none productive swards is far greater when swards contain only a minimal quantity of PRG; - €292 in swards with 10% PRG, €237 in swards with 25% PRG, €202 in swards with 40% PRG and €111 in swards with 65% PRG when compared to the 100% PRG swards. Table 10 shows full reseeding costs with all costs incorporated, however most farms have lower reseeding costs than those outlined. Reseeding is a medium term investment and should always be carried out to achieve the best possible results. In general, the cost of reseeding can be reduced to the contractor cost (cultivation and spraying), seed and spray costs. Most of the machinery costs are offset by the farm itself. From the survey results, most farmers place the cost of reseeding at between €150-200/ac (€370-500/ha). Given the economic loss associated with poor levels of PRG in pastures, newly reseeded swards will cover the reseeding costs within 2 years. Reseeding swards with <65% PRG is worthwhile, however there may be other reasons to reseed swards, e.g. poaching, weeds infestation, previous poor variety choice etc.

Table 10. Conventional method full reseeding (costs 2008/09)

	€/acre
Soil test (€25 per 5 acres)	5
Spraying	10
Glyphosate (Round-Up (2 litre/acre)	21
Ploughing (40) / Till & sowing (one pass) (35)	75
Fertiliser (2 bags x 10:10:20)	47
Fertiliser spreading	10
Levelling	10
Rolling	10
Grass seed	55
Total – ex post emergence sprays	**243**
Post emergence herdicide sprays	
Alistell – (1.5litre/ac -€30)	30
Legumex DB - (2.8litre/ac - €23)	23
Duplosan - (1 litre - €9/ac)	9
Spraying	10

The contribution of grass breeding to grassland productivity

Gains from forage grass breeding have varied widely from one region to another. Over the last 50 years gains in dry matter yield (DMY) of the important forage grass species, such as perennial ryegrass, have been 4-5% per decade in North Western Europe. More recently in the UK, the DMD of perennial ryegrass has been improved by 10g/kg (1%) per decade.

Table 11. Northern Ireland recommended list data 1994-1995 to 2008/09

	Grazing DM yield (t/DM/ha)	Silage DM yield (t/DM/ha)	
1994/95	11.8	13.6	Mean of 50 varieties
2003/04	12.2	14.8	Mean of 50 varieties
2008/09	12.4	15.2	Mean of 52 varieties
Increase (t/ha)	0.6	1.6	
Increase/year	0.04 t DM	0.114 t DM	

Source: Northern Ireland Recommended list

Grass DM production from the Northern Ireland recommended variety list (Gilliland, 2007) has increased by 0.04t DM/year in grazed swards (frequent harvesting) and 0.114t DM/ha/year in silage swards (infrequent harvesting). This data shows a progressive increase in DM production - on average a net increase of 5% DM yield over the last decade. Results from Teagasc Moorepark's grass growth data would agree with these findings.

<u>Current evaluation procedures for Recommended Lists</u>

In Ireland, North and South, a grass variety recommended list is published annually. The Department of Agriculture in both countries are responsible for their respective lists. These lists are vital for the recommendation of grass cultivars and are the internationally practised method of screening cultivars for the industry. However, there are differences in the methods (evaluation protocols) employed by both departments when evaluating varieties.

Republic of Ireland

Varieties are evaluated for a minimum of two separate sowings and four harvest years. Trials are conducted at Backweston Farm, Leixlip, Co. Kildare; Fermoy Co, Cork; Raphoe, Co. Donegal; Athenry, Co. Galway and Kildalton Co. Kilkenny. Perennial ryegrasses are sown in the autumn and assessed over the following two years under a 6 cut system with 350kg N/ha applied per annum.

The main characteristics considered are:

(1) DM yields: Expressed as a % of the yield of a basket of control varieties (selected from the top 50% of varieties on the outgoing RL).
(2) Heading date: is based on the first heading date in spring
(3) Ground cover score: Based on visual assessment of sward openness at the end of the second harvest year.
(4) Spring Growth: Based on the yield of first cut which is harvested in early-April
(5) Autumn Growth: Based on the combined yield of the last two cuts, which is measured from mid-August.
(6) Grass DMD and WSC: Measured from the spring, two silage harvests and autumn DM yield

Agri-Food and Biosciences Institute of Northern Ireland (AFBNI)

The AFBNI system is conducted at a single centre, Crossnacreevy. A three stage hierarchical recommendation scheme is operated, with varieties entering the list as provisional 'P' recommendation, and then as more trial data are produced, varieties potentially progress into the' plain type' category and finally to the highest' bold type' class. This is achieved through a programme of re-sowing and sequential testing that is designed to link into the National List programme. At the end of the National List testing programme, replication of years permits immediate consideration for provisional recommendation. Only consistently very high performing varieties attain the bold type classification, the main distinction between these three categories is the amount of data available and so the precision of the recommendation.

Perennial ryegrass varieties are assessed under simulated rotational grazing management with 320kg N/ha applied per annum and under a 3-cut silage management with simulated grazing thereafter - 350-kg N/ha per annum is applied. In the first year potential new varieties are grazed with cattle with no yield data is recorded. In the second and third year, they are assessed for long-term DM yield potential under a simulated rotational grazing management and a 3-cut silage management respectively. The seasonal grazing yield is calculated from cuts taken at three weekly intervals until June, followed by monthly cuttings after July 1. These cuts are divided into four seasonal periods of spring (end of April), early summer (May-July), late-summer (July-September) and autumn (September to November). The seasonal silage yields comprise a total of 5-cuts, with 1, 2 and 3 cuts being taken as the main silage cuts, and the remaining two cuts combined as the aftermath grazing performance.

The main characteristics considered are:

(1) DM yields: Total DM yield is expressed as a percentage of the bold type diploid varieties in each group.
(2) Ground cover: Assessed at the end of a harvest year on a scale of 0 to 9 of increasing density.
(3) Seasonal grazing yield: DM yield is divided into four seasonal periods of spring (up to the end of April), early summer (May to July), late summer (July to Sept.) and autumn (Sept. to Nov.)
(4) Seasonal Silage yields: Comprises of a total of five cuts, with first, second and third being taken as the main silage cuts and the remaining two cuts combined as the aftermath grazing performance.
(5) Heading date: is based on the first heading date in spring.
(6) In recent years digestibility of both 1st and 2nd cut silage yield and simulated grazing cut 6 are being estimated.

<u>Future evaluation systems</u>

Current grassland management practise has moved considerably from traditional conservation regimes to more focussed grazing regimes. Evaluation systems of grass cultivars have moved in some instances (simulated grazing to mirror frequent livestock grazing). In many ways the animal effect is vital as it represents the true evaluation of a grass from both a grazing and treading perspective. Internationally there is no common approach to grass evaluation, however a number of countries have adopted a simulated grazing protocol, UK, Northern Ireland, Holland, New Zealand (actual grazing). Work underway at Moorepark is comparing varietal performance between actual grazing and simulated grazing protocols, with current evaluation methods. The focus is to develop a simulated grazing protocol that will represent animal grazing systems. This will mirror the seasonality of DM production of varieties as achieved in a commercial farm grazing situation.

Conclusions

On farm productivity gain can be achieved with better standards in grassland management. A key structure that needs to be put in place is a productive high quality sward – combined with best grazing management practise this will ensure high levels of performance from the dairy herd. Currently research farms and the better commercial farms are producing 16t grass DM/ha. It is possible to increase levels beyond this point. A realistic objective is to target 18t DM/ha grass grown on dairy farms. To achieve this a number of key grazing management guidelines are listed below:

i) Target a long grazing season (280-300 days) with 10-11 grazing rotations. The first and last rotation should be the longest in length.
ii) Target early spring grazing with high utilisation – achieved by grazing to (4cm);
iii) Maintain grazing covers of between (1200-1600kg DM/ha) during the grazing season;
iv) Implement a reseeding strategy (8-10% of farm every year), targeting the lower producing paddocks;
v) Reseed the grazing platform - preferably in spring (after the second rotation in April);
vi) Choose varieties from the Irish Recommended lists (Republic and Northern Ireland), generally three varieties are sufficient but ensure the varieties chosen have higher than average figures for seasonality of production, quality and density.
vii) Ensure soil fertility is at its optimum for grass DM production i.e. **soil test**.

References

Dillon, P., Roche, J.R., Shalloo, L. and Horan, B. (2005). Optimising financial return from grazing in temperate pastures. In: J.J. Murphy (ed.), Utilisation of grazed grass in temperate animal systems. Pp: 131-148. *Proceedings of a satellite workshop of the XXth International Grassland Congress*, Cork, Ireland. Wageningen Academic Publishers, The Netherlands.

Gilliland, T. Northern Ireland Grass Variety Recommended List (Agri-Food and Bbioscience Institute *annual publications*)

Holmes, C.W., Hoogendoorn, C.J., Ryan, M.P. and Chu, A.C.P. (1992). Some effects of herbage composition, as influenced by previous grazing management, on milk production on ryegrass/white clover pastures. 1. Milk production in early spring: effects of different regrowth intervals during the preceding winter period. *Grass & Forage Sci*., **47**: 309-315.

Kennedy, E., O'Donovan, M., Murphy, J.P., Delaby, L. and O'Mara, F. (2006). The effect of spring grazing date and stocking rate on sward characteristics and dairy cow production during lactation. *J. Dairy Sci*. **90**: 2035-2046.

Kennedy, E., O'Donovan, M., Murphy, J.P., O'Mara, F. and Delaby, L. (2007). The effect of initial spring grazing date and subsequent stocking rate on the grazing management, grass dry matter intake and milk production of diary cows in summer. *Grass & Forage Sci*., **61**: 375-384.

MacCarthy, D. (1984). Milk production from grassland, p1-66. In: *Moorepark 25th Anniversary Publication*. Part 1; Milk production; AFT publication.

O'Donovan, M., Delaby, L. and Peyraud, J.L. (2004). Effect of time of initial grazing date and subsequent stocking rate on pasture production and dairy cow performance. *Anim. Res*. **53**: 489-502.

Shalloo, L., Dillon, P., Rath, M. and Wallace, E.M. (2004). Description and validation of the Moorepark Dairy Systems Model. *J. Dairy Sci*. **87**: 1945-1959.

Stakelum, G. and Dillon, P. (2007). The effect of grazing pressure on rotationally grazed pastures in spring/early summer on subsequent sward characteristics. *Irish J. Agric. Food Res*. **46**: 15-28.

Off farm rearing of replacement heifers

John Donworth, George Ramsbottom and Riona Sayers
Teagasc

Summary

- Off-farm rearing of replacement heifers has the potential to increase profit/ha on beef farms.
- Several advantages exist for the rearers, including:
  - Improved cash flow due to a steady monthly income;
  - Freeing up of the capital required to stock the farm.
- Challenges also exist for the rearer. These include:
  - Complying with the wishes of a third party (in this case the heifer owner) on how the heifers are raised;
  - Engaging in a new enterprise with different targets – live weight, reproductive and husbandry than those associated with conventional drystock production.
- Animal disease issues, both regulatory and non-regulatory may represent a serious challenge to both owner and rearer of replacement heifers.

Introduction

A total of 225,400 in-calf dairy heifers were present on Irish dairy farms in June 2008 (CSO). Virtually all of these were reared by their owners. This contrasts with the situation in New Zealand, where almost 90% of yearling heifers are contract reared. If a similar proportion of heifers were reared on Irish beef farms, approximately 7,000 beef farmers could become involved in the business (assuming that on average 30 yearling heifers were reared per beef farm).

The structure of the Irish dairy industry is changing. Issues such as labour, the size of the ‘grazing platform’ and the cost of investing in additional dairy facilities become increasingly important as dairy farms expand. Such issues make off-farm rearing of replacement heifers an increasingly attractive option for dairy farmers. The objective of this paper is to explore the potential of off-farm heifer rearing from the beef farmers perspective.

What are the attractions from the beef farmer's perspective?

Off farm heifer rearing is attractive to the beef farmer for a number of reasons:

- It can provide beef farmers with a means of utilising their land and buildings without investing in stock – reducing the risk involved.
- The enterprise can often be run as a part-time enterprise.
- The need to go to the livestock mart to buy and sell stock is reduced.
- Cash flow can be improved because the 'norm' is that the rearer is paid by direct debit on a monthly basis.
- The business may return a higher profit than the rearer's existing enterprise!

What are the risks from the beef farmer's perspective?

The issues that need to be considered with off-farm heifer rearing include:

- Loss of control in the day-to-day management of the replacement heifers.
- The risk of a disease outbreak. With animals on two farms, the risk of either group contracting diseases such as TB, Leptospirosis etc. is doubled. If the rearer is simultaneously taking heifers from other owners or has another livestock enterprise the risks may be further multiplied. Contingency plans must be put in place to ensure that an outbreak of disease does not have implications for the smooth return of the heifers to the dairy farm at the end of the rearing period or result in calving heifers 'stuck' with a rearer with no facilities to calve or milk such animals.
- Possibly poorer replacement heifers. Not all rearers will be suitably skilled to achieve the target weights set down for replacement heifers. It is imperative that heifers are weighed at defined times throughout the rearing process to ensure that the appropriate targets are achieved. A plan should be put in place in advance of entering the contract to address the issue where targets are not reached e.g. through concentrate supplementation over winter.
- Risk of conflict between the owner and rearer. In all cases, clear targets must be agreed by both parties in advance of entering the contract arrangement. In addition, an independent arbitrator should be agreed in advance in the event of a conflict occurring between the owner and rearer.

Many of the risks outlined above can be minimised by preparing a written contract of agreement. If underdeveloped heifers are returned to the farmer who is at fault? The easy answer is the rearer, however, both parties are at fault. The rearer failed to manage the heifers and the dairy farmer failed to manage the rearer. Who will pay the higher price? It is the dairy farmer's future that has been damaged. Heifers that are underweight at calving will produce less milk during their lifetime.

Off farm rearing of replacement heifers – The New Zealand Experience
In New Zealand, over 95% of the one million yearling replacement heifers and 75% of the yearling heifers are reared off the main grazing platform.

- The main reason why heifers are grazed off farm is because of the high stocking rates on the grazing platform – the national average is 2.8 cows/ha.
- Demand for quality heifer rearers is high, and exceeds supply as the dairy herd in New Zealand has increased by approximately one third over the past 10 years.
- Formal written contracts for rearing replacement heifers have been in place for over 20 years. Approximately 70% of heifers are grazed off-farm with a written contract in place. The balance don't have a written contract and usually involve owners and rearers who have a long established business relationship.
- Farmer experience with replacement heifer contracts is that they are not foolproof, however they are useful in highlighting the key management issues and targets that need to be agreed before heifers arrive on the rearers farm.
- TB is not a widespread disease in New Zealand (0.34% of herds are affected nationally) and is rarely an issue.
- The control of Bovine Viral Diarrhoea (BVD) however, is a major issue. Vaccination of heifers usually takes place on the rearers' farms. This is done primarily for insurance purposes to ensure that high pregnancy rates are obtained as heifers from different sources are mixed on rearers farms. In addition, stock bulls, by far the most commonly used method of breeding heifers, are usually BVD tested before they are introduced to the breeding mobs on the rearers' farms. This test is carried out to identify the persistently infected (PI) stock bulls and ensure that they do not come in contact with the heifers.

A variety of payment systems are used.

- These vary from a weekly rate where no formal contract exists (they operate most successfully where established grazers with proven track records consistently deliver replacements of the required standard). Generally such rearers are in high demand and deal with the same group of customers over a long period of time so opportunities to avail of their services are limited.
- Fixed price contracts with a 'guarantee' to achieve a certain liveweight gain are the second payment system. Such contracts were more commonly employed by the grazing companies. Heifer liveweight gain is monitored frequently (every 6-8 weeks) as such weighings form the basis for payment and are a useful means of informing the owner of how his animals are performing. These contracts usually have inbuilt bonuses and penalty clauses for liveweight gain above or below the agreed targets. While generally higher cost, the additional costs involved could be viewed as an insurance policy to ensure that the appropriate liveweight gains are being achieved.

- In general, payment is made on ‘the first of the month basis’ directly into the grazier’s bank account. In addition to the ‘bed and breakfast’ costs outlined above, extra costs are also incurred while heifers are off-farm. These include the costs of bull hire, dosing, vaccination and synchronisation programmes and transport.

Disease control in Ireland

Diseases associated with replacement heifers fall into two categories – regulatory diseases (TB and brucellosis) and non-regulatory diseases. These include the viral diseases, BVD and IBR, bacterial diseases, leptospirosis, Johne’s, Salmonellosis, Mycoplasmosis and parasitic diseases such as Neosporosis.

The fundamental step in any biosecurity programme to protect against the diseases listed above is the maintenance of a closed herd policy, i.e. no cattle movement onto the farm. Engaging in off-farm heifer rearing makes closed herd farming an unrealistic goal, and a number of other biosecurity measures should be strictly implemented to reduce the disease risk.

When off-farm heifer rearing is being practised, always;

- Establish the current disease status of the herd of origin. Such information is important in determining the likelihood of disease exposure before the heifers leave the farm, and is absolutely critical to management of the heifer herd once they are re-introduced to the herd. They will need protection (e.g. management and vaccination strategies) against circulating diseases in the herd of origin before their re-introduction.
- Ideally engage in a contract with a single dairy farm.
- Implement a strategic vaccination protocol for heifers based on the disease status of the farm of origin, e.g. if required, BVD vaccination should be carried out at a specific time before breeding (specified by the vaccine manufacturer) and heifers should receive a primary course of two injections separated by a correct time interval. Incorrectly administered vaccines will not yield the desired level of disease protection.
- Implement a parasite control strategy to include roundworm, fluke and lungworm.
- Return in-calf heifers to the owners farm 6 weeks before they calve down. This is to ensure that they are not being transported on the point-of-calving and are properly acclimatised to their environment so that they also have the required level of ‘local’ antibodies in their system before calving.

- The pre-movement test should be carried out when heifers are approximately 22 months of age. Its specific date should take into account the time lag between the taking of tests and the results being returned to the farmer, e.g. a TB test takes 3 days before the results are relayed back to the farmer. If a blood test is required, at least 5 days will elapse before the results are relayed back to the farmer.

Replacement heifer liveweight targets

Liveweight is a key component of successful heifer rearing. Replacement heifers should weigh 30%, 60% and 90% of mature liveweight at 6 months of age, pre-breeding and pre-calving respectively. The recommended pre-calving weights of replacement heifers for a variety of breeds are presented in Table 1.

Table 1. Recommended pre-calving liveweights of replacement heifers by breed

Breed	Weight (kg)
Holstein-Friesian	560
Norwegian Red	530
Norwegian Red / Holstein Friesian Cross	560
New Zealand Friesian (pure)	530
New Zealand / Holstein Friesian Cross	560
Montbeliarde	560
Jersey	410
Jersey / Holstein Friesian Cross	490

Economics of replacement rearing for the beef farmer

Rearing replacement heifers is justified if both the dairy and the beef farmer benefit from the process. For the enterprise to be attractive to the rearer, the margin earned must be greater than that currently available from sheep or cattle farming. The data in

Table 2 shows the trends in net profit (€/ha) excluding premia for the top 1/3 of breeding and non-breeding beef farms for the years 2006, 2007 and 2008.

Table 2. Net margin (€/ha) for the top 1/3 of suckler and non-breeding beef farms (2006-2008 inclusive)

Year	Net margin/ha Suckling farms/ha	Net margin/ha Non-breeding farms/ha
2006	€134	€324
2007	€97	€199
2008	€61	€83
Average	€97	€202

For many beef farmers, the data suggests that a review of the income generating potential of their beef enterprises is warranted. For some, the option of improving their income through rearing replacements for the dairy industry may be a real alternative. In estimating the potential profitability of the enterprise, it is necessary to first look at the costs of replacement heifer rearing.

The costs included in Table 3 are those incorporated in the EBI model (Shalloo, 2003) and updated in 2007.

Table 3. Costs associated with rearing replacement heifers to calving at 24 months of age (based on Fischler costs and prices)

Category	Cost (€)
Variable costs	
Concentrates	142
Fertilizer, lime & reseeding	201
Land rental	194
Machinery hire	9
Silage making	89
Vet, AI & medicine	128
Total variable costs	**763**
Fixed costs	
Car use, water & electricity	30
Labour	221
Machinery operation & repair	20
Phone	10
Insurance, A/C's, transport, sundry	39
Interest repayments – term loan	66
Total fixed costs	**386**
Depreciation	
Buildings	55
Machinery	22
Total costs	**1,226**
Initial value of the calf	350
Sales of heifers failing to conceive	**-23**
Net cost of rearing a replacement heifer	**1,553**

The net cost of rearing a replacement is €1,553 per head. The figure includes a charge of €221 per head for the farmers' own labour. A land charge based on an opportunity cost of €291/ha (€118/ac) is also included. An adjustment for the cost of empty replacement heifers is incorporated in the model. The rearer will incur both variable and fixed costs. Typically, calves will move to the rearer's farm on the May 1. They will return home in early December of the following year.

The data in Table 4 indicates the level of cost that may be incurred while on the beef farm. It excludes the costs incurred prior to the arrival on the beef farm (at 3 months of age) and those incurred after the heifers return home to the dairy farmers own herd (at 22 months of age).

Table 4. Estimate of variable and fixed costs incurred in rearing spring born replacement heifers from May 1 to December 1 of the following year

	May 1 to December 1
No. days	579
Breed of animal	Holstein Friesian
Concentrates[1]	€48
Grass[2]	€183
Silage[3]	€99
Vet/AI	€70
Fixed costs	€104
Labour	€180
Total	**€684**
Cost/week	€8.27
Cost/day	€1.18
Average daily gain	0.83 kg

[1]Concentrate input estimated at 220kg from May 1 to Dec. 1 the following year.
[2]Grass and silage costs include a land charge estimated at €350/ha for the beef farmer's land.
[3]No silage is fed during the second winter on the beef farm

The costs of rearing replacements will vary considerably from farm to farm.

- Some rearers will feed more concentrates than the quantity assumed in Table 4.
- Additional silage may be required at the start of the second winter.
- Some farmers may feed kale during the first winter, which would decrease costs.

The daily heifer rearing costs will range from €1.00/day to €1.35/day.

The labour charge assumed in Table 4 is €15 per hour and the time incurred is 12 hours per heifer for the 579 day period. This includes the cost of heat detection. The number of hours spent rearing the replacement heifers may be lower on beef farms where labour is more efficiently employed than average, or where heifers are bred to a stock bull (so that labour intensive heat detection is not required.

