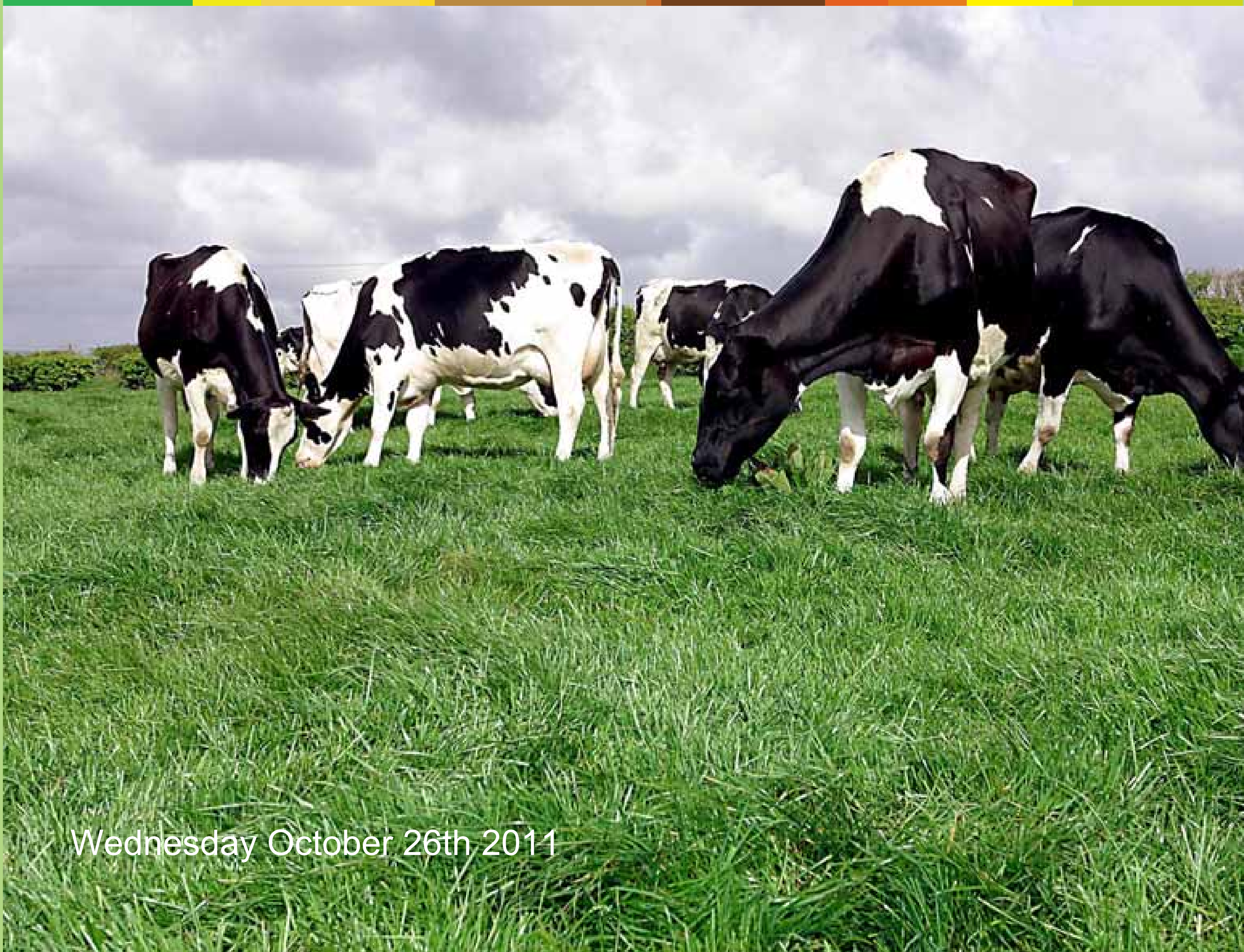
National Liquid Milk Conference

Planning for the Future in Liquid Milk



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Teagasc
Agriculture and Food Development Authority

Ulster Bank
Help for what matters
175 Years

Teagasc National Liquid Milk Conference 2011

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Nutritional Factors Affecting Milk Solids

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Summary

- High milk solids does not mean high feed costs, it means doing the simple things right.
- Milk fat is driven by fibre digestion in the rumen and a supply of fatty acids in the diet. Key minimum targets to create an environment to optimise milk fat include
  - Diet NDF = 28%
  - Diet ADF = 21%
  - NDF from forage 21%
  - Forage : concentrate ratio 40: 60 (minimum)
- Milk protein is driven by maximising PDI (protein digestible in the small intestine) supply to the animal. How?
  - Maximise forage quality, both conserved forage and fresh grass
  - Ensure concentrate feeds are correctly balanced for PDI using good quality protein and energy feeds
  - Target 100-110 g PDI / kg diet dry matter
- It is important to remember that without an appropriate breeding programme, nutritional factors will have a limited effect on milk solids production.

Introduction

The introduction of a payment system based on milk solids for liquid milk suppliers has created some concern that feeding systems will need to change significantly to maximise milk solids production and this will incur additional costs. This is not the case. But it will mean doing the simple things right. Table 1 presents data from 200 liquid milk eProfit Monitor farms which demonstrate that feed costs do not drive milk solids. Average milk solids production across the three categories is approximately 450 kg milk solids / cow / year. The herds with 7.5% milk solids were achieving 450 kg milk solids with less volume. In the new payment system for liquid milk, this group will have a milk price and feed cost advantage.

Table 1. Milk Solids concentration and Feed Costs, Total Variable Costs and Net Margin

	Annual Milk solids %		
	7.00%	**7.25%**	**7.50%**
Annual milk solids kg	451	450	454
Feed cost (c/l)	6.00	5.35	4.71
Total variable cost (c/l)	11.99	11.48	10.97
Net margin (c/l)	5.83	6.99	8.15

MILK FAT

Milk fat is made up of fatty acids which are manufactured in the mammary gland and other fatty acids that arise predominantly from the diet. Acetic acid results from fibre digestion and is an important element of milk fat synthesis. Two things are required for milk fat depression to be experienced, one is an altered rumen environment limiting fibre digestion, and the other is a supply of unsaturated fatty acids in the diet. Rumen function has a major impact on the fatty acids supplied to the mammary gland and therefore on milk fat content. Low rumen pH will alter rumen function and reduce fibre digestion.

Dietary fibre levels

Requirements for fibre (neutral detergent fibre (NDF) and acid detergent (ADF)) are driven in part by the need to maintain milk fat. Dietary fibre is necessary for acetic acid production which is required in the mammary gland to produce milk fat. Target fibre content in the diet of the cow is 28% neutral detergent fibre (NDF) and 21% acid detergent fibre (ADF). Once these requirements are met there is no benefit in supplying additional fibre.

Fibre from forage
The effective fibre concept is an attempt to formulate diets for the ability to stimulate chewing activity. To achieve this, there must be adequate fibre from forage sources. A minimum of 21% of the fibre (NDF) should come from forage. As the amount of NDF from forage increases, the total NDF concentration can be decreased and vice versa.

There is increasing interest in the use of straw in the diet. Straw is useful in cases where there is insufficient forage fibre in the diet. However, there is no advantage in feeding more than is needed to achieve the target fibre from forage. Excessive feeding of forage fibre can reduce intake and consequently, total energy intake and milk protein.

Particle size
Importantly the length of forage particles is critical in ensuring chewing activity, minimising the risk of low pH. In general, particle size is not an issue in precision chopped silage in this country. Typical chop length is 3-4 cm, while in the US its closer to 1 cm. However, excessive mixing / chopping of the feed in the diet feeder can result in excessively small chop length, reducing effective fibre and resulting in depressed milk fat.

Dietary starch/sugar levels
Feeding a low fibre, high starch / sugar diet will depress milk fat. A high dietary content of starch/sugar can be associated with rapid fermentation giving rise to peaks of acid and low pH in the rumen. Aim for 20-25% starch + sugar in the diet if feeding a total mixed ration (TMR), decrease this to 10-15% where cows are parlour fed only.

Source of starch
Starch sources that break down rapidly in the rumen can depress fibre digestion and consequently milk fat. Wheat is the most rapidly degraded starch source. Barley is more slowly degradable than wheat and maize is more slowly degradable than barley. Processing of grain can affect the rate of degradation. Ground cereals and cooked cereals break down more readily in the rumen. If high levels of cereal are being used, it may be advisable to supply some of the cereal as maize grain to slow the degradability.

Forage : concentrate ratio
A minimum of 40% forage to 60% concentrate should be included in diets. However the points mentioned above in terms of dietary fibre, effective fibre, forage fibre, starch concentration and source of starch are all key interrelated factors.

Unsaturated fatty acids (UFA's) in the diet
It was stated above that two things are required for milk fat depression to be experienced, one is an altered rumen environment and the other is a supply of unsaturated fatty acids in the diet. All the factors above are basically related to changing the rumen environment by reducing the rumen pH. Normally in the rumen, the unsaturated fatty acids from the diet are utilised using a particular pathway. However, when the pH in the rumen is reduced the pathway changes to produce unique fatty acids, some of which are potent inhibitors of milk fat synthesis.

Buffers
If a decrease in milk fat depression is experienced the diet should be examined in order to assess if there is correct forage fibre included to maintain a normal rumen environment, particularly rumen pH. In cases where this is not possible to achieve, other rumen modifiers (such as buffers, yeast, etc.) which can increase rumen pH may be required.

Table 2. Factors contributing to a healthy rumen and reducing the risk of milk fat depression

	TARGET
kilograms of concentrates fed at first milking	≤ 4 kg
Rate of increase in concentrate feeding after calving	≤ 0.75 kg /day
Diet NDF % from forage	> 21%
% of forage particles > 4 cm	15 - 20%
Diet starch + sugar %	< 20 - 25%
Individual **mid-lactation** cow data. Herd average milk fat% - individual cow milk fat%	<1.0%
Individual **mid-lactation** cow data. Milk protein% - milk fat% (milk fat is usually greater than milk protein)	<0.4%
% of cereals in the concentrates	35 - 40%

Source : Mulligan et al 2006

MILK PROTEIN

Milk protein is made from building blocks called amino acids. The quantity of amino acids reaching the mammary gland is reliant on the quantity of microbial protein produced in the rumen and the quantity of by-pass protein i.e. protein that is not digested in the rumen but digested in the small intestine. High energy or high crude protein alone in the diet is insufficient to do this. There must be a balance of the two.