In Table 5, the return to labour per hectare for the beef farmer for rearing replacement heifers, for different stocking rates and charges based on the costs outlined in Table 4 before labour, is estimated as follows.

Table 5. Estimated return (€/ha) to the beef farmer for replacement heifer rearing

Fee (€/heifer/day)	0.90		1.00		1.10		1.20	
Stocking rate (heifer unit/ha)[1]	2	3	2	3	2	3	2	3
Receipts (€/ha)	1042	1563	1158	1737	1274	1911	1390	2084
Costs excl. labour (€/ha)	1008	1512	1008	1512	1008	1512	1008	1512
Margin for labour (€/ha)	34	51	150	225	266	399	382	572

[1]A heifer unit is a weanling and yearling heifer, i.e. 3 heifer units per hectare equals 3 weanling and 3 yearling heifers per hectare.

According to the data presented in Table 5, the margin obtained per hectare for labour varies considerably with the daily fee paid, and the stocking rate. At current milk prices, dairy farmers will be especially sensitive to the fees charged for off-farm rearing of replacement heifers.

Depending on the fee agreed, the return per hectare might potentially be higher than that generated on the top one-third of suckling and non-breeding beef farms. However stock and grassland management skills must be excellent to achieve the target weights demanded of replacement heifer rearing. In addition, excellent skills in reproductive management are required of the beef farmer. They must also have suitable facilities for over wintering the heifer. Ideally such animals should be housed in cubicles, as this is generally the preferred overwintering option of mature cows.

Maximising grazed grass - pushing up stocking rate. Lessons from Curtins 2008

Brendan Horan, John Coleman, Brian McCarthy and Aidan Brennan
Teagasc Moorepark, Fermoy, Co. Cork

'On the seabed, the strongest coral always grows in the most turbulent waters'

Introduction

The introduction of milk quotas on Irish dairy farms capped production and focused producers on profitability per litre of quota by reducing production costs on their fixed quotas (Shalloo *et al.*, 2004). This policy indirectly motivated producers to increase milk production performance per cow and resulted in gross under production and utilisation of homegrown feed on Irish farms. Recent analysis carried out within the EU has suggested that milk quotas are now constraining the development of an efficient European dairy industry (van Berkum and Helming, 2006). Quota deregulation will result in a reduction in dairy farm numbers with international prices determining the price received by farmers for their milk, an expansion in production with increases in cow numbers and land conversions from other enterprises to dairying, reductions in input costs, increases in productivity as farmers reduce expenditure and redistribute resources to areas of comparative advantage (Philpott, 1995). Ireland has a comparative advantage over other countries in the production of milk because of our temperate grass growing climate and lower costs of milk production. Lips and Rieder (2005), in an international analysis of the impact of quota change projected that EU quota abolition will allow production to move to areas of competitive advantage such as Denmark, Ireland and the Netherlands, predicting that milk production in Ireland could increase by up to 39% post quotas. A further study of Irish dairy farmers in 2007 (O'Donnell *et al.*, 2008) showed that with best practice management among existing suppliers, milk production could increase by 80% post milk quotas.

Recent EU level policy outlook press releases suggest that EU milk quotas will be increased by 9% between 2008 and 2015. This increase which includes a 2% rise in April 2008 is anticipated to include an approximate 2% increase due to the removal of butterfat correction on quotas as part of the Health check review in 2009 and further annual 1% increases in overall EU quotas between 2009 and 2015. There are only 6 countries anticipated to increase milk production inline with quota increases (Austria, Denmark, Germany, Ireland, Italy, Luxembourg and The Netherlands) and it is also expected that only 2/3rd or 6% of the total increase in quotas will be taken up in the period to 2015. On that basis and taking into consideration the EU preference for a *'soft landing'* for dairy markets prior to quota removal in 2015, EU dairy farmers are unlikely to experience milk quotas beyond 2011 if not before.

A brief history and change in objective for dairy production research

Under the quota system, increased profitability could only be achieved through increases in efficiency at farm level, with producers focused on management strategies that reduced costs of production to a minimum. With the removal of milk quotas, the objective of the production system must become profit maximisation achieved through increased scale at farm level and the development of a new business ethos on Irish dairy farms as the production frontier changes to the next most limiting factor of production. While in the short-term, expansion at farm level may be constrained by the availability of replacement heifers, the inevitable longer-term limitation will be the area and pasture productivity of land within walking distance of the milking parlour. **The objective of farm systems at both farm gate and research level must therefore be to maximise profitability per hectare through excellence in grassland management practice to facilitate increased overall farm stocking rates in combination with the realisation of appropriate animals to suit expansive systems.** Successful farming systems must also facilitate sustainable profitability irrespective of fluctuations in milk prices, interest rates and operational costs. **At a practical level, for the first time Irish dairy farms must now deliver sufficient feed to allow dairy farmers to expand herd size post quotas without increasing their exposure to high cost external feed sources.**

Table 1 below outlines the overall changes in management practice at Curtins farm, Moorepark over the last 8 years as well as the impact of management changes towards the development of superior milk production systems for a quota free environment. The overall objective of all systems research is now to increase farm profitability per hectare by implementing practices that increase the amount of energy harvested per hectare for milk production, by increasing milk solids production from home grown feed while improving nutrient use efficiency. Unlike the results presented from Lincoln University dairy farm, Curtins can still be considered at an early developmental phase in terms of these new systems characteristics. As illustrated in the Table 1, the stocking rate on the farm has increased from 2.5 LU/ha in 2005 to 2.82 LU/ha in 2008, while reducing both concentrate use and artificial fertiliser usage. Grazing management practice has resulted in total pasture production increases by 25% from 12.5ton DM/ha on grazing paddocks in the 2001 to 2005 period to 15.7 tons DM/ha in 2008. (This increase in total growth has resulted in the development of a surplus of 1.6 tons of DM per hectare on the farm, which will increase stock carrying capacity to 3.3 LU per hectare for next season.) Milk solids production per cow has fallen from 500 to 430kg due to increased grazing intensity and reduction in concentrate usage, and consequently milk solids production per hectare has largely remained static. **The net consequence of these initial 2 years of development have been to identify significant quantities of extra feed within the system, which coupled with a further increase in overall farm stocking rate to 3.3 LU/ha will facilitate the realisation of increased milk solids production per hectare from home grown feed in future years.** The productivity gain indicators on which success will be judged over the next 5 years are outlined in the target column of Table 1 below.

In terms of the individual management practices, the challenge within the farm gate is essentially four fold:

- Environmental sustainability based on increased nutrient use efficiency;
- Grow more higher quality grass on each paddock within the farm;
- Manage for high animal performance and a long grazing season;
- Develop appropriate animals for high productivity within this system.

Table 1. A comparison of the Curtins farm production system 2001-2008

Year	2001-2005	2007	2008	Target
Stocking rate (LU/ha)	2.5	2.65	2.89	3.3
Concentrate (kg/cow)	350	190	275	-
Fertilizer (kg N/ha)	300	305	246	250
Grass growth (t DM/ha/yr)	12.5	14.7	16.0	18
Surplus feed (t DM/ha)	-	1.7	1.6	-
Milk solids (kg/cow)	500	478	420	450
(kg/ha)	1,250	1,254	1,220	1,500

Environmental sustainability based on increased nutrient use efficiency

Increased nutrient efficiency must be a primary objective of all production systems into the future and therefore, the optimisation of agronomic practices and strategies to minimise environmental impact are paramount within higher stocking density systems. The N surplus of a farm taking into consideration total N input (i.e. fertilizer and concentrates) and output (milk, meat and harvested feeds) can be used as a stable and informative index of efficiency of N use within the farm. Table 2 shows the farm gate surplus and N use efficiency for a range of Irish milk production systems. The mean annual farm-gate N surplus based on the average National Farm Survey (NFS) dairy farm is 162kg with N use efficiency of 24%. This is achieved at a stocking rate of 1.9 cows/ha, nitrogen input of 175kg N/ha, concentrate input of 669kg/cow and with a milk output of 638kg of milk solids/ha. Using data from Curtins farm average from 2001 to 2005 (McCarthy *et al.*, 2007), the mean annual farm-gate surplus was 226kg N/ha with an N use efficiency of 29%. This was achieved at a stocking rate of 2.47 cows/ha, nitrogen input of 300kg N/ha, concentrate input of 358kg/cow and a milk output of 1,225kg of milk solids/ha. The target for 2010 is that N surplus/ha is reduced to 155kg and efficiency is increased to 43% with a milk output of 1,500 kg of milk solids/ha. These increases will be achieved through better grazing management (growing and utilising more grass), which also results in more active nutrient cycles (N, P, K, S), greater tactical use of chemical N fertilizer and increased use efficiency of organic N fertilizer.

Table 2. Effect of various Irish grass-based systems on N-use efficiency

	NFS[1]	CRT 2005[2]	CRT2010[3]
Cow intakes - grass (kg DM/cow)	2546	4040	3,516
- silage (kg DM/cow)	1272	1133	981
- concentrates (kg DM/cow)	669	358	324
Stocking rate (cow/ha)	1.90	2.47	3.3
Nitrogen (kg N/ha)	175	300	250
Milk solids (kg/ha)	630	1217	1,500
N imported (kg/ha)	214	320	274
N exported (kg/ha)	52	94	119
Grazing days (No.)	220	275	285
N surplus (kg/ha)	162	226	155
N efficiency (%)	24	29	43

[1]NFS - National Farm Survey, [2]McCarthy *et al*., 2007, [3]CRT 2010 – Curtins farm target.

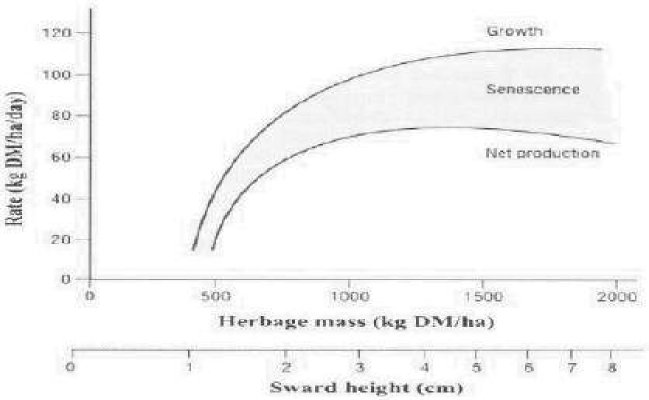
Growing more higher quality grass

The extent to which new growth occurs is dependant on soil fertility, climatic conditions (moisture, sunlight) and sward characteristics (variety and leaf area). The approach to maximising pasture production has focused on creating the ideal environment for growth by:

- Annually reviewing soil fertility

- Maximising sward sunlight penetration by grazing to 3.5cm residual height. The sward grazing residual, combined with grazing interval and pre-grazing height are the primary determinants of overall pasture production, where net pasture production results from the difference between pasture growth and decay within the sward. Optimal growth will be achieved by grazing to keep stem compressed and the growing point below grazing height. If stem is allowed to elongate, the growing point will be removed during the grazing process resulting in reduced regrowth rates. The optimum postgrazing height for net pasture production is 3.5cm. In poorly grazed swards (>4cm residual), the remaining material decays while the shading effect of this material prevents light reaching the primary growing points (newly formed tillers at the base of the sward). Figure 1 below illustrates the impact of residual grazing height on net leaf production from the sward.

Figure 1. Relationship between herbage mass and leaf growth, leaf senescence, and net herbage production in continuously grazed swards (adapted from Bircham and Hodgson, 1983)



When residual grazing height is 6cm, approximately 30% of the material remaining in the sward is senesced and unavailable for future production. At a practical level, grazing to 3.5cm removes the requirement for topping, which further reduces total annual production by 3 to 5%.

- Maximise sward leaf area by realising the optimal grazing horizon. Leaf area within the sward determines the portion of incoming solar radiation that is intercepted and absorbed by green leaf. While maintaining an optimal grazing residual will ensure green leaf availability to the sward base, ensuring that the pregrazing herbage mass is maintained at 1,200 to 1,400kg DM per hectare will ensure that the postgrazing pasture is leafy to the base and capable of trapping light from the day of grazing.

- Identify and reseed 15% of the lowest productivity sward each season. At high stocking rates, feed budgetary requirements will restrict opportunities for reseeding. Spring reseeding in mid-April will allow area to be removed from the system for 7 weeks without influencing the overall feed budget. Varieties currently being used include Tyrella and Bealey.

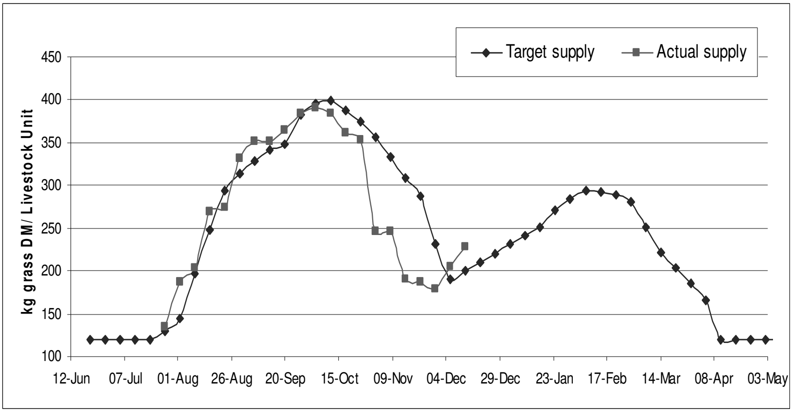
Manage for high animal performance over a long grazing season

Within the context of the grazing residual criteria outlined above, management practice will continue to have a significant impact on the ability of herds to achieve high animal performance over an extended grazing season. In this respect there are three critical components:

a) An understanding that production today is of less importance than production for the year.

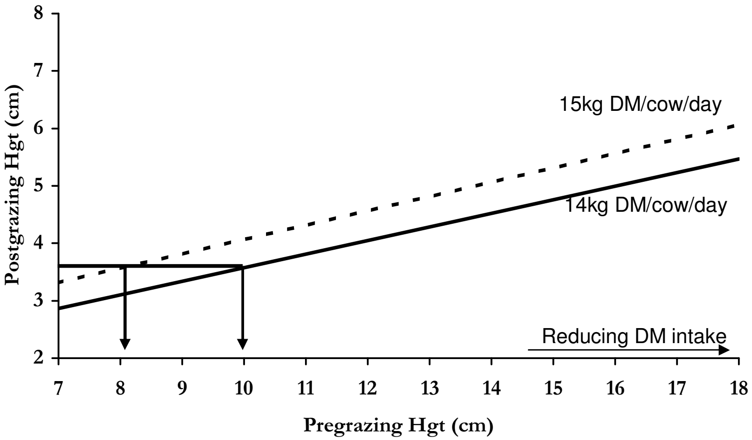
b) Measurement and feed budgeting. As stocking rates increase, the financial implications of deviation from the herd feed budget are likely to cause significant financial loss. On that basis, management practice must be disciplined to react swiftly (based on measurement) to any surplus/deficit within the system. Figure 2 below represents the feed budget for Curtins farm over the winter/spring period and illustrates how immediate reaction to unanticipated changes to pasture growth can ensure that minimum additional cost is incurred while still extending the grazing season into late November.

Figure 2. Curtins farm feed budget 2008/2009



c) Maintaining the grazing horizon. The DM intake of the dairy herd is partially determined by residual grazing height, but also by the relationship between pregrazing herbage mass and postgrazing residual height. As evident from Figure 3 below (INRA, 2007), a DM intake of 15kg per cow per day will only be achieved where pregrazing sward height is maintained at 8cm. For every 1cm increase in pregrazing sward height above 8cm, pasture DM intake will be reduced by 0.5kg DM per cow per day or equivalent to 0.11kg MS per cow per day.

Figure 3. The relationship between pasture pregrazing height, pasture postgrazing height and DM intake per cow per day (adapted from INRA, 2007)



d) Changing cow behaviour to increase DM intake. The habitual behaviour of dairy cows is often ignored by dairy farmers and can have important consequences on animal performance from pasture. Previous grazing behaviour experiments have observed two main grazing bouts during the day, one in the morning and another in the evening (Linnane *et al*., 2001; Rook *et al*., 1994), generally coinciding with the time cows return to pasture after milking. Kennedy *et al*., (2009) designed an experiment to manipulate cow grazing behaviour to increase daily DM intake and maintain performance during periods of inclement weather. The hypothesis of the experiment was to restrict access time to pasture, to periods of the day when advantage could be taken of the cow's natural instinct to graze/forage – early in the morning and later in the evening. Three treatments were used during the experiment; cows at grass full-time between milkings (24hr), cows at grass for 9 hours between morning and evening milking only (9hr) and finally cows at grass for 2 periods of 3 hours after each milking (2x3hr) with no silage offered to animals when housed. Table 3 below illustrates the results from this experiment.

Table 3. The impact of restricted access time on animal performance and grazing behaviour

Access time (hr)	24	9	2×3
Milk solids yield (kg/day)	1.7	1.7	1.6
Grazing time (hr/day)	9.0	7.2	5.8
% of time spent grazing	41	80	97
DM Intake (kg/cow/day)	17.4	15.7	16.6
% of 24hr intake achieved		90	95

Kennedy *et al.*, 2009

The results show that where cows are given access to pasture for only 6 hours per day in two three hour blocks/periods, animals have a much greater grazing efficiency, and will compensate for the short access time by adjusting their natural grazing behaviour (grazing time and bite rate) to achieve 95% of total 24 hour intake through increased foraging behaviour during the grazing window. On the basis of this study, management practice has been adjusted to restrict access time during inclement conditions, while providing no silage to animals at housing thereby ensuring a greater compulsion to graze at the next allocation.

Develop appropriate animals for high productivity within this system

The system as outlined above is based on creating the ideal environment within the farm to grow higher quantities of higher energy pasture which can in turn feed additional animals and consequently realise new levels of productivity. This process will only be successful if animals capable of high milk solids production, good reproductive performance and satisfactory BCS can be identified for higher stocking rate systems. Recent results at Teagasc Moorepark (Coleman *et al.*, 2008, Table 4) have shown that higher EBI animals will deliver increased milk solids production within the context of such systems, while exhibiting superior reproductive performance to lower EBI animals. The results also indicate that the overall level of reproductive efficiency within such systems is sub-optimal and therefore continued genetic selection for fertility traits will be required to achieve desirable levels of reproductive efficiency.

Ultimately, excellence in grassland management will reach a certain energy production capacity within the farm gate at which point further increases in productivity can only be realised through increases in feed conversion efficiency. While Irish dairy farms are many years removed from reaching the feed production capacity of their farms, the selection of animals with increased feed conversion efficiency must now begin in earnest to realise such animal characteristics in advance of this necessity. On that basis, recent results from the New Zealand Cattle Database (LIC, 2007) show that within the New Zealand cow population, high genetic potential (EBI/BW) Jersey cross-Holstein-Friesian progeny outperform the two parent breeds in terms of lifetime productivity, survival and feed conversion efficiency (Table 5).

Table 4. The impact of genotype on the milk production and reproductive performance of Holstein-Friesian dairy cows within likely futuristic pasture-based production systems

Genotype	NALow[1]	NAHigh[2]	NZHigh[3]
EBI (€)	46	90	84
Milk subindex (€)	36	41	41
Fertility subindex (€)	12	41	50
Calving date (Day of year)	28- Feb	22- Feb	18- Feb
Concentrate (kg/cow)	215	213	225
Milk solids (kg/cow)	435	439	437
(kg/ha)	1,121	1,138	1,175
Average lactation weight (kg)	562	566	540
Average lactation BCS	2.73	2.77	2.89
24 day submission rate (%)	73	93	90
Pregnancy rate in 42 days (%)	51	63	69
Empty rate (%)	23	19	15

[1]North American Low EBI, [2]North American High EBI, [3]New Zealand High EBI

Table 5. Productive performance and measures of efficiency of the major breed groups of dairy cattle in New Zealand (production season 2006-07; Livestock Improvement, 2007)

	Breed of cow		
Measurement	Holstein-Friesian (F)	Jersey (J)	Crossbred (JFX)
Number of lactating cows	942,121	344,785	749,713
Lactation length, days	220	223	223
Milk solids yield kg	335	296	334
Live weight, kg	468	381	442
Pasture dry matter required, kg[1]	4454	3732	4234
Feed conversion efficiency[2]	75.2	79.3	78.9

[1]Pasture dry matter required for production, maintenance and pregnancy calculated according to AFRC (1991).
[2]Feed conversion efficiency calculated as (kg fat + kg protein)/t pasture dry matter.

As illustrated in Table 5, Holstein-Friesian cows produce on average 34kg milk solids more than Jersey cows, but are on average 112kg heavier than Jersey cows. Holstein-Friesian/Jersey crossbreds are intermediate for productivity and liveweight in comparison with straight bred Holstein-Friesian and Jersey cows. Jersey cows have the highest feed conversion (kilograms of fat plus protein/kg pasture DM eaten) compared with the other breed groups. Consistent with this finding, a review of 11 experiments by Grainger and Goddard (2004) showed that Jersey cows had higher DM intake per 100kg live weight, and had higher feed conversion efficiency (g milk solids per kg of DM intake).

Conclusions

Recent research results within Irish grass-based systems demonstrate that considerable potential exists to increase pasture growth and quality beyond historical levels through improved management practice, in combination with a reseeding programme on poorly performing pastures. When this increase in sward productivity is matched with an appropriate stocking rate, the performance and profit potential per hectare of Irish dairy farms can increase significantly in a no milk quota scenario and on that basis management systems (animals and pastures) should now be implemented towards this defining objective.

(Weekly updates on research herds at Moorepark are available online at: www.agresearch.teagasc.ie/moorepark)

Acknowledgements

Teagasc Moorepark wishes to acknowledge National Dairy Levy, NDP and EU Funding for this research.

References

Bircham, J. and Hodgson, J. (1983). The influence of sward condition on rates of herbage growth and senescence in mixed swards under continuous stocking management. *Grass and Forage Sci*. **38**: 323-331.

Coleman, J., Horan, B., Berry, D., O'Connor, P. and Rath, M. (2008). The influence of genetic selection and feed system on the milk production performance of spring calving dairy cows. (*Pers. Comm*.).

Grainger, C. and Goddard, M.E. (2004). A review of the effect of dairy cow breed on feed conversion efficiency - an opportunity lost? *Proc. 25th Biennial Conference of Aust. Soc. of Animal Prod.* University of Melbourne, Victoria July 4-8.

INRA, (2007). Alimentation des bovines, ovins et caprins, Besoins des animaux – valeurs des aliments. ISBN: 978-2-7592-0020-7, ISSN: 1952-2770.

Kennedy, E., McEvoy, M., Murphy, J.P. and O'Donovan, M. (2009). Effect of restricted access time to pasture on dairy cow milk production, grazing behaviour and dry matter intake. *J. Dairy Sci.* (*In press*).

Livestock Improvement (2007). Dairy statistics 2006 – 2007. *Livestock Improvement Corporation*, Hamilton, New Zealand.

Lips, M. and Rieder, P. (2005). Abolition of raw milk quota in the European Union: A CGE analysis at the member country level. *J. Agric. Econ.* **56**: 1-17.

Linnane, M.I., Brereton, A.J. and Giller, P.S. (2001). Seasonal changes in circadian grazing patterns of Kerry cows (*Bos Taurus*) in semi-feral conditions in Killarney National Park, Co. Kerry, Ireland. *Appl. Anim. Behav. Sci.* **71**: 277-292.

McCarthy, S., Horan, B., Dillon, P., Berry, D.P., O'Connor, P., Rath, M. and Shalloo, L. (2007). Economic comparison of divergent strains of Holstein-Friesian dairy cows in various pasture-based production systems. *J. Dairy Sci.* **90**: 1493-1505.

National Farm Survey (NFS) (2007). Teagasc, Athenry, Ireland.

O'Donnell, S., Shalloo, L., Horan, B. and Butler, A.M. (2008). A survey analysis of opportunities, challenges and limitations of Irish dairy farmers. *J. Farm Management* (*In press*).

Philpott, B. (1995). New Zealand aggregate and sectoral productivity growth 1960-95. *RPEP Paper 274*, Victoria University, Wellington, New Zealand.

Rook, A.J., Huckle, C.A. and Penning. P.D. (1994). Effects of sward height and concentrate supplementation on the ingestive behaviour of spring-calving dairy cows grazing grass-clover swards. *Appl. Anim. Behav. Sci.* **40**: 101-112.

Shalloo L., Dillon, P., Rath, M. and Wallace, E.M. (2004). Description and validation of the Moorepark Dairy Systems Model. *J. Dairy Sci.* **87**: 1945-1959.

Van Berkum S. and Helming, J. (2006). European dairy policy in the years to come: impact of quota abolition on the dairy sector. *Agricultural Economic Research Institute*, P.O. Box 29703, 2500 LS The Hague, The Netherlands.

A strategy for growth

Bill O'Keeffe
Conna, Co. Cork

Background

The farming business is located in Conna, Co Cork. Experience gained in New Zealand in 1997/98, suggested that the farming business needed to be stream lined. The existing mixture of winter and spring milk producing 120,000 gals, pedigree Limousin breeding and pig fattening was not sustainable.

To be successful in the future, it was decided to focus exclusively on milk production; and the most profitable simple way to do this was to have a spring calving grass system. It took two years to exit all the other farming enterprises and change the herd to a spring based system. In 2001 a further 70ha was leased from a neighbour, and in 2002, 53,000 gallons of quota was leased from Tipperary. Subsequently in 2005, a milk production partnership was entered into with a neighbouring farmer, bringing a further 20ha into the production base, plus an additional 20ha outside block. This operation brought a further 120,000 gallons into the system.

Why change the existing *status quo*?

- The need to be able to stand back from farming at various stages throughout year. The desirability of not being tied to the farm 24/7.
- The intent to keep pace with the standard of living of friends and acquaintances'.
- A desire to grow wealth and the business for the future.

The steps needed to achieve the vision – planning for future growth

Good staff

- In the initial stages of expansion the focus was very much on the cost side of staff. As a result of not having the right staff in place, business performance, animal performance and management performance suffered as a result. Experience gained is that the right people need to be in place from the start. The notion of 100 cows for 1 man, 200 cows for 2 men is fine when the system is up and running. When growing and expanding extra staff are needed in place. It takes time to bed a system in and extra help is needed in the initial stages for aggressively growing the business. It is very easy to underestimate the extra time and effort required.

How to access quota and land?

- Initially the land base was split in two blocks with a milking platform of 25ha. The opportunity of leasing a block of land which joined the two blocks presented itself, and was availed off. This then gave a milking platform of 70ha, and reduced cost by allowing more grass be made available the cows. The farm was now relatively lowly stocked (120 cows on 70ha). The next limiting factor was quota. This was successfully leased allowing cow numbers increase to 170. A partnership deal then presented itself. This facilitated increasing the land base further and growth in cow numbers, culminating in the employment of a second full time member of staff in 20056. Cow numbers increased to 300 and land base to 100ha milking platform.

How to finance rapid growth – cash-flow?

- An aggressive breeding policy to organically grow cow numbers was put in place. As well as the partnerships introducing stock to the operation (which contributed to the breeding program), an initial stock purchase was financed by bank debt. Debt levels had to be increased on the farm to allow investment in the necessary infrastructure. Productivity drops when introducing new animals and land blocks, and while the system beds down (the system has to carry the cost of keeping all the stock to grow the herd etc.). This has a major impact on cash flow.

<u>Budgets</u>

- It is important to budget realistically. They may not always work, but there needs to be some fat in the system. There must always be a plan B.

Mentors

- Advice is critical – there is a need for clear thinking. Pick mentors carefully!

Infrastructure

- There is a need to put infrastructure in place at the start. Whilst new roads were built etc., a 42 unit parlour did not come until later, and a considerable amount of time was wasted down through the years. A large herd demands the proper facilities for handing large numbers of stock.

Introducing new stock

- It is important to have the right type of animal for any given system. When amalgamating two herds small problems can quickly become big problems. It is easy to underestimated the next generation when focused on looking after cows in the parlour etc.

<u>System – core competency!</u>

- The core business is to produce milk as efficiently as possible, and day to day decisions should be focused around this principle.

Simplicity

- The system should be easy for staff to understand; one feed – grass; short calving pattern – spring;, not breeding and calving together (focus on one job); simple milking parlour; simple grazing system; small number of groups of animals on farm; one man operation for 6 weeks a year!

Cow Type

- Breed cows that have proven to be the best converters of grass to milk (Jersey cross). Easy calving sires.

Staff

- Staff need to be given responsibility for making decisions. This involves time and money on education and one-to-one training and mentoring (discussion groups, courses etc.). Staff are your eyes on the ground, and need to be capable of implementing target objectives.

Infrastructure

- Infrastructure needs to be in place that makes life easy for staff and stock.

Conclusions

- Have clear goals
- Plan properly
- Have the right systems in place

Grass measurement and budgeting to drive sustainable profits and better decision-making

Shane Phelan
Ballymacarbery, Co Waterford

Farm Details

The farm is nestled in the Nire Valley, part of the Comeragh Mountains, and rises in altitude to between 660 -700 feet above sea level. Land is classified as a brown podzol (heavy clay soil). This challenges growth rate on the shoulders of the grazing year.

- Grazing block = 90ha
- Quota size 468,000 litres (103,000 gallons)
- Farm supplies Glanbia Co-op
- Cow numbers:
  2005 = 85
  2006 = 90
  2007 = 96
  2008 = 124
  2009 = 135
- Herd EBI = €75
- Heifer calves 0-1 yrs = 53 (EBI €92)
- Weanlings 1-2 yrs = 35 (EBI €98)

Farm development since 2005

Farm infrastructure

The farm is setup for grazing. This means good roadways and paddocks. Paddocks were redesigned in size so that they are big enough for 200 cows. Each paddock has 2 to 3 entrances. This is vital so that in the spring and wet weather the paddocks can be accessed easily and on / off grazing practiced (critical for the soil type). All paddocks have access to water. New water troughs (350 gal tanks) were installed.

Reseeding

Table 1 shows the amount of reseeding completed since 2006. In 2006, 2.5ha were reseeded. This increased to 16ha in 2008. In total 30% of the farm was reseeded over the last 3 years. The method of reseeding has been to use a catch crop such as kale and rape, followed by reseeding in the spring. Weanlings are wintered on the catch crops and perform very well. There is not sufficient slurry storage for all animals, as the nitrate directive requires. Using the catch crops reduces wintering costs and improves performance. Reseeding costs for 2008 were €310/acre. The intention for 2009 is to reseed a further 20% of the farm (16ha).

Table 1. Hectares reseeded and percentage of farm reseeded since 2006

Year	2006	2007	2008	Total
Total hectares	2.47	7.65	16	26.12
% of farm	3	9	18	30

While development costs on infrastructure and reseeding are initially high, without this investment the farm could not be run as a viable unit. The intention is to get a good long-term return on investment.

System changes

The cattle enterprise was phased out in 2008. Cows and dairy herd replacements will be the only animals kept on the farm going forward. This means concentrating all efforts on full time commercial dairy farming. Table 2 below shows the herd profile. As can be seen a large proportion of the herd were 1st lactation animals in 2008. This slightly reduced average herd milk yield volumes for 2008.

Table 2. Herd profile (cow numbers)

	2007	2008
Overall cows	93	128
1st lactation	14	42
2nd lactation	14	11
3rd lactation	19	17
4th lactation	10	16
5th lactation (+)	36	42
07 calves	27	35

Breeding policy

Prior to 2005 the breeding policy was mainly to use Dairygold AI sires e.g. GMI, MFX and some Swedish/ Norwegian Red semen. Since 2005 the policy has been to use high EBI, New Zealand Friesian and Jersey semen.

Getting started

To become a top class grassland dairy farmer, it is necessary to be proficient with modern grass technology. A new Teagasc/Germinal grass budgeting project provided the learning environment. As a host farmer for West Waterford, there was a requirement to build up a team of support farmers. This support group was required to attend a farm walk every 3 weeks. Currently this group extends to 20 local farmers, aptly named '*Deise 1,250'*. (Why 1,250? The target for the group then was 1,250kg milk solids/ha).

A brief summary on the Teagasc/Germinal project

Basically there are 20 host farmers located from Westmeath in the northern half of the country, to West Waterford in the South, and from Ennis in the West, to Kildare in the East. Each of these host farmers is expected to measure and budget grass on a weekly basis. Around each of the farmers is a support group that visits the farm every 3 weeks, and in conjunction with the project leader, walk the farm. The group then makes written decisions based on the data recorded from the farm walk, and checks how previous management decisions were implemented. In the intervening weeks, the host farmer walks the farm, and the resultant budgets discussed with the project leader. The information is also submitted to the Teagasc client site and to the Grass Watch page in the Irish Farmers Journal. Both these facilities display all the host farmers' growth rate figures (visit http://www.client.teagasc.ie/ for more information and weekly details). Looking at all this information can be useful as you can see how others are getting on.

Results of measurement for 2008

Milk production

Milk yield per cow for 2008 was just over 5000l/cow at 3.50% protein and 4.29% fat (381kg of milk solids/cow). This is the milk-recorded figure adjusted up to the end of November (250 days in milk). Milk protein percentage rose by 0.2% while fat % increased by 0.35%. In 2008 over 30% of the herd comprised heifers.

In 2007 milk volume was higher at 5600kg/cow, but protein and fat concentration was lower at 3.29% protein and 3.85% fat respectively. The end result was that milk solids per cow were slightly higher in 2007 at 401kg of milk solids/cow. When measured on a per hectare basis, milk solids increased as stocking rate increased slightly. In 2007 milk solids was 670kg of milk solids/hectare rising to 705kg of milk solids/hectare in 2008 as stocking rate increased from 1.67 to 1.85 cows/ha.

Nitrogen fertiliser use in 2008

In 2007, 250kg N/ha were applied. In 2008 it was decided to follow nitrogen application advice for lower stocked farms. As a result in 2008, only 190kg N/ha was used. During the main grazing season, daily grass demand is low (35kg/day) so only relatively low amounts of nitrogen are required to produce the quantity and quality of grass necessary. However, there are challenges in the shoulders of the year to increase grass supply. More reseeding in 2009 will hopefully improve this situation.

Table 3. Fertiliser use in 2008 (kg N/ha)

Jan	0
Feb	34
Mar	43
April	29
May	18
June	18
July	18
Aug	0
Sept	34
Total	**191**

Meal

In 2008, 437kg meal per cow was used. From Table 4 below, it can be seen that the bulk of this feed was used in April when grass supply was tight. By having more grass at this time of year, it is hoped to reduce meal fed by 130kg/cow. In 2009 the hope is to reduce meal fed/cow to 350kg.

Table 4. Meal fed per cow/month 2008

Month	Kg Meal Fed / cow
Jan	0
Feb	35
March	77
April	130
May	29
June	0
July	33
Aug	32
Sept	36
Oct	40
Nov	24
Total	**437**

Grass production

Grass production/ha is low relative to higher stocked and fertilised farms (see Table 5). The best paddocks produced between 7 and 8t DM/ha. This data can be viewed in 3 ways. Firstly, without this data for the farm, it is impossible to set any benchmarks! Secondly, due to a low stocking rate, there is relatively low demand during the main grazing season so quantity of grass grown is not of primary concern. However, as more quota becomes available and cow numbers are increased, growing and utilizing more grass will become increasingly important. Off more concern is that the farm is growing less than 15% of total grass production between Feb. 1 and April 24. It s hoped that an increase in reseeding will produce more grass in the shoulders of the year and improve soil fertility.

Table 5. Grass grown in 2008 and % grass grown from Feb 1 to April 24

Paddock No.	Average Tons grown 2008	% Of grass grown from Feb. 1 – April 24
1	6.30	10.2
2	5.40	24.1
3	4.70	23.4
4	8.50	11.8
5	6.10	23.0
6	7.20	10.3
7	6.00	16.7
8	4.00	5.0
9	5.90	3.4
12	5.00	4.2
13	5.00	2.4
14	4.50	2.7
16	7.00	8.6
17	7.10	15.5
18	7.20	1.7
19	5.40	3.7
20	7.00	14.3
25	7.20	8.9
26	5.40	8.3
27	6.70	7.5
28	6.30	9.5
29	5.50	1.8
31	4.10	33.2
32	4.00	11.3

Grass management

Grass is grazed down to 3.5 – 4.5cm for the whole grazing season, which ensures good quality grass throughout. Pre grazing covers (the covers cows are going into) are kept below 1,500 kg DM/ha. At this level it's relatively easy to graze paddocks out properly.

In 2008, the milking cows were out day and night from February 7, and remained at grass until November 20. Weanling heifers remain out until December 1. The use of 'back fencing', good access and on/off grazing worked well in 2008, and without these tools utilization would have been considerably poorer than that actually achieved.

A sample of the grass that the cows are going into every week is sent to the Moorepark Grassland lab to test quality. It can be seen from Table 6 that grass quality remained high during the whole grazing season. Grass dry matter digestibility (DMD) remained high even for mid season grass production.

Table 6. Grass quality results for 2008

	Dry Matter (%)	DMD (units)	ME Grass	Protein (%)
Jan	13	78	11	25
Feb	18	81	12	26
Mar	18	78	12	21
April	23	79	12	18
May	20	83	12	23
June	19	81	12	19
July	14	78	11	21
Aug	16	75	11	21
Sept	13	75	11	24
Average		**78**	**11.8**	**22**

Soil testing

The farm was soil tested at the end of 2007. Soil pH was relatively low, and consequently lime was applied in 2008, with more required in 2009. The P and K levels are at index 4 and 2 respectively.

Table 7. Current soil fertility of my farm

pH	6.06
P index	4
K index	2

Things done well in 2008

- meal use reduced
- milk solids increased
- Nitrogen fertiliser usage down
- profit increased
- Improved grass budgeting skills

<u>Lessons learned from 2008</u>

- Developed an understanding of the true potential of farm
- **land type is not limiting**
- recording is crucial
- **mindset** is the hardest thing to change
- support farmers important
- reseeding is crucially important
- Spring is the best time of year for reseeding
- speed of reseeding is important
- Good to get grass results – you can see what grass quality is like
- easier to manage grass at higher stocking rates
- ●I need to increase my stocking rate
- a post grazing height of 3.5 - 4cm is achievable - it ensures high quality grass for the next grazing
- it is important to 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 excellent way to manage in wet weather

<u>Mid season</u>

- the farm is currently under stocked
- grazing lower covers mid season is important
- taking out higher covers fast is important

<u>Autumn</u>

- rationing grass is important in the autumn
- It can be difficult to reach autumn targets, and it may be necessary to introduce more meals to achieve these targets
- If target covers are not reached by mid Sept, then the rest of the year becomes a struggle. **[It is important to react in time]**

- minimise poaching

Explanation of low stocking rate

Overal stocking rate on the farm is 1.85 cows/ha. While cow numbers have increased, the drystock component of the business has decreased. Stocking rate, ranges from 1 cow/ha early in the season as cows calve, rising to a maximum of about 2.6 cows/ha as first cut silage is closed off. This means that the maximum demand for any week of the year is less than 40kg/day. Growing anymore than this may result in having to remove surplus grass as baled silage. Thus N rates are relatively modest, and high growth rates are not a prime objective as there is not the stock to utilize the grass. Long term the intention is to increase cow numbers as more quota becomes available.

A secondary objective (in the short term) is to manage grass to facilitate reducing inputs. It is important to appreciate that 70% of the farm hasn't been reseeded for 20+ years, and that the farm rises to 700 feet above sea level, which means less growth in February and March (none on the old paddocks until April). All of these factors are compounded by low stocking rate, which means less nitrogen in the main season as demand for grass is low. Taking all these matters into account, and following one of the wettest years on record, the results do not seem too surprising.

Goals

- Increase grass grown from 6 to 12 t/ha = €600/ha
- Increase stocking rate from 1.85 to 2.5 cows/ha
- Increase profit from €1200 to €2500/ha
- Increase milk solids from 705 to 1250kg milk solids/ha
- Breed more Replacements 30 to 40% Jersey X
- Personal Development Attend relevant meetings & training
- Staying focused Meeting like minded people
- Maintaining good work life balance Minimum 2 holidays/year!

Summary

Grass budgeting is easy! This is not a top performing farm today, but it will become one in the future. Embracing the latest technology is vital to improve the business. Measuring grass growth and budgeting provides a tool to control the farm business, and the confidence to face the next decade.

With the results from 2008, it is now possible to benchmark the farm against research data and the best farms. Data shows that the farm is under performing, but that it has considerable potential. Putting in place the correct infrastructure, reseeding, correcting soil fertility and improving the breed of cow will put this farm in prime position for the future.

'The greatest danger for most of us is not that our aim is too high and we miss it but that it is too low and we reach it' *(Michael Angelo)*

BVD – How big an issue is it and what can we do?

Ríona Sayers
Herd Health Research Officer, Teagasc, Moorepark.

Summary

- Non-regulated infectious diseases such as BVD are resulting in significant economic losses on Irish dairy farms e.g. a BVD outbreak in a 100-cow naïve herd can result in losses of approximately €30,000 through reduced fertility, peri-natal mortality and culling of persistently infected animals.
- The key to BVD control is identification and culling of persistently infected animals (PIs).
- The impact of BVD on the national herd can be reduced by implementation of on-farm health plans, which incorporate biosecurity, diagnostic testing and strategic vaccination.

Introduction

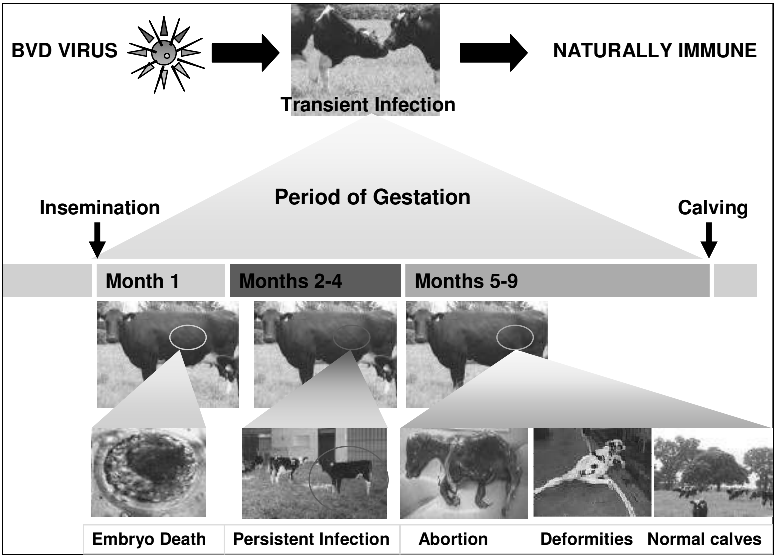
BVD (Bovine Viral Diarrhoea) is a highly contagious and economically important viral disease of cattle. It is a relatively new disease in Ireland, with initial reports of its occurrence dating back to the late 1980's, early 1990's. The prevalence of BVD in Ireland is unknown, although it is estimated that approximately 80-90% of Irish herds have been exposed to BVD virus. The impact of this disease in terms of farm profit and animal welfare should not be underestimated, and on-farm control programmes must be initiated in order to increase the health status of the national herd and to limit future on-farm losses.

Bovine Viral Diarrhoea (BVD)

Two types of BVD infection exist;

- <u>Transient viral infection (TI)</u>. This type of infection occurs when a previously unexposed healthy animal (naïve animal) becomes infected with BVD virus. This infection only lasts for a two-week period (approximately) and the majority of these transient infections do not result in clinical signs. On occasion, however, a severe transient infection (severe acute BVD) can prove fatal. Following a transient infection an animal develops long-lasting immunity.
- <u>Persistent viral infection (PI)</u>. This type of infection can only be generated by infection of an unborn calf between months 2 and 4 of gestation (Figure 1) i.e. calves are born persistently infected and will carry and shed BVD virus for their entire lives. PIs, therefore, can only be generated *in-utero*. It should be noted that PIs cannot be cured and will allow BVD virus to persist in a herd. PI animals can look perfectly healthy or may look noticeably below target weight.