How is this applied in formulating a diet for the dairy cow to maximise milk protein yield? A diet formulation system called PDI (protein digestible in the small intestine) is used to ensure that the protein requirements of the cow are matched by protein supply in the diet.

Using this system, the protein requirement of the animal and the supply from the diet are expressed in terms of PDI. This is now the standard system used by Teagasc for research and advisory purposes. It works on the basis that all feeds have 2 protein values:

i) PDIN- protein yield from the available nitrogen (g/kg)
ii) PDIE- protein yield from the available energy (g/kg)

For example, maize distillers grains has a PDIN = 200 g/kg DM and PDIE = 134 g/kg DM. In other words, every kg of maize distillers grains has enough crude protein to produce 200 grams of PDI but only enough energy to produce 134 g PDI. Therefore, the actual protein value of distillers grains is 134 grams / kg DM. This demonstrates that the energy is needed alongside the crude protein to maximise microbial protein yield and consequently milk protein.

A cow requires around 400g PDI for maintenance and 50g PDI per litre of milk. Ideal range is 100-110g PDI per kg DM in the total diet during early lactation, with a minimal difference between PDIN and PDIE. This ensures the right balance between energy and protein. In most Irish diets, energy (or PDIE) is most limiting. In general, there is plenty of PDIN. Research from France and Ireland would suggest that there is no benefit from increasing PDI above 110 g / kg DM for cows producing up to 2.4 kg milk solids per day.

How to make sure there is enough PDI in the diet to deliver high milk protein?

Forage Quality

Over 65% of the cow's diet comes from forage (fresh and conserved) and forage quality is the starting point in achieving high milk protein. High quality forages can deliver a good supply of PDI.

Maximising the proportion of high quality grazed grass in the diet of the cow will help achieve high milk protein. Getting cows out to grass early in Spring will result in a lift in milk protein.

Why so? The PDI content of grazed grass (100-105 g PDI) is considerably higher than that of grass silage (60 g PDI) and maize silage (75 g PDI).

Spring rotation plan should be used in conjunction with a rationed allowance of quality feed to manage early spring. High digestibility pasture with a pre-grazing yield of 1300-1500 kg DM has excellent energy and PDI content and can lead to large feed cost saving in summer. Autumn grazing should be planned depending on the calving pattern, with target pre-grazing not exceeding 1700 kg DM for fresh calved cows.

Feeding higher digestibility grass silage has been shown to increase milk protein concentration. A 6-7 unit increase in DMD results in an increase of 0.1% in milk protein. Feeding between 50-70% of forage dry matter intake as good quality maize silage can increase milk protein concentration by a similar amount.

Protein Type
Not all protein types are of the same quality. Any ingredient can have high crude protein but that does not mean that the yield of PDI will be good. For example (Table 3), sunflower meal has a crude protein of 27.5% and the PDI value is 100 g/kg DM. However, maize gluten feed has a lower crude protein (23.5%) but the PDI value is 125 g/kg DM. The PDI value of a concentrate mix is the sum of the contribution of all the ingredients in the diet. Table 4 offers guidelines on the target PDI required in different concentrate feeds.

Formulating diets to achieve a target PDI (with a good balance of PDIN and PDIE) will actually reduce the crude protein content of the diet, while improving the quality of the protein.

Table 3. Energy and protein content of selected feed ingredients

Analysis / kg DM	**Crude Protein**	**PDIN**	**PDIE**
Barley	11.3	74	103
Maize grain	10.1	83	120
Citrus pulp	6.9	46	91
Soya hulls	11.9	77	107
Beet pulp	10	64	110
Soyabean meal	55.7	396	269
Maize Distillers	29.9	200	134
Rapeseed meal	39.1	254	151
Maize gluten feed	23.5	158	125
Sunflower meal	27.5	179	100
Urea	287.5	1472	-

Table 4. Suggested Nutrient Compositions of a Range of Dairy Concentrates

	UFL	**Crude Protein**	**PDIE[1]**
16% CP Dairy	0.94 +	16%	105+
18% CP Dairy	0.94 +	18%	115+
20% CP Dairy	0.94 +	20%	120+
24% CP Maize / Beet	0.94 +	24%	130+
28% CP Maize Beet	0.94 +	28%	140+

[1]PDI – Using PDIE, this is generally the lower of the two – PDIE and PDIN in dairy concentrate mixes

Concentrate feeding rate
In feeding systems where forage is fed ad-lid, increasing the concentrate feeding level leads to an increase in overall energy intake and a reduction in the forage to concentrate ratio. However, concentrate feeding rate will be decided by forage quality, concentrate price, effect on milk fat and quota situation etc.

Energy Source
Increasing starch in the diet of dairy cows should increase milk protein because of an increase in energy supply. But the evidence of this has been varied. Target starch + sugar levels in the complete diet of the cow in early lactation of 20-25% if feeding a total mixed ration and 10-15%, if feeding in parlour. The cow does not have a specific requirement for sugar or starch individually but a supply of energy for the rumen bugs and this can come from starch or sugar.
Maize grain starch is digested in the small intestine to yield glucose, a blood metabolite associated with improved mammary amino acid supply, which may improve milk protein. The inclusion of maize grain will be driven by price.
The inclusion of high oil levels in the concentrate supplement tends to reduce milk protein concentration. Maximum oil level in the complete diet should be 5-6%. If higher than that, it should be protected fat.

Protein Level
Most studies on the effect of protein level in the diet have indicated that, provided there is not severe protein under-nutrition, increasing protein level in the diet has only a small and inconsistent effect on milk protein concentration.

Protected Amino Acids
The performance of dairy cows in response to feeding ruminally protected lysine and / or methionine products has been extensively researched over the past 30 years. The response in terms of milk production has been variable.

Table 5. Summary of Feeding for Milk Protein

FACTOR	EFFECT
1. FORAGE QUALITY	
High DMD grass silage (+6% DMD)	+0.1% milk protein
Low starch maize silage (green-70% DMD)	+0.1% milk protein No extra milk
Low starch maize silage (weathered - 61% DMD)	+0.13% milk protein -2.2 kg milk yield
High starch maize silage (30% starch)	+0.16% milk protein +2.1 kg milk
Other feeds replacing grass silage (33%) e.g. fodder beet, brewers grains	+0.1 to 0.2% milk protein +3.0 to 3.5 kg milk yield
2. GRASS IN THE DIET	
Cows calving closer to turnout	+0.18% milk protein
Early turnout to Spring grass (part-time)	+0.1-0.25% milk protein 2.9 kg milk
High quality pasture	Improved milk yield & composition
Supplementation at pasture - With concentrates - With silage	 No effect on milk protein negative effect on milk protein & milk yield when grass is plentiful
3. CONCENTRATE FEEDING LEVEL	
Higher concentrate feeding indoors	Higher milk protein % & yield
Moorepark studies (4-8 kg/day)	0.025 - 0.54% protein / kg concentrate
4. CONCENTRATE INGREDIENTS Energy sources	 Generally little difference between energy sources (molassed beet pulp, pressed pulp, cereals, corn gluten, caustic-treated wheat = ground wheat)
Added fat (>5% protected/unprotected)	Depressed milk protein % but may increase milk yield
5. PROTEIN LEVEL AND PROTEIN SOURCE	
Low level of protein (12-15%)	Reduces milk protein
Moderate to high levels (17-25% CP)	No effect on milk protein
Maize distillers grains	Depressed milk protein by 0.12-0.18% at high inclusion (50-70% of concentrate)
6. PROTECTED AMINO ACIDS	
Some response both in conserved forage diets and grazed grass diets but results are variable	
7. PRE-CALVING FEEDING OF PROTEIN SUPPLEMENT	
Soyabean meal or fishmeal with grass silage to appetite	No effect on milk protein
8. METHOD OF CONCENTRATE FEEDING	
Flat rate vs feeding to yield	No effect on milk protein
Complete diet vs separate feeding of silage & concentrate	No effect on milk protein

A calving pattern model for liquid milk herds

Joe Patton, Teagasc Liquid Milk Specialist

Summary

- Calving pattern influences feed costs through its effect on the annual feed budget
- Supplying winter milk in excess of contracts adds extra cost in a split calving system
- Optimum calving pattern for a liquid milk herd depends on liquid contract, milk yield per cow, grass growth pattern, stocking rate and purchased feed cost
- Teagasc have developed a model which calculates the best calving pattern on an individual farm basis. This model also sets targets for feed costs
- Herd fertility performance must improve to achieve the full benefit of an optimized calving pattern

Introduction

Liquid milk farms have a characteristic all-year-round milk supply pattern in order to meet contract requirements. The average liquid milk supplier sells approximately 54% of annual output as daily contract milk, but this varies greatly from farm to farm. In addition, there are various winter bonus schemes in place which also vary between suppliers. Therefore, the pattern of supply required across the year is specific to individual farms, which means that calving pattern may also be specific to individual circumstances.

For many liquid milk herds, supplying milk 365 days a year has meant that calving has gradually slipped to an unstructured all-year-round pattern. A decline in herd fertility performance has contributed heavily to this development. This is illustrated by the mean calving interval for Glanbia liquid milk herds, which now stands at 432 days.

It is often stated that all-year-round calving has little impact on liquid milk herds because cows are milked 365 days per year anyway, or that high yielding cows are capable of milking for over 400 days so compact calving is less relevant. However, this ignores the fact that on a daily basis, the feed cost difference for producing milk indoors is estimated at 5-6cpl extra compared to a grazing situation, despite the potential for higher milk yield. Producing winter milk in excess of supply contracts is unavoidable with an unstructured calving pattern. Extended lactations (greater than 320 days) and keeping carryover cows will reduce milk output per litre of feed consumed, which further contributes to elevated feed costs on many farms. Therefore, having a controlled calving pattern is likely to have a significant impact on feed costs and system efficiency for liquid milk herds. A first step is to define the optimum calving pattern for a given set of on-farm conditions

Developing a calving pattern model

Defining the best calving pattern is a complex function of milk yield per cow, liquid and winter milk contracts, stocking rate, grass growth and feed budget costs. To this end, a model has been developed by Teagasc that brings this information together in a workable format. This model functions by calculating the calving pattern which meets daily milk supply contracts for the least annual feed cost.