Figure 1. Possible outcomes of BVD viral infection



From Figure 1, it can be seen that if the dam becomes infected with BVD (transient infection) for the first time during gestation, there are a number of possible calf outcomes depending on the time of gestation that the exposure occurs. If exposure and transient infection of the dam occurs during month one of gestation, embryo death will result with the dam returning to heat. If infection occurs during months two to four of gestation, a persistently infected (PI) calf will result. If infection occurs during months five to nine of gestation, a number of possible outcomes are possible and include abortion and calf deformities. Infection of the dam at this time can also result in the birth of healthy off-spring. BVD is also an immunosuppressive disease in that it reduces the efficiency of an infected animal's immune system, to the degree that other infectious agents are allowed to establish. On the basis of this range of possible effects, therefore, indications that BVD exists in a herd include:

- Poor fertility (conception rates, % empty);
- Increased number of abortions, stillbirths, weak calves, and/or deformities;
- Poor calf health i.e. unprecedented or undeserved level of calf scour and/or pneumonia;
- Occurrence of severe acute BVD;
- Occurrence of fatal mucosal disease. This is only possible in persistently infected animals and is characterised by very severe diarrhoea and rapid deterioration of the affected animal. This can be accompanied by respiratory

illness, lameness due to inter-digital ulceration and reduced appetite due to ulceration in the mouth.

How big an issue is it? A Case Study

The economic impact of non-regulated infectious diseases in Ireland can be clearly demonstrated by examining the effects that Bovine Viral Diarrhoea (BVD) can have in a naïve herd. A total of 47 heifers in a case study herd were served between November 16, 2007 and February 23, 2008 (14-week breeding season) to yield autumn calves in 2008. Poor fertility was noted during the breeding season (Table 1) with conception rates to first service well below target at 49%. Total number of services over the breeding period was 88, yielding 2.1 services per conception, again below target. A total of six heifers did not conceive yielding an empty rate of 13% (Table 1). A BVD control programme was initiated in this herd in July 2008. All autumn in-calf heifers (n=41) tested negative for BVD virus. The heifers began calving down on August 20, 2008. Of the 40 live calves submitted for testing, 18 tested positive for BVD virus. On repeat testing, only four calves had cleared the virus and were therefore classified as transiently infected. The remainder were deemed persistently infected, yielding a PI rate of 35%. The mean birth weight (BW) of the PI calves was 5kg lower than the mean BW of the non-PI calves. Outbreaks of both diarrhoea and respiratory illness were recorded in the autumn calf population. Prior to PI removal, approximately 50% of the entire calf group was affected with diarrhoea and/or respiratory illness. Based on the clinical picture recorded in this group of naïve animals, the overall cost of a BVD outbreak in a similar herd of naïve animals in terms calf mortality, calf morbidity and PI culling alone is estimated at approximately €9000 per 100 cow herd. Although it was not possible to quantify the exact contribution of BVD to the poor fertility parameters recorded in this group of heifers due to the unknown BVD status of previous autumn calving groups on the farm, it is worth pointing out that such a fertility picture in a 100-cow spring calving herd would result losses of €19500 (Table 1). This study demonstrates the productive and economic consequences of BVD infection.

Table 1. Potential financial loss due to a BVD outbreak in a naïve 100-cow herd

Calf-associated factors	Actual	Target	Cost/100 cows
Direct PI costs General calf health	€101.25	€11.30	**€8995**
Fertility parameters			
Conception rate to 1st service	49%	>60%	€6400
Serves per conception	2.1	<1.5	€2400
% Empty	13%	<5%	€10700
Total cost			**€19500**

As well as the direct on-farm costs of BVD as outlined here, it should be noted that many countries in Europe, as well as Australia and New Zealand, have implemented BVD control programmes in order to reduce the economic and animal welfare impact of BVD on their national herds. Ireland is currently lagging behind its global trading partners in the implementation of such a control programme. This situation will have to change in order to maintain Irish competitiveness in an increasingly challenging global market.

What can we do?

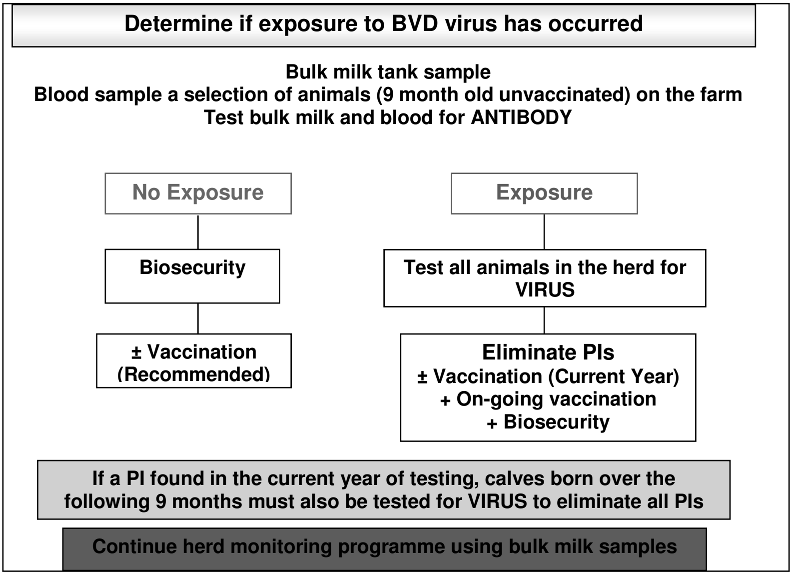
At farm level
Figure 2 outlines the steps that should be taken to determine if exposure to BVD has occurred in a herd, and the necessary follow up procedures should viral exposure be indicated. Briefly, it is first necessary to determine if viral exposure has occurred by testing a bulk milk sample and blood samples from a selection of 9-month-old (approximately) unvaccinated weanlings for ANTIBODIES to BVD virus. If exposure is indicated by a medium to high level of antibody in the bulk milk sample, combined with any or all of the weanlings testing positive for ANTIBODIES, control measures will have to be put in place. Both transient and persistently infected animals shed virus particles in all bodily secretions such as nasal and oral discharges, tears, milk and semen, but persistently infected animals shed significantly higher levels of virus, and as such, pose a greater threat to the herd. The key to BVD control, therefore, is culling of PIs, as these act as the constant source of virus in a herd. Following diagnostic testing, if a PI is found in the herd, **IT SHOULD NOT BE SOLD**. As the number of PIs identified in an adult herd is usually low (approximately 1-3 in a 100 cow herd), immediate culling of these animals should be undertaken. Under no circumstances should a known PI be kept in contact with the breeding herd or the cycle of BVD infection will continue. Once all PIs have been removed from a herd, biosecurity, routine diagnostic monitoring, and vaccination should be implemented to prevent re-introduction of the disease.

Vaccines play a hugely important role in the control of many infectious diseases. Their use, however, without the supporting knowledge provided by diagnostic testing and the implementation of a biosecurity plan, could potentially undermine their effectiveness in a disease control programme. It is essential that they be viewed as a component of a control programme but not the sole means of disease prevention within a herd. Over-reliance on vaccination, without the backup of proper management, biosecurity and diagnostics should be avoided with vaccine breakdown a potential consequence.

Biosecurity
Once complete PI removal has been achieved, biosecurity is the single most important contributor to the prevention of BVD re-introduction and subsequent losses on a farm. Biosecurity in its simplest form means the implementation of measures to prevent the introduction and spread of infectious diseases. It can be applied at a national level where measures are employed to prevent the introduction of a disease into a country. Biosecurity can also be applied at farm level, in order to prevent the introduction and spread of an infectious disease onto an individual farm. The higher the level of a particular disease in a country (prevalence of a disease), the stricter the biosecurity measures required to reduce the risk of disease introduction. With the already high prevalence of BVD in Ireland, biosecurity must now become an

essential component of good farm management both on dairy farms and at a national level.

Figure 2. Monitoring and control of BVD in a dairy herd



Implementation of a strict closed herd policy is a critical component of biosecure disease control. A closed herd policy (i.e. no cattle movement onto the farm, including bulls) will optimise protection against the introduction of BVD onto a farm. This critical risk factor for disease introduction will assume much greater importance in the future as dairy farms expand their herds through cattle purchases. The current lack of disease control measures for BVD will result in farmers having to resort to purchasing cattle of unknown disease status with the resultant biosecurity risks. In order to minimise viral disease risk when purchasing, therefore, the following biosecurity measures can be employed;

- 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.
- On day 21 of the quarantine period, newly purchased animals should be tested for BVD virus.

These procedures will minimise the risk of viral disease introduction and transmission in open herds.

As disease transmission can also occur by indirect contact with disease vectors, e.g. farm visitors, vehicles etc., the following procedures should be implemented on all farms, regardless of cattle movement, in order to minimise the disease risk.

- Footbaths – the use of well-maintained (cleaned and re-filled regularly) will reduce the disease risk on farms;
- Signage should be used to maintain awareness of biosecurity on farm;
- Basic veterinary equipment e.g. nose tongs, should be available on every farm; transfer of nose tongs from one farm to another without sufficient disinfection between farms can result in disease introduction;
- Separate disposable needles should be used for each animal when administering medications or taking samples;
- Separate rectal sleeves should be used for each animal when scanning, examining or treating cows;
- Vehicles visiting the farm should be kept at a safe distance from animal areas e.g. housing, holding yards, and roadways. This is particularly important in the case of knackery carcass collection vehicles, which should not be permitted to enter farms and should collect carcasses from the farm entrance only.

It is important to recognise that biosecurity measures, once implemented, will act as an insurance policy against viral infectious diseases. It is not a guarantee that a herd will remain disease free but it will significantly reduce the risk of disease introduction into a herd.

At national level
Many EU and non-EU countries are now implementing disease control programmes utilising bulk-milk testing in centralised laboratories to routinely screen herds, monitor their disease status, and promote implementation of appropriate biosecurity strategies. With the increasing prevalence of diseases such as BVD in Ireland, it is necessary for dairy farmers to take such practices on board in order to maintain competitiveness. In this regard, Teagasc, Moorepark, in co-operation with ICBF, has initiated a new herd health research initiative – the 'Herd Ahead' programme. This project aims to address the lack of recent published disease prevalence data for BVD and a range of additional diseases, and to then use that data as a basis for designing a dairy herd health strategy. This project will identify the non-regulatory infectious diseases requiring prioritisation in Ireland based on prevalence and economic impact data. The baseline data generated in this study will act as a benchmark from which the impact of future herd health strategies and their contribution towards sustainable dairy farming in Ireland can be measured. Ireland has the advantage of an exceptional data reporting system i.e. the ICBF database and HerdPlus reporting system, which can be adapted to allow efficient reporting of results and interpretation

of data and will pave the way for a health statement system for Irish dairy farmers. Diagnostics will play an important role in disease monitoring on dairy farms going forward and economical methods of sample collection and testing will be required. In this regard, the use of bulk milk testing in a centralized laboratory would provide the necessary vehicle to carry out economic and practical disease testing, as well as addressing the logistical concerns of running such a disease monitoring programme. Should such a milk-testing system be introduced and combined with the HerdPlus reporting system, a practical, economical and functional health screening system for Irish dairy herds could be implemented in order to maintain competitiveness in an increasingly challenging global market.

Conclusion

Diseased animals perform sub-optimally and decrease on-farm profitability through waste feed, labour and veterinary costs. By using the combined approach of biosecurity, diagnostic testing and vaccination on individual farms, control of BVD, both on-farm and nationally, will become feasible, will reduce the economic impact of this costly disease and will improve Ireland's trading status in future years.

Eliminate BVD from your herd by
1. Testing for and removing persistently infected animals 2. Designing and implementing a biosecurity plan including diagnostic testing 3. Vaccinating

References

Heuer, C., Healy, A., and Zerbini, C. (2007). Economic effects of exposure to bovine viral diarrhoea virus on dairy herds in New Zealand. *J. Dairy Sci.* **90**: 5428-5438.

Hoe, F.G.H. and Ruegg, P.L. (2006). Opinions and practices of Wisconsin dairy producers about biosecurity and animal well-being. *J. Dairy Sci.* **89**: 2297-2308.

Maunsell, F. and Donovan, G.A. (2008). Biosecurity and risk management for dairy replacements. *Veterinary Clinics of North America; Food Animal Practice*. **24**: 155-190.

Mee, J.F., Fahey, J. and Crilly, J. (1999). Breeding the dairy cow of the future - today's challenges. *Proceedings of the National Dairy Conference*. http://www.teagasc.ie/publications/ndc1999/index.asp

More, S. (2007). Shaping our future: animal health in a global trading environment. *Irish Vet. J.* **60**: 540-545.

More, S. (2008). A case for increased private sector involvement in Ireland's national animal health services. *Irish Vet. J.* **61**: 92-100.

Payne, M., Bruhn, M., Reed, B., Scearce, A. and O'Donnell. (1999). On-farm quality assurance programs: a survey of producer and industry leader opinions. *J. Dairy Sci.* **82**: 2224-2230.

Villarroel, A. Dargatz, D.A, Lane, V.A., McCluskey, B.J. and Salman, M.D. (2007). Food for thought for food animal veterinarians: Suggested outline of potential critical control points for biosecurity and biocontainment on large dairy farms. *JAVMA*, **230**: 808-819.

Sheep Ireland; new data, new indexes & new programs for Irish sheep farmers

Peter Amer[†], Tim Byrne[†], Pat Donellan[‡], Graham Potterton [‡], Mike Lynch[‡] and Andrew Cromie[‡]
[†]*AbacusBio Ltd, Dunedin, New Zealand,* [‡]*ICBF, Ireland*

Background.

ICBF has been very successful in accelerating rates of genetic progress for farm profitability traits for the dairy and beef industries in Ireland. A new initiative for the sheep industry is currently being rolled out by ICBF under the banner "Sheep Ireland". The intention is to bring state of the art animal identification, data capture systems, database technology, and genetic evaluation statistical methodology together, to support new recording and breeding program initiatives in the industry.

This new initiative in the sheep breeding area has been motivated by the struggling competitiveness of the sheep industry in Ireland, as clearly evidenced by the fall in sheep numbers over recent years. As in many other countries, historic efforts to bring about genetic improvement using scientific means have suffered from poor adoption rates, and with some exceptions, have tended to focus on a restricted range of growth and carcase traits. A lack of recognition of the benefits of these genetic improvement efforts by commercial sheep farmers in Ireland has further stifled any incentives for sheep breeders selling rams to take part.

A strategy project team made up of sheep breeding experts from Ireland and New Zealand engaged with stakeholders in the Irish sheep industry in August 2008 *(Amer et al., 2008)*. The strategy team put together a set of recommendations for the development of sheep breeding in Ireland. This paper provides an update of progress towards meeting many of the objectives set out by the strategy project team, and also attempts to put forward some practical reasons for the changes proposed.

A broader base of evaluation

From a commercial farmer's perspective, breeding decisions are effected via the choice of rams that are mated to breeding ewes. The ram purchasing process must encompass a choice of one or more breeds, a choice of one or more breeders, and a choice among rams available for sale. In the absence of scientific data, the choice must be based on breed and/or breeder reputation, and on the physical characteristics of the rams. Breed reputation is sometimes influenced more by marketing than substance, and breeders can tend to focus on very intensive management to put forward, large, early born, very well fed rams for sale. Physical characteristics of rams provide some assistance, but once rams with obvious genetic faults are removed from those available for sale, it is very difficult to distinguish by eye the true genetic differences between a genetically superior late born twin and a genetically inferior early born single.

The immediate impact of the commercial farmer's choice of rams will be on the lamb crop that follows subsequently. However, impacts of individual rams are commonly masked by seasonal differences between years, and the difficulty in identifying which lambs came from which rams. For rams from which replacement females are retained, there are much longer-term impacts. For example, the 70 brothers of a group of 30 young replacement breeding ewes may have attracted premiums of €5 each (i.e. €350 extra profit), but if the 30 replacement breeding ewes wean 0.1 less lambs each over successive lambings (3 lambings x 30 ewes x €40 margin per lamb x 0.1 less = €360 lost revenue), require replacement at an average of 4 years of age instead of 4.2 years of age (7% more replacements at €165 per replacement x 30 ewes = €350), and require 1/4 hour extra labour per ewe each year at €17/ hour (3 lambings x 30 ewes x €17 x 1/4 = €380, compared with the current flock, then the farmer will be substantially worse off (€350 from brothers - €360 - €350 - €380 = -€740). In this context, there is clearly a need for a broad focus in genetic improvement efforts.

Focus on profit traits, with new emphasis on 'Easy-care'.

Sheep Ireland aims to develop breeding values for a wider range of performance traits and indexes with a higher emphasis on maternal performance. This will shift the focus of breed selection to include more economically relevant traits alongside the established terminal traits of importance. To improve commercial ewe performance, the emphasis must be on maternal traits that will lead to lower cost and easy care sheep. It is acknowledged that there is a need to consult with, and inform industry partners so that real gains in profitability will be made, if such genetic improvements can be achieved. Achieving these goals will increase the uptake of performance recording by breeders, allowing them to utilise a tool to make better breeding decisions but very importantly will give commercial farmers more information to aid in ram purchasing decisions.

<u>Overall index and relevant sub-indexes.</u>
The new indexes are based on the same profit principles as the dairy EBI & beef €uro-Star systems and will likely include:

- a production index taking in breeding values for growth and meat traits;
- a lambing index taking in performance in lambing difficulty and lamb survival;
- a maternal index taking in the performance of the daughters in lambing difficulty, maternal lamb live weight, number of lambs born, lamb survival, and ewe mature weight,
- and a later developed health index including breeding values for foot health and parasite resistance;
- an overall index which identifies rams suitable to breed flock replacements for a typical sheep farm in Ireland;
- an overall index which identifies rams suitable for use as a terminal sire for a typical sheep farm in Ireland.

Capturing value from all possible data sources

As we move into the 21st century, information capture is increasingly part of our everyday lives. For the Irish beef industry, the capture of data from the meat plants, from animal registrations, and as part of the suckler cow welfare scheme, provides a huge quantity of useful data that is unmatched by any other beef breeding evaluation system in the world. Industry data facilitates comparison of animals across breeds, and evaluates their performance in the true commercial environment. *The proof of the pudding is in the eating!* The same competitive advantage that will rapidly accrue to the beef industry in Ireland through better identification of superior breeding bulls must be strived for by the sheep industry. A more structured approach is required for sheep, than is sufficient for beef, because of the difficulty of tracing sires of lambs on commercial farms. For this reason, two new breeding initiatives are being put in place for data capture.

The new breeding scheme

A new breeding scheme makes up part of the new genetic improvement strategy. This will include the development of a national central progeny test (CPT), supported by data collected from a number of maternal lamb producer (MALP) groups. The CPT flocks are modelled on a very successful system in New Zealand. Rams from a diverse spread of performance recording flocks are mated to central groups of ewes and their progeny recorded in some detail for their performance both as lambs for slaughter, and also as replacement breeding females. In time, this structure will provide strength and validity to genetic evaluations of rams in performance recording flocks throughout Ireland.

MALP groups are composed of commercial farmers recording data to identify which rams deliver gains in ewe performance in their flocks and which ones do not *(Byrne, et al., 2009, In press).* Data will feed back into the central database and evaluation systems to help participating pedigree breeders identify superior rams. The program also requires participating farmers to swap animals to create so-called "genetic links" that allow genetic comparisons between rams from different flocks. Lamb performance data will be linked back to sires using DNA.

The focus of the proposed breeding schemes in the Sheep Ireland genetic improvement program is to increase recording by breeders to include additional economically relevant traits such as lambing difficulty. The rationale behind the MALP group scheme is to, not only provide valuable data which will be linked to a proposed CPT, but also provide a convincing demonstration of the range in genetic merit among a group of rams. The focus is on the financial and management impacts of using rams with the appropriate traits to improve income and decrease costs.

The MALP scheme currently involves some 23 commercial farms of sizes ranging from 80 to 1020 breeding ewes, assembled into five groups, involving a total of 224 rams and 8000 ewes. These commercial farms are spread over geographically diverse locations running a range of breeds, to provide regional interest and relevance to a variety of land types and production systems. Within each of the groups rams have been swapped during the mating season to provide genetic links between farms and therefore enable a comparison of rams across the group. A minimum of 2 rams have been used as links between participating farms to ensure adequate genetic linkage is obtained. Hence of the 224 rams, 70 will provide genetic linkage between flocks and between groups. Rams will also be used to link between years.

A very important aspect of this system is that the MALP scheme aims to assess the commercial producers' own rams. This ensures transparency in terms of the results. All of these rams are from pedigree flocks (i.e. they have a pedigree identity). In addition, rams from each of the major recorded breeds (Suffolk, Texel, Charollais, Belclare and Vendeen) will be selected from existing performance-recorded flocks for inclusion in the future in order to facilitate links between the MALP and CPT.

This structure also presents a great opportunity for breed societies to make significant contributions to the sheep industry through improvement and dissemination of elite breeding animals, and encouragement of performance recording by members. There will be opportunities to showcase the performance of elite rams from their respective breeds across a wide range of commercial environments. Genetic linkages formed between the CPT, MALP and pedigree flocks will allow valuable data from relatives (progeny of elite sires), whose performance will have been recorded in commercial environments, to feed back to predictions of genetic merit in pedigree animals.

New technologies

The MALP scheme also provides an opportunity to demonstrate the use of electronic identification and DNA technology in sheep breeding. In order to maintain individual animal identification in a commercial farm environment, all ewes and their progeny are to be electronically tagged using low frequency electronic identification. This will simplify data collection for all traits and also simplify animal management (drafting, feeding management and record keeping). The real value proposition lies in the use of the data collected via electronic identification in the generation of information that can be applied on-farm to increase efficiency (e.g. culling of poor performers), and reduce costs on farm (cull for persistent lameness).

DNA parentage allows the producer to not only minimise the disturbance of lambing ewes and accurately identify each lamb to a dam, but also provides the opportunity to store blood samples that may be potentially valuable in the future. DNA parentage will be used in the MALP and CPT programs to allow commercial multi-sire mating, ensure accuracy of parentage recording, and reduce the workload required at lambing. This will mean that all ewes, rams, and lambs will be DNA sampled.

Challenges remaining

While the majority of key technical hurdles facing Sheep Ireland have been overcome, there will be much to be learned from the new data and how best to use it. It will take some time for the new data to build up, and it is anticipated that estimated breeding values for new traits, as well as new sub-indexes will be released over time as the necessary testing and industry consultation steps are worked through.

Another area requiring further thought over the next few years is that of how Sheep Ireland can build, along with breed societies, adoption and dissemination structures that result in identified elite breeding animals having their favourable genes spread into commercial flocks as quickly as possible.

Conclusions

There is much to be gained by the sheep breeding industry in Ireland from the new data, new indexes and new breeding programmes being rolled out by Sheep Ireland. A huge amount of work has been going on behind the scenes leading up to the launch. A number of key hurdles have been overcome, and it is now time for the wider sheep industry in Ireland to get behind these new initiatives to drive the dissemination of the genetic improvements for the future good of the industry.

References.

Amer, P.R., Fennessy, P.F., Rohloff, M., Byrne, T.J., Hanrahan, S., Keady, T., McHugh, M., Veerkamp, R., Cromie, A. and Wickham, B. (2008). Breeding profitable sheep in Ireland; Recommendations to the interim Sheep Board from the Sheep Strategy Team (September 2008).
http://www.sheep.ie/publications/files/Appendix_1_Strategy_Project_Team_Report.pdf

Byrne, T.J., Amer, P.R., Fennesy, P.F., Rohloff, R.M., Cromie, A., Donnellan, P., Potterton, G., Hanrahan, S. and Wickham, B. (2009). Progress in the development of breeding schemes for the Irish sheep industry; maternal lamb producer groups. *Proc.18th conference of association for the advancement of animal breeding and genetics. Barossa Valley South Australia. Sept 28 to October 1, 2009. (In press).*

What do we need from sheep breeding in the future?

Crosby Cleland
21 Greens Road, Saintfield, Ballynahinch, BT24 7EE

Introduction

Sheep farming should be like any other business, managed to make a profit. In this instance the sheep business is managed along side a fencing business. Both require raw materials, which through hard work are processed into a final product and sold to generate income. If the business is to be successful the income generated must leave a margin over costs. One business is not allowed to subsidise the other.

How are the businesses assessed?

	Agricultural fencing	Sheep farming
Area	Within 100 mile radius	70 Hectares (172 acres)
Labour	0.75 units (owner) 0.25 units (Fence Yard Manager) 3 fence teams	0.25 units (owner) 0.75 units (farm manager) 1-2 units available for 5-6 main roundups (shearing, showering, weaning, scanning, lambing, etc.)
Inputs	Source inputs throughout Europe based on value for money.	Buying inputs through a Group. Genetics are purchased or reared on farm. The latter are performance recorded through the Shearwell Farmwork programme with the pedigree Lleyns also genetically evaluated through the Signet Sheepbreeder Service.
Outputs	The owner is a price setter based known input costs such as labour and materials.	Owner was a price taker irrespective of input costs, until recently. Now involved in a new initiative with a local food processor to supply a leading multiple. Costs of production are valuable in building trust through this relationship.

Key business data

In today's world there is a tendency to suffer from information overload. Too much data often confuses and leads to too few business decisions. Keep it simple and focus on one thing at the time. Currently the focus is on labour. Having an excellent farm manager means that some staff can be assigned from fencing to sheep duties when needed, but all labour is paid for and must provide a return.

- **Input costs and output prices**

  Lamb prices are currently fairly buoyant. In 2008 each kg of lamb carcase sold averaged £3.13 (46% of lambs sold dead weight, 20% lambs sold as stores and 34% lambs sold for breeding). Live sales are converted to deadweight prices assuming a 44% kill-out. Unfortunately due to rising input prices it cost £3.18 to produce each kg of lamb. Therefore it required money from the Single Farm Payment to cover these losses, and this cannot be allowed to continue.

- **Labour**

  Labour accounts for a third of input costs at over £1.00/kg. It is the highest single cost to the business.

Actions to reduce labour costs on the farm

<u>Farm and flock size</u>

At present the farm extends to 70ha of grassland, supporting 700 lambing ewes and a further 300 hoggets and shearling rams as followers. Current stocking rate is approximately 12 ewes/ha. A recent report presented to a NI Task Force examining the production and processing costs associated with beef and lamb concluded that full time sheep farmers would require 1300 ewes to make the average industrial wage. This will create some difficult as existing management policy dictates that land is only rented close to the farm. This is based on experience that land more than 2 miles away costs an additional £15 above rental price per acre in labour and transport. Calculations suggest that if the flock could be expanded to 1000 ewes, labour costs would reduce from over £1 to £0.70/kg carcase weight. There is no point in wasting effort complaining about the price of lamb, this is not under farmer control. Better to re-organise resources so the business can compete with flocks around the world where one labour unit looks after up to 5000 ewes.

There is a need to maximise output/ha, through stocking ewes capable of weaning their own body weight when lambs are 14-16 weeks of age

<u>Efficiently sell each lamb for maximum returns</u>

Selling lambs through the local marketing group is labour efficient. It replaces the need to spend 4 hours each time a batch of lambs is taken to the local live market. Such savings could represent £1/lamb. Selling direct to the processor also provides the business with valuable feedback about the product produced. This information can then be used to make informed selection decisions, on a weekly basis. In the future the slaughter profile of lambs will be the basis of a supply contract agreement with a food processor. By building relationships with the processor and retailer, vital feedback on lambs will be coming directly from the customer, e.g. eating qualities, such as tenderness and succulence.

The flock must consist of fertile ewes, which all lamb in a short period of time and are capable of mothering and growing their lambs quickly. Terminal sires must produce lamb with the desired eating qualities

<u>House stock during the winter to make feeding easier</u>
In a typical year, all sheep are removed from owned land by mid December. This means there should be high quality spring grass to offer triplet bearing and poorer ewes from February onwards. A proportion of the flock is housed and the remainder grazed on neighbouring dairy farms. In 2008, 600 ewes were housed and offered silage at a cost of 45p/hd/week. The remainder of the flock were grazed (off farm) at a cost of 45p/hd/week. It took 45 minutes per day to check the ewes in the house whilst it took 2 hours to travel and check those grazing 'off farm'. Housing is much more labour efficient but has associated fixed costs. However, these are offset to some degree by subsequent usage over winter, as well as for roofed handling facilities year round. All sheep are housed by January 10 when scanning usually takes place. Triplet bearing ewes are separated, and in early February are split into groups of 15 - 20 depending on breed and condition, and allowed out to grass at the far end of the farm. As lambing approaches, the triplet bearing ewes are grazed closer to the lambing yard and during lambing they are allowed to lamb outdoor in paddocks adjacent to the lambing pens. If a ewe wants to produce 3 lambs, I will let her have them, but it's important her nutrition is managed properly.

I can house more ewes if they are of medium size

<u>Lambing at grass outdoors?</u>
Whilst there are massive potential labour savings with outdoor lambing, in this system the majority of ewes are lambed indoors. **Lambing is the most important time of the sheep year, and hard work for 3 weeks sets up the farm for profit for the rest of the year**. As the farm is on predominantly heavy clay soils that do not soak particularly well, severe weather at lambing is always a risk. Lambing dates would also need to be moved back a couple of weeks to ensure sufficient grass, remembering also that the ram does not go out until later in November, so grazing will not be closed of until January and so on. A further consideration in trying to establish a closed flock, is the need to record birth weights, lambing ease, individually tag lambs, match up individual lamb numbers with their mothers, tail and castrate lambs; this can be carried out a lot easier from the house before allowing the stock out to the young fresh grass.

There is a need for ewes that can lamb without assistance and terminal sires capable of producing lambs, which can be born easily. Also need sources of recorded genetics bred for easier lambing

Maximise production from grass/clover

Grass is the cheapest feed to grow, but with unpredictable weather it can be very difficult to utilise efficiently. Grassland is typically reseeded every 7-10 years with mid to late heading ryegrasses and 1.5kg of small and medium sized clover seed in the mix. In recent times the grass varieties used have all been high sugar. In addition chicory has been added to the mix in fields used only for grazing. This should help keep lamb worm burdens under control; as well as promote lamb growth rates as grass quality diminishes in the autumn. To maximise production from grass, sheep need to be selected to thrive and finish when offered grass only. The efficiency with which lambs convert concentrates to carcase weight is very poor (10-14kg concentrate: 1kg carcase weight), and the labour to carry the concentrates makes it unviable. In recent years particular interest has been paid to fat depth Estimated Breeding Values when selecting rams, with rams carrying very little fat avoided.

Ewes must produce lambs which are capable of being finishing when offered grass only

In summary

Ewe genetics

- Lamb unassisted
- Display excellent maternal behaviour, including milk production
- Mature weight 65kg
- Wean their own body weight of lamb
- Display resistance to major health threats such as worms, footrot and mastitis
- Able to produce 5 lamb crops

Ram genetics

- Rapid growth from grass only diets
- Produce 17-20kg carcase weight with acceptable fat cover
- Produce lamb with the desired eating quality traits
- As shearlings and older rams be capable of mating 150+ ewes

In this paper the focus has been on the genetic material needed for the business to be successful in the future. However, what the industry needs are breeding programmes and the breeders willing to use them, to deliver this genetic material to commercial lamb producers.

Finishing lambs in the summer

Michael Mc Hugh
Teagasc

Introduction

In midseason lambing flocks, grass forms the major part of the lamb's diet. In well-managed grass based systems, good quality grass will supply sufficient energy and nutrients to have lambs reach target slaughter weight for age. However, in recent years on many sheep farms, lambs fed grass only diets are not achieving growth or drafting targets, and other diets (mainly concentrates), are been used to finish lambs to slaughter weight.

The 2008 Teagasc Sheep Profit Monitor shows that on average, the total variable cost of producing a lamb in 2008 was €35.55. Concentrate is the single largest variable cost amounting to €13.10/lamb or 36% of total variable costs. Even on the top 1/3 farms, concentrates are costing €11.80/lamb or 36% of total variable costs (€32.30). Many farmers are opting to feed meals so as to finish lambs earlier to avoid price falls in the market due to late finishing.

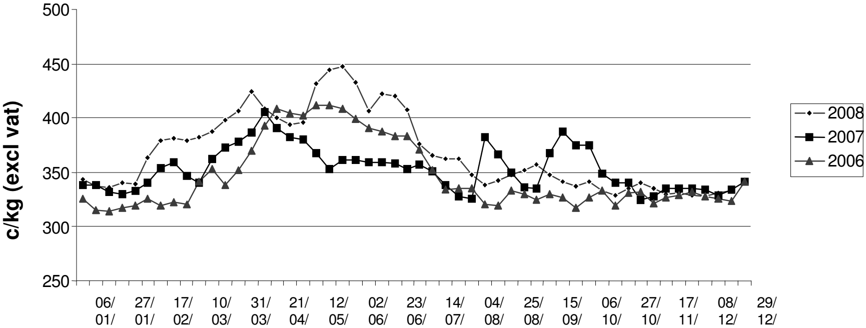
The market price drop in 2008 as shown in Figure 1 was 58c/kg from late June (weaning) until late July. The price drop for August and September was 12 and 13c/kg respectively. Selling lambs at a similar carcass weight of 19kg in late June and late September resulted in a price differential of €15.77 per lamb in favour of June sold lambs. It is becoming more and more important to achieve high lamb growth rates so that a significant proportion of lambs are drafted before the price bottoms in late August, and to ensure there is sufficient grass for ewes prior to mating.

<u>Grass finishing</u>

At current cereal prices, concentrates costing €200 - €280 per tonne are 230% - 330% more expensive than grazed grass. Clearly in the current economic climate the challenge for sheep farmers is to finish lambs on grass with the minimum concentrate input. Good grassland management can get mid season born lambs to weights that will result in the majority of lambs finishing off grass without supplementary feeding. Research at Teagasc Athenry has shown that lambs can be finished off grass only diets provided target growth rates and weight for age is achieved.

Lamb growth pre-weaning is optimised by grazing grass at a height of 6cm in April and May, and increasing to 7 - 8cm for June. In order to maintain grass quality in June, grass should be eaten down to a post grazing height of 4cm in April/May. On most farms, studies have found that lamb growth in the first 10 weeks of age is at or near target but can often fall behind target in the 4-week period before weaning. Lamb growth rates are generally better in mixed cattle/sheep enterprises compared to all sheep grazing, giving higher lamb weaning weights of about 2kg (E. Grennan, Teagasc, Athenry, 1999). A similar weaning weight advantage was found in experiments from grazing pasture that was not grazed by sheep the previous year.

Figure1. Lamb prices (c/kg) – excluding VAT, 2006 -2008



Source Bord Bia

Table 1. Pre weaning targets

Age	Singles	Twins
0 – 5 weeks (gm/day)	386	306
5 – 10 weeks	367	331
10 -14 weeks	245	229
Birth - weaning	337	292
Weaning weight (kg)	38.5	33.4
Drafted at weaning (%)	53	21

Keady, T., Athenry (2008)

Creep grazing

The challenge in June is to minimise the drop in lamb growth rates that occur in the four weeks pre-weaning. This can be achieved by grazing at higher sward heights whilst also maintaining grass quality through eating down pastures to a post grazing height of 4 - 5cm. Forward creep grazing, where lambs can graze high grass covers in the paddock in front of the ewes, increases lamb weaning weight by 2kg and facilitates grazing pastures tight in June without reducing lamb thrive. This will maintain grass quality for post weaning grazing in July.

Post weaning lamb thrive

Lamb thrive can vary greatly post weaning and reports of poor growth are frequent at this time. The target post weaning growth rate on grass fed lambs is 150g per day (1kg per week), but this can range from less than 100 to over 200 g/day depending on sward height and type (Table 2). A pasture height of 9cm is optimum for weaned lambs and should be grazed down to 6cm in a rotational grazing system. Pasture grazed tightly in May/early June keeps grass leafy and improves lamb growth post weaning. Clean pastures (such as after-grass or swards grazed by cattle), were also found to result in additional weight gain in weaned lambs. Grass/clover swards also improve lamb performance.

Table 2. Effect of pasture height and type on growth rate (g/day) in weaned lambs

	Pasture height (cm)		
	5	7	9
Old pasture (g/day)	99	141	159
Ryegrass pasture (g/day)	90	139	153
Grass/clover (g/day)	117	173	222

Grennan, E., Teagasc (1994**)**

Creep feeding

Experiments carried out by Teagasc Athenry on creep feeding lambs pre weaning show:

- response is better where grass supply is limiting,
- feeding meals at 300g/day on low swards gave a similar response to feeding no meals on high swards,
- higher response from feeding meals in set stocking compared to rotational grazing,
- in rotational grazing there is an added response from creep grazing and creep feeding,
- feeding 250g/day from 5 weeks to weaning resulted in lambs consuming 17kg concentrates and being 3 – 4kg heavier at weaning,
- the carcass conversion ratio to feeding 250 – 300g/day is in the order of 10: 1 pre weaning,
- 20% of lambs fed creep drafted at weaning compared to 3% where no meals were fed.

In further experiments concentrate supplementation post weaning increased daily live weight gain, carcass weight and kill out %. Again the response was greater if grass supply is limited i.e. swards under 9cm, and was better when 250g concentrate was fed compared to 500g. Carcass conversion ratios varied from 7 to 12 on short grass and 7 to 20 on long grass.

Table 3. Effect of sward height and concentrates on lamb performance

Sward Height (cm)	Concentrates (g/day	Live weight (kg)	Carcass weight (kg)	Kill – out %
8.6	0	43.4	17.3	39.8
	250	45.7	19.1	41.9
	500	47.2	20.0	42.4
5.9	0	41.6	17.1	41
	250	44.8	19.1	42.6
	500	46.6	20.3	43.7

Grennan, E., Teagasc Athenry

Economics of concentrate feeding

A study by Massey and Crosby (2000) was carried in UCD on the performance of creep fed and non-creep fed lambs on similar pastures. Two groups of lambs were compared where one group was fed grass only and the other group was fed creep from 5 weeks of age, and limited when their concentrate intake reached 500g/head/day. Table 4 shows the drafting pattern and price per kg at 2008 prices for each group.

Table 4. Drafting dates and 2008 price/kg for grass and 500g meal and grass only lambs

	Meals 500g/head/day		No Meals		
Drafting Date	No. sold	% Cumulative	No. Sold	% Cumulative	Price (c/kg)
June 7	3	3.3	0	0	450
June 21	16	20.9	2	2.2	460
June 28[t]	12	34.1	0	2.2	440
July 12[t]	20	56.1	18	21.5	410
August 9	24	82.5	14	36.6	393
August 21	5	87.9	14	51.6	388
September 6	6	94.5	14	66.7	392
September 20	5	100	12	79.6	383
			19	20.4	stores

Approximately 56% of the meal fed group were drafted at weaning on July 12, compared to 21% of the grass only group. At the end of the trial on September 20 all the meal fed lambs were drafted for slaughter, but approximately 20% of the grass fed group remained. The average age at slaughter was 98 days and 130days for the meal fed and grass only group respectively (Table 5).

Table 5. Performance of meal fed and grass only lambs

	Meal Fed	No Meals
No of lambs	91	93
Meals consumed (kg/lamb)	43	0
Age at slaughter	98	130
Sold at weaning (%)	56	22
Not finished by September 20	0	19 (20%)
Av. Live weight at slaughter	40.9	41.6
Av. Carcass wt.	19.3	18.2
Kill out %	46.9	44.1
Av. Price c/kg(2008)	416	396
Av. Lamb price	€80.22	€72.10
Include store price		€71.00

Table 6. Cost analysis of meal feeding

Meal €/t	280	230	200
Extra value of lamb (€)	9.22	9.22	9.22
Meal costs (€)	12.04	9.89	8.60
Margin over meals (4)	-2.82	-0.67	0.67
Value of grass 35 days (€)	1.54	1.54	1.54
Margin (€)	-1.28	0.87	2.21

At 2008 lamb prices (despite the extra performance in terms of live weight and carcass gains), the margin from feeding meals is small at best and can be a substantial cost unless meals are cheap. There are additional costs in providing creep feeders and extra labour requirements associated with meal feeding. On many farms with low stocking rates the saving on grass will not be utilized and may result in over grown low quality grass pastures.

When prices are stable it is difficult to justify meals. However, meals may be used strategically to bring forward drafting dates when prices are high and likely to fall e.g. increasing the drafting rate at weaning. Performance from simple loose rations containing predominately cereals will equal that of the more expensive compound rations. In the UCD trial, pre weaning daily weight gains of 219 and 279g/day for the grass-only and meal fed lambs respectively, was lower than the 292g/day achieved on grass only swards by Keady at Teagasc Athenry.

Michael Doyle, Bord Bia Quality Lamb Producer 2008, uses excellent grassland management, forward creep grazing and the limited use of concentrates to optimize lamb thrive and achieve a good drafting pattern in his mid season lambing flock. This results in his sheep enterprise returning a gross margin of €900 per hectare. Lambs are introduced to creep feed at about 6 weeks of age and are encouraged to creep graze with the use of the creep feeders. Meal feeding is limited to 20kg per lamb and simple rations comprising mainly of homegrown cereals costing €200/t are used. Total meal costs fed to ewes and lambs are less than €8 per lamb and under 24% of total variable costs.

Table 7. Michael Doyle 2008 drafting date and lamb price

Month	Number drafted	Cumulative %	Average Price (€)
May	4	1	98.88
June	64	22	89.29
July	96	54	78.82
August	66	76	76.81
September	46	91	76.98
October	27	100	72.38
Total	303		80.00

Table 8 compares the drafting patterns in the UCD trial with that of the Doyle and Teagasc flocks. In the UCD trial, concentrates fed per lamb was 43kg, in the Doyle flock 20kg per lamb and in the Teagasc Athenry flock all lambs except triplets were finished on grass only. The Doyle flock includes the progeny of approx. 50 ewe lambs. The other 2 flocks have mature ewes only. With concentrates costing €200/t, the UCD lambs are costing €8.6/lamb, and the Doyle flock €4/lamb extra in meal costs compared to the Athenry flock.

Table 8. Drafting %

Date	UCD (meals)	Doyle (meals)	Teagasc (no meals)
June 25	34	22	21
July 25	56	54	44
Aug. 25	88	76	44
Sept. 8	94.5	66	69
Oct. 6	100	91	87
Nov. 4	100	100	100

Good grassland managers and some farms with low stocking rates are able to finish the majority of their lambs without creep feeding. However where target drafting dates are not being achieved, it may be necessary to feed meals to compensate for poor performance. The target must be to control and minimise the meal input to a maximum of 25kg/lamb. Lamb health and grass quality are key to reducing the need for creep feeding. Generally lamb performance is adequate up to the end of May on most farms.

Poor thrive is more of an issue from early June as grass quality deteriorates. The best response to creep meals is obtained at low feeding levels. Enhance the response to creep meals by using them to encourage lambs to creep graze ahead of the ewes. Limit creep meals to a maximum of 300 to 400g/lamb/day.

Target drafting pattern, when lambing in early to mid-March, should be 20% sold by weaning at the end of June, 45% sold by the end of July, 70% sold by the end of August, 90% sold by the end of September with all lambs sold by the end of October. If creep meal feeding is required to achieve the drafting pattern outlined above, introducing meals from June 1 at 300g/lamb/day will result in total consumption of less than 25kg/lamb in the flock. In the present economic climate and at current lamb prices the medium term target for sheep producers must be to concentrate their efforts on improving grass quality and incorporating clover to minimize dependence on meal feeding. Strategic use of concentrates may be necessary to finish tail enders but spending on concentrates should be reduced to 20% of total variable costs (from the current 36%). Achieving this target is worth up to €100 per hectare.

Forage crops

There has been increasing interest recently in the role of forage crops as a feed for finishing lambs. Whole forage crops like kale or turnips are more suitable for winter feeding ewes or store lambs than summer fattening mid season lambs. Tyfon, rape sown after cereals or stubble turnips, are the crops most suitable for lamb fattening. Tyfon can be grazed 6 weeks after sowing and is capable of giving yields of 4.5 – 10t/ha. It also has the advantage in that it can be multi grazed and if rotationally grazed will give 3 grazings. On tillage/sheep farms tyfon has a role as a break crop that would improve soil fertility and provide a cheap high quality feed for finishing lambs. However in all grass farms the cost of sowing the crop, the fact that the land is out of grass for a whole year and the cost of reseeding makes the crop uneconomical. On farm measurements carried out by Michael Gottstein in Cork and Kerry, and an experiment carried out by Joe Day at Kildalton College in 2008 show a role for tyfon as part of a spring reseeding programme on all grass sheep farms.