Calculations are based on the energy (UFL) demand profile of the herd versus the UFL supplied by available grass and feed. The pattern of energy demand will change depending on calving pattern. Annual feed cost is reduced by meeting a higher proportion of feed demand from the most cost-effective energy source, i.e. grazed grass.

The model was constructed in Microsoft Excel. Its structure contains:

i) lactation curves to define milk yield and composition by month of calving;
ii) liquid and winter supply contract conditions to define supply requirements
iii) grass growth curves to define total pasture available;
iv) spring, summer and autumn rotation plans to ration available grass;
v) a budget for feed supplements
vi) body weight curves to calculate maintenance demand

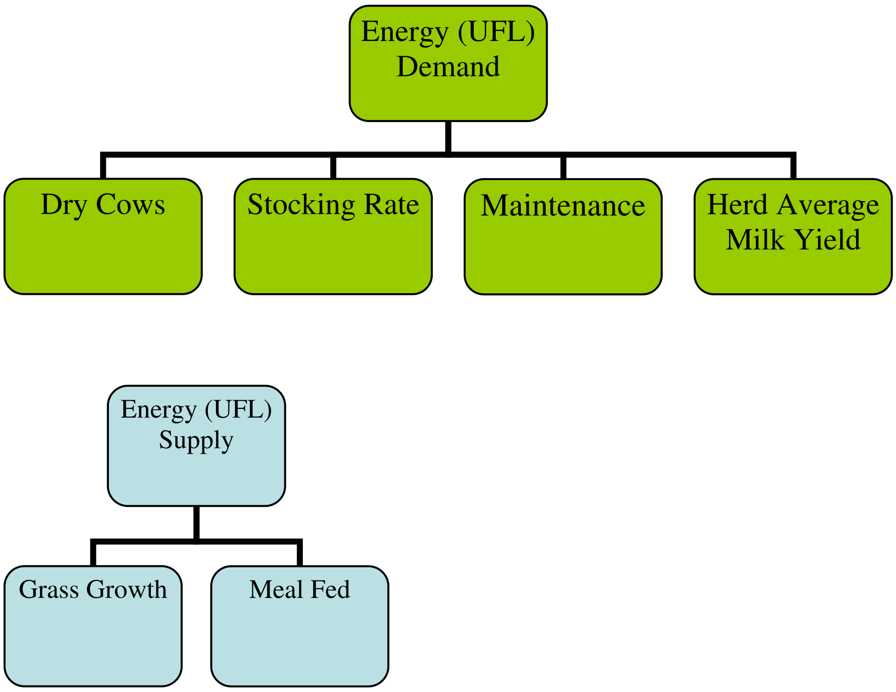


Figure 1. Energy supply and demand in calving pattern model

Calculation of optimum calving pattern is performed using the *Solver* function in Microsoft Excel. This function calculates the minimum cost of the annual feed budget based on a series of model inputs:

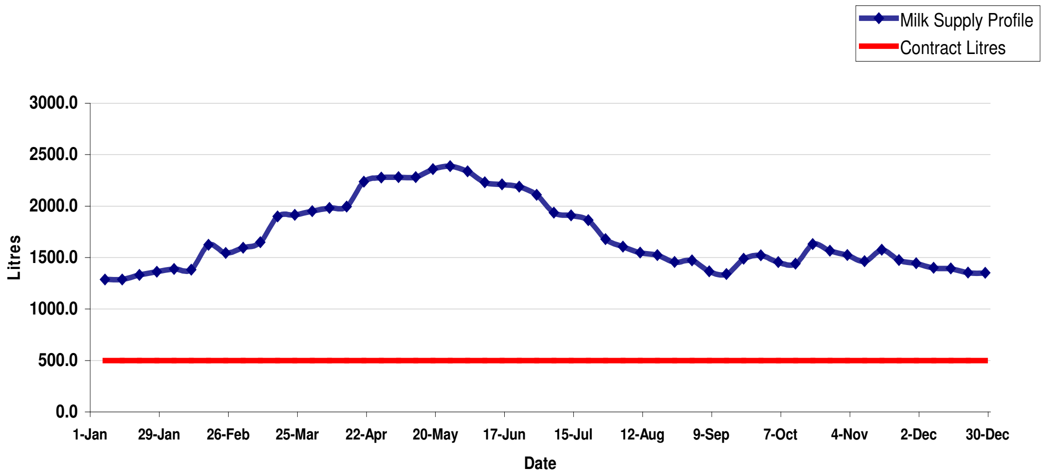
- Annual herd milk yield, fat and protein percentages
- Current calving pattern
- Liquid and winter milk contract litres
- Grazing platform hectares
- Concentrate price
- Annual grass growth curve
- Grazing hectares cut for silage
- Strain of cow

The model results and outputs are:

- Optimum calving pattern i.e. cows calving per month to meet supply contracts while keeping feed budget costs to a minimum
- Herd average milk yield, fat and protein projections for each week of the year
- Target feed budget for the individual farm

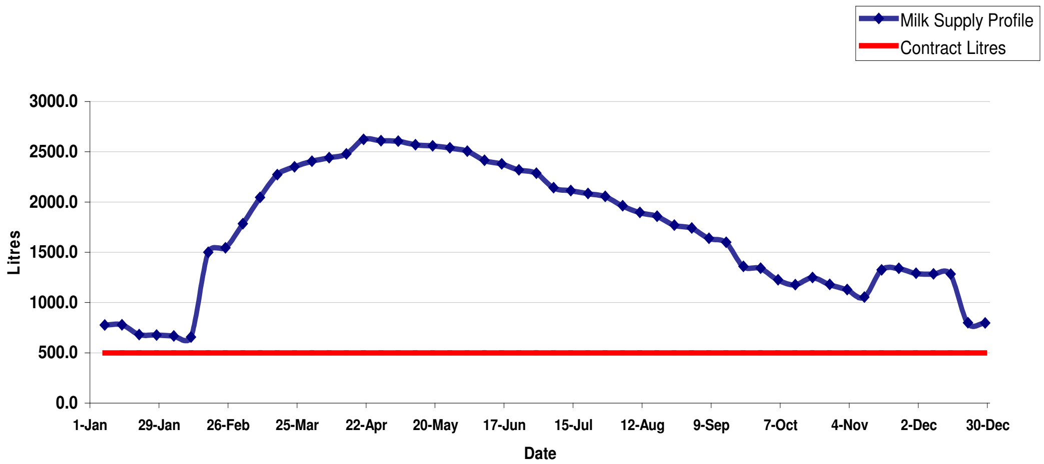
Some practical examples

Farm A: A Co. Meath farm with 100 Holstein cows on 40ha grazing block (Stocking rate 2.5 cows per ha). Average milk production per cow is 6400 litres at 3.84% fat and 3.29% protein. Liquid contract is 500 litres per day. Purchased feed cost is 5.9 cent per litre.
Milk supply profile for this herd is shown in Figure 2a. The herd has an unstructured calving pattern with cows calving for 10 months of the year. There is an excess supply of milk during indoor months.



Calving Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cows Calving	11	16	14	12	5	0	0	5	14	11	6	6
Cows in milk	70	86	88	95	100	100	95	81	75	94	94	83

Figure 2a. Current milk supply pattern for Farm A

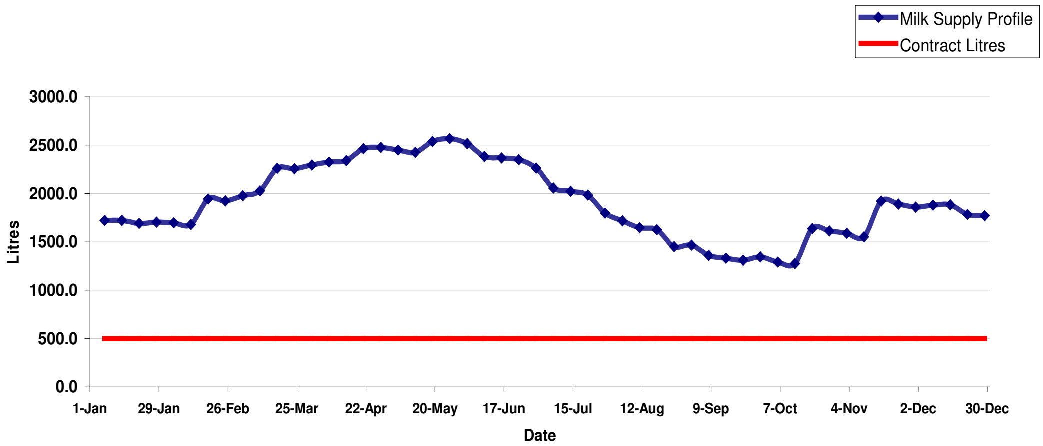


Calving Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cows Calving	0	58	12	5	0	0	0	0	0	5	15	5
Cows in milk	30	88	95	100	100	100	100	100	95	85	95	95

Figure 2b. Milk supply for Farm A based on optimum calving pattern

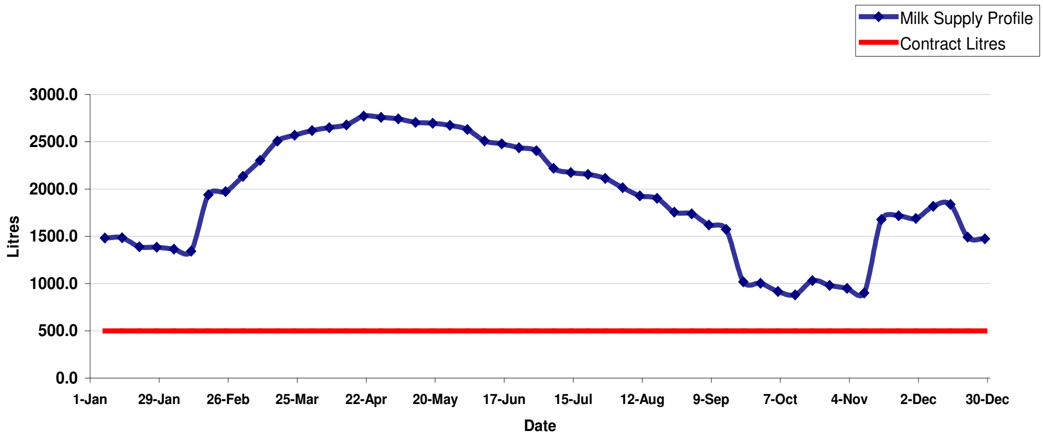
Figure 2b shows the model solution for optimum caving pattern- 75 compact spring calving cows and a further 25 cows calving in October-December. The proportion of surplus-to-contract milk is reduced to a minimum in this scenario. Target purchased feed cost is 3.1 cent per litre. The projected feed budget, based on Ballyhaise growth curves, is shown in Figure 4a

Farm B: A Co. Louth dairy farm with 100 Holstein cows on a 28ha grazing block (Stocking rate 3.57 per ha). Milk production per cow is 7100 litres at 3.90% fat and 3.32% protein. The farm sells 500 litres of liquid contract milk per day. Current total purchased feed cost is 8.8 cent per litre. which is a combination of purchased forage and concentrates. Similar to the first example, there is an unstructured calving pattern (Figure 3a).



Calving Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cows Calving	5	16	12	5	6	0	0	5	12	18	17	4
Cows in milk	72	88	95	94	100	100	95	83	70	83	96	91

Figure 3a. Current milk supply for Farm B



Calving Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cows Calving	0	37	10	3	0	0	0	0	0	8	37	4
Cows in milk	52	89	96	99	99	99	99	99	91	62	95	95

Figure 3b. Milk supply for Farm B based on optimum calving pattern

Figure 3b shows the milk supply based on optimum calving pattern for Herd B- 49 late autumn calving cows and 51 compact spring calving cows centred on November and February respectively. The target total feed cost in this case is 7.2 cent per litre (Figure 4b). Autumn calving proportion is not reduced to the same degree as in Farm A. This is due to the higher stocking rate and milk yield level. The model shows that February calving is the most cost-efficient month of calving, but the relative advantage is reduced as stocking rates increase.

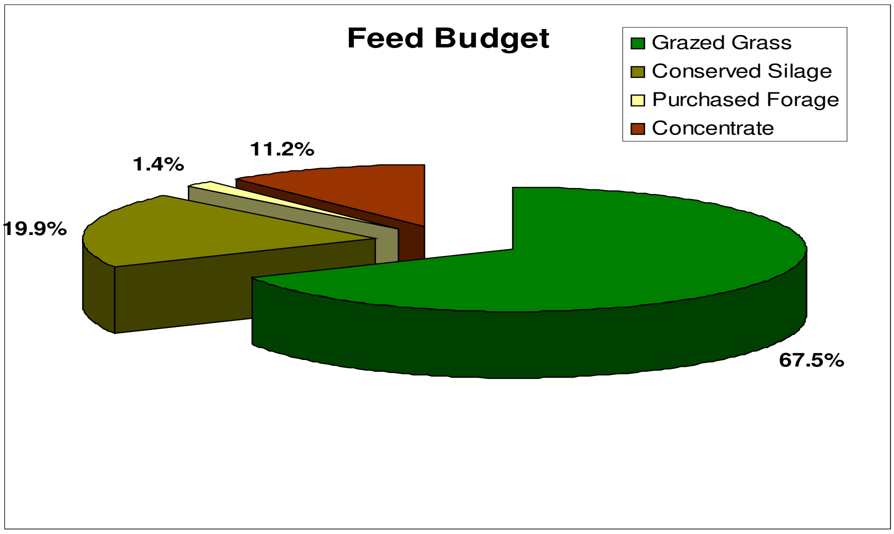


Figure 4a. Feed budget for optimum calving pattern on Farm A

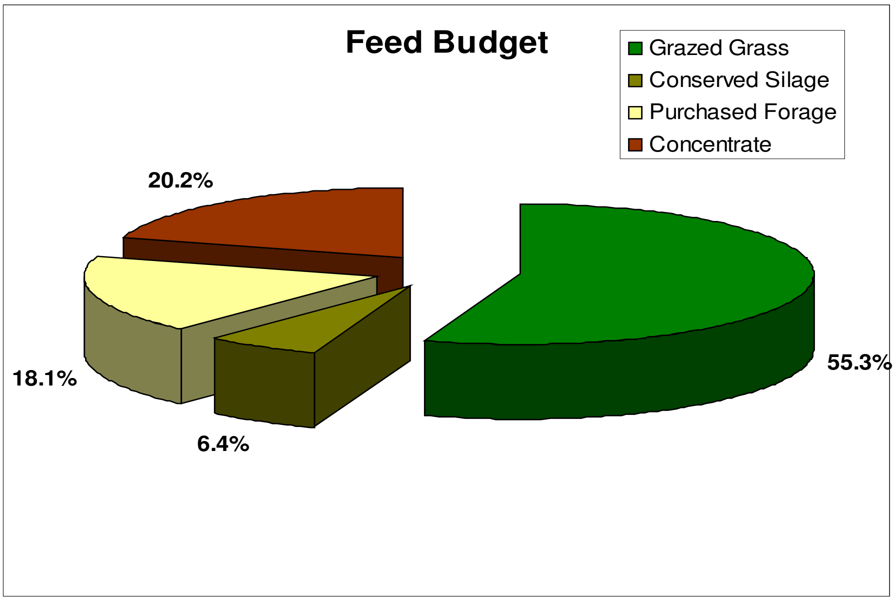


Figure 4b Feed budget for optimum calving pattern on Farm B

Conclusions

The model outputs detailed in this paper demonstrate that significant feed efficiency gains are possible if a planned approach is taken to calving pattern. Excess milk supply during high cost months can be minimized and more milk produced from fresh forage. There is also potential to reduce the duration of the calving season while maintaining liquid milk contract supply, which has positive implications for labour and youngstock management. However, the first step to a planned calving pattern is improving herd fertility performance. Low conception rates, long calving intervals and high culling rates will mean that any calving pattern plan on paper will break down very quickly in practice. Fertility performance must be given top priority in breeding and management decisions for liquid milk herds- milking all year round should not be allowed to mask the issue.

Grazing management for the Johnstown Castle research herd

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Introduction

The Johnstown Castle winter milk project has recently concluded after three years in operation. The objective of the project has been to compare a range of feeding options for autumn calving herds, and to develop guidelines for farmers managing these herds. An interesting comparison within the trial has been the high input versus high forage systems:

- The high input **(RED)** herd was heavily stocked at 4.0 cows per ha (equivalent to 160 cows on 100 acres) and imported 50% of its annual feed budget as maize silage, grass silage, wet grains and concentrate
- The high forage **(GREEN)** herd was moderately stocked at 2.75 cows per ha (equivalent to 110 cows on 100 acres) and produced all its own forage as grass or grass silage.

Both herds had all cows calved from September-November. This paper will focus on the grazing management protocols for each system across 3 periods: i) spring rotation, ii) main grazing season, and ii) autumn grazing rotation.

Spring rotation

Early spring grazing means better growth and a long interval to 2nd rotation, which sets up a good supply of quality pasture in April. Although spring feed demand per hectare was greater for the highly stocked RED group in Johnstown, it was planned to commence grazing by early to mid-February for both herds rather than delaying turnout. A rotation plan was used to set targets for the percentage of farm area grazed each week (Table 1). Differences in feed demand were offset by extra buffer feeding for the RED group. In contrast, the GREEN group had silage ground available for grazing, so grass made up a larger proportion of the diet in the early season.

Table 1. Spring rotation and feed budget for Johnstown winter milk trial herds

Week End	% Area grazed by weekend	Feed Deficit kg DM per cow RED	GREEN
15th Feb	6	16.0	14.0
22nd Feb	14	15.0	13.0
1st Mar	23	14.0	11.5
8th Mar	35	12.5	9.0
15th Mar	50	11.0	8.0
22nd Mar	66	10.0	6.5
29th Mar	85	8.5	4.5
5th Apr	104	8.0	3.8

In practical terms the rotation plan was a useful week-to-week grazing guide. Minimum grass allowance for any grazing bout was 4kgDM per cow. In the early weeks there was not enough grass available to offer this allowance every day to the RED group in particular. Instead, the herd was grazed for 4-5 days per week to achieve the target percentage area grazed. A flexible approach was adopted to take advantage of good weather conditions where possible.

Indoor feed allowance was reduced on grazing days to encourage a post grazing height of 3.5 to 4cm. For the RED group, this was done by feeding the same indoor diet mix but for fewer cows, e.g. feeding a 40-cow mix to 50 cows when 4kgDM grass was being offered. This simplified management of the indoor diet mix. For the GREEN group, silage allowance was gradually reduced as pasture allowance increased so that a grass plus a 5kg concentrate diet was being offered by late March. Supplement feeding was further reduced based on farm grass cover measurements after the first grazing rotation.

Main grazing season

The objective for the main grazing season was identical for both groups- maximise the amount of high quality pasture in the diet and use supplements to balance demand. Autumn-calving cows have a persistent milk production curve, with milk yields up to 90% of peak possible at >200 days in milk. Ensuring a supply of highly digestible pasture (1200-1400kg DM pre grazing yield) is important to achieve this potential.

Following closing of silage area, stocking rate on for the GREEN group was increased to 4.0 cows per ha in early April, similar to the RED group. A weekly farm cover was completed to assess pasture availability, with a target cover of 180kgDM per cow. The aim was to graze 5% of available area each day to a post grazing height of 4cm. Supplements were introduced when average cover per cow dropped below 140kgDM, while surplus grass was removed if covers exceeded 200kg per cow.

Mean daily milk performance from early April to mid-July was:

	Milk kg	***Fat %***	***Protein %***
GREEN	***24.8***	***3.78***	***3.71***
RED	***24.1***	***3.85***	***3.68***

From mid-July, cows were dried off 60 days ahead of expected calving date. This significantly reduced grass demand during August.

Autumn grazing management

Autumn grass has high crude protein content (20-22%) but is 15-20% lower in energy than spring grass. Supplementation with energy and quality protein is required for freshly calved cows. To extend the grazing season, it is standard practice for spring calving herds to build grass covers to a peak of around 1100kgDM per ha in mid-September. This results in pre-grazing yields in excess of 2200kgDM during September and October. However, this is unsuitable for freshly calved cows. The target for autumn grass in Johnstown was to keep pre-grazing yields at 1700kgDM or less for freshly calved cows. To achieve this, grass cover should not be allowed to exceed 850kgDM per ha in mid-September (Figure 1). Surplus bales were removed and youngstock brought onto the grazing block during August to avoid building excessive covers entering the autumn period.