Tyfon sown at the rate of 5 – 6kg/ha (2 – 2.5kg/ac) with a grass/clover mix when reseeding in spring will provide feed to finish 60 – 75 lambs per hectare (25 – 30/acre) from about 6 weeks after sowing. The crop should be sown 6/7 weeks before planned weaning date. The only extra costs associated with sowing tyfon in this system is the seed cost of approx €93 per hectare. In the above studies, growth rates of 300g/day (2 kg/week) were achieved with weaned lambs. When compared to lambs finished on grass and 300g concentrates per day, the tyfon lambs killed out 0.6% higher at 47.2% and were 0.3kg heavier carcass weight. It was concluded from the Kildalton experiment that finishing lambs on tyfon reduced costs by €4 per lamb compared to lambs finished on grass and 300g concentrates, and €9.52 per lamb when compared to lambs fed concentrates *ad lib*.

Forage rape or stubble turnips can be sown as a catch crop after cereals and used to finish lambs in the autumn/winter period. As these crops are sown from July onwards and become available for grazing from October, they are more suitable for late born mid season lambs or bought in store lambs. Chicory and other similar type crops are reported to be giving good results in terms of lamb thrive and savings on anthelmintic use. However, there has been limited research carried with these crops on these islands and at this stage it is difficult to say with any confidence if they can play a role in finishing lambs economically.

Increasing margins from sheep

Andrew Kinsella
Ballinaclash, Rathdrum, Co. Wicklow

Farm details

All sheep 'upland type farm' in mid-Wicklow

Altitude	170m above sea level
Area	23.52ha
Ewes to the ram	240-260
Replacements	62-70
Stocking rate	2.5 Livestock units per unadjusted ha (around 13.5 ewes/ha including replacements)

This farm went down the intensive route because of limited acreage and to achieve higher margins. Off-farm employment meant that there was a requirement for experienced labour at lambing time. Acquiring good labour is not cheap and the only way it can be paid for is by maximising the number of lambs born.

Flock performance over past 5 years (lambs/ewe to ram)

Scanning results	2.10 - 2.32
Weaning rate	1.9 – 2
Sales plus replacements	1.8 – 2

Around 40% of the ewes scan for threes and fours each year. In 2009 there were 105 ewes with threes and fours and 23 with singles.

Breeding policy

The flock is self-contained, and with the exception of rams no stock are purchased off farm. Belclare rams have been used since 1986 to produce replacements. Currently, 25% of stock are replaced annually. Terminal sires consist of Charollais and Suffolk. The Suffolk is used to maintain sufficient 'black ewes' to cross with the Belclares to produce replacements. All rams are genotype ARR/ARR for scrapie.

Replacements (hogget ewes) are vaccinated with Toxovax to prevent abortion. This practice commenced following a severe outbreak of abortion in the early 1990's, when about 25% of the ewes aborted. Vaccination also appears to have helped in reducing the number of 'weaker early born lambs' that despite nursing, invariably died within a few days.

There is nothing as annoying as having a ewe lambing down with three lambs and not having sufficient milk - due to poor body condition or having no milk in one side because an udder problem had been overlooked at ewe selection. Udders are inspected three times from weaning to mating and any ewes that have not regained body condition at mating are sold.

Housing

Success with a high lamb crop is dependent on having ewes in good condition at mating and maintaining body condition right through until lambing time.

- Fields are grazed off rotationally from the end of October/early November. Once the last field has been grazed, the ewes are housed. In most years housing takes place around December 1 (in 2008, despite the fact that rams went out on October 21 (as in all previous years), the ewes were housed on November 15). Winter forage is generally hay/haylage with a small amount of silage being fed in the last few weeks before lambing.

- Ewes are winter shorn around two weeks after housing. While shearing (i) allows for increased pen density; (ii) prevents ewes from going onto their backs during April, and (iii) leaves it easier to monitor ewe condition; its main purpose (iv) is to increase lamb birth-weight. The ewes get a small amount of meals around shearing time, aimed at preventing wool slip.

- Ewes are worm-dosed 2-3 weeks after housing and for the first time in over 20 years were also given a fluke dose this year. The only reason for the worm dose is the higher proportion of triplets and to give these ewes every chance possible. It is considered a waste to dose ewes for stomach worms where there are less than 20% bearing triplets.

- Scanning takes place between January 5 and 7 each year. This leaves exactly 10 weeks to lambing. Meals are immediately introduced to triplet bearing ewes and increased incrementally to 1.25kg for the last 2 weeks pre-lambing. Meals are introduced to twin bearing ewes eight weeks pre-lambing so that they are receiving 1.0kg in the final two weeks of pregnancy.

- A cheap ration is used in the first weeks of feeding but is replaced by one based on barley (35%), beet-pulp (35%), soyabean (25%), together with molasses, minerals and vitamins for the month before lambing.

- Meal feeding levels are also tied in with body condition. Should ewe body condition start falling, meal levels will be increased more rapidly. Also, individual ewes losing condition will be transferred to a pen receiving a higher allocation.

- Ewes are foot-bathed every 3 weeks using a 10% zinc sulphate solution. A number of years ago silage was the main winter forage but as the ewes are bedded on straw it was near impossible to prevent lameness. Hydrated lime is used along the side fronts of the pens as a further aid in the control of lameness.

Lambing

In earlier years no ewe went out with more than two lambs, and excess lambs were artificially reared. As the number of triplets increased, and after some trial and error it was found to be easier to leave the three lambs on the ewe (provided she is capable of rearing them). However, it does require planning and attention to detail - starting with flock selection. The importance of ewe body condition cannot be over emphasised. Over the past 10 years the farm has ended up with somewhere between 60 - 80 ewes rearing triplets at grass each year.

There is round the clock supervision for about three weeks from the commencement of lambing. After lambing, ewes and lambs are moved to individual pens, navels dipped (50/50 iodine/methylated spirits), ewes checked for milk and a simple recording made of tag number, number of lambs and any problem(s). Ewes with serious problems such as blind teats are ear-punched.

Every use is made of ewes with singles to cross foster. In some cases ewes with two lambs may get an additional lamb. Normally the lamb to be fostered is fully dipped in warm water with some salt added and is then placed on a plastic (fertiliser) bag behind the lambing ewe and wet fostered. The plastic bag collects all the lambing fluids, which would otherwise be lost in the straw.

While in the individual pens, lambs are inspected every 4-5 hours and any lambs found to be hungry are stomach-tubed with cow colostrum (secured from a local dairy farmer and freezer stored in 2.5l plastic bottles). Rubber rings are used for castration and de-tailing, and female lambs sired by Belclare rams are tagged.

Ewes rearing triplets occupy individual pens for an extra few days and there is a requirement for additional pens where the lambs are maintained on the ewes.

At grass

- The farm is divided into eight paddocks/fields, two of which are closed for hay/haylage in early May.
- Nitrogen is spread in early to mid February, towards the end March/early April, during June (on aftermaths), and in August.
- After let-out, triplet ewes and their lambs are treated as a separate flock and normally rotate ahead of twins (on the best available pasture) until the second worm dose is given. Ewes are fed meals (around 1kg/day) for five weeks and lambs have continual access to concentrate creep.
- Lambs are wormed at 5 weeks, 10 weeks, at weaning and about every 8 weeks there after.

- Animals are foot-bathed each time they are in the handling unit for dosing drafting etc.

- All lambs have access to creep (about 300g/day) after the first worm dose. Creep feeders are placed in fields with triplets and lambs have access through creep gates. (The merits of forward creep grazing, particularly during wet conditions are considered highly questionable!).

- Replacements graze behind twins and singles.

- Weaning takes place during the first week of July.

- Replacement ewe lambs are selected on weight at weaning and the practice up to 5-6 years ago was to discontinue meal feeding at this stage. However, this led to wide variation in lamb weight at housing and in latter years meal feeding is discontinued when lambs reach 40kg.

- Majority of cull ewes are sold at weaning.

- An increase in sward clover content is desirable, but options are limited in the absence of reseeding which is not possible in the current situation.

Carcass weights and classification

Lambs and cull ewes are sold through the ‘Rathdrum Quality Lamb Producer Group’. A summary of lamb carcass classification and weights for various years since 2000 is included in Table 1 below. The data were compiled from the summary kill sheets for each batch of lambs sold. This exercise may have underestimated average carcass weights a little as the batch ‘total cold weight’ includes lamb weights up to the ceiling weight (payment weight) only. Between 350 and 400 lambs were classified each year.

Table 1. Summary of lamb carcass classification for 2000-06

	U3 (%)	R2 (%)	R3 (%)	Fat score 4 (%)	Average carcass wt. (kg)
2000	40	2	51	5	19.65
2001	39	2	55	2	19.53
2002	20	2	71	4	19.53
2003	23	3	67	6	19.71
2004	42	3	45	9	20.34
2005	15	5	65	15	20.63
2006	27	3	65	5	19.88
2007	26	3	56	15	20.65
2008	34	4	51	11	20.52

- It is clear from the results that increasing average lamb carcass weight resulted in an increase in the proportion of carcasses in fat class 4 for which there is a 28c/kg price reduction and the loss of the quality bonus.

- The most striking aspect of the results is the variation in the proportion of U3's. In 2000 and 2001 there was around 40%. During 2002 and 2003 this figure was almost halved. Conformation also follows the rule that applies to fatness - that as carcass weight increases conformation scores improve. However for 2000 - 2003 there was little difference in average carcass weights. In 2004, when average carcass weight was 20.3kg over 40% of carcasses were U3 while in 2005 there were only 15% despite an increase in carcass weight.

The flock-breeding programme on the farm has remained unchanged since the mid 1980's with all ewe replacements homebred. The same individual rams that produced lambs one year, with a high proportion of U3 carcasses produced a low proportion the following year. This basically rules out both ewes and rams as being the likely source of the variation in conformation.

Fast growing lambs (such as an early lambing system) tend to have a higher proportion of better conformed carcasses, while slower growing lambs (store lamb systems) tend to have a lower proportion. In the case of the this flock, such aspects can also be discounted as ram let-out date has been October 21 each year with around 80% of the lambs finished by the end of the following October.

- Carcass classification has to be consistent and transparent to maintain farmer confidence. Unfortunately this does not appear to be the case, and farmer confidence in conformation classification is totally lacking, and to many, having no system is better than the current bad one.

Margins

The margins as outlined above make disappointing reading for any lamb producer (fixed costs and income tax still has to be taken into account!).

2008 was a particularly pain-full year due to high concentrate, fertiliser and contractor prices. The current price cost squeeze has put real pressure on intensive sheep systems.

In the situation as described below, the high concentrate usage is more a consequence of high stocking rate than higher rearing rate. The plan for the next few years is to reduce stocking rate by 20-30% and maintain weaning rate at near current levels. However, this action has it’s own dilemma. When ewe numbers fall below a certain level, the sheep enterprise is making such a small contribution to income that hobby farming with a limited number maintaining the grassland is likely to be a more attractive alternative.

Table 2. The financial data for the farm

Costs and Returns in 2008		
Sales	€ total	€ per ewe to ram (243 ewes)
380 lambs @ €77.06 to factory	29,283	120
44 cull ewes @ €49.51	2,178	9
10 lambs @ €75 sold live	750	3
Inventory change 10 lambs	771	3
Total sales	**32,982**	**135**
Variable costs		
Purchased concentrates (45t)	12,478	51
Fertiliser	3,600	15
Veterinary - €1400		
- winter dip €212		
- Vetrazin €1032	2,644	11
Contractor – Hay making	960	4
- Spreading FYM	520	2
Polythene	84	
Levies	463	2
Transport	660	3
Straw	700	3
Sundry (scanning, sheep tags)	302	1
Total variable costs	**22,411**	**92**
Gross margin	**10,571**	**43**

Perhaps, producers who maintained stocking rate at around nine ewes/ha down through the years (as signalled by Teagasc National Survey data), have followed the correct course.

Improving sheep and flock health: some key pointers for farmers and industry

Michael L. Doherty
School of Agriculture, Food Science and Veterinary Medicine, University College Dublin

Introduction

Despite significant advances in our understanding of economically important diseases of sheep such as footrot, the incidence rate of these diseases in many flocks remains unacceptably high. The challenges to be faced in the rapidly changing international agricultural industry of the 21st century are to prevent disease, enhance animal welfare and farmer profitability while taking cognisance of food safety issues, the consumer and the environment.

Although there will always be more to learn about individual diseases of sheep at the molecular level, a significant body of knowledge already exists which should allow us to optimally manage and control these diseases (Doherty, 2007). However, significant challenges are faced with translating 'knowledge into practice'. Surveys of sheep farmers in the UK for example, have revealed that there was little consensus about optimal control methods for footrot, and that few farmers adopted the practice of segregation of infected sheep and flock entrants; a fundamental component of the control of any infectious, contagious disease (Wassink *et al.,* 2005). This paper will highlight some of the flock health challenges facing the sheep industry in Ireland.

Biosecurity

Ireland has seen the importation of many diseases such as Sheep Pulmonary Adenomatosis (Jaagsiekte) and Caseous Lymphadenitis (O'Doherty *et al.,* 2000). Furthermore, memories of the Foot and Mouth outbreak of 2001 and the ever-present threat of Blue Tongue infection underline the importance of disease biosecurity at both national and individual flock level. Awareness of biosecurity among sheep farmers needs to be raised, as it is critical when purchasing replacement or foundation stock, including rams, that farmers are cognisant of the health status of the incoming sheep. Some of the most important diseases to be aware of when introducing new stock include sheep scab, resistant internal parasites, footrot, contagious ovine digital dermatitis and orf.

<u>General guidelines</u>

1. Replacements should be bought from flocks of known disease status (e.g. UK Disease Accreditation Schemes for Maedi Visna and Enzootic Abortion);
2. Purchased sheep must be quarantined and observed for 21 days;

3. Provide stock-proof fences/hedges and if possible avoid common grazing and do not borrow rams;
4. Prevent access of birds, rodents and pets including cats to stored feed;
5. When purchasing rams, try and identify R1 animals (scrapie resistant).

The quarantine period is critical as during this time the sheep can be observed and treated for the diseases above as appropriate. Since anthelmintic resistance is predominantly to the white drenches (benzimidazoles), all purchased sheep should be treated with a combination of avermectin and levamisole wormers and yarded for 24-48 hours afterwards to ensure that no resistant eggs are passed onto pasture by the treated animals.

Foot lameness

Footrot represents a particular flock health challenge as it continues to be a significant cause of economic loss, and is a major welfare concern. Interestingly, studies have cast doubt on the efficacy of routine foot trimming in control and prevention of footrot. While careful and judicious foot trimming clearly has a role as part of the treatment of sheep severely affected with footrot in high prevalence flocks, evidence is emerging that routine trimming is detrimental to foot health in flocks that are trying achieve a low prevalence status (Abbot and Lewis, 2005). Implicit in these approaches is the need for basic record keeping and lameness scoring as part of the flock health plan. The emergence of contagious ovine digital dermatitis (CODD) as a significant cause of lameness in Irish sheep flocks underlines the need for veterinary diagnostic input in the context of flock health surveillance and planning. Contagious ovine digital dermatitis is a disease of the ovine hoof, which results in acute, severe lameness. In contrast to virulent foot rot, which is characterized clinically by lesions involving the heel and the interdigital area, CODD is characterised by ulcerative lesions of the coronary band which progress and result in disruption of the abaxial wall lining the hoof and loss of the horn case in untreated cases. Whilst documented evidence of CODD in Ireland is sparse, anecdotal evidence from shepherds highlighting persistent ‘incurable’ footrot and ineffective vaccine strategies, suggest that CODD may be prevalent and being incorrectly diagnosed as virulent footrot. Recent research at University College Dublin has now identified the causative treponeme bacteria associated with this disease in Irish sheep (Sayers *et al.,* 2009).

Sustainable parasite control

Anthelmintic resistance to worms is of major concern to the industry. It is an individual farm phenomenon as the pattern of resistance on a given farm can be totally different to that on neighbouring farms, highlighting the importance of biosecurity. Body condition score and faecal worm egg counts should be monitored at specific times. This depends on management practices on the farm and it may also be useful to increase monitoring etc. in times of management change. Regular monitoring of faecal worm egg counts to avoid overly frequent drenching on the one hand, and unacceptable production losses or welfare problems related to bowel worms on the other is important. Worms should be tested for resistance every 2-3 years, with each test customised to one specific type of drench in order to have an idea which drench should form the main player in worm control on that farm. The simultaneous use of effective anthelmintics e.g. combining levamisole with a benzimidazole or ivermectin may be a useful way of limiting the onset of resistance. There is also significant evidence of resistance in fluke to the widely used anthelmintic triclabendazole and every effort should be made to address this problem (www.deliver-project.eu).

The SCOPS (sustainable Control of Parasites in Sheep) inititiative in the UK represents a positive industry response to the challenge to balance the need to control worms against a reduction in the selection pressure for resistance in the worm populations (www.nationalsheep.org). It is based on a number of key messages.

- Resistance to benzimidazoles (white drenches) is now widespread.
- Resistance to anthelmintics is often brought in with purchased sheep.
- Mature sheep that are healthy have immunity to most worms.
- Underestimation of the weight of sheep results in under-dosing and facilitates the development of resistance.
- Farmers who use Faecal Egg Counts to monitor worm burdens use less anthelmintic without any loss in flock performance.
- Dosing sheep and then putting them straight on to clean pasture increases the risk of anthelmintic resistance developing on your farm.
- Rams are being bred that have a greater resistance to worms. This trait is passed on to their progeny, reducing dependence on anthelmintics in the future.
- Preserve susceptible worms. Treat sheep a few days before moving onto clean pasture and consider leaving a small number of sheep untreated.

Clostridial diseases

These diseases are invariably fatal; they include pulpy kidney, lamb dysentery, braxy and tetanus and worryingly, recent evidence from the veterinary diagnostic laboratories in both Ireland and the UK suggest that there has been an increased incidence of mortality from these diseases associated with failure to use the vaccine or inappropriate use of the vaccine. There can be no excuse for not using these economically effective vaccines on Irish farms, and all purchased animals should receive a full course if their status is unknown.

Pneumonia

Pasteurellosis continues to be a cause of significant economic loss and to illustrate this, a recent outbreak of pasteurellosis in a 200 ewe flock investigated by the author was associated with over 10% mortality in a pregnant ewes; the flock was unvaccinated, highlighting the importance of vaccination in prevention. *Mycoplasma ovipneumoniae* is also being diagnosed in cases of acute pneumonia in Irish sheep (Sheehan *et al.,* 2007) and infected sheep can be detected by laboratory testing of nasal discharges.

Flock health planning

A recently published report by the National Sheep Association in the UK, which examined attitudes towards health planning in the English sheep sector, emphasized the following fundamentally important points:

- The desire for the dissemination and clear communication of relevant information on health and welfare issues amongst sheep farmers;
- The need to link sheep health and welfare to the efficient and profitable management of the business is a key driver;
- Prevention on a flock basis is the optimal way forward for sheep farmers;
- Welfare is a growing concern against the background of consumer confidence;
- Flock health plans need to be as simple and practical as possible;
- Any successful programme to improve the health and welfare of the sheep sector through better planning and understanding will require a cross industry delivery.

The flock health plan should be agreed between the farmer and the veterinarian. It involves regular, planned visits to the flock by the farmer's own veterinary surgeon. The key visit is at the pre-tupping stage in the autumn. Where appropriate this could be followed by visits at mid-pregnancy and shortly after lambing. It would be preferable if all of the visits were carried out by the same veterinary surgeon, who would also be responsible for drawing up the health plan on the first visit as well as an annual review. At a minimum, flock health planning require records to be kept of:

1. Number of ewes to ram.
2. Scanning results.
3. Number of abortions.
4. Number of ewe deaths.
5. Number of barren ewes.
6. Number of lambs born alive/dead.
7. Number of lambs reared/sold.
8. Medicines record book.
9. Movement book.

Animal health is critical to the international competitiveness of Irish agricultural product because of its potential to affect product quality, or consumer perceptions thereof, and because national animal health status is an important determinant of Irelands ability to access export markets. The creation of Animal Health Ireland (AHI), (http://www.animalhealthireland.ie), the initial aim of which is to provide a coherent and unified approach to the control of certain bovine diseases that are not subject to governmental regulation offers an exciting template which in time could be applicable to other sectors.

A major challenge in the context of flock health will be to develop and implement practical, integrated, flock health plans for the management and prevention of the economically significant diseases of sheep. These plans would assist farmers in providing reassurance regarding the health status of the farming enterprise, thus increasing trust, transparency and acceptability on issues of animal health and welfare to the sheep industry, retailers and consumers.

Optimal disease prevention will require the adoption of a multidisciplinary team approach involving the farmer, the veterinarian and the farmer's advisors, nutritional and animal breeding consultants. While strategic whole-flock advice and the implementation of appropriate preventative measures are not new concepts, flock health plans will become increasingly important in the sheep industry of the 21st century.

References

Abbot, K.A. and Lewis, C.J. (2005). Current approaches to the management of ovine footrot. *The Veterinary Journal*, **169**: 28-41.

Doherty, M.L. (2007). Addressing the knowledge bottleneck. *Irish Veterinary Journal*, **60**: 521-521

O'Doherty, S., Prendergast, M., Scanlon, M., Schofield, W., Doherty, M.L. Frame, M. and Bassett, H.F. (2000). *Corynebacterium pseudotuberculosis* infection in an imported ewe. *Irish Veterinary Journal*, **53**: 632-634.

Sayers, G., Marques, P.X., Evans, N.J., O'Grady, L., Doherty, M.L., Carter, S.D. and Nally, J.E. (2009). Identification of Spirochetes associated with Contagious Ovine Digital Dermatitis. *Journal of Clinical Microbiology*, **47**: 1199-1201.

Sheehan, M., Cassidy, J.P., Brady, J., Ball, H., Doherty, M.L., Quinn, P.J., Nicholas, R.A.J. and Markey, B.K. (2007). An aetiopathological study of chronic bronchopneumonia in lambs in Ireland. *Veterinary Journal*, **173**: 630-637.

Wassink, G.J., Moore, L.J., Grogono-Thomas, R. and Green, L.E. (2005). Footrot and interdigital dermatitis in sheep: farmers' practices, opinions and attitudes. *Veterinary Record,* **157**: 761-766.

Making more money from identifying the most profitable suckler cows

Ross Evans[†], Pat Donnellan[†], Andrew Cromie[†] and Peter Amer[‡]
[†]ICBF, [‡]Abacus Bio, N.Z.

Introduction

The majority of the commercial Irish suckler cow herd consists of crossbred cows from a range of breed matings. The use of crossbred cows has been practised for many years and is relatively unique in Europe. Breeding a similar type of cross within the herd can be difficult, hence many herd owners prefer to purchase replacements rather than breed specifically for replacements within the herd. Traditionally there are two main purchase options: the purchase of dairy-beef cross heifer calves, or weanlings from dairy herds or weanling heifers from other suckler beef herds. These two genotypes of suckler cow have different strengths and weaknesses. Beef-dairy cross females are favoured for their milkability and ease of management traits, while suckler herd replacements are favoured for their weanling and carcass merits. However the categorisation of heifers or cows into various types in order to decide on merit for purchase can have drawbacks in that it will over value certain cows and undervalue others. It is likely that there is as much difference in profit potential between cows of the same type (e.g. two Limousine x Simmental crosses) as there is when comparing two different breed types (e.g. a Limousine x Simmental cow versus a Belgian Blue x Friesian cow). The development of selection indexes offer a better prediction of profit, whereby the replacement heifers future profit potential is based on the performance of her relatives. The same principle applies to cows but with higher reliability, as her previous progeny performance is also taken into account. Such a system of individual comparison could offer much more to improving future farm profits and overcome the traditional characterisation of breed or crosses.

One of the main priorities of the ICBF database is to capture movements and destinations of cattle born in Irish beef herds in order to evaluate all aspects of a cow's impact on farm profitability; - from the birth of the cow herself, evaluation of her progeny, through to eventual slaughter at the end of her productive life. There are many links needed in order to achieve this goal, such as information flowing back from the marts, factories, farm-to-farm movements and information generated on the farms themselves. The purpose of this paper is to determine a lifetime profit measure on a sample of commercial suckler cows which have complete information throughout their lifetime, and examine the relationship between this measure of profit and the replacement component of the new €uro-star Suckler Beef Value (SBV) indexes which ICBF has commenced publishing over the last two years.

Figure 1 shows a diagrammatic representation of the costs of production and revenue generated from a typical commercial suckler cow and the various informative traits which ICBF collect in order to predict the overall profit value of these cows.

Figure 1: Information used by ICBF to determine Suckler cow profitability

Revenue	Costs

Revenue from progeny:

Category	Data source
Mart sales:	CMMS, Marts Sold
off farm for export:	CMMS only Sold
direct to factory:	Factory info Sold
as in-calf replacements:	CMMS
Kept in herd as replacements:	CMMS

Revenue from cow herself:

Cull cow mart sale:	Marts
Cull cow factory sale:	Factory

Production costs:

Category	Data source
Rearing costs:	Age at first calving
Calving costs:	Animal events calving scores
Milkability:	Weaning weight on the calf
Calving interval:	CMMS calving dates
Survival:	Subsequent calving event
Feed Cost:	Feed intake and liveweight
Labour, land buildings:	Teagasc
AI, Vet costs for infertility:	Inseminations
Death on farm knackery charge:	CMMS

Analysis

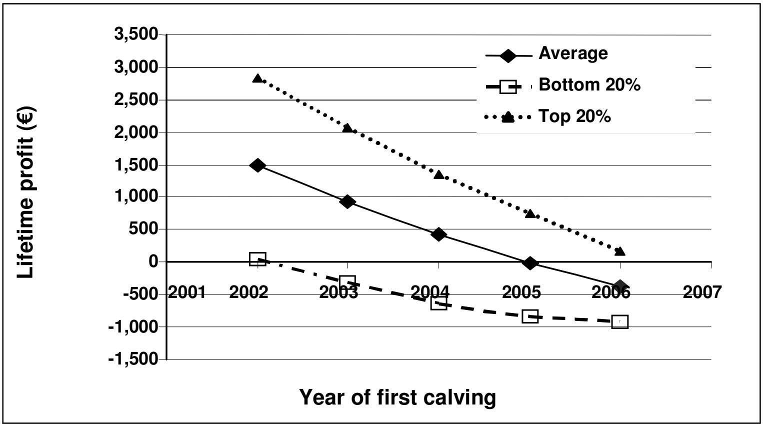
All available calving data, mart data, factory data and CMMS movement data on suckler herds in the ICBF database was examined. The purpose was to find a group of cows that were still alive, and measure the profit they generated to date. Age at first calving, calving interval and calving data provide information relating to the cost of rearing the cow to the point of calving, and her maintenance cost throughout her lifetime. Mart weight, price per kg, carcass traits and number of daughter replacements provide profit contribution through her progeny. In order to carry out this piece of work the number of progeny and current fate of all her progeny had to be available on the ICBF database. This limited the dataset significantly as most herds only joined the ICBF database in 2008 and therefore would have incomplete information for many older cows.

In order to determine the lifetime profitability of a cow, assumptions had to be made regarding costs of production such as calving costs and feed costs, and also for revenue from progeny beef output and production of replacements. Monetary values placed on these traits were taken from the economic values used to create the SBV indexes. Table 1 shows the monetary values for a number of the key traits in the analysis. The actual mart sale price/kg and factory price information were used where it was available. Certain assumptions were also made regarding the dry matter intake (DM) of the progeny. It was assumed that where female progeny of cows remained in the herd and became replacements, the cow was credited with the purchase value of the replacement.

Table 1. Economic assumptions used to evaluate lifetime profit

Trait	Economic Value assumed
Age at first calving of the cow herself	€0.96/day past 2 yo (opportunity cost of no calf)
Cost of caesarean (calving survey 4)	€306 (Vet costs plus labour)
Cost of veterinary assistance (calving survey 3)	€138 (Vet costs plus labour)
Cost of DM/kg finishing diet, steers and heifers	€0.126 /kg DM
Cost of DM/kg finishing diet, young bulls	€0.150 /kg DM
Dry Matter Intake (kg/day) bulls, steers, heifers	6kg, 7kg, 8kg
Value of in-calf replacement on point of calving	€1391
Cost of delayed calving interval	€1.37 / day over 365 days, lighter weaning weight
Other variable costs maintenance of suckler cow such as purchased feed, fertiliser, contractor, vet etc.	€250 per year

Figure 2 shows the year of first calving, the bottom 20%, average and top 20% lifetime profit of the cow for 102,989 cows, which calved for the first time between 2002 and 2006 and had full traceability on their progeny.



As expected lifetime profit shows a strong relationship with the year of first calving of the cow, and hence the number of progeny which generated income through mart sales, slaughter in the factory and generation of daughters as replacements. The results show a large deviation in profit generated when comparing the top 20% to the bottom 20% for any individual year. The difference is larger as the cows get older (have more progeny) and thus more time to express their profit potential. Not surprisingly the revenue from progeny sales for the bottom 20% is not enough to pay for the cost of keeping the cow. Sadly this is the case on a lot of Suckler farms today. Most farmers can readily identify their most profitable cows late in life themselves. Identifying and culling poor cows is probably a more important exercise. A more useful tool would be a predictor of profit while the cow is relatively young, which would allow farmers to cull poor cows at an earlier stage and replace them with heifers of better genetic merit. This is the aim of the €uro-star SBV indexes, and for commercial cows in particular the two replacement indexes; the Milk & Fertility index and the Calf Quality index. The Milk & Fertility index contains the traits; age at first calving, calving difficulty, maternal weaning weight (milkability), calving interval, survival and cull cow carcass weight. The Calf Quality index is a reflection of the quality of the calf the cow is likely to produce and factors in weaning weight, carcass traits and feed intake.

Using the dataset of 102,989 cows from Figure 1, 13,929 cows were identified as having a sire recorded and hence an SBV index. From this subset of cows the relationship of lifetime profit with the Milk & Fertility index and the Calf Quality index was determined. Again there was a requirement that all cows had full traceability on all their progeny from birth to final destination of mart sale, whether for export, subsequent slaughter in Ireland, or subsequent use as a replacement heifer, slaughter directly out of the herd or kept as a replacement in the herd. Of the 13,929 animals in the analysis 2%, 6%, 14%, 27% and 52% were born in the years 2002, 2003, 2004, 2005 and 2006 respectively. Figure 3 shows an example of the €uro-star indexes available on a cow and the Replacement Value at the bottom divided into the Milk & Fertility component and the Calf Quality component. The same indexes are available for cows with sires recorded.

Figure 3. An example of a €uro-star Index on an eight year old commercial suckler cow

Within Breed		Index	Data rel	Across Breed
★★★★★	Suckler Beef Value	€ 178	44%	★★★★
	Beef Value			
★★★	Calving Traits	-€ 4	38%	★★★★
★★★★★	Weanling Export	€ 94	50%	★★★
★★★★	Beef Carcass	€ 106	51%	★★
	Replacement Value			
★★★★★	Milk & Fertility	€ 141	24%	★★★★★
★★★★	Calf Quality	€ 298	52%	★★★

Table 2 shows the relationship between the estimated lifetime profit for the 13,929 cows with a first calving in the years 2002-2006 and the two Replacement indexes. The results show a strong relationship between the indexes and the estimated lifetime profit. Cows that have a strong combination of both Milk & Fertility Traits and Calf Quality traits (overall replacement value) have the best lifetime profit. In fact two of the five groups, "*cows with an average overall replacement value*" and "*cows in the bottom 20% for replacement value*" had negative profit, indicating that the revenue from progeny sales was not enough to cover costs of production. Comparing the Top 20% to the Bottom 20% on overall replacement value, there is a difference of €820 over the lifetime of the cows to date. Spread over the average of 3.5 calves (average of Top and Bottom 20%) this equates to a difference of €234 per calf born.

Further analysis of the data indicates that the Top 20% of animals for Milk & Fertility index have slightly higher profit than the Top 20% for Calf Quality index, indicating the importance of this index as a reflection of lowering costs of production and increasing farm profit. The higher profit is coming from a combination of lower rearing cost of the cows themselves, more calves born, lower mortality, reduced calving interval and more replacements returned to the herd. Hence even though the Top 20% of cows for Calf Quality index had higher returns in the mart and the factory per calf born, these cows produced less calves to offset the production costs. Looking at the average performance of the calves sold in the mart, the Top 20% of cows on overall replacement value had higher progeny mart weights (379kg) than either the Top 20% on Milk & Fertility index (365kg) or Calf Quality index (373kg) at roughly the same age. This suggests that the progeny of these cows got the benefit of better genes for growth rate, and also better rearing from their dams - most likely due to better milk yield. Cows in the Top 20% for Calf Quality index, as expected had higher progeny prices per kg in the marts and better progeny carcass performance, but less overall lifetime profit from both sources due to poorer fertility traits when compared to the Top 20% on overall replacement value. The cows in the Top 20% for Milk & Fertility have more young-stock still on the farm compared to all the other categories, followed by the Top 20% on overall replacement value which will in the future widen the revenue gap between these two and the rest. The category with the lowest level of young-stock still on farm is the Top 20% on Calf Quality category which has also has the lowest Milk & Fertility (-€31). The last column in Table 2 shows the average number of daughter replacements out of each category of index comparison, and also the number of grand-progeny from these daughter replacements. One point to note is that this number of daughter replacements includes those daughters sold on which calved down outside the herd of origin. The average number of daughters which remained in the herd of origin for replacement was 0.1 for four of the categories listed, with the only exception being the Top 20% for Milk & Fertility category where an average of 0.2 daughters were kept in the herd of origin for replacement.

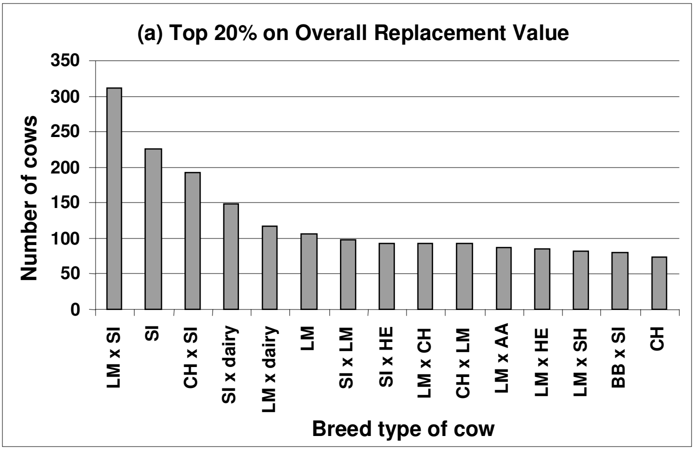
Table 2. The relationship between the estimated lifetime profit for 13,929 cows with a first calving in the years 2002-2006 and the two replacement indexes which are part of the suckler beef value: Milk & Fertility and Calf Quality

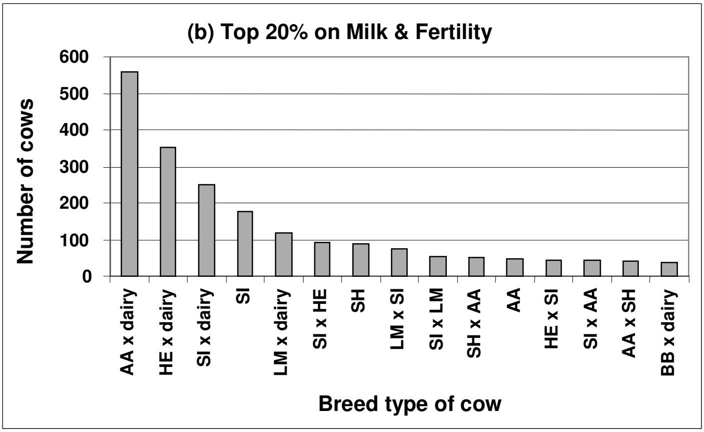
Category of cow genetic index	Estimate of lifetime profit (€)	Age at 1st calving (years)	Index values: repl. value/milk & fertility/calf quality	Avg. no. calves born	Avg. no. progeny dead at 28 days	Avg. calving interval (days)	Avg. young progeny still alive in herd	Avg. no animals sold	Avg. Mart weight (kg) / age (days)	Avg. Mart price (cents per kg)	Avg. carcass weight (kg)/age (days)	Avg. carcass grade	Avg. no. daughters became a replacement / Average number grand progeny
Cows in top 20% for repl. value (milk & fertility + calf quality)	€638	2.41	€362/€79/ €283	3.7	0.06	404	1.17	2.4	379/3 57	1.79	369/ 680	Between R+ and U-	0.5/0.8
Cows average for repl. value (milk & fertility + calf quality)	-€145	2.49	€231/€39/ €192	3.5	0.06	417	1.04	2.3	362/3 71	1.82	352/ 703	R+	0.4/0.6
Cows in bottom 20% for repl. value (milk & fertility + calf quality)	-€182	2.58	€113/€22/ €91	3.3	0.08	432	1.06	2.0	370/4 05	1.77	343/ 716	Between R= and R+	0.3/0.4
Cows in top 20% for milk & fertility	€540	2.41	€265/€16 8/€97	3.7	0.06	404	1.22	2.3	365/3 65	1.67	344/ 690	Between R= and R+	0.5/0.8
Cows in top 20% for calf quality index	€205	2.45	€313/ -€31/€344	3.5	0.07	418	1.00	2.3	373/3 57	1.85	376/ 692	U-	0.3/0.5

The differences shown in Table 2 between the Top 20% of cows for the various indexes are likely to have originated from different breeds/breed crosses. Figure 4 shows the breed type of the top 20% for (a) Overall Replacement value (Milk & Fertility + Replacement Calf Quality), (b) Milk & Fertility index, (c) Replacement Calf Quality index for the 15 most frequent types in each category. In the Top 20% on Overall Replacement merit, seven different beef breeds are represented and some first cross dairy beef cows. However the comparison of the Top 20% for Milk & Fertility versus the Top 20% for Calf Quality shows quite a different picture with the traditional breed crosses and the dairy-beef crosses predominant in the former and the continental breed crosses dominant in the latter.

However there is still a large breed mix with 6 beef breeds and a number of dairy crosses in the Top 20% for Milk & Fertility, while there were seven beef breeds represented in the Top 20% for Calf Quality. The dams of the dairy crosses were a mixture of Holstein and Friesian. Table 3 shows the percentiles for the 23,929 cows in the analysis compared with all commercial crossbred cows which have indexes and which had a calf in the last two years (107,522). The comparison shows that the cows in the analysis had a relatively similar average index and spread in index, compared to all commercial crossbred cows in the ICBF database with indexes. Thus conclusions drawn from the analysis should also be relevant to the commercial cow population as a whole.

Figure 4. Breed type of the top 20% of 23,929 cows in the analysis for (a) overall replacement value (Milk & Fertility + Calf Quality); (b) Milk & Fertility index; (c) Calf Quality index for the 15 most frequent types in each category




(b) Top 20% on Milk & Fertility
Number of cows
600
500
400
300
200
100
0
AA x dairy
HE x dairy
SI x dairy
SI
LM x dairy
SI x HE
SH
LM x SI
SI x LM
SH x AA
AA
HE x SI
SI x AA
AA x SH
BB x dairy
Breed type of cow

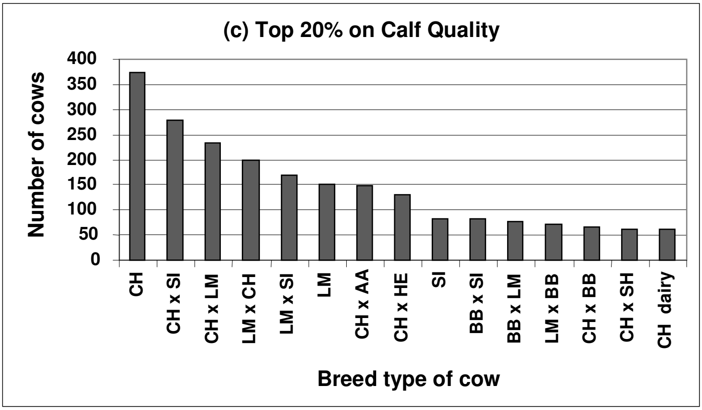

(c) Top 20% on Calf Quality
Number of cows
400
350
300
250
200
150
100
50
0
CH
CH x SI
CH x LM
LM x CH
LM x SI
LM
CH x AA
CH x HE
SI
BB x SI
BB x LM
LM x BB
CH x BB
CH x SH
CH dairy
Breed type of cow

Table 3. Comparison of the indexes on the 23,929 cows in the analysis with all commercial crossbred cows which have indexes and which had a calf in the last two years (107,522)

Category	Trait	Bottom 20%	Bottom 40%	Average	Top 40%	Top 20%	Top 10%
23,929 cows in current analysis	Milk & fertility	-€34	€19	€43	€69	€126	€162
	Replacement calf quality	€97	€166	€190	€220	€282	€330
All (107,522) commercial cows with indexes	Milk & fertility	-€30	€26	€49	€77	€133	€167
	Replacement calf quality	€62	€147	€173	€203	€272	€324

Conclusions

The analysis of lifetime profit indicates that the bottom 50% of commercial cows struggle to return a profit to suckler farmers. The cow lifetime profit measure calculated in this analysis, showed a good relationship with the €uro-star indexes for replacement merit on these cows. This is an important finding as it indicates the indexes are heading in the right direction. However the lifetime profit measure calculated also has some obvious limitations: i) the same variable cost structures apply across all cows and herds even though there are big management differences on farms for both cows and their progeny; ii) there is no accounting for farm fixed costs in analysis; iii) there is no accounting for genetic merit of sire in the analysis; iv) the cow has to have a number of progeny before profit is known. Not withstanding all these limitations, there are enough cows in the comparison to counter these management and sire differences and allow a comparison with the €uro-star replacement value indexes on the cows.

Selection indexes can allow farmers to rank cows for culling or selection of replacements on their own individual merits and are independent of the breed or cross type to which the animal belongs. However, the indexes also have limitations. Among the most obvious are that they require a sire to be known on the cow. Currently only 10% of the ~960,000 commercial cows have a sire known. Also low reliability and inaccurate indexes on the cows that do have indexes, are due to unavailability of quality performance data on the cow herself or her progeny. Commercial farmers should now realise that the level of information provided by commercial herds will be the main determinant to the progress and accuracy of the new indexes. In that regard a small investment in time could yield a large return.

<u>Key recommendations to improve the reliability of the indexes:</u>

1. Record the sires of calves born in herds as far back as possible. Through the ICBF website each farmer can view his/her own herd details and record sires on calves easily, even if the calves have already left the herd. This will

have a two-fold effect in that it will increase the reliability of the figures on an individuals stock bull and cows, but it will also allow the purchaser of female progeny sold for breeding to assess the genetic merit of the stock. The suckler scheme has had a huge impact on the level of sire recording with data on >90 % of calves born since January 2008. The impact on the Milk & Fertility index will only take effect from 2010 onwards when the 2008 born females begin to calves down. Hence a once off drive to collect and record missing sires on the current cow population could yield enormous dividends to the beef industry as a whole, including both commercial and pedigree farmers.

2. Record ease of calving, suckler welfare docility and calf quality accurately. The docility information has already been harnessed into providing new docility evaluations on AI sires comparable across all breeds. This will eventually be rolled out to stock bulls and cows. In a similar way the calf quality data is now being looked at for inclusion into the €uro-star indexes.

3. Weigh calves at weaning time and record the information through the website or through animal events. The weight on a weanling provides information on the genetic merit of the sire for growth rate but also on the milk yield of the dam of the calf. The age limits for which weaning data is used is from 150-300 days of age.

Using the indexes - Careful selection of breeding stock

4). Use the Herdplus reports to focus on weaknesses in the herd and address them. This can be done whether selecting AI bulls, natural service sires or culling cows and selecting replacements for the herd. Decide the type of sire mating which will yield the most profit, i.e. cows with strong Calf Quality indexes will yield superior quality progeny for mart or factory sales, while cows with a good balance of Milk & Fertility and Calf Quality could be considered for breeding replacements by mating with bulls proven for good maternal ability. The use of a lifetime profit measure on cows that have no sire or indexes could also aid in selection decisions on older cows.

Grass budgeting – what it can do for suckler beef farmers

David Kirwan
Kilmacthomas, Co. Waterford

Introduction

The farm is located 6km from the coast in the townland of Drumlohan, between Kilmacthomas and Stradbally in Co. Waterford, and sits at 200 feet above sea level. Total land area is 84ha, of which 65ha comprise relatively dry brown shale soils. The remaining 19ha is reclaimed ground that is heavy and of limited use during wet periods. A suckler herd of 100 cows calve from September to December (65) and from January to March (35). Some of their progeny is brought through to beef. Approximately 25% of calves are bred from A.I bulls, the remainder being produced by two Charolais stock bulls. Some of the male calves are finished as heavy bulls out of the shed (carcase weights are 450+ kg), with the remainder sold as stores. Heifers are finished mostly off grass. All replacement heifers are bred within the farm. The farm is currently a demo farm for the new Teagasc-Farmers Journal BETTER Farm Programme.