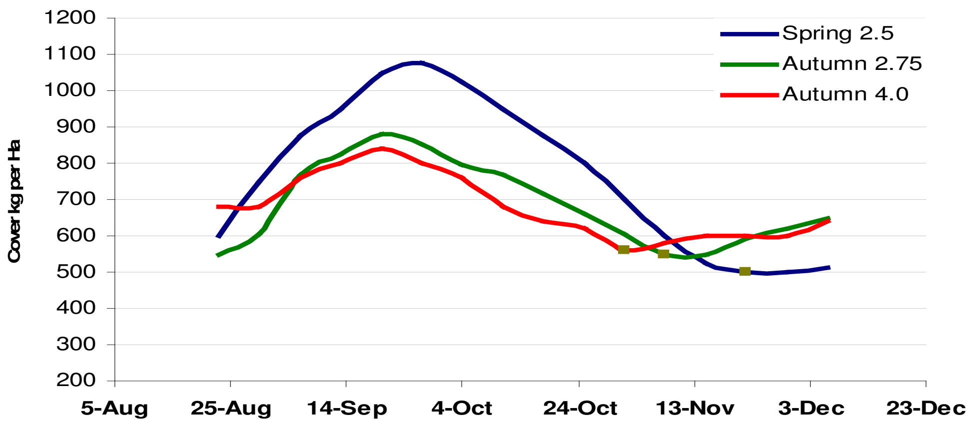

Figure 1. Autumn grass budgets for spring and autumn calving systems

To improve grazing efficiency, extra forage/silage was excluded from the diet until early October if possible. A concentrate allowance of 4-6kg containing high energy and quality protein was offered at grass. Depending on weather and ground conditions, cows were housed by night from mid-October to keep intakes stable. The final rotation commenced around October 5th to be completed in 30 days for the RED group and 40 days for the GREEN group. The target closing cover was at least 600kgDM for both groups with heaviest cover on an individual paddock of 1100kgDM or less. This set the farm up for an early start to spring grazing.

Summary and conclusions

There is considerable potential to exploit grazed grass from February to November in autumn calving herds. Mid-lactation cows are capable of good milk yields with high solids percentages when grazing quality grass on minimal supplementation. It is important to make a good start to the grazing year and the spring rotation plan is a very useful tool. Do not delay turnout because of high spring demand- use supplements strategically instead. High autumn pre-grazing covers do not work well for freshly calved cows. Aim for a peak farm cover of 850kgDM in mid-September where a high proportion of the herd is autumn calving.

Cashing in on grass for Liquid Milk Herds

Benny Keogan, Teagasc B&T Dairy, Navan

Introduction

Quality grass has the potential to improve milk production and reduce costs for both winter milk and spring milk farms. For this reason there has been a huge focus on grazing management through research and advisory over the years. The most important point is that the best grazing practices are adopted at farm level and make a positive difference to overall performance and profit. In the Louth Meath area, there are Teagasc 270 dairy clients participating in 15 discussion groups. This provides a good structure for delivering the key messages. This paper gives some observations on how grazing and herd management practices have developed across these groups, and discusses some areas where progress could be made.

Efficiency Comes First

There has been a lot of discussion on herd expansion over recent years. This has been the case for liquid and spring herds. However, it is clear from the range in costs and net margin in the dairy profit monitor figures that the majority of herds should focus on improving efficiency first. Much of the difference in net margin between farms is due to feed, fertilizer and machinery costs. Better grazing management has a big role to play in closing the gap.

Farm Grazing Infrastructure

It is almost impossible to have efficient grazing without the right infrastructure. The basics of good roadways, a planned paddock layout with mapped areas, and the proper water supply are all in place on the most efficient farms. Money spent on these areas will give a much better return on investment than extra buildings or machinery. For liquid milk herds in particular, good roadways are vital for managing early spring grazing. Mapping paddocks makes grass allocation possible, which is essential to get buffer feeding right during spring.

Reseeding

Much progress has been made on reseeding in recent years, with many liquid milk farms now reseeding 10-15% of grazing area as standard annually. The benefits easily pay for the costs in 2-3 years. Reseeding is the main step to improving grass growth capacity. Increasing annual growth from 8 tonnes to 12 tonnes dry matter will result in feed cost savings of over €15,000 for a 30 ha grazing block, which is achievable with a good effort on reseeding and soil fertility. Alternatively, the extra grass grown through reseeding can be used to sustain higher stocking rate. However, some farms continue to put a lot of attention into winter diets and alternative crops while ignoring this potential improvement.

Benefits of Grass Measurement

The benefits of tuning into grass measurement have clearly been demonstrated by numerous farmers in the Louth Meath region. This holds true from low input spring herds to high yielding liquid milk herds. An excellent method that has been adopted is working in small groups of 3-4 neighbouring farmers. These groups meet to do a grass cover once per week, rotating around members' farms. A farm cover is worked out and management decisions for the week are discussed. This helps build confidence in the decisions being made. Benefits listed by members include:

- Identifying grass surpluses or deficits early decisions can be made in time
- More control over pre-grazing covers and grass quality
- Improved use of fertilizers and meal feeding- less wastage
- More milk from forage with better solids
- A plan for spring and autumn grazing to get more days at grass
- Group encourages members to try new ideas and be less conservative in management ideas

Grazing practices and guidelines

Good grazing infrastructure and learning the skills of grass measurement are necessary for liquid milk farmers to cash in on grass. In addition, grazing guidelines and targets are needed that suit the liquid milk system. The following points are a summary of the practical experiences of liquid milk producers in Co. Meath:

Autumn rotation

- The spring grazing plan starts with autumn grazing. The aim is to start closing paddocks by 5^{th} - 10^{th} October. Grazing is completed by mid-November with a closing grass cover of around 700kg per ha.
- It is possible to carry covers of 1000kg through the winter
- Good cleanout of paddocks is essential in the last round. This will not be achieved with fresh calved cows on high covers. The maximum autumn pre-grazing yield should be 1700-1800kg DM.
- Keep silage out of the diet as long as possible in autumn- it will reduce grazing appetite
- Be flexible and use techniques like on-off grazing to minimize poaching. This works well where there is a high percentage of spring calvers in the herd

Spring rotation

- A bad start to the grazing season will likely reduce grass quality for the rest of the year
- Don't wait for grass to start growing in the spring before starting to graze. Getting out early and removing covers will promote better growth.
- Delaying turnout until March causes a short first round which can lead to grass shortages in late April
- Follow a simple rule of grazing 1/3 area by March 1^{st}, 2/3 area by March 17^{th} and the whole grazing area by early April.
- Make up the balance of feed demand by offering the correct amount of feed indoors, this will make sure the cow is fed and post grazing height is right

Main grazing season

- Keep pre-grazing covers at 1300-1500kg DM. High yielding cows struggle to eat enough at lower covers, and quality begins to suffer at high covers. Grazing this material during mid-season gives a good boost to milk protein
- Meal feeding at grass should complement grass quality rather than be an aid to bad management. Meal feeding levels can be reduced for high yielding cows if grass quality is correct
- Where a grass quality problem exists, fix the problem first before reducing meal feeding levels. Cutting meals on low quality pasture will hit high yielding cows hard.
- There is a benefit to mowing paddocks at least once during the grazing season- this may be to remove surplus bales, as topping, or pre-mowing. The need for multiple rounds of topping is removed by controlling pre-grazing covers

Young Stock

- There is a huge benefit to managing pasture quality for young stock. This is overlooked on many farms and needs much more attention
- Calves and maiden heifers should be offered top quality grass through the grazing season. This has a significant effect on growth rates and is key to making 24-month calving possible
- Meal inputs for young stock can be greatly reduced if grass quality is improved

Summary and Conclusions

There is great potential for improved performance from grazed grass for liquid milk herds. Grazing infrastructure, reseeding and soil fertility are the important first steps. The grazing season can be considered as three phases- spring, mid-season and autumn rotation. Management guidelines developed for these phases are being implemented and adopted on liquid milk farms in the region to good effect. Participating in a weekly grass walk with local group is a good way to develop the skills of grazing management

Fertility: A nutrition solution? Experience from UCD monitored herds

Tim Geraghty, UCD Herd Health Group

Introduction

Optimal fertility performance is an essential component of efficient, sustainable dairy farming regardless of the specific production system (e.g. seasonal vs. non-seasonal etc). Fertility performance can be assessed with 3 basic components:

Name	What does it mean?	Achievable target?
1. Submission rate	How likely is a cow to be served when she should be?	90%
2. Conception rate	How likely is a cow to go in calf after I serve her?	50-60%
3. Pregnancy rate	How likely is a cow to be pregnant when I review my records?	90%

These components can be calculated for any farm, as long as basic fertility events (e.g. calving dates, service dates etc) are recorded. In seasonal herds, a review at the end of the season is appropriate. In non-seasonal herds, an annual or bi-annual review can be used instead.

Investigating Sub-Optimal Fertility Performance

Fertility performance is always affected by multiple factors, e.g. no single 'solution' can be used to improve fertility in any farm. If we can monitor and record performance in these areas (e.g. body condition scores for energy balance, EBI for genetics etc) then we can evaluate whether they are affecting fertility performance. This in turn allows you to invest only in areas likely to improve performance in your own herd.

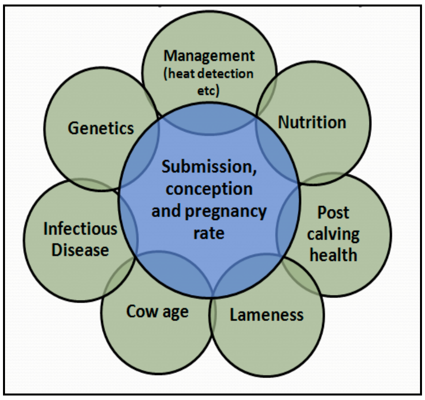

Figure 1: Some common factors that affect fertility performance on dairy farms

Part 2: Nutrition and Fertility in UCD Monitored Herds

UCD Herd Health started providing a fertility monitoring and review service to a small number of commercial dairy farmers in Co. Kildare in January 2009. The key objective of the project was to utilise regular review of performance records to increase understanding of the factors limiting fertility performance in each herd. Excessive negative energy balance is monitored on our herds by recording BCS any time the cow is handled (e.g. at calving, service, scanning, dry off etc). Change in BCS data is then calculated for each cow in the herd. Fertility performance is compared in cows that lose excess condition (over half a unit) against those that do not.

Excess body condition loss consistently reduces all components of fertility performance in UCD monitored herds.

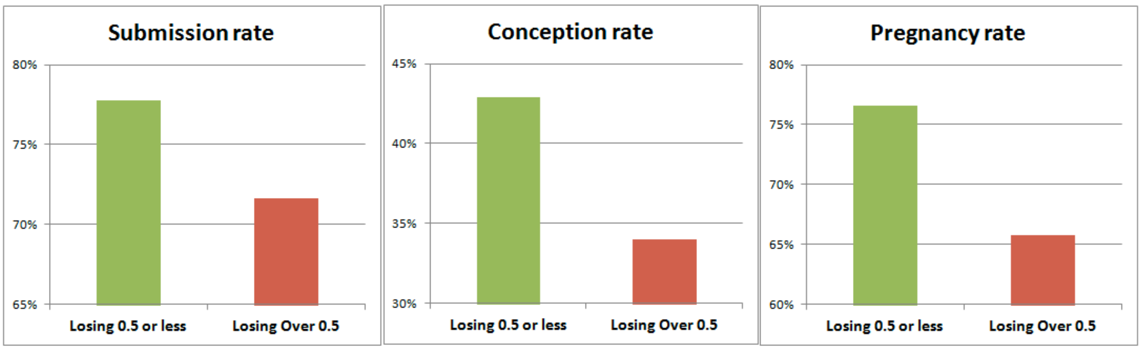

Figure 2: Effect of condition loss on fertility performance in UCD monitored herds (data from 2009 and 2010, 843 cows, 155 losing excess condition)

Keep nutrition in perspective
Excess condition loss is common in our monitored herds but it is not always the main cause of reduced performance and is never the only cause of reduced performance. Other nutritional problems (e.g. milk fever leading to retained foetal membranes) are occasionally present. Non-nutritional factors are frequently present.
For example, in one extended calving herd where heat detection inaccuracy was considered a primary problem, the conception rate increased by 13% when cow side 'heat test' was introduced. Interestingly, excessive negative energy balance was also limiting performance, but at a lower rate than the poor heat detection.

Part 3: Nutrition management to increase fertility performance

Know how you are getting on – Start Monitoring
BCS monitoring is simple and not overly time consuming when done at times when cattle are handled anyway. Recording is easier using farm-software programmes that allow condition scores to be recorded and analysed.
Some key achievable targets are to have:

- Unrestricted access to high quality feed in the last three weeks of the dry period
- Cows in body condition 3 at calving (2.75-3.25)
- Cows not losing more than half a unit of body condition after calving

In our experience thin cows at calving have very low submission rates, and cows fat at calving are at high risk of excess condition loss.

Change areas that are limiting performance
There are no absolute rules for the practical methods to achieve these targets. The unique design of individual farms requires innovative, individual solutions. A diverse range of management practices can all successfully feed cows in different farming systems.
Some methods used by our monitored herds to improve excess BCS at calving or BCS loss after calving have been:

When cows were gaining weight in late lactation and were fat at dry off:

- Condition scoring in late lactation and at dry off and restricting feed when necessary (until 3 weeks from calving at the latest). Dry cow mineral were fed as recommended at all times.

When cows were gaining weight during the dry period:

- Reducing the energy content of the dry cow diet until 3 weeks before calving; this is ideally done with a mixer wagon by increasing the straw in the diet and feeding ad-lib. Competition at the feed face (because feed is not always available) can lead to variable intakes and stress.

When cows were starting to lose condition before calving down (in the late dry period):

- Increasing feed space allowance and diet quality in the last three weeks of the dry period. Basically, all late dry cows should be able to get to feed easily and at the same time.

When cows were losing excess condition after calving:

- Segregating the herd by milk yield and preferentially feeding high yielding cows with TMR out of parlour.

- Increasing in-parlour allowances to recently calved / higher yielding cows.

- Limiting higher yielding / late calving cows to once a day milking (spring herds).

- Culling cows when 305 day milk yields were excessively above the herd target and were forcing an unwanted change in nutritional management.

Fertility benchmarking in Northern Ireland herds

Dr David Mackey
Greenmount Campus, College of Agriculture, Food and Rural Enterprise (CAFRE)

Summary

- Trends in Northern Ireland have been for larger dairy herds with 56% of the dairy cows now being in herds of 100 cows or more.
- Fertility performance in Northern Ireland dairy herds is generally poor but there is a considerable range in performance between herds with the best performance occurring in spring calving, lower yielding and smaller herds.
- Profitable Lifetime Index (£PLI), the equivalent of EBI, summarises all production and fitness traits into a single lifetime-based financial index.
- Fertility Index is a component of £PLI and has been demonstrated to improve daughter fertility at herd level.
- Lifetime performance is closely related to productive life of the cow with the best lifetime performance occurring in herds with 24-month calving and above average milk yields.

Introduction

At the June 2010 agricultural census there were 281,000 dairy cows in Northern Ireland with an average herd size of 88 cows. While the total number of cows has remained relatively stable over the last 10 years, the number of herds has decreased from 4,855 in 2000 to 3,194 in 2010 with the number of cows per herd increasing from 59 cows in 2000 to 88 over the same period. This has been largely due to an increase in the proportion of larger herds with 100 cows or more. In 2000, 13% of herds had 100 cows or more and by 2010 this increased to 31%, with 56% of the dairy cows in Northern Ireland now in herds of 100 cows or more.

In Northern Ireland, due to previous milk pricing arrangements favouring winter milk production, the majority of dairy farmers produce milk all year round. This has been exacerbated over the last 10 years with the investment in larger dairy units increasing the proportion of spread calving herds and flattening the milk supply across the year still further.

Fertility Benchmarking

CAFRE has Fertility Benchmarked dairy herds in Northern Ireland since 2005 and assesses heat detection efficiency, conception rates and overall fertility performance. Average submission rates are 61% while conception rates based on pregnancy diagnosis are 48% with a projected calving index of 394 days and 14% of cows identified as not in calf at the end of the breeding season. Some of these will be culled while others are carried over for breeding in the subsequent season.

The best fertility performance occurs in seasonal calving herds, particularly spring calving herds where both submission rates and conception rates are highest (Table 1). Fertility performance decreases as milk yield increases, with decreases in both submission rate and conception rate. In larger herds with over 130 cows, the greatest impact on fertility is a decrease in conception rate.

Infertility inevitably leads to extended calving intervals and an increase in the lactation yield of cows but this has a depressive effect on the amount of milk sold per cow per year due to proportionately more milk being produced in late lactation when yields are lower. The financial cost of infertility within the Fertility Benchmarking program is based on the cost of extended lactations and cost of replacing cows potentially culled for infertility with the latter generally being the bigger cost. In 2009-10, the total infertility cost was estimated to be around £200 per cow but with the increased milk prices in 2010-11 this is now around £220/cow. The cost of infertility is generally lower in seasonal calving herds but despite the saving in infertility costs, at current milk and feed prices, margin over concentrate is still higher in autumn and spread calving herds where average yields are higher.

Table 1: Calving pattern and fertility performance of Northern Ireland dairy herds.

	Autumn	All year round	Spring
Herd details:			
No. herds	11	67	12
Annual milk production (litres)	7,758	7,266	5,961
Concentrate fed (kg/cow/year)	2,146	1,961	1,099
Margin over Concentrate (£/cow) (27 p/l; £250/t)	1,558	1,472	1,335
Heat detection efficiency:			
Submission rate (%)	72	57	70
Days to first service	78	79	73
Conception rate:			
1st service (%)	53	52	60
Overall fertility performance:			
Projected calving index (days)	383	392	367
Potentially culled not-in-calf (%)	8	17	9
*Infertility cost (£/100 cows) – extended calving index	4,069	5,854	671
*Infertility cost (£/100 cows) – cows potentially culled	6,834	15,308	8,133
*Total herd infertility cost (£/100 cows)	10,903	21,162	8,804
*Herd infertility cost (£/cow)	109	211	88
Margin over Concentrate and Infertility (£/cow)	1,449	1,261	1,247

Genetic trends

There has been a long established genetic trend for increased milk production in Northern Ireland. This has been achieved through the introduction of the Holstein breed, the use of breeding technologies and indices such as £PIN (Profit Index) encouraging further selection for production. However, placing such emphasis on production alone has had implications for other traits leading to declines in fertility and longevity. In recent years, this has been addressed through the introduction of the Profitable Lifetime Index (£PLI), the UK equivalent of the Economic Breeding Index (EBI), which is now starting to reverse the genetic trend in infertility and lower lifetime performance.

What is £PLI expected to deliver for non-productive traits at herd level?

a) Fertility: Although levels of herd fertility are more dependent on management than breeding, a number of traits including calving interval and non-return rate have been combined into a Fertility Index for use in selecting bulls. Fertility Index is a financial figure and typically ranges from -15 to +15. This has been available in all proof runs since May 2005. Daughters of a bull with an above average Fertility Index are predicted to have reduced calving intervals and increased non-return rates. Each one-point increase in Fertility Index, say from 1 to 2, is expected to decrease calving interval by half a day and improve non return rates by 0.5%.

b) Lifespan: The Lifespan PTA of sires is calculated from a range of sources including pedigree information and the dairy type traits (feet and legs composite, mammary composite), SCC and survival data of female relatives. The Lifespan PTA is expressed in lactations and typically ranges from -0.5 to +0.5. Daughters of a bull with a Lifespan PTA of 0.3 are expected to survive on average 0.3 lactations longer than the daughters of an average bull with a Lifespan PTA of zero.

c) **Somatic Cell Count:** The somatic cell count PTA is based on national milk recording records and is expressed as a percentage, typically ranging from -30 to +30. Sires with a negative SCC PTA are expected to reduce the SCC of their daughters compared to the average bull. Each 1% change in a sire's SCC PTA is predicted to change his daughters' SCC by 1% so the daughters of a bull with a SCC PTA of -10% would be expected to be 10% lower than daughters of a bull with a SCC PTA of zero. As there is a strong link between SCC and mastitis, the daughters of sires with a negative SCC PTA are expected to have reduced mastitis incidence.