<u>Progress to date</u>
Teagasc data from eProfit Monitor is available since 2002. Over this period the focus has been on improving breeding, grassland management, stocking rate, output of beef per hectare and hence my profit per hectare. A summary of the progress made to date is outlined in Table 1.

Table 1. Improvements in output and profitability since 2002

	2002	2004	2006	2008
Stocking rate (Lu/ha)	1.75	1.85	1.88	2.02
Output beef (kg LW/ha)	567	662	645	862
Gross output (€/ha)	708	966	953	1567
Variable costs (€/ha)	413	416	500	815
Gross margin (€/ha)	295	549	453	752

<u>Farm strengths' and weaknesses</u>
Most of the farm is relatively dry, and has been reseeded over the years. Relatively new pasture combined with proximity to the sea means that the farm can grow reasonably early grass. Hence cattle can be put to grass early in the year. The farm is all in one block (divided by a secondary road), so fragmentation is not a problem.

Parts of the farm are quite heavy and in wet periods this puts a huge stocking rate pressure on the remainder of the farm. A restricted amount of housing limits the option of rehousing large numbers of cattle if the weather is particularly bad. The split autumn and spring calving herd means there is a large number of grazing groups on the farm.

Grass budgeting – the mechanics
A grass budgeting course for a small number of interested suckler farmers in the Co. Waterford was initiated over four years ago. Each year the group visits one particular farm at regular intervals, measures the amount of grass and calculates the number of days grazing available. The group then makes decisions in conjunction with the host farmer as to what should be done over the coming weeks. From day one it was decided to keep the 'mechanics' of grass measurement simple, practical and user friendly.

Grass cutting shears and quadrants are used to train the eye as to how much grass dry matter (DM) there is per hectare in a field or paddock. In a short period of time it is then possible to move to estimating the grass cover in each paddock. Each grazing division is categorized as a 1, 2, 3, 4 or 5. Over 90% will be 1, 2 or 3. The ranges are as follows;

- 1 = < 500kg DM/ha
- 2 = 500 to 1000kg DM/ha
- 3 = 1000 to 1500kg DM/ha
- 4 = 1500 to 2000kg DM/ha
- 5 = > 2000kg DM/ha

As the farm is walked, the area of each paddock is noted. At the end of the farm walk the total area within each category is known, and hence the cover for the entire farm. Demand per day is based on the number of cattle on the farm and an estimate of their weight. It is assumed that 2% of body-weight is consumed (in DM) each day. Taking into account grass utilization rate, cover is divided by demand to give the number of days grass ahead on the farm.

Calculating how much grass is on your farm and how long it is likely to last is only the start of grass budgeting. It is what is done with this information that delivers the real value from it.

Grassland objectives
There are three main objectives when it comes to grassland management. They are:-

- To lengthen the number of days cattle are at grass during the year,
- To grow more quality grass,
- To optimise the performance of my cattle at grass.

To achieve these objectives: -
Start to close up accessible ground from early October onwards. The aim is to have a cover of grass grown in the autumn for cattle to go out onto early in the spring. Grass budgeting is used to quantify what grass is on the farm. This gives more confidence to make informed decisions in allocating this grass. However, even with measuring grass, it is still necessary to take into account other factors such as the

current weather conditions, the coming weather, ground conditions and soil temperatures.

Prioritise the stock that are to be turned out first. The following is a suggested order of turnout.

Spring calvers – these are turned out almost immediately after calving (weather permitting). They are the first group to go out as this saves a huge amount of time and labour, and also the calves are much healthier outside compared to staying inside.
Autumn cows – these are turned out by day to begin with until covers start to build up from the middle of February onwards. During the winter their calves have access from the shed out to grass every day. Again this has huge benefits in terms of health and labour, and it also gets them used to eating a grass diet.
Store heifers – some of these will be bred and those that are not bred will be finished off grass.

By mid-March 50% of the entire farm will be grazed. This is an important benchmark as it gives this ground time to rebuild a cover of grass for the second rotation, which starts in early April.

<u>Management changes as a result of grass budgeting</u>
Paddocks are walked weekly. This is hugely important - especially over the last number of extremely difficult weather years. The sooner an impending problem is identified, the sooner a decision can be made as to what to do.

Target pre-grazing covers have been reduced considerably. In the past it was a common practice to graze paddocks with over 2000kg DM/ha. Today the aim is to graze covers that are less than 1500kg DM/ha. Grazing these lower covers means getting a much higher percentage of high quality leafy grass into the animals diet.

Tighter grazing, especially in the first two rotations is now the target, e.g. down to 3.5cm. By achieving these target heights, the old dense mass of dead grass at the butt of the sward that has built up over the winter is eliminated. The grass that grows as a result of these target grazing-heights is green right to the base of the plant, and the resultant sward is much thicker. In later grazings, the aim is to graze to 5cm or lower, depending on the weather and ground conditions.

The following is a suggested plan of how many days grazing it is optimum to have ahead of the cattle at different times of the year.

- Feb./March 30 days
- April to June 12 to 14 days
- July/Aug 16 to 18 days
- Sept. 25+ days

Non-performing paddocks are being identifying (based on the amount of grass grown compared to other paddocks), and targeted for reseeding.

The effects of taking out paddocks for silage, when there is an excess of grass is very evident - it is hugely beneficial and absolutely vital if control is to be maintained.

Matching the supply of grass to the demands of different groups of stock is critical. The autumn calvers and their calves have a significantly higher demand per day than the spring calving cows and calves.

<u>For consideration</u>

Grazing big numbers of suckler cows together in wet weather is very hard to manage, especially when you go above 50 cows and their calves. When weather is extremely wet, cows have to be confined or housed altogether. Severe poaching retards growth significantly for the remainder of the year – thin pastures just do not yield!

Confining cows to 'stand-of areas' and letting their autumn born calves through creep gates to remain at pasture works extremely well. It also works with the spring born calves, which can creep out under a raised electric wire. It is a last resort to re-house cows with calves due to the risk of pneumonia and injury with young calves.

Use of a back fence minimizes damage during very wet weather. Infrastructure is vital for both flexibility and control. This includes roadways through out the farm and properly positioned water troughs. Wet ground is a big problem with rotational grazing in wet weather. It cannot be grazed and this increases the stocking rate on the dry ground to critically high levels.

Reseeding has changed the seasonal distribution of grass growth, with more early and late grass now available. Late heading diploid varieties with a small amount of white clover are considered optimum in this situation. The aim is for thick persistent swards that will survive well in wet weather, and will put up with a certain amount of hardship. For this reason tetraploid varieties are not included in reseeding mixtures.

Having a split herd can generate a large numbers of groups to manage (e.g. autumn cows with bulls, autumn cows with heifers, spring calving cows, dry cows, store heifers, cull cows etc.). Seriously consideration should be given to having all cows calving in the one period. Less groups of stock would simply grassland management. Trying to budget with the current number of groups is very difficult.

The need for flexibility cannot be overstated!

<u>Performance at grass</u>

Teagasc have been weighing cattle on this farm for a number of years. In 2008, from the March 23 to December 8, the autumn bull weanlings gained an average of 1.45kg LW/day. As part of the GROW programme, autumn born weanlings (bulls and heifers) were weighed on May 28 2009. Liveweight gain from birth for 52 calves was 1.3kg/day. At 243 days of age they weighed an average of 346kg.

Summary

In every business, efficiency is essential for profitability and survival. While many factors that contribute to viability are outside farm-gate control, it is important to focus on those that can be improved on. Grass budgeting is one such tool that is under the farmers control, and when properly implemented will result in cost savings at farm level. It provides confidence to the decision making process, and allows decisions to be made earlier than would otherwise be the case. Grass is the cheapest feed used in beef production, so anything that helps to increase its efficient use, has to be beneficial in cutting costs.

What feed efficiency in the suckler cow has to offer beef farmers

Mark McGee
Teagasc, Grange Beef Research Centre

Introduction

Providing feed is the largest variable cost on beef farms. In suckler beef systems, there is a large maternal cost to production. For example, the cow herd consumes approximately 85% and 50% (or greater) of the annual feed budget in suckler calf-to-weanling and calf-to-beef systems, respectively. As about 70% of the total energy consumed by beef cattle goes towards maintenance requirements, this means that cow maintenance costs are a considerable proportion of the total costs of beef production systems. Accordingly, beef breeding selection strategies need to focus on improving feed efficiency without negatively altering performance or output traits. Improving feed efficiency in this way will result in reduced input costs and ultimately increased profitability for producers. It should also result in reduced excretion of nutrients to the environment and thus, a lower environmental footprint for beef production.

Feed efficiency measures

Traditionally, feed efficiency was expressed as the ratio of feed intake to weight gain (FCR) but selection for this measure leads to an increase in mature size and maintenance requirements (Crews, 2005). This has negative ramifications for the efficiency of both the suckler cow and their progeny but it is of much greater significance for the cow component because of the proportionately higher costs associated with it.

An alternative measure of feed efficiency, that is independent of growth and body size, is <u>residual feed intake (RFI)</u> (also called net feed efficiency). This is defined as the difference between an animal's actual intake and its predicted intake, calculated from its weight and rate of gain, with negative or lower values desirable. [The predicted intake is based on tabular values or regression analysis]. Take for example two steers, the same age and weight and both are growing at the same rate. Say, that the predicted intake for each of them is 10.0 kg dry matter (DM)/day. However, one steer is eating 9.5 kg DM/day and the other one is eating 11.0 kg DM/day. In this case, the steer eating 9.5 kg DM has a RFI of -0.5 kg DM and the steer eating 11.0 kg DM has a RFI of +1.0 kg DM. Therefore, efficient animals eat less than expected and have a negative or low RFI value, whereas inefficient animals eat more than expected and have a positive or high RFI value. In other words, for the growing animal, RFI is the variation in intake that remains after accounting for the requirements for maintenance and growth. What makes up the variation in the remaining or residual portion is not fully understood. Through using RFI, cattle are selected for lower maintenance and feed intake, without increasing body size and growth rate.

In order to calculate RFI, individual intake and growth of animals needs to be recorded over at least 70+ days, following a period of dietary adaptation. Understanding why one animal is more efficient than another is also important, in order to enhance our rate of progress. Consequently, many additional measurements are needed.

In beef cattle, most of the published research is based on growing and finishing cattle with the latter often offered high-concentrate diets. There is very little information published on RFI in cattle offered grass-based diets and even less published on RFI in the suckler cow herself.

The question is, what has RFI to offer and is it a trait worth pursuing?.

Residual Feed Intake in pedigree breeding bulls

A preliminary study was carried out at Teagasc Grange using data from pedigree breeding bulls at the National Bull Performance Centre, Tully. It included the main breeds in Ireland. Results showed that when bulls within each breed were divided into three groups based on phenotypic RFI - low (efficient), medium and high (inefficient) - those with low and high RFI had similar growth rates, live weight and weight per day of age (an indicator of mature size) but high RFI bulls consumed approximately 11% more feed per day (Drennan *et al*., 2005; 2006). Recent results from a more comprehensive investigation of a much larger dataset from Tully, encompassing both phenotypic and genetic analysis, also demonstrated that RFI was applicable across all the main breeds, and additionally, that there is significant genetic variance; heritability is ~0.46 (Crowley *et al*., 2009). This heritability is similar to that of growth rate. Thus, with sufficient data, we can effectively select for RFI.

Residual Feed Intake in the suckler cow herd

Similarly, analysis of data from a suckler cow herd at Teagasc Grange showed that where cows were divided equally into two groups based on phenotypic RFI, those with low (efficient) and high (inefficient) RFI did not differ in live weight, daily live weight gain and body condition score but cows with high RFI consumed approximately 14% more (Table 1). Furthermore, there was no effect of cow RFI group on calving difficulty score, colostrum yield and immunoglobulin concentration, calf immune status or on cow milk yield and calf daily gain. Likewise, in a subsequent study at Grange, cows with high (inefficient) RFI consumed approximately 10% more than cows with low (efficient) RFI, but there was no difference between the RFI groups in performance or output (Table 2).

These results indicate large variation in feed efficiency in the suckler cow herd.

Table 1. Productivity traits in beef suckler cows with low and high phenotypic residual feed intake (RFI)

	RFI group		Sig.
	Low (Efficient)	High (Inefficient)	
Expected silage intake (kg DM/day) [n=56]	9.7	9.8	NS
Actual silage intake pre-partum (kg DM/day)	9.1	10.4	***
RFI (kg DM/day)	-0.6	+0.6	***
Live weight (kg)	728	724	NS
Daily live weight gain (kg)	0.49	0.57	NS
Body condition score (0-5)	3.1	3.1	NS
Calving difficulty (scale 1-5)	1.5	1.5	NS
Calf birth weight (kg)	45.3	49.4	*
Cow serum IgG_1 (mg/ml) [n=38]	16	18	NS
Colostrum yield (ml)	3770	3504	NS
Colostrum total Ig (mg/ml)	178	177	NS
Calf serum total Ig @ 48-h (mg/ml)	59	52	NS
Intake post-partum (kg DM/day) [n=30]	8.9	9.4	P=0.
Milk yield (kg/day)	7.7	7.9	NS
Calf gain (g/day) [37-d period]	795	824	NS

Source: McGee and Drennan (2006a and b) - Grange Beef Research Centre

Table 2. Annual performance of first-calving beef suckler cows with low and high phenotypic residual feed intake (RFI) and growth of their calves pre-weaning

	RFI group		Sig.
	Low (Efficient)	High (Inefficient)	
Recorded intake period			
Expected silage intake pre-partum (kg DM/day)	7.5	7.6	NS
Actual silage intake pre-partum (kg DM/day)	7.1	7.9	***
RFI (kg DM/day)	-0.4	+0.3	***
Live weight (kg)	503	511	NS
Daily live weight gain (kg)	0.22	0.21	NS
Body condition score (0-5)	2.7	2.6	NS
Start of grazing season			
Live weight (kg)	464	463	NS
Body condition score (0-5)	2.1	2.0	NS
End of grazing season			
Live weight (kg)	513	509	NS
Body condition score (0-5)	2.0	1.9	NS
Calving difficulty (scale 1-5)	1.4	2.2	NS
Calf live weight (kg)			
Birth	38.6	39.3	NS
Start of grazing season	66	69	NS
Weaning	279	276	NS

Source: McGee *et al.*, (2007) - Grange Beef Research Centre

Current research at Teagasc Grange on residual feed intake

Following the preliminary results outlined above, a detailed study was initiated at Teagasc Grange to evaluate the concept of RFI as a measure of identifying feed efficient suckler cows and progeny. This is a collaborative project involving Teagasc, UCD, ICBF and Colorado State University. The evaluation encompasses divergent selection for the trait (i.e. efficient cows are mated to efficient bulls and inefficient cows are mated to inefficient bulls) using the Simmental breed as a model. The objectives of the project are to, firstly, demonstrate the magnitude of the benefit for farmers, secondly, to determine some of the biological basis underlying the trait and thirdly, to identify any associated changes and/or markers in selecting for it.

In this study, purchased weanling heifers (purebred Simmental and Simmental × Friesian) were individually offered grass silage *ad libitum* and 2kg of supplementary concentrate daily during the indoor winter period. At the end of the feeding period, RFI was calculated for each heifer. To better appreciate the range in herd variation, they were divided into three groups based on phenotypic RFI - low (efficient), medium and high (inefficient). The three RFI groups did not differ in live weight, live weight gain, body and ultrasound measurements, muscularity score, blood variables or lying and standing time (not presented) but the high RFI group consumed 19% more feed than the low RFI group (Table 3). These heifers were subsequently bred to Simmental sires with known estimated breeding values (EBV) for RFI.

Table 3. Productivity related traits in weanling beef heifers differing in phenotypic residual feed intake (RFI)

	RFI group			
	Low (Efficient)	Medium (Neutral)	High (Inefficient)	Sig.
Actual Feed intake (kg DM/day)	5.4	6.0	6.4	***
RFI (UFL/d)	-0.43	0.04	0.41	***
FCE (g live weight /kg DM)	114	105	95	*
Live weight (kg)	324	326	316	NS
Daily live weight gain (kg)	0.59	0.60	0.57	NS
Body condition score (0-5)	2.8	2.7	2.6	NS
Ultrasonic rib fat depth	1.9	1.9	1.8	NS
Ultrasonic lumbar fat depth	2.0	2.1	2.0	NS
Ultrasonic lumbar muscle depth	49	49	48	NS
Muscularity score (1-15)	5.5	5.4	5.2	NS
Withers height (cm)	112	112	111	NS
Back length (cm)	104	103	102	NS
Pelvis width (cm)	44	43	43	NS
Chest circumference (cm)	165	165	164	NS
Chest depth (cm)	61	60	60	NS

Source: McGee *et al.*, (2008) - Grange Beef Research Centre

During the following winter they were individually offered grass silage only *ad libitum* (plus a mineral vitamin supplement) and RFI was calculated for each animal during pregnancy (i.e. as first calvers). Similarly, they were divided into low (efficient), medium and high (inefficient) RFI groups. Intake of grass silage for the high RFI group was 21% greater than the low RFI group and yet, the RFI groups did not differ in live weight or live weight gain, body condition score, ultrasonic fat and muscle depth, withers height, back length, pelvis width, chest depth or circumference, calving difficulty or calf birth weight (Table 4). Time spent lying, standing or active did not differ either (not presented). There were differences in muscularity score in favour of the low RFI animals. Analysis is ongoing for other measurements carried out on the cows, which included intake of grazed grass, blood and rumen variables, feed digestibility, colostrum yield and quality, and milk yield.

Table 4. Productivity related traits in pregnant beef heifers differing in phenotypic residual feed intake (RFI)

	RFI Group			Sig.
	Low (Efficient)	Medium (Neutral)	High (Inefficient)	
Expected feed intake (kg DM/day)	7.8	8.1	7.8	NS
Feed intake pre-partum (kg DM/day)	7.1	8.1	8.6	***
RFI (kg DM/day)	-0.7	0.0	+0.8	***
Live weight (kg)	559	575	565	NS
Daily liveweight gain (kg)	0.46	0.53	0.46	NS
Body condition score (0-5)	2.9	2.8	2.8	NS
Ultrasonic fat depth (mm)	3.1	3.3	3.0	NS
Ultrasonic muscle depth (mm)	59.9	58.8	57.0	NS
Muscularity score (1-15)	5.8	5.6	5.2	*
Withers height (cm)	122	126	125	NS
Back length (cm	116	118	113	NS
Pelvis width (cm)	52	53	52	NS
Chest depth (cm)	71	72	71	NS
Chest circumference (cm)	197	196	195	NS
Calf birth weight (kg)	43.8	46.6	44.7	NS
Calving difficulty (scale 1-5)	2.7	3.0	2.6	NS

Source: Lawrence *et al*., (2009) - Grange Beef Research Centre

The results of these studies confirm that there is large variation in phenotypic RFI within a suckler cow herd.

Another aspect of the study is the examination of the repeatability of RFI through the various stages in the life-cycle of the suckler cow (weanling heifer to pregnant heifer to mature cow). In other words, will a feed-efficient weanling heifer also turn out to be a feed-efficient cow? In this case observing how weanling heifers that were extreme in RFI (i.e. Low vs. High RFI groups in Table 3) subsequently performed as first-calving cows, is of interest. Preliminary analysis shows that intake was approximately 14% higher for the high than the low RFI group with no obvious difference in animal performance (Lawrence *et al.*, unpublished). This indicates repeatability.

Similarly, detailed measurements on the progeny of these cows are ongoing.

Summary

The results to date demonstrate the large phenotypic variation in feed efficiency (RFI) within the suckler cow herd (>20%) and the potential cost savings to farmers if feed efficient animals can be identified and selected for in a breeding programme.

References

Crews, D.H., Jr. (2005). Genetics of efficient feed utilisation and national cattle evaluation: a review. *Genetic and Molecular Research,* **4 (2)**: 152-165.

Crowley, J.J., McGee, M., Kenny, D.A., Crews, Jr, D.H., Evans R.D. and Berry, D.P. (2009). Phenotypic and genetic parameters for different measures of feed efficiency in different breeds of Irish performance tested beef bulls. *J. Animal Sci.* (*In press*).

Drennan, M.J., McGee, M. and Grogan A. (2005). Residual feed intake, feed conversion ratio, growth and body composition traits in pedigree beef bulls. *Proceedings of the Agricultural Research Forum,* March 14 & 15, p69, Tullamore, IRELAND.

Drennan, M.J., McGee, M. and Cromie, A. (2006). Intake, growth, body composition and feed conversion efficiency in pedigree beef bulls differing in residual feed intake. *Proceedings of the Agricultural Research Forum*, March 15 & 16, p102, Tullamore, IRELAND.

Lawrence, P., McGee, M., Kenny, D.A., Crews, Jr. D.H. and Earley, B. (2009). Grass silage intake, rumen and blood variables, ultrasound and body measurements and behaviour in pregnant beef heifers differing in phenotypic residual feed intake. *Proceedings of the Agricultural Research Forum* 2009, March 12 & 13, p50, Tullamore, IRELAND

McGee, M. and Drennan, M.J. (2006a). Relationships between residual feed intake and maternal productivity and metabolic traits of beef suckler cows. *Proceedings of the Agricultural Research Forum,* March 15 & 16, p100, Tullamore, IRELAND.

McGee, M. and Drennan**,** M.J. (2006b). Maternal productivity of beef suckler cows with low and high residual feed intake. *Book of abstracts of the 57th Annual Meeting of the European Association for Animal Production,* Antalya, Turkey, September 17-20, 2006, (ed. Ynze Van der Honing), (Session C 33, Poster 47), p329.

McGee, M., Clarke, A.M. and Drennan, M.J. (2007). Performance of beef suckler cows with low and high residual feed intake on grass-based systems. B*ook of abstracts, 14th Symposium of the European Grassland Federation,* Ghent, Belgium 3-5 September 2007 (ed. A. De. Vliegher, L. Carlier), Abstract No. 2136, p40.

McGee, M., Drennan, M.J., Kenny, D.A. and Earley, B. (2008). Body and ultrasound measurements, muscularity scores, blood physiology and behaviour in growing beef heifers differing in phenotypic residual feed energy intake. *J. Animal Sci.,* **86**, (2), 284.