Practical benefits of sire Fertility Index at herd level

Since the launch of the Fertility Index in 2005, one of the sire selection criteria in Greenmount's Future Herd has been to select bulls with a positive Fertility Index. However, some sires used before this time carried a negative Fertility Index. This highlights the importance of having and using good information. As discussed earlier, each one point increase in sire Fertility index is expected to increase daughter conception rates by 0.5% points and reduce daughter calving interval by 0.5 days on average. This has been examined at a practical herd level using records from Greenmount's Future Herd from 2004-2011 and records from a few other commercial dairy herds throughout Northern Ireland.

Sire Fertility Index had a statistically significant effect on daughter conception rate and calving intervals in the Greenmount Herd, despite the relatively small number of cows and the degree of variability. When comparing the three sires with the lowest and highest Fertility Index, there was a 21% point difference in daughter conception rate and 21-day difference in average daughter calving interval as shown in Table 2. This equates to a 1.2% point increase in daughter conception rate and a 1.2 day decrease in daughter calving interval per one unit increase in sire Fertility Index.

Table 2: Comparison of daughter fertility performance in sire of low and high Fertility Index.

Sire Name	Sire Fertility Index*	Average daughter conception rate (%)	Average daughter calving interval (days)
Lowest Fertility Index sires:			
Shaker	-12.2	36.4	395
Bestow	-6.4	33.3	406
Promise	-5.2	25.7	399
Weighted average	**-9.6**	**33.1**	**397**
Highest Fertility Index sires:			
Roxell	+6.7	61.9	361
Jamboree	+8.0	50.0	379
Tugolo	+10.5	56.0	382
Weighted average	**+8.4**	**54.4**	**376**
Difference	**18.0**	**21.4**	**-21.8**
Difference/Unit Fertility Index		**1.2**	**-1.2**

* Sire proofs taken from August 2011 proof run

The results above demonstrate the benefits of positive Fertility Index bulls in just one herd. Similar results have been replicated from calving records in other commercial dairy herds in Northern Ireland where there are 15 or more daughter lactation records per sire. The benefits of a one-point increase in sire Fertility Index all exceed the 0.5 day reduction in calving interval anticipated by DairyCo and ranged from a reduction in calving interval of 0.6 to 1.0 days per unit on the farms of Gary McHenry (Lurgan) and Drew McConnell (Newtownstewart), respectively. A conception rate benefit of 0.7% per unit sire Fertility Index was observed in Gary McHenry's herd when historic service records were analysed.

Results from CAFRE's Fertility Benchmarking have established that infertility currently costs the average dairy herd around £220 per cow per year. The cost of extended calving intervals at current milk and feed prices is currently estimated to be around £3.20/cow/day for a herd producing 8,100 litres/cow/year for each day beyond a calving interval of 365 days. Given the 22-day difference in average daughter calving interval between the two groups of sires used in Greenmount's Future Herd, the benefit of using the higher Fertility Index bulls is worth around £7,100 per cow 100 cows per year.

Importance of lifetime performance

Lifespan is one of the traits included in the Profitable Lifetime Index (£PLI) and there is a strong link between this and the lifetime performance of dairy cows. Both lifespan and the lifetime yield of dairy cows are relatively new terms, nevertheless they are important in the overall profitability of a dairy herd. Research from the AgriSearch funded fertility study at AFBI Hillsborough established that infertility, lameness and mastitis are the three principal reasons for culling dairy cows, accounting for 27%, 15% and 10% of culls, respectively, with the average cow being culled after completing around 3.5 lactations. All of these are addressed within £PLI.

A recent dataset of milk records from United Dairy Farmers comprising details of over 48,000 culled cows from 680 Northern Ireland dairy herds has been analysed at CAFRE. This has established that the average cow is culled at 6.1 years of age after having completed 3.6 lactations and producing 28,000 litres of milk. However, further analysis has established that there are considerable differences in the lifetime yield of cows at herd level and this has considerable implications for the financial cost of bringing heifer replacements into the herd. Results of this work are shown in Table 3, highlighting the importance that productive life has on lifetime yield.

Table 3: Comparison of lifetime yield and its effect on the production and replacement rate of NI dairy herds.

	Top 25%	**Second 25%**	**Third 25%**	**Bottom 25%**
Average lifetime yield (litres)	35,279	29,648	24,828	17,806
Average no. lactations	4.2	3.6	3.4	2.7
Age related characteristics:				
Age at first calving (years)	2.4	2.4	2.5	2.6
Longevity (years)	6.7	6.2	5.9	5.3
Productive life (years)	4.3	3.7	3.4	2.6
Production/Fertility:				
Average annual yield (litres)	7,966	7,766	7,163	6,562
Average calving interval (days)	424	424	421	421
Replacement rate (%):	23.9	27.4	29.4	36.5

Breeding for fertility and longevity- a Holstein breeders perspective

Richard Whelan
"Lumville" herd, Clonard, Co. Meath

Introduction

My name is Richard Whelan. I'm delighted to have been asked to speak at today's forum and to contribute along with the other excellent speakers on what is a very relevant topic at farm level. I'm a dairy farmer from Clonard in Co Meath. I milk 60 pedigree registered Holstein cows to fill a winter milk quota. In addition to running my dairy farm I am also Chairman of the Irish Holstein Friesian Association (IHFA) which is the herdbook for pedigree registered Holstein Friesian cattle in Ireland.

The farm has a grazing platform of 80 acres around the yard with a further 40 acres of rented land nearby. I rear all bull calves born on farm, most are sold as pedigree breeding bulls to other farmers, and the remainder are finished for the factory. The current herd average is approx 11,000 kgs of milk, at 4.11% Fat and 3.24% Protein. Total milk solids produced in the last year was 844 kgs. Herd classification was 17 EX, 30 VG and 2 GP. The herd competes in the annual herds' competition run by the local North Eastern Friesian Breeders club. Through it I have qualified and also achieved success in the national Irish Holstein Friesian Association herds' competition. I have always had a passion for breeding good stock. Part of the enjoyment I gain from it is taking part in shows both locally and at a national level. Over the past twenty years I have had the good fortune of having some very good cows who have achieved great success in the show ring; *Stairway Bstar Rhonda, Lumville Jed Rhonda*, *Moneymore Joan*, *Tubbertoby Shottle Ashlyn*, *Northlake Add Shottle and Lumville Danoise 2*. The Danoise cow in particular has been very successful. A particular highlight was in 2008 when she was won the Baileys championship in Virginia and was also champion of the RUAS Winter Fair in Balmoral. She was again crowned the Supreme and Interbreed Champion of the RUAS Winter Fair 2010 and was also Reserve Champion of Tullamore Show 2010. Taking part in these shows is just a hobby. However it also helps to raise the profile of the herd and it is an enjoyable way of meeting lifelong friends.

Breeding Policy

My breeding policy can be summarised as "To produce trouble-free profitable cows". Invariably 95% of the cows will fall into this category however there always seems to be the 5% who require extra work. Inevitably cases of lameness, SCC problems, infertility, milk fever, mastitis etc will occur. I am happy to aim for an average calving interval of 13 months. This is a realistic target bearing in mind the important variables involved in winter milk production. Getting the calved heifers back in calf is a big landmark, if they successfully conceive at this time it's a general indicator that they will last in the herd into the future. As a breeder I feel the importance of cow families is very often overlooked. I think sometimes the industry focuses solely on the male side without taking into account the part played by the females. In the herd we have a number of international cow families who have bred well producing a lot of female offspring. These would include the Rhonda, Danoise, Margot and DRA August families. All have proven their ability to be regular breeders of high quality animals who leave a profitable impact on the herd.

Currently, I am using Derren, Beacon, Fever, Jordan, Seaver, Jeeves and Tennyson. These are a mixture of Goldwyn, Outside and Shottle sons, with some being out of O-Man dams. Most of the semen used in the herd is international sires from the USA, Canada and the UK. Bull selection is based on a number of criteria. I would be very slow to use a bull that is negative for daughter fertility in his home country. It's extremely important to study the country-of-origin proof, converted breeding values usually don't convey the true picture. In some of these countries the amount of information and data on fertility measures can be very detailed. For example, within the UK's "Fertility Index" there are 6 traits used to assess the fertility performance of cows; Calving Interval, Non Return Rate, Body Condition Score, Number of days from Calving to 1st service, Number of Inseminations per conception and milk yield at the time of insemination. The U.S. breeding industry has recently worked on the possibility of publishing the Sire Conception Rate (SCR) of AI sires who receive widespread use. This benefit to this is that each bull's performance in terms of pregnancies per insemination is scientifically evaluated and then published.

Daughter Fertility

Daughter fertility is a complex trait affected by genetics and management. It takes many years for a bull's true phenotype for fertility to be known. By this stage he can very often be dead and no longer available. The famous "To-Mar Blackstar" was a bull who sired daughters with good fertility. These were long-lasting cows. Sons of Blackstar, such as "Lord Lily", also transmitted this ability. "Champion" was a sire who bred fertile cows. He is a son of "Rudolph", who also bred long lasting cows. I am currently milking cows sired by various Durham sons. They have good fertility with good udders and moderate production. These are sires such as Mr Sam, Atlas and Damion. A lot of my current crop of calved heifers are by Watha (SUW). I am very pleased with their performance to date. "O-Bee Manfred Justice" (O-Man) is a bull I have used a little in my breeding programme. The breed can only benefit from the recent gradual move away from the tall, frail, angular cow. An increased emphasis on dairy strength is a positive move.

A lifetime of experience has shown me that breeding is far from a perfect science! Very often there are surprises along the way. "Juniper Rotate Jed" was a Canadian bull renowned for breeding daughters with good conformation. Two of his sons received extensive use by breeders; Leduc and Gibson. I used both in my herd. The daughters by Gibson performed poorly for fertility while Leduc bred very well, he had a major positive impact in the herd.
O-Man has international acclaim today as a breed improver for certain traits, especially overall fitness. His paternal grand-sire was Cubby Manfred who was not noted for good daughter fertility. O-Man has a full brother called Justin, who never made it as a proven sire, his breeding pattern was much different to that of O-Man's yet they (in theory) have the exact same genes!
Genomics is a new technology with the potential to be a useful tool in advancing cattle breeding. As it a new technology there are clear limitations to its capability. Taking all this into account, it's fair to say that the parameters and possibilities for improvements in fertility performance have many unexplored avenues to be considered for potential future research work. The Holstein Friesian breed is in good hands as all breeding programmes worldwide have concentrated on fertility in the last ten years. The decline in fertility has bottomed out and the graph has started to improve. This can now be seen in Ireland through data from the I.C.B.F.

Genetic merit for fertility traits and effects on cow performance

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Summary

- Herd fertility is a key determinant of farm profit
- Large variation in genetic merit for fertility traits exists within the national herd.
- An on-going trial in Moorepark has clearly demonstrated that cows with poor genetic merit for fertility traits have substantially lower fertility performance compared with cows with high genetic merit for fertility traits.
- Cows with high genetic merit for fertility traits had greater BCS, and some indicators of improved metabolic status.
- It is essential to use high EBI sires with a strong fertility sub-index to build long-term improvement in genetic merit for fertility.

Introduction

Good herd fertility is essential to achieve compact calving in spring-calving herds, autumn-calving herds and split-calving herds. Genetic merit for fertility traits has declined in most dairy breeds during the last half century. The introduction of the Economic Breeding Index (EBI) in 2000 heralded the incorporation of fertility traits into genetic selection in Ireland for the first time. The fertility subindex currently contributes to 34.8% of the total weighting in the EBI. Achieving good fertility performance and a compact calving pattern will favourably impact farm profit. This will be achieved through the following technical efficiency gains:

- Maximising labour efficiency related to calving, calf-rearing and breeding.
- Increased milk production per cow through longer lactations and more mature cows with greater production potential.
- Fewer extended lactation carryover cows.
- Reduced incidence of costly interventions related to hormonal treatments for non-cyclic cows.
- Reduced empty rates, less involuntary culling, more scope for voluntary culling for cell count, lameness or poor production.
- Lower replacement rate and hence greater heifer availability for expansion.

Study comparing cows with High and Low Fertility sub-index.

A trial has been established at Moorepark to investigate the performance of cows with similar genetic merit for milk production but with differences in genetic merit for fertility/survival (as indicated by their fertility sub-index). With the aid of the ICBF, the national database was screened for in-calf Holstein-Friesian heifers with similar genetic merit for production traits, but with extremes of good (Fert+) or poor (Fert-) genetic merit for fertility traits. A total of 36 heifers due to calve in spring 2008 were purchased and moved to the Moorepark farm. All 36 cows had a similar percentage of Holstein-Friesian genetics (93%) and similar values for the milk production sub-index (€40). The 18 High Fertility sub-index heifers had a fertility sub-index of €51 and an overall EBI of €105 and the remaining 18 had a fertility subindex of €-30 and an overall EBI of €6. All 36 cows are managed as one herd in accordance with the Moorepark blueprint for pasture-based milk production and cows were inseminated with frozen thawed semen at standing heat. The fertility performance of both groups during Year 1 of the study (all 1st lactation) is illustrated in Figure 1.

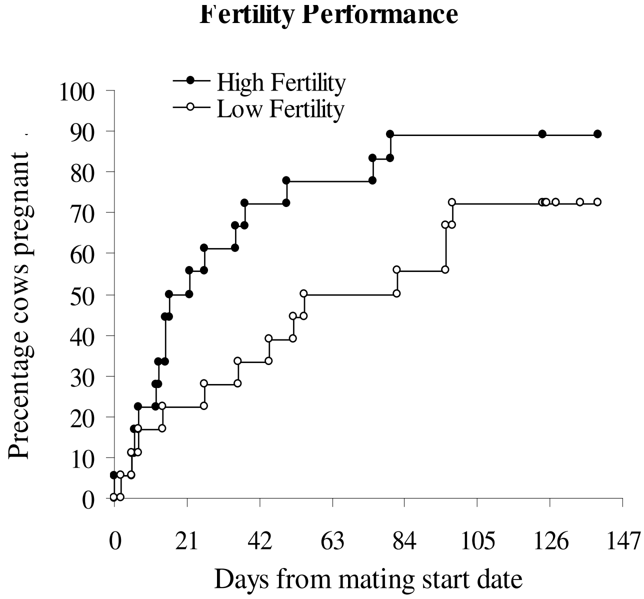

Figure 1. Days from mating start date to pregnancy in the high and Low Fertility herds. The breeding season started on Day 0, and the High Fertility cows (closed black circles) successfully established pregnancy quicker than the Low Fertility cows (open white circles).

During their first lactation, the Fert+ group had good reproductive performance during the breeding season. They had a higher submission rate (83 vs. 72%), better conception rates to first service (56 vs. 28%), and a lower overall empty rate (11 vs. 28%) compared to the Low Fertility group. In the second and third lactations, breeding was delayed to allow collection of samples of interest, and hence the fertility results are not reported. The fertility performance of a large number of cows with similar genetic merit to the Fert+ and Fert- cows from the national database has confirmed these differences.

Milk production

Milk production records from all the first lactation cows in 2008 and the mixture of first and second lactation cows in 2009 were combined into a single dataset (~80 cow records in total, roughly half the cows were first lactation and half were second lactation). During the full lactation, Fert+ cows averaged slightly more milk per day (19.5 kg/day) compared with the Fert- cows (18.7 kg/d). Average milk fat, lactose and protein concentrations were generally similar, and peak milk yield in both groups was ~28 kg/cow per day.

Blood indicators of metabolic status

Blood samples were collected frequently throughout 2009 to allow measurement of indicators of metabolic status. Glucose is a sugar used by the cow to produce lactose in milk, NEFA is an indicator of body fat mobilisation, and hydroxybutyrate is an indicator of ketone body production (the cause of ketosis). Together, glucose, NEFA and hydroxybutyrate concentrations in blood can be used as an index of metabolic status. There were no differences between the two groups of cows for any of these measurements at any stage of pregnancy or lactation. Insulin and insulin-like growth factor–I are metabolic hormones that are responsible for stimulating the uptake of nutrients by body tissues. Higher concentrations of these metabolic hormones have been linked to improved reproductive performance in a large number of studies. Insulin-like growth factor-I was higher in the Fert+ cows throughout lactation, and in early lactation insulin was higher in Fert+ cows (Figure 2).

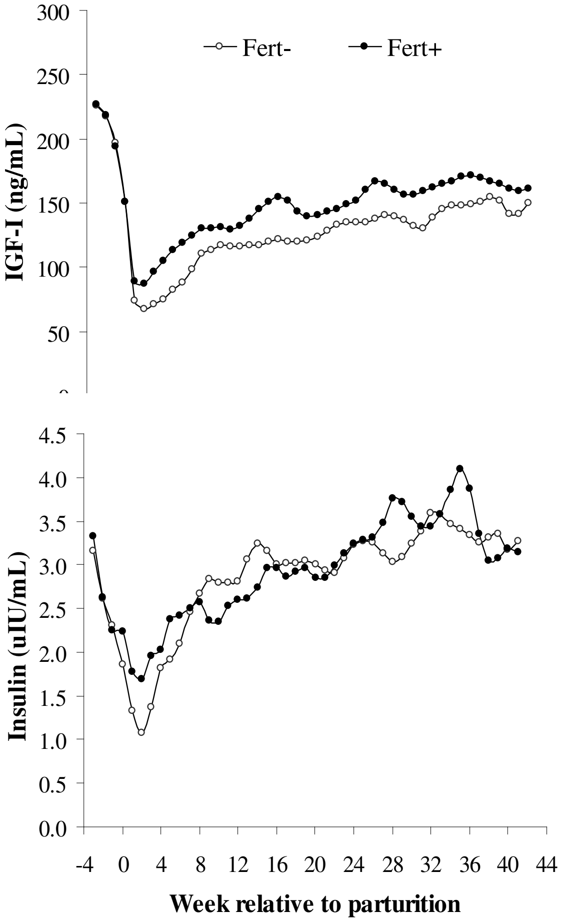

Figure 2. Profiles of insulin-like growth factor-I and insulin during gestation and lactation

Body Condition Score

Bodyweight was similar in the two groups of cows, but Fert+ cows had greater BCS during early (+0.13 units), mid (+0.1 units) and late (+0.09) lactation compared with Fert- cows. The Fert+ cows tended to have greater nadir BCS after calving (i.e., the lowest BCS value observed was higher than Fert- cows), but the time when this nadir occurred was similar in both groups (~10 to 12 weeks after calving). The BCS profile for both groups during late pregnancy and lactation is illustrated in Figure 3. The BCS results agree closely with the observed differences in metabolic hormones, which play an important role in partitioning of nutrients towards body tissues.

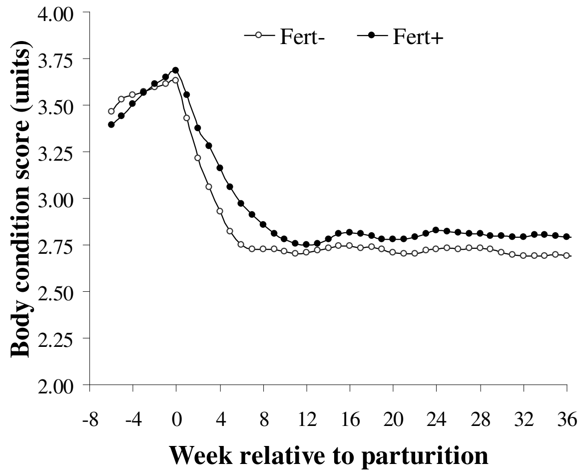

Figure 3. Body condition score profile during late pregnancy and lactation in Fert- and Fert+ cows.

Conclusions.

Genetic merit for fertility traits had a significant effect on reproductive efficiency in the current study. The Fert+ group had improved calving to conception interval, fewer services and conceived more quickly after breeding began than the Fert- group. The observed differences in reproductive performance were independent of management, plane of nutrition, proportion Holstein ancestry, genotypic and phenotypic milk yield, and blood metabolite concentrations of glucose, NEFA and hydroxybutyrate. Fert+ cows maintained greater BCS and circulating concentrations of IGF-I throughout lactation and had greater circulating concentrations of insulin during the first 4 wk of lactation. This supports the premise that animals with superior fertility are less reliant on body reserves for milk synthesis. These results highlight the effect of genetic merit for fertility traits on phenotypic reproductive performance, which may not necessarily be to the detriment of milk production.

